BROWARD COUNTY
FLORIDA

Climate Change Element Support Document

The associated BrowardNEXT2.0 Comprehensive Plan was adopted on March 28, 2019 (Ordinance No. 2019-11) by the Board of County Commissioners.

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List of Acronyms

AAA	Adaptation Action Areas
BC	Broward County
BMP	Best Management Practices
BMPO	Broward Metropolitan Planning Organization
CCTF	Climate Change Task Force
FDEM	Florida Division of Emergency Management
FDEO	Florida Department of Economic Opportunity
FDEP	Florida Department of Environmental Protection
FEMA	Federal Emergency Management Agency
FS	Florida Statute
GHG	Greenhouse Gas
ICLEI	Local Governments for Sustainability
LEED	Leadership in Energy and Environmental Design
LEED-ND	Leadership in Energy and Environmental Design for Neighborhood Development
LiDAR	Light Detection and Ranging
LMS	Local Mitigation Strategy
NOAA	National Oceanic and Atmospheric Administration
PPA	Priority Planning Area
SITES™	Sustainable Sites Initiative™
SLR	Sea Level Rise
SFRPC	South Florida Regional Planning Council
SFWMD	South Florida Water Management District
STAR™	STAR Community Index™
TOD	Transit Oriented Development

USACE	United States Army Corp of Engineers
USDOE	United States Department of Energy
USDOI	United States Department of Interior
USEPA	United States Environmental Protection Agency
USGBC	United States Green Building Council
USGS	United States Geological Survey
VMT	Vehicle Miles Travelled
WWS	Water and Wastewater Services

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Adaptation – Adjustment in natural or human systems to a new or changing environment that exploits beneficial opportunities or moderates negative effects. "Adaptation Planning" is any action or strategy that reduces vulnerability to the impacts of climate change.

Adaptation Action Area – As defined by Senate Bill CS/SB 1122 amendment: "'Adaptation Action Area' or 'Adaptation Area' means a designation in the Coastal Management Element of a local government's comprehensive plan that identifies one or more areas which experience coastal flooding due to extreme high tides and storm surge, and which are vulnerable to the related impacts of rising sea levels for the purpose of prioritizing funding for infrastructure needs and adaptation planning." As further defined in the bill: "as part of this element, a local government that has a coastal management element in its comprehensive plan may develop an adaptation action area designation for those low lying coastal zones which are experiencing coastal flooding due to extreme high tides and storm surge and are vulnerable to the impacts of rising sea level. Local governments that elect to adopt an adaptation action area are encouraged to consider policies within the coastal management element to improve resilience to coastal flooding resulting from high tide events, storm surge, flash floods, storm water runoff and related impacts of sea level rise. Criteria for the adaptation action area may include but not be limited to areas with land elevations below, at, or near mean higher high water, hydrologic connection to coastal waters, and designated evacuation zones for storm surge."

Adaptive Management – A systematic approach for improving resource management by learning from management outcomes. Adaptive management is an iterative approach in which managers, scientists, and stakeholders work together to evaluate a problem, select and implement strategies, monitor conditions, evaluate the effectiveness of the strategies, and adjust future actions accordingly.

Alternative Fuels – A substitute for traditional liquid, oil-derived motor vehicle fuels like gasoline and diesel. As defined by the Energy Policy Act of 1992, "alternative fuels" include: methanol, ethanol, and other alcohols; blends of 85% or more of alcohol with gasoline (E85); natural gas and liquid fuels domestically produced from natural gas; propane; hydrogen; electricity; biodiesel (B100); coal-derived liquid fuels; fuels, other than alcohol, derived from biological materials; and P-Series fuels.

Aquifer – A natural underground layer, often of sand or gravel, that contains water. The two aquifer systems in Broward County are the Floridan Aquifer and the Biscayne Aquifer. The Floridan extends through the entire state but has varying degrees of permeability. In the north it is shallower and is the principal source of water supply, while in the south it is deeper and more brackish, mostly used for the injection of sewage and industrial waste. The Biscayne Aquifer is the primary source of water for all of Dade and Broward Counties, the southern portion of Palm Beach County, and is transported by pipeline to the Florida Keys. In most places, the highly permeable limestone rocks of the Biscayne aquifer are covered by a thin veneer of porous soil and aquifer water levels rise rapidly in response to rainfall.

Base Finish Floor Elevation Standards (also Minimum Finished Floor Elevations) – A minimum height requirement for the lowest floor of livable space, based on flood zones established by The Federal Emergency Management Agency (FEMA), to be considered during applications for building permits and environmental licenses for new construction and substantial improvements to existing structures.

Beach Nourishment and Re-nourishment – The systematic augmentation by artificial means of the linear width and/or elevation of the beach exposed above the high tide line. Nourishment suggests the first augmentation project; Re-nourishment suggests maintenance projects thereafter.

Biscayne Aquifer – A surficial aquifer system and the main source of water for Broward County. A shallow layer of highly permeable limestone under about 4,000 square miles of South Florida. For more information, see "Aquifer".

Broward County Flood Map – Refers to Broward County's 100-year flood map, describing zones with a flood elevation that has a 1 percent chance of being equaled or exceeded each year.

Carbon Footprint – The total amount of greenhouse gases that are emitted into the atmosphere each year by a person, family, building, organization, or company. A person's carbon footprint includes greenhouse gas emissions from fuel that he or she burns directly, such as by heating a home or riding in a car. It also includes greenhouse gases that come from producing the goods or services that the person uses, including emissions from power plants that make electricity, factories that make products, and landfills where trash gets sent. Personal and household carbon footprints can be estimated using online calculators, while communities and larger institutions may use greenhouse gas emissions inventory methodologies to calculate their carbon footprint. (EPA.gov & coolclimate.berkeley.edu)

Carbon Mitigation Banks (also Carbon Sequestration Markets/Carbon Offset Markets) – In a carbon market, each ton of carbon sequestered (see definition below) is called a carbon credit. Carbon markets provide credible standards by which carbon storage is measured and verified, so that forest landowners may sell these units of sequestration on the open market to companies interested in offsetting their carbon dioxide (CO_2) emissions. Currently these markets within the United States are

entirely voluntary. While a mandatory national "cap-and-trade" system does not exist for carbon, EPA's Acid Rain Program allows trading to meet SO2 and NOx emissions caps.

Carbon Sequestration and Storage – The uptake and storage of carbon. Trees and plants, for example, absorb carbon dioxide, release the oxygen and store the carbon. Fossil fuels were at one-time biomass and continue to store the carbon until burned. Efforts to increase terrestrial carbon sequestration are based on the premise that reforestation adds to the planet's net carbon storage and helps moderate global warming by slowing the growth of carbon emissions in the atmosphere.

Circular Economy (also Industrial Ecology, Cradle to Cradle, or Closed Loop Economy) – Generic terms for an industrial economy that is, by design or intention, restorative and in which materials flows are of two types, biological nutrients, designed to reenter the biosphere safely; and technical nutrients, which are designed to circulate at high quality without entering the biosphere. (ellenmacarthurfoundation.org)

Clean Energy – Any energy source that meets the needs of the present without compromising the ability of future generations to meet their needs. "Clean Energy" is produced from renewable sources using processes that have minimal impact to the environment. Also see renewable energy.

Climate – Long-term weather patterns, and variations in elements such as temperature, precipitation, and humidity attributed to a given location.

Climate Change – Alteration of long-term weather patterns that can be identified (e.g. using statistical tests) by shifts in the mean and/or the variability of these properties and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcing, or to persistent anthropogenic changes in the composition of the atmosphere or in land use. Article 1 of the UNFCCC defines 'climate change' as "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods". (IPCC)

Climate Change Action Plan – A comprehensive document that outlines a government's or community's response to climate change, tailored to local circumstances. It typically includes a detailed emission inventory; sets emission reduction goals; discusses potential impacts on resources; identifies mitigation and adaptation actions or policies which should be adopted; and a method for tracking implementation.

Climate Resilient Community – A geographic location that takes proactive steps to prepare for (i.e. reduce the vulnerabilities and risks associated with) climate change impacts. Also see resiliency.

Climate Variability – Oscillations in the mean state and other statistics (such as standard deviations, the occurrence of extremes, etc.) of the climate on all spatial and temporal scales beyond that of individual weather events. Variability may be due to natural internal processes within the climate

system (internal variability), or to variations in natural or anthropogenic external forcing (external variability). (IPCC)

Cluster Development – A land use planning technique in which a portion of a site is allowed to be developed at a greater density than would otherwise be allowed, in favor of leaving the rest of the site as open space.

Coastal Buffer Area (also Coastal Buffer Zone) – Is a land area adjacent to a shoreline (coastal) features that is, or will be, vegetated with native shoreline species and which acts as a natural transition zone between the coast and adjacent upland development.

Cogeneration Systems – Electricity generator that recovers and reuses its own waste heat to generate steam that drives auxiliary turbines to produce additional power. Also called total energy system or Combined Heat and Power (CHP) generation.

Community Connectivity (also Street Connectivity) – A system of streets providing multiple routes and connections to the same origins and destinations. Connectivity relates to how an entire area is connected by the street system, not only to the number of intersections along a street segment. A highly connected area includes a system of parallel routes and cross connections, few closed-end streets, many points of access, and narrow streets with sidewalks or off-street paths. Frequent intersections are provided which create a pedestrian scale block pattern.

Critical Facilities – Defined as those structures from which essential services and functions for victim survival, continuation of public safety actions, and disaster recovery are performed or provided. Shelters, emergency operation centers, public health, public drinking water, sewer and wastewater facilities are examples of critical facilities. Though not explicitly included in the definition, supporting life-line infrastructure essential to the mission of critical facilities are also included when appropriate.

Down-Scaled Climate Models – Computer based simulations which take global information on climate response to changing atmospheric composition and translating it to a finer spatial scale that is more meaningful in the context of local and regional impacts. (IPCC)

Dune – A mound or ridge of loose sediments, usually sand-sized sediments, lying landward of the beach and deposited by any natural or artificial mechanism, which may be bare or covered with vegetation and is subject to fluctuations in configuration and location. (62B.003(17) FAC)

Eco-Industrial Development – Is an emphasis on fostering networks among businesses and communities to optimize resource use and reduce economic and environmental costs. It encompasses a range of approaches including pollution prevention, by-product exchange, green design, life cycle analysis, joint training programs, and public participation.

Energy Efficiency – The ratio of useful energy output of a system, conversion process or activity to its energy input. (IPCC)

Embedded Energy (also Embodied Energy) – Is defined as the energy that was used in the work of making a product. Embodied energy attempts to measure the total of all the energy necessary for an entire product lifecycle. This lifecycle includes raw material extraction, transport, manufacture, assembly, installation, disassembly, deconstruction and/or decomposition.

Erosion Control Line – A delimiter which determines the landward extent of the claims of the state in its capacity as sovereign titleholder of the submerged bottoms and shores of the Atlantic Ocean. (Section 161.151, F.S.)

Florida-Friendly Landscaping™ – A set of nine guiding principles which help protect natural resources and preserve Florida's unique beauty. These nine principles include: right plant, right place; water efficiency; fertilize appropriately; mulch; attract wildlife; manage yard pests responsibly; recycle; reduce storm water runoff; and protect the waterfront. (University of Florida's Florida Yards & Neighborhoods Program)

Food Security – The state achieved when a given population has access to sufficient, safe, nutritious food to maintain a healthy and active life. (World Health Organization)

Green Design Standards – Building codes and architectural and engineering criteria that take energy efficiency, material recycling, zero waste, water conservation and related sustainability issues into account. Green building codes and sustainable design and construction standards are readily being adopted by local and state governments. Examples of some of the most commonly used standards are Leadership in Energy and Environmental Design (LEED), 2012 International Green Construction Code (IgCC), ICC-700 National Green Building Standard, ENERGY STAR versions 2, 2.5, and 3.0, and the 2009 International Energy Conservation Code (2009 IECC). (USDOE Building Energy Codes Program)

Green Infrastructure – Strategically planned and managed networks of natural lands, working landscapes and other open spaces that conserve ecosystem values and functions and provide associated benefits to human populations.

Green Roof (also Rooftop Gardens) – Vegetative matter integrated into the cover of a structure to reduce rooftop and building temperatures, filter pollution, lessen pressure on sewer systems, and reduce the heat island effect.

Greenhouse Gas Emissions – Gasses released into the Earth's atmosphere that prevent radiated heat from escaping into space causing a warming the atmosphere and other climate impacts. One major greenhouse gas is carbon dioxide. Combustion of all fuels containing carbon (gasoline, natural gas, coal, diesel, wood, and propane) yield carbon dioxide which in turn absorbs and emits heat in the atmosphere causing global warming.

Heat Island Effect – Localized increase in ambient urban air temperatures resulting primarily from the replacement of vegetation with buildings, roads, and other heat-absorbing infrastructure. The heat

island effect can result in significant temperature differences between rural and urban areas and contributes to global warming. (EPA.gov)

Hydrological Modeling – Simplified, conceptual representations of a part of the hydrologic cycle, used for hydrologic prediction and for understanding hydrologic processes.

Infrastructure – Constructed structures which serve the common needs of the population, such as roads, sewers, water treatment plants, and canals.

Infiltration and Inflow – Storm and/or groundwater that enters the sanitary sewer system through holes, breaks, joint failures, connection failures, illegally connected sump pumps, down spouts, and footing drains, and from cross-connections with storm sewers. Most inflow comes from storm water and most infiltration comes from groundwater. High groundwater levels and storm events can contribute to excessive sewer flows.

Leadership in Energy and Environmental Design™ (LEED™) – A rating system developed by the U.S. Green Building Council to verify that a building, home or community was designed and built using strategies aimed at achieving high performance in key areas of human and environmental health: sustainable site development, water savings, energy efficiency, materials selection and indoor environmental quality. (USGBC.org)

Leadership in Energy and Environmental Design for Neighborhood Development (LEED-NP) – A rating system which integrates the principles of smart growth, urbanism and green building into a national system for neighborhood design. LEED for Neighborhood Development is collaboration among USGBC, Congress for the New Urbanism, and the Natural Resources Defense Council. (usgbc.org)

Light Detection and Ranging (LiDAR) – An optical remote sensing technology that can measure the distance to, or other properties of, a target by illuminating the target with light, often using pulses from a laser. In practical application, LiDAR is often used to measure land elevation levels.

