MEMORANDUM

Agenda Item 1(F)2

TO: Honorable Chairwoman Rebeca Sosa, and Members, Board of County Commissioners

DATE: July 1, 2014

FROM: Honorable Harvey Ruvin, Clerk
Circuit and County Courts

Christopher Agrippa, Director
Clerk of the Board Division

SUBJECT: Miami-Dade Sea Level Rise Task Force Report and Recommendations

Attached is the Miami-Dade Sea Level Rise Task Force Report and Recommendations submitted by Harvey Ruvin, Task Force Chairperson, Honorable Clerk of Courts, Miami-Dade County.

CA/fcd

Miami-Dade Sea Level Rise Task Force Report and Recommendations

July 1, 2014

CLERK OF THE BOARD
2014 JUN 23 PM 4:15
CLERK, CIRCUIT & COUNTY CTS.
MIAMI-DADE COUNTY, FLA.
#1

Miami-Dade Sea Level Rise Task Force Members

Harvey Ruvin, Task Force Chairperson, Honorable Clerk of Courts, Miami-Dade County

James Murley, Esq.,Task Force Vice-Chairperson, Executive Director, South Florida Regional Planning Council

David Enfield, Ph.D., Research Oceanographer

Sara E. Fain, Esq., Executive Director, Everglades Law Center

T. Willard Fair, President, Urban League of Greater Miami, Inc.

Jorge Gonzalez, Chief Executive Officer, City National Bank

Arsenio Milian, P.E., President, Milian, Swain & Associates, Inc.

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SEA LEVEL RISE TASK FORCE REPORT

"The potentially empowering capacity to be able to 'foresee and forestall' is what ultimately distinguishes the human species from all others..."
Buckminster Fuller, Legendary Futurist

Sea Level Rise is an inevitable consequence of the warming of the oceans and the accelerated melting of the planet's ice sheets -regardless of cause. It is a measurable, trackable and relentless reality. Without innovative adaptive capital planning it will threaten trillions of dollars of the region's built environment, our future water supply, our unique natural resources, our agricultural soils, and our basic economy.

Dealing with this challenge will require a coordinated effort of unprecedented commitment. As the report chronicles, that effort has already begun. Miami-Dade County has been a leader among local governments, thinking globally and acting locally.

The prior Miami-Dade Climate Change Advisory Task Force (CCATF), after nearly 5 years of work, produced a range of recommendations dealing with adaptation of both our built and natural environments. The current Sea Level Rise Task Force (Task Force), rather than reinvent the wheel, is recommending a more structured implementation and oversight commitment by the County Administration.

The ongoing Southeast Florida Regional Climate Change Compact has been doing great work in helping to set the stage for what needs to be a multi-level intergovernmental partnership to effectively address sea level rise. The City of Miami Beach, with newly elected and appointed leadership is meeting the short term challenge of "sunny day flooding" (a harbinger of sea level rise) in a proactive way. Others are lining up to be part of the solution.

This Report is an urgent, though optimistic, call to begin the step by step process needed to design and build a re-engineered urban infrastructure that over time will withstand a worst case scenario. It begins with the Board's calling for a commitment by the Administration to obtain the technical expertise needed to vet the elements and timing of the plan.

Make no mistake, it will be costly, but its costs are dwarfed by the potential human, physical and economic values at stake. The members of your Sea Level Rise Task Force are grateful for the opportunity to present this Report and are confident that both the Board and the Mayor will take the necessary actions.

Harvey Ruvin

Harvey Ruvin, Chair

Report

I. Introduction

Warming of the oceans, melting ice sheets, and extreme weather events have become more prominent realities during the past year. Southeast Florida has been experiencing some of these effects first-hand, with severe downpours and "king tides" causing localized flooding in some areas of Miami-Dade County. These events provide a glimpse into the future of what we may expect to experience even more frequently and to more extremes in the region. They also provide an opportunity to better understand what these extremes may mean for our community and how we can begin to address these impacts now. Noting the mounting evidence supporting the overwhelming scientific consensus that climate change is real and in fact already accelerating sea level rise, the Miami-Dade Board of County Commissioners (BCC) wisely created the Miami-Dade County Sea Level Rise Task Force (Task Force) in July 2013 by unanimously passing Resolution No. R-599-13 (Appendix A), as a focused next step to better gauge and plan for what lies ahead.

Our charge was multifaceted:

a) To provide a realistic assessment of the likely impacts of sea level rise and storm surge over time.

b) To make recommendations relative to the Comprehensive Development Master Plan (CDMP), Capital Facilities Planning and other priorities.

The Task Force was provided with prior studies, reports and evaluations of potential impacts on vital services and facilities, ecological resources and infrastructure. The Task Force met fourteen times and heard presentation from various experts on topics ranging from a review of county and regional planning efforts regarding climate impacts, storm-water management and drainage, sewerage systems, vulnerabilities of freshwater aquifers and wells, the role of Everglades restoration and natural systems in resilience, how to build resilience in communities, as well as the serious insurance and reinsurance implications of expected sea level rise.

All presentations and minutes of the Task Force meetings are posted on line at the Miami-Dade Sea Level Rise Task Force webpage.[1] All of our deliberations and discussions have been guided by Sunshine Law directives. A detailed list of all presentations made at the Task Force meetings can be found in Appendix B.

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[1] Southeast Florida Regional Climate Change Compact (June11, 2012).
Retrieved from: HTTP://WWW.MIAMIDADE.GOV/PLANNING/BOARDS-SEA-LEVEL-RISE.ASP

II. Overarching Recommendation

This Report contains five recommendations, the first of which is the most crucial.

In order to secure a future that is resilient to threats of sea level rise, much detailed and truly comprehensive expert analysis must be undertaken in order to plan and design a robust capital plan: not just to update, but in a sense, to reinvent our urban infrastructure in a timely, sequenced manner to meet our future as it unfolds. In order to accomplish this, we need to start the process now. The following overarching recommendation is a critical first step.

RECOMMENDATION 1: The Sea Level Rise Task Force recommends accelerating the adaptation planning process by seeking and formally selecting the engineering and other relevant expertise needed to develop the robust capital plan, vetting the elements (i.e., flood protection, salinity structures, pump stations, road and bridge designs, etc., just to name a few possibilities) as well as what measurable indicators will trigger timely sequencing.

The plan, its development and its implementation must be fully collaborative, involving all levels of government. The framework for action should also include the South Florida Water Management District (District). The Southeast Florida Regional Climate Change Action Plan (RCAP) will also be essential as an overarching guide as implementation gets carried out. Involving the Re-Insurance Industry in the plan's development will facilitate their effective buy in. Carrying out this plan will be costly, but far less than the cost of inaction.

III. Laying the Foundation for Action

In 2006 the Miami-Dade Board of County Commissioners (BCC) created the Miami-Dade Climate Change Advisory Task Force (CCATF), comprised of eighteen individuals, a multi-disciplinary group of stake-holders and experts, tasked to make recommendations on the overall issue of Climate Change, focusing predominantly on adaptation. This group divided into sub-committees and directly involved hundreds of others in sixty-five separate meetings over the five-year period. At the time of their sunset, fifty-seven multi-part recommendations had been produced regarding needed steps relative to adaptation of natural systems, built environment, health and economic systems, as well as a series of Green House Gas mitigation recommendations (Appendix C – Miami-Dade County CCATF Members & Recommendations).

Many of these recommendations were incorporated into GreenPrint, Miami-Dade County's community-wide sustainability plan developed in 2010, and are currently being

implemented. The CCATF recommendations addresses the cross section of specific elements called for in Resolution # 599-13.

RECOMMENDATION 2: The Sea Level Rise Task Force recommends that the Miami-Dade Board of County Commissioners direct County administration to establish formal oversight, and dedicate sufficient resources and staffing to ensure implementation and update of the specific Climate Change Advisory Task Force (CCATF) recommendations.

In 2010, recognizing that climate change has little regard for man-made territorial boundaries, the four counties in southeast Florida formed the Southeast Florida Regional Climate Change Compact (Compact). Miami-Dade, Broward, Palm Beach and Monroe counties became the first, perhaps the only, neighboring local governments to collaborate on their common concerns about climate change. These four counties, comprised of over 100 cities and representing over 30 percent of the state's population, agreed to contribute staff, resources, and expertise to address climate change issues, including sea level rise. In October 2012, the Compact produced over one hundred recommendations in a well thought-out Regional Climate Action Plan for Southeast Florida (RCAP) (Appendix D – A Region Responds to a Changing Climate).[2]

Clearly this format provides a pathway structure to continue to build on.

In October, 2013, the Board of County Commissioners approved amendments in the County's Comprehensive Development Master Plan (CDMP) which incorporate language addressing climate change and sea level rise in over thirty Objectives and Policies of the Plan (Appendix E). This followed the CDMP 2011 Evaluation and Appraisal Report (EAR), as required per Florida statutes, when these issues were identified as priorities to address as part of the CDMP update. For example, CDMP Land Use Element Policies LU-3K and LU-3L focus on determining vulnerable areas that can be designated as Adaptation Action Areas, which will facilitate focused funding and adaptation planning in these areas to help mitigate impacts and build resilience to climate change and sea level rise. These CDMP policies now form a sound foundation for Miami-Dade County to actively incorporate these considerations into existing capital investment and infrastructure planning processes, and will continue to be evaluated and updated as part of the ongoing EAR process.

RECOMMENDATION 3: The Sea Level Rise Task Force recommends that Miami-Dade County implement the Adaptation Action Areas (AAA's) called for in the Comprehensive Development Master Plan (CDMP) and to incorporate sea level rise and storm surge risks utilizing best available data.

[2] Southeast Florida Regional Climate Change Compact (June11, 2012).
Retrieved from:
http://southeastfloridaclimatecompact.org/pdf/Regional@20Climate%20Action%20Plan%20Final%20ADA%20Compliant.pdf

The Board of County Commissioners has already taken a first bold step by unanimously adopting Resolution R-451-14 (Appendix F) on May 6, 2014, setting policy for Miami-Dade County by requiring all county infrastructure projects to consider the potential impact of sea level rise during all project phases and calling for an evaluation of existing infrastructure in the face of sea level rise. This action sets the stage for a fully comprehensive assessment and plan to provide an evolving infrastructure, resilient to a worst case scenario.

At the time of the submission of this Report, a proposed ordinance was pending before the BCC that would require inclusion of a statement regarding consideration of sea level rise for all agenda items related to planning, design and/or construction of County infrastructure. We urge passage of this ordinance as fully consistent with, and supportive of, this Sea Level Rise Task Force Report.

IV. Flooding Risk Due to Sea Level Rise, Storm Surge and Other Factors

About 90% of the excess heat due to Greenhouse Effect warming is absorbed by the ocean rather than the atmosphere or land. The basic science is that as water warms, it expands. This effect, coupled with ice loss from the Greenland and Antarctic ice sheets, are the fundamental causes of global sea level rise. In addition, as we lose reflective surface due to melting ice, we are seeing a feedback loop that increasingly reinforces the Greenhouse Effect and accelerates sea level rise.

Tide stations measure local sea level rise which refers to the height of the water as measured along the coast relative to a point on land. Because the heights of both the land (subsidence or uplift) and the ocean are changing, sea level in some locations is rising faster than the global average (e.g., New Orleans) while in other regions sea level my actually be falling (Alaska). By estimating present and future local rates of relative sea level change for a specific area based on observations and projections of global sea level rise, coastal managers and engineers can begin to analyze and plan for the impacts of sea level rise for comprehensive planning. Future land use decisions should reflect lessons learned from allowing development in vulnerable areas.

The Task Force chose to focus primarily on the next 50 years, to 2060, as our present planning horizon and relied heavily on the projections produced by the Southeast Florida Regional Climate Change Compact partners of two feet of sea level rise by 2060 (Figure 1 below). This projection was adopted by all four Compact counties as a guideline for planning purposes. The workgroup of experts convened by the Compact to develop this projection agreed to reconvene approximately every four years, or more often as needed,

to review new data and science to determine if the projection should be revised. The workgroup is expected to reconvene later in 2014. For longer range planning up to 2100, at least three feet of sea level rise should be utilized. Specific infrastructure and planning projects should design for the projected sea level during the life expectancy of a project.

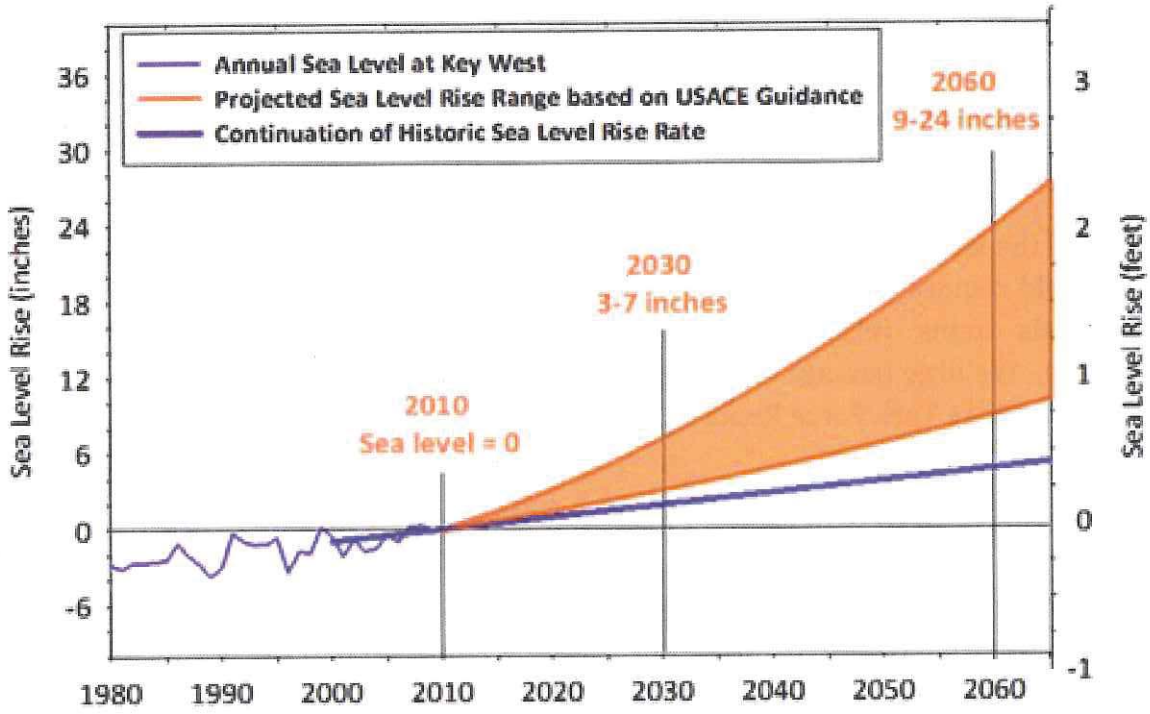

Figure 1 – The Southeast Florida Regional Climate Change Compact convened a group of experts in 2010 which reviewed the most current science and data and developed a sea level rise projection over time for the Southeast Florida region.

We must keep in mind that this is literally a moving target; sea level is no longer a constant and as new scientific research becomes available, the projections of the future rate of rise will also change. As we move forward, we will need to keep abreast of new information from key sources such as the Intergovernmental Panel on Climate Change (IPCC), the National Oceanic and Atmospheric Administration (NOAA), the U.S. Army Corps of Engineers (USACE) and the National Climate Assessment (NCA), and stay alert to events that could have a dramatic impact on the rate of sea level rise. Because the County is now confronted with a changing environment, the challenge is to craft flexible policies that can adapt to evolving needs.

Storm surge is an abnormal rise in sea level accompanying a hurricane or other intense storm, and whose height is the difference between the observed level of the sea surface and the tide level expected to occur in the absence of the storm. Storm surge can range from a few feet, up to fifteen to twenty feet in extreme cases, and typically lasts from several hours

up to a day. It is accompanied by large and destructive ocean waves, and will typically affect a specific stretch of shoreline, usually ten miles or less.

It is not possible to consider future storm surges without also accounting for the interacting effects of sea level rise. Although sea level rise is gradual (2-4 feet in this century) and less in magnitude than storm surge, it is always present, it affects shorelines everywhere and exacerbates the effects of storm surges when and where they occur. In the course of this century, sea level rise will eventually add up to one-fourth to one-half the magnitude of any storm surge that occurs on any parts of Miami-Dade County's coastline. Figure 2 below illustrates the disproportionate effect of a two-foot rise in sea level on a hypothetical storm surge accompanying a Category 3 Hurricane. Storm surge recedes, sea level rise does not.

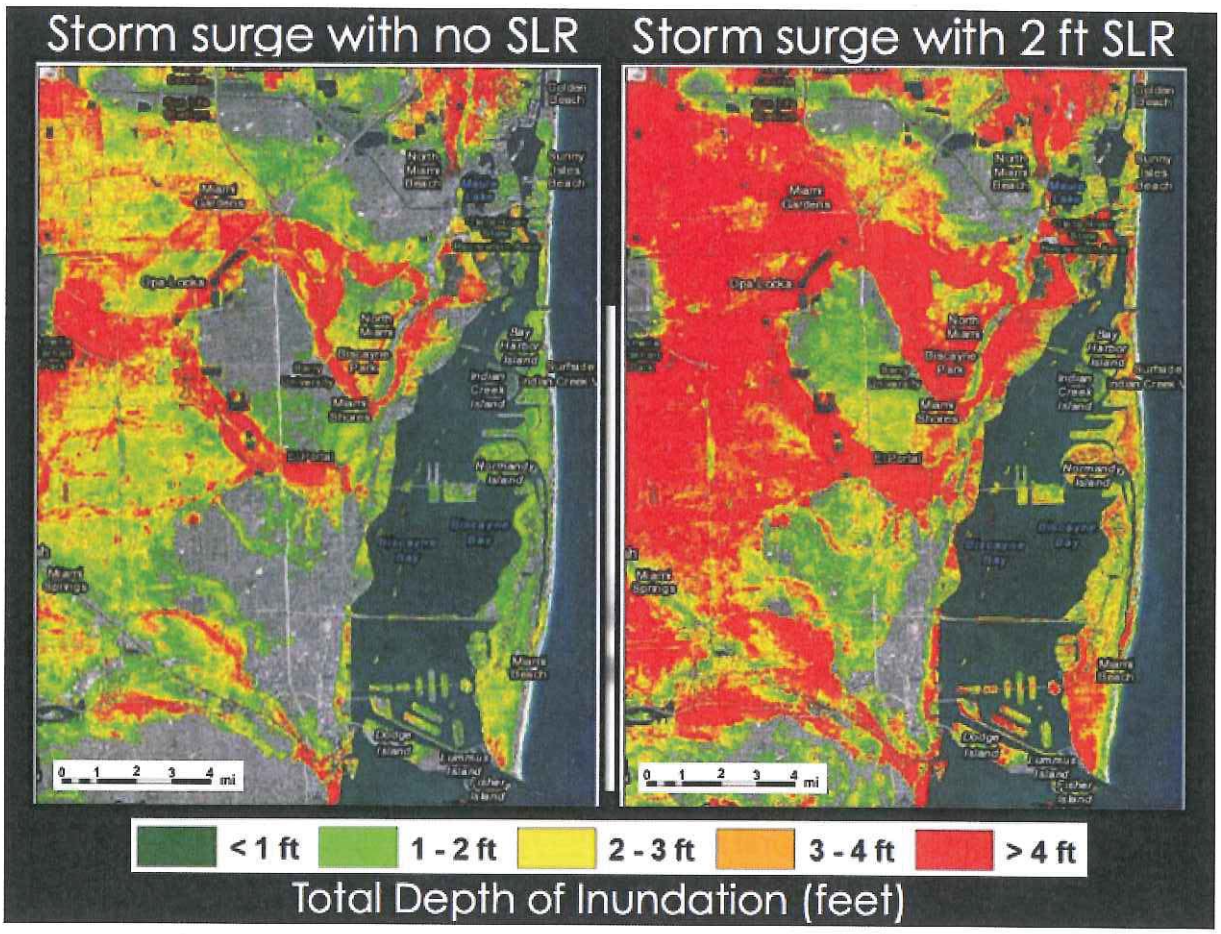

Figure 2 – Two images of Miami-Dade County showing the inundation from a hypothetical storm surge that would typically accompany a Category 3 Hurricane at high tide. On the left is the depth of surge as it would affect coastal and inland areas with present-day sea levels. On the right is the depth of surge as it would affect the same areas with an additional two feet of sea level rise if no adaptation measures are taken. Maps are based on the Sea, Lake, and Overland Surges from Hurricanes (SLOSH) surge model used by the National Hurricane Center. (Courtesy of Dr. Keren Bolter).

Depending on measures taken globally to mitigate the effects of Greenhouse Gases on the planet -- and how soon they are implemented -- the world and specifically Miami-Dade County are committed to a continued rise in sea levels beyond this century with the potential to permanently inundate large parts of the County. *Long before permanent inundation occurs, however, and perhaps within decades, flooding events will become progressively more frequent*, especially in low-lying areas, due to the exacerbating effect of higher sea levels on high tides, heavy rain events and storm surges. Other aspects of climate change, such as the expected increase in the intensity of rainstorms and hurricanes, will further exacerbate the impacts of flooding events. The best illustration of this is what we have already observed happening in Miami Beach over the last decade and a half. The annual number of flooding events in Miami Beach from all causes has been steadily increasing and will likely continue to increase to the point where some areas will need to be abandoned or re-purposed when insurance becomes unavailable or too expensive, and/or engineering measures can no longer mitigate against the problems. What is now happening in Miami Beach is the "*canary in the coal mine*" for what will inevitably occur in other low-lying areas of the county. Saltwater intrusion into the Biscayne Aquifer, the primary source of freshwater for Southeast Florida, is also a considerable threat with sea level rise, and steps must be taken to avoid or mitigate this potential impact.

RECOMMENDATION 4: While recognizing the recent efforts to address flood protection and saltwater intrusion by the South Florida Water Management District and the Miami-Dade County, the Sea Level Rise Task Force recommends that Miami Dade County work jointly with the District and the SE Climate Compact partners to conduct a comprehensive study and develop adaptation strategies to address potential flood damage reduction and saltwater intrusion associated with sea level rise. This strategy should expeditiously address rising sea levels, a time frame for implementation, and a potential funding mechanism.

Lands in public ownership are crucial to restoring hydrology and surface water levels, which can help reduce the threat of salt water intrusion. Wise land use planning and incorporating the benefits received from natural systems must be an essential part of a resilience strategy, and funds and legislative support are needed to complete the targeted acquisitions and protect these natural areas.

RECOMMENDATION 5: The Sea Level Rise Task Force recommends that Miami-Dade County's resiliency efforts must incorporate support for Everglades restoration, including making restoration a top priority for County lobbying efforts, and must strategically utilize and fully fund both acquisition and management needs for the County's Environmentally Endangered Lands Program (EEL).

Clearly, without adaptation, current ground levels and essential fresh water, flood, and drainage related systems will be critically compromised, if not overwhelmed.

V. Reinsurance Industry and Potential Economic Implications

Perhaps the most impactful presentation made to the Sea Level Rise Task Force came from representatives of the Re-Insurance Industry. Mark Way, Sustainability Director of Swiss Re, stated that the insured losses for the global insurance industry totaled $6.4 billion per year in the 1980's for weather related impacts. This has risen to $40 billion during the first decade of this century. Over the past six years, Swiss Re has been conducting research to assess the cost of adapting to severe weather impacts using a rigorous risk management approach to assess local total climate risk and included proposed adaptation measures to address total climate risk on an economic basis. Using predictive scenarios, this study estimated the expected losses for Southeast Florida by scenario and by hazard ranged from $17 billion, or 8.5 percent of Gross Domestic Product (GDP) in 2008, to $33 billion or 10% of GDP in 2030. This study also suggested the most cost-effective ways to minimize loss. According to the cost/benefit curve developed in this study for the Southeast Florida region, it is estimated that approximately $30 billion of the total expected loss in 2050 could be avoided if a comprehensive plan for adaptation were implemented. It was explained to the Task Force that adaptation policies implemented now will significantly lower the insurance costs to the County and its residents in the future, and in some cases avoid or postpone wholesale abandonment due to non-insurability or the high cost of premiums.

A recent report by the Geneva Association (Appendix G), the leading international think tank for strategically important insurance and risk management issues, concluded that Historic Climate Records are no longer reliable tools in either risk assessment or rate setting. Insurance rates are climbing and could soon become prohibitive: the cruelest "tax" of all.

RECOMMENDATION 6: Recognizing the need to develop insurance mechanisms that will provide real help to the victims of climate change impacts, The Sea Level Rise Task Force recommends that Miami-Dade County consider initiating discussions with private insurance and reinsurance professional organizations, member local governments in the Southeast Florida Climate Change Compact and the Florida Office of Insurance Regulation in the Department of Financial Services to develop long-term risk management solutions.

VI. Conclusion

With trillions of dollars of built environment and invaluable natural resources at stake in the region, the economic imperative to take action sooner rather than later is clear.

WE BELIEVE THAT WITHOUT A PROFESSIONALLY WELL THOUGHT OUT ADAPTATION PLAN IN PLACE, WE RISK LOSING INSURABILITY AND FINANCIAL SUPPORT FOR OUR FUTURE.

Although the need to begin is urgent, we are optimistic that with commitment we can continue to build a future South Florida that will not just remain viable, but one that will continue its emerging status as a vibrant world class Region.

Appendices

A. MIAMI-DADE BOARD OF COUNTY COMMISSIONERS RESOLUTION # 599-13

OFFICIAL FILE COPY
CLERK OF THE BOARD
OF COUNTY COMMISSIONERS
MIAMI-DADE COUNTY, FLORIDA

APPENDIX A

MEMORANDUM

Amended

Agenda Item No. 11(A)(12)

TO:	Honorable Chairwoman Rebeca Sosa and Members, Board of County Commissioners	**DATE:**	July 2, 2013
FROM:	R. A. Cuevas, Jr. County Attorney	**SUBJECT:**	Resolution creating the Miami-Dade Sea Level Rise Task Force; providing for membership, organization and procedures; setting forth purpose, function, responsibility, and sunset provision Resolution No. R-599-13

The accompanying resolution was prepared and placed on the agenda at the request of Prime Sponsor Chairwoman Rebeca Sosa.

R. A. Cuevas, Jr.
County Attorney

RAC/ jls

MEMORANDUM

(Revised)

TO: Honorable Chairwoman Rebeca Sosa
and Members, Board of County Commissioners

DATE: July 2, 2013

FROM: R. A. Cuevas, Jr.
County Attorney

Amended
SUBJECT: Agenda Item No. 11(A)(12)

Please note any items checked.

_____ **"3-Day Rule" for committees applicable if raised**

_____ **6 weeks required between first reading and public hearing**

_____ **4 weeks notification to municipal officials required prior to public hearing**

_____ **Decreases revenues or increases expenditures without balancing budget**

_____ **Budget required**

_____ **Statement of fiscal impact required**

_____ **Ordinance creating a new board requires detailed County Mayor's report for public hearing**

_____ **No committee review**

_____ **Applicable legislation requires more than a majority vote (i.e., 2/3's ____, 3/5's ____, unanimous _____) to approve**

_____ **Current information regarding funding source, index code and available balance, and available capacity (if debt is contemplated) required**

2

Approved _____ Mayor
Veto _____
Override _____

Amended
Agenda Item No. 11(A)(12)
7-2-13

RESOLUTION NO. R-599-13

RESOLUTION CREATING THE MIAMI-DADE SEA LEVEL RISE TASK FORCE; PROVIDING FOR MEMBERSHIP, ORGANIZATION AND PROCEDURES; SETTING FORTH PURPOSE, FUNCTION, RESPONSIBILITY, AND SUNSET PROVISION

WHEREAS, Southeast Florida is considered one of the most vulnerable areas of the country to suffer from the consequences of sea level rise; and

WHEREAS, Miami-Dade County is composed of a large section of water front property and is a low-lying coastal community at the frontline to experience the impacts of sea level rise; and

WHEREAS, Miami-Dade County has various vital facilities and infrastructure that could be adversely affected by sea level rise; and

WHEREAS, local and regional tide data show a trend of rising sea levels and more recent data and factors suggest this trend may accelerate in the future; and

WHEREAS, climate scientists and other groups such as the Southeast Environmental Research Center and the National Oceanic and Atmospheric Administration's Costal Services Center have predicted the potential erosion of dry land and loss of water front property in Miami-Dade County as a result of sea level rise; and

WHEREAS, according to the National Wildlife Federation and the Florida Wildlife Federation a mid-range sea level rise of fifteen (15) inches in Biscayne Bay would result in an

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85% loss of cypress swamp, a 33% loss of inland fresh marsh, a 79% loss of tidal flats, and a 54% loss of salt marsh; and

WHEREAS, Miami-Dade County has been in the forefront of these issues for many years; and

WHEREAS, sea level rise was identified as a major issue in the Comprehensive Development Master Plan (CDMP), 2003 Evaluation and Appraisal Report (EAR), approved by the Board of County Commissioners and as a result, policies have been proposed for amendment of the CDMP; and

WHEREAS, Miami-Dade County is a member of the Southeast Florida Regional Climate Compact; and

WHEREAS, a "Unified Sea Level Rise Projection for Southeast Florida" was developed by a Sea Level Rise Technical Ad Hoc Work Group of the Southeast Florida Regional Climate Compact; and

WHEREAS, the Board of County Commissioner had previously created the Miami-Dade Climate Change Advisory Task Force, established in July 2006 through the adoption of Ordinance 06-113, which served as an advisory board to the Board of County Commission on the issue of global warming climate change and was charged with identifying potential future climate change impacts to Miami-Dade County, while providing recommendations regarding mitigation and adaptation measures to respond to climate change; and

WHEREAS, the Miami-Dade Climate Change Advisory Task Force co-chaired the Interagency Climate Change Adaptation Task Force with the White House Council on Environmental Quality, the Office of Science and Technology Policy, and the National Oceanic

and Atmosphere Administration, and released its interagency report in October of 2010 outlining recommendations to the President of the United States for how Federal Agency policies and programs can better prepare the United States to respond to the impacts of climate change; and

WHEREAS, in 2010, Miami-Dade County was featured as a best practice case study — Adapting to Sea Level Rise in Miami-Dade County, Florida — as part of the National Oceanic and Atmospheric Administration's Digital Coast Initiative and Inundation Toolkit; and

WHEREAS, the Miami-Dade Climate Change Advisory Task Force, sunset and dissolved in 2011, pursuant to Ordinance 06-113; and

WHEREAS, the City of Miami Beach has developed a Stormwater Master Plan in 2012 with estimated costs of over $206,000,000 in infrastructure needs for its drainage system, which is being increasingly compromised by sea level rise; and

WHEREAS, local, regional and national news media outlets have recently featured numerous stories with varied predictions on Southeast Florida's vulnerability to sea level rise; and

WHEREAS, it is desirable to create a Miami-Dade County focused task force to review existing studies, scientific reports, and other relevant information to determine the current realistic impact of sea level rise on Miami-Dade County vital facilities, real estate, water front property, vital water resources, and infrastructure,

NOW, THEREFORE, BE IT RESOLVED BY THE BOARD OF COUNTY COMMISSIONERS OF MIAMI-DADE COUNTY, FLORIDA, that:

Section 1. Creation. There is hereby created the Miami-Dade Sea Level Rise Task Force.

Section 2. Purpose. The purpose of the Miami-Dade Sea Level Rise Task Force is to review the relevant data and prior studies, assessments, reports, and evaluations of the potential impact of sea level rise on vital public services and facilities, real estate, water and other ecological resources, water front property, and infrastructure, and to provide a comprehensive and realistic assessment of the likely and potential impacts of sea level rise and storm surge over time, which shall be used to help develop a set of recommendations relative to amendments to the Comprehensive Development Master Plan, capitol facilities planning, budgetary priorities and other County programs as necessary to ensure that Miami–Dade County is taking all appropriate actions to reduce its contributions to climate-induced sea level rise and to ensure its resiliency to that increase in sea level rise, storm surge and related impacts which are expected to occur.

Section 3. Limitations on Authority. The Miami-Dade Sea Level Rise Task Force is advisory only and shall not have the power or authority to commit Miami-Dade County or any of its agencies or instrumentalities to any policies, incur any financial obligations or to create any liability, contractual or otherwise, on behalf of Miami-Dade County or any of its agencies or instrumentalities.

Section 4. Membership. The Miami-Dade Sea Level Rise Task Force shall consist of six (6) members who reside in Miami-Dade County. At least (1) member of the Miami-Dade Sea Level Rise Task Force shall possess an expertise in civil engineering with a focus on infrastructure. At least (1) one member shall possess an expertise in community and real estate development. At least (1) one member shall possess expertise in one or more of the following areas: climatology; geophysics; coastal management, oceanography or coastal ocean science. At

least (1) one member shall possess expertise in emergency management. At least (1) one member shall possess expertise in economics. The sixth (6th) member shall be Harvey Ruvin, the Clerk of Courts. The members should have reputations for integrity and community service. The members shall be appointed in the following manner:

(a) Within thirty (30) days of the effective date of this resolution each member of the Miami-Dade County Board of County Commissioners may nominate experts to be considered for service on the Miami-Dade Sea Level Rise Task Force by providing those names to Harvey Ruvin, the Clerk of Courts;

(b) Within thirty (30) days of the effective date of this resolution interested experts may submit their qualifications to be considered for service on the Miami-Dade Sea Level Rise Task Force to Harvey Ruvin, the Clerk of Courts;

(c) If Harvey Ruvin has not received more than a total of six (6) nominations from the Miami-Dade County Board of County Commissioners and submissions from interested experts within thirty (30) days of the effective date of this resolution, Harvey Ruvin shall immediately notify the Clerk of the Board of County Commissioners in writing. The Clerk of the Board shall immediately notify the Miami-Dade County Board of County Commissioners and the deadline for nominations and submissions shall be extended by fifteen (15) days.

(d) Harvey Ruvin shall ensure that the nominees are qualified to serve and that the nominees meet the criteria set forth in this Section. Within four (4) days of the deadline for the submission of expert nominations, Harvey Ruvin shall forward the names of all qualified nominees to the Clerk of the Board of the Miami-Dade

County Board of County Commissioners. In addition to forwarding all qualified nominees to the Clerk of the Board of the Miami-Dade County Board of County Commissioners, Harvey Ruvin may make recommendations to the Miami-Dade County Board of County Commissioners from the qualified nominees for service on the Miami-Dade Sea Level Rise Task Force.

(e) Within thirty (30) days of the receipt of the list of qualified nominees prepared by Harvey Ruvin, the Miami-Dade County Board of County Commissioners shall select the five (5) additional members to serve on the Miami-Dade Sea Level Rise Task Force;

(f) The Miami-Dade County Board of County Commissioners shall consider all qualified nominations as compiled by Harvey Ruvin in making the selection of who shall serve on the Miami-Dade Sea Level Rise Task Force;

(g) The Miami-Dade County Board of County Commissioners shall ensure a diversity of scientific experts in making the selection of who shall serve on the Miami-Dade Sea Level Rise Task Force;

(h) The Miami-Dade County Board of County Commissioners shall ensure that the membership of the Miami-Dade Sea Level Rise Task Force reflects the diversity of the community;

(i) The same day the five (5) additional members of the Miami-Dade Sea Level Rise Task Force are selected by the Miami-Dade County Board of County Commissioners, the Miami-Dade County Board of County Commissioners shall select one (1) member of the Miami-Dade Sea Level Rise Task Force to serve as

chairperson and one (1) member of the Miami-Dade Sea Level Rise Task Force to serve as the vice chairperson.

Any member, chairperson, or vice chairperson who ceases to meet the membership requirements set forth above shall immediately forfeit his or her position on the Miami-Dade Sea Level Rise Task Force. Any member vacancies on the Miami-Dade Sea Level Rise Task Force shall be filled in the manner provided for in the initial appointment. In the event of a chairperson vacancy, the vice chairperson shall conduct the next meeting and the members of the Miami-Dade Sea Level Rise Task Force shall select a new chairperson at that meeting. In the event of a vice chairperson vacancy, the chairperson shall conduct the next meeting and the members of the Miami-Dade Sea Level Rise Task Force shall select a new vice chairperson at that meeting.

Section 5. Organization and procedures at meetings. The Miami-Dade Sea Level Rise Task Force may establish, adopt, and amend bylaws, rules, and regulations for its own governance. The chairperson and vice chairperson shall serve at the will of the Miami-Dade Sea Level Rise Task Force. The chairperson shall preside at all meetings at which he or she is present. The vice chairperson shall act as chairperson in the absence or inability of the chairperson.

In order to transact any business or to exercise any power vested in the Miami-Dade Sea Level Rise Task Force, a quorum consisting of a majority of those persons duly appointed to the Miami-Dade Sea Level Rise Task Force shall be present. The members of the Miami-Dade Sea Level Rise Task Force shall serve without compensation.

Section 6. Regulations. All proceedings of the Miami-Dade Sea Level Rise Task Force shall be conducted in accordance with the Government in the Sunshine Law (Sec. 286.011,

Fla. Stats.) and the Citizens Bill of Rights of the Miami-Dade County Home Rule Charter. The Miami-Dade Sea Level Rise Task Force shall be deemed an "agency" for purposes of the Public Records Law. The Miami-Dade Sea Level Rise Task Force shall be governed by all State and County conflict of interest laws, as applicable, including the Miami-Dade County Conflict of Interest and Code of Ethics Ordinance, Section 2-11.1 the Code of Miami-Dade County. The Miami-Dade Sea Level Rise Task Force shall meet within fifteen (15) days of the appointment of its members, and shall meet no less than every thirty (30) days from the date of the initial meeting. Additional meetings may be held at the discretion of the Miami-Dade Sea Level Rise Task Force.