Local Vulnerability – According to the IPCC, vulnerability is a function of the character, magnitude and rate of climate variation to which a system is exposed; its sensitivity; and adaptive capacity. Exposure is defined as the degree of climate stress upon a particular unit analysis; it may be represented as either long-term changes in climate conditions, or by changes in climate variability, including the magnitude and frequency of extreme events. Sensitivity is the degree to which a system will be affected by, or responsive to climate stimuli, and adaptive capacity refers to the potential or capability of a system to adjust to climate change, including climate variability and extremes, so as to moderate potential damages, to take advantage of opportunities, or to cope with consequences. (IPCC, 2001) (Smith et al., 2001) (Smith and Pilifosova, 2001).

Mandatory Reuse Zones – An area designated by a local government to require water users to connect to a reclaimed water system for irrigation and other non-potable uses.

Master Partnership Agreement with the School Board of Broward County – A contract that allows Broward County and the School Board of Broward County to work together in terms of environmental best practices, academic programs, pollution prevention, air quality educational programs and the NatureScape Broward program.

Mitigation – The actions required to reduce greenhouse gas emissions that contribute to climate change.

Mixed-Use Development – The practice of incorporating more than one land use designation (such as residential, commercial, industrial, office, institutional, and/or recreational) into a single planning location. Can be specific to a single development site (vertical mixed-use), but is more commonly a zoning district that allows for a variety of uses within one district (horizontal mixed-use). Putting different land uses in close proximity to one another is one of 10 Smart Growth Principles.

Multimodal System – A transportation system which offers many different modes of travel and transport options (e.g. pedestrian ways, public transportation, roadways, bikeways, rail, waterways, and aviation) in a connected and efficient manner.

Native Vegetative Communities – Those areas which contain ecological communities, such as coastal strands, oak hammocks, and cypress swamps, which are classified based on the presence of certain soils, native vegetation and animals.

NatureScape Broward – A strategy of landscaping that encourages the use of native plants to create Florida friendly green spaces that conserve water, protect water quality, and create wildlife habitat. Native species are uniquely adapted to South Florida and require little watering and are naturally pest resistant.

Life-Cycle Emissions – The aggregate quantity of greenhouse gases related to the full production, use, and disposal of a product, process, or service. Life-cycle analysis or assessment (LCA) is a technique to assess the environmental aspects and potential impacts, from "cradle to grave", by compiling an inventory of relevant energy and material inputs and environmental releases; evaluating the potential environmental impacts associated with identified inputs and releases; and interpreting the results to help managers and users make a more informed decision.

Priority Planning Area for Sea Level Rise Map – A map in the natural resource map series that identifies areas near tidal water bodies at increased risk of inundation under a two-foot sea level rose scenarios, projected to occur as soon as 2060. (2012 Amendment to Broward County Land Use Plan)

Quality of Life Measures – Standard indicators of the health and well-being of individuals and societies. These include wealth and employment, state of the built environment, physical and mental health, education, recreation and leisure time, and social belonging.

Quality Walking Environments (also Walkability) – The extent to which pedestrian movement is facilitated through readily available safe, connected, accessible and pleasant walkways. Factors affecting walkability include, but not limited to: street connectivity; land use mix; residential density; transparency; place making; mass transit; presence and quality of footpaths; buffers to moving traffic and pedestrian crossings, aesthetics, nearby local destinations, air quality, shade, street furniture, traffic volume and speed, and wind conditions.

Region – A territory characterized by specific geographical and climatological features. The climate of a region is affected by regional and local scale forcing like topography, land-use characteristics, lakes etc., as well as remote influences from other regions.

Renewable Energy – Any form of energy from solar, geophysical or biological sources that is replenished by natural processes at a rate that equals or exceeds its rate of use. Renewable energy is obtained from the continuing or repetitive flows of energy occurring in the natural environment and includes low-carbon technologies such as solar energy, hydropower, wind, tide and waves and ocean thermal energy, as well as renewable fuels such as biomass.

Resource Recovery – The process by which materials which still have useful physical or chemical properties after serving a specific purpose are reused or recycled for the same or other purposes, including use as an energy source. (Chapter 403.703(28) F.S.)

Resiliency (also Resilience) – A capability to anticipate, prepare for, respond to, and recover from significant multi-hazard threats with minimum damage to social well-being, the economy, and the environment. (National Research Council, America's Climate Choices)

Risk – A combination of the magnitude of potential consequences of climate change impacts and the likelihood that the consequences will occur. (National Research Council, America's Climate Choices)

Salt Water Intrusion – The invasion of fresh surface or ground water by saline water. If it comes from the ocean it may be called sea water intrusion. (EPA.gov)

Sea Level Rise (SLR) – An increase in the mean level of the ocean. Eustatic sea-level rise is a change in global average sea level brought about by an increase in the volume of the world ocean. Relative sea-level rise occurs where there is a local increase in the level of the ocean relative to the land, which might be due to ocean rise and/or land level subsidence. (IPCC)

Southeast Florida – As defined through the Southeast Florida Regional Climate Compact, a four-county region including Broward, Miami-Dade, Palm Beach and Monroe Counties.

Southeast Florida Regional Climate Change Compact – A joint commitment of Broward, Miami-Dade, Palm Beach and Monroe Counties to partner in mitigating the causes and adapting to the consequences of climate change. The compact, which was ratified by all parties in January of 2010,

outlines an on-going collaborative effort among the Compact Counties to foster sustainability and climate resilience at a regional scale. (southeastfloridaclimatecompact.org)

STAR Community Index™ – A voluntary rating system for gauging the sustainability and livability of U.S. communities and is modeled on the LEED green building system. (ICLEI Sustainability Planning Toolkit)

Storm Surge – The vertical rise in the still water level near the coast caused by wind stresses on the water surface and low barometric pressure often associated with tropical systems and hurricanes.

Sustainability – Meeting the needs of the present without compromising the ability of future generations to meet their own needs. (UN Commission on Sustainable Development)

Sustainable Community Development – Planning and design which aims to integrate economic, social and environmental objectives in community development.

Sustainable Development Patterns – Land use planning which considers the environmental, economic, and social costs and benefits of location, density, scale, and connectivity of systems, uses, and services. Examples include the promotion of redevelopment in the urban core, more compact development, and increased public transit and transit-oriented development.

Sustainable Sites Initiative™ (SITES™) – Is an interdisciplinary effort by the American Society of Landscape Architects, the Lady Bird Johnson Wildflower Center at The University of Texas at Austin and the United States Botanic Garden to create voluntary national guidelines and performance benchmarks for sustainable land design, construction and maintenance practices.

Tidal Flooding – Ponding of water caused by the inflow of sea water onto land or the prevention of storm water runoff in coastal areas caused by high tides.

Urban Canopy (also Urban Tree Canopy) – The layer of leaves, branches and stems of trees that cover the ground of an urbanized area when viewed from above.

Vector-Borne Disease – A contagion that is transmitted to humans or other animals, insects, or other arthropods.

Vital Signs Monitoring Network – A network of basic indicators of climate change as a means of local documentation of long-term climate changes with relevance across the Southeast Florida region. This could potentially include precipitation, saltwater intrusion, air/water temperature and tidal gauge measurements.

Vulnerability – The degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity. (National Research Council, America's Climate Choices)

Vulnerable Populations – Any group of people (e.g. low-income residents, the homeless, elderly, physically or mentally disabled, ethnic minorities and recent immigrants), more susceptible to the impacts of a given pressure. A label often evoked in the context of disaster planning and public health.

Support Document

Climate Change

Introduction

A. General

The purpose of the Climate Change Element (CCE) is to provide a planning framework for addressing the economic, environmental, and social impacts of climate change. A Countywide strategy, based on local vulnerability and consistent with regional efforts, the CCE aims to mitigate the causes, and address the local implications, of global climate change. In doing so, Broward County moves one step closer to building a greener, more sustainable and climate resilient community.

Broward County recognizes the widespread international scientific consensus that climate change is occurring, and that GHG emissions, primarily from the burning of fossil fuels, may be a contributing cause. Furthermore, the County understands that our region, Southeast Florida, is extremely vulnerable to sea level rise and other climate change impacts. Because of these global and local realities, Broward County has made reducing carbon emissions and protecting and preparing residents, businesses and natural resources from the unavoidable consequences of climate change a priority.

In 2007, the Broward County Board of County Commissioners (Board) adopted Resolution 2007-391 to reduce greenhouse gas emissions in Broward County and to support the U.S. Mayors' Climate Protection Agreement. In 2008, the Board passed Resolution 2008-442 to create the Broward County Climate Change Task Force (Task Force) to develop and advise on the implementation of strategies to mitigate the causes and adapt to the consequences of climate change. The policies in the CCE are an extension of the 126 recommendations developed by the Task Force. These recommendations are detailed in the report "Climate Change Action Plan – Local Strategy to Address Global Climate Change" (CCAP) which was approved by the Board on November 16, 2015.

One of the high-ranked recommendations in the CCAP and the 2011 Evaluation and Appraisal Report (EAR) was to develop and include a Climate Change Element into the Broward County Comprehensive

Plan to provide for a sustainable environment and to reflect the best available data and strategies for adapting to future climate change impacts.

B. Service Area

The planning area for the CCE is the geographic extent of Broward County. The regulatory service area is generally confined to the BMSD; however, some programs that relate to natural resources, water resources and flood control include a greater geographic scope. In these cases, a broader planning and regulatory approach is taken. Broward County encourages municipalities to incorporate these or other climate change policies into their planning and regulatory framework.

C. Planning Horizon

The CCE uses multiple planning horizons to achieve the goal of a sustainable and climate-resilient community. The CCAP is meant to be simple and clear to support implementation. There are two overarching goals for this plan:

1. Mitigate the effects of climate change by reducing GHG emissions by 2% per year by 2020, ultimately leading to a total 80% reduction by 2050, and
2. Increase the resilience of our community to the effects of climate change.

Most of the policies in the CCE focus on steps that need to be taken in the short-term, with the County's long-term trends and needs in mind. The CCE also acts as a framework; one that can be added to or amended as new data and examples of best practices become available.

Data and Analysis Requirements

A. Greenhouse Gas (GHG) Emissions

Global warming and climate change are driven by the amount of GHG like carbon dioxide (CO2) in the atmosphere. Human activities such as the burning of fossil fuels and changing of land use patterns are increasing GHG concentration, thereby trapping more of the sun's radiant heat in the atmosphere and amplifying the natural greenhouse effect. The National Oceanographic and Atmospheric Administration (NOAA) reports that atmospheric carbon dioxide (CO2), has risen from about 340 parts per million (ppm) in 1981 to 402 ppm in 2016, fueling global warming and climate instability. The Intergovernmental Panel on Climate Change (IPCC) reported in 2007 that the warming of the climate system was unequivocal. That same year, the U.S. Supreme Court deemed greenhouse gases in the atmosphere a threat to the public health and welfare of current and future generations and mandated the U.S. Environmental Protection Agency (EPA) to regulate the emissions of these six gases under the Clean Air Act: carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF6).

1. Regional GHG Emissions Inventory

Broward County, as part of the Southeast Florida Regional Climate Change Compact, recognizes not only the profound effects GHG has on our global weather and climate (and our responsibility to reduce our contribution to that trend), but also the unique vulnerability of our region to the various local impacts resulting from climate change, many of which we have already begun to experience. In response, Broward and the other Compact Counties have begun to assess the scope and source of GHG emissions in our region. A Regional Greenhouse Gas Emissions Inventory was completed in 2011 (Appendix CC-A) which provides a profile of emissions sources across the region and establishes an emissions baseline for which future studies can compare.

The regional emissions assessment tracked the six internationally recognized greenhouse gases regulated under the Kyoto Protocol, listed above, for the residential, commercial, industrial, and transportation sectors. The six gases are measured using equivalent carbon dioxide units, or eCO2, a commonly used method for comparing different greenhouse gases in similar terms. This standard is based on the Global Warming Potential (GWP) of each gas. As shown in the chart below, methane is twenty-one times more powerful than carbon dioxide in its capacity to trap heat, so one metric ton of methane emissions is equal to 21 metric tons of eCO2. Converting emissions to equivalent carbon dioxide units allows for the results to be aggregated and compared more uniformly across geographical areas or sectors.

Table CC-1: Global Warming Potential (GWP) of Six Major Greenhouse Gases

Greenhouse Gas	Chemical Formula	Global Warming Potential
Carbon Dioxide	CO_2	1
Methane	CH_4	21
Nitrous Oxide	N_2O	310
Hydrofluorocarbons	Various	43-11,700
Perfluorocarbons	Various	6,500-9,000
Sulfur Hexafluoride	SF_6	23,900

Source: Southeast Florida Regional Climate Compact – Regional GHG Emissions Inventory.

Sector-based analysis was performed as part of the regional inventory, an approach which provides results that is useful to local governments for policy making and project management. Emission inventories provide information that can inform and guide local reduction efforts and serve as a reference point to compare and measure the effectiveness of these strategies over time.

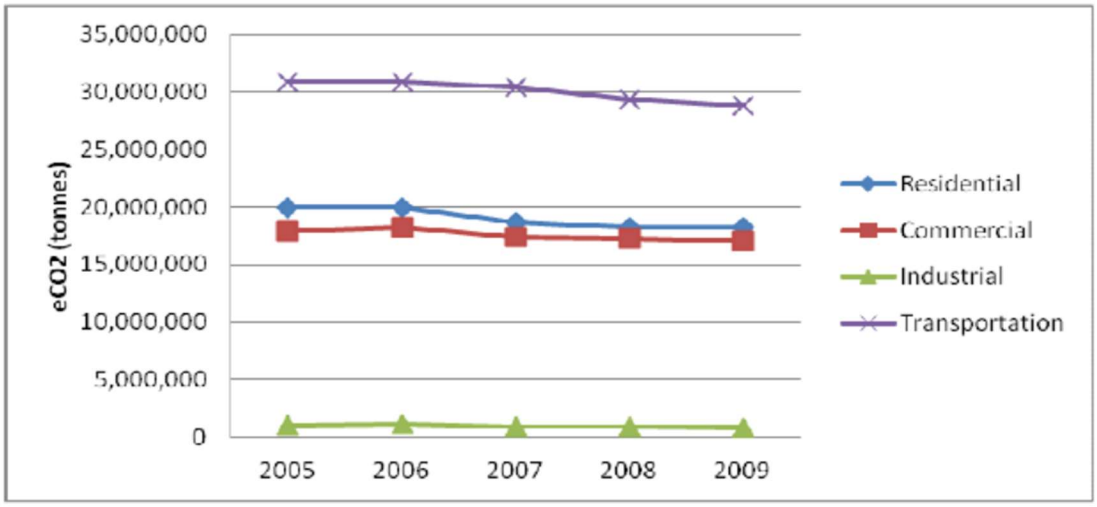


Figure CC-1: Regional GHG Emissions by Sector, 2005-2009

Source: Southeast Florida Regional Climate Compact – Regional GHG Emissions Inventory.