Section 7. Reports. The Miami-Dade Sea Level Rise Task Force shall strive to provide its report setting forth its findings and recommendations to the Board of County Commissioners within ninety (90) days from the date of the Miami-Dade Sea Level Rise Task Force first meeting. The report submitted shall consist of a comprehensive assessment of the realistic impacts of sea level rise and storm surge on vital public services and facilities, water and other ecological resources, water front property, real estate, and infrastructure over time. These shall then be used to help develop a set of recommendations relative to amendments to the Comprehensive Development Master Plan, capitol facilities planning, budgetary priorities and other County programs as necessary to ensure that Miami–Dade County is taking all appropriate actions to reduce its contributions to climate-induced sea level rise and to ensure its resiliency to that increase in sea level rise, storm surge and related impacts which are expected to occur. If during the preparation of the report the Miami-Dade Sea Level Rise Task Force requires additional time to complete the report, the Miami-Dade Sea Level Rise Task Force shall provide

a written request for additional time to the Clerk of the Board of County Commissioners no later than fifteen (15) days prior to the report due date. The Miami-Dade Sea Level Rise Task Force may request additional time up to one-hundred-forty (140) additional days to complete the report. Upon receipt of the written request for additional time to complete the report, the Clerk of the Board of County Commissioners shall place the request on the next Board of County Commissioner's agenda.

Section 8. Staff. The Miami-Dade Sea Level Rise Task Force shall be provided adequate staff and support services by Miami-Dade County. The staff shall maintain and keep records of the Miami-Dade Sea Level Rise Task Force; prepared in cooperation with the chairperson, the agenda for each meeting; be responsible for the preparation of such reports, minutes, documents, or correspondence as the Miami-Dade Sea Level Rise Task Force may direct; and generally administer the business and affairs of the Miami-Dade Sea Level Rise Task Force, subject to budgetary limitations. The Miami-Dade Sea Level Rise Task Force may request the Board of County Commissioners to provide such other specialized consulting expertise as it may determine are necessary from time to time. The County Attorney's Office shall provide legal counsel, as needed, to the Miami-Dade Sea Level Rise Task Force.

Section 9. Sunset. The Miami-Dade Sea Level Rise Task Force shall sunset and stand dissolved within thirty (30) days of the issuance of their report or within three-hundred-sixty-four (364) days of the passing of this Resolution, whichever occurs first.

The Prime Sponsor of the foregoing resolution is Chairwoman Rebeca Sosa. It was offered by Commissioner **Rebeca Sosa**, who moved its adoption. The motion was seconded by Commissioner **Dennis C. Moss** and upon being put to a vote, the vote was as follows:

Rebeca Sosa, Chairwoman			**aye**
Lynda Bell, Vice Chair			**aye**
Bruno A. Barreiro	**aye**	Esteban L. Bovo, Jr.	**absent**
Jose "Pepe" Diaz	**aye**	Audrey M. Edmonson	**aye**
Sally A. Heyman	**aye**	Barbara J. Jordan	**absent**
Jean Monestime	**aye**	Dennis C. Moss	**aye**
Sen. Javier D. Souto	**aye**	Xavier L. Suarez	**aye**
Juan C. Zapata	**aye**		

The Chairperson thereupon declared the resolution duly passed and adopted this 2nd day of July, 2013. This resolution shall become effective ten (10) days after the date of its adoption unless vetoed by the Mayor, and if vetoed, shall become effective only upon an override by this Board.

MIAMI-DADE COUNTY, FLORIDA
BY ITS BOARD OF
COUNTY COMMISSIONERS

HARVEY RUVIN, CLERK

By: ***Christopher Agrippa***
Deputy Clerk

Approved by County Attorney as
to form and legal sufficiency.

Christopher A. Angell

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B. LIST OF PRESENTATIONS/PRESENTERS TO MIAMI-DADE SEA LEVEL RISE TASK FORCE

Miami-Dade County Sea Level Rise Task Force Meetings & Presentations

Meeting Date	Presenter Name & Title	Affiliation	Presentation Title
November 21, 2013	Dr. Nancy Gassman, Natural Resources Administrator, Energy & Sustainability Program	Broward County Natural Resources Planning & Management Division	*Climate 101 – A Quick Users Guide to Understanding Sea Level Rise*
	Mr. Mark Woerner, AICP, Assistant Director for Planning	Miami-Dade County Regulatory & Economic Resources Department	*Southeast Florida Regional Climate Compact Overview*
	Ms. Debbie Griner, Sustainability Initiatives Coordinator, Office of Sustainability	Miami-Dade County Regulatory & Economic Resources Department	*GreenPrint Overview & Progress Update on Local and Regional Climate Action Recommendations and Plans*
December 20, 2013	Mr. Tommy Stroud. P.E., Assistant Executive Director, Operations, Maintenance & Construction	South Florida Water Management District	*Implications of Sea Level Rise on Water Management*
	Ms. Marcia Steelman, CFM, Engineer 3	Miami-Dade Public Works and Waste Management Department	*Miami-Dade's Stormwater Master Planning program*
	Ms. Virginia Walsh Sr. Professional Geologist	Miami-Dade Water and Sewer Department	*The WASD/USGS Surface Water/Stormwater Interface GIS model*
	Dr. Douglas Yoder Deputy Director	Miami-Dade Water and Sewer Department.	*Miami-Dade Water and Sewer Dept. Planning for Sea Level Rise*
February 11, 2014	Mr. Mark Way and Mr. Alex Kaplan	Swiss Re America Holding Corporation	*Climate Change and Resilience Building a Reinsurer's Perspective*
	Mr. Jeb Brugmann Partner	The Next Practice	*Kick-starting the Resilient City*
March 7, 2014	Mr. Dan Kimball, Park Superintendent, Everglades National Park & Dr. Erik Stabenau, Oceanographer & Coastal Ocean Modeler	National Park Service, South Florida Natural Resources Center	*Connecting Everglades Restoration with Sea Level Rise Mitigation*
	Ms. Lauren Ordway Associate Director Philanthropy Florida Chapter	The Nature Conservancy	*The Role Natural Infrastructure Plays in Coastal Resilience and Risk reduction*
	Mr. Paul Voight, PG Intergovernmental Affairs Administrator	Environmental Resources Management, Regulatory and Economic Resources Department	*Preserving Our Natural Resource Resilience*
March 19, 2014	Mr. John Englander, Oceanographer, Consultant and Author		*Miami-Dade & Sea Level Rise*

Miami-Dade County Sea Level Rise Task Force Meetings & Presentations

April 4, 2014	**Dr. David Enfield** **Oceanographer**	**University of Miami**	***Overview of IPCC-AR5 Sea Level Rise Projections and the Implications***
	Mr. Glenn Landers Civil Engineer	U.S. Army Corps of Engineers, Planning and Policy Division, Jacksonville, Florida	*Sea Level Change and Long Range Water Resources Planning for Florida*

C. MIAMI-DADE COUNTY CLIMATE CHANGE ADVISORY TASK FORCE MEMBERS AND RECOMMENDATIONS

Miami-Dade County Climate Change Advisory Task Force

Appointed Members

Clerk Harvey Ruvin, Chairperson Mr.
Jim Murley, Vice-Chairperson

- Leo A. Daly
- Dr. Adriana Cantillo, Chemist, National Oceanic and Atmospheric Administration (Retired)
- Ms. Carolyn Dekle, Executive Director, South Florida Regional Planning Council
- Mr. Marcus A. Frankel, President, Frankel Benayoun Architects, Inc.
- Mr. Jose Fuentes, South Florida Director, The Fuentes Consulting Group, LLC
- Ms. Jane Gilbert, High Impact Integrated Solutions
- Dr. Hugh Gladwin, Director, Institute of Public Opinion Research, Florida International University
- Ms. Cynthia Guerra, Program Director, Environmentally Endangered Lands, Miami-Dade County
- Mr. Alberto Harum-Alvarez, SmallCo
- Mr. Ed Hernandez, South Florida Water Management District Regional Service Center Director
- Mr. Dan Kimball, Superintendent, Everglades National Park
- Capt. Dan Kipnis, Director At Large, Florida Wildlife Federation
- Mr. Arsenio Milian, President, Milian, Swain & Associates, Inc.
- Mr. Tony Moss, Esquire, Law Office of Tony Moss, Inc.
- Mr. Jim Murley, Director, Center for Urban & Environmental Solutions, Florida Atlantic University
- Mr. Guillermo Olmedillo, Urban & Regional Planner, OLMEDILLO X 5, Inc.
- Dr. Jack Parker, Environmental Studies Department, Florida International University
- Mr. Richard Pettigrew, Former Chair, Governor Chile's Commission on a Sustainable South Florida
- Ms. Elizabeth Plater-Zyberk, Principal, Duany Plater-Zyberk & Company, LLC
- Mr. Rafael Rodan, Executive Vice President, Flagler Development
- Mr. Manny J. Rodriguez, P.E., Miami Dade Regional Director, Florida Power and Light
- Mr. Harvey Ruvin, Clerk of Courts, Miami-Dade County
- Dr. Hal Wanless, Professor and Chair, Department of Geological Sciences, University of Miami
- Mr. Keqi Zhang, Director, Laboratory for Coastal Research, Florida International University

CLIMATE CHANGE ADVISORY TASK FORCE
RECOMMENDATIONS -FINAL

Recommendation#	Recommendation
	Science Recommendations
A1	The County should use the Science Committee's Statement on Sea Level in the Coming Century to guide future climate change mitigation and adaptation policy.
A2	The County should commission detailed maps for all of Miami-Dade County created from calibrated LIDAR (Light Detection and Ranging) surveys (or other elevation survey technology that employs best known practices). The maps will allow identification of which areas will become flooded in association with different sea levels.
	GHG Recommendations
B1	Ordinances related to the award/allocation of taxicab medallions include a requirement for all new medallions issued after January 1, 2008 to be allocated to hybrid or other vehicles having a combined average fuel efficiency of 28 MPG or higher
B2	Require that taxicabs being retired be replaced with new hybrid or other vehicles having a combined average fuel efficiency of 28 MPG or higher. Implementation of this recommendation is expected to affect 300 owners each year. The County should develop a financing mechanism to either subsidize the initial purchases or provide a revolving loan fund to assist owners to purchase new hybrids on reasonable terms and at reasonable interest rates.
B3	It is recommended that Miami-Dade County regularly evaluate greenhouse gas emission reductions and the net environmental benefit of each fuel and vehicle under consideration for purchase and use in internal operations in order to ensure the use of the most efficient vehicles and sustainably-sourced alternative fuels, including those that are locally produced, and adjust investment accordingly. Net environmental benefit shall be determined.
B4	Procurement Management Department should take necessary steps to improve pricing and access to sustainably-sourced alternative fuels and high efficiency vehicles for County operations. This would include forming a joint committee or committees to pursue collective purchasing opportunities and to evaluate the costs and benefits of collective bids.

Recommendation#	Recommendation
	GHG Recommendations
B5	The Climate Change Advisory Task Force recommends that as Miami-Dade County fueling facilities are built, modified, or upgraded, they be designed and constructed to accommodate alternative fuels, including, but not limited to, E85 and B100. In addition, the County should consider dispensing E85 at two Miami-Dade County fueling stations within 6 months of it becoming locally available as determined by the process described in Recommendation B.3. It is recommended that Miami-Dade re-evaluate the use of E85 six months after dispensing is initiated to assess local availability, overall net costs and environmental impacts. Furthermore, new vehicles being purchased now and in the future by Miami-Dade County should have the capability of using ethanol and biodiesel, without the need for retrofit.
B6	Require the use of sustainably-sourced biodiesel in all County diesel fleet vehicles and equipment (except standby equipment) as determined by the process described in Recommendation B.3, starting with B5 and increasing to B20 in 6 months. The Climate Change Advisory Task Force recommends that a portion of the local option gasoline tax be used to offset the cost difference for biodiesel.
B7	Require that Miami-Dade County develop a vehicle procurement process, which ensures that vehicles owned by MDC increase their mpg by 5% annually per vehicle class (whenever higher MPG vehicles are available) and that the cost of carbon emissions is included in the life cycle cost analysis process.
B8	The purchase of a hybrid SUV shall be an allowable alternative for Miami-Dade County fleet procurement if that vehicle is determined to be more fuel-efficient than a light truck or comparable vehicle.
B9	Direct the Office of Sustainability to initiate an energy and fuel conservation incentive and awareness campaign for employees. Department. This campaign should use information from the Chicago Climate Exchange membership, the Climate Change Advisory Task Force (CCATF) Science Committee, and other pertinent sources toconservation incentive and awareness campaign for employees in conjunction with the Miami-Dade County's Resource Conservation Committee, DERM's Pollution Prevention and Environmental Education work groups, and GSA.
B10	The Climate Change Advisory Task Force supports recommendations put forth as a result of the most recent Miami-Dade County fleet analysis that lead to an increase in fleet fuel efficiency and a reduction in vehicle miles traveled (VMT). The Task Force recommends that the County further strengthen these recommendations by creating incentives to reduce VMT and by not excluding any departments or vehicle types initiatives. As an example, it is recommended that hybrid sedans be purchased for non-pursuit police vehicles at the time of replacement.

Recommendation#	Recommendation
	GHG Recommendations
B11	The Task Force recommends that Miami-Dade County implement the following steps to ensure their ability to meet the Cool Counties greenhouse gas reduction commitments: i. Commit to a 20% reduction in GHG emissions by 2020 through an annual 2% reduction from the base year of 2005 for both County government and County-wide GHG emissions. Provide annual reporting on greenhouse gas emissions for the County government and Countywide GHG emissions. This annual report should include steps taken to reduce GHG emissions internally and geographically, results, and steps needed to meet the next year target. ii. Recognize this commitment takes dedicated resources to develop, implement and report on these plans. The County Manager intends to adequately resource this initiative to achieve targets established in the Cool Counties resolution and in paragraph (i) of this resolution. iii. The County establish a countywide alliance of municipalities and large corporations, public and nonprofit institutions that will need to collaborate in order to meet previously established targets. This consortium will be used to: a. Enlist partners to explicitly adopt all primary goals of the Cool Counties GHG reduction targets and to report on their own GHG reductions. b. Identify and implement strategies for the financing and performance of energy efficiency and renewable energy upgrades in Miami Dade County/South Florida, c. Increase purchasing power of energy efficiency related financing, services and products, and d. Enlist partners to assist with the dissemination of information and incentives designed to assist individuals and small businesses in meeting these reduction goals. (This alliance could also be used to coordinate Countywide adaptation).
B12	The CCATF recommends that Miami-Dade County implement the following in order to promote energy conservation and efficiency in buildings owned by Miami-Dade County and support Resolution R-228-09 (Resolution to Reduce Miami-Dade County's Electrical Energy Consumption): 1. Conduct a feasibility study and develop a plan for retrofitting all County-owned outdoor lighting to high efficiency lighting technologies. The study should include a review and summary of current standards and case studies of implementation in other communities. High efficiency light options to be considered may include: Light emitting diodes (LED), induction lighting, with a preference given to solar powered lights. Additionally, an evaluation should be made to improve the efficiency of outdoor lighting with the goal to reduce non-essential outdoor lighting during daytime hours.

Recommendation#	Recommendation
	GHG Recommendations
	2. Require that all county buildings that annually consume more than 500,000 kilowatt hours (kwh) and have not received a comprehensive energy audit in the last 5 years, receive a comprehensive energy audit and/or retro commissioning, with the intent of identifying energy saving and carbon footprint reducing opportunities. 3. Require that all County departments include their goals and plans for greenhouse gas reduction and climate change adaptation in their strategic plans and that each Department Director's performance evaluation include a reporting on outcomes. Present sustainability award to Departments and Directors that achieve most impressive results. One department (e.g., Office of Sustainability, DERM and/or GSA) could be responsible for providing strategies, tools and resources to each department to assist departments in achieving their reduction goals.
B.13	The CCATF recommends that Miami-Dade County continue to support funding opportunities available through the American Recovery and Reinvestment Act (ARRA) and other federal programs to retrofit homes, commercial, and housing facilities for energy and water efficiency, and educate residents and homeowners about conservation. The following should be included in order to optimize, leverage, and facilitate energy conservation federal programs and funding. including but not limited to Neighborhood Stabilization Program, Weatherization programs, Public Housing Capital improvements, Community Development Block Grants, Community Services Block Grants, and homelessness prevention. 1. Incorporate educational, behavioral, and operational training programs with all retrofit and renovation options. 2. Monitor and analyze results of retrofits to include but not be limited to obtaining an energy rating of all renovated homes and public housing facilities. 3. Use some or all of the funds created from the resale of foreclosed and renovated homes for further development and promotion of energy and water efficiency outreach programs. 4. Maximize the use of Smart Meters to monitor results and compliment behavioral programs.

Recommendation#	Recommendation
	GHG Recommendations
B 14	The CCATF recommends that Miami-Dade County develop incentives for energy and water efficiency, conservation, and distributed low- and no-carbon energy generation for existing residential, industrial, and commercial buildings. The CCATF recommends that the County: 1. Explore development of a public/private partnership that would provide financing and technical assistance to smaller scale commercial, multifamily and residential facilities to retrofit homes for improved energy and water efficiency. This should support current and future technologies (e.g., metered charging stations in parking garages for electric vehicles and roof hook ups for PV, and, where feasible, the installation of renewable energy technologies such as solar water heaters). 2. In the short term, identify potential partners to develop and implement a financing solution for solar water heaters similar to Lakeland Electric. 3. Analyze and maximize GHG reduction opportunities through all county services to residents and businesses. 4. Work with FPL on the installation of a real-time, web-based smart meter program in County government and other large institutions. 5. Promote the use of green roofs, e.g. vegetative roofing, high reflectivity roofing materials, etc.
B.15	The CCATF recommends that Miami-Dade County educate the business sector and the public on energy and water efficiency and conservation. The CCATF recommends that this would best be accomplished if Miami-Dade County collaborates with corporate, nonprofit, and educational organizations to develop a broad scale and culturally competent media and community based educational campaign dedicated to promote the adoption of conservation, efficiency and renewable behaviors, systems and technologies in residences and businesses. CCATF suggests that this educational campaign should: 1. Inform residents and the business sector of the economic benefits of, and resources available for, energy efficiency and appropriate renewable technologies (e.g., green roofs, solar water heaters, smart meters, etc.). 2. Develop two separately designed and targeted campaigns and approaches: one for residents and one for business. For consumer/resident examples, refer to the Home Energy Saver (attached) and Green Homes Challenge (attached) descriptions. For a business example see www.e4s.org, the Entrepreneurs for Sustainability website. 3. As part of this education campaign, include information about the Energy Gauge performance rating system for new and existing commercial and residential buildings and encourage property buyers to ask for the rating.
B.16	WASD is the County's highest consumer of electricity and one of the highest consumers in the State of Florida. The CCATF recommends that Miami-Dade County undertake an assessment of the County's water and sewer rates and conservation/efficiency programs. The County should:

Recommendation#	Recommendation
	GHG Recommendations
	1. Conduct a long term comparative cost/benefit analyses on the combination of increasing electricity and water generation vs. ramping up conservation and efficiency programs. The CCATF recognizes that both options may be necessary but a preference should be given to increasing conservation and efficiency. 2. Provide consumer education on the current comparatively low rates they have enjoyed and the need for increasing rates to pay for efficiency and conservation efforts. The goal of this education is to build voter acceptance that increased rates are essential to maintaining and improving the quality of life here. 3. Determine the feasibility of using Miami-Dade County's Water and Sewer Department (WASD) facilities for installation of renewable energy technologies, including for water and sewer operations.
B.17	Recognizing that support at the state and federal level are important in facilitating action at the local level, the Climate Change Advisory Task Force recommends that Miami-Dade County advocate that: 1. The Florida Public Service Commission require FPL to achieve at least a 20% reduction in GHG generation from the 2005 baseline by 2020. This would include incorporating the costs of the proposed nuclear power plants by Florida Power and Light at Turkey Point in the comparative costs and benefits of energy efficiency and renewable energy systems and improve and expand incentive structures for energy efficiency, energy conservation and renewable generation. These incentive structures need to promote both customer owned and utility owned energy efficiency and demand side renewable energy systems. Additionally, the cost benefit analysis needs to place a greater emphasis on reducing overall energy consumption, not just capacity reduction, to achieve greater reduction in greenhouse gas emissions. 2. The Florida Building Commission, the Energy Technical Advisory Committee, and the 2010 Energy Code Work Group work to ensure that new construction and significant renovations and replacement equipment requirements increase energy efficiency and promote renewable by requiring a combination of methods and elements to include: solar water heaters, photovoltaic panels, shading devices, vegetative roofing, controllers and monitoring equipment, best practices and quality installation procedures such as HVAC sizing and duct testing, pre-wiring of buildings to accommodate future GHG reducing technologies such as monitoring devices, HVAC zoning, centralized data centers and distributed renewable power sources on rooftops and metered charging outlets in parking garages for electric vehicles. Advocate for the use of green building standards including the National Association of Homebuilders' (NAHB) Green Building Standards and the Florida Green Building Coalition as one of several model options that can be used to reduce GHG emissions and promote energy efficiency.

Recommendation#	Recommendation
	Built Environment Adaptation
	3. Florida and/or the United States pass an energy efficiency resource standard (EERS), a target that will help utility companies reduce electricity usage by 15%. 4. State and Federal Renewable Portfolio Standards of at least 20% by 2020 be implemented. 5. The Federal Clean Energy bill includes a goal of reducing GHG reduction by 20% from 2005 by 2020. (This would parallel's the County's current target.) 6. Federal appropriations for the Energy Efficiency Conservation Block Grant (EECBG) program are continued, at least at current levels.
C1	Require all County agencies (and entities that receive County funding for significant infrastructure or built investments) to assess climate change impacts on the agency's/entity's responsibilities. This assessment should be incorporated into their master planning agenda or such a planning process should be initiated if it does not exist. The assessment should include the impact of sea level rise on all public investments and identification of vulnerabilities in order to produce strategies for mitigation and adaptation. These assessments should utilize a 50-year planning horizon.
C2	Use County charter authority to establish minimum criteria and standards related to climate change (including sea level rise), for public investment for all municipalities in Miami-Dade County.
C3	Expand the mission of the County's Office of Sustainability (OOS), and thus its resources and staffing, to provide a centralized agency for climate change information, monitoring, analysis, and benchmarking. (Note: also see Recommendation F.4) a.) Establish a base case of information at an identified current or recent past date, to which all ensuing data might be compared; b.) Assist in integrating the activities of the various entities including the coordination of data collection so that it can be used across departments/disciplines for analysis and comparison; and determine the appropriate metrics for critical issues; c.) Monitor the effects of climate change on Miami-Dade County using the evolving data base, and publish the results for use by elected leaders, public agencies, and the general public.

Recommendation#	Recommendation
	Built Environment Adaptation
C4	The CCATF recommends that Miami-Dade County use the on-going cycle of the Evaluation and Appraisal Report to include amendments to the Comprehensive Development Master Plan that will further the principles of Smart Growth (www.smartgrowth.org)
C5	The County should begin a process of planning and public education, coordinated with the South Florida Regional Planning Council and the Metropolitan Planning Organization that integrates the mapping of projected sea level rise and storm surge impacts with the locations of infrastructure and other public investment, and with the locations of projected growth and development. The goal is to ensure the safety and resilience of public investment, and to consolidate private investment on transit-served high ground.
C6	The CCATF recommends that Miami-Dade County (by its departments of Planning and Zoning, DERM, MPO, and Public Works) develop a memorandum of understanding for integrated planning efforts with the Florida Department of Transportation and the South Florida Regional Planning Council.
	Natural Systems Adaptation
C7	The CCATF recommends that Miami-Dade County develop mandates and incentives for building designs that meet green building standards such as those established by Energy Star, the Florida Green Building Coalition, the U.S. Green Building Coalition (USGBC) Leadership in Energy and Environmental Design (LEED) or the National Association of Home Builders (NAHB) Green Building Standards. These standards must comply with the Florida Building Code and not conflict with the Comprehensive Development Master Plan. If the County does develop such mandates and incentives, the CCATF further recommends that: ° Buildings eligible to receive an EPA rating using Energy Star's Portfolio Manager, should achieve an energy performance rating of at least 70. ° Buildings not eligible to receive an EPA rating using Portfolio Manager, demonstrate energy efficiently in at least the 20th percentile for typical buildings of similar type using benchmarking against national median energy source data provided in the Portfolio Manager tool.
C8	The CCATF recommends that Miami-Dade County advocate for amendments to the Florida Building Code that will reduce the impact of greenhouse gas emission and improve climate change resiliency.

Recommendation#	Recommendation
	Natural Systems Adaptation
D2	Increase funding and resources for land acquisition and management programs of Miami-Dade County. Investigate new and creative mechanisms to boost funding, such as the creation of a County-administered "carbon credit purchasing" program, as a potential alternative to current development, industry, and government mitigation requirements.
D3	Acquire all undeveloped lands needed for restoration purposes and for mitigation and adaptation to climate change effects. Secure strategic open lands to provide transition zones to accommodate retreat or spatial shifts in natural areas, such as coastal wetlands and freshwater marshes.
D4	Create a plan to locate infrastructure and development outside coastal or flood hazard prone areas using projections of sea level rise to identify those areas. Describe a transitional zone between the hazard area and the built area to be protected and prohibit incompatible land uses that would convert open lands in the transitional zone. Establish a comprehensive planning and zoning policy, such as development setbacks and limits on density and infrastructure in coastal and transitional zones to consider vulnerability to sea level rise and saltwater intrusion. *(Note: see also Recommendations C.2. and E.1)*
D5	Encourage the continued funding of the County Agriculture Purchase of Development Rights Program beyond the current funding levels to maintain open lands for aquifer recharge, habitat, and buffers.
D5	Encourage the continued funding of the County Agriculture Purchase of Development Rights Program beyond the current funding levels to maintain open lands for aquifer recharge, habitat, and buffers.
D6	Provide incentives to study and develop best practices for agricultural management that contribute to carbon sequestration and reduce greenhouse gas emissions.
D7	Increase funding for County-administered management activities like those programs within Natural Areas Management and Environmentally Endangered Lands. Establish a multi-agency task force to expand County capacity and coordinate conservation activities. Develop a collaborative and integrated approach to conservation involving universities, government agencies, landowners, botanic gardens, zoos, and non-governmental organizations. (Note: see also Recommendation F.2)
D8	Review current stormwater management operations, including the operation of canals and structures, in order to eliminate unnecessary over-drainage and limit the extent of saltwater intrusion into ground and surface water resources. Additionally, require water conservation measures for all users of the Biscayne Aquifer. (Note: see also Recommendations D.2 and D.3)

Recommendation#	Recommendation
	Natural Systems Adaptation
D9	Develop a "Vital Signs" monitoring program, following the model of the National Park Service, to serve as a multi-parameter ecosystem monitoring program that will help track climate change effects. Expand current ongoing monitoring efforts, such as those within the Comprehensive Everglades Restoration Plan (CERP), to include specific areas of Miami-Dade County, to provide a better view of how natural areas are changing over time and what forces are responsible. Dedicate a source of funds to collect information and establish and maintain a long-term data management system.
D10	Miami-Dade County should establish partnerships, both formal and informal, with other governmental entities, including local, State, and Federal governments; the private sector; non-governmental organizations; and other stakeholders in the County. Partnerships should focus on cooperative efforts to restore existing natural ecosystems; protect natural and open lands; mitigate impacts; and monitor natural systems and indicators of climate change. Partnerships should also be undertaken to effectively practice adaptive management as we increase our understanding over time of the effects of climate change on natural systems in the County and implement management actions to restore and protect natural systems in the County. (Note: see also Recommendations D.3, D.8, F.2, and F.3)
	Economic, Social and Health Adaptation
E1	The Task Force recommends that the Miami-Dade County Comprehensive Development Master Plan (CDMP) be revised to include a new policy to restrict land uses in areas that would be at risk from sea level rise and associated impacts within the next 50 years as per the CCATF Science Committee's Statement on Sea Level in the Coming Century report and projections. A continuous 50-year planning horizon should be used. (Note: see also Recommendations C.2 and D.4)
E2	Initiate an additional long-term CCATF advisory board committee composed of representatives from federal, state, and local environmental agencies (including Miami-Dade County DERM, WASD, Cooperative Extension), the Miami-Dade County Department of Health, local colleges and universities, and community leaders to address potential human infectious disease changes and increases that may accompany climate change and to make technical and funding recommendations to the Miami-Dade County Board of County Commissioners.
E3	The County shall form an interdisciplinary, community-wide working group, including the media and institutions of higher education, which (a) focuses on public education and information regarding climate change and adaptation and (b) assesses public opinion regarding these subjects.
E4	The Task Force recommends that the County bring together all agencies and entities involved in economic development and planning in order to develop a unified and comprehensive response to the challenges of climate change, housing, economic development, and quality of life.

Recommendation#	Recommendation
	Economic, Social and Health Adaptation
E5	The CCATF recommends the following in reference to green jobs and the economy: 1. The County should sign the Local Government Green Jobs Pledge (attached). 2. The County should establish a full Green-collar Jobs Task Force. This committee should promote green jobs and building a local green economy as follows: · Establish a local action plan for Miami-Dade County, · Indentify goals and opportunities, and · Identify key partners, both governmental and NGO's, for sharing best practices and resources.
E6	The CCATF recommends that Miami-Dade County initiate efforts for a county-wide assessment of local public knowledge and opinion on climate change. The effort should: 1. Review and assess existing data on local public knowledge and opinion related to climate change (both mitigation and adaptation), and 2. Supplement available data through additional polling, attitude research, and other appropriate information gathering methods.
E7	The CCATF recommends that Miami-Dade County take the following steps to facilitate a county-wide education outreach program on climate change to educate the general public:
	Intergovernmental Affairs
	Step I - review and assess existing entities (such as internal County departments, Miami-Dade County Environmental Education Providers consortium, local colleges and universities, etc.) that could provide education on climate change Step II - coordinate relevant entities identified through Step # I in order to share information gathered as a result of County-wide Assessment of Local Public Knowledge and Opinion on Climate Change (as outlined in #1) Step III - direct funding and resources to relevant entities identified through Step # I

Recommendation#	Recommendation
	Intergovernmental Affairs
F1	Conduct a survey of Miami-Dade County municipalities to gauge their level of knowledge and engagement in climate change issues, learn about their activities, and begin the creation of an intergovernmental, learning network that allows members to work with each other and the County on adaptation / mitigation issues. Once the survey has been completed, engage the cities in a dialogue about the survey findings and work of the Climate Change Advisory Task Force. This dialogue could happen in a number of ways including a meeting with the Miami-Dade League of Cities and/or a convening of Miami-Dade municipal and county leaders in a shared discussion of the issues and information exchange
F2	Convene local and state agencies and water and sewer utilities around a discussion of climate change and impacts on water quantity, quality, and availability and implications for infrastructure planning and investment. **(Note: see also Recommendations D.7, D.10, and F.3)**
F3	Convene a broader group of local and state agencies around a discussion of their activities related to climate change. Agencies / groups would include, but not be limited to, DOT 4 & 6, DEP, SFWMD, DCA, Health Planning Agencies, Ecosystem Restoration Task Force, etc. In this conversation we will gain a better understanding if there are issues or concerns that we need to be aware of and identify opportunities for collaboration moving forward. (Note: see also Recommendations D.10, and F.2)
F4	Develop a County internet website with up-to-date information about the work of the Miami-Dade Board of County Commissioners, the CCATF, and municipalities with links to information and best practices related to climate change, adaptation and mitigation efforts by individuals and organizations. (Note: see also Recommendations C.3 and E.3)
F5	Work with the region's children's museums and foundations to create and fund educational exhibits on climate change, green technologies, clean cities, etc. (Note: see also Recommendation E.3)
F7	The CCATF recommends that Miami-Dade County develop as quickly as possible an Action Plan identifying the "who, what, when, where, and how" that will further the objectives identified in the Board of County Commissioners' December 1, 2009 resolution in support of the Southeast Florida Regional Climate Change Compact (Compact) and related activities. Taking immediate action to further the activities highlighted in the Compact and BOCC Resolution will help elevate the importance of mitigating greenhouse gas emissions and adapting to the potential impacts of climate change in Miami-Dade County and the Region. The CCATF recommends that these actions be taken well in advance of the 2010 Climate Summit to allow for stakeholder participation and regional discussion.

Recommendation#	Recommendation
	Intergovernmental Affairs
	1. Common measures of success and benchmarks; 2. Acknowledgement of the need to create uniform standards and regulations to minimize confusion and business costs associated with conducting business in different parts of the region and to encourage business activity and competition; and 3. A comprehensive outreach strategy that will engage the wide range of stakeholders, acknowledge differing views, and work to reach consensus on a shared course of action moving into the future.
F8	The CCATF recommends that the County collaborate with and encourage its regional partners in the development of uniform message on climate change as part of a regional outreach and education campaign. Such a campaign should include the use of high profile media and other appropriate outlets to raise general awareness of climate change in Southeast Florida. This regional message on climate change can be supplemented with county-specific information as needed to educate Miami-Dade County residents on the potential impacts of climate change and make the connection between mitigation, adaptation, and policy changes in the County's climate change and sustainability initiatives.
F9	The Office of Sustainability, in partnership with the Miami-Dade County League of Cities, should develop a local government outreach program to raise awareness about climate change science and potential climate change impacts on Miami-Dade County and possible mitigation and adaptation strategies. Local governments should be encouraged to identify a point of contact who will serve as an agency liaison to the County in issues of climate change and sustainability.
F10	To enhance coordination between the County and its municipalities and make it easier to incorporate "green technologies" in both residential and commercial settings, the CCATF recommends the following: 1. To enhance understanding among code officials and design professionals of what green technologies and innovative approaches are currently allowed in the code, request that the Florida Building Code Commission consider a statewide augmentation of continuing education requirements for Engineers and Architects. 2. Request that the Office of Code Compliance develop checklists that can be used as guidelines for Building Officials and Design Professionals to further the uniform application of codes.

Recommendation#	Recommendation
	Intergovernmental Affairs
F11	The CCATF recommends that the Board of County Commissioners encourage the convening of a regional discussion around the opportunities and challenges posed to the Region's businesses and economy by potential climate change related impacts. Key partners in a regional discussion include, but are not limited to, the region's economic development organizations, county economic development officials, Chambers of Commerce, key business organizations representing existing and emerging industries in Southeast Florida, Enterprise Florida, and the South Florida and Treasure Coast Regional Planning Councils.

D. A REGION RESPONDS TO A CHANGING CLIMATE – SOUTHEAST FLORIDA REGIONAL CLIMATE CHANGE COMPACT REGIONAL CLIMATE ACTION PLAN, OCTOBER 2012

OFFICIAL FILE COPY
CLERK OF THE BOARD
OF COUNTY COMMISSIONERS
MIAMI-DADE COUNTY, FLORIDA

Appendix D

MEMORANDUM

Agenda Item No. 8(M)(1)

TO:	Honorable Commissioner Rebeca Sosa and Members, Board of County Commissioners	**DATE:**	April 2, 2013
FROM:	R. A. Cuevas, Jr. County Attorney	**SUBJECT:**	Resolution accepting the Southeast Florida Regional Climate Action Plan Resolution No. R-240-13

The accompanying resolution was prepared by the Regulatory and Economic Resources Department and placed on the agenda at the request of Prime Sponsor Commissioner Sally A. Heyman.

R. A. Cuevas, Jr.
County Attorney

RAC/smm

Memorandum

MIAMI-DADE COUNTY

Date: April 2, 2013

To: Honorable Chairwoman Rebeca Sosa
and Members, Board of County Commissioners

From: Carlos A. Gimenez
Mayor

Subject: Resolution Accepting the Southeast Florida Regional Climate Action Plan

---

Recommendation
It is recommended that the Board of County Commissioners accept the Southeast Florida Regional Climate Action Plan (Attachment A) which includes recommendations for regionally coordinated climate change mitigation and adaptation strategies which are expected to provide long-term cost benefits to the region, through new economic development opportunities and infrastructure planning and improvements that reduce risk and future economic losses. The Regional Climate Action Plan does not provide a mandate but rather is designed to serve as a guidance document with options that each county and local government could voluntarily align to their own plans and utilize based on their interests and vision for the future.

Scope
The impact of this plan is countywide.

Fiscal Impact/Funding Source
All implementation shall be done on an annual basis and as set forth in the annual budgets approved by this Board. Many recommendations in the Plan are low cost or no cost, involving only continued collaboration and leveraging of existing investments.

Track Record/Monitor
Nichole Hefty, staff in the Regulatory and Economic Resources Department serving on the Southeast Florida Regional Climate Change Staff Steering Committee, will monitor implementation of the South Florida Regional Climate Action Plan.

Background
The Southeast Florida Regional Climate Change Compact (Compact) is a partnership among Miami-Dade, Broward, Palm Beach, and Monroe counties, which was unanimously approved by the Board of County Commissioners in December 2009 through Resolution R-1388-09 (Attachment B). The Compact includes the following commitments, to be achieved through collaboration among existing staff with no additional resources:

- Coordinate in climate policy development and advocacy;
- Collaborate in the development of common baseline tools for planning;
- Dedicate staff time and resources to create a Southeast Florida Regional Climate Change Action Plan to include mitigation and adaption strategies; and
- Meet annually in Regional Climate Summits to mark progress and identify emerging issues.

A Compact Staff Steering Committee, comprised of representatives from each of the partner counties, was created early on to coordinate Compact implementation. This committee convened a technical work group to develop regionally coordinated baseline planning tools, including a regional greenhouse gas emissions inventory, a unified sea level projection, and a common methodology for mapping inundation and performing vulnerability assessments. The counties also coordinate joint policy and legislative priorities, and meet at a yearly leadership summit, as called for in the Compact Resolution.

The Regional Climate Action Plan (Attachment A) is the culmination of more than three years of technical and planning process, and is the most significant milestone and work product of the Compact to date.

The Compact Staff Steering Committee convened three work groups (Built Environment, Transportation, and Natural Systems and Agriculture) for the purpose of reviewing information and developing recommendations in seven topical areas. More than 100 individuals representing the public and private sector as well as not-for-profit entities and other stakeholders participated and lent their expertise to this process. The Compact unveiled the draft report including 106 recommendations at the 3rd Annual Southeast Florida Regional Climate Leadership Summit hosted by Monroe County in December 2011.