The Regional GHG Emissions Inventory focused on emissions from the built environment and transportation sectors. Results found that emissions from the Transportation Sector accounted for 44% of total regional emissions in 2005 and 45% in 2009. This rate is higher than the national average, suggesting a need for local reduction strategies to focus on this area. Electricity and natural gas consumption within the Residential Sector contributed 29% of the Region's overall emissions in 2005 and 28% in 2009. Strategies to advance renewable energy and improve energy efficiency and conservation would help to reduce the eCO2 emissions contributions from this sector.

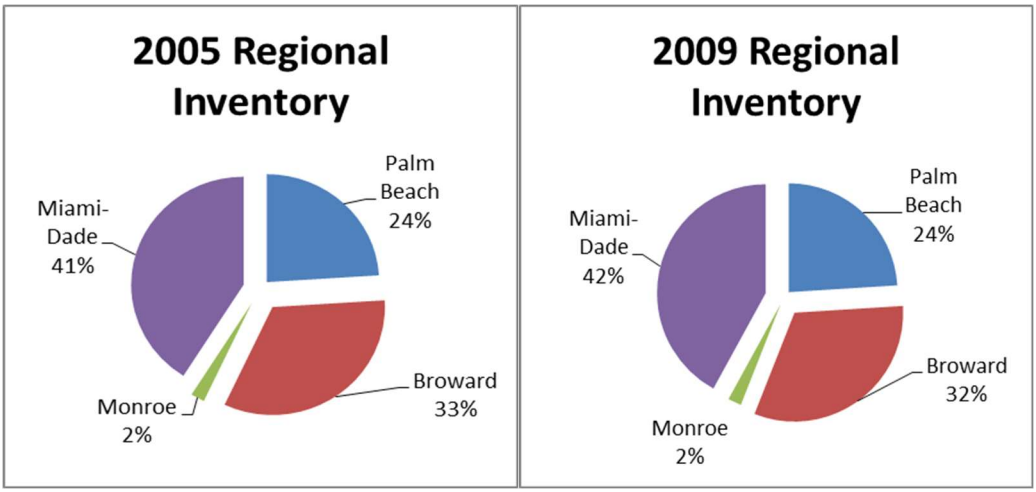


Figure CC-2: Regional GHG Emissions by County

Source: Southeast Florida Regional Climate Compact – Regional GHG Emissions Inventory.

Broward County's contributed roughly a third of the regional GHG emissions during the 2005 – 2009 study period. This number is consistent with Broward County's population relative to the region: 1.7 of the 5.6 million people in Southeast Florida live in Broward County. As such, Broward County recognizes its responsibility to assess and mitigate local contribution to global climate change as part of the regional Compact.

2. Broward Community Wide GHG Emissions Inventory

In 2016, Broward County set a county-wide greenhouse gas emissions reduction goal of 10% by 2020 and 80% by 2050, compared to 2007 levels, with a commitment to regularly monitor and track progress of programs and initiatives that contribute to the ultimate reaching of these goals. The 2016 Broward County Communitywiide Greenhouse Gas Emissions Inventory (Appendix CC-B) provides emission inventories for 2011 through 2014, updates the 2007, 2009 and 2010 baseline inventory, and projects emissions to 2050. The community-wide inventory analyzes emissions within the Residential, Commercial, Industrial, Transportation, Waste, and Other sectors.

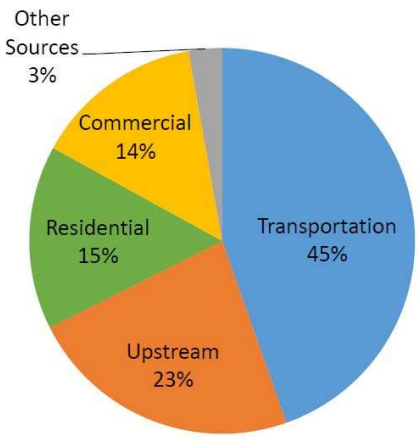


Figure CC-3: 2011-2014 Broward County Community-Wide GHG Emissions Percentage by Sector

Source: Broward County Community-Wide Greenhouse Gas Emissions by Sector 2011-2014 (2016).

Table CC-2: 2011-2014 Broward County GHG Emission Sectors and Sources

GHG Emission Sector	GHG Emission Sources
Residential Buildings	Electricity – Florida Power and Light Natural Gas - TECO People's Gas Natural Gas - Florida City Gas Natural Gas - City of Sunrise
Commercial Buildings	Electricity – Florida Power and Light Natural Gas - TECO People's Gas Natural Gas - Florida City Gas Natural Gas - City of Sunrise
Transportation and Mobile Sources	On Road Passenger and Freight Vehicles Airports (FLL, FXE, HWO, PMP) Broward County Transit Buses Broward County Community Buses Tri-Rail Commuter Rail and Connector Buses Amtrak Passenger Rail CSX and Florida East Coast Freight Rail Off Road Equipment and Mobile Sources Port Everglades *(inventory in development)*
Upstream Impacts of Activitiies	Primary Fuels Used for Electricity Generation Electricity Transmission and Distribution Losses Natural Gas Production and Transport Transportation Fuel Production and Transport
Other Sources	Municipal Solid Waste Industrial Buildings Wastewater Treatment Agricultural Livestock

Source: Broward County Community-Wide Greenhouse Gas Emissions Inventory for 2011-2014 (2016).

From 2011 through 2014, the total annual GHG emissions in the community varied between 24.85 and 25.59 million tonnes of carbon dioxide equivalent (Mt CO_2e). Table CC-2 summarizes the sectors and sources included in the inventory. In addition, three sectors not included in previous inventories were analyzed in this inventory: wastewater, agriculture, and the upstream impacts of energy production, transport and distribution. Due to the minimal quantity of GHG emissions from solid waste, industrial buildings, wastewater, and agriculture compared to other major emission sectors, these sectors were grouped into an "Other Sources" category of GHG emissions.

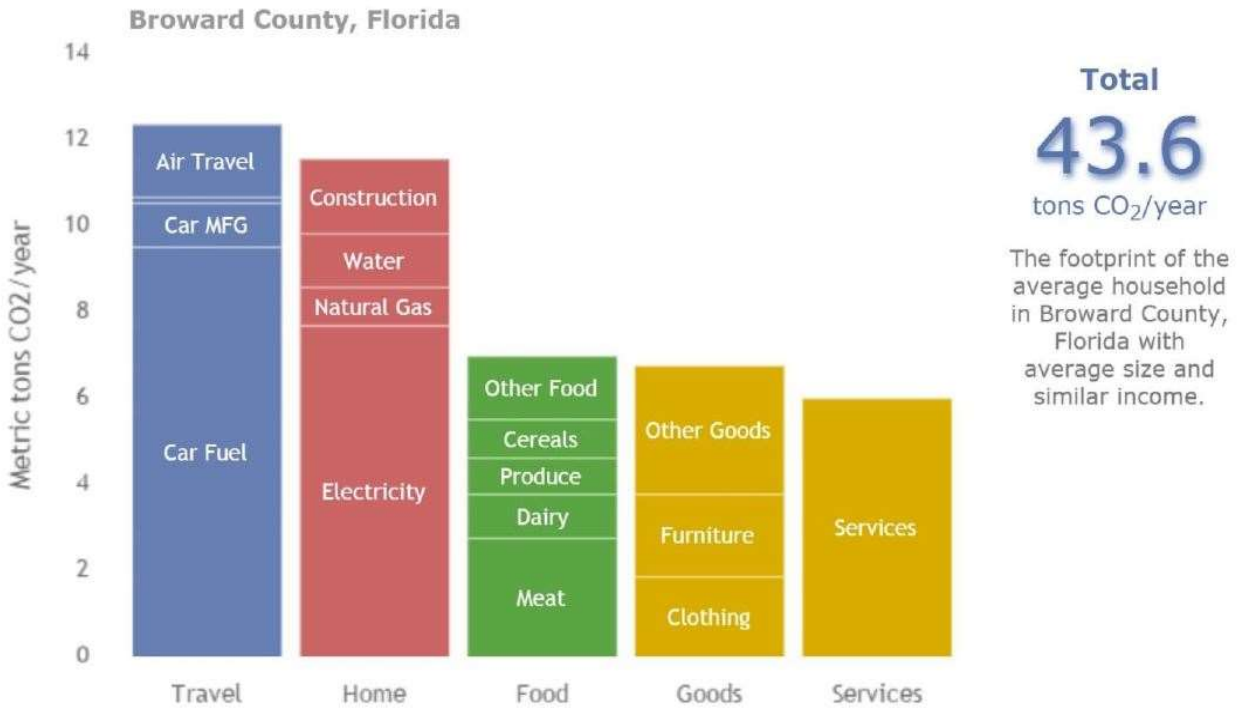


Figure CC-4: Average Annual Household Consumption Based GHG Emissions in Broward County
Source: Broward County Community-Wide Greenhouse Gas Emissions Inventory for 2011-2014 (2016).

3. Broward County Government Operations GHG Emissions Inventory

Figure CC-4 shows that the foods, goods, and services consumed by Broward County households produce almost half of total annual household GHG emissions (45.3%), or 19.8 tonnes of CO_2e. The annual carbon footprint of household food consumption (7.0 t of CO_2e) or household goods (6.7 t of CO_2e) was almost equal to the impact of household electricity use (7.7 t of CO_2e). The consumption-based life cycle GHG emissions shown in Figure CC-4 are primarily determined from a top down approach, using household spending and econometric models to calculate GHG emissions from various economic sectors. The consumption-based emissions shown in this figure indicate that household consumption in Broward County is responsible for a significantly larger quantity of GHG emissions than is typically stated in geographic based inventories. This suggests that a large portion of Broward County household consumption emissions are "exported" to other areas of the U.S. and internationally. In addition, local communities should broaden their GHG reduction efforts beyond buildings and transportation, to address the additional impacts of household consumption of food, goods, and services.

In FY 2011, Broward County's government operations carbon footprint was 250,255 tonnes eCO2. A net reduction of 5,781 tonnes of eCO2 emissions from 2010 levels was achieved as a result of energy efficiency measures and improved operational practices.

The Broward County Climate Change Government Operations Workgroup meets monthly to identify potential emission reduction actions, propose implementation of selected actions, and share progress made. In 2011, Broward County government agencies reported 58 GHG emission reduction measures being employed. A detailed description of each measure, its cost savings and environmental benefits, are included in the Broward County Government Operations Climate Change Fourth Annual Progress Report (Appendix CC-C).

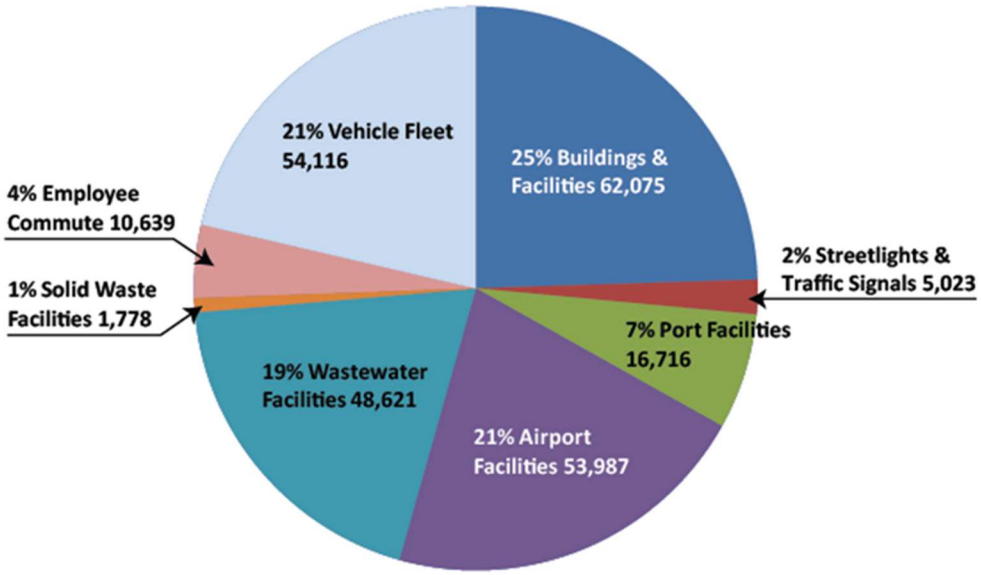


Figure CC-5: Broward County FY2011 Government Operations GHG Emissions by Source
Source: Broward County Government Operations Climate Change 4th Annual Progress Report (2012).

The County's commitment to reduce GHG emissions is important for several reasons. First reducing emissions may help to reduce some of the physical risks associated with climate change impacts, of which, South Florida is already beginning to feel the effects. Employing GHG reduction measures early on also avoids certain economic risks, as future strategies are likely to be more drastic (and thus more expensive). Finally, considering projections (such as future demands on resources, emissions projections, and impact scenarios) in the County's long-term planning and capital improvement decisions, is imperative in order to guide community development and protect public and private long-term investments.

B. Assessing the County's Vulnerability to Sea Level Rise

Broward County is home to over 1.9 million people and part of the subtropical region known as Southeast Florida. With populous coastal communities, porous geology and low topography, the County is particularly vulnerable to the effects of climate change, especially sea level rise. Broward County, as a member of the Southeast Florida Regional Climate Change Compact, has made projecting sea level rise, mapping inundation scenarios, assessing local vulnerability and responding to shared challenges a high priority.