Following its December 2011 release, the Draft Regional Climate Action Plan was posted for 90 days for public comment. The Staff Steering Committee received comments from nearly 100 different individuals. All comments were cataloged and the Compact Staff Steering Committee met on two separate occasions to review and consider all feedback and suggestions and convened separate work groups to assist with revisions to recommendations pertaining to the subjects of Water Resources and Agriculture. Notable edits to the final Regional Climate Action Plan document include:

- Discussion of governance structure and resources and their influence on implementation;
- Inclusion of a separate section dedicated to Agriculture;
- Inclusion of separate section focused on Public Policy and Outreach; and
- Preparation of an informal companion document as an Implementation Guide.

This Regional Climate Action Plan recognizes the diversity of issues across Southeast Florida, and that implementation of the recommendations contained within will inevitably occur at various stages and varying degrees by a multitude of agencies and jurisdictions, but with the benefit of working within a regional context. The Plan, organized in seven areas, provides the common framework for sustainable communities and transportation planning to be aligned across the region, as implemented. It recognizes the need to protect and address our vulnerable water supply, management and infrastructure and to preserve our fragile natural systems and agricultural resources. The plan provides for steps to move towards resilience to the impacts of climate change, and to reduce emissions through exploring alternatives and decreasing our use of energy and fuel. The plan builds upon our strength as effective emergency responders and integrates climate change hazards in risk reduction and emergency management planning. Finally, the Regional Climate Action Plan proposes to create a common vocabulary for outreach and public policy development to effectively communicate the steps from risk to resilience with the general public, voters, elected officials and decision makers in Southeast Florida, the state and the nation.

The Regional Climate Action Plan, as developed, provides an excellent roadmap and vision for a resilient South Florida. Many of the recommendations would synchronize current efforts of each county in our distinct areas of the region. Staff will report back within a year on the progress of the Regional Climate Action Plan.

Jack Osterholt, Deputy Mayor

MEMORANDUM
(Revised)

TO: Honorable Chairwoman Rebeca Sosa
and Members, Board of County Commissioners

DATE: April 2, 2013

FROM: R. A. Cuevas, Jr.
County Attorney

SUBJECT: Agenda Item No. 8(M)(1)

Please note any items checked.

_____ **"3-Day Rule" for committees applicable if raised**

_____ **6 weeks required between first reading and public hearing**

_____ **4 weeks notification to municipal officials required prior to public hearing**

_____ **Decreases revenues or increases expenditures without balancing budget**

_____ **Budget required**

_____ **Statement of fiscal impact required**

_____ **Ordinance creating a new board requires detailed County Mayor's report for public hearing**

_____ **No committee review**

_____ **Applicable legislation requires more than a majority vote (i.e., 2/3's ____, 3/5's ____, unanimous _____) to approve**

_____ **Current information regarding funding source, index code and available balance, and available capacity (if debt is contemplated) required**

Approved _____ Mayor
Veto _____
Override _____

Agenda Item No. 8(M)(1)
4-2-13

RESOLUTION NO. R-240-13

RESOLUTION ACCEPTING THE SOUTHEAST FLORIDA REGIONAL CLIMATE ACTION PLAN WHICH INCLUDES ACTIONABLE RECOMMENDATIONS FOR REGIONALLY COORDINATED CLIMATE CHANGE MITIGATION, ADAPTATION STRATEGIES, AND EFFORTS IN BUILDING COMMUNITY RESILIENCE

WHEREAS, as recognized by this Board in Resolution No. R-1388-09, Florida is an area of the country that is most vulnerable to the consequences of global climate change, and Southeast Florida is considered at the frontline to experience the impacts of a changing climate, especially sea level rise; and

WHEREAS, in 2010 the counties of Miami-Dade, Palm Beach, Broward, and Monroe entered into the Southeast Florida Regional Climate Change Compact in recognition of the need for immediate, coordinated and visionary action to address the impacts of a changing climate and provide for economic and environmental resilience in Southeast Florida; and

WHEREAS, these four counties developed the Regional Climate Action Plan in accordance with the Compact commitment and through a two year collaborative process involving nearly 100 subject matter experts who represented the public and private sectors, universities, and not-for-profit organizations; and

WHEREAS, the Regional Climate Action Plan offers recommendations that provide a common integrated framework for a stronger and more resilient Southeast Florida; and

WHEREAS, these recommendations include: (1) providing a common framework for sustainable communities and transportation planning to be aligned across the region; (2) recognizing the need to protect and address vulnerable water supply, management infrastructure

and preserve fragile natural systems and agricultural resources; (3) providing steps to move towards resilience and reducing emissions through exploring alternatives and decreasing the use of energy and fuel; (4) building upon strength as effective emergency responders and integrating climate change hazards in risk reduction and emergency management planning; and (5) providing for effective public outreach initiatives to educate the public on the consequences of climate change and providing guidance for developing and influencing public policies related to climate change; and

WHEREAS, the Regional Climate Action Plan does not provide a mandate but rather is designed as a living guidance document with options that each county and local government could align to their own plans and utilize based on their interests and vision for the future,

NOW, THEREFORE, BE IT RESOLVED BY THE BOARD OF COUNTY COMMISSIONERS OF MIAMI-DADE COUNTY, FLORIDA, that this Board hereby accepts the Southeast Florida Regional Climate Action Plan, and the Mayor or Mayor's designee shall report back to the Board within one year on the progress of the Regional Climate Action Plan.

The foregoing resolution was offered by Commissioner **José "Pepe" Diaz**, who moved its adoption. The motion was seconded by Commissioner **Sally A. Heyman** and upon being put to a vote, the vote was as follows:

	Rebeca Sosa, Chairwoman		**aye**
	Lynda Bell, Vice Chair		**aye**
Bruno A. Barreiro	**absent**	Esteban L. Bovo, Jr.	**aye**
Jose "Pepe" Diaz	**aye**	Audrey M. Edmonson	**aye**
Sally A. Heyman	**aye**	Barbara J. Jordan	**aye**
Jean Monestime	**aye**	Dennis C. Moss	**aye**
Sen. Javier D. Souto	**aye**	Xavier L. Suarez	**aye**
Juan C. Zapata	**aye**		

The Chairperson thereupon declared the resolution duly passed and adopted this 2nd day of April, 2013. This resolution shall become effective ten (10) days after the date of its adoption unless vetoed by the Mayor, and if vetoed, shall become effective only upon an override by this Board.

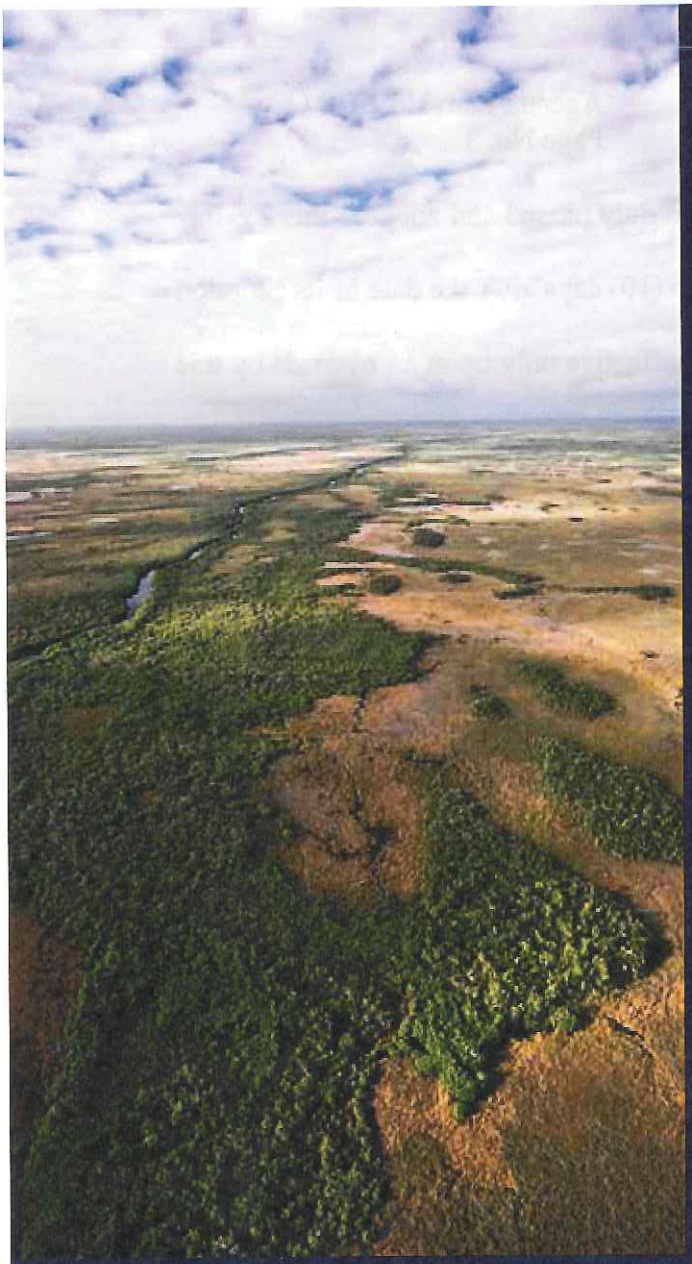
MIAMI-DADE COUNTY, FLORIDA
BY ITS BOARD OF
COUNTY COMMISSIONERS

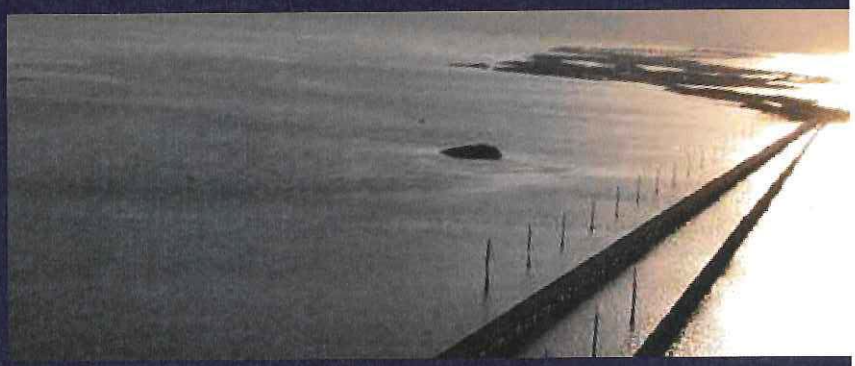
HARVEY RUVIN, CLERK

By: Christopher Agrippa
Deputy Clerk

Approved by County Attorney as
to form and legal sufficiency.

Abbie Schwaderer-Raurell





A Region Responds to a Changing Climate

Southeast Florida Regional Climate Change Compact Counties

Regional Climate Action Plan

October 2012

SOUTHEAST FLORIDA
REGIONAL COMPACT
CLIMATE CHANGE

A Region Responds to a Changing Climate

Southeast Florida Regional Climate Change Compact Counties

Regional Climate Action Plan

October 2012

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D. A Unified Sea Level Rise Projection for Southeast Florida

E. Analysis of the Vulnerability of Southeast Florida to Sea Level Rise

F. Adaptation Action Areas (Florida Department of Economic Opportunity White Paper)

ACKNOWLEDGEMENTS

This Regional Climate Action Plan is the result of true collaboration – this document and its many supporting publications are the product of existing staff and resources from the various cooperating agencies. No additional public dollars were dedicated to this effort. The Southeast Florida Regional Climate Change Compact was forged during the most difficult national economy since the Great Depression. We came together with purpose and quickly realized the value of sharing resources, expertise and information. Competitors became collaborators. Challenges became successes. At a moment when local government is pressed to achieve maximum efficiency, the Compact enabled a level of intergovernmental cooperation unprecedented in Southeast Florida's history. Many have contributed to the Compact process, including more than 90 members of the public that took the time to submit comments to a previously published draft. While several individuals are recognized here, Appendix C contains a full list of the people and organizations that helped bring this Regional Climate Action Plan to fruition.

Staff Steering Committee

Mr. Jon Van Arnam, Palm Beach County
Ms. Carrise LeJeune, City of Boynton Beach (Palm Beach County)
Dr. Jennifer Jurado, Broward County
Ms. Patti Webster, Broward County
Ms. Susanne Torriente, City of Fort Lauderdale (Broward County)
Ms. Nichole Hefty, Miami-Dade County
Mr. Mark Woerner, Miami-Dade County
Mr. Roman Gastesi, Monroe County
Mr. Michael Roberts, Monroe County
Ms. Alison Higgins, City of Key West (Monroe County)
Mr. Rod Braun, South Florida Water Management District
Ms. Kim Shugar, South Florida Water Management District (former)
Mr. Jim Murley, South Florida Regional Planning Council (ex officio)
Mr. Steve Adams, Institute for Sustainable Communities (staff)

Support and Technical Staff

Ms. Bonnie Finneran, Palm Beach County
Mr. John Reiser, Palm Beach County
Dr. Nancy Gassman, Broward County
Mr. Donald Burgess, Broward County
Ms. Debbie Griner, Miami-Dade County
Ms. Rhonda Haag, Monroe County
Mr. Kevin Wilson, Monroe County
Mr. Doug Gregory, Monroe County
Ms. Diana Umpierre, South Florida Water Management District
Dr. Jayantha Obeysekera, South Florida Water Management District
Mr. Chris Bergh, The Nature Conservancy

Joint Policy Advisory Team

Mr. Jon Van Arnam, Palm Beach County
Mr. Todd Bonlarron, Palm Beach County
Mr. Robert Robbins, Palm Beach County
Ms. Bonnie Finneran, Palm Beach County
Mr. Rich Walesky, Palm Beach County (former)
Dr. Jennifer Jurado, Broward County
Ms. Patti Webster, Broward County
Ms. Susanne Torriente, City of Fort Lauderdale
Mr. Joe Rasco, Miami-Dade County
Mr. Paul Voight, Miami-Dade County
Mr. Roman Gastesi, Monroe County
Mr. Michael Roberts, Monroe County
Mr. Rod Braun, South Florida Water Management District
Ms. Kim Shugar, South Florida Water Management District (former)

I. Executive Summary

Welcome to the first Southeast Florida Regional Climate Action Plan. The Southeast Florida Regional Climate Change Compact (Compact), a unique and collaborative effort among Palm Beach, Broward, Miami-Dade, Monroe Counties, their municipalities and partners, has worked over the past two years to develop this plan with an initial five-year horizon. The plan is a critical milestone of the Compact, entered into by Palm Beach, Broward, Miami-Dade, and Monroe Counties in January 2010. Much of the Compact's work up to this point has served to unite, organize, and assess our region through the lens of climate change in setting the stage for action. Specific accomplishments include the development of regionally-consistent methodologies for mapping sea-level rise impacts, assessing vulnerability, and understanding the sources of regional greenhouse gas emissions. Collectively, these work products provide the foundation for this Regional Climate Action Plan, which calls for concerted action in reducing greenhouse gas emissions and adapting to regional and local impacts of a changing climate. The recommendations presented here aim to accomplish those goals while also serving to protect the assets of the region's unique quality of life and economy, guiding future investments, and fostering livable, sustainable and resilient communities.

The Compact was established with a strong recognition of the region's diversity and its commonalities. It accepted the varying degrees of progress in the areas of climate change adaptation and mitigation in order to inform, to improve, and to advance regional planning efforts together. This Regional Climate Action Plan too recognizes the diversity of Southeast Florida, yet provides the common framework for **Sustainable Communities and Transportation Planning** to be aligned across the region, as implemented. Inevitably this will occur at various stages and varying degrees, but with the benefit of working within a regional context. This is Southeast Florida, with all its uniqueness; the plan recognizes the need to protect and address our vulnerable **Water Supply, Management and Infrastructure** and preserve our fragile **Natural Systems and Agricultural** resources. The plan provides for steps to move toward resilience and reduce emissions through exploring alternatives and decreasing our use of **Energy and Fuel.** The plan builds upon our strength as effective emergency responders and integrates climate change hazards in **Risk Reduction and Emergency Management** planning. Finally, the Regional Climate Action Plan creates a common vocabulary for **Outreach and Public Policy** development to effectively communicate the steps from risk to resilience with the general public, voters, elected officials and decision makers in Southeast Florida, the state and the nation.

The specific recommendations put forth in this plan were developed through a collaborative process involving nearly 100 subject matter experts from a host of professions representing the

Southeast Florida is considered one of the most vulnerable areas to climate change and sea level rise.

public and private sectors, area universities, and not-for-profit organizations. These stakeholders brought to the table the knowledge of their "craft" as well as information on successful initiatives already underway locally or in other communities. Many of the recommendations build upon best practices sprinkled throughout our region, such as regional collaboration on transportation planning and land use criteria that foster walkable and healthy communities. Others delve into "new" frontiers in calling for the integration of climate change into planning and decision-making processes in ways that no local government has yet implemented.

The overall objective was and remains to integrate climate adaptation and mitigation into existing decision-making systems and to develop a plan that can be implemented through existing local and regional agencies, processes and organizations. It is in that spirit that this plan provides the common integrated framework for a stronger and more resilient Southeast Florida starting today and for tomorrow.

The 110 action items detailed in the plan's seven goal areas are to be accomplished over the next five years with annual reports to mark progress. The policy recommendations will be implemented through several approaches including:

- **existing legal structures**, planning and decision-making processes;
- the development of **new policy guiding documents** by local and regional governing bodies; the development of **operational guidance documents**;
- the development of **consistent goals and progress indicators** throughout the various governments in the region;
- a coordinated **multi-disciplinary outreach and education program;** and
- processes for **focused and prioritized investments**

Every organization in the region has a role to play in making Southeast Florida a resilient and sustainable community of communities.

II. Introduction and Background: Southeast Florida Climate Change Compact Guidance for Regional Policy and Planning

Southeast Florida is considered one of the most vulnerable areas to climate change and sea level rise. In the spring of 2009, several Southeast Florida counties and cities were making the rounds in the halls of Congress to advocate for climate policy. A great deal of work had been invested individually by each jurisdiction; however, each had slightly different baseline emissions figures at different points of time and different sea level rise planning scenarios. The need for regional coordination became quite evident. With 5.6 million residents within the geographic boundaries of the four counties as of the 2010 Census, exceeding the population of 30 states and representing 30 percent of Florida's population and Gross Domestic Product, there is an obvious and unique strength in the region's size and in numbers. That realization paved the way for a unique arrangement – the Compact – a voluntary and cooperative partnership among governing bodies to tackle one of, if not the most important issue facing our generation. This targeted and focused collaborative is the vision and framework for regional resilience. It respects the diversity of the region and the autonomy of the many governing bodies.

The Compact began with a commitment among elected officials representing each of the four counties to return to Southeast Florida and to coordinate in the hosting of a regional climate summit. The Summit would serve as a platform for broader discussion among county and municipal elected officials and the community as to the pressures and challenges that climate change poses for Southeast Florida with a call for unified action. Just four months later, their vision began to take shape when the four County Commissions jointly held the 2009 Regional Climate Leadership Summit. This first Regional Summit led to the ratification of the Southeast Florida Regional Climate Change Compact by January 2010, with unanimous votes within each County Commission (Appendix A). Since adoption, the Counties have assigned existing staff resources to support implementation of the Compact under the direction of a Compact Staff Steering Committee.

The Compact Staff Steering Committee is comprised of two staff members from each county, one municipal representative from each county and a non-voting member from the South Florida Water Management District who was invited to participate. Municipal members represent the cities of Fort Lauderdale, Key West and Boynton Beach. The Compact Staff Steering Committee is a small, core group of professional staff engaged in this process since 2009.

The Compact commitments include:

- Joint legislative policy development;
- Development of a regional greenhouse gas (GHG) baseline;
- Development of regionally consistent sea level rise projections for the coming decades;
- Development of Preliminary Inundation Mapping;
- Development of a Regional Climate Action Plan; and
- Coordination of Annual Leadership Summits.

The regional scale of the resilience strategies effectively integrate human and natural systems

The Compact paved the way for early work in 2010 to develop the unified regional baseline and sea level rise planning scenarios. Summaries of these work products are provided in Section IV. This early work served as the foundation for the development of this regional framework through three Work Groups: Built Environment, Transportation, and Land and Natural Systems. These Work Groups were chaired by Staff Steering Committee members and expanded to include local and regional experts from the public and private sectors and academia.

III. Compact Awards and Recognitions

Since adoption, the Compact has won recognition through awards from ICLEI and the National Association of Counties, a requested white paper from the White House Domestic Policy Council, a request to host a listening session for the White House Council on Environmental Quality's (CEQ) Interagency Adaptation Task Force, and specific references within the Task Force's Final Report to the president. Subsequent federal agency engagement in the Compact has been highlighted in CEQ reports to the president, including the most recent Task Force report submitted in October 2011.

IV. Compact Work Completed

The adoption of the Compact initiated an ambitious schedule requiring the completion of a robust body of work leading to this Regional Climate Action Plan. Since Compact adoption in January 2010, the four Compact Counties have completed the following:

a. Policy and Advocacy

Sections 1 – 4 of the Compact Resolution commit the Compact Counties to develop joint climate and energy-related policy positions and advocacy strategies to influence state and federal legislation. Specifically, provisions of the Compact call for urging Congress to pass legislation that: recognizes the unique vulnerabilities of Southeast Florida to climate change impacts, especially sea level rise; allocates federal climate change funding based on vulnerabilities; designates areas of Southeast Florida as uniquely vulnerable and of federal interest for the purpose of securing enhanced levels of federal participation in regional adaptation projects; and supports strengthening policies relating to global climate change.

Since the ratification of the Compact, the Compact partners have advanced policy and advocacy goals through joint positions, resolutions, letters and funding proposals and advocacy in Tallahassee and Washington, D.C. In addition, during the 111th and 112th sessions of the United States Congress, the Compact partners collaborated in the submittal of a *joint Climate Adaptation Pilot Project Proposal,* a funding request to support regional hydrologic modeling needed to guide adaptation planning in response to projected sea level rise. In May 2010, elected officials and other leaders representing the Compact Counties jointly advocated in Washington, D.C. to highlight the region's vulnerabilities and needs related to climate change impacts, to seek support for greater recognition of adaptation strategies in federal climate policies and for the appropriations of projects such as the regional Pilot Project.

On June 24, 2010, in response to the Deepwater Horizon Oil Spill that threatened the region's environment and economy, the Compact Counties conducted a well-attended conference calling for comprehensive federal energy policy and protection of Florida's state and federal waters from the impact of oil drilling. In concert with local municipalities and Leagues of Cities, the event produced the Southeast Florida Response to Deepwater Horizon Oil Spill Letter to President Obama and resolutions in support for comprehensive climate legislation, restoration of damages due to the oil spill and for a ban on oil drilling within Florida's Territorial Waters.

As a centerpiece of the Compact Counties' commitment to developing regional legislative policies and advocacy strategies, the Compact Counties adopted the 2011 and 2012 *Southeast Florida State and Federal Energy and Climate Legislative Programs* and utilized these programs as the basis of joint advocacy to Congress and the Florida Legislature. The 2011/12 State and Federal Legislative Programs include support for:

The plan is a critical milestone of the Compact ...

... a vision and framework for regional resilience.

- the Southeast Florida Climate Adaptation Pilot Project Proposal;
- providing a definition of "Adaptation Action Areas (AAA)" in state law;
- greater recognition of adaptation as a critical climate strategy;
- adopting a State Renewable Energy Portfolio Standard of 20 percent renewable energy by 2020;
- federal legislation to create and fund new infrastructure programs to assist local governments in adapting to the impacts of sea level rise;
- federal recognition of AAA's for the purpose of funding infrastructure vulnerable to sea level rise
- removing federal barriers to Property Assessed Clean Energy (PACE) and PACE-like programs, posed by the Federal Housing Finance Agency, to encourage energy efficiency and renewable energy improvements for residential homes and commercial buildings; and
- opposing oil drilling in federal waters on Florida's Outer Continental Shelf and the Everglades.

The four County Commissions jointly held the first Regional Climate Leadership Summit in 2009.

Utilizing the Compact Counties' Legislative Programs as guidance during the 2011 Florida Legislative Session, the Compact Counties were successful in helping to amend state law to reflect priority policy goals. The regional partners helped draft and led efforts to provide for a designation of "Adaptation Action Areas" in Florida's growth management laws, thus creating a new tool for local governments to identify areas vulnerable to coastal flooding resulting from the impacts of sea level rise and to prioritize infrastructure improvements and funding for improved resilience. Immediately following changes to

state law, a Members Letter was signed by several members of Florida's Congressional Delegation requesting support for defining AAA in federal law. Subsequent to the Members Letter, the Compact Counties' lobbyists and Delegation Members have requested the inclusion of language enabling at-risk, multi county regions impacted by sea level rise to qualify for 2012 Energy and Water Appropriations. During the 2012 Florida Legislative Session the Compact Counties were successful in helping to amend the Florida Energy Act to provide for commercial buildings to qualify for energy efficiency program funding through the Local Option Sales Tax.

The Regional Climate Action Plan contains actionable recommendations related to public policy and outreach in recognition of the fact that a continued commitment to collaborate with local, state and federal policy makers, as well as the non-profit and private sectors, is fundamental to long-term success of the Compact. Additionally, the continued and enhanced role of policy advocacy through regional collaboration, especially during tumultuous economic and political times, are important to ensure that current efforts are not undermined and the Compact Counties' future efforts related to sustainability are achieved.

b. A Baseline of Greenhouse Gas Emissions for Southeast Florida

Prior to the Compact, many jurisdictions within Southeast Florida had completed emission inventories using a variety of baseline years. The Compact called for the identification and quantification of Greenhouse Gas (GHG) emissions across Southeast Florida "with a particular focus on emissions from inter-county travel and commerce." Consistent with this charge, staff estimated GHG emissions resulting from an inventory of select sectors – transportation and the built environment divided into residential, commercial and industrial subsectors – using the ICLEI International Local Government Emissions Analysis Protocol (IEAP) within the ICLEI Clean Air and Climate Protection 2009 (CACP 2009) software. "Non-regional" emissions such as the waste sector (including landfill and wastewater treatment) and local government operations were not included as they were deemed to be primarily under the control of individual jurisdictions. Other sectors such as natural areas and agriculture (including their carbon sequestration or "sink" capacity) were not included here due to lack of local information.

As emissions track closely with economic output and as this analysis was initiated during the most significant economic downturn since the 1930s, staff decided to inventory annual emissions for each year from 2005 through 2009 (five full years) and average the results for each sector over those five years for use as a future baseline. By doing so, the inventory averages contain years of both high growth and contraction. The full Regional Inventory report is included as a supporting document to the Regional Climate Action Plan process.

The transportation sector is the largest single source of regional emissions.

Residential and commercial building are jointly responsible for 54 percent of regional emissions.

Southeast Florida peaked in total GHG emissions in 2006 and declined in the following three years, consistent with the performance of the national economy during this period (Table 1). The relative emissions contribution of each County to the aggregated regional emissions reflects population and size.

Table 1: Regional Emissions by County ($MMTCO_2e$)

County	2005	2006	2007	2008	2009
Broward	22,655,421	22,657,880	21,921,832	21,216,712	20,810,719
Miami-Dade	28,715,847	29,058,677	27,832,307	27,057,988	26,859,326
Monroe	1,504,047	1,532,500	1,465,634	1,408,288	1,417,206
Palm Beach	16,588,536	16,658,369	15,920,070	15,785,752	15,675,174
Regional Sources	254,537	250,984	237,691	222,113	155,359
Totals	69,718,390	70,158,412	67,377,537	65,690,854	64,917,785

Regional emissions, across all sectors examined, were approximately 64.9 million metric tonnes of carbon dioxide equivalent ($MMTCO_2e$) in 2009, down from 69.7 $MMTCO_2e$ in 2005. The five-year average of emissions (67.6 $MMTCO_2e$) shows that the transportation sector is the largest single source of regional emissions. The Residential and Commercial buildings sectors jointly contribute 54 percent to regional emission (Table 2).

Table 2: Regional Emissions by Sector ($MMTCO_2e$)

Sector	2005	2006	2007	2008	2009	Five Yr Avg
Residential	19,963,638	19,989,441	18,685,833	18,186,886	18,237,990	19,012,757
Commercial	17,884,892	18,212,352	17,356,620	17,314,930	17,083,809	17,570,521
Industrial	1,075,979	1,103,572	961,883	888,111	811,016	968,112
Transportation	30,793,879	30,853,046	30,373,200	29,300,926	28,784,969	30,021,204
Totals	69,718,390	70,158,412	67,377,537	65,690,854	64,917,785	67,572,596

c. Unified Sea Level Rise Projection

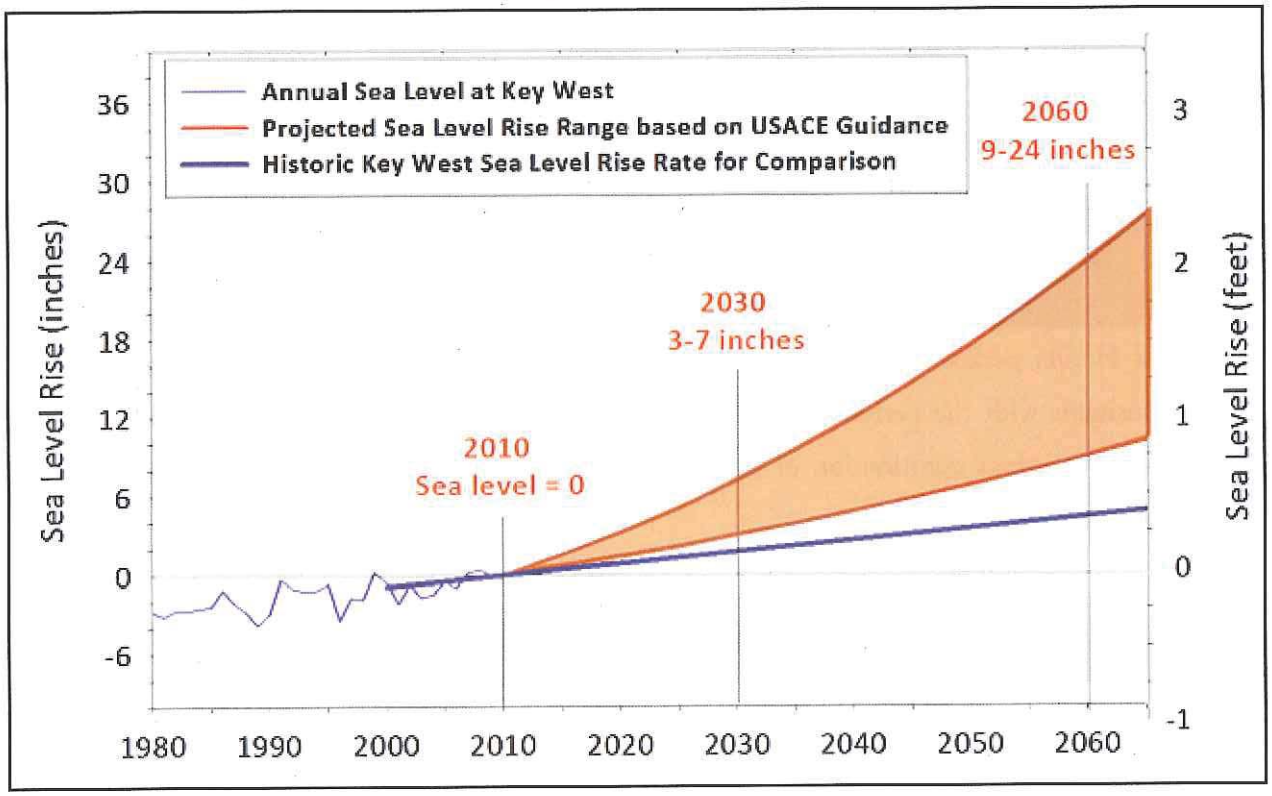

Figure 1: Unified Southeast Florida Sea Level Rise Projection for Regional Planning Purposes. This projection uses historic tidal information from Key West and was calculated by Kristopher Esterson from the United States Army Corps of Engineers using USACE Guidance (USACE 2009) intermediate and high curves to represent the lower and upper bound for projected sea level rise in Southeast Florida. Sea level measured in Key West over the past several decades is shown. The rate of sea level rise from Key West over the period of 1913 to 1999 is extrapolated to show how the historic rate compares to projected rates. Methods are described in a supporting document, "A Unified Sea Level Rise Projection for Southeast Florida" available online at: southeastfloridaclimatecompact.org.

At the first Regional Climate Leadership Summit, the local diversity in sea level rise (SLR) projections was highlighted as a concern, and a barrier, to achieving regionally consistent adaptation policies and demonstrating a coordinated local effort to higher decision-making levels. Following the summit, the Compact Staff Steering Committee recognized the critical need to unify the existing local SLR projections to create a single regional SLR projection. Key participants in developing the existing projections and other local scientists specializing in the areas of sea level rise and climate change were invited to participate as the Regional Climate Change Compact Technical Ad hoc Work Group (Work Group). Their objective was to work toward developing a unified SLR projection for the Southeast Florida region for use by the Compact Counties and partners for planning purposes to aid in understanding potential vulnerabilities and to provide a basis for outlining adaptation strategies for the region.

Through a series of facilitated discussions, the Work Group reviewed the existing projections and the current scientific literature related to SLR with particular emphasis on the impact of accelerating ice melt on projections. The Work Group recommended that the SLR projection be based on the United States Army Corp of Engineers (USACE) July 2009 Guidance Document until more definitive information on future SLR is available. The projection uses Key West tidal data from 1913-1999 as the foundation of the calculation and references the year 2010 as the starting date of the projection. Two key planning horizons are highlighted: 2030 when SLR is projected to be 3-7 inches and 2060 when SLR is projected to be 9-24 inches. Based on the projection, a SLR of one foot is projected to occur between 2040 and 2070 with sea level continuing to rise into the future. Due to the rapidly changing body of scientific literature on this topic, the Work Group recommended that the projection be reviewed and possibly revised four years from final approval by the Compact Staff Steering Committee and after the release of United Nations Intergovernmental Panel on Climate Change Fifth Assessment Report. "A Unified Sea Level Rise Projection for Southeast Florida" White Paper is available as a supporting document to this Regional Climate Action Plan.

Mapping different SLR inundation scenarios helps to identify areas at potential risk and aids in planning for adaptation strategies.

d. Inundation Mapping and Vulnerability Assessment of Areas at Risk by Sea Level Rise

Southeast Florida is highly vulnerable to SLR due to its peninsular geography and low topography. Mapping different SLR inundation scenarios helps to identify areas at potential risk and aids in planning for adaptation strategies. The Compact Inundation Mapping and Vulnerability Assessment Work Group was formed to perform a regional vulnerability assessment. Geographic Information System (GIS) practitioners, representing the Compact Counties as well as the South Florida Water Management District (SFWMD), local universities and federal agencies, worked with National Oceanographic and Atmospheric Administration (NOAA) Coastal Services Center (CSC) experts to understand inundation mapping methodologies, define the local challenges, review available topographic

source data and create a consensus set of methods and criteria for inundation mapping. Additional discussions, surveys and workshops were used to develop planning parameters that would be part of the regional SLR vulnerability assessment. Using these commonly agreed-to parameters and data sources, the SFWMD produced inundation layers to represent areas potentially vulnerable to one-, two- and three-foot SLR scenarios. These layers were used by each of the four Compact Counties to perform a vulnerability assessment for their jurisdiction. See the supporting publication for the County level assessments and detailed methods for inundation mapping and the vulnerability analyses.

This understanding of a likely future allows us to take action now to protect assets and invest wisely.

All of the Compact Counties are vulnerable to SLR. However, the degree and extent of potential impacts vary across the region due to differences in land elevation and geomorphology. The southernmost counties are expected to experience the greatest direct impacts, with lessening impacts as one travels northward. Nearly 80 percent of the lands potentially affected regionally in the one-foot scenario are conservation lands, especially coastal wetlands. Low lying natural systems made up of buttonwood, mangrove, scrub mangrove, and herbaceous coastal saline and freshwater wetlands are significantly impacted in all SLR scenarios. The upper estimate of current taxable property values in Monroe, Broward, and Palm Beach Counties vulnerable in the one-foot scenario is $4 billion with values rising to more than $31 billion at the three-foot scenario. The greater values reflected in the financial impacts are coastal residential properties with ocean access and high taxable value.

In terms of the critical infrastructure reviewed, projected inundation is often confined to marginal areas of the properties or impacting existing drainage infrastructure on site. This is generally true for the region's ports, airports, schools, landfills and hospitals. Monroe County is the exception with predicted building and infrastructure damage to these critical resources especially at the two

Taxable property value vulnerable in the one-foot SLR scenario is $4 billion ...

with values rising to more than $31 billion at the three-foot SLR scenario.

and three-foot SLR scenarios. Three of Monroe's four hospitals, 65 percent of schools and 71 percent of emergency shelters are located on property at elevations below sea level at the one-foot scenario. Power plant properties in Miami-Dade and Broward as well as energy transmission facilities in Monroe begin to become inundated at the one-foot scenario. While railroads are negligibly impacted, more than 81 miles of roadway from Miami-Dade through Palm Beach are impacted at the one-foot scenario, increasing to more than 893 miles at the three-foot scenario.

The intent of the GIS-based analysis conducted by the Compact Work Group was to provide a preliminary assessment of sea level rise vulnerabilities for regional planning and policymaking purposes. This analysis did not include other possible impacts associated with sea level rise that require more complex modeling efforts, or indirect impacts, such as delineating what properties may become less accessible due to inundated roadways. Despite these limitations, the GIS-based vulnerability assessment conducted by the Compact Work Group serves to identify areas of potential concern for regional planning of adaptation strategies. It also highlights the need for continued mitigation of greenhouse gas emissions as a means to reduce future sea level rise impacts.

To prepare Southeast Florida for the likely impacts of sea level rise estimated by the vulnerability assessment, cooperation is vital, not only among the Compact Counties, but also among the municipalities, local, regional, state and federal agencies serving the region. Strengthening this regional effort will be critical in order to coordinate public policies and adaptation measures that ensure the region's sustainability and economic growth

V. Southeast Florida Regional Climate Action Plan Planning Process

Members of the Compact Staff Steering Committee and representatives of numerous federal, state, and county agency partners met in February 2011 for a workshop to review the work completed to date and plan a course of action going forward. Workshop participants brainstormed issues including the scope of the Regional Climate Action Plan, criteria to select priority issues, defining regional versus local efforts, areas of expertise needed in issue specific work groups and how best to separate issue areas to be examined into logical, workable groupings. Also discussed were the timeline for the planning process and how to incorporate feedback from the Compact Staff Steering Committee and other stakeholders.