In October of 2009, Broward County hosted the first Southeast Florida (SE FL) Regional Climate Leadership Summit. Following the summit's call to action, the four counties of Southeast Florida (Monroe, Miami-Dade, Broward and Palm Beach) signed the Southeast Florida Regional Climate Change Compact (Compact) to work cooperatively to address climate concerns in the region. One of the first things the Compact Counties committed to work on together was creating a single sea level rise (SLR) projection for the region. Local scientists specializing in the areas of sea level rise and climate change were invited to participate with Compact Counties and partnering agency staff in a Regional Climate Change Compact Technical Ad hoc Work Group (Work Group) to accomplish this task.

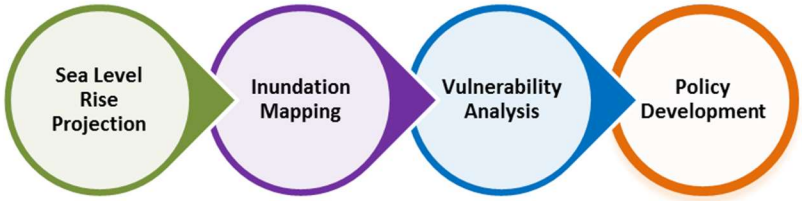


Figure CC-6: The Science Supporting Adaptation Planning

1. Sea Level Rise Projection

Developing a unified SLR projection for the SE Florida region was the first step to understanding potential vulnerabilities of the region and provides a basis for adaptation planning. The Unified Sea Level Rise Projection for Southeast Florida (Appendix CC-D) is intended to be used for planning purposes by the Compacts Counties in order to identify infrastructure and resources at risk, develop strategies to address this risk and build climate-resiliency and adaptation capacity into the community.

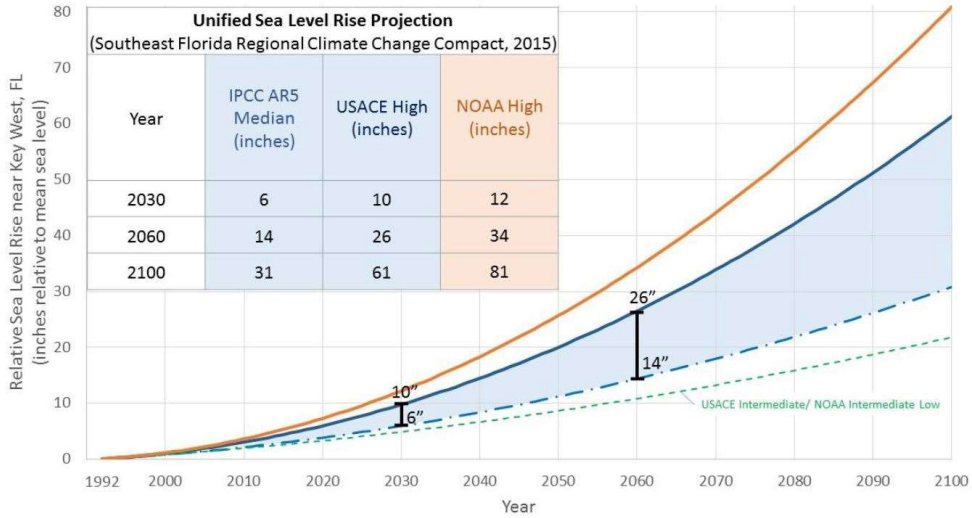


Figure CC-7: Unified SE Florida Sea Level Rise Projection (2016)

Figure CC-7 shows the Unified Sea Level Rise projection for Southeast Florida, which projects the anticipated range of sea level rise for the region from 1992 to 2100. The projection highlights three planning horizons.

Figure CC-7 illustrates the Unified Sea Level Rise Projection for Southeast Florida (2016). These projections are references to mean sea level at the Key West tide gauge. The projection includes three global curves adapted for regional application: the median of the IPCC AR5 RCP8.5 scenario as the lowest boundary (blue dashed curve), the USACE High curve as the upper boundary for the short term for use until 2060 (solid blue line), and the NOAA High curve as the uppermost boundary for medium and long-term use (orange solid curve). The incorporated table lists the projection values at years 2030, 2060 and 2100. The USACE Intermediate or NOAA Intermediate Low curve is displayed on the figure for reference (green dashed curve). This scenario would require significant reductions in GHG emissions in order to be plausible and does not reflect current emissions trends.

1. Short term, by 2030, sea level is projected to rise 6 to 10 inches above 1992 mean sea level,
2. Medium term, by 2060, sea level is projected to rise 14 to 34 inches above 1992 mean sea level,
3. Long term, by 2100, sea level is projected to rise 31 to 81 inches above 1992 mean sea level.

The titles of the global mean sea level rise curves were retained for simplicity of referencing source, but the curves have been adjusted from the global projections to reflect observed local change. The projection consists of the NOAA High Curve, the USACE High Curve (also known as the NOAA Intermediate-High) and the median of the IPCC AR5 RCP8.5 scenario, with specific guidance as to how and when they should be used in planning.

1. The lower boundary of the projection (blue dashed line) can be applied in designing low risk projects that are easily replaceable with short design lives, are adaptable and have limited interdependencies with other infrastructure or services.
2. The shaded zone between the PCC AR5 RCP8.5 median curve and the USACE High is recommended to be generally applied to most projects within a short-term planning horizon. It reflects what the Work Group projects will be the most likely range of sea level rise for the remainder of the 21st Century.
3. The upper curve of the projection should be utilized for planning of high risk projects to be constructed after 2060 or projects which are not easily replaceable or removable, have a long design life (more than 50 years) or are critically interdependent with other infrastructure or services.

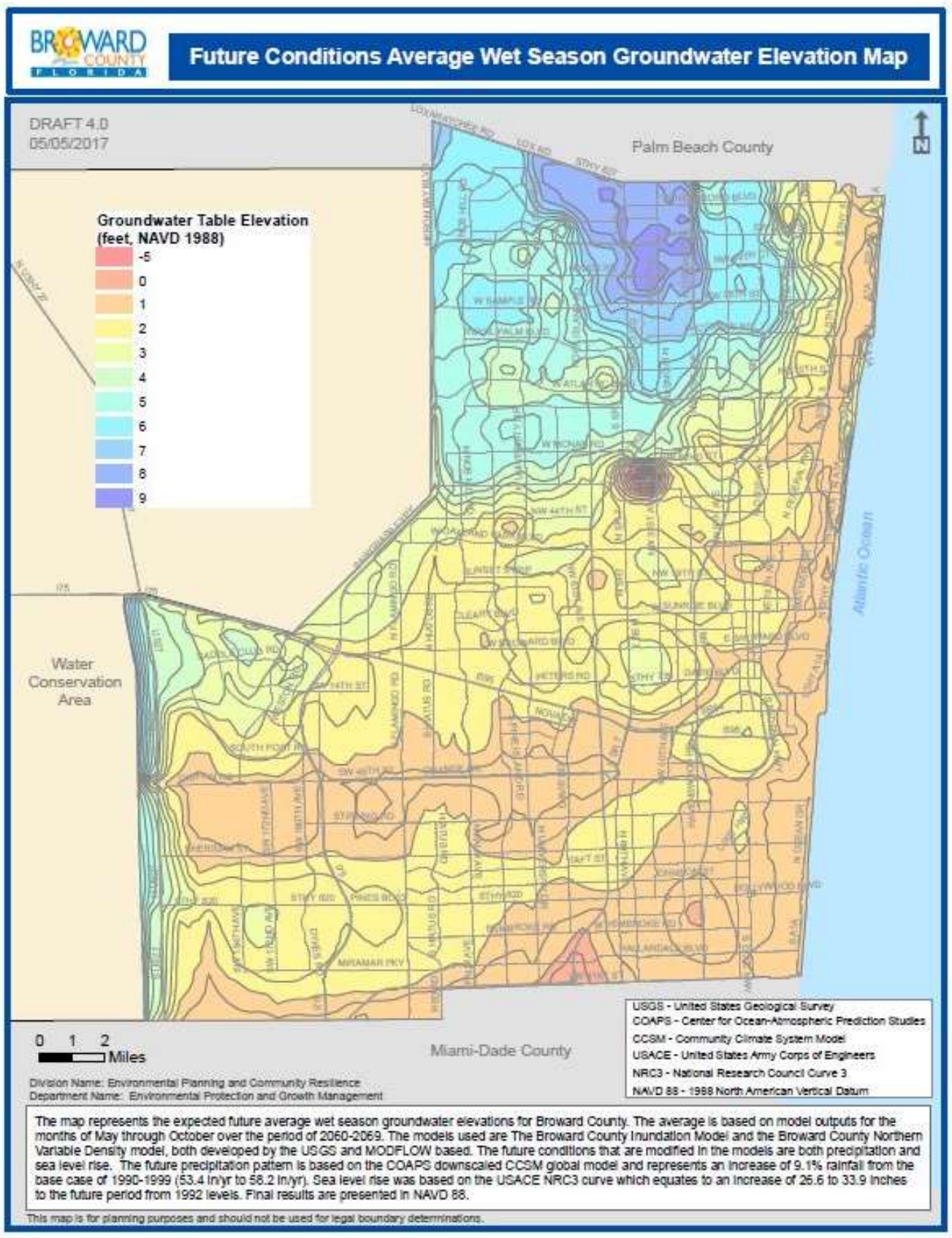


Figure CC-8: Map – Future Conditions Average Wet Season Groundwater Elevation

To ensure the resiliency of current and future infrastructure investments, it is necessary to modernize many aspects of regional planning and licensing requirements. With the influence of climate change, and the impacts of sea level rise in particular, it is no longer prudent to rely solely upon historic and current environmental conditions as the basis for infrastructure planning, design and permitting.

To further resilience planning in Broward County, in November 2015, the Board accepted the Updated Regional Sea Level Rise Projection (2015) of the Southeast Florida Regional Climate Change Compact and directed staff to use the updated projection as the basis for sea level rise adaptation planning. This action reflected the recognized vulnerability of both coastal and inland areas to the impacts of rising seas, including increased coastal flooding, changes in groundwater levels, and reduced capacity of gravity-dependent storm water systems.

In 2017, the Board directed the Environmental Protection and Growth Management Department (EPGMD) to develop maps future conditions showing groundwater, flooding due to sea level rise, and increased rainfall. Using these Future Conditions maps, infrastructure investments can be designed to be resilient.

The first regulatory map of the series, effective July 01, 2017, is the Future Conditions Average Wet Season Groundwater Elevation Map (Figure CC-8). It constitutes an important step in formally addressing future flood risk in the design and licensing of surface water management systems in Broward County, and strengths storm water permitting requirements for new developments and major redevelopments. The calculated average groundwater elevation is based on model outputs for the months of May through October over the period of 2060-2069. The models used are The Broward County Inundation Model and the Broward County Northern Variable Density model, both developed in partnership with the United States Geological Survey (USGS). The future conditions that are modified in the models are both precipitation and sea level rise. The future precipitation pattern is based on the Center for Ocean-Atmospheric Prediction Studies (COAPS) downscaled Community Climate System Model (CCSM) global model and represents an increase of 9.1% rainfall from the base case of 1990-1999 (53.4 inches/year to 58.2 inches/year). Sea level rise was based on the United States Army Corps of Engineers (USACE) National Research Council Curve 3 (NRC3) curve which equates to an increase of 26.6 to 33.9 inches to the future period from 1992 levels.

The second map of the series, currently being developed, is the Future Conditions 100-yr Flood Elevation. It recognizes need for progressive building requirements that will deliver flood protection for the duration of the investment, including under future climate conditions and changes in sea level. While the FEMA FIRMs will continue to reflect flood risk under current conditions, it is expected that as these maps are updated in ensuing years, the flood elevations will again begin to proximate those of the more forward-looking community flood map. As such, it is

fully anticipated that the Broward County 100-year Flood Elevation Map may undergo future adjustments as trends in sea level and flood condition warrant.

2. Inundation Mapping

The Compact Counties, along with the South Florida Water Management District (SFWMD), the National Oceanographic and Atmospheric Administration (NOAA) Coastal Services Center, and other experts from local universities and federal partners, came together in 2011 to form the Southeast Florida Regional Climate Change Compact Inundation Mapping and Vulnerability Assessment Work Group (work group). The goal of the work group was to create a regionally-consistent methodology for inundation mapping and vulnerability analysis suitable for South Florida. Each of the compact counties used the agreed upon methodology, and layers provided by SFWMD, to map vulnerability at the one-, two- and three-foot sea level rise scenarios. Results of this analysis are compiled in the report: Analysis of the Vulnerability of Southeast Florida to Sea Level Rise (Appendix CC-E). The inundation maps below show areas potentially vulnerable under 1, 2, and 3-ft sea level rise scenarios for Broward County.

In the simplest terms, the inundation maps identify land at elevations below sea level, or potentially below sea level within a certain timeframe. Based on the Unified Sea Level Rise Projection, the one-foot SLR scenario could occur from 2040 – 2070, the two-foot scenario from 2060 – 2115, and the three-foot scenario from 2075 – 2150.

The level of certainty in the tidal surface and elevation data used for the projection is presented on each map. Areas shaded in pink are considered "more likely" and have a 75-100% certainty of the location having an elevation below sea level at high tide for the given scenario. Areas shaded in yellow are considered "possibly" inundated and have a 25-74.9% certainty level. These numbers are important for understanding the level of confidence achieved by the current data.

The maps highlight areas located near Broward County's coastline, tidal waterways and in the southwest urban core. Inland areas identified as vulnerable are low lying areas which may be of future concern for storm water management but are less likely to be affected by sea level rise in the immediate future because, hydrologically, they are not directly connected to tidal waters.

A more detailed description of the methodologies and results of the vulnerability analysis are offered in the next section.