The Compact Staff Steering Committee organized three work groups to develop specific recommendations for reducing GHG emissions and building climate resilience across the region.

The three work groups, **Built Environment, Transportation, and Land and Natural Systems** were designed to bring local experts with differing work experiences and areas of responsibility together to share knowledge and expertise. Each work group consisted of more than 30 individuals from all parts of the four-county region, listed in Appendix C. Work group participants included representatives of academia, non-profits, the private sector and all levels of government. After several work sessions, surveys and much correspondence, draft recommendations were presented to the Compact Staff Steering Committee at a July 2011 workshop. After review and comment, the Compact Staff Steering Committee provided guidance to the three work groups in finalizing the strategies to be included in the Regional Climate Action Plan and convened a "Super Committee" to address three cross-cutting issues that emerged separately from the work groups. The full extent of recommendations from each work group is available as a supporting publication.

Every organization in the region has a role to play in making Southeast Florida a resilient and sustainable community of communities.

Structure of the Regional Climate Action Plan

To further review, consolidate, and categorize the numerous recommendations, the Super Committee was created consisting of key representatives from each Work Group, the Work Group chairs, and representative County staff. The Super Committee worked to consolidate the recommendations into seven categories, including:

- Sustainable Communities and Transportation Planning
- Water Supply, Management and Infrastructure
- Natural Systems
- Agriculture
- Energy and Fuel
- Risk Reduction and Emergency Management and
- Outreach and Public Policy

The definition of each category and the recommendations are detailed as the Regional Climate Action Plan.

The draft Regional Climate Action Plan was released at the third annual Regional Climate Leadership Summit held in Key Largo on December 8 and 9, 2011. The Compact Staff Steering Committee aggressively sought public input and feedback from December through March 2012.

During this time, many public presentations on the draft plan and the Regional Compact were delivered throughout the region. Officially, 105 distinct comments were received through the Compact website from 91 individuals. All comments were reviewed by the Compact Staff Steering Committee and the Work Group Chairs. Since many comments were focused on the details of implementation, those thoughts and ideas are captured in the Implementation Guide that is published as a companion resource to the Regional Climate Action Plan. This public comment period resulted in a more robust regional document.

RCAP ... Regional and Municipal Government Collaboration and Shared Implementation

The Southeast Florida Regional Climate Change Compact emerged in 2009 as a collaborative venture among Palm Beach, Broward, Miami-Dade and Monroe Counties and as such, served as the impetus for creating a common framework for climate change mitigation and adaptation strategies throughout the Southeast Florida region. This initial effort for the Compact Counties to collaborate on a regional scale, proved to be an important first step in gaining public and political support required for the advancement of this comprehensive planning initiative. Early on, municipal government engagement and commitment was also recognized as critically important to the success of the Compact.

There are more than 100 local city governments in the region, each at varying stages of climate mitigation and adaptation planning and implementation. To formally begin collaborative efforts among local governments, the Compact Counties met jointly with municipal government representatives at the Second Annual Climate Leadership Summit in 2010. More recently, the Compact Staff Steering Committee membership was expanded with municipal representation to ensure involvement of cities in the drafting of the Regional Climate Action Plan. Successful implementation of the Regional Climate Action Plan strategies requires this continued collaboration.

In the forthcoming years, the Compact Counties expect to build coalitions with more municipalities, the various Leagues of Cities, special districts and other governmental entities, including the Treasure Coast counties participating in the Seven50 Sustainable Communities Initiative.

The Compact Counties and municipal partners are committed to the implementation of the Regional Climate Action Plan. Of course, implementation strategies must be sensitive to the different governance structures of counties and municipalities. Because of the variances in government structures, management policies, land use authorities, charters (where present), and the political environments of member counties and municipalities, implementation is expected to take on different forms. This Plan should be viewed as a framework to help guide policies and projects and implementation must be flexible to address specific local conditions.

It is also important to emphasize that the Regional Climate Action Plan does not provide a mandate for any county or municipal actions, but rather serves as a living document with options that each regional or local government may adopt and utilize based on their interests and vision for the future. Over time, this document will be enhanced as more data becomes available, scientific projections are refined, and best management practices are developed and tested.

The success of the planning efforts thus far is a testament to the political leadership and staff dedication to Southeast Florida. We recognize that by combining our efforts and resources, we are in a better position moving forward. The Compact is at an important turning point. As each partner continues to implement different initiatives, at its own pace and within the context of each individual entity, these individual steps will lead to collective results for a more resilient region. Join us, no step is too big or too small.

VI. Regional Plan Recommendations

The following recommendations are the result of much labor by many individuals and organizations dedicated to a more sustainable and resilient Southeast Florida. The 110 actionable recommendations presented here form the core of Southeast Florida's first Regional Climate Action Plan. These measures draw from and build upon the experience of each partner gained prior to regional collaboration. Some, therefore, are familiar requiring only additional partners for differing scales of implementation. Others are new and designed specifically to address the challenges that become evident through a regional perspective. The Compact Staff Steering Committee has produced a companion document, titled the *Regional Climate Action Plan Implementation Guide*, to provide further insight and guidance on how each of these recommendations can be put to work for Southeast Florida. The Regional Climate Action Plan Implementation Guide is available online at: southeastfloridaclimatecompact.org/.

Sustainable Communities and Transportation Planning

With the establishment of a Unified SLR Projection and the Preliminary Vulnerability Analysis, the picture of the likely future of our region is coming into focus. While the specific conditions at a given point in the future are impossible to predict, the range of potential future conditions has been defined based upon the best available science which includes an agreed upon level of uncertainty. This understanding of a likely future allows us to take action now to protect assets and invest wisely. As the science, monitoring, and modeling of impacts continue to be refined, this area of the plan recommends actions to integrate climate change consideration into existing and future policy decision making processes and municipal and county Comprehensive Plans with the goal to achieve resilience, reduce risk and further greenhouse gas emissions reductions.

As one of many tools available in the comprehensive planning process, this section includes several recommendations addressing the designation and implementation of Adaptation Action Areas which are expected to aid in focusing technical assistance and funding opportunities to areas most vulnerable to the impacts of sea level rise and coastal flooding. In 2011, the Florida Legislature amended state law to provide for Adaptation Action Areas as an optional designation in local comprehensive plans for those identified areas experiencing coastal flooding due to extreme high tides and storm surge and the related impacts of sea level rise. The law also provides for the development of adaptation policies and will maximize funding opportunities for infrastructure needs associated with Adaptation Action Areas. Subsequent to recent changes to state law, members of Congress have since requested the definition of Adaptation Action Areas in federal law to provide for appropriations for adaptation planning and infrastructure needs in designated areas. It is realistic to believe that future funding opportunities will become available through federal and state appropriations and grants for Adaptation Action Areas or areas similarly designated for adaptation planning.

Sustainable Communities

GOAL: Reduce financial and physical losses in our building stock by reshaping where and how we build.

SP-1 Support implementation of the Regional Climate Action Plan by including

recommendations from the Plan into existing land use and policy decisions and related elements of the municipal and county Comprehensive Plans, as appropriate; and recognize the Plan as a basis for the development of new goals, objectives and policies through the appropriate local government Comprehensive Plans.

SP-2 Develop policies, strategies and standards that will serve as guidance for climate change related planning efforts. Municipal and county planning authorities are encouraged to develop policies to improve resilience to coastal and inland flooding, salt water intrusion, and other related impacts of climate change and sea level rise in their Comprehensive Plans, Sustainability Action Plans, Vision Plans, Stormwater Master Plans, Transit Development Plans, Long Range Transportation Plans, Adaptation Action Area Plans, Climate Change Plans and other green planning efforts.

SP-3 Incorporate "Adaption Action Area" definition (as provided for in Florida law) into municipal and/or county Comprehensive Plans, to provide a means to identify those areas deemed most vulnerable to sea level rise and other climate change impacts including but not limited to extreme high tides, heavy local rain events, and storm surge for the purpose of prioritized funding and adaptation planning.

SP-4 Develop criteria in collaboration with municipal and county planning authorities for the purpose of defining Adaptation Action Areas as well as other areas requiring adaptation improvements related to coastal flooding and sea level rise that may include, but not be limited to:

- Areas below, at, or near mean higher high water;
- Areas which have a hydrological connection to coastal waters;
- Areas designated as evacuation zones for storm surge; and/or
- Other areas impacted by climate related drainage/flood control issues.

SP-5 Conduct new or utilize existing vulnerability analysis and other technical tools as they are developed as a means for identifying Adaptation Action Areas as well as other areas requiring adaptation improvements related to coastal flooding and sea level rise, to provide guidance for adaptation planning efforts in areas especially at risk to sea level rise, tidal flooding and other related impacts of climate change.

SP-6 Develop policies, as provided for in Florida law and in collaboration with the appropriate municipal and county planning authorities, related to areas designated as Adaptation Action Areas or similarly vulnerable areas to improve resilience to coastal flooding, sea level rise and other climate related vulnerabilities and provide guidance for other adaptation planning efforts.

SP-7 Develop sea level rise scenario maps to be considered for inclusion in appropriate Comprehensive Plans and/or regional planning documents as determined by the appropriate local government to guide municipal and county government climate adaptation planning efforts and continue to update regional and local planning efforts as more data becomes available and scientific projections are refined.

SP-8 Identify locations within Adaptation Action Areas or similarly vulnerable areas where targeted infrastructure improvements, new infrastructure, or modified land use and/or development practices could reduce vulnerability and/or improve community resilience.

SP-9 Coordinate regionally across municipalities and county planning authorities on the development of projects and funding proposals to seek prioritized funding for identified infrastructure needs and specific adaptation improvements required within Adaptation Action Area or other related adaptation planning areas.

SP-10 Work with appropriate local, regional and state authorities to revise building codes and land development regulations to discourage new development or post-disaster redevelopment in vulnerable areas to reduce future risk and economic losses associated with sea level rise and flooding. In these areas, require vulnerability reduction measures for all new construction, redevelopment and infrastructure such as additional hardening, higher floor elevations or incorporation of natural infrastructure for increased resilience.

SP-11 Identify within Adaptation Action Areas and similarly impacted areas populations and communities most vulnerable or of special concern for the purpose of ensuring the

proper consideration of individual needs and resources as part of local and regional planning activities.

SP-12 Develop new community flood maps reflective of a 100-year storm event under future sea level rise scenarios and use this information, in conjunction with similarly updated storm surge models for revising required elevations for new and redevelopment, and in the permitting/licensing of transportation projects, water management systems, and public infrastructure.

SP-13 Designate or otherwise recognize "Restoration Areas" to identify undeveloped areas that are vulnerable to climate change impacts for the purpose of environmental restoration, dune restoration, agriculture, conservation of natural resources or recreational open space, or as stormwater retention areas. Local governments and appropriate regional planning authorities should prioritize land acquisition in these areas. These areas could also be established or acquired through mitigation or transfer-of-development rights initiatives.

SP-14 Designate or otherwise recognize "Growth Areas" as areas outside of Adaptation Action Areas, or other areas subject to adaptation planning efforts, where growth is encouraged due to higher topographic elevation and the presence of existing infrastructure, such as transportation and water and sewer infrastructure. Growth Areas should be developed with Urban Design guidelines that address character of urban place and provide a high quality pedestrian experience through landscaping and the creation of public space.

SP-15 Modify or develop new design standards for transportation infrastructure located in identified vulnerable areas to include environmentally supportive road materials, bridge design, elevation, and stormwater management. Include different pitches combined with stormwater design to effectively remove water from the roadway; explore roadway materials that may be utilized in road construction that are more tolerant of extended periods of extreme temperatures.

SP-16 Develop policies to address new transportation infrastructure development in light of anticipated future climate impacts, such as consideration of future floodplain conditions and vulnerable areas which could require the rerouting of roads because of potential flooding and related damage.

SP-17 Analyze potential blighted sites and develop an approach for converting underutilized or unused properties and structures, including properties in financial distress, into community gardens or farmers' markets. (i.e., Redfields to Greenfields)

Transportation Planning

More than 100 entities in the four-county region exercise governance over transportation planning, operation, and investment decisions.

The transportation sector contributes 45 percent of the region's greenhouse gas emissions, with the majority of trips taken for family and personal purposes in single occupancy vehicles. Reducing vehicle miles traveled (VMT), which reduces emissions, can be achieved by shifting trips taken in the personal vehicle to walking, biking, and public transportation, and shortening or avoiding trips altogether through community design and sustainable development strategies. Recent studies demonstrate the significant impact this approach can have on avoiding greenhouse gas emissions - estimating that the five "Ds" of compact development – density, diversity, design, destination and distance to transit – are expected to reduce VMT by 12 to 18 percent (Urban Land Institute). Clearly, the success of this reduction is dependent on the extent and timing of implementation. While recommendations in this area call for increased funding for mobility solutions that achieve a reduction in greenhouse gas emissions and also increase the livability and economic strength of the region by reducing our dependence on the personal vehicle, others focus on more immediate strategic service improvements as well as initiatives to attract individuals who could drive their cars but who choose to ride transit or share a ride because of the conveniences and other benefits represented by these choices.

More than 100 entities in the four-county region, including municipalities, county and state governments, metropolitan planning organizations, and regional planning bodies, exercise governance over transportation planning, operation, and investment decisions. A continued and expanded collaborative approach to these activities will be a cornerstone to implementing these recommendations that not only serve to reduce greenhouse gas emissions but will realize cross-cutting benefits of more livable and desirable communities within our region.

GOAL: Reduce greenhouse gas emissions by planning, designing, and prioritizing walkable, affordable communities supported by sustainable multimodal transportation options.

SP-18 Identify means to effectively engage the multiple public and private sector entities with roles and responsibilities involving the provision and maintenance of transportation infrastructure and the delivery of transportation services in the region, in climate adaptation and mitigation initiatives. Document current and evolving coordination efforts among these entities.

SP-19 Focus transportation investments and service expansions on projects and strategies contributing to greenhouse gas emissions reductions and enhancing resilience to climate change.

a. Continue to enhance and implement regionally coordinated transportation planning through the Regional Long Range Transportation Plan (RLRTP). Identify goals and objectives in the RLRTP which, as they are attained, reinforce the desired achievement of greenhouse gas emissions reductions and enhanced resilience to climate change. Articulate the supportive role of these goals and objectives for emissions reductions and climate resilience.

b. Give higher investment priority to and advocate for state and federal transportation infrastructure investments, programs and services that will reduce greenhouse gas emissions and enhance resilience and adaptability to climate change. Performance standards for climate and related metrics, such as reduced VMT and increased mode split, should be incorporated in transportation plans and programs. Transportation planning should include performance measures[1] in major decision-making phases such as land use visioning, long range transportation plans, corridor studies, programming, environmental review, and performance monitoring.

c. Incorporate evaluation criteria and processes to prioritize projects that meet RLRTP goals and objectives — into local and regional planning and programming processes — with an initial emphasis on evaluation criteria that reduce VMT and increase use of transportation modes other than the personal vehicle. Projects that enhance economic vitality should also be given priority, such as projects and service expansions along transit-oriented corridors and those that improve connections to major airports and seaports.

d. Prioritize studies funded through existing programs and other sources addressing effective climate adaptation and mitigation strategies, particularly those addressing barriers to adaptation and assisting in integrating land use and transportation planning.

e. Improve coordination among economic development, land-use/housing, transportation and water resource planning activities. Review local and regional planning and decision making processes to ensure a complementary approach toward developing and maintaining a transportation network, including for purposes of reducing VMT and providing more transportation choices.

SP-20 Require that new development and redevelopment in areas with existing and planned multimodal corridors that connect urban and other centers in the region be planned and designed to support walking, biking and transit use.

SP-21 Support effective planning and implementation of transit oriented developments (TODs)[2], from both a local and regional scale, in coordination with effective planning and delivery of transit services, particularly transit stations[3], to maximize ridership.

a. Recognize that planning for TOD requires consideration of transit and land use issues at the system, corridor and station levels, as well as evaluation of adequate infrastructure such as water and sewer mains.

b. Develop policies to streamline approval processes involving TODs.

c. Ensure equitable distribution of the benefits of TOD and premium type transit services.

SP-22 Introduce a new activity-based regional travel demand forecast model to directly simulate individual trip making and mode choice behaviors. Simulations done using the model will allow for robust tests of the effectiveness of policy alternatives.

SP-23 Consider regional implementation of rapid transit zones to maintain land use control around a station with multiple jurisdictions. Modify local land use plans and ordinances to support compact development patterns, creating more walkable and affordable communities.

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[1]*One example of incorporating sustainable transportation performance measures into existing planning processes is: Environmental Protection Agency's Guide to Sustainable Transportation Performance Measures (EPA 231-K-10-004, August 2011).*

[2]*Transit oriented developments (TODs) are compact moderate to high intensity and density mixed use areas, within one-half mile of transit stations, designed to maximize walking trips and access to transit.*

[3]*A transit station in this context means one serving a premium type of transit including commuter rail, light rail, express bus service such as the 95 Express Bus, bus rapid transit service (as defined by the Federal Transit Authority), or a station that functions as a local bus hub or transfer station, serving a minimum of three fixed routes operating with headways of 21-30 minutes or less.*

Recommendation: Work regionally to improve safety for pedestrians and bicyclists.

a. Identity potential future land use map and other comprehensive plan changes at the local level. Also address the subject in regional level plans.

b. Adopt form-based codes that have physical form, design of buildings and the public realm, and an emphasis on mixed and evolving land uses as organizing principles.

c. Consider regional implementation of rapid transit zones or other such designations to maintain land use control around transit stations, including ones with multiple jurisdictions.

SP-24 Consider the adoption of green neighborhood certification programs, such as LEED ND (Neighborhood Development) to guide decision making and development and to provide an incentive for better location, design, and construction of new residential, commercial, and mixed-use developments with the goal of increasing transportation choices while reducing household transportation costs. Incorporate sustainable building and neighborhood ratings or national model green building codes, including but not limited to those defined in Section 255.253(7), Florida Statutes, into municipal codes region-wide.

SP-25 Adopt or create a green rating system for roads to reduce emissions from construction, maintenance, and agency operations through practices such as using recycled materials, purchasing materials found or manufactured sustainably in the region, and requiring construction contractors to implement emissions reductions practices such as using alternative fueled vehicles and clean diesel practices.

SP-26 Improve movement and safety for non-motorized modes through the adoption and implementation of best practice models including Complete Streets.

a. Develop policy, ordinances, guidelines, models and projects to accelerate implementation.

b. Identify partners and resources to support training and the research into new techniques for transportation design and other professionals.

SP-27 Complete, expand and connect networks of bicycle and pedestrian facilities, including supporting access to transit.

a. Prioritize implementation of planned bicycle and pedestrian networks. Improve overall coordination of local and regional agency planning and implementation efforts. Evaluate whether these facilities are connected regionally and on a local scale to major employment, education, and recreation centers.

b. Implement a roadway design project checklist that includes measures of pedestrian, bicycle, and transit (e.g. bus bay) accommodation.

c. Work regionally to improve safety for pedestrians and bicyclists.

d. Consider regional adoption of Transit, Pedestrian, and Biking programs that aim to improve access to transit.

e. Develop policies to increase designated bike parking facilities at office and retail developments.

Recommendation: Partner to implement a Virtual Freight Network as part of the region's comprehensive Intelligent Transportation System.

SP-28 Continue to implement strategies aimed at maximizing the efficiency of the existing transportation network by all agencies across the region. Many of these strategies also result in greenhouse gas emissions reductions. There is a need for a toolbox of successful strategies that can be duplicated across the region. Agencies should make an effort to collect information that will allow for evaluation of the effectiveness of a strategy in reducing greenhouse gas emissions. Information collected by implementing agencies should include emissions reductions, fuel reductions, VMT impacts, or other performance measures as appropriate. Information collected should also include steps for implementation, costs, and lessons learned. Among the strategies to consider are use of roundabouts, real time operation of the traffic signal system, traffic signal prioritization and queue jumps for transit, interstate ramp metering, and employment

of a virtual freight network (freight network managed in real time using intelligent transportation systems).

SP-29 Increase transit ridership by providing premium transit service[4] on targeted regional corridors. Examples of successful routes include the I-95 Express bus service and "The Flyer" route from Miami International Airport to Miami Beach. The goal of these routes is to bring people who might otherwise drive to work (known as "choice riders") from residential areas to regional centers of employment. Agencies should review levels of service policies and service standards and modify as necessary to prioritize increasing services along corridors with dense land use. Improve quality of service by continuing to monitor and address safety and performance.

SP-30 Increase the amenities and infrastructure available to transit riders, such as shade, shelters, kiosks utilizing solar power when feasible, and route and real time boarding information.

SP-31 Provide seamless transitions to increase the use of low carbon modes for the movement of people and freight in the region.

a. Improve connections among Tri-Rail and county transit service, municipal trolley and community shuttle bus services which may include realignment of routes. District circulators, such as the Metro Mover in downtown Miami, which connects to Metro Rail, provide the last leg of a commute for transit riders and should have high frequency and ease of transfer.

b. Implement seamless regional transit fare and transfer media (traditional or virtual) across transit services in the region while improving walking and biking access to transit.

c. Develop planning strategies to address planning for the "First and Last Mile" of transit trips, which act as barriers for commuters who could potentially take transit but whose starting point or final destination cannot be conveniently accessed from

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[4] *The term premium transit service in this context means rail, express bus service, or the Federal Transit Authority definition of Bus Rapid Transit service, which are routes predominantly on fixed guideways or high frequency bus service with the following elements: substantial transit stations, traffic signal priority or preemption, low-floor vehicles or level platform boarding, and separate branding of the service. High-frequency service is defined as 10-minute peak and 15-minute off-peak headways for at least 14 hours of service operations per day.*

the nearest transit stop/station due to distance, terrain (street patterns), or real or perceived safety issues (traffic, crime).

d. Partner to implement a Virtual Freight Network as part of the region's comprehensive Intelligent Transportation System/Transportation System Management and Operations Programs. Establish a software application to provide "load matching" for shippers and truckers to alleviate "deadheading" of empty trucks traveling back to destination.

e. Incorporate climate adaptation strategies and greenhouse gas emissions inventories into Seaport and Airport Master Plans and Regional Freight Plans. Plans should address the critical last mile to and from major seaports and airports in part by providing comprehensive plan land use designations, policies, and standards that protect that function of roadway segments connecting seaports and airports (hubs) to corridors, such as interstates.

Recommendation: Increase transit ridership by providing premium transit service on targeted regional corridors.

f. Establish performance measures including VMT reduction and emissions reductions monitoring for freight projects such as ship to rail projects which remove drayage truck operations[5].

g. Support clustering of distribution facilities to promote intermodal centers and economic development.

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[5] *"Drayage truck operations" refer to truck container pickup from or delivery to a seaport terminal with both the trip origin and destination in the same urban area.*

SP-32 Use and expand Transportation Demand Management (TDM) strategies, which reduce peak hour and single-occupant vehicle travel.

a. Vanpool and Carpool Programs - Work with MPOs, South Florida Commuter Services and South Florida Vanpool to identify and pursue opportunities to more fully utilize and expand these programs.

b. Car and Bike Sharing Programs - Work with companies providing these services and strategic partners (universities, municipalities, large employers, etc.) to establish zip car, bike sharing and personal vehicle sharing programs.

c. Employee Benefits – Encourage sharing of information on and use of employee benefits that support use of walking, biking and transit modes for work commutes (e.g., pre-tax benefits and Emergency Ride Home program).

d. Commute Trip Reduction Programs - Local governments should promote participation in programs such as the EPA Commuter Choice Program and explore the adoption of commute trip reduction ordinances.

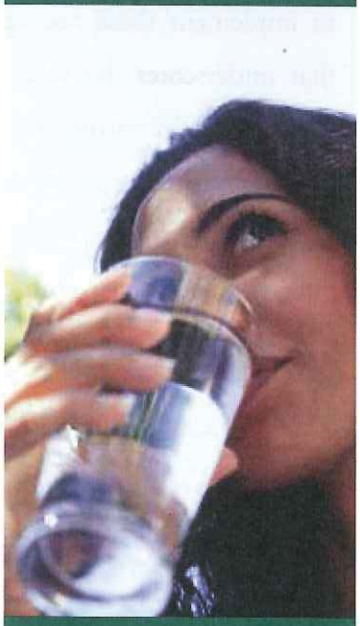
SP-33 Coordinate initiatives with those of the seven-county Southeast Florida Prosperity Plan, known as Seven50, to maximize the opportunities presented as Seven50 is developed (e.g., sharing data and analyses; participating in alternative future scenario planning; engaging a myriad of public, private and civic partners) and actively engage in Seven50 implementation efforts, designed to address the following Livability Principles:

- Provide more transportation choices
- Promote equitable, affordable housing
- Enhance economic competitiveness
- Support existing communities
- Coordinate policies and leverage investment;
- Value communities and neighborhoods and
- Enhance community resilience to the impacts of Climate Change

Water Supply, Management and Infrastructure

Climate change presents serious challenges for water managers with impacts on the quality and abundance of water supplies, water and wastewater infrastructure, and drainage and flood control operations. An effective response will require the coordinated efforts of governmental agencies and service providers and a holistic approach that treats water supply, disposal and management as integrated systems.

Climate change presents serious challenges for water managers.



It is essential to identify practical solutions today.

In Southeast Florida, climate change is predicted to influence precipitation patterns with both water supply and water management implications. Fewer storm events, drier winter and spring months, and an increase in local evapotranspiration rates (water lost to the atmosphere through evaporation and plant transpiration) will increase the frequency and severity of droughts while less frequent but more intense storms will tax water management systems causing both inland and coastal flooding. Impacts will be compounded by sea level rise with the loss of coastal wellfields due to saltwater intrusion and constraints on water management operations due to increases in groundwater levels and reduced discharge potential at canal water control structures. Addressing the impacts of climate change will require: finding solutions to consistently maintain high quality and adequate water supplies for all local communities, strategies to reduce the cost and energy demands of alternative water supplies, consideration of future conditions with respect to the placement of infrastructure, and investments in new and upgraded infrastructure to maintain essential drainage and flood control operations. Additionally, SLR from climate change is threatening the Florida Everglades, the backbone of our natural resource system, highlighting the urgent need for restoration of the Everglades with improved delivery and distribution of water flow to provide both natural resources and water supply benefits.

Given these challenges, it is essential to identify practical solutions today to help mitigate the impact of climate change on our future water supply. The Regional Climate Action Plan proposes recommendations to provide regionally coordinated water management plans that address

stormwater use and disposal, traditional and alternative water supplies, wastewater disposal and reuse, water conservation measures, and continued support for Everglades restoration efforts.

A unified effort among government, businesses, and consumers is needed to implement near-term solutions and develop long-term strategies to mitigate adverse impacts of climate change on water supplies while developing new sources that add diversity to our water supplies. Efforts will require optimized use of all water resources, with conservation being paramount, along with development of new sources less vulnerable to changing climate conditions. The challenge will be to implement these necessary projects without marked increases in energy consumption, a difficulty that underscores the value of conservation as a priority strategy. Policy and regulatory changes, funding for infrastructure, development of alternative water supplies, and public education will all be necessary in order to make significant progress. The issues are vast and the investments to be great, with effective response requiring the collaboration of the public, financial participation of state and federal governments, and the exploration of new finance strategies.

GOAL: Advance water management strategies and infrastructure improvements needed to mitigate for adverse impacts of climate change and sea level rise on water supplies, water and wastewater infrastructure, and water management systems.

WS-1 Develop local and, where appropriate, regional inventories of existing potable water supply delivery and collection systems, vulnerable wellfields, wastewater collection and/or treatment infrastructure, septic tanks/drainfields, and stormwater drainage and treatment facilities; assess the potential impact from climate change of each component; and develop different climate change scenarios and adaptation strategies for high-risk utilities and/or infrastructure which may require replacement, reinforcement, or relocation to ensure the long-term viability of the system (e.g., modified site, depth, elevation, materials, or connection requirements).

WS-2 Develop a regional saltwater intrusion baseline and utilize saltwater intrusion models to identify wellfields and underground infrastructure at risk of contamination/ infiltration by saltwater with increases in sea level.

WS-3 Utilize existing and refined inundation maps and stormwater management models to identify areas and infrastructure at increased risk of flooding and tidal inundation with increases in sea level, to be used as a basis for identifying and prioritizing adaptation needs and strategies.

WS-4 Evaluate the impacts of rising sea and groundwater levels on soil storage, infiltration rates and inflow to stormwater and wastewater collection and conveyance systems; consider longer-term influences on water quality; and develop strategies for implementing reclaimed water and stormwater reuse projects that account for current and future conditions.

WS-5 Develop and apply appropriate hydrologic and hydraulic models to further evaluate the efficacy of existing water management systems and flood control/ drainage infrastructure under variable climate conditions. Quantify the capacity and interconnectivity of the surface water control network and develop feasible adaptation strategies.

WS-6 Coordinate with the South Florida Water Management District, Drainage/Water Control Districts, and utilities/public works officials to identify flood control and stormwater management infrastructure already operating below the design capacity. Further examine water control structures to ensure that they can provide for inland or upstream migration of riparian species as freshwater habitats become more saline.

WS-7 Develop Integrated Water Management Plans that present a joint assessment and planning strategy involving local water utilities, wastewater service providers, water managers, and partners to the Southeast Florida Regional Climate Change Compact, for coordinated consideration of stormwater use and disposal, traditional and alternative water supplies, wastewater disposal and reuse, and water conservation measures for use by local leadership to guide planning decisions as well as amendments to applicable codes and regulations.

WS-8 Develop and test water management and drainage system adaptation improvements needed to maintain existing levels of service relating to drainage, flood control, and water supply, and use cost-benefit analyses to prioritize potential improvements.

WS-9 Incorporate and prioritize preferred climate adaptation improvement projects in capital improvement plans and pursue funding.

WS-10 Encourage, foster, and support investigative work and scientific research that improves the understanding of local and regional climate change impacts specific to Southeast Florida, including:

- Improved down-scaling of global climate models for representation of precipitation at the regional/local scales
- Identification and targeting of gaps in monitoring to improve quantification of the hydrologic system and its response to climate change, such as evapotranspiration, groundwater levels, and precipitation, and local sea level
- Development of risk-based decision support tools and processes for application in analysis of infrastructure design, water resource management, natural systems management, and hazard mitigation alternatives. Tools should provide for consideration of potential economic costs of comparative planning scenarios, management decisions, and infrastructure investments and the evaluation of potential tradeoffs.

WS-11 Undertake efforts to fill identified data gaps through local program efforts, agency collaborations, and advocacy for additional state/federal resources, as needed.

WS-12 Foster the development and exchange of new information, methods and technical capabilities to address key questions of concern related to climate variability and sea level rise to support management decisions:

- Assess impacts of observed and predicted climate variability and sea level rise on the frequency, duration, and intensity of flooding as a result of extreme tidal excursions, storm surge, and 100-year storm events, and where impacts are likely to be greatest.
- Examine the effects of climate change on water availability and groundwater vulnerability due to sea level rise, and predicted changes in precipitation and evapotranspiration patterns and rates.
- Establish a venue for a periodic exchange of ideas between resource managers, policy makers, and researchers.

WS-13 Develop agency capabilities to provide rapid deployment of resources in immediate response to intense precipitation and storm events through use of Next RAD technology.

Recommendation: Mitigate climate change on water supplies, water and wastewater infrastructure, and water management systems.

WS-14 Cultivate partnerships with federal and state agencies and professional associations with expertise in integrated water resource planning (such as the U.S. Army Corps of Engineers Institute for Water Resources, the United States Geological Survey, and Water Foundations) as sources of important research, reports, and information regarding climate change, and efforts being undertaken in other communities.

WS-15 Monitor changes in rainfall patterns, temperature means and extremes and sea level rise through coordination with NOAA and other key organizations/partners to better predict future wet-season and dry-season rainfall. Monitor emerging science in order to assess the adequacy of regional climate models. Choose an annual conference or other venue at which such trends can be reviewed at regular intervals.

WS-16 Manage water storage in the region's publicly-owned uplands and wetlands and in other land uses compatible with water storage, including wetland restoration, certain agricultural operations and certain renewable energy production facilities. This will further serve to protect high quality drinking water supply, increase aquifer recharge, and as a means for managing saltwater intrusion.

WS-17 Support complete implementation and funding for the Comprehensive Everglades Restoration Plan (CERP) and its updated versions as fundamental to Everglades restoration, to include increased freshwater flows to the Everglades system, thereby improving water quality, maximizing regional freshwater storage and aquifer recharge, and providing potential to abate saltwater intrusion, which will become increasingly important under variable climate conditions and in the face of sea level rise.

WS-18 Combine existing and develop new land acquisition priorities in a regional setting to protect high quality drinking water supply.

Natural Systems

Southeast Florida's natural communities exist within specific climate, water and salinity regimes; coral reefs and seagrasses grow in clear, shallow seawater with abundant sunlight and stable temperatures while mangroves thrive in the often brackish areas between the low and high tide lines. Freshwater-dependent hardwood hammocks and pine rockland forests support an abundance and diversity of rare plants and animals unrivaled in the United States. Similarly, Everglades tree islands depend upon wet and dry seasonal rainfall patterns that have existed for centuries. Climate change threatens many of the native plants and animals important to Southeast Florida's culture, economy and distinctive sense of place.

Changing weather patterns are not new to the native flora and fauna of Southeast Florida. Plants and animals are always living and competing on the edge of their limits. Wetland plants gain ground, moving up the slope in wet years and perhaps losing that same ground in dry years. But in many climate change scenarios, the speed and direction of such changes may be unprecedented. Climate change may exceed the capacity of native species to keep pace. By taking specific action now, we may be able to manage our native flora and fauna without losing species diversity and without introducing potentially harmful species.

Coral reefs are vital to local fisheries and the economy. Healthy oceans provide most of the oxygen in the air we breathe. Much research is already underway regarding the impact of climate change on the world's oceans. Locally, strategies are being developed to maintain our ocean in the face of climate change. In estuarine systems, mangroves and seagrasses are primary converters of sunlight energy to food energy. However, they are both limited

Climate change threatens many of the native plants and animals ...

... important to Southeast Florida's culture, economy and distinctive sense of place.

by water depth. As seas rise, they may not survive in their current locations. It will be incumbent on us to ensure that newly inundated areas are available for them to colonize. The fate of freshwater wetlands is currently harder to predict. Tide water may reach further inland and some freshwater sources may become more brackish. These 'lightly salty' estuaries can be biologically healthy habitats but we must ensure that other land uses, including drinking water supplies, are not threatened.

Most of the regions' freshwater wetlands and native uplands are supplied with rainwater. At this time, no one knows exactly what changes in rainfall patterns are in store for us. What we do know is that storage of freshwater is an important mitigation option whether rainfall is too much or too little – or both. Having freshwater storage options allows us to collect flood waters and hold them for later release during drought.

Given the opportunity, some species can adapt, migrate, or transition. Adaptation and migration or transition, necessary for sustaining natural plant and animal communities, will require careful and thoughtful planning. Land use planning and land acquisition programs will have to allow for such transitions. Hardened shorelines may be transformed to living shorelines. Open lands or vacant parcels may be suitable locations for habitat restoration.

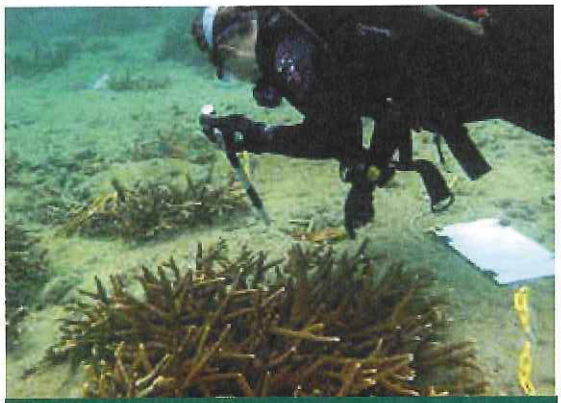
The following strategies recommend ways in which all levels of government can share information necessary to plan for and implement the maintenance of natural areas, rare and endangered native species populations as well as the green industries necessary for our local economy.

GOAL: Implement monitoring, management, and conservation programs designed to protect natural systems and improve their capacity for climate adaptation.

NS-1 Develop a vital signs status and trends monitoring program for biological communities. Key parameters may include rate of sea level rise, saltwater intrusion boundary and monitoring wells, landscape-level vegetation patterns, percent coral cover and condition in offshore reef zones, water temperature and pH in areas, and occurrence and range of invasive exotic plants and animal species.

NS-2 Promote collaborative federal, state and local government conservation land acquisition programs. Explore fee simple and less-than-fee approaches which reflect regional acquisition priorities and result in conserving a diversity of natural areas including hot spots of biological diversity, protecting open space and buffer areas to create or maintain resilience and adaptive capacity of existing natural areas to transition inland/ upslope.

NS-3 Support regional fire management coordination efforts emphasizing frequent, low intensity fire regimes in wetland and pine forest systems to maximize habitat quality, resilience to change and carbon neutrality while preventing hazardous fuel load buildup that leads to major carbon releases.



Goal: Implement monitoring, management, and conservation programs designed to protect natural systems and improve their capacity for climate adaptation.

NS-4 Quantify monetary values of hazard mitigation and adaptation provided by natural systems using Ecosystem Services Valuation or comparable model. Create a sustainable funding mechanism for their protection and management.

NS-5 Maintain or restore multiple areas of habitat and large-scale connectivity to facilitate native species population stability and habitat shifts resulting from climate change.

NS-6 Coordinate and implement regional invasive exotic species prevention and control efforts to minimize the diversity and abundance of habitat-homogenizing exotic plants and animals by emphasizing prevention of new invasions and early detection/rapid response to nascent invasions.

NS-7 Coordinate "living shorelines" objectives at regional scale to foster use of natural infrastructure (e.g. coral reefs, native vegetation and mangrove wetlands) instead of or in addition to grey infrastructure (e.g. bulkheads).

NS-8 Leverage existing work of the Florida Reef Resilience Program's "Climate Change Action Plan for Florida's Coral Reef System 2010-2015" for protection of marine habitat.