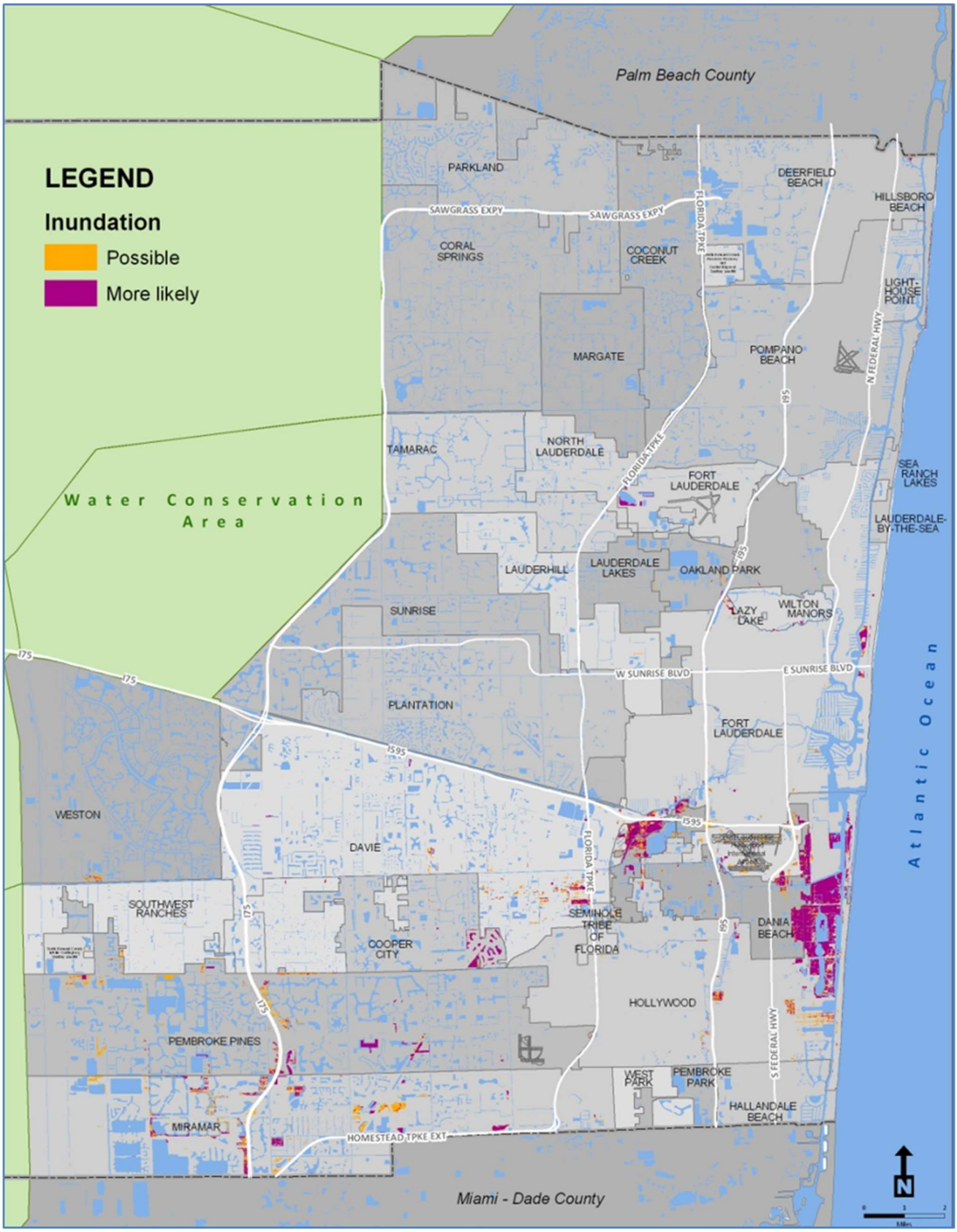


Figure CC-9: Map – Broward County Inundation, One-Foot Sea Level Rise Scenario

Source: Analysis of the Vulnerability of Southeast Florida to Sea Level Rise (2012).

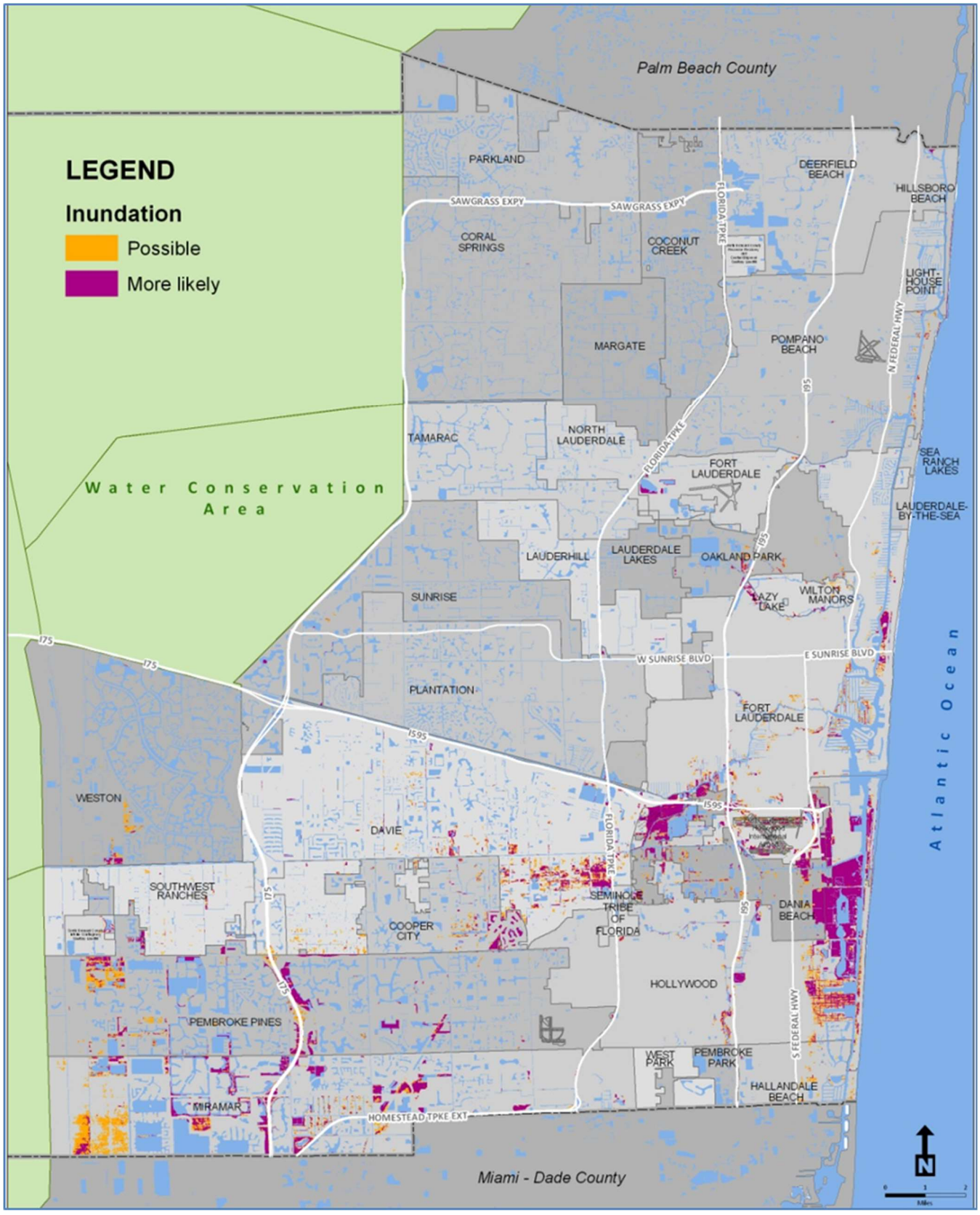


Figure CC-10: Map – Broward County Inundation, Two-Foot Sea Level Rise Scenario

Source: Analysis of the Vulnerability of Southeast Florida to Sea Level Rise (2012).

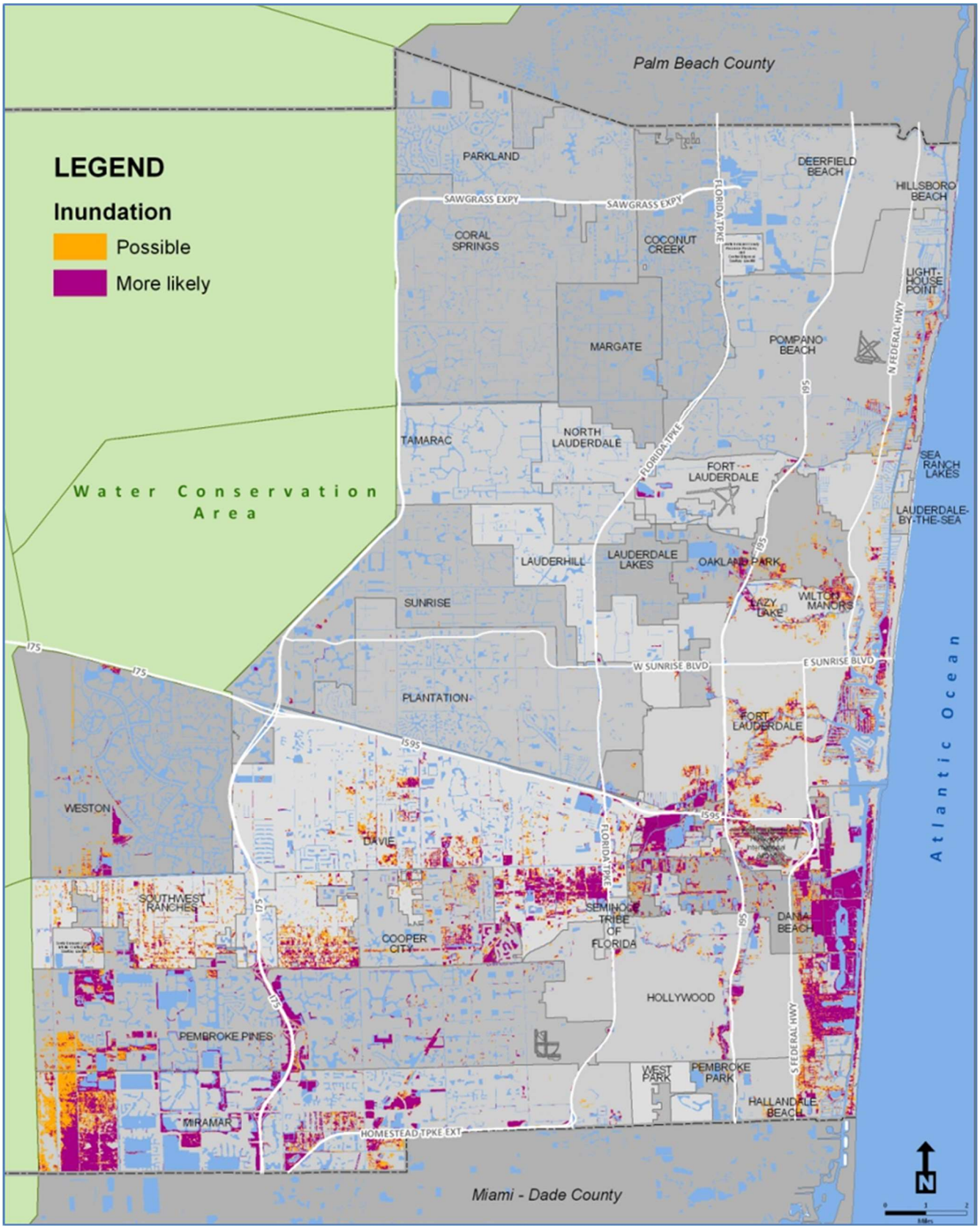


Figure CC-11: Map – Broward County Inundation, Three-Foot Sea Level Rise Scenario

Source: Analysis of the Vulnerability of Southeast Florida to Sea Level Rise (2012).

3. Vulnerability Analysis

Each of the four compact counties took the inundation layers created by the SFWMD (using the commonly agreed to parameters and data sources developed by the work group) to perform vulnerability analysis for their jurisdiction. The information within the tables below is derived from the analysis completed by Broward and the Compact Counties and is intended to be used for planning purposes. The vulnerability analysis is specifically useful for identifying infrastructure at risk and developing adaptation strategies to reduce these risks.

a. Property and Land Uses at Risk

Significant vulnerabilities were identified through the analysis. The current taxable value of property vulnerable in Broward County at the one-foot scenario was $403-828 million. At three-foot sea level rise, properties valued at $6.9-12.1 billion were impacted. Regionally, the upper estimate of taxable property values vulnerable to sea level rise ranges from more than $4 billion at the one-foot scenario, to over $31 billion at the three-foot scenario.

Table CC-3: Analysis of Affected Property Values in Broward County

Level of Inundation	Estimated Range of Taxable Value
One-Foot	$ 403 – 828 Million
Two-Foot	$ 1.8 – 3.8 Billion
Three-Foot	$ 6.9 – 12.1 Billion

Source: Analysis of the Vulnerability of Southeast Florida to Sea Level Rise (2012).

Under a one-foot sea level rise scenario, 1.3% of the County is impacted with conservation lands being the major land use type inundated. At the two-foot scenario, 3% of the land is impacted with Electrical Generation Facilities among the top ranked impacted. At the three-foot scenario, 7% of the total land mass of the County is impacted including 28% of the agricultural lands and 10% of transit-oriented development. For the complete list of Future Land Use categories analyzed as part of the regional vulnerability analysis, see Appendix CC-E.

Table CC-4: Impact of Sea Level Rise on Land Uses, One-Foot

Land Use	More Likely (acres)	Possible (acres)	Total Inundation (acres)	Total Coverage (acres)	Percent Inundation of that Land Use
Conservation Land/ Open Space & Recreation*	1,172.78	285.86	1,458.64	20,703.96	7.0%
Commercial/Industrial**	329.12	185.99	515.11	49,010.83	1.1%
Residential***	689.02	461.21	1,150.23	140,441.55	0.8%
Utilities/Transportation****	318.76	225.04	543.80	58,968.14	0.9%
Agricultural/Rural*****	9.07	55.57	64.64	44,382.94	0.1%

** Combination of Conservation – Natural Reservations, Recreation and Open Space, and Commercial Recreation categories in SE Florida Regional Compact Report, April 2011.*
*** Combination of Local Activity Center, Regional Activity Center, Employment Center – High, Industrial, Office Park, Commercial, and Employment Center – Low categories.*
**** Combination of Low-3 Residential, Residential Irregular Areas, Estate-1 Residential, Low-5 Residential, Low-Medium-10 Residential, Medium-16 Residential, Medium-High-25 Residential, and High-50 Residential.*
***** Combination of Electrical Generation Facility, Transportation, Utilities, Transit Oriented Corridor, Right of Way, Community Facilities, and Transit Oriented Development*
****** Combination of Agricultural, Rural Estates, and Rural Ranches.*
Source: Analysis of the Vulnerability of Southeast Florida to Sea Level Rise (2012), as presented in the Broward County Emergency Management DRAFT Enhanced Local Mitigation Strategy (eLMS) (2012). Coverage of Future Land Use was provided by the Broward County Planning Council, most recently updated September 28, 2010.

Table CC-5: Impact of Sea Level Rise on Land Uses, Two-Foot

Land Use	More Likely (acres)	Possible (acres)	Total Inundation (acres)	Total Coverage (acres)	Percent Inundation of that Land Use
Conservation Land/ Open Space & Recreation	1,335.27	777.86	2,113.13	20,703.96	10.2%
Commercial/Industrial	1,179.61	709.14	1,888.75	49,010.83	3.9%
Residential	856.77	468.51	1,325.28	140,441.55	0.9%
Utilities/Transportation	1,304.53	791.65	2,096.18	58,968.14	3.6%
Agricultural/Rural	340.69	348.51	689.20	44,382.94	1.6%

Source: Same as Table CC-4.

Table CC-6: Impact of Sea Level Rise on Land Uses, Three-Foot

Land Use	More Likely (acres)	Possible (acres)	Total Inundation (acres)	Total Coverage (acres)	Percent Inundation of that Land Use
Conservation Land/ Open Space & Recreation	2,783.22	1,371.80	4,155.02	20,703.96	20.1%
Commercial/Industrial	3,792.42	2,307.04	6,099.46	49,010.83	12.4%
Residential	2,681.70	1,791.22	4,472.92	140,441.55	3.2%
Utilities/Transportation	2,259.90	1,057.42	3,317.32	58,968.14	5.6%
Agricultural/Rural	1,489.43	836.72	2,326.15	44,382.94	5.2%

Source: Same as Table Table CC-4.

b. Natural Systems at Risk

Almost 80% of the lands affected regionally in the one-foot sea level rise scenario are conservation lands. Coastal wetlands show the greatest vulnerability. Low lying natural systems of buttonwood, mangrove, scrub mangrove, herbaceous coastal saline wetlands and freshwater wetlands are significantly impacted in all three SLR scenarios mapped through the regional vulnerability analysis. While many of these habitats can tolerate frequent short-term inundation by salt or brackish water, longer periods of inundation and deeper submersion levels could cause significant impacts to these systems.

In Broward, more than 25% of our 4,090 acres of Conservation Lands are at risk of inundation under the three-foot sea level rise scenario. The habitats with the largest extent of acres vulnerable to inundation are wetland hardwood forests and vegetative non-forested wetlands.

Table CC-7: Natural Areas Vulnerable to Sea Level Rise in Broward County

Habitat Type	Total Acres	Acres Inundated at 1 ft. SLR	Acres Inundated at 2 ft. SLR	Acres Inundated at 3 ft. SLR	Percent Inundation at 1 ft. SLR	Percent Inundation at 2 ft. SLR	Percent Inundation at 3 ft. SLR
Wetland Hardwood Forests	5,577.71	1,701.19	2,100.76	2,812.20	30.50	37.66	50.42
Vegetated Non-Forested Wetlands	6,341.78	607.94	1,211.92	1,864.77	9.59	19.11	29.40
Upland Hardwood Forests	3,492.33	195.63	468.42	917.17	5.60	13.41	26.26
Upland Mixed Forests	1,170.52	59.02	176.58	302.19	5.04	15.09	25.82
Herbaceous (Dry Prairie)	13,197.03	194.45	670.25	2,732.86	1.47	5.08	20.71
Upland Shrub and Brushland	1,231.69	21.92	83.80	203.52	1.78	6.80	16.52
Wetland Coniferous Forests	397.51	-	5.24	7.86	-	1.32	1.98
Upland Coniferous Forests	425.07	1,36	2.28	3.58	0.32	0.54	0.84
Wetland Forested Mixed	131.39	-	-	-	-	-	-

Source: Analysis of the Vulnerability of Southeast Florida to Sea Level Rise (2012). Land Cover/Habitat Type is represented in acres, based on spatial data provide by the South Florida Water Management District. Data dated 2004. This table is condensed to only show the habitat types which represent natural systems.

c. Infrastructure at Risk

Critical infrastructure, such as roadways, power plants, ports and airports, landfills, hospitals and schools were reviewed as part of the regional vulnerability assessment. Some physical infrastructure in Broward County is at risk beginning at the one-foot scenario.

a. Power plants properties in Broward County were found to be vulnerable under the one-foot SLR scenario.

b. A percentage of both Port Everglades and the Fort Lauderdale-Hollywood International Airport (FLL) are at elevations below sea level. Most of these areas are coastal wetlands, existing storm water management ponds and ditches.

c. While railroads were not particularly vulnerable, many roads were, especially low volume roads and parking areas. The miles of roads vulnerable increased by a magnitude at each scenario with almost 300 miles of roads inundated at 3 feet of sea level rise.

d. While no wastewater facility appears to be impacted at the one-foot sea level rise scenario, the Hollywood and Ferncrest facilities were among the most vulnerable at the two- and three-foot scenarios.

e. Landfills were primarily impacted in retention or natural areas surrounding the property.

f. Only two of 26 hospitals showed any inundation up to two-foot of sea level rise with no building infrastructure affected.

g. While only one school property was affected and only at the three-foot scenario, roadways near many schools are low lying and may result in access issues.

h. Since most emergency shelters are in schools, they were not impacted.

i. Evacuation Routes to and from the barrier islands are vulnerable due to bridges being inaccessible from local roadway inundation.

j. Impacts to coastal marinas remain a concern.

d. Water Supply and Drainage Infrastructure at Risk

Climate change will impact the quality and quantity of our water supply, shorten the lifespan of water and wastewater infrastructure, and exacerbate current drainage and flood control challenges. Changing precipitation patterns and rates of evapotranspiration are expected to produce more frequent and severe droughts, while more intense storm events will tax water management systems. Sea level rise will compound the effects of these impacts and pose new challenges. Drinking water supplies are threatened by saltwater intrusion and increases in groundwater levels reduce the discharge potential of our water management systems.

Additionally, sea level rise from climate change is threatening the Florida Everglades, the backbone of our natural resource system. Restoration of the Everglades is critical for improved delivery and distribution of water flow to meet the future needs of both the natural and urban

environments. Restoration would also increase both the resilience and adaptability of this freshwater community to climate change issues.

Given these challenges, practical solutions are needed to address the impact of climate change on our future water supply. The Southeast Florida Regional Climate Change Action Plan recommends that regionally coordinated research, policies and programs focus on:

a. finding solutions to consistently maintain high quality and adequate water supplies for all local communities;

b. strategies to reduce the cost and energy demands of alternative water supplies;

c. consideration of future conditions with respect to the placement of infrastructure; and

d. investing in new and upgraded infrastructure to maintain current levels of drainage and flood control.

Figure CC-12, below shows the status of Broward County wells regarding saltwater intrusion due to potential sea level rise. In this map, high vulnerability structures are red, medium vulnerability are orange, and low vulnerability are green.

Figure CC-12: Map – Saltwater Intrusion Line and Saltwater Monitoring Wells in Broward County

Source: Environmental Protection & Growth Management Department (2014). Saltwater Intrusion Line and Saltwater Monitoring Wells in Broward County, Broward County Water Resources Fact Book.

C. Other Local Impacts of Global Climate Change

Sea level rise is just one of many possible impacts our community will face because of changing climate conditions. Changes in temperature and evapotranspiration, rainfall patterns and the occurrence of extreme weather events are also likely. Impacts are also multi-directional and interdependent, making predictions highly challenging. For instance, some impacts have cascading effect, the way sea level rise exacerbates coastal erosion, reduces drainage capacity (which can cause inland flooding), and accelerates salt water intrusion into our drinking water supply. Extreme weather is hard to predict but shifts in the timing and length of seasons is impacting local wildlife health and food production. Additionally, the frequency of tropical storms and hurricanes is expected to decrease, but the intensity of these weather events is predicted to increase. Similarly, while projections for average precipitation vary greatly, changes in the intensity and timing of rainfall is likely to lead to increased incidents of both flooding and drought.

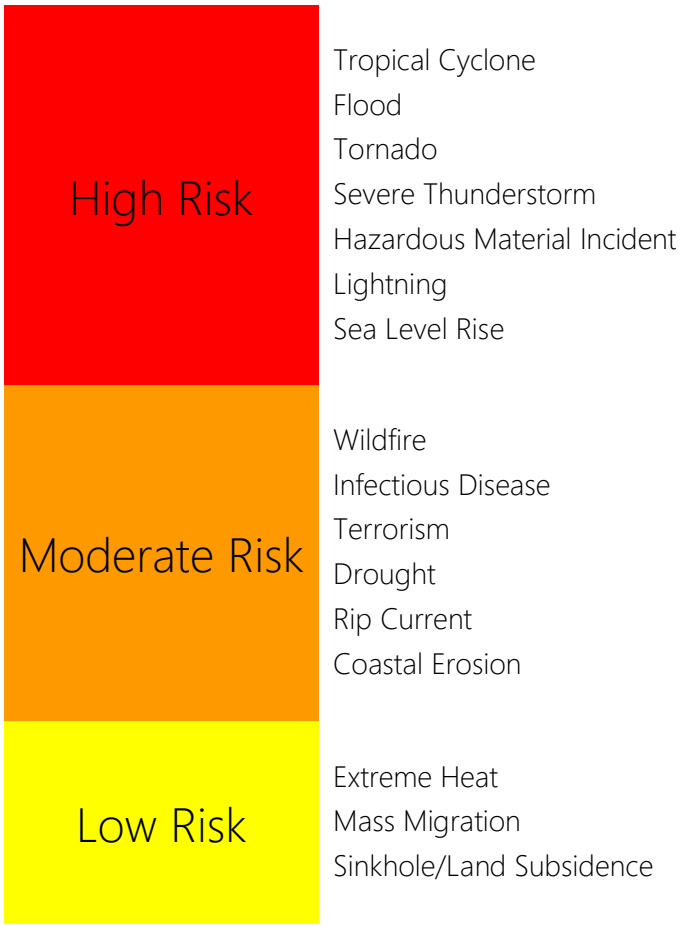


Figure CC-13: Summary of Climate Risk for Broward County

Source: Broward County Emergency Management, Enhanced Local Mitigation Strategy (June 2012).

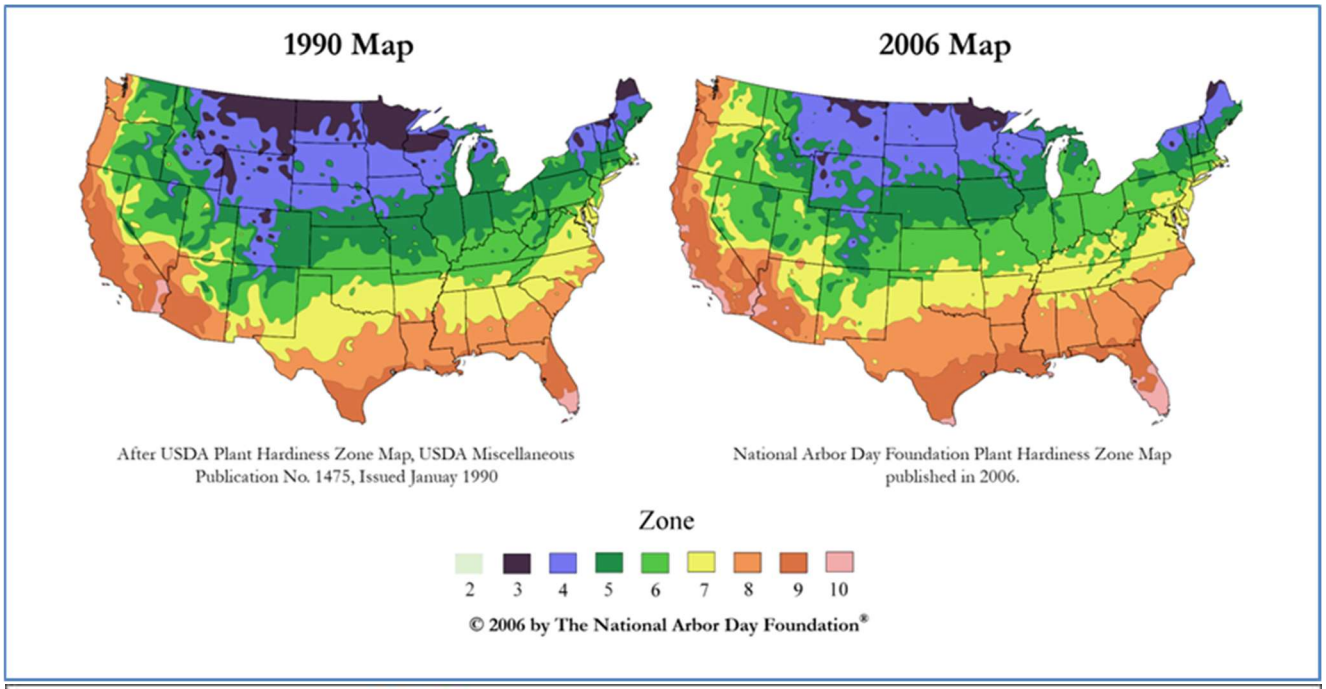
1. Impacts to Natural Resources and Green Infrastructure

Broward's numerous natural resources will be impacted by rising sea level, but also from other climate change impacts, such as increasing temperatures, storm surge, coastal erosion, and more extreme weather patterns. A brief discussion of the expected impacts on our coral reefs, beaches, wetlands, and other natural areas is offered below.

Increasing ocean temperatures and acidification are already threatening the largest coral reef barrier system in the United States. Our coral reefs protect Southeast Florida's coasts and beaches, are a major tourist attraction, acts as a nursery for many commercially valuable fish species, and provide habitat for endangered sea turtles. The reefs also provide an economic benefit to the region on the magnitude of approximately $1 billion in income, $2.3 billion in sales tax, and 40,000 jobs (Broward County EAR Major Issues Chapter 3).