Sea level rise from climate change is threatening the Florida Everglades, the backbone of our natural resource system.

NS-9 Engage and cooperate with marine resource agencies to maintain coral reef (e.g., selective breeding) and mangrove ecotones as estuarine habitat and natural barriers to storm surge that also maintain coastal biodiversity.

NS-10 Advocate for federal and state funding for applied monitoring and climate related science:

- identify economic and physical linkages between marine systems (e.g. reefs and mangroves) and hazard risk/damage claim reduction
- monitor coastal and freshwater marsh vegetation tolerance to changing salinity, depth and other climate variables
- improve data on estuarine bathymetry and use appropriate models to help identify habitats at risk
- develop refined climate projections, hydrologic and ecological models to aid in planning

NS-11 Support regulatory requirements that provide for ecologically beneficial uses of clean, dredged materials.

NS-12 Develop long-term turtle-nesting beach preservation and management strategies to reduce nest vulnerability and mortality.

NS-13 Compile information on rare plant species in threatened natural communities and develop adaptation plans that include, at a minimum, seed bank repository collection and assisted propagation.

NS-14 Maintain/restore urban tree canopy.

Agriculture

Consideration of agricultural impacts is vital to any regional action plan.

Agriculture is consistently one of the three economic drivers to Florida's economy. When the economic impact of tourism, development and agriculture are reviewed over many years, agriculture tends to be the stabilizing component of the economy.

Southeast Florida is unlike any other growing area in the nation due to a 12-month growing season and ample local market potential. More than 250 different and unique crops grow in Southeast Florida. These crops supply the entire east coast of the United States with winter vegetables, contributing to the food security of the nation. Many tropical and ethnic crops are also grown and marketed to the diverse population of the region.

Farmers are actively adapting Best Management Practices that efficiently utilize nutrient application (right time, right place) and conserve water resources. They are also evaluating alternative methods to utilize and retain water when it's not harmful to current or projected growing practices.

The agriculture community is committed to sustainability, and the economic viability of regional agriculture will allow farmers to remain on the land to grow food, fuel and fiber for area residents as well as the nation. Consideration of agricultural impacts is vital to any regional action plan which should include action plans to address flooding, salt-water intrusion, exotic pests and disease introduction and crop changes due to climate change.

GOAL: Ensure the continued viability of agriculture in Southeast Florida through policies which remove barriers to production, promote economic incentives, improve water reliability, and provide research on best management practices, thereby encouraging sustainable production in the face of a changing climate.

AG-1 Promote policies which preserve the economic viability of agriculture as the industry adapts in the face of climate change.

AG-2 Develop and seek regional, state, and county-based funding for willing buyer/willing seller Agriculture Purchase of Development Rights Program to maintain agricultural land for its

ability to lessen climate change impacts and provide tor national food security.

AG-3 Support academic research in the agriculture sector on best management practices for crops presently grown or new crops which may be grown as climate conditions change in Southeast Florida.

More than 250 crops grow in Southeast Florida, contributing to the food security of the nation.

AG-4 Provide incentives to growers/land owners to manage agricultural lands to lessen impacts of climate change regionally and provide environmental benefits (which may include, but not be limited to: open space, water aquifer recharge and storage, carbon sequestration, wind farms, biofuels, and wildlife habitat).

AG-5 Ensure availability of water supply, at reasonable cost, to meet the diversity of needs across Southeast Florida to include agricultural irrigation needs and crop freeze protection.

AG-6 Identify and reduce obstacles for permitting agricultural practices (including growing and selling produce) in urban areas, in order to encourage urban farming and reduce greenhouse gas emissions related to the transport of farm produce.

Energy and Fuel

The vast majority of the energy consumed in the region is to fuel our vehicles and to generate electricity for our buildings. It is widely understood that the most accessible and cost-effective way to reduce energy consumption is through efficiency and conservation. The recommendations in this area address these important strategies and also take the next step by encouraging the use of alternative and renewable energy. They call for public-private partnerships and addressing barriers, including regulatory processes, which currently prevent the broad application of these technologies. Recommendations are comprehensive, ranging from setting regional goals, increasing renewable energy capacity to establishing a regional framework to deliver finance options. Recommendations also aim to reduce idling and prepare our region for the shift to plug-in electric vehicles.

GOAL: Increase renewable energy capacity and reduce consumption of electricity and fuel.

EF-1 Undertake regional efforts to advance energy efficiencies, energy conservation and the deployment of alternative and/or renewable energy technologies in existing and proposed developments through local ordinance, incentives, education, and energy efficiency financing strategies.

Recommendations aim to reduce idling and prepare our region for the shift to plug-in electric vehicles...

EF-2 Work toward the establishment of a regional framework to deliver Energy Efficiency and Renewable Energy finance options, in addition to other local government initiatives and partnerships, to achieve regional greenhouse gas emissions reductions, the use of alternative and renewable energy technologies, in furtherance of green sector economic development.

EF-3 Set a recurring five–year regional goal to increase renewable energy capacity and conservation – which includes the co-benefits of economic development and job creation – through revising building and zoning codes and architectural design guidelines to allow for, encourage, and integrate renewable energy sources into the power supply.

EF-4 Seek amendments to existing land development regulations and development standards and revise or eliminate provisions that act as a barrier to the installation and use of renewable energy systems pursuant to Section 163.04, F.S.

EF-5 Develop policies to facilitate and streamline the deployment of energy efficient and renewable energy such as the installation of LEDs and use of solar power for public infrastructure such as street lighting, parks, and parking facilities. Survey counties, cities and regional agencies with lighting infrastructure to determine the

... and to advance energy efficiencies, energy conservation and the deployment of alternative and/or renewable energy technologies on a regional basis.

level of deployment and to gather best practice policies and implementation steps to facilitate the application of efficient, environmentally sensitive (sea turtles), and responsive lighting practices in additional infrastructure.

EF-6 Support or facilitate development and distribution of *local* sources of sustainable fuels and availability of fueling infrastructure. Adopt policies to facilitate the development of *locally sourced* sustainable alternative fuels, those achieving a reduction in lifecycle greenhouse gas emissions when compared to conventional fossil fuels (including, but not limited to, waste-based bio-diesel and methane gas from sources like landfills). Include these policies in regional plans and Local Comprehensive Plans. Identify incentives and modify local code to encourage the establishment of a local alternative energy industry.

EF-7 Establish a working group of public and private stakeholders to develop a strategy to promote the use of Plug-in Electric Vehicles in the region.

a. Establish locations where infrastructure and/or battery switching stations are needed. Solar charging and other renewable options should be designated a priority to maximize emission reduction benefits and to improve the community's emergency management preparedness in times of power outages.

b. Develop policies to provide incentives for the deployment of infrastructure to complement transit oriented corridors. Preferred and/or reduced parking fees should be a consideration for riders accessing transit facilities by electric or other alternative fuel vehicles. Transit facilities should develop plans to establish electric vehicle charging infrastructure.

c. Work with relevant stakeholders to streamline permitting processes associated with charging equipment to encourage the safe and expeditious installation on customer premises and elsewhere.

d. Coordinate monetary and non-monetary incentives available to the general public and organizations purchasing electric vehicles.

e. Support regional efforts to establish a framework for siting/locating public electric vehicle charging stations.

EF-8 Develop a strategy to promote the development of truck parking with electrification facilities and the use of auxiliary power units to reduce extended idling by trucks.

a. Survey state, local and regional transportation agencies for existing studies identifying trucking patterns and needs.

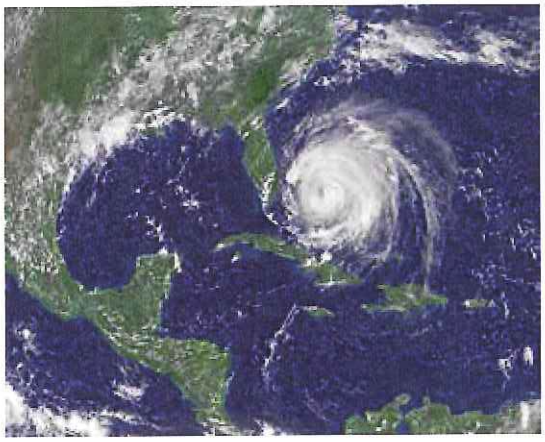
b. Identify strategic locations for truck parking facilities and seek competitive funding opportunities as a region.

Risk Reduction and Emergency Management

The recommendations presented in this section of the Southeast Florida Regional Climate Action Plan provide a foundation for establishing a more predictable physical environment in the face of climate change through regulations, adaptation strategies, and emergency operations, with the goal of reducing future economic losses and threats to public safety. Southeast Florida is no stranger to the devastating effects of hurricanes and other severe weather. Our experience has made us experts in planning, preparedness, response, mitigation, and recovery. Our emergency managers are trained in an all risk-based, all hazards approach. Disaster can strike anytime, anywhere. It takes many forms – a hurricane, a tornado, a flood, a fire or a hazardous spill, an act of nature or an act of terrorism. In fact, in the aftermath of September 11, homeland security preparedness was easily incorporated into Southeast Florida's all hazards approach to emergency management. An emergency can build over days or weeks, or hit suddenly, without warning. Southeast Floridians are resilient and accustomed to this and can mitigate, prepare, respond, recover, and return to better than normal.

Planning for more and possibly new weather-related threats needs to be incorporated into our emergency preparedness and hazard mitigation plans.

Climate change differs, however, with impacts that may not be immediately evident as the changing conditions are slower and occur over longer time scales. With climate change there is no overnight return to "normal." Sea level rise does not appear on the on 6 o'clock news weather map moving towards the coast of Florida. It is that difference that makes it more difficult for the general public to understand and to react to climate change. Yet, we are already experiencing more extreme weather conditions – from extreme rain to extreme droughts, from unseasonable heat waves to early cold fronts. Climate



is changing. Adapting and planning for more and possibly new weather-related threats need to be incorporated into preparedness procedures, and one step further is to include climate change in our emergency preparedness and hazard mitigation plans.

The collection of strategies and actions in this area is aimed at integrating climate change risk into all-hazards emergency management planning and response models. This approach provides support for the objectives of the Coastal Zone Management Act of 1972 which recognizes sea level rise as a threat to coastal communities and encourages strategies for improved protection of life and property, and builds upon requirements of Section 163.3178 and Chapter 252 F.S. relating to coastal and emergency management plans.

GOAL: Provide a more resilient natural and built physical environment in light of climate change.

RR-1 Perform vulnerability analysis to identify and quantify the economic value of regional infrastructure at risk under various sea level rise scenarios and other climate change scenarios utilizing inundation mapping, modeling, and other appropriate tools. While the initial regional vulnerability assessment completed by the Compact Counties for use in this Regional Climate Action Plan has yielded important new insights on regional risk, additional and ongoing analysis is required to further refine our current understanding and to monitor changes in Southeast Florida's risk profile over time.

RR-2 Evaluate and improve adaptation responses for communities at risk, to include:

- Development and implementation of methodologies for the assessment and evaluation of evacuation and relocation options
- Development of model evacuation policies and procedures for communities at increased risk of flooding
- Development of model relocation policies for affected communities.

RR-3 Incorporate climate change adaptation into the relevant Local Mitigation Strategy (LMS) to reduce or eliminate long-term risk to human life and property from disasters. Within the LMS, update local risk assessments to include climate change in the hazard analysis and vulnerability assessment section. Develop strategies for hazard mitigation and post-disaster redevelopment planning.

RR-4 Identify transportation infrastructure at risk from climate change in the region, and determine whether, when, where, and to whom projected impacts from climate change might be significant. Employ inundation mapping, modeling and other appropriate tools to assess the vulnerability of transportation infrastructure to the projected impacts of climate change under various sea level rise and other climate change scenarios. At a minimum, assess the vulnerability of the following transportation infrastructure:

- local transportation networks of the Compact Counties
- the Regional Transportation Network designated by the Southeast Florida Transportation Council composed of interconnected, strategic corridors (roadway, rail line, waterway), hubs (airports, seaports, intermodal terminals, freight terminals, passenger rail and intercity bus terminals) and connectors critical to the mobility of people and freight and the region's economic competitiveness and quality of life (map included in Appendix D); and evacuation routes adopted under the Statewide Regional Evacuation Corridor Program.

Recommendation: Communicate the risks related to climate change.

RR-5 Enforce Coastal Construction Control Line and build upon goals, objectives and policies related to Coastal High Hazard Area designations in Comprehensive Plans.

RR-6 Adopt consistent plans at all levels of regional government that adequately address and integrate mitigation, sea level rise and climate change adaptation. The following plans must all be consistent: disaster recovery and redevelopment plans, comprehensive plans, long-range transportation plans, comprehensive emergency management plans, capital improvement plans, economic development plans, Local Mitigation Strategy, Climate Change Action Plan, and Future Land Use Plan.

RR-7 Continue to implement and enforce strong building codes that require new construction and substantial improvements to existing structures to mitigate against the impacts of flooding, severe winds, and sea level rise, and which are consistent with Climate Change Adaptation policy.

Outreach and Public Policy

Outreach and Public Policy recommendations are combined in recognition of the fact that the best planning efforts in the world will not be implemented or reach their full potential without the support of the public, often through local government public outreach programs, and without the leadership of local, state and federal policy makers and private sector decision makers who are committed to a sustainable planet.

Public Outreach

Today's world is marked by instant communication, immediate information and multitasking behaviors. News and information related to climate change is difficult to communicate in a sound bite. It's relatively easy to communicate the threat of an imminent storm, tornado or other natural disaster, but much more difficult to mobilize the public to hazards that unfold over years and decades. The state of the current economy also makes a long-term discussion on climate change more difficult when many Americans are thinking about short-term housing, employment and other immediate needs. And, of course, the science of climate change is still contested by some.

The strategies and actions in this area aim to educate stakeholders in all sectors and at all levels – from the general public and voters to elected officials, professionals and other decision makers. These are initiatives to inform and create a common understanding of the benefits of energy independence, energy use reduction, water conservation, smart growth, and natural area protection that will create demand for a healthy, sustainable and resilient region.

GOAL: Communicate the risks related to climate change and the value of adapting policies and practices to achieve resilience throughout the region.

PO-1 Provide outreach to residents, stakeholders and elected officials on the importance of addressing climate change adaptation and preparedness and develop a program to educate specific interest groups about the Compact, Regional Climate Action Plan, and the benefits of Adaptation Action Area. Consider utilizing the Academy concept to educate elected leaders, academic interests and other decision makers.

PO-2 Collaborate among counties, municipalities and appropriate agencies to develop and carry out outreach/educational programs to increase public awareness about hazards

exacerbated by climate change, mitigation efforts, and adaptation strategies to minimize damage and risk associated with climate change.

Successful implementation of the Regional Action Plan strategies requires continued collaboration.

PO-3 Provide education and improve communications on energy conservation and available technologies with a focus on both short-term and life-cycle economic benefits, and incentives available within the region.

PO-4 Modify existing and encourage new public outreach, education and messaging programs associated with natural areas including upland, wetland, marine, coastal and nearshore environments and the Everglades to include climate change mitigation and adaptation messaging and volunteer opportunities to create awareness about the impacts of climate change on the environment.

PO-5 Initiate a regional public education campaign to educate residents, business owners, and policy makers on the merits of preserving open land as an "insurance policy" for adaptation to sea level rise in Southeast Florida.

PO-6 Develop early warning systems and social media applications to both inform residents and visitors of extreme high-tide events and to raise overall awareness on sea level rise and climate change issues. Also consider roadway signage for tidal flooding zones.

PO-7 Leverage resources for campaign and promotional advertisements by coordinating public transportation messaging in the region to attract non-transit-dependent (choice) riders. Messages should focus on making riding transit "cool."

PO-8 Deploy social media applications, to facilitate use of transit including access to real-time information such as arrival times.

PO-9 Develop strategies to promote fuel efficient driving habits, including anti-idling practices, and to raise awareness of rules and safety practices for sharing the road

with bicyclists and pedestrians. Conduct best practice research on existing campaigns and look for opportunities to integrate tools into existing high school, county and municipal driver education courses, traffic school curriculum, truck driver training, and fleet associations. Also include messaging on the benefits of purchasing fuel efficient vehicles.

PO-10 Coordinate outreach efforts with states, regions and counties that are subject to the impacts of climate change with special emphasis on coastal entities experiencing sea level rise and coastal flooding to create a national Climate Adaptation Coalition for the purpose of impacting public policy and influencing appropriations requests.

PO-11 Create a working group to expand marketing efforts such as Redland Raised to promote local organic and sustainable agriculture and economy by connecting farmers with local users such as restaurants, grocers, and farmers markets and encourage the establishment of farm-to-school initiatives and community supported agriculture programs.

Public Policy

Public policy development and advocacy are core components of the Compact and commitments that the Compact partners have fulfilled. Recent amendments to Florida law that provide for Adaptation Action Area designation for areas vulnerable to the impacts of climate change, and the subsequent request by members of Congress to amend federal law to mirror this action are just a few examples of the Compact's success to influence policies. The Regional Climate Action Plan provides the next step to gain support for ordinances, regulations and state and federal policies on behalf of the region. The Public Policy goal complements numerous other recommendations noted in the Sustainable Communities and Transportation Planning sections of this Plan.

On June 24, 2010, partners in the Southeast Florida Climate Compact convened a regional press event to respond to the Deepwater Horizon Oil Spill in an urgent call for comprehensive federal energy policy and a demand for a permanent ban on oil drilling and exploration in Florida's territorial waters and along Florida's outer continental shelf.

Additionally, the continuation of regional efforts to influence public policy is key to ensure that state and national policies considered during these uncertain times do not impede regional efforts already underway. Compact successes to date can easily be undermined without vigilance in monitoring policy developments on all levels of government.

GOAL: Guide and influence local, regional, state and federal climate change related policies and programs through collaboration and joint advocacy.

PP-1 Compact Partners will continue the support for the core Compact policies and the role of joint advocacy as provided for in Sections 1 – 4 of the Compact calling for changes to federal law that better recognize the unique vulnerabilities of Southeast Florida to climate change and for providing appropriations based on vulnerabilities, with special attention to funding infrastructure projects to adapt to sea level rise.

PP-2 Compact partners will continue to develop state and federal legislative programs on a yearly basis that will serve as guidance for advocacy in Tallahassee and Washington, D.C. Regional programs will be considered for inclusion into Compact partners' legislative packages and joint advocacy in Tallahassee and Washington, D.C., is encouraged when appropriate.

PP-3 Continue to seek the support of other municipal and county jurisdictions including the Leagues of Cities, Florida Association of Counties (FAC), etc. within Florida and the National Association of Counties (NACo) and other entities that influence national policy for the purpose of building coalitions, sharing resources, and influencing state and national policy on mutual climate related issues through joint advocacy.

PP-4 Counties, municipalities, regional agencies and other appropriate government and private sector partners should integrate consideration of climate change impacts and adaptation strategies into existing and future systemwide planning, operations, policies, and programs. The guiding principles developed by the Interagency Task Force on Climate Change Adaptation[6] for federal agencies should be incorporated by entities when designing and implementing adaptation strategies:

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[6](http://www.fedcenter.gov/programs/climate/guidingprinciples/)

- Prioritize the most vulnerable
- Use best-available science
- Build strong partnerships
- Apply risk-management methods and tools
- Apply ecosystem-based approaches
- Maximize mutual benefits
- Continuously evaluate performance

We will continue to seek the support of entities that influence national policy for the purpose of building coalitions, ...

PP-5 Advocate for new authorization of the federal surface transportation programs with increased priority for funding public transit and non-motorized travel and integrated regional and local planning as means to reduce the greenhouse gas emissions from the transportation sector. Such a federal program should explicitly incorporate climate change and shift priorities toward programs that encourage reinvestment in existing infrastructure and communities ("fix-it-first" programs), support public transportation and transit-oriented development, and address congestion management through means other than new road building.

PP-6 Support federal actions to reform transportation models and enhance the National Environmental Policy Act (NEPA) processes to integrate climate change analysis. The essential purpose of NEPA is to ensure that environmental factors are weighted equally when compared to other factors in the decision making process. NEPA processes are central to highway and transit project investment analysis.

PP-7 Advocate for stronger Corporate Average Fuel Economy (CAFE) Standards and other initiatives to promote clean fuel alternatives and encourage more stringent vehicle emission standards in recognition of the value of these initiatives to mitigate the impacts of climate change by reducing greenhouse gas emissions.

PP-8 Support and advocate for continued implementation and funding on the state and federal levels for the Comprehensive Everglades Restoration Plan (CERP) in recognition of the important role of CERP in climate adaptation planning and local water resource management related to regional water storage and aquifer recharge, important under variable climate conditions and sea level rise.

PP-9 Advocate to interests in Tallahassee for the preservation of the authority and resource capacity of the Water Management Districts in support of their continued

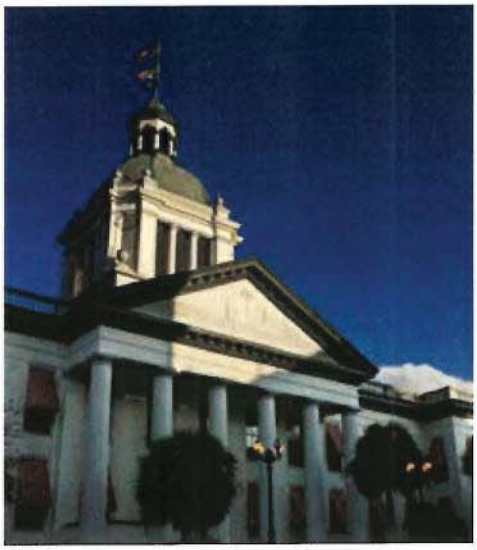
participation in integrated water resource planning, particularly in Southeast Florida where climate change and sea level rise pose additional challenges to the complex issues of alternative water supply development, Everglades restoration, salt water abatement, and drainage and flood control operations.

... sharing resources, and influencing state and national policy on mutual climate related issues through joint advocacy.

PP-10 Encourage federal support for research and investigations of potential energy efficiencies in pumping and water treatment processes necessary for meeting energy reduction goals concurrent with a growing reliance on pumps and advanced treatment technologies for drainage and flood control, water production and wastewater operations.

PP-11 Urge Congress to provide recognition of an "Adaptation Action Area" designation in federal law for the purpose of prioritizing funding for infrastructure needs and adaptation planning, with special attention to modifications in law that enhance funding opportunities through USACE and EPA appropriations processes, as requested by members of Congress.

PP-12 Urge Congress to pass legislation that would create a permanent funding source to finance infrastructure projects to adapt to the impacts of climate change with emphasis on investments in areas such as water management, water supply, transportation and other projects that serve to reduce risks to urban infrastructure from extreme weather events and rising sea levels.



PP-13 Urge Congress to pass legislation that removes federal barriers posed by the Federal Housing Finance Agency to Property Assessed Clean Energy (PACE) residential initiatives that are intended to assist property owners to finance energy efficiency and renewable energy improvements.

VII. Conclusions

This Regional Climate Action Plan provides the initial framework for an ongoing regional commitment to building resilience and sustainability as cornerstones of Southeast Florida's regional economic, social and ecological system. The five-year scope of this document is indicative of the fact that this is the beginning rather than the end of the Regional Compact process. The Compact Counties recognize that a given document is less important than the ongoing collaborative process of assessing progress over time, developing new policies and collaborations among the public, private and nonprofit sectors to adjust accordingly and incorporating new knowledge provided by ongoing scientific endeavors. While much can be learned about sustainability and resilience from past experience, new technologies, changes in the regional economy and changes in the historical climatic conditions within Southeast Florida require active learning over the decades to come. The Southeast Florida Regional Climate Change Compact has developed the institutional capacity to enable the collaborative learning required to meet these challenges over time.

The Significance of the Southeast Florida Regional Climate Change Compact

While providing direct benefits to the region, the Compact has provided a national model for state and federal agency engagement with local government around the specific issues of place. As the Compact is led by local government and further, as the Compact represents a significant aggregation of effort by four counties containing over 100 municipalities, it has become a highly efficient mechanism for state and federal agency engagement in the local process. Since its adoption in early 2010, the Compact has received extensive technical support from NOAA, the United States Geological Survey, the U.S. Army Corps of Engineers, EPA Region IV as well as the Florida Department of Transportation, the Florida Department of Economic Opportunity and the South Florida Water Management District.

The regional scale of the Compact has enabled participants to develop resilience strategies that effectively integrate human and natural systems. The Regional Climate Action Plan has effectively connected resilience efforts within the urban core of Southeast Florida with broader ecosystem scale efforts including

comprehensive Everglades restoration, protection of the Southeast Florida coral reef tract, and regionally important threatened and endangered species and habitats. The ecosystem services provided to the human settlements of the region are evident in the nature of projected vulnerabilities such as salt water intrusion into local drinking water supplies and the increased exposure to storm surge impacts associated with the loss of natural barriers. And the strategies developed to enhance environmental and habitat quality fully recognize the benefits these strategies will have for the ongoing livability of the region.

The Compact has provided a national model for state and federal agency engagement with local government.

The Compact has enjoyed stable, bipartisan political support since its initiation in 2009 despite the swings in the political salience of global climate change observed over this time in state and federal political dynamics. This stability has remained despite the departure of early champions of the Regional Compact from County Commission seats and a change of administration within one of the four Compact Counties. The scope and extent of regional engagement made possible by the Regional Compact has served to foster on-going bipartisan support as the Compact continues to enjoy strong political leadership from each of the Compact Counties.

As an ongoing collaboration, the Compact provides a formal framework for policy development, implementation and evaluation that is so critical to enable learning over time. Implementation of this Regional Climate Action Plan will require the active participation of many actors, not least of which are the many municipalities within the four county region who have primacy in many cases for the decisions that will determine the shape of Southeast Florida in the years to come. The Regional Compact process has benefited greatly from the active participation of municipal representatives who have contributed much perspective and many insights thus far. As implementation progresses, this ongoing collaboration will be all the more critical for success.

Next Steps

The release of this Regional Climate Action Plan is the first of several subsequent steps to follow in the Regional Compact process. The following provides an overview of these subsequent next steps:

- Upon completion of the final Regional Climate Action Plan, the Compact Staff Steering Committee will transmit the final plan to the four Boards of County Commissioners for the acceptance and/or approval of the final recommendations.

- The Compact Counties will continue development of a set of progress indicators for use in monitoring and evaluating the impact of implemented recommendations in building resilience and sustainability in Southeast Florida.

- The Compact Counties will continue to collaborate with the Southeast Florida Regional Sustainable Communities Initiative funded by the U.S. Department of Housing and Urban Development in addressing a wide range of sustainability and livability considerations for Southeast Florida. The Compact Counties will continue to collaborate with the Southeast Florida Regional Partnership in addressing a wide range of sustainability and livability considerations for the region, including through development and implementation of the Seven50 Regional Vision and Blueprint for Economic Prosperity.

- Annually, the Compact Policy Coordination Team will continue the Compact energy and climate policy coordination process for state and federal legislation and will continue to monitor legislative developments in both levels of government.

- In early 2013, the Sea Level Rise Projection Technical Advisory Committee will reconvene following the December 31, 2012 publication deadline for peer-reviewed scientific literature to be used in the Fifth Assessment Report of the Intergovernmental Panel on Climate Change due in 2014. Members of the technical advisory committee have advised that they anticipate many new publications in 2012 that will have significant bearing on mid- to longer-terms rates of sea level rise as an issue of concern for Southeast Florida. At that time, the technical committee will provide regionally consistent sea level rise projections for use in the Compact process through 2100 while adjusting guidance provided for 2030 and 2060 as warranted by the science.

There are more than 100 local governments in the region, each at varying stages of climate mitigation and adaptation planning and implementation.

This first Regional Climate Action Plan recommends several first steps toward reducing emissions and building resilience to climatic impacts across Southeast Florida, but it isn't the final outcome of the Compact. Compact participants have the opportunity to learn from early implementation: what works and what doesn't, what are the implications of new science, and what are the

Our individual and collective steps will result in a more resilient region.

implications of changes in state and federal policy. Over the next few months, the Compact Counties will continue working with the Coastal Services Center at NOAA to develop a set of performance indicators for use in monitoring and evaluating progress made in implementing this first Regional Climate Action Plan. By implementing an ongoing set of performance metrics for this Regional Plan and by remaining engaged with leading practitioners of science and public policy, the Compact will be well positioned to capitalize on success, learn from challenges, and produce subsequent future iterations of this Regional Climate Action Plan as a means to securing a more prosperous Southeast Florida.

Join us on this journey and visit our website for more information, source documents and to view the Implementation Guide: southeastfloridaclimatecompact.org.

Appendix A - Southeast Florida Regional Climate Change Compact

Southeast Florida Regional Climate Change Compact

WHEREAS, there is consensus among the world's leading scientists that global climate change is among the most significant problems facing the world today; and

WHEREAS, Florida is considered one of the most vulnerable areas in the country to the consequences of climate change with Southeast Florida on the front line to experience the impacts of climate change, especially sea level rise; and

WHEREAS, Broward, Miami-Dade, Palm Beach and Monroe Counties, herein the four counties that constitute the Southeast Florida Region, share in common a strong quality of life rooted in the region's rich cultural heritage, vigorous economy, and environmental resources of global significance; and

WHEREAS, the aforementioned four counties of Southeast Florida, which represent approximately 30% of the population of the State of Florida, are physically linked one to the other by the Atlantic Ocean coastline and share some of the world's most renowned natural resources such as the Everglades, our unique coral reefs, beautiful beaches, and fragile Keys ecosystem; and

WHEREAS, the four counties of Southeast Florida and their respective populations, totaling more than five million residents, are expected to share in disproportionately high risks associated with climate change due to low land elevations, rising sea level projections, and anticipated increases in tropical storm events; and

WHEREAS, rising sea levels could limit the effectiveness of critical drainage infrastructure, endanger beaches, and coastal natural resources and increase incidents of saltwater intrusion on the Biscayne Aquifer – putting at risk the drinking water supply for the entire population of Southeast Florida; and

WHEREAS, local governments, and the region as a whole, must give significant consideration to adaptation strategies designed to protect public infrastructure, property, water resources, natural areas and native species, and basic quality of life; and

WHEREAS, the aforementioned four counties of Southeast Florida account for a combined Gross Domestic Product of more than $2.5 billion annually and more than 37% of statewide economic output; and

WHEREAS, while the four counties of Southeast Florida have independently taken steps to address global climate change, all parties recognize that coordinated and collective action on this, the defining issue for Southeast Florida in the 21st Century, will best serve the citizens of the region;

NOW THEREFORE, BE IT RESOLVED BY THE BOARDS OF COUNTY COMMISSIONERS OF THE FOUR COUNTIES OF SOUTHEAST FLORIDA:

SECTION 1: That each county shall work in close collaboration with the aforementioned counties of Southeast Florida party to this compact to develop a joint policy position urging the United States Congress to pass legislation that recognizes the unique vulnerabilities of Southeast Florida to the impacts of climate change and to further a joint policy position that includes specific recommendations regarding the allocation of federal climate change funding based on vulnerability to climate change impacts. Such recommendations might include designation of areas of Southeast Florida as uniquely vulnerable and of federal interest for the purpose of securing enhanced levels of federal participation in regional adaptation projects.

SECTION 2: That each county shall work in close collaboration with the other counties party to this compact to develop additional legislative policy statements relating to global climate change and future legislation to be considered by the Congress of the United States for transmittal to the Congressional Delegation representing, in part or in whole, districts within the area covered by this compact.

SECTION 3: That each county shall work in close collaboration with other counties party to this compact in developing joint position statements on proposed State legislation and energy/climate policies including but not limited to issues such as the region's energy and climate security and a renewable energy portfolio standard that defines renewable energy sources as wind, solar, geothermal, biomass, landfill gas, qualified hydropower, and marine and hydrokinetic energy, and also including nuclear energy, and to collaborate on other emerging energy/climate issues that may be considered by the 2010 Florida Legislature for transmittal to the Legislative Delegation representing, in part or in whole, districts within the area covered by this compact.

SECTION 4: That each county shall work with other counties party to this compact in developing joint position statements for future State legislation that may be considered by the Florida Legislature for transmittal to the Legislative Delegation representing, in part or in whole, districts within the area covered by this compact.

SECTION 5: That each county shall commit appropriate staff resources and expertise, within budget constraints, to participate in a Regional Climate Team with other counties party to this compact toward the development of a Southeast Florida Regional Climate Change Action Plan.

SECTION 6: That each county shall work with other counties party to this compact in developing a Southeast Florida Regional Climate Change Action Plan, understanding that no county will work at cross-purposes with the other counties. The Action Plan could, at a minimum, include the following components:

(a) A baseline of greenhouse gas emissions for Southeast Florida;

(b) Strategies for coordinated emission reductions throughout the built environment to include the use of energy efficiency, energy conservation, and the use of demand-side renewable energy resources;

(c) Strategies for coordinated emission reductions from the transportation sector to include increased reliance on public transit, emerging vehicle technologies, and advanced biofuels;

(d) Strategies for coordinated emission reductions resulting from changes in local and regional land use;

(e) Strategies for the coordinated regional preparation for and adaptation to a rapidly changing global environment based upon regional mapping of projected sea-level rise and any resulting amplification of localized impacts of tropical cyclone events. Such strategies shall incorporate climate preparation concerns for the regional economy, regional infrastructure and the built environment, social and cultural needs, and natural systems within the four counties party to this compact.

SECTION 7: That each county shall commit to participating with other counties party to this compact in hosting the Second Southeast Florida Regional Climate Change Summit in October, 2010.

Adopted December 8, 2009

Adopted December 1, 2009

Adopted January 20, 2010[1]*

Adopted December 15, 2009

*City of Key West: Resolution of support for the Compact – December 15, 2009

[1] Second adoption date following minor changes made by partnering Counties

Appendix B - Work Group Recommendations

The recommendations put forth in the Regional Climate Action Plan were developed through a collaborative process involving nearly 100 subject matter experts from a host of professions representing the public and private sectors, area universities, and not-for-profit organizations. These stakeholders brought to the table the knowledge of their "craft" as well as information on successful initiatives already underway locally or in other communities.

Many of the recommendations build upon best practices sprinkled throughout our region, such as regional collaboration on transportation planning and land use criteria that foster walkable and healthy communities. Others delve into "new" frontiers in calling for the integration of climate change into planning and decision-making processes in ways that no local government has yet implemented.

Below are the full set of recommendations, organized as focal areas and strategies, offered by each of the three working groups: Built Environment Working Group, Land and Natural Systems Working Group, and the Transportation Working Group, as they were submitted.

Built Environment Work Group

Focal Areas and Strategies

Final Draft August 15, 2011

Focal Area 1

Create Land Development Strategies for Climate Resilience, Sustainable Growth, Risk Reduction, and Emergency Preparedness

There is a demonstrated synergy between sustainable development practices and efforts to improve community resilience to climate change impacts. By promoting a "no regrets" approach, it is possible to affect positive outcomes that further regional climate change mitigation and adaptation goals while improving community livability, economic opportunities and resource sustainability. These adaptation strategies address: building design, elevation and hardening; transportation networks; other critical public infrastructure (potable water, wastewater, stormwater and energy/power); and green infrastructure.

Strategies

1) Regional Planning: Incorporate "Adaptation Action Area" designation, and other applicable provisions, into local Comprehensive Plans and regional planning documents to identify those areas deemed most vulnerable to sea level rise and other climate change impacts including extreme high tides, heavy local rain events, storm surge, or inadequate drainage systems.

Action 1: Perform vulnerability analysis to identify and quantify the economic value of regions and infrastructure at risk under various sea level and other climate change scenarios utilizing inundation mapping, modeling, and other appropriate tools.

Action 2: Identify and designate "Adaptation Action Areas" (AAA) based on the results of vulnerability analyses. Inside AAA, local governments should identify "Adaptation Areas," "Restoration Areas," and "Growth Areas."

Adaptation Areas – designate areas within the AAA that include developed vulnerable land targeted for infrastructure improvements or modified land use and/or development practices in order to reduce risks and improve hazard mitigation. In these areas, the high cost of retrofitting, building and maintaining infrastructure is outweighed by the return in investment.

Restoration Areas - designate areas within the AAA that include vulnerable lands that may or may not be already developed and could include Coastal High Hazard area and high storm surge areas. Local governments should place priority on the acquisition of land in these areas for restoration, agriculture, or recreational open space.

Growth Areas – to consist of areas outside of the AAA where growth is encouraged due to higher topographic elevations and the presence of existing transportation infrastructure. These designated areas should be developed with Urban Design guidelines that address character of urban place and provide a high quality pedestrian experience through landscaping, and the creation of public space.

Action 3: Provide public outreach and education to better inform the community about the need for climate change planning, the provision in state law that provides for the designation of "Adaptation Action Areas," and the purpose and implications of such a designation.

2) Local Planning and Zoning: Develop policies, strategies, and standards that will serve to reduce future risk and economic losses associated with sea level rise and flooding in these designated areas through infrastructure improvements and by directing future development and redevelopment to areas outside AAA. This will also foster sustainable growth patterns, multi-modal transportation options, transit, mixed use development, and the use of sustainable building techniques.

3) Building Code: Revise building codes and require increased resiliency of buildings and infrastructure for new and redevelopment, particularly for those areas within Adaptation Action Areas.

4) Emergency Preparedness: Evaluate adaptation responses for communities at risk and enhance preparedness measures to address climate-related risks and hazards.

Action 1: Improve adaptation responses for communities at risk with the development and implementation of:

- Methodologies for the assessment and evaluation of evacuation and relocation options
- Model evacuation policies and procedures for communities at increased risk of flooding
- Model relocation policies for affected communities

Action 2: Incorporate climate change adaptation in the relevant Local Mitigation Strategy (LMS) to reduce or eliminate long-term risk to human life and property from disasters. Within the LMS, update local risk assessments to include climate change in the hazard analysis and vulnerability assessment section.

5) Education: Develop outreach programs to increase public awareness about hazards exacerbated by climate change and mitigation and adaptation strategies by the local government to minimize damage and risk.