The Florida Department of Environmental Protection has estimated that 21.3 of the 24 miles of Broward County's beaches are critically eroded. According to a 1997 study, Broward's beaches protect over $4 billion in upland property, structures, and infrastructure. They also contribute $548 million annually to Broward County's economy, attract 7.2 million visitors a year, create 17,700 full-time jobs, and add $1.4 billion to County property values. Broward's beaches provide numerous environmental benefits as well, as the primary nesting grounds for threatened and endangered sea turtles and important habitat for a number of plant and animal species. Climate change is expected to affect future coastal erosion rates due to changes in future sea levels and increased coastal storm intensity.

Two-thirds of Broward County is within the Everglades ecosystem. This natural system is threatened by changing climate which will allow increasing success of exotic floral and faunal species such as Maleleuca and the Burmese Python. Changing temperatures are causing migrating species and their food supply to shift out of phase. An increase in wildfires and droughts are predicted and habitat regions are expected to shift to the north as temperatures climb.



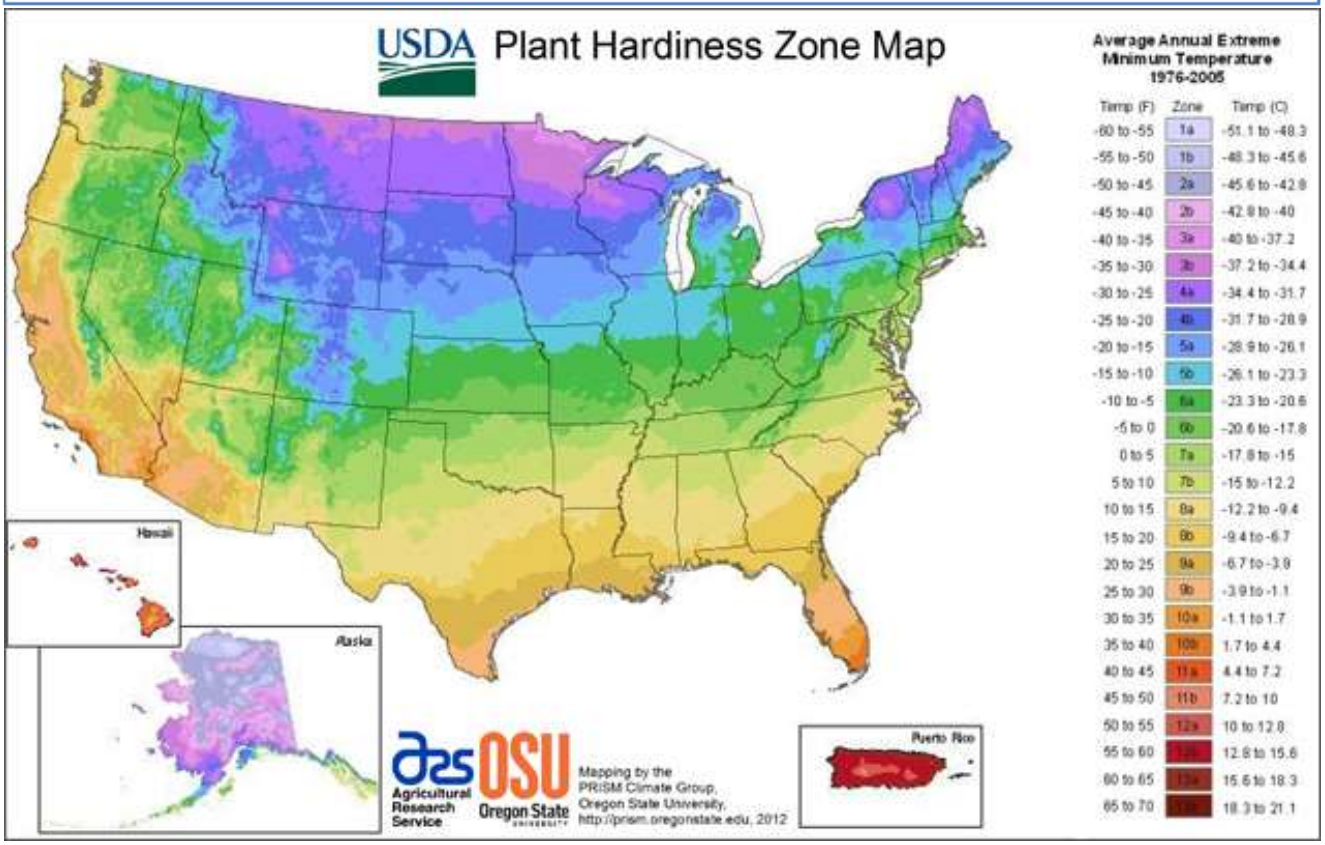


Figure CC-14: Map – 1990 Hardiness Zones vs. 2006 Hardiness Zones vs. 2012 Hardiness Zones

Comparing 1990 USDA hardiness zones, 2006 arborday.org hardiness zones and 2012 USDA hardiness zones illustrates the trend of plant regimes shifting north due to a warming climate.

Source: Arbor Day Foundation http://www.arborday.org/media/map_change.cfm

Climate change will cause habitat evolution and species succession. Broward County will need adaptive management approaches to address these impacts. Adaptive management approaches for natural systems and green infrastructure will be needed in the future to deal with habitat evolution, species succession and other resulting issues from a changing climate.

The Green Infrastructure Map Series was developed to support planning and coordination regarding the enhancement of resources within Broward County. Each map in the series can be used separately or as a group to measure and compare environmental and green infrastructure markers. The maps engage policy makers and program managers to help identify focus areas and opportunities for collaborative programming, and guide policy and planning.

The map series allows for a visual display of information from solar installations, light at night pollution, water reuse capacity, and food deserts to more traditional aspects of green infrastructure such as urban forests, natural lands, and coastal dunes.

2. Public Health, Emergency Preparedness and other Social Considerations

Climate instability is currently being experienced around the globe. In 2010-2011, the northeast United States experienced one of the snowiest winters on record. South Florida has seen record rainfalls as well as record droughts in the past few years. Average global temperatures in April 2016 were the highest temperature departure for April since global records began in 1880. Overall, 13 of the 15 highest monthly temperature departures in the record have all occurred since February 2015.

According to the 2012 Enhanced Local Mitigation Strategy for Broward County, extreme heat presents a significant life and safety threat to Broward County's population.

"Extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region and that last for an extended period of time. Health risks from extreme heat include heat cramps, heat fainting, heat exhaustion, and heat stroke. According to the National Weather Service, heat is the leading weather-related killer in the United States and during the ten-year period between 1993 and 2002 killed more people than lightning, tornadoes, floods, and hurricanes combined. The elderly and the ill are most at-risk, along with those who exercise outdoors in hot, humid weather."

Figure CC-15 shows high heat days, where temperatures exceed 90°F. During the 1960s and 70s, Broward County averaged 60-90 high heat days per year. However, by the end of this century, projections show there will be 165-80 high heat days. Much of the southern United States is projected to have more than twice as many days per year above 90°F by the end of this century. According to the projection by the U.S. Global Change Research Program, South Florida will gradually shift from an average of 60 days a year when the thermometer exceeded 90°F to nearly 180 days of +90°F by the end of the century.

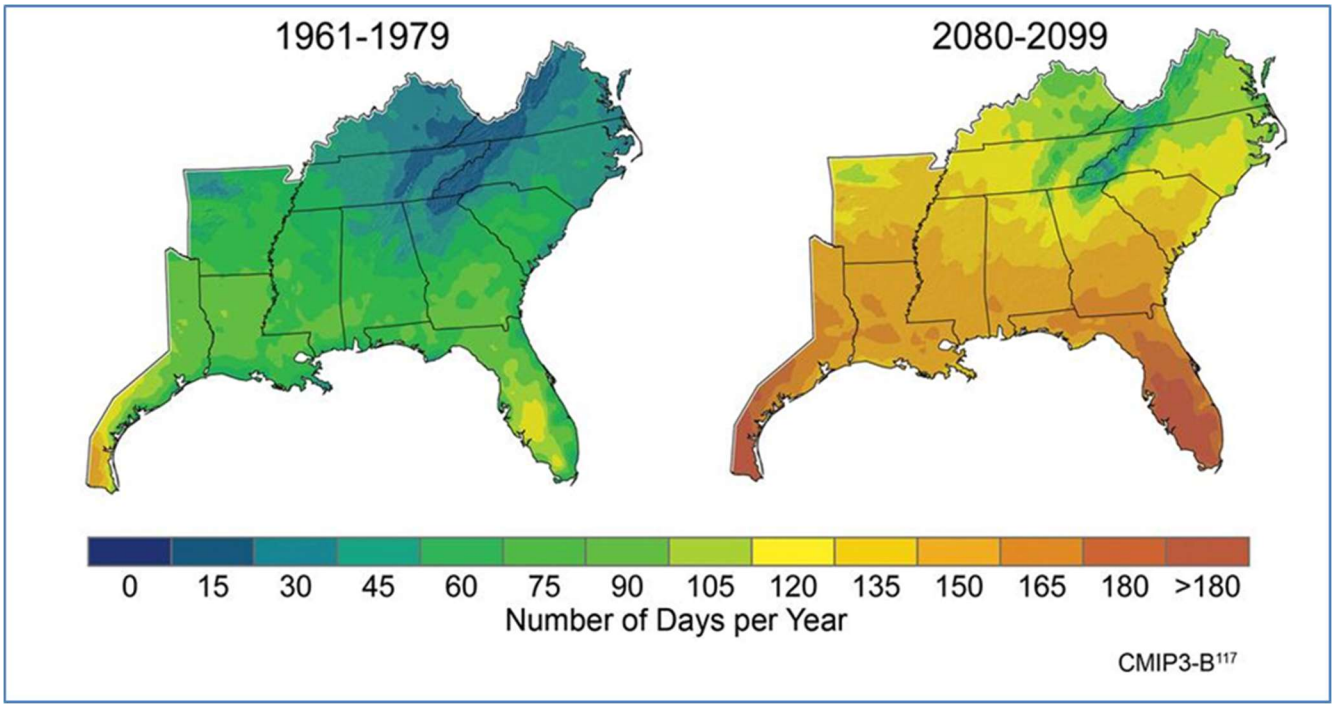


Figure CC-15: Map – Number of Days with High Exceeding 90°F
Source: U.S. Global Change Research Program, Global Climate Change Impacts in the United States, 2009 Report.

Broward County has a large number of seniors who are particularly susceptible to the effects of extreme heat. While most studies have focused on the impacts of isolated extreme heat events, such as large-scale urban power loss following a hurricane or tropical storm, the effects of more chronic long-term temperature trends on public health have yet to be studied in full. Impacts to natural systems, water quality, food systems, vulnerable populations (as well as youth and users of alternative forms of transportation and pedestrian ways), and other potential impacts of rising sea and land temperatures need to be assessed as changes in local temperature trends occur.

The connection between public health and climate change planning is becoming clearer. Climate change impacts relating to the social sphere include the spread of vector-borne diseases, extreme and prolonged heat waves, air pollution, wildfires, and resource scarcity. Beyond the prevention of disease, the public health arena can be a key player in making progress towards reducing these vulnerabilities and making our community more climate resilient.

Planning more walkable/pedestrian friendly communities helps to reduce Vehicle Miles Travelled (VMT), which reduces GHG emissions and air pollution, gets people outside and more active, and improves community vitality and health. Reducing health disparities among low-income and/or underserved populations will improve the entire community's ability to fight against vector-borne illnesses, which may spread at higher rates through new climate regimes and increased human migration around the globe. Promoting local agriculture reduces the carbon footprint of our food because distribution distances are reduced, but also improves our ability to manage local food supply as energy and water demands shift with a changing climate, a term known as food security.

Climate change affects emergency management. One of the Technical Advisory Committees (TACs) for the Broward County Emergency Management Division's Long-Term Recovery and Redevelopment Strategy (LTRRS) is tasked to consider Environmental Preservation and Climate Change Adaptation. The TAC recognizes the numerous ecological services our region's ecosystems provide to our residents, visitors, and business community, and considers environmental restoration critical to restoring the quality of life and economic livelihood of the County after a disaster.

Additionally, the Broward County 2012 Enhanced Local Mitigation Strategy (eLMS) includes a new subsection on climate change and sea level rise in the Risk Assessment chapter, and utilizes wind, flood, and sea level rise hazard risk information in a new Economic Vulnerability chapter. Analysis concludes that the County is likely to continue to be vulnerable to sea level rise, with the level of impacts being moderate to severe.

Besides the addition of sea level rise/climate change as a hazard, the Enhanced LMS has made the following connections and commitments to link emergency management and planning or climate change:

1. Takes into consideration the effects of climate change on other risks evaluated, such as future flood conditions, drought, wildfire, coastal erosion, storm surge and hurricane wind speeds;

2. Supports the Climate Change Government Operations Group on 16 actions that overlap with hazard mitigation from the 2010 Climate Change Action Plan;

3. Commits to reinforce the Climate Change Task Force's Adaptation Action Areas for long term planning; and

4. Incorporates consideration of sea level rise and climate change in criteria used in the Loss Estimation Tool (LET), which helps measure cost-effectiveness and screen potential mitigation projects for FEMA mitigation programs.

The eLMS is an example of how the County is working to integrate hazard mitigation into comprehensive planning and capital improvement planning. The County's Emergency Management Division, Risk Management Division and Government Operations Climate Change group are working collaboratively to better include hazard mitigation into annual decisions about county growth, investment and redevelopment. Climate change adaptation planning is an inherent part of that very discussion, as long-term recovery and community resiliency have similar goals and are often seen as two sides of the same coin.

D. Response Options: Mitigation and Adaptation

Prudent public and private investments today will reduce future costs and risks. Mitigation to reduce GHG emissions is important because:

- it reduces physical risks associated with climate change,
- it avoids higher costs and economic risks in the future, and
- it promotes investment in resilient capital improvements.