Focal Area 2

Ensure the Long-term Adequacy of Surface Water Management Systems, Water Supplies and Wastewater Infrastructure

Climate change presents an array of challenges to future water supply planning and water management efforts. The combined influences of altered precipitation patterns, increased groundwater elevations, and sea level rises present complex hurdles to regional and local efforts in providing critical drainage and flood control; high quality, sustainable, and abundant water supplies; and effective management of stormwater and wastewater. By assuming an integrated approach to water resource management and climate adaptation planning, the influence of a changing climate on the quality and quantity of water resources and related infrastructure can be effectively addressed. Interrelationships between stormwater management, water supply, wastewater disposal and water reuse must be reviewed and actions implemented to ensure the beneficial supply and use of all available water resources in a manner that benefits the public, protects resources, accounts for future conditions, and provides for necessary levels-of- service.

Strategies

1) Risk Assessments**:** Inventory existing potable water, wastewater, and stormwater treatment, delivery and collection systems; assess the status of each component; determine the potential impact from climate change; and develop different climate change scenarios and adaptation strategies for high-risk utilities and/or infrastructure which may require replacement, reinforcement, or relocation to ensure the long term viability of the system.

Action 1: Identify and/or develop baseline hydrologic conditions to provide a measure for comparison in assessing the potential impacts of climate change on regional and local water resources and infrastructure, including the short-term the development of a saltwater intrusion baseline.

Action 2: Utilize inundation mapping, variable density models, and water management models to identify areas and infrastructure at risk.

Action 3: Identify and quantify vulnerable wellfields, water supply infrastructure, wastewater collection and/or treatment infrastructure, and drainage facilities, and devise strategies to protect or relocate, as needed.

2) Reuse and Aquifer Recharge**:** Identify opportunities to advance beneficial use of stormwater and reclaimed water to reduce potable water demands and provide aquifer recharge and implement as appropriate, as an alternative to disposal.

Action 1: Evaluate the impacts of rising sea and groundwater levels on soil storage, infiltration rates and inflow to stormwater and wastewater collection and conveyance systems; consider longer-term influences on water quality; and develop strategies for implementing reclaimed water and stormwater reuse projects that account for current and future conditions.

Action 2: Identify potential sites for use in providing stormwater storage and mechanisms to increase aquifer recharge as a means for managing saltwater intrusion and enhancing water supplies.

Action 3: Consider regional projects and opportunities to gain efficiencies through collaborative approaches and projects.

3) Integrated Water Resource Planning: Develop Integrated Water Management Plans that present a joint assessment and planning strategy involving local water utilities, wastewater service providers, water managers, and partners to the Southeast Florida Regional Climate Change Compact, for coordinated consideration of stormwater use and disposal, traditional and alternative water supplies, wastewater disposal and reuse, and water conservation measures for use by local leadership to guide planning decisions as well as amendments to applicable codes and regulations.

4) Drainage and Flood Control: Identify and pursue adaptation strategies to improve drainage and flood control in areas designated as "Adaptation Action Areas" and where changing hydrologic conditions are anticipated to impact surface water management.

Action 1: Coordinate with the South Florida Water Management District, Drainage/ Water Control Districts, and public works officials to identify flood control and stormwater management infrastructure already operating below the design capacity.

Action 2: Develop and apply appropriate hydrologic and hydraulic models to further evaluate the efficacy of existing water management systems and flood control/drainage infrastructure under variable climate conditions.

Action 3: Develop and test adaptation improvements needed to maintain existing levels of service and conduct a cost-benefit analysis to prioritize potential improvements, trade-off decisions, and any proposed land acquisitions.

Action 4: Incorporate and prioritize preferred improvement projects in capital improvement plans and pursue funding.

5) Everglades Restoration: Support and advocate for complete implementation and funding for the Comprehensive Everglades Restoration Plan as fundamental to Everglades restoration, but also the viability of local water resource management efforts given the overall contributions of the Everglades to regional water storage and aquifer recharge, which will become increasingly important under variable climate conditions and in the face of sea level rise.

Focal Area 3

Reduce Greenhouse Gas Emissions through Improved Regional Strategies for Energy Efficiency, Conservation & Renewable Energy

Climate change mitigation can be addressed through plans, incentives, and regulations which promote the efficient use of energy in buildings, transportation and industry; through the use of less carbon-intensive energy sources; and through the production and use of renewable energy. Regulatory barriers to alternative energy generation must be removed in order to allow these sources of energy to be tapped. Federal and state policies that promote alternative energy use, such as renewable energy portfolio standards for utilities and tax credits for home owners installing small-scale renewable systems must be developed.

Strategies

1) Regional Coordination: Undertake regional efforts to advance energy-efficiencies, energy conservation and the deployment of renewable and alternative energy technologies in existing and proposed developments through local ordinance, incentives, education, and energy efficiency financing.

2) Green Building Code: Incorporate sustainable building and neighborhood ratings or national model green building codes, including but not limited to those defined in Section 255.253(7), F.S., into municipal codes region-wide.

3) Local Codes: Develop and implement amendments to local and state building codes, land use regulations and laws to facilitate and encourage the installation of renewable energy systems. Examine existing zoning codes and development standards and revise and update provisions that act as a barrier to the installation and use of renewable energy systems.

4) Finance: Work collaboratively toward the establishment of regional framework to deliver Energy Efficiency and Renewable Energy finance options, in addition to other local government initiatives and partnerships, to advance regional greenhouse gas emissions goals, the use of alternative and renewable energy technologies, and in furtherance of green sector economic development.

5) Goals: Set recurring 5–year regional goals to increase renewable energy capacity – which include the co-benefits of economic development and job creation -- through revision of building and zoning codes and architectural design guidelines to allow for, and encourage, integration of renewable energy sources and technologies.

6) Measures: Build upon established methodologies and mechanisms for Greenhouse Gas measurement, verification and validation to create quantifiable recordkeeping and reporting which conforms with accepted global standards.

7) Education: Provide education and improve communications on energy efficiency and available technologies with a focus on both short-term and life-cycle economic and energy gains, incentives available within the region (federal, state, local and commercial).

Land and Natural Systems Working Group

Priority Recommendations

Monitor Climate Change

a. Establish coordination with NOAA regarding trends in rainfall patterns. Choose an annual conference or other venue at which such trends can be reviewed at regular intervals.

b. Monitor changes in rainfall patterns to better predict future wet-season and dry- season rainfall as well as the salt content in the wells of agricultural lands.

c. Develop a vital signs status and trends monitoring program for biological communities. Key parameters may include rate of sea-level rise; saltwater intrusion boundary and monitoring wells; landscape-level vegetation patterns; percent cover in offshore reef zones; water temperature and pH in areas; and occurrence and range of invasive exotic plants and animal species. Ensure Department of Health beach water quality monitoring continues and expand methods of notifying the public and tourism industry when exceedances are detected.

Water Storage

It is probable that climate change will also bring about changes in rainfall patterns, either by quantity, intensity in any given rain event or seasonality and perhaps all of these. Although the extent of such changes cannot be known, it is known that fresh water storage can ameliorate such changes.

a. Identify lands to be used for water storage to ameliorate changes in rainfall patterns. Storage areas and methods should be planned and located to accommodate drinking water supply, agricultural consumption, accepting flood waters and to maintain hydroperiods on natural lands.

b. Identify and promote other land uses compatible with water storage including wetland restoration, certain agricultural operations and certain renewable energy production facilities. Develop joint acquisition and management strategies with these other entities.

c. Manage water storage in the region's publicly-owned uplands and wetlands.

d. Encourage continued funding for the Comprehensive Everglades Restoration Plan (CERP).

e. Support CERP Everglades Agricultural Area (EAA) flow-way plans that increase freshwater flows to the Everglades, maximize freshwater storage and provide opportunities to improve water quality by establishing marsh communities.

Resource Acquisition

Acquisition efforts should emphasize preserving existing species diversity as well as considering changing rainfall patterns and elevated saline waters, increasing the region's resiliency against he impacts of natural hazards.

a. Develop acquisition priorities in a regional setting to:

1. Ensure preservation of many habitat types and that those types will be represented in a changing climate.

2. Protect high quality drinking water supply

3. Identify hot spots of biological diversity and ensure those locations are either protected or are identified for future land acquisition.

4. Identify and protect higher level lands to which mangrove and salt-marsh species might 'retreat'.

b. Assess acquisition priorities in light of changing rainfall patterns, i.e., if rainfall is more, is the parcel still valuable for identified vulnerable species, if rainfall is less, is the parcel still valuable to other vulnerable species. Consider linkages and migration opportunities for vulnerable species.

c. Incorporate "Adaptation Action Area" designation into local comprehensive plans and regional planning documents to identify those natural areas deemed most vulnerable to climate change impacts including changes in sea level and rainfall patterns.

d. Share acquisition priorities among planning and regulatory agencies

e. Promote federal, state and local government conservation land acquisition programs that including fee simple and less-than-fee approaches to conserve natural areas, protect open space and create or maintain resilience and adaptive capacity by maintaining or creating connectivity among natural areas from the coast to inland/upslope.

f. Following the model set by Monroe County, link rate of new construction permit issuance to conservation land acquisition rate.

g. Monetize ecological services provided by natural systems and create a sustainable funding mechanism for their protection and management.

Resource Management

Climate change will likely bring about more rapid introduction of exotics species. Some tools, such as prescribed fire, may become more difficult to implement. Management efforts may become more intense as lands are managed for certain vulnerable species. Regional cooperation among land management entities will become more essential.

a. Coordinate regional invasive exotic species prevention and control efforts emphasizing prevention of new invasions and early detection/rapid response to nascent invasions.

b. Coordinate regional fire management efforts emphasizing frequent, low intensity fire regimes in wetland and pine forest systems to maximize habitat quality, resilience to change and carbon neutrality while preventing fuel load build up that leads to major carbon releases.

c. Coordinate "living shorelines" objectives at regional scale to foster use of green infrastructure (e.g. coral reefs and mangrove wetlands) instead of or in addition to grey infrastructure (e.g. bulkheads).

d. Leverage existing work of the Florida Reef Resilience Program's "Climate Change Action Plan for Florida's Coral Reef System 2010-2015 for protection of marine habitat.

e. Maintain natural resources critical to support the Region's Largest Economic

Sectors

Migration & Species Diversity

a. Identify potential species and habitat vulnerabilities to extremes in precipitation, including extended drought and intense storms, combined with higher temperatures.

b. Examine water control structures to ensure that they can provide for inland or upstream migration of riparian species as freshwater habitats become more saline.

c. With the assistance of climate models, maintain or restore multiple areas of habitat and large-scale connectivity to facilitate population stability and habitat shifts resulting from climate change.

d. Minimize diversity and abundance of habitat-homogenizing exotic plant and animal species by monitoring for introductions, colonization, establishment, and connections with other populations.

e. Engage and cooperate with marine resource agencies to maintain coral reef (e.g., selective breeding) and mangrove ecotones as estuarine habitat and natural barriers to storm surge for maintaining coastal biodiversity.

Public Outreach

a. Modify existing public outreach, education and engagement programs at natural areas (including upland, wetland, marine, coastal and nearshore environments) to include climate change mitigation and adaptation messaging and volunteer opportunities to enhance green infrastructure that will facilitate climate change resilience and adaptation.

b. Initiate a regional public education campaign to educate residents, business owners, policy makers on the merits of preserving open land as an 'insurance policy' for adaptation to sea level rise in South Florida.

Agricultural Lands

Research

a. Identify & secure research funding to include but not limited to:

i) Review and document freshwater marsh peat potential responses to saltwater intrusion.

ii) Monitor root-zone salinities and changes to vegetation communities. Adapt planning and management in response to surprises.

iii) Identify seagrass, mangrove, and coastal freshwater marsh environmental tolerances to changing factors such as salinity, water depth, substrate, and nutrients. Use this information with climate and hydrological modeling to aid management.

iv) Improve Florida Bay shallows bathymetry and use SLR and storm surge modeling to aid identification of habitats at risk.

v) Better identify linkages between marine system (e.g. coral reefs and mangrove wetlands) area/condition and hazard risk reduction.

Policy

a. Develop regulatory requirements that compatible dredge material may be utilized in the restoration of previously existing or establishment of new seagrass beds.

b. Ensure that zoning regulations allow for the ability of plant and animal species to migrate inland as sea levels rise (e.g., limit armoring.) Ensure that land acquisition priorities consider landscape features which may limit species ability to migrate in response to sea level rise and other impacts related to climate change.

c. Enforce Coastal Construction Line and Coastal High Hazard Area designations.

d. Develop policies and regulations that will serve to reduce future risk and economic losses associated with sea-level rise and flooding in these designated areas through infrastructure improvements, insurance subsidization of high- hazard development and by directing development and growth to non-vulnerable areas.

Protected and Vulnerable Species

In the coastal Everglades, higher elevation plant species may be at more of a risk from sea-level rise than the surrounding freshwater marsh because the marsh can migrate inland, but the upland berms are isolated and their dependent species have no path for migration. Twenty-one of the 43 critically imperiled species extant in Everglades National Park occur in the buttonwood forests coastal hammocks of the Everglades and Florida Keys. In all initiatives aimed at protecting the natural environment, first emphasize a broad ecosystem approach, then evaluate potential conflicts with specific protected resources. Where conflicts are recognized, attempt to resolve them with the least compromise to broad ecosystem values.

a. Identify those narrow beaches lacking natural dunes which might possess high turtle-nesting density but which might also be prone to high nest mortality due to nest wash-out during more frequently expected storms and Identify more stable 'receiving' beaches to which nest may be relocated.

b. Develop long-term turtle-nesting beach preservation strategies and methods in advance of anticipated coastal armoring which might result in loss of beach nesting habitat.

c. Identify zoos, aquariums, herbariums and gardens that might be the repository for seed stock and captive breeding programs for those listed plants and animals under imminent threat of local extirpation due to sea-level rise.

d. Compile species information for rare plant species in coastal hardwood hammocks and buttonwood forests and develop adaptation plans that include, at a minimum, seed bank repository collection and assisted propagation.

Additional Language for Consideration:

During the five years of this initial Regional Action Plan, those areas within the Southeast Florida region that have been deemed most vulnerable to impacts associated with sea-level rise based upon LiDAR mapping and vulnerability assessments, will be monitored for impacts. These impacts may be from extreme high tides, heavy local rain events, storm surge, or inadequate drainage systems. Those areas most impacted by these events will be considered for inclusion into one or more of the "Adaptation Action Areas".

Climate change imposes long-term, continuous change on systems. Continuous changes make management goals a moving target and an observable systems response to actions under current conditions only a partial indicator of success. An adaptive management strategy must include preparation for long-term, often gradual changes with potential for large abrupt changes. Successful use of this strategy will require ecological and physical modeling to develop hypotheses and goals. Integration of directed research, management, and research-focused monitoring, risk assessment, and database management will be critical.

Transportation Working Group

Focal Areas and Strategies

The first focal area addresses adapting transportation infrastructure to the impacts of climate change as well as planning policies to guide prioritization and investment that take into account climate change impacts and emissions reductions. Incorporating climate change considerations into planning and project programming processes would provide the opportunity for transportation professionals and decision makers to develop the most cost effective strategies to best address the impacts of climate change on transportation infrastructure.

The next focal areas are strategies to reduce emissions and are organized by the following categories: alternative fuels and vehicle efficiency, system operation efficiencies, and vehicle miles traveled. Each area is often referred to as a leg of a stool, recognizing the importance of addressing all areas to achieve a balance, a strong foundation to build upon. Clearly, there is no silver bullet approach to reducing emissions; it will take a variety of approaches to achieve emissions reductions. Strategies to reduce vehicle miles traveled and provide for multiple modes of travel should be emphasized because of their long-term emissions reductions benefits and health and social benefits. This approach addresses the three pillars of sustainability and aligns with the Federal Livability Principles developed in 2009 to help guide transportation and other planning conducted at the local and regional levels and federal investment decisions.

A final focal area is dedicated to funding issues and federal policies and programs critical to the success of local and regional efforts.

Focal Area 1

Develop strategies to evaluate risk, adapt the existing transportation infrastructure, and prioritize future investments that maximize resiliency and greenhouse gas (GHG) emissions reductions.

Strategies

1) Identify means to effectively engage the multiple public and private sector entities with roles and responsibilities involving the provision and maintenance of transportation infrastructure and the delivery of transportation services in the region. Document current and evolving coordination efforts among these entities.

2) Work together to identify transportation infrastructure at risk from climate change in the region; determine whether, when, where, and to whom projected impacts from climate change might be significant. Employ inundation mapping, modeling and other appropriate tools to assess the vulnerability of transportation infrastructure to the projected impacts of climate change under various sea level rise and other climate change scenarios. At a minimum, assess the vulnerability of the following transportation infrastructure:

a) Local transportation networks of the Compact Counties

b) The tri-county Regional Transportation Network[1] designated by the Southeast Florida Transportation Council (SEFTC), which includes facilities that provide the highest level of mobility, strategic transportation facilities that are critical to region's economy and quality of life, including corridors (roadway, rail, waterway), airports, seaports, freight rail terminals, passenger rail and intercity bus terminals, and evacuation routes.

3) Develop adaptation actions that prioritize the people, places, and infrastructure most vulnerable to the projected impacts on the transportation network. Use a risk-management approach to adapt the existing network including criteria such as timing, likelihood, intensity of anticipated risks as well as costs relative to action versus inaction (description in the Circular on *Adapting Transportation to the Impacts of Climate Change State of the Practice 2011* http://onlinepubs.trb.org/onlinepubs/circulars/ec152.pdf. Best practices also available from NY, CA, and London.)

a) Develop regional priorities for short and long term maintenance and retention of the transportation network for a 50 year and a 100 year timeframe; evaluate the costs and benefits for maintenance and retention of existing transportation infrastructure, or construction, maintenance and retention of new infrastructure.

b) Address issues of inequality and environmental justice associated with climate change impacts and adaptation. Involve all parts of society in the development design and implementation of adaptation actions addressing the transportation network.

c) Identify those strategies that provide co-benefits, such as improving disaster preparedness, promoting sustainable resource management, and reducing GHG emissions including the development of cost-effective technologies.

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[1] *SEFTC, Technical Memorandum #8: Regional Transportation Network, April 2010. This network for Miami-Dade, Broward and Palm Beach counties is composed of regional interstate and expressway facilities; major regional facilities (urban or rural principal arterial roadways and other roadways that cross county lines); regional connection facilities, regional facility designation extensions, Strategic Intermodal System hubs, corridors and connectors designated by the Florida Department of Transportation; adopted physical extensions of current regional facilities; and the statewide regional evacuation network with termini determined by the South Florida and Treasure Coast Regional Planning Councils and the state legislature.*

4) Integrate consideration of climate change impacts and adaptation into the planning, operations, policies, and programs of local and regional transportation agencies.

a) Develop policy statements to incorporate the consideration of climate adaptation into planning processes and investment decisions and adopt the U.S. Department of Transportation's Guiding Principles for Climate Change Adaptation

- Adopt integrated approaches.
- Prioritize the most vulnerable.
- Use best-available science.
- Build strong partnerships.
- Apply risk-management methods and tools.
- Apply ecosystem-based approaches.
- Maximize mutual benefits.
- Continuously evaluate performance.

(http://www.dot.gov/docs/climatepolicystatement.pdf)

b) Develop policies to incorporate climate change adaptation strategies into hazard mitigation and post-disaster redevelopment planning.

c) Develop policies to address new transportation infrastructure development - to consider future floodplain conditions and vulnerable areas – e.g. rerouting of roads because of potential flood damage.

d) Modify or develop new design standards for transportation infrastructure located in identified vulnerable areas, e.g. asphalt concrete composition, bridge design, elevation, stormwater management. i.e. Include different pitches combined with stormwater design and/or use of more permeable surfaces to effectively remove water from the roadway; Explore roadway materials that may be utilized in road construction that are more tolerant to quick changes in hot or cold weather, or more tolerant of extended periods of extreme temperatures, in order to decrease repair costs, enhance safety, and increase longevity of road surfaces.

e) Develop and require a training program to educate professionals in relevant fields (e.g., architecture, engineering, and construction management) to incorporate adaptation to climate change as a basis for establishing design criteria for new transportation infrastructure. Completion of such training to be a condition for relicensing. (FL Energy & Climate Action Plan – Adaptation Strategies, pg. 8-7).

f) Consider the adoption of a "Green" road design and construction sustainability rating system.*(Best practice research: NYDOT, University of Washington)*

5) Focus investments and service expansions on strategies contributing to greenhouse gas emissions reductions and enhancing resilience to climate change.

a) Continue and enhance regionally coordinated transportation planning through the Regional Long Range Transportation Plan (RLRTP). Identify goals and objectives in the

RLRTP whose ultimate attainment reinforces the desired achievement of GHG emission reductions and enhancing resilience to climate change. Articulate the supportive role each objective has with respect to emissions reductions.

b) Transportation Investment Priorities. Give higher investment priority to transportation infrastructure, programs and services that will reduce greenhouse gas emissions. Performance standards for climate and related metrics, such as reduced VMT and increased mode split, should be incorporated in transportation and infrastructure programs.

i) Develop policies in local and regional planning processes to incorporate evaluation criteria and a process to rank and prioritize projects that meet plan goals and objectives, with an emphasis on those that reduce VMT and use of transportation modes other than the personal vehicle. Projects that enhance economic vitality should also be given priority, such as projects and service expansions along transit oriented corridors and those that improve connections to major airports and seaports. Develop performance measures related to climate change (i.e. VMT reduction) as a means to prioritize projects for funding.

c) Prioritize the funding of studies addressing effective adaptation and mitigation strategies, particularly those addressing barriers and assisting in integrating land use and transportation planning approach towards developing a transportation network that reduces vehicle miles traveled by ensuring transportation choices other than the use of personal vehicles.

e) Implement the recommendations in the RLRTP to incorporate/use modal prioritization tools.

6) Other

a) Develop early warning systems and social media applications (apps) to both inform residents and visitors of high-tide events and to raise overall awareness.

b) Identify incentives to encourage migration to less vulnerable areas.

Additional language for consideration:

Incorporate "Adaptation Action Area" designation into local comprehensive plans and the Regional Climate Change Action Plan for those areas within the Southeast Florida region that have been deemed most vulnerable to impacts associated with sea level rise. Within the "Adaptation Action Areas", special regulations will be established to reduce or eliminate the potential for damage from flooding. During the five years of this initial Regional Action Plan, those areas within the Southeast Florida region that have been deemed most vulnerable to impacts associated with sea level rise based upon LiDAR mapping and vulnerability assessments, will be monitored for impacts. These impacts may be from extreme high tides, heavy local rain events, storm surge, or inadequate drainage systems. Those areas most impacted by these events will be considered for inclusion into one or more of the "Adaptation Action Areas".

Focal Area 2

Develop strategies to reduce GHG emissions through use of alternative fuels, vehicle and system operation efficiencies, vehicle miles traveled (VMT) reduction, and provision of multiple transportation choices.

Strategies

Alternative Fuels & Vehicle Efficiency

1) Develop policies to create conditions for the development of alternative fuel (bio-diesel/ waste- based bio-diesel) and include these policies in regional plans and Local Comprehensive Plans. Incentivize and remove legislative, local code that may act as obstacle to stimulate the alternative energy industry.

(Example: Plan and program infrastructure improvements for Electric Vehicle Infrastructure (EVI) in collaboration with local utilities. Policies should be developed to incentivize private deployment of infrastructure. Solar charging for electric vehicles should be prioritized to improve the community's emergency management preparedness in times of power outages.)

2) Establish a working group of public and private stakeholders to develop a strategy to promote the use of Plug-in Electric Vehicles in the region.

a) Establish locations where infrastructure is needed. Solar charging options should be prioritized to maximize mitigation benefits and to improve the community's emergency management preparedness in times of power outages.

b) Develop policies to incentivize the deployment of infrastructure to complement transit oriented corridors. Reduced transit fares should be a consideration for riders accessing transit facilities by electric vehicles.

c) Work with relevant stakeholders to streamline permitting processes associated with charging equipment to encourage the safe and expeditious installation on customer premises and elsewhere.

d) Coordinate monetary and non-monetary incentives available to the general public and organizations purchasing electric vehicles.

3) Develop strategies to promote fuel efficient driving habits.

a) Conduct best practice research on existing campaigns and look for opportunities to Integrate tools into existing high school, county and municipal driver education courses, traffic school curriculum, truck driver training, and fleet associations. http://climatechange.transportation.org/ghg_itigation/operations.aspx)

System Operation Efficiencies

1) Develop a toolbox of successful strategies to maximize the efficiency of the existing transportation network that have been used by partners in the region. When feasible information should include implementing steps, costs, and effectiveness of GHG emissions reductions. Some strategies to consider include the use of roundabouts, traffic signal prioritization for transit, queue jumps, etc.

2) Develop policies to facilitate and streamline the deployment of energy efficient and renewable energy such as the installation of LEDs and/or solar for public infrastructure such as street lighting, parks, parking facilities.

a) Survey counties and regional agencies with lighting infrastructure to determine the level of deployment and to gather best practice policies and implementation steps to facilitate the application of efficient lighting practices in additional infrastructure.

3) Develop a strategy for incentivizing the development of truck parking with electrification facilities and the use of auxiliary power units to reduce extended idling by trucks.

a) Survey transportation agencies (MPOs, FDOT, etc.) for existing studies identifying trucking patterns and needs.

b) Identify strategic locations for truck parking facilities and seek competitive funding opportunities as a region.

4) Develop policies to reduce the impact of transportation construction, maintenance, and agency operations - such as substituting fly ash for cement, using warm-mix instead of hot-mix asphalt- on GHG emission reduction, and require construction contractors to implement emissions reductions practices. Incorporate actions that reduce GHG emissions during project development and implementation, such as using recycled materials, incorporating low carbon cement mixtures, utilizing alternatively fueled vehicles, and purchasing locally or regionally manufactured materials.

5) Provide seamless transitions between transportation modes to increase the use of low carbon modes for the movement of people and freight in the region.

a) Improve connections between Tri-Rail and county transit service, municipal trolley and community shuttle bus services (may include re-alignment of routes). District circulators (Metro Mover in downtown Miami connects to Metro Rail) provide the last leg of a commute for transit riders and should have high frequency and ease of transfer.

b) (Placeholder for regional freight strategies to integrate the many regional activities underway, e.g. periodic convening of regional freight summits providing opportunities to address that audience, development of a virtual freight network, studies exploring the potential for freight rail on a western corridor, etc.)

c) Improve the transfers between transportation modes and move towards the delivery of a seamless fare media across the region.

d) Develop planning strategies to address planning for the "First and Last Mile" of transit trips.

Reduce Vehicle Miles Traveled and Promote Multiple Modes

Local communities with mixed-use developments and streets designed to encourage non-motorized modes of transportation are expected to reduce personal automobile trips. There is a need to connect those communities to corridors that link to regional employment centers and other destinations through low-carbon transportation options. The policies in this area will be developed to support the Federal Livability Principles which among other things emphasize the reduction of household transportation costs for people of all ages, incomes, races and ethnicities through reliable access to employment centers, educational opportunities, services and other basic needs.

1) Land Use Approaches.

a) Require new development and redevelopment projects in existing and planned multimodal corridors and urban centers to be planned and designed to promote transit oriented development and transit use, which mixes residential, retail, office, open space and public uses in a pedestrian-friendly environment that promotes the use of rapid transit services.

b) Develop policies to plan Transit Oriented Developments (TOD) along Transit Oriented Corridors (TOC). Consider the Regional Transportation Network in the development of potential TOCs. Develop policies to streamline the approval process for TODs.

c) Explore expansion of activity based transportation modeling to more accurately predict, inform, and utilize transit trip data.

d) Develop policies to improve the movement of non-motorized modes through the adoption of best practice models including Complete Streets.

i) Develop guidelines, models, and implementation projects to accelerate implementation.

ii) Identify partners and resources to support training and the research into new techniques for transportation design professionals.

e) Modify local land use ordinances to encourage compact development patterns.

i) Adopt form-based codes or hybrid codes that use physical form, rather than separation of land uses, as their organizing principle and that take into consideration the urban transect or context zones.

ii) Consider regional implementation of rapid transit zones to maintain land use control around a station with multiple jurisdictions.

f) Consider the adoption of green neighborhood certification programs to guide decision making and development and to provide an incentive for better location, design, and construction of new residential, commercial, and mixed-use developments.

2) Transit Options – Transit

a) Study increasing service frequency on key routes and developing targeted transit routes, in the model of I-95 express to bring people directly from residential areas to regional centers of employment. Another example is "The Flyer" route from MIA to Miami Beach. Utilize existing studies of direct routes to inform this process.

b) Leverage limited resources for campaign and promotional advertisements by coordinating regional public transportation messaging to attract "choice" riders. Messages should focus on making riding transit cool.

c) Deploy social media applications, (apps) to facilitate use of transit including access to real-time information such as arrival times.

d) Increase the amenities available to transit passengers, such as shade, shelters, kiosks, and real time boarding information.

3) Transportation Demand Management

a) Vanpool/Carpool programs - Work with MPOs and South Florida Commuter Services to identify opportunities to expand these programs.

b) Car & Bike Sharing Programs - Work with companies providing these services and strategic partners (universities, municipalities, large employers, etc.) to establish zip car, bike sharing and personal vehicle sharing programs.

4) Bicycle Facilities

a) Prioritize implementation of planned bicycle and pedestrian networks. Evaluate whether these facilities are connected regionally and on a local scale to major employment, education, and recreation centers.

b) Implement roadway project checklist that includes measures of pedestrian and bicycle accommodation.

c) Consider regional adoption of Transit and Biking programs that aim to improve access to transit.

d) Develop policies to increase designated bike parking facilities at commercial and retail developments.

Focal Area 3

Federal Policies needed to support local and regional efforts

1) Federal Surface Transportation Authorization. Support new authorization of the federal surface transportation programs with increased priority for funding public transit and non-motorized travel and integrated regional and metropolitan planning as means to reduce the greenhouse gas emissions from the transportation sector. The federal program needs to explicitly incorporate climate change and shift priorities toward programs that encourage reinvestment in existing infrastructure and communities ("fix-it-first" programs), support public transportation and transit- oriented development, and address congestion management through means other than road building.

2) Reform Transportation Models and Enhance NEPA Processes. To recognize when shifts are taking place in the true costs of road and transit, the surface transportation authorization legislation should encourage the development of up-to-date models and tools that measure the relative shifts in auto and transit costs, both up-front and on an operating basis as well as costs related to climate impacts and performance. Further, the U.S. Department of Transportation should be directed to develop ways and means to enhance the NEPA process in this regard as NEPA is central to all highways and transit project investment analysis.

3) Increase CAFE Standards. Establish stronger Corporate Average Fuel Economy (CAFE) Standards and enforce their adoption.

Appendix C - Contributing Technical and Staff Experts

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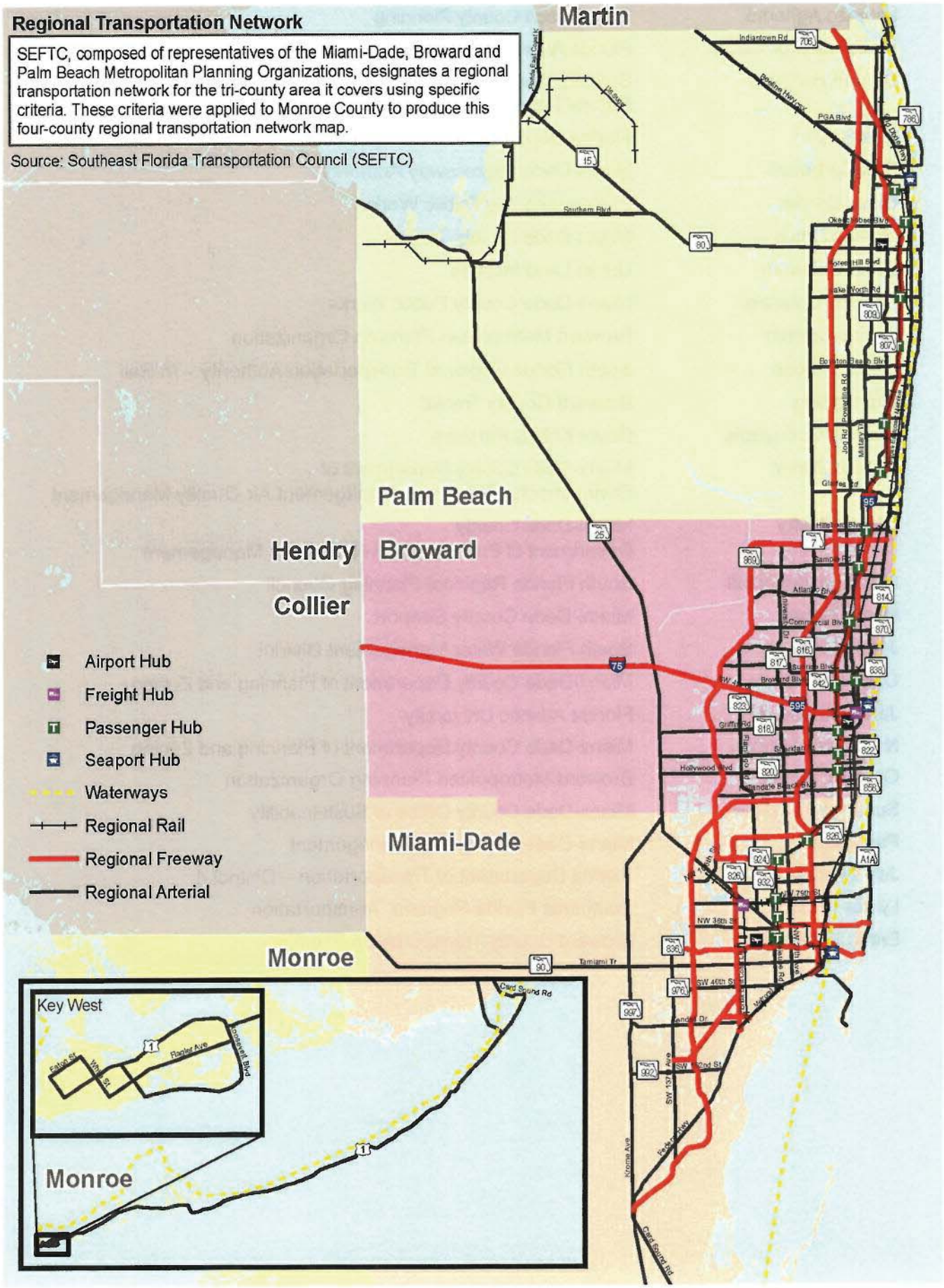
Appendix D - Regional Transportation Network



IX. Supporting Documents

The following support documents from the Southeast Florida Regional Climate Change Compact are available on the Compact website at:
southeastfloridaclimatecompact.org

A. Regional Climate Action Plan Implementation Guide

B. Compact Counties' Policy and Advocacy Implementation Report

C. Regional Greenhouse Gas Emissions Inventory Baseline Period: 2005 – 2009

D. A Unified Sea Level Rise Projection for Southeast Florida

E. Analysis of the Vulnerability of Southeast Florida to Sea Level Rise

The White Paper on Adaptation Action Areas by the Florida Department of Economic Opportunity (Support Document F) is also available on the Compact website.

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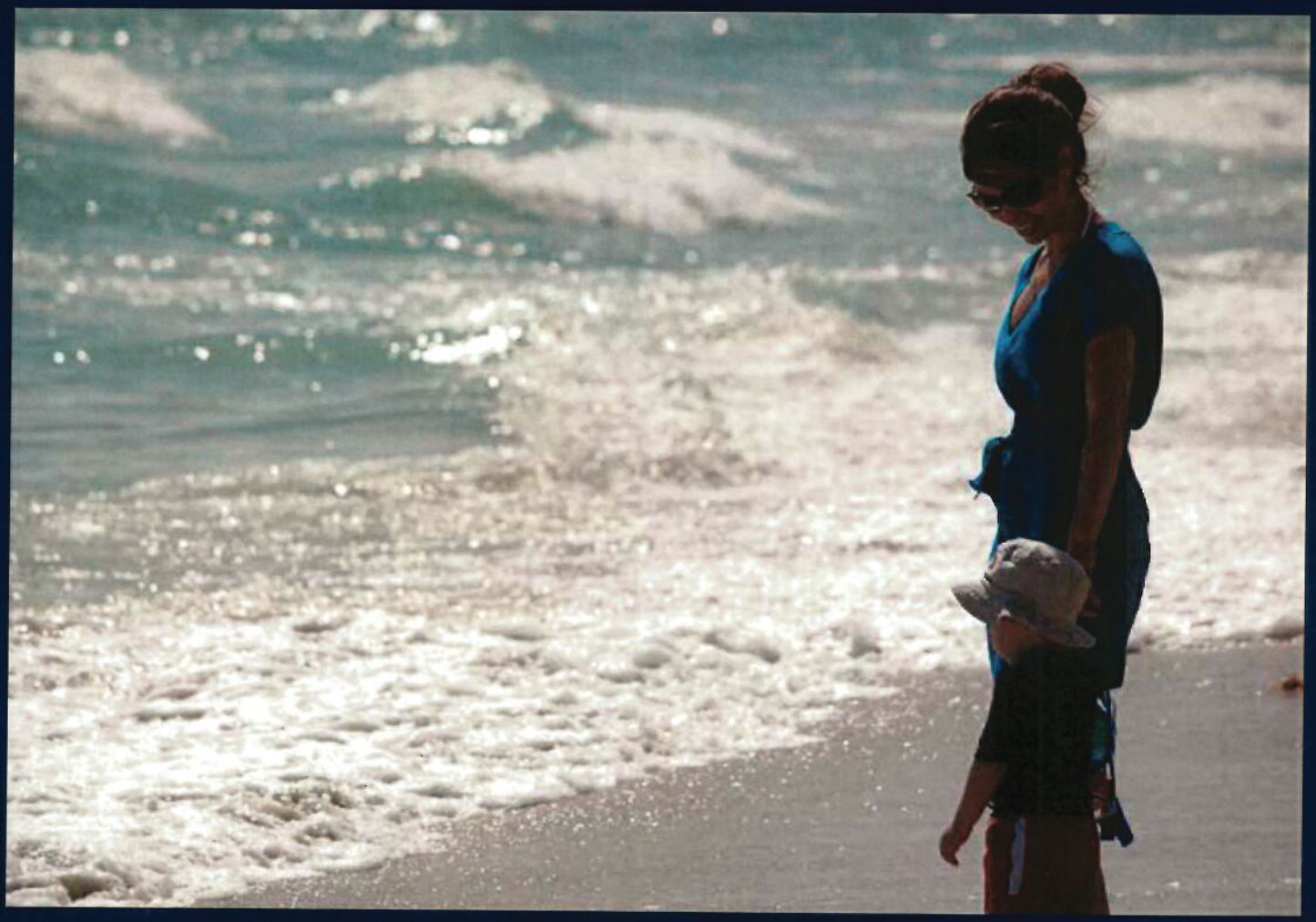
Page 41:	News reporter, provided by Miami-Dade County
Page 43:	Children planting trees, provided by Broward County
Page 44:	Compact press conference after BP spill, provided by Broward County From left to right: Monroe County Commissioner George Neugent, Miami-Dade County Commissioner Katy Sorenson, Palm Beach County Commissioner Shelley Vana, and Broward County Commissioner Kristin Jacobs.
Page 51:	People exiting South Beach bus, provided by Miami-Dade County
Back Cover:	Mom and son at beach, provided by Miami-Dade County



SOUTHEAST FLORIDA
REGIONAL COMPACT
CLIMATE CHANGE

BROWARD COUNTY FLORIDA

MIAMI-DADE COUNTY

PALM BEACH COUNTY FLORIDA

This document was produced by the Southeast Florida Regional Climate Change Compact, a regional collaborative including Broward, Miami-Dade, Monroe and Palm Beach Counties, and promulgated at a cost of $4,634 or $6.62 per copy, for the purpose of providing information on climate change planning strategies relevant to Southeast Florida.

NR201249411 09/12

E. SUMMARY OF CLIMATE CHANGE POLICIES IN THE MIAMI-DADE COUNTY COMPREHENSIVE DEVELOPMENT MASTER PLAN

Summary of Climate Change Policies in the Miami-Dade County Comprehensive Development Master Plan

INTERGOVERNMENTAL COORDINATION ELEMENT

ICE-5F. The County shall continue participation in the Southeast Florida Regional Climate Change Compact and shall coordinate with other agencies, local municipalities, and the private sector to develop initiatives and goals to address climate change mitigation and adaptation. Climate related goals that support regional climate change objectives shall be integrated into the CDMP as appropriate.

ICE-5G. All County departmental master plans and strategic business plans shall include and prioritize climate change mitigation and adaptation strategies. Climate change related amendments shall be recommended through the next feasible, regularly scheduled amendment process or departmental master plan update for each respective planning document.
a) Each County department shall consider extending planning horizons as appropriate to adequately address (i.e. 30, 50, 75-year plans) the projected long-term climate change impacts into resource allocation recommendations.
b) All new departmental climate change policies and programs shall be monitored for effectiveness.

LAND USE ELEMENT

LU-3E. By 2017, Miami-Dade County shall initiate an analysis on climate change and its impacts on the built environment addressing development standards and regulations related to investments in infrastructure, development/redevelopment and public facilities in hazard prone areas. The analysis shall consider and build on pertinent information, analysis and recommendations of the Regional Climate Change Action Plan for the Southeast Florida Regional Climate Change Compact Counties, and will include the following elements:

a) an evaluation of property rights issues and municipal jurisdiction associated with the avoidance of areas at risk for climate hazards including sea level rise;
b) an evaluation of the current land supply-demand methodology to consider and address, as appropriate, the risk associated with infrastructure investments in flood prone areas; and
c) an evaluation of the CDMP long-term time horizon in relation to addressing projected long-range climate change impacts.

Recommendations from the analysis shall address appropriate changes to land use designations and zoning of impacted properties, and development standards, among other relevant considerations.

LU-3F. By 2017, Miami-Dade County shall develop a Development Impact Tool or criteria to assess how proposed development and redevelopment project features including location, site design, land use types, density and intensity of uses, landscaping, and building design, will help mitigate climate impacts or may exacerbate climate related hazards. The tool would also assess

each development's projected level of risk of exposure to climate change impacts, such as inland flooding.

LU-3G. Miami-Dade County shall, by 2017, analyze and identify public infrastructure vulnerable to sea level rise and other climate change-related impacts. This analysis shall include public buildings, water and waste water treatment plants, transmission lines and pump stations, stormwater systems, roads, rail, bridges, transit facilities and infrastructure, airport and seaport infrastructure, libraries, fire and police stations and facilities.

LU-3H. In order to address and adapt to the impacts of climate change, Miami-Dade County shall continue to improve analysis and mapping capabilities for identifying areas of the County vulnerable to sea level rise, tidal flooding and other impacts of climate change.

LU-3I. Miami-Dade County shall make the practice of adapting the built environment to the impacts of climate change an integral component of all planning processes, including but not limited to comprehensive planning, infrastructure planning, building and life safety codes, emergency management and development regulations, stormwater management, and water resources management.

LU-3J. Miami-Dade County shall continue to actively participate in the Southeastern Florida Regional Climate Change Compact and collaborate to increase regional climate change resiliency by sharing technical expertise, assessing regional vulnerabilities, advancing agreed upon mitigation and adaptation strategies and developing joint state and federal legislation policies and programs.

LU-3K. By 2017, Miami-Dade County shall determine the feasibility of designating areas in the unincorporated area of the County as Adaptation Action Areas as provided by Section 163.3177(6)(g)(10), Florida Statute, in order to determine those areas vulnerable to coastal storm surge and sea level rise impacts for the purpose of developing policies for adaptation and enhance the funding potential of infrastructure adaptation projects.

LU-3L. Miami-Dade County shall work with its local municipalities to identify and designate Adaptation Action Areas as provided by Section 163.3164(1), Florida Statute, in order to develop policies for adaptation and enhance the funding potential for infrastructure projects.

LU-3M. Miami-Dade County shall support the implementation of climate related policies, through education, advocacy and incentive programs. Public outreach, such as workshops or a website with relevant information, shall seek to shift residents' everyday transportation decisions and housing choices to support transit oriented communities and travel patterns. The County shall provide opportunities for the public, including students, building industry and environmental groups, to participate in the development of any new climate related land planning regulations and initiatives.

TRANSPORTATION ELEMENT

GOAL
DEVELOP AND MAINTAIN AN INTEGRATED MULTIMODAL TRANSPORTATION SYSTEMIN MIAMI-DADE COUNTY TO MOVE PEOPLE AND GOODS IN A MANNER CONSISTENT WITH OVERALL COUNTYWIDE LAND USE AND ENVIRONMENTAL PROTECTION
GOALS AND INTEGRATION OF CLIMATE CHANGE CONSIDERATIONS IN THE FISCAL

DECISION-MAKING PROCESS.

Objective TE-1
Miami-Dade County will provide an integrated multimodal transportation system for the circulation of motorized and non-motorized traffic by enhancing the Comprehensive Development Master Plan and its transportation plans and implementing programs to provide competitive surface transportation mode choice, local surface mode connections at strategic locations, and modal linkages between the airport, seaport, rail and other inter-city and local and intrastate transportation facilities. These plans and programs shall seek to ensure that, among other objectives, all transportation agencies shall consider climate change adaptation into their public investment processes and decisions.

TE-1G Miami-Dade County shall develop and adopt climate change adaptation and mitigation strategies for incorporation into all public investment processes and decisions, including those concerning transportation improvements.

TE-1H Transportation agencies developing their transportation plans for Miami-Dade County shall take into consideration climate change adaptation and mitigationstrategies through project review, design, and funding for all transportation projects. Transportation agencies should consider extending their planning horizons appropriately to address climate change impacts.

Objective TE-4
By 2015, Miami-Dade County shall develop a "Complete Streets" program to be considered in the design and construction of new transportation corridors and reconstruction of existing corridors, wherever feasible.

TE-4A By 2015, Miami-Dade County shall develop a "Complete Streets" program which will be sensitive to the needs of the users of all modes of transportation including bicyclists and pedestrians and include the following components: street typology based on land use content due to how a roadway passing through different land uses will vary in character; hierarchy of street types and designs; provision of sidewalks and bicycle facilities; adequate landscaping and street furniture; bus lanes and transit facilities; improve aesthetics, and design for the safety of all users, including vulnerable populations such as children and seniors.

Transportation Monitoring Program

Objective TE-1. Number of transportation plans prepared and adopted by State, Regional and local governments reviewed during the EAR reporting period; and review and analyze Metrorail, Metrobus and Metromover boardings and compare the boarding rates with the County's population growth rates for the same previous reporting period. Number of transportation plans addressing multimodalism, climate change mitigation and adaptation strategies, and extensions of planning horizons.

Objective TC-6
Plan and develop a transportation system that preserves environmentally sensitive areas, conserves energy and natural resources addresses climate change impacts, and promotes community aesthetic values.

Policies

TC-6A. The County shall avoid transportation improvements which encourage or subsidize increased development in coastal high hazard areas, environmentally sensitive areas identified in the Coastal Management and Conservation, Aquifer Recharge and Drainage Elements, and areas of high risk of significant inland flooding.

TC-6D. New roadways shall be designed to prevent and control soil erosion, minimize clearing and grubbing operations, minimize storm runoff, minimize exposure and risk of climate change impacts such as increased flood conditions, and avoid unnecessary changes in drainage patterns.

TC-7E. The County shall promote coordination with all relevant transportation agencies in the development of their plans when considering extending their planning horizons appropriately to address climate change impacts.

Objective TC-6. Number of transportation demand management (TDM) and transportation system management (TSM) programs implemented, number of environmental reviews conducted for roadway construction and reconstruction projects, and number of arterial landscaping improvements completed. Number of transportation projects that address climate change impacts, such as increased flood conditions.

Objective TC-7. Quantify the number of reviews completed on various plans and programs of FDOT, MPO, and where appropriate, adjacent counties, and annually verify the consistency of programmed improvements for implementation in the TIP with the CDMP. Number of transportation plans extending planning horizons to address climate change impacts.

Objective MT-2
Coordinate the provision of efficient transit service and facilities with the location and intensity of designated future land use patterns as identified on the Land Use Plan Map, and the goal, objectives and policies of the Land Use Element.

MT-2E. Miami-Dade Transit should consider climate change mitigation and adaptation strategies and prioritize those strategies and programs.

Objective PM-4
The Port shall continue to ensure compatibility of its facilities and operations with surrounding communities and the natural environment.

PM-4H. PortMiami shall incorporate sound conservation principles in the development of its projects and consider climate change mitigation and adaption strategies in their long-range plans.

CONSERVATION, AQUIFER RECHARGE AND DRAINAGE ELEMENT

INTRODUCTION

The environmental sensitivity of Miami-Dade County is underscored by the fact that the developed area of the County portion lies between two national parks, Everglades and Biscayne National Parks, and the Florida Keys National Marine Sanctuary. The preservation of Miami-Dade County's unique native plants, fish, wildlife, beaches and near shore water quality is closely related to the continued success of the County's tourism industry. So, natural resource preservation in Miami-Dade County has been recognized as an economic as well as environmental issue. The proximity of an expanding urbanized area to national and State resource-based parks, and over 6,000 acres of natural areas within County parks, presents a unique challenge to Miami-Dade County to provide sound management. In addition, many experts suggest that South Florida will be significantly affected by rising sea levels, intensifying droughts, floods, and hurricanes as a result of climate change. As a partner in the four county Southeast Florida Regional Climate Change Compact, Miami-Dade has committed to study the potential negative impacts to the County given climate change projections, and is working to analyze strategies to adapt to these impacts and protect the built environment and natural resources.

The County has is also working to address these challenges by working closely with other public and private sector agencies and groups to obtain a goal of sustainability. The Conservation Element builds upon past and present initiatives such as the Comprehensive Everglades Restoration Plan, GreenPrint, the County's plan for sustainability, and over three decades of local planning, monitoring, and evaluating proposed activities in wetlands and uplands. Since 1975, Miami-Dade County has sought to channel growth toward those areas that are most intrinsically suited for development, in conjunction with municipalities and the development community.

GOAL

PROVIDE FOR THE CONSERVATION, ENVIRONMENTALLY SOUND USE, AND PROTECTION OF ALL AQUATIC AND UPLAND ECOSYSTEMS AND NATURAL RESOURCES, AND PROTECT THE FUNCTIONS OF AQUIFER RECHARGE AREAS AND NATURAL DRAINAGE FEATURES IN MIAMI-DADE COUNTY.

Objective CON-1

Improve air quality in the County to meet all National Ambient Air Quality Standards set by the Environmental Protection Agency (EPA) and their respective deadlines; and reduce human exposure to air pollution; and take into consideration climate change mitigation and adaptation strategies.

CON-1J. Miami-Dade County shall continue to implement its CO2 Plan recommendations to reduce CO2 levels and take into consideration the recommendations of the Southeast Florida Regional Climate Change Compact to reduce greenhouse gas emissions in accordance with all applicable regulations.

Objective CON-6

Soils and mineral resources in Miami-Dade County shall be conserved and appropriately utilized in keeping with their intrinsic values.

CON-6G. Miami-Dade County shall coordinate with cities to develop a long-term vision for agricultural and other undeveloped lands outside of the UDB to ensure these lands continue to support urban communities and protect native plant and animal species from climate related impacts. Long-term land planning outside the UDB should alsoconsider water storage opportunities.

COASTAL MANAGEMENT ELEMENT

Objective CM-9
Miami-Dade County shall continue to orient its planning, regulatory, and service programs to direct future population concentrations away from the Coastal High Hazard Area (CHHA) and FEMA "V" Zone. Infrastructure shall be available to serve the existing development and redevelopment proposed in the Land Use Element and population in the CHHA, but shall not be built, expanded, or oversized to promote increased population in the coastal high-risk area.

CM-9H. Rise in sea level projected by the federal government, and refined by the Southeast Florida Regional Climate Change Compact, shall be taken into consideration in all future decisions regarding the design, location, and development of infrastructure and public facilities in the County.

WATER, SEWER & SOLID WASTE ELEMENT

Objective WS-3
The County will provide an adequate level of service for public facilities to meet both existing and projected needs as identified in this plan through implementation of those projects listed in the Capital Improvements Element. All improvements for replacement, expansion, or increase in capacity of facilities shall conform with the adopted policies of this Plan including level of service standards for the facilities.

WS-3F. The Miami-Dade County Water, Wastewater, and Reuse Integrated Master Plan, the primary vehicle for planning for water, sewer, and reuse facilities, shall continue to be updated on a regular basis. The integrated Master Plan shall include initiatives to address climate change and sea level rise that would impact the water and sewer infrastructure and drinking water supplies.

Objective WS-4
Miami-Dade County shall protect the health of its residents and preserve its environmental integrity by reducing the proportion of residences and commercial establishments within the County using private wastewater treatment facilities. Miami-Dade County shall discourage the new or continued use of such facilities through the strict application of the CDMP and land development regulations.

WS-4H. Miami-Dade County shall coordinate with municipalities and the State of Florida to monitor existing septic tanks that are currently at risk of malfunctioning due to high groundwater

levels or flooding and shall develop and implement programs to abandon these systems and/or connect users to the public sewer system. The County shall also coordinate to identify which systems will be adversely impacted by projected sea level rise and additional storm surge associated with climate change and shall plan to target those systems to protect public health, natural resources, and the region's tourism industry.

Monitoring Program

This section of the Element outlines the substantive components of Miami-Dade County's monitoring program pertinent to the objectives, policies and parameters referenced elsewhere in this Element.

Water and Sewer Monitoring and Evaluation Program

In practice, the use of quantitative measures of objective implementation is preferred to individual policy evaluation. The following measures are recommended for use in monitoring the objectives proposed in this report for the Water and Sewer Subelement. These measures were selected based on their ability to represent overall achievement of an objective and on their ease and economy in collection, recording, and evaluation. At least one measure is recommended for each objective, and one alternative measure is recommended for several objectives. The alternative measure is recommended for those objectives where none of the primary measurements recommended are available from existing data sources in Countywide circulation at the time of the report. The alternative measurement, if suggested, will always be based on an existing data source.

Objective WS-4. Reduction in the use of septic tanks and other private wastewater treatment facilities. Recommended measurements include: proportion of septic tank permits issued that are for new septic tanks as opposed to septic tank abandonments; number of non-residential septic tanks and other private treatment facilities, unsewered and developed areas with wellfield protection areas; number of IW (industrial wastewater) permits; number of conversions by permit from septic tank system to central system per year or any given period; and location of existing septic tanks in areas of the County at higher risk of malfunction due to climate change impacts such as higher groundwater levels and increased storm surges.

F. MIAMI-DADE BOARD OF COUNTY COMMISSIONERS RESOLUTION # R-451-14

OFFICIAL FILE COPY
CLERK OF THE BOARD
OF COUNTY COMMISSIONERS
MIAMI-DADE COUNTY, FLORIDA

APPENDIX F

MEMORANDUM

Agenda Item No. 11(A)(17)

TO:	Honorable Chairwoman Rebeca Sosa and Members, Board of County Commissioners	**DATE:**	May 6, 2014
FROM:	R. A. Cuevas, Jr. County Attorney	**SUBJECT:**	Resolution setting policy for Miami-Dade County; directing the Mayor to require all County infrastructure projects to consider potential impacts of sea level rise during all project phases Resolution No. R-451-14

The accompanying resolution was prepared and placed on the agenda at the request of Prime Sponsor Chairwoman Rebeca Sosa, and Co-Sponsors Commissioner Sally A. Heyman and Commissioner Barbara J. Jordan.

R. A. Cuevas, Jr.
County Attorney

RAC/smm

MEMORANDUM
(Revised)

TO: Honorable Chairwoman Rebeca Sosa
and Members, Board of County Commissioners

DATE: May 6, 2014

FROM: R. A. Cuevas, Jr.
County Attorney

SUBJECT: Agenda Item No. 11(A)(17)

Please note any items checked.

_____ **"3-Day Rule" for committees applicable if raised**

_____ **6 weeks required between first reading and public hearing**

_____ **4 weeks notification to municipal officials required prior to public hearing**

_____ **Decreases revenues or increases expenditures without balancing budget**

_____ **Budget required**

_____ **Statement of fiscal impact required**

_____ **Ordinance creating a new board requires detailed County Mayor's report for public hearing**

_____ **No committee review**

_____ **Applicable legislation requires more than a majority vote (i.e., 2/3's ____, 3/5's ____, unanimous _____) to approve**

_____ **Current information regarding funding source, index code and available balance, and available capacity (if debt is contemplated) required**

Approved _____ Mayor
Veto _____
Override _____

Agenda Item No. 11(A)(17)
5-6-14

RESOLUTION NO. R=451-14

RESOLUTION SETTING POLICY FOR MIAMI-DADE COUNTY; DIRECTING THE MAYOR OR DESIGNEE TO REQUIRE ALL COUNTY INFRASTRUCTURE PROJECTS TO CONSIDER POTENTIAL IMPACTS OF SEA LEVEL RISE DURING ALL PROJECT PHASES INCLUDING BUT NOT LIMITED TO PLANNING, DESIGN, AND CONSTRUCTION, AND FURTHER DIRECTING THE MAYOR OR DESIGNEE TO EVALUATE THE EXISTING INFRASTRUCTURE IN THE FACE OF SEA LEVEL RISE

WHEREAS, Southeast Florida is considered one of the most vulnerable areas of the country to the consequences of sea level rise; and

WHEREAS, Miami-Dade County is composed of a large section of waterfront property and is a low-lying coastal community at the frontline to experience the impacts of sea level rise; and

WHEREAS, Miami-Dade County has various vital facilities and infrastructure that could be adversely affected by sea level rise; and

WHEREAS, local and regional tide data show a trend of rising sea levels and more recent data and factors suggest this trend may accelerate in the future; and

WHEREAS, climate scientists and other groups such as the Southeast Environmental Research Center and the National Oceanic and Atmospheric Administration's Costal Services Center have predicted the potential erosion of dry land and loss of waterfront property in Miami-Dade County as a result of sea level rise; and

WHEREAS, according to the National Wildlife Federation and the Florida Wildlife Federation a mid-range sea level rise of fifteen (15) inches in Biscayne Bay would result in an 85% loss of cypress swamp, a 33% loss of inland fresh marsh, a 79% loss of tidal flats, and a 54% loss of salt marsh; and

WHEREAS, Miami-Dade County has been in the forefront of these issues for many years; and

WHEREAS, the Miami-Dade County Comprehensive Development Master Plan (hereinafter "the CDMP") was recently amended to address sea level rise and climate change, through policies which call for the consideration of sea level rise and climate change as an integral component of all planning processes, including incorporation into public investment processes and decisions; and

WHEREAS, Miami-Dade County is a member of the Southeast Florida Regional Climate Compact; and

WHEREAS, a "Unified Sea Level Rise Projection for Southeast Florida" was developed by a Sea Level Rise Technical Ad Hoc Work Group of the Southeast Florida Regional Climate Compact; and

WHEREAS, the Board of County Commissioners (hereinafter "the Board") had previously created the Miami-Dade Climate Change Advisory Task Force, established in July 2006 for a period of five years, through the adoption of Ordinance 06-113, which served as an advisory board to the Board on the issue of global warming climate change and was charged with identifying potential future climate change impacts to Miami-Dade County, while providing recommendations regarding mitigation and adaptation measures to respond to climate change; and

WHEREAS, the Miami-Dade Climate Change Advisory Task Force co-chaired the Interagency Climate Change Adaptation Task Force with the White House Council on Environmental Quality, the Office of Science and Technology Policy, and the National Oceanic and Atmosphere Administration, and released its interagency report in October of 2010 outlining recommendations to the President of the United States for how Federal Agency policies and programs can better prepare the United States to respond to the impacts of climate change; and

WHEREAS, in 2010, Miami-Dade County was featured as a best practice case study — Adapting to Sea Level Rise in Miami-Dade County, Florida — as part of the National Oceanic and Atmospheric Administration's Digital Coast Initiative and Inundation Toolkit; and

WHEREAS, the Miami-Dade Climate Change Advisory Task Force, sunset and dissolved in 2011, pursuant to Ordinance 06-113; and

WHEREAS, in 2012 the City of Miami Beach has developed a Stormwater Master Plan with estimated costs of over $206,000,000 in infrastructure needs for its drainage system, which is being increasingly compromised by sea level rise; and

WHEREAS, in 2012 through Resolution No. R-240-13, the Board accepted the Regional Climate Action Plan, with recommendations for regionally coordinated climate change mitigation, adaptation strategies, and efforts in building community resilience; and

WHEREAS, local, regional, and national news media outlets have recently featured numerous stories with varied predictions on Southeast Florida's vulnerability to sea level rise; and

WHEREAS, in July of 2013 the Board created the Miami-Dade Sea Level Rise Task Force through the adoption of Resolution No. R-599-13; and

WHEREAS, the Miami-Dade Sea Level Rise Task Force is currently reviewing the relevant data and prior studies, assessments, reports, and evaluations of the potential impact of

sea level rise on vital public services and facilities, real estate, water and other ecological resources, water front property, and infrastructure; and

WHEREAS, the Miami-Dade Sea Level Rise Task Force will provide a comprehensive and realistic assessment of the likely and potential impacts to sea level rise and storm surge over time, which shall be used to help develop a set of recommendations relative to amendments to the CDMP, capital facilities planning, budgetary priorities and other County programs as necessary to ensure that Miami–Dade County is taking all appropriate actions to reduce its contributions to climate-induced sea level rise and to ensure its resiliency to the increase in sea level rise, storm surge and related impacts which are expected to occur,

NOW, THEREFORE, BE IT RESOLVED BY THE BOARD OF COUNTY COMMISSIONERS OF MIAMI-DADE COUNTY, FLORIDA, that:

Section 1. It is the policy of Miami-Dade County that all County infrastructure projects, including but not limited to County building elevation projects, County installation of mechanical and electrical systems, County infrastructure modifications, and County infrastructure renovations, initiated from the effective date of this resolution shall consider sea level rise projections and potential impacts as best estimated at the time of the project, using the regionally consistent unified sea level rise projections, during all project phases including but not limited to planning, design, and construction, in order to ensure that infrastructure projects will function properly for fifty (50) years or the design life of the project, whichever is greater.

Section 2. This Board directs the Mayor or designee to establish recommended priorities for adapting existing County infrastructure located in areas at increased risk of flooding and tidal inundation with increases in sea level to the degree opportunity and resources allow, and shall present such recommended priorities to the Board for approval, including committee review, within one-hundred-twenty (120) days of the effective date of this resolution.

The Prime Sponsor of the foregoing resolution is Chairwoman Rebeca Sosa, and the Co-Sponsors are Commissioner Sally A. Heyman and Commissioner Barbara J. Jordan. It was offered by Commissioner **Dennis C. Moss**, who moved its adoption. The motion was seconded by Commissioner **Rebeca Sosa** and upon being put to a vote, the vote was as follows:

Rebeca Sosa, Chairwoman			**aye**
Lynda Bell, Vice Chair			**aye**
Bruno A. Barreiro	**absent**	Esteban L. Bovo, Jr.	**aye**
Jose "Pepe" Diaz	**aye**	Audrey M. Edmonson	**aye**
Sally A. Heyman	**aye**	Barbara J. Jordan	**aye**
Jean Monestime	**aye**	Dennis C. Moss	**aye**
Sen. Javier D. Souto	**aye**	Xavier L. Suarez	**aye**
Juan C. Zapata	**absent**		

The Chairperson thereupon declared the resolution duly passed and adopted this 6th day of May, 2014. This resolution shall become effective ten (10) days after the date of its adoption unless vetoed by the Mayor, and if vetoed, shall become effective only upon an override by this Board.

MIAMI-DADE COUNTY, FLORIDA
BY ITS BOARD OF
COUNTY COMMISSIONERS

HARVEY RUVIN, CLERK

By: **Christopher Agrippa**
Deputy Clerk

Approved by County Attorney as
to form and legal sufficiency.

Christopher A. Angell

G. WARMING OF THE OCEANS AND IMPLICATIONS FOR THE (RE) INSURANCE INDUSTRY – A GENEVA ASSOCIATION REPORT

APPENDIX G

THE GENEVA ASSOCIATION
Risk & Insurance Economics

Warming of the Oceans and Implications for the (Re)insurance Industry

A Geneva Association Report

June 2013

The Geneva Association

(The International Association for the Study of Insurance Economics)

The Geneva Association is the leading international insurance think tank for strategically important insurance and risk management issues.

The Geneva Association identifies fundamental trends and strategic issues where insurance plays a substantial role or which influence the insurance sector. Through the development of research programmes, regular publications and the organisation of international meetings, The Geneva Association serves as a catalyst for progress in the understanding of risk and insurance matters and acts as an information creator and disseminator. It is the leading voice of the largest insurance groups worldwide in the dialogue with international institutions. In parallel, it advances—in economic and cultural terms—the development and application of risk management and the understanding of uncertainty in the modern economy.

The Geneva Association membership comprises a statutory maximum of 90 Chief Executive Officers (CEOs) from the world's top insurance and reinsurance companies. It organises international expert networks and manages discussion platforms for senior insurance executives and specialists as well as policy-makers, regulators and multilateral organisations. The Geneva Association's annual General Assembly is the most prestigious gathering of leading insurance CEOs worldwide.

Established in 1973, The Geneva Association, officially the "International Association for the Study of Insurance Economics", has offices in Geneva and Basel, Switzerland and is a non-profit organisation funded by its members.

Chairman: Mr Mike **McGavick**, CEO, XL Group plc, Hamilton.

Vice Chairmen: Mr Michael **Diekmann**, Chairman of the Management Board, Allianz SE, Munich; Mr John **Strangfeld**, Chairman and CEO, Prudential Financial Inc., Newark; Mr Shuzo **Sumi**, Member of the Board and President, Tokio Marine & Nichido Fire Insurance Company Ltd, Tokyo.

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Secretary General: Mr John H. **Fitzpatrick**, Basel/Geneva.

Deputy Secretary General and Head of Research: Dr Shaun S. **Wang**, Geneva.

Vice Secretaries General: Prof. Jan **Monkiewicz** (Head of PROGRES and Liaison—Eastern Europe), Warsaw; Dr h.c. Walter R. **Stahel** (Head of Risk Management), Geneva.

Heads of Programmes and Research Directors: Dr Etti **Baranoff** (Research Director for Insurance and Finance), Richmond, VA; Dr Christophe **Courbage** (Head of Health and Ageing and Insurance Economics), Geneva; Mr Daniel **Haefeli** (Head of Insurance and Finance), Geneva; Mr Anthony **Kennaway** (Head of Communications), Geneva; Prof. Krzysztof **Ostaszewski** (Research Director for Life and Pensions), Normal, IL.

Special Officers: Mr Katsuo **Matsushita** (Liaison—Japan & East Asia), Yokohama; Mr Richard **Murray** (Head of Liability Regimes Project), New York; Dr Hans Peter **Würmli** (Chairman of Chief Risk Officers Network), Zurich.

Chairman of the Scientific Advisory Council: Prof. Harold **Skipper**.

Former Presidents of The Geneva Association: Prof. Raymond **Barre**, Paris (1973-1976); Mr Fabio **Padoa**, Trieste (1976-1983); Mr Julius **Neave**, London (1983-1986); Prof. Dr Dr e.h. Reimer **Schmidt**, Aachen (1986-1990); Sir Brian **Corby**, London (1990-1993); Drs. Jan H. **Holsboer**, Amsterdam (1993-1999); Mr Walter **Kielholz**, Zurich (1999-2003); Mr Henri **de Castries**, Paris (2003-2008); Mr Martin J. **Sullivan**, New York (2008); Mr Jacques **Aigrain**, Zurich (2008-2009); Dr Nikolaus **von Bomhard**, Chairman of the Board of Management, Munich Re, Munich (2009-2013).

Former Secretaries General of The Geneva Association: Prof. Orio **Giarini** (1973-2000), Mr Patrick M. **Liedtke** (2000-2012).

Warming of the Oceans and Implications for the (Re)insurance Industry

A Geneva Association Report

Lead author and editor: Falk Niehörster

Contribution authors: Markus Aichinger, Richard Murnane, Nicola Ranger, Svenja Surminski

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June 2013

Warming of the Oceans and Implications for the (Re)insurance Industry
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Executive summary

- There is new, robust evidence that the global oceans have warmed significantly. Given that energy from the ocean is the key driver of extreme events, ocean warming has effectively caused a shift towards a "new normal" for a number of insurance-relevant hazards. This shift is quasi irreversible—even if greenhouse gas (GHG) emissions completely stop tomorrow, oceanic temperatures will continue to rise.
- In the non-stationary environment caused by ocean warming, traditional approaches, which are solely based on analysing historical data, increasingly fail to estimate today's hazard probabilities. A paradigm shift from historic to predictive risk assessment methods is necessary.
- Due to the limits of predictability and scientific understanding of extreme events in a non-stationary environment, today's likelihood of extreme events is ambiguous. As a consequence, scenario-based approaches and tail risk modelling become an essential part of enterprise risk management.
- In some high-risk areas, ocean warming and climate change threaten the insurability of catastrophe risk more generally. To avoid market failure, the coupling of risk transfer and risk mitigation becomes essential.

4

Introduction

There is now evidence that, over recent decades, the climate has changed and we have already reached a "new normal" for many climate- and weather-based (extreme) indices (IPCC, 2012). Even former "sceptics" of climate change have started to admit that global warming is detectable and that it is most likely attributable to human emissions of greenhouse gases (GHG) (Muller, 2012). In fact, this is true not only for the land surface of our planet, but also for the global ocean.

Ocean warming is a topic of growing concern, as it indicates a long-term (on the order of centuries) change of our climate, even if anthropogenic GHG emissions stopped entirely tomorrow.

The global ocean and its currents are of fundamental importance for the storage and distribution of solar energy absorbed by the climate system. Energy is exchanged between the atmosphere and ocean mainly via radiative transfer and the transport of latent heat from evaporation and condensation. By transporting vast amounts of energy and being the main source of water to the atmosphere, the oceans determine weather patterns and provide the energy needed for the development of extreme events. Understanding the changes of ocean dynamics and the complex interactions between the ocean and the atmosphere is the key to understanding current changes in the distribution, frequency and intensity of global extreme events relevant to the insurance industry, such as tropical cyclones, flash floods or extra-tropical winter storms.

Recently, improved observational records and the increased length of reliable time series have provided new evidence of the degree of global ocean warming and the distribution of energy within the ocean (e.g. Levitus *et al.*, 2012). A positive temperature trend in the ocean is now detectable and has already changed selected but relevant metrics for extreme events away from what we have observed in the past (e.g. Elsner, 2008).

The implications of the level of ocean warming that already has been attained include the need to reassess the way we quantify and manage today's catastrophe risk; specifically, after moving away from historical averages, the need to define a "new normal" which is itself highly uncertain.

Historical data-driven (or climatological) approaches to estimate the background risk of different events will fail in a non-stationary environment as they don't adequately incorporate recent changes. Even if some of the changes might not be significant yet, risk estimation has to include the consequences of

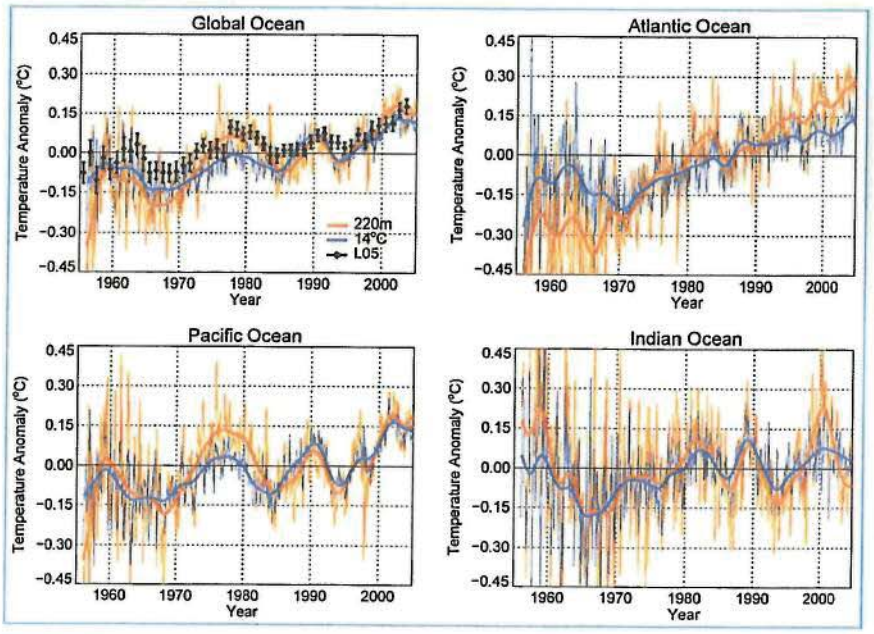
what current physical understanding can tell us about the implied changes of the observed ocean warming. New methods in risk estimation, such as scenario-based approaches and tail risk modelling, are becoming an essential part of the insurance business with a variety of different applications, such as capital requirement determination, pricing and/or risk mitigation.

This report gives an overview of the detected changes in the oceans (Chapter 1) and their impact on extreme events and hazard probabilities over the last decades (Chapter 2). It summarises the changes in risk management strategies (Chapter 3) that (re)insurance companies can implement in order to address the new situation appropriately, comply with regulatory requirements and ultimately improve their ratings.

Evidence for ocean warming since the mid-20th century

Since the Industrial Revolution, the atmospheric CO_2 concentration has increased substantially (IPCC, 2007a). This fact, together with the well-known radiative properties of CO_2 and other gases such as methane with similar characteristics, produces the colloquially known "greenhouse effect". GHG trap some of the infrared radiation emitted from the Earth, resulting in a warming of the atmosphere. Consequently, as the atmosphere exchanges heat with the ocean, the ocean has gradually been storing this energy, causing an increase in sea surface temperatures (SSTs), the temperature of the upper ocean layer (see Figure 1) and the vertically-integrated ocean heat content (OHC) (Figure 2).

Figure 1

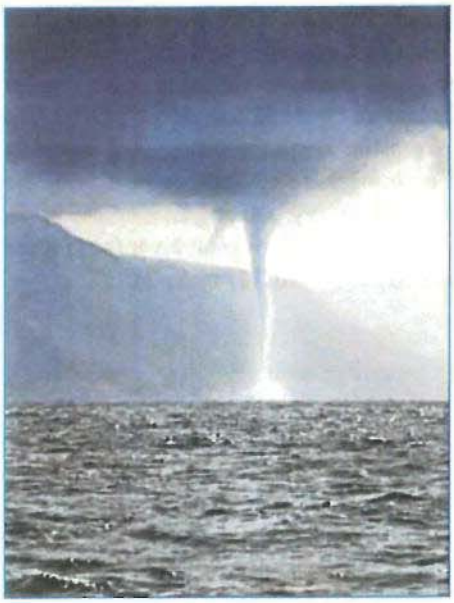


Time series of monthly mean temperature abnormally above the 14°C isotherm (blue) and 220 (orange) for (a) Global Ocean, (b) Atlantic Ocean, (c) Pacific Ocean, and (d) Indian Ocean. The thick lines show these data after a 5-year low-pass filter has been applied. These data have been selected to have identical geographical coverage for the 14°C and 220m analyses. Also shown are the annual temperature anomalies with error bars (black) for the upper 300m of the Global Ocean (L05).

Source: Palmer *et al.*, 2007.

The OHC plays an important role in powering the dynamics of global climate (Hansen *et al.*, 2005, Arndt *et al.*, 2010). The increase in OHC is accompanied by the thermal expansion of sea water, which is the dominant component of sea level rise, and represents a direct threat to coastal regions around the world. In addition, rising mean sea level indirectly increases the damage potential of extreme events, such as extra-tropical cyclones or tsunamis. The OHC is also of direct relevance to many types of weather extremes, such as tropical cyclones or severe convective events, because OHC is the energy source for the development of these atmospheric phenomena.