Unfortunately, climate change impacts, especially sea level rise, are already occurring in our County, making adaptation efforts also necessary. Critical public infrastructure including beaches, roadways and especially storm water drainage treatment and conveyance systems have already begun to show vulnerabilities to the current rate of rise of sea level, extreme rainfall and seasonal high tides. Coastal communities have begun to seek infrastructure improvements to address mounting drainage concerns. The predicted accelerated rate of sea level rise will further exacerbate the impact of saltwater intrusion on our source of drinking water and on coastal habitats. Climate-related challenges currently exist suggesting action to address these issues is needed today. (CCAP)

The County has invested in developing the research tools and multi-jurisdictional partnerships needed to develop and harness best available science for the basis of sound climate change strategies, policies and programs. Greenhouse gas emissions inventories tell us which sectors and activities have the greatest local contribution to global warming, and assist in tracking the effectiveness of emissions reduction strategies. Sea level rise projections help us to envision our community's future, in order to make informed long-term land use decisions. Vulnerability analysis is especially crucial in identifying areas of particular concern where adaptation measures need to be considered in order to protect residents, public and private investments, and our shared natural resources. Areas identified as having increased vulnerability should be prioritized for capital improvements and progressive policies that provide both short-term long-term benefits. These tools cannot tell us where to strike the balance between providing protection today and building climate resilience for tomorrow. What it can do is provide critically needed information, science based on best available data and local realities. This information serves as the basis for the creation of sound and multi-beneficial policies that reduce our contribution to global warming, reduce current vulnerability and risk, and prepare our community for projected impacts.

The State has also provided guidance on climate change planning and has provided for a new tool in the adaptation planning toolbox. Last year, the Florida Legislature amended state law, through Senate Bill CS/SB 1122, to provide for a definition of Adaptation Action Areas (AAA) as an optional component of Local Comprehensive Plans for those low-lying coastal zones that are experiencing coastal flooding due to extreme high tides and storm surge, and which are more vulnerable to the impacts of rising sea level. It further specifies that local governments which adopt an AAA designation may consider policies within the Local Comprehensive Plan to improve resilience to coastal flooding resulting from

high-tide events, storm surge, flash floods, storm water runoff, and related impacts of sea level rise. Subsequent to state legislative action, the concept of AAA designations moved to the federal level and members of Congress have since requested the definition of AAA in federal law to provide for appropriations for adaptation planning and infrastructure needs in designated areas.

Implementation

A. Authority

Article I of Broward County's Charter, Section 1.04 (P), Environmental Statement, describes Broward County Government's duty to enact policies which protect citizens' rights to a sustainable environment while encouraging a stewardship of natural resources, as approved by the voters on November 4, 2008.

In 2007 the Board adopted Resolution 2007-391 to reduce GHG emissions in Broward County and to support the U.S. Mayors' Climate Protection Agreement. In 2008 the Board passed Resolution 2008-442 to create the Broward County Climate Change Task Force (Task Force) to develop and advise on the implementation of strategies to mitigate the causes and adapt to the consequences of climate change. On May 4, 2010 the Board approved the 126 recommendations developed by the Task Force, detailed in the Broward County Climate Change Action Plan – Addressing our Changing Climate (CCAP) (Appendix CC-G) and authorized implementation of the plan to the extent possible.

Many of the policies in the Climate Change Element are rooted in the recommendations provided by the Task Force and approved for implementation by the Board. One of the high-ranked recommendations in the CCAP was to develop and include a Climate Change Element into the County Comprehensive Plan to provide for a sustainable environment and to reflect the best available data and strategies for adapting to future climate change impacts.

B. Programs

This section describes some of the programs and initiatives Broward County and its municipal, regional, state and federal partners will utilize to implement the goals, objectives and policies presented in this Element. While some of the policies will require the creation of new initiatives and partnerships, many of the policies refer to existing programs and efforts which have, or have the potential to, make significant progress towards the goals of a sustainable and climate resilient community. As they relate to the recommendations in the Broward County Climate Change Action Plan, the Broward County Climate Change Task Force will track progress and provide guidance on the implementation of the policies put forth in this Element.

Broward County Environmental Planning and Community Resilience Division (EPCRD)

Responsible for ensuring the protection, preservation, and enhancement of Broward County's diverse natural resources and dependent ecosystems through coordinated management efforts, planning, monitoring, project implementation, and outreach activities. These efforts are administered through the Division's five program areas:

1. Water Resources Policy and Planning

Coordinates county-wide water quality initiatives and water resource management activities. Planning efforts consider multiple challenges, including future water availability, ocean outfall legislation, and climate change impacts such as increased saltwater intrusion and increased risk of flooding. Outreach and education is advanced through the Broward Water Conservation and Incentives Program, NatureScape Irrigation Service, and NatureScape Broward programs. Advanced hydrologic modeling and research is used to analyze future conditions, guide development of alternative water supplies, and help identify climate change adaptation strategies.

2. Beach and Marine Resources

Responsible for coral reef management, beach erosion control, and the protection of sea turtles and manatees. Preservation of our coral reefs and marine ecosystems are heavily dependent on the adaptive capacity of these systems to climate change. With coral populations already compromised by the influences of pollution and disease, marine resources managers are tasked with the challenge of identifying and implementing strategies for reducing these stressors and increasing ecosystem resiliency to the additional pressures from climate change, such as increasing ocean temperatures and ocean acidification.

The Beach Program is responsible for restoring and maintaining the County's publicly accessible beaches to provide adequate storm protection, sea turtle nesting habitat, and recreational opportunities. Beach management efforts are also challenged by the effects of climate change. Rising sea level and more intense tropical events will enhance the rate of additional beach erosion and likely necessitate more frequent beach nourishment projects. Recognizing the importance of the County's beaches to protecting coastal infrastructure, Broward County has committed to maintaining its beaches as an important climate adaptation strategy.

3. Land Stewardship

Ensures compliance with land management plans and grant agreements supporting the "Partners in Preservation" and "Parks for People" programs. Natural lands and green spaces purchased through the most recent Land Preservation Bond Program reflect a $200 million investment in green infrastructure. Although the total monetary value is not known, Broward's publicly- and privately-owned landscaping is an important part of our urban forest, providing natural and quality of life benefits relating to community health, maintaining and improving property values, storm water management, windstorm impact mitigation, reduction of heat island effects, shading to reduce energy use, carbon sequestration, support of migratory birds and other natural and wildlife benefits. A recently completed Natural Lands Inventory will aid urban reforestation efforts and the identification and prioritization of sites for additional ecological enhancement.

4. Energy and Sustainability

Plays a central role in addressing climate change in Broward as part of the County's commitment to build climate resiliency into local programs and long-term plans.

Since 2008, the Energy and Sustainability Program within EPCRD has substantially advanced the County's climate mitigation and adaptation goals by:

1. Leveraging Energy Efficiency and Conservation Block Grant (EECBG) funds,
2. Tracking progress on the implementation of the County's Climate Change Action Plan (CCAP),
3. Advancing various aspects of the Southeast Florida Regional Climate Change Compact (Compact), and
4. Coordinating activities with local, national and international institutions for the creation of best available information for adaptation planning and decision-making. This broad collaboration encourages the pooling of resources and expertise in pursuing effective climate change strategies.

In 2013, Broward County participated in a year-long Pilot Program to test the new national rating system for sustainability called STAR (Sustainability Tools for Assessing and Rating communities). Reporting over 500 initiatives throughout the community, Broward County successfully became the first 4-STAR Rated County in the Country on Feb 11, 2014. STAR has broadened how we view sustainability in Broward to include all aspects of the community well-being, economy, and environment. After the assessment, the County highlighted Light in the Community: reducing light pollution and light trespass in STAR's Built Environment Goal Area as one of seven critical areas for focused attention and improvement.

The Natural Night Sky Initiative was created to develop standards and practices to effectively, efficiently, responsibly illuminate Broward County. By adopting best practices for illumination, Broward County ensures that lighting enhances safety, is efficient, and reduces light pollution through standardized policies and codes.

Light pollution wastes an astonishing amount of energy, thereby wasting taxpayer money and exacerbating our contribution to climate change. More than one-third of all outdoor lighting in the U.S. is wasted by poorly aimed or unshielded outdoor lighting, which equate to $3.3 billion of energy lost to sky glow each year, and the release of an extra 21 million tons of carbon dioxide per year (which would require the planting of 875 million trees annually to mitigate). Smart lighting, on the other hand, increases safety for drivers and pedestrians by reducing hazardous glare and increasing visibility, ultimately creating the most comfortable and safe spaces for our community.

In fact, all plants and animals depend on Earth's daily cycle of light and dark rhythm to govern life-sustaining behaviors such as reproduction, nourishment, sleep and protection from predators. In

this way, light pollution is negatively impacting the health and resilience of our wetland habitats, sea turtles nesting and hatchling success, migratory birds, insects, pollinators, and other wildlife.

In 2015 Broward's Environmental Planning and Community Resilience Division began educating the public on light pollution and create spaces to dialogue with local planners, architects, recreation managers, and others on the benefits of reducing excessive or misplaced light. Support for Night Friendly Lighting policies and standards is documented in the 2015 Municipal Green Initiatives Survey and has been demonstrated by municipal and community involvement in a multiple Sustainability Stewards events and workshops since 2015.

In 2016, Light at Night was included in the Broward County Green Infrastructure Map Series, a project which won a 2016 NACo Achievement Award.

In 2017, a Sky Quality Monitoring Program was launched, installing Sky Quality Meters at parks, libraries, and other county-owned facilities throughout the community, to access Broward County's night sky quality and measure progress in reducing light pollution over time. Most recently, on October 11th, the Sustainability Stewards of Broward meet at Fern Forest to choose locations for the remaining sky quality meters, compare municipal lighting codes, and identify best practices for utilization community-wide.

Broward County's energy and sustainability initiatives and regional approach to climate mitigation and adaptation planning have received national recognition and accolades for innovative and forward-thinking approaches to addressing South Florida's vulnerability to climate change.

5. Environmental Monitoring

The Environmental Monitoring Laboratory provides program managers with data needed to formulate management decisions and policy recommendations and supports the County's regulatory programs and enforcement activities. The environmental laboratory collects, maintains, and interprets data from our coastal, marine and freshwater systems for the purpose of informing program staff, influencing policy, and assessing the effectiveness of program efforts. Groundwater wells monitored by the laboratory complete a regional data set and serve to document migration of the saltwater front in the Biscayne Aquifer. This data is critical in modeling response of this front to changing environmental and operational influences, including sea level rise, changing precipitation patterns and rates of evapotranspiration, wellfield modifications, and water management operations. The County's environmental laboratory could also provide the necessary agency participation and support for the establishment of a regional Vital Signs Monitoring Network, as recommended in this Broward County Climate Change Element and in the Southeast Florida Regional Climate Change Compact Action Plan. The goal of this monitoring network would be to identify and track the basic physical indicators of climate change specific to natural systems and the urban environment as regionally consistent documentation of long-term climate changes with relevance across Southeast Florida.

C. Other Broward County Programs and Collaborative Initiatives which May Be Useful in the Implementation of the Climate Change Element

1. Advanced Hydrologic Modeling with USGS

In specific support of the County's climate adaptation planning efforts, EPCRD has secured cost share support from the U.S. Geological Survey (USGS) to develop a climate/storm water vulnerability model that will provide a comprehensive assessment of the climate related impacts of sea level rise and increased intensity of storms on water management infrastructure and practices in coastal and inland Broward County. As part of this 4-year project, the County's integrated surface and groundwater model will be coupled with variable density flow and transport models and down-scaled climate models to evaluate the projected impacts of climate change to vulnerable coastal and inland areas to identify and test various adaptation strategies necessary to maintain current levels of flood protection. The results of this project are expected to guide future adaptation strategies and investments in infrastructure recognized to enhance the resiliency of the Broward community to climate change.

2. Southeast Florida Regional Climate Change Compact

The Southeast Florida Regional Climate Change Compact represents a joint commitment of Broward, Miami-Dade, Palm Beach and Monroe Counties to work collaboratively to address the regional challenges and threats associated with global climate change. The Compact was ratified in January 2010 after its introduction at the 2009 Southeast Florida Climate Leadership Summit, coordinated by EPCRD and hosted by Broward County. The Compact commits the Counties to work on federal and state climate policies and joint advocacy in Tallahassee and Washington, DC on climate policies related to the shared challenges of climate change. Accomplishments include a regional GHG emissions inventory, a unified sea level rise projection for the region, development of regionally-consistent methodologies for inundation mapping and vulnerability assessment, joint policy positions on climate change and the development of a Regional Climate Change Action Plan (Appendix CC-F).

3. Climate Change Government Operations Work Group

The Broward County Climate Change Government Operations Workgroup focuses on identifying opportunities across Broward County agencies to reduce carbon emissions from County government activities. The Workgroup includes representatives from many County agencies, organized into committees in the areas of buildings/infrastructure, waste, transportation, natural systems and policies. Initial activities included review of government operations in the context of carbon emissions, setting of an emissions reduction goal and development of a baseline governmental greenhouse gas emissions inventory. The Workgroup Steering Committee meets monthly to identify potential emission reduction actions, propose implementation of selected actions and share progress made.

4. School Board of Broward County

Since 2007, Broward County has partnered with the School Board of Broward County to actively promote water conservation and environmental stewardship through the County's NatureScape program. Today, more than 40% of Broward's schools are Certified Schoolyard Habitats, over 25% of the student body is active in outdoor learning, and 110 teachers have completed Habitat Steward Training and are implementing environmental curriculum with their students. Teachers and students also take the "Earth Hero Pledge", were they learn about waste reduction and recycling, water conservation and the use of native plants, energy conservation and the connection with climate change, land stewardship, walking and biking and other ways to positively impact their environment.

Beyond the numerous benefits of education, the partnership has also made significant physical progress on making the schools' properties more sustainable. Thirty-five learning gardens have been created on middle school campuses, which contributed to the School District recently achieving certification as the largest certified school district in the nation by the National Wildlife Federation. The program has also helped save over 166 million gallons of water on school properties though irrigation assessments, and plants approximately 700 native trees and shrubs at middle schools every year.

5. The Southeast Florida Regional Partnership (SFRP)

Funded through a grant from the US Department of Housing & Urban Development's Sustainable Communities Initiative, the Partnership is a collaboration of more than 200 public, private, and civic stakeholders from the Southeast Florida 7 county region (Monroe, Miami-Dade, Broward, Palm Beach, Martin, St. Lucie and Indian River). Spearheaded by the South Florida and Treasure Coast Regional Planning Councils, the Partnership has united to leverage resources and coordinate strategic long-term planning to drive competitiveness and prosperity for the region. A plan called Seven50 ("seven counties, 50 years") is being developed to help ensure socially inclusive communities, a vibrant and resilient economy, and stewardship of our fragile ecosystem