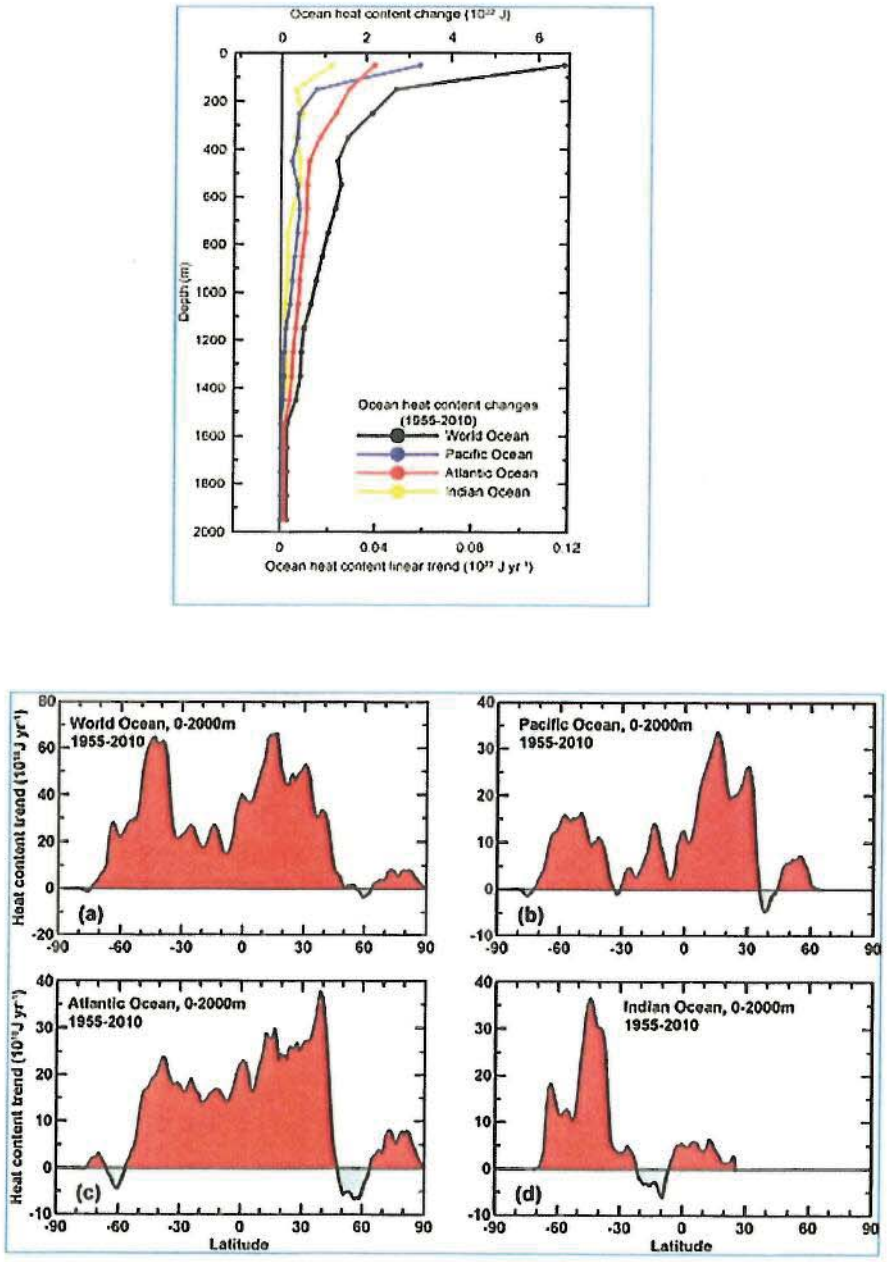
The first observations of rising levels of OHC were published in the year 2000 (Levitus *et al.*, 2000) and have been confirmed by the International Panel on Climate Change (IPCC) *Fourth Assessment Report* (IPCC, 2007a). Since then, substantial improvements have been made to better constrain the observed increase in OHC. Observational records from sources ranging from ship measurements, satellite observations and recently established networks of autonomous floaters in the oceans, improve our knowledge about the extent of ocean warming and reveal that it is more pronounced than previously reported (Domingues *et al.*; 2008, Ishii and Kimoto 2009; Levitus *et al.*, 2012).



Tornado and storm clouds forming over rough sea.

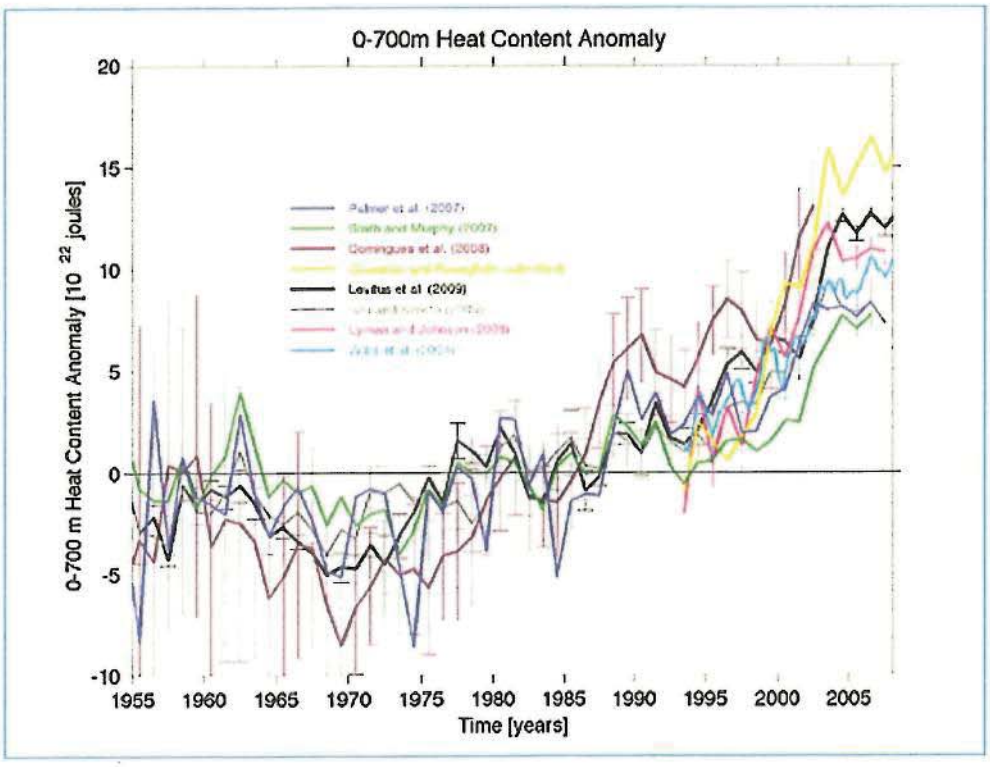
Current observations of OHC (as derived from temperature anomalies in upper ocean layers, see Figure 1) show a positive trend over the last decades on a global level, which is also apparent in individual ocean basins (Palmer *et al.*, 2007, Levitus *et al.*, 2012). It is most pronounced in the Atlantic basin and evident in the Pacific basin. Additionally, the Indian Ocean shows a minor upward trend, which is more pronounced in the tropical part of the Indian Ocean (see Figure 2). Beside these trends, short- and long-term variations in the OHC can be observed; these are caused by natural variability in the climate system. The variability on different timescales and the uncertainty estimation for the estimates have caused considerable debate in the scientific community about the quality of the data sets used and the mechanisms involved (see *Real Climate* for a summary). Although some uncertainty remains, different studies now agree not only on the fact that OHC has indeed been rising, but also more or less on the extent of the ocean warming (see Figure 4). Furthermore, recent modelling studies suggest that the observed ocean warming can be attributed to anthropogenic emissions of GHG (Gleckler *et al.*, 2012).

Figure 2: The linear trend in ocean heat content for different basins as a function of depth (top) and latitude (bottom)



Source: Levitus *et al.*, 2012.

Figure 3: Annual ocean heat content anomaly (1022 J) for the 0–700 m layer



A number of observation-based estimates of annual ocean heat content anomaly for the 0-700 m layer. Differences among the time series arise from: input data; quality control procedure; gridding and infilling methodology (what assumptions are made in areas of missing data); bias correction methodology; and choice of reference climatology. Anomalies are computed relative to the 1955–2002 average.

Source: Palmer *et al.*, 2010.

2 The impact of ocean warming on extreme events

The energy stored in the ocean has changed and, consequently, so too have the distribution, frequency and intensity of different extreme events in the climate system (IPCC, 2012). Changes in SSTs (an indicator of OHC change) are not homogenous and this has implications for global weather patterns. A stronger than average increase can be observed in the tropics (see Figure 2) and this has, in a manner similar to the El Niño Southern Oscillation (ENSO), various local and remote effects on extreme events.

In addition to overall warming, increased evaporation from the ocean's surface has led to local increases of humidity in the lower atmosphere in various regions (Willet *et al.*, 2010; Santer *et al.*, 2007). Because of the important role of humidity in atmospheric dynamics, weather patterns have changed and, consequently, so has the occurrence of extreme events in various regions.

In this chapter we provide a brief summary of the changes for different natural hazards and the confidence in the detection of change.

2.1 Main drivers of change

Many insurance-relevant hazards show increased loss potential due to the warming of the oceans. The main drivers of change in the loss potential associated with ocean warming are: (i) sea level rise, (ii) an intensified hydrological cycle and (iii) changes in large-scale climatic phenomena like ENSO.

(i) Sea level rise

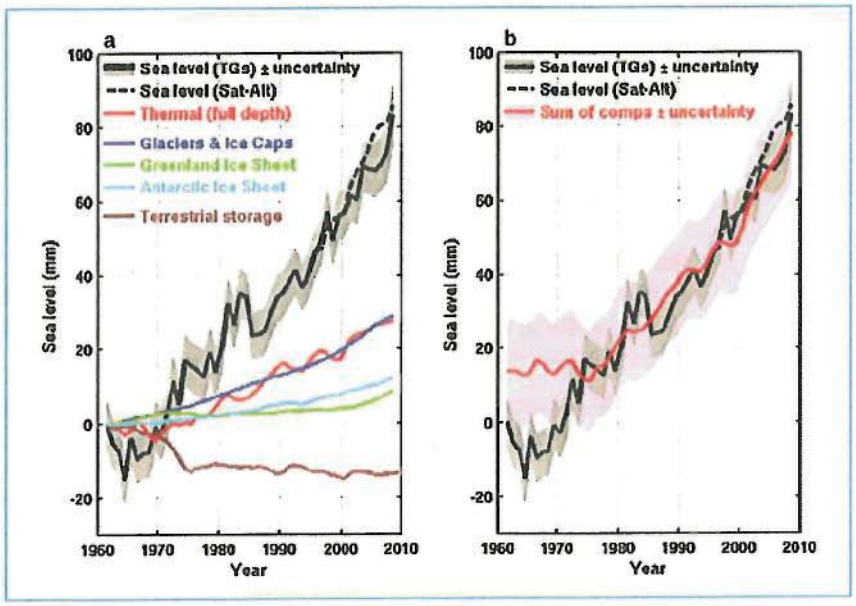
A first and direct consequence of rising OHC is sea level rise. This is not only due to the thermal expansion of the warming ocean water but also to melting continental ice shelves and glaciers. The global sea level has risen roughly 20 cm over the last century and has been rising with accelerated speed since

Erosion caused by rising sea levels due to global warming.

1930 (see Figure 4) (Church and White, 2011). Various mechanisms have already translated higher sea-levels into an increased flood risk in many coastal regions (IPCC, 2012). An indirect effect of sea level rise is an increased impact of storm events, like tropical or extra-tropical cyclones (see 2.2 and 2.3) through an increase in coastal flooding and storm surge. In general, sea level rise decreases the return period of events coastal infrastructure is designed for, e.g. the Dutch dykes or the Thames barrier. Considering all the consequences, sea level rise is probably the major driver of increased risk due to natural catastrophes.

Note that some of the changes in the world's oceans are also linked to certain geophysical risks. Sea level rise, for example, increases the severity of inundation by tsunamis. The probability of the tsunami event itself remains unchanged, but the damage caused is increasing as the sea level rises.

Figure 4: The global sea-level budget from 1961 to 2008. (a) The observed sea level using coastal and island tide gauges and (b) observed sea level and the sum of components.



The global sea-level budget from 1961 to 2008. (a) The observed sea level using coastal and island tide gauges and (b) observed sea level and the sum of components. Source: Church *et al.*, 2011.

(ii) Intensified hydrological cycle

The exchange of energy between ocean and atmosphere is described by an exponential increase in the evaporation from the ocean's warming surface (Yu and Weller, 2007). With enhanced evaporation from the warmer ocean surface, increasing water-holding capacity and a vertical extension of the warming troposphere, the hydrological cycle of the climate system has intensified in many regions. Significant positive trends in specific humidity have been observed for most parts of the globe (Peterson *et al.*, 2011). Increasing amounts of precipitable water in the atmosphere and more energy available for convection have both worked to significantly increase the potential intensity of precipitation events, such as from tropical cyclones or local convective events (Trenberth, 2008; Yang *et al.*, 2011).

A recent study by Min *et al.* (2011) found evidence that the effects of global warming have contributed to the observed intensification of heavy precipitation events found over approximately two thirds of data-covered parts of northern hemispheric land areas. As the average annual rainfall amount has not increased at a rate comparable to extreme events, the variability of precipitation over space and time has significantly increased. Drought periods and flood conditions are both on the rise (IPCC, 2012) resulting in drier dry and wetter wet events.

Brisbane flood, January 2011. Aerial view of homes under water in Australia's worst flooding disaster.

Just as for sea level rise, the intensified hydrological cycle increases the impacts of a variety of extreme events and, thus, is one of the major drivers of changes in the loss potential of natural catastrophes.

(iii) Dominant drivers for large-scale variations in the climate system

Variability and extremes in the atmosphere–ocean system are dominated by different large-scale modes of climate variability. Phenomena like ENSO, the North Atlantic Oscillation (NAO) or different monsoon systems have well-known, dominant, local and remote effects on the variability in extreme events. These modes are very likely to be affected by the warming of the ocean, as they are driven by sensitive ocean–atmosphere interactions. Unfortunately, due to the long timescales of ocean dynamics and the relative short length of observational data, these changes are difficult to detect. The underlying dynamics of these modes are highly complex, and the scientific understanding of them is still far from being complete. Consequently, an estimation of the impacts of the changes in climate modes on catastrophe risk remains a serious challenge and is simply not quantifiable.

2.2 Tropical cyclones

Although issues remain with regard to the quality of historical data records on tropical cyclone activity, there is evidence that increased SSTs have led to an increase in the intensity of the most severe tropical cyclones over the last decades (Emanuel, 2005; Kossin *et al.*, 2007; Elsner *et al.*, 2008). This finding, based on analyses of the latest observations, is consistent with the physical fact that tropical cyclones are powered by the exchange of latent heat between the atmosphere and the warming oceans. Although there is still some debate about

the link between global warming and tropical cyclone intensity and even more so with their frequency (Vecchi *et al.*, 2008; Knutson *et al.*, 2010), it is becoming increasingly obvious that the observations describe a non-stationary behaviour of cyclonic activity in the Atlantic as well as in the Pacific (Wang *et al.*, 2011).

Another implication of ocean warming is the potential for longer tropical cyclone seasons. This can be observed for example in the North Atlantic, where the increase in SST is most pronounced (Kossin, 2008). A longer hurricane season, starting earlier and ending later, can change some of the storm characteristics and increase the damage potential of cyclone season. There are indications that this is the case for example in the Hurricane Sandy on the U.S. East Coast at the end of October 2012. Sandy's interaction with an extra-tropical upper trough, a phenomenon that is more likely later in the season, helped to increase its damage potential by maintaining the storm's intensity and influencing the cyclone towards making landfall.

Serious damage to the buildings at the Seagate neighbourhood due to impact from Hurricane Sandy in Brooklyn, New York, U.S., on Thursday, 1 November 2012.

The impact of ocean warming on other loss-relevant hurricane characteristics, such as size, genesis potential and location of landfall, is deeply uncertain and, because of the sparse data, it will take some time until a potential signal may appear in observational time series.

However, the damage potential of tropical cyclones has risen not only due to the observed intensification, but also due to the links with sea level rise and the intensified hydrological cycle (see 2.1). Both effects add to the flood risk associated with tropical cyclones by increasing the storm surge and precipitation amounts.

2.3 Extra-tropical winter storms

Due to the amplified warming of the polar oceans, the poleward temperature gradient between the tropics and the poles has decreased. This has an impact on the position of the jet streams and consequently for the main storm tracks of extra-tropical cyclones (ETCs) in both hemispheres. It is likely that these changes have already led to a poleward shift in extra-tropical storm tracks (Berry *et al.*, 2011; Wang *et al.*, 2012) which has changed the spatial distribution of risk associated with these storms.

A recent analysis of newly available data (Wang *et al.*, 2012) suggests that ETC activity has increased slightly over the period 1871–2010 in the Northern Hemisphere with more substantial increases being seen in the Southern

Hemisphere. Notable regional and seasonal variations in trends are evident, as is profound decadal or longer-scale variability. For example, the Northern Hemisphere increases occur mainly in the mid-latitude Pacific and high-latitude Atlantic regions.

Also, the damage potential of ETCs has changed due to a significant positive trend in precipitation as well as their wave heights (IPCC, 2012; IPCC, 2007a). The IPCC Fourth Assessment Report (AR4) reported statistically significant positive trends in wave heights over the period 1950–2002 over most of the mid-latitudinal North Atlantic and North Pacific. Global trends in 99th-percentile satellite-measured wave heights show a mostly significant positive trend of between 0.5 and 1.0 per cent per year in the mid-latitude oceans, but less clear trends over the tropical oceans from 1985–2008. However, some of these trends remain insignificant due to the length of reliable observations (Young *et al.*, 2011; Young *et al.*, 2012).

It is important to note that the flood risk of storm surge of ETCs also positively couples with sea level rise and is driven by an intensified hydrological cycle (see 2.1).

2.4 Severe convective storms

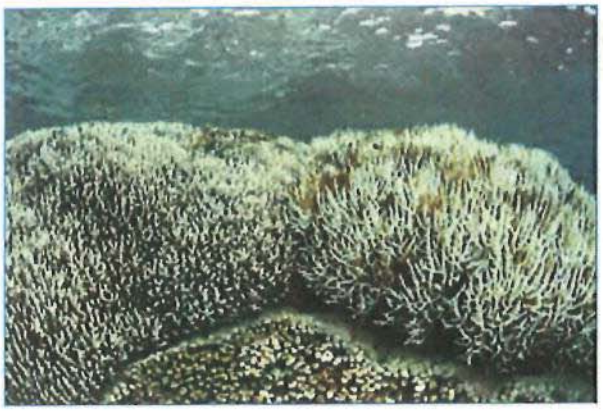
Due to issues with observational data for small-scale convective events like tornadoes and hailstorms, it is particularly difficult to detect trends in these events. Findings from existing data sets are uncertain, owing to changes in the observational standards and population densities, as well as high inter-annual variability in the number of severe convective events (Kunkel *et al.*, 2012; Doswell *et al.*, 2009; Verbout *et al.*, 2006).

Since the analysis of raw event data is problematic, research has focused on trends in the large-scale environmental conditions which are favourable for the development of severe convective storms. The overall positive trend in humidity (see 2.1), especially in the lower troposphere, has led to a positive trend in the instability of the atmosphere which is necessary for severe convection to take place. On the other hand, vertical wind shear in higher levels of the atmosphere is another precondition for convective events to happen, and is understood to decrease together with a decreasing poleward temperature gradient. Thus, the necessary condition for increased frequency of convective events is a balance between an increase in lower tropospheric instability and a decrease of vertical wind shear. It is this co-dependence which makes it difficult to detect significant trends in the large-scale environment producing severe thunderstorms (Brooks and Dotzek, 2008).

However, although the overall confidence is medium only, physical understanding and model results consistently indicate an increase in the number and volatility of severe convective events, especially in the U.S. (Trapp *et al.*, 2009; Sander *et al.*, 2013).

2.5 Uncertain future of the marine ecosystems

Warming of our oceans has a significant influence on their ecosystems. The vitality of many important parts of sensitive ecosystems, like corals or



A field of corals has been bleached as high sea surface temperatures have caused the corals' symbiotic dinoflagellates to exit the corals' tissues. If temperatures do not fall the corals will die.

plankton, are critically dependent on water temperatures as well as levels of acidity, which increase with rising CO_2 concentrations, a phenomenon referred to as ocean acidification. The impacts of ocean warming and acidification affect the whole maritime fauna and flora and have repercussions on ocean productivity, human health, resource management and the tourism industry. Although significant scientific progress has been made in recent years, there are still considerable uncertainties in the implications of ocean warming and acidification on various marine ecosystems. Further research is needed to quantify the potentially huge risks for mankind of warming oceans, including impacts on the ocean's carbon uptake, biodiversity, food security or medical resources. The implications for insurance are, as yet, unclear but could potentially be significant and, therefore, the marine biological response to ocean warming should be monitored.

2.6 Summary: ambiguity[1] in today's hazard probabilities

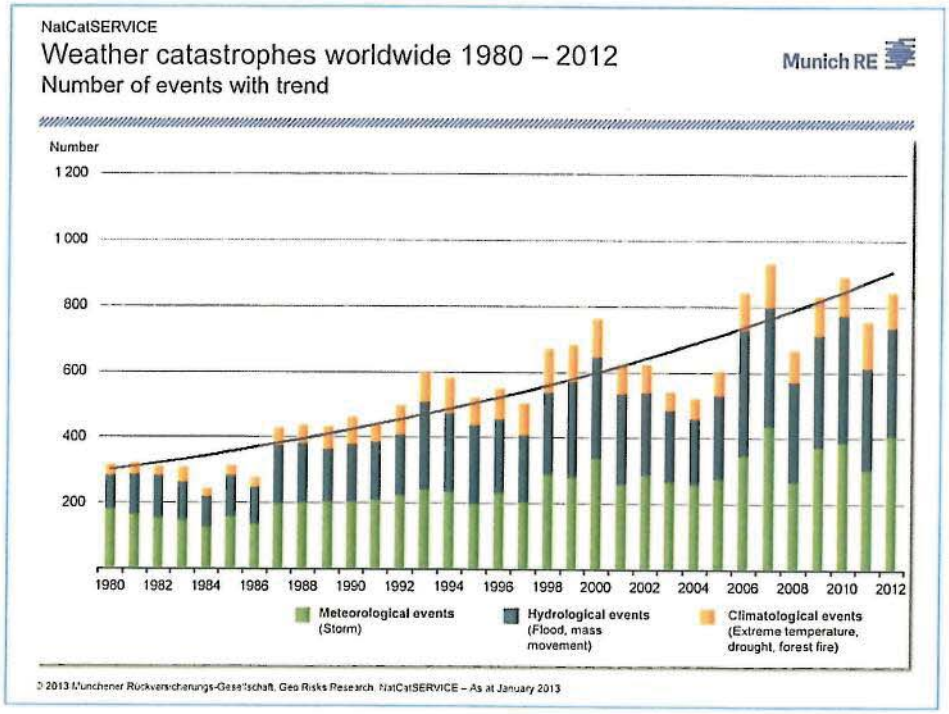
Most impacts of ocean warming on extreme events are qualitatively well understood and, consequently, it is rather obvious that, for many regions, hazard risk can no longer be seen as stationary. Even if they are not yet significant, recent changes in the occurrence of extreme events consistently follow the storyline of the scientific understanding of the impacts of ocean warming. However, it remains a challenge to quantify the changes for any given time frame or region due to data issues, the infrequent occurrence of extreme events and, more generally, the complexity of the climate system. In most cases there is simply not enough data to reasonably estimate a linear trend, and that aside, inherent non-linear coupling and feedback effects in the climate system make the assumption of linearity very likely to fail. For a variety of different hazards, it is uncertain whether apparent trends will progress over time, or whether they are part of the stochastic nature of the climate system. Ranger and Niehörster (2012, Appendix A. Supplementary data) demonstrate how this leads to an inability to accurately estimate current risk levels.

An alternative approach to traditional data-based methods in a transient environment is to move from the current historic to predictive risk estimation methods. These forward-looking approaches have the potential to overcome the data issues in the estimation of current likelihoods of extreme events. The available tools are time-dependent model forecasts which incorporate the improved observations of changes in the ocean and simulate its likely influence

1 It is important for this paper to understand the meaning of ambiguity. Ambiguity in this paper describes the inability to assign probabilities to future events with a satisfactory precision. Walker and Dietz provide a formal, mathematical definition of ambiguity (Walker and Dietz, 2012). Note that the concept of ambiguity applies whenever there is Knightian uncertainty (Knight, 1921), but Knightian uncertainty doesn't necessarily imply ambiguity since decision-makers might still treat Kightian uncertainty as if it was risk.

on the short- to medium-term future. Such time-dependent or medium-term outlooks, which go beyond historical averages, are already provided by commercial model vendors, such as Risk Management Solutions (RMS). These products represent, at least in principal, a significant improvement over simple long-term averages of historical data.

Figure 5



Also, an increasing number of weather and research centres around the world offer seasonal to multi-year forecast products based on global numerical weather models (GCMs or general circulation models), which build the basis of the medium-term outlook as part of the upcoming 5th IPCC assessment report on climate change. GCMs are cost-intensive simulation tools, as they need to be high-resolution coupled atmosphere–ocean models running in ensemble mode, and intend to incorporate the physical changes in the climate system.

Unfortunately, time-dependent, model-based estimates of hazard probabilities also come with significant uncertainties, arising from general model imperfections, their numerical structure and parameter estimation problems inherent in models of high-dimensional chaotic systems (Smith, 2002). There remain challenges with the underlying model assumptions as well as with the historical data (Niehörster and Murnane, 2012) which lead to alternative and maybe equally likely views and have caused substantial intra-model and inter-model differences. This uncertainty is irreducible, which by no means implies that the existing models are not useful or scientifically sound. It rather reflects the limits of the scientific understanding and the ability to predict extreme events in a chaotic system.

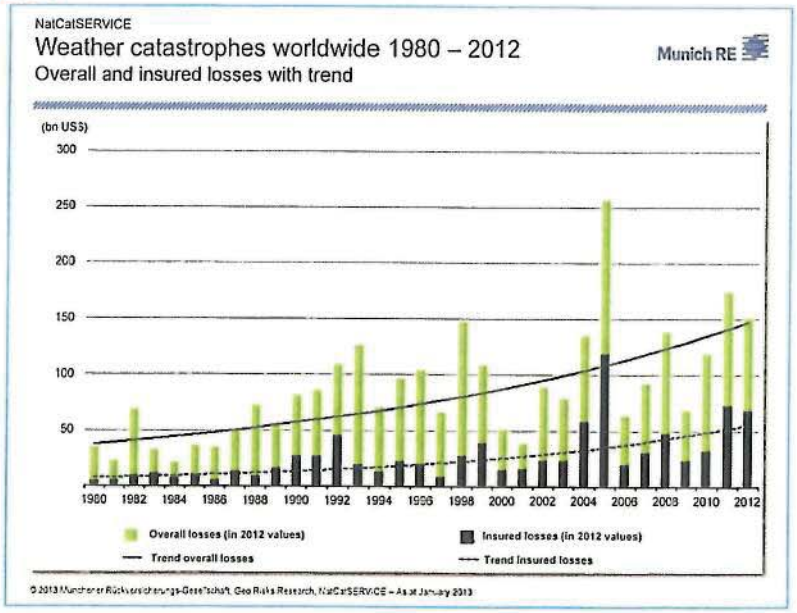
In summary, the lack of historical and observational data and the existence of competing theories formalised in competing forecasting models, leads to a multitude of different answers for the return periods of certain extreme events in today's transient environment. Unfortunately, it is difficult to assign confidence or the probability of one answer being better than the other, a situation which can be described as ambiguity. It is characterised by a secondary uncertainty in the shape of the probability distribution function (PDF) rather than the lack of knowledge of where exactly in the PDF next year might fall.

3 Impact of ocean warming on the global insurance industry

There is a significant upward trend in the insured losses caused by the extreme weather events discussed in Chapter 2 (see Figure 6). This is true for primary insurance, which is impacted by an increasing attritional loss burden caused by severe local weather events, as well as for reinsurance losses caused by large-scale catastrophic extreme events. There is broad agreement among experts that this global trend in economic as well as insured losses from natural disasters is primarily driven by socio-economic factors (e.g. Bouwer, 2011; Neumayer and Barthel, 2011). However, the serious challenge to adequately estimate present-day hazard risks, which follows from ocean warming, puts additional pressure on a market that is already facing the stress of upward trends in absolute disaster loss.

As a consequence of ocean warming and global change, the return periods for a number of high-loss extreme events are ambiguous rather than simply uncertain. Furthermore, this is true also for the timing of loss claims and the correlations of losses within portfolios. This has direct implications for the financial risk in catastrophe insurance, appropriate levels of capital requirement and the pricing of insurance premiums.

Figure 6



On a more general level, there are growing concerns about the indirect impact of changes in the risk landscape which question the sustainability of the catastrophe risk business in many countries. For some regions, the combination of rising risk levels and a heavily regulated market might lead to decreasing commercial viability. One option to address the insurability challenges of rising risk levels is to engage in efforts to couple risk transfer to risk reduction.

This chapter provides an overview of the responses in internal risk management strategies (3.1) and potential strategies to help improve risk reduction measures (3.2).

3.1. Internal: risk management strategies under ambiguity

Evidence for a non-stationary environment of natural catastrophes raises the important question of how risk management strategies can reflect the ambiguity about the changes of the underlying risk, ensure adequate pricing strategies and set a robust capital requirement.

It is clear that a continuous use of simple stationary climatological approaches to quantify probabilities of extreme events, in combination with expected utility-based methods to quantify financial risk, will increasingly fail in the presence of ocean warming. In the future, this might be reason enough for rating agencies to penalise companies which fail to address these issues in the enterprise risk management.

As it will be impossible to exactly predict the behaviour of the atmosphere and ocean in the medium term (see 2.7), it will be vital for risk management to amend any multi-model probabilistic modelling with defined and deterministic scenarios that reflect the wide range of plausible developments (Swiss Re, 2009; Davis, 1998). A rigorous scenario approach improves the knowledge of the (tail) value at risk (TVaR)[2] where existing models might fail. Although the scenario approach is traditionally used primarily for long-term planning purposes, in the current environment it has become an important part even in short-term risk management.

The selection of scenarios should include a reasonably wide range of hypothetical but scientifically justifiable scenarios, including an upper limit defining the worst case. Alongside hypothetical scenarios, a set of scenarios should also include all available and scientifically justifiable models (e.g. Ranger and Niehörster, 2012). It is important to note that stress-testing a single model is not sufficient to cover the range of potential future outcomes, as the structure of this particular model might not allow the full exploration of all plausible events.

The need for an unbiased set of scenarios has the potential to change the risk modelling business substantially. The structural limitation of a single model to produce the full range of potential outcomes makes it desirable to have a platform in which components of risk models, such as event sets or vulnerability functions, can be exchanged in a modular way rather than stress-testing a monolithic model. Although there remain technical challenges, the development of platforms showing the potential to facilitate such an approach is underway. Not only commercial risk model vendors but also public open-source platforms

2 The TVaR quantifies the expected loss caused by an event below a certain probability level (Sweeting, 2011).

are currently developing the necessary infrastructure for rigorous scenario approaches.

An unbiased set of scenarios can be used for the pricing of ambiguous insurance contracts and estimating the associated TVaR. The existing ambiguity about the hazard occurrence, or in other words, the unknown probabilities of the realisation of certain scenarios, precludes the usage of expected utility-based approaches (Savage, 1954). Nevertheless, other methods of decision theory provide rational ways to adjust the capital requirements for any additional ambiguity load and the price for ambiguous insurance contracts (Walker and Dietz, 2012).

In general, ambiguity leads to increased capital requirements for constant probability of ruin (0.005 for Solvency II) when compared to a well-quantified risk in a portfolio. However, the additional capital requirement will depend on the belief over the set of scenarios and the preferences for ambiguity levels of the decision-maker. The price of ambiguous contracts will actually depend on the distribution of scenarios, which might, for example, all predict the same variance in losses, but differ in the annual average loss (AAL). For a given portfolio, the characteristics of the scenario distribution will decide if the prices for ambiguous insurance contracts should be higher or lower relative to a situation with no ambiguity.

3.2. External: maintaining insurability through promoting risk mitigation

As shown, ocean warming implies that the threat of natural catastrophes is ambiguous. At the same time, it can be shown that the ambiguity aversion of rational individuals may increase self-insurance but decrease self-protection (Alary *et al.*, 2010). The interplay between the potential of rising risk levels and insurance demand, but decreasing self-protection, could create a risk environment that is uninsurable in some regions (Herweijer *et al.*, 2009). Examples for markets with this potential are U.K. flood or Florida wind storm insurance.

In general, the only way to ensure that ambiguous risks remain insurable is to promote risk mitigation today (Ranger and Surminski, 2012). The insurance industry should play an active role in raising awareness of risk and climate change through risk education and disseminating high-quality risk information (Ward *et al.*, 2008). In addition, there is real benefit for the industry in supporting and encouraging adaptation through innovative product design. This can and should be done in collaboration with local authorities through engagement in public–private cooperation. This will, as well as enhancing reputation, lead to a more resilient building stock and an overall reduction of risk.

On the investment side, there are new market opportunities associated with the transition to a low-carbon economy. Investment in innovation and global capacity-building for new energy technologies and infrastructure does not only promise good returns but also contributes to the reduction of greenhouse gas emissions which will ultimately create a more resilient society. To support this transition, the industry should use its unique knowledge base to inform the debate on climate change and actively lobby government to take action to reduce risks and curb emissions of greenhouse gases.

These actions, alongside the support of science in tackling the major challenges in projecting the impacts of ocean warming and climate change more

generally, will help the insurance industry to avoid market failures and increase societal resilience.

Abbreviations

AAL	annual average loss
CAPE	convective available potential energy
ERM	enterprise risk management
ENSO	El Niño Southern Oscillation
ETC	extra-tropical cyclone
GCM	general circulation model
GHG	greenhouse gas
IPCC	International Panel on Climate Change
NAO	North Atlantic Oscillation
OHU	ocean heat uptake
OHC	ocean heat content
PDF	probability distribution function
SST	sea surface temperature
TVaR	tail value at risk

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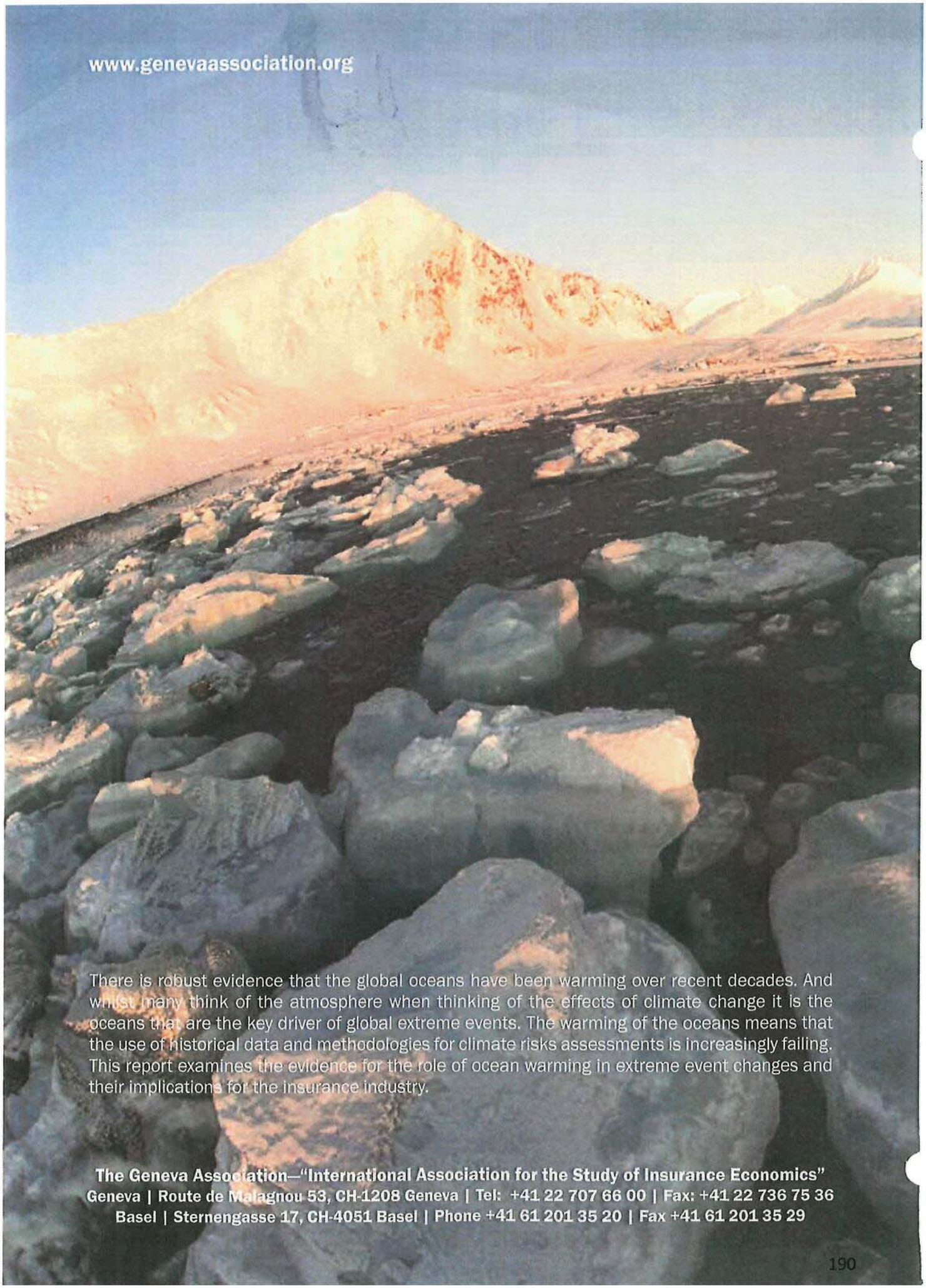

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There is robust evidence that the global oceans have been warming over recent decades. And whilst many think of the atmosphere when thinking of the effects of climate change it is the oceans that are the key driver of global extreme events. The warming of the oceans means that the use of historical data and methodologies for climate risks assessments is increasingly failing. This report examines the evidence for the role of ocean warming in extreme event changes and their implications for the insurance industry.

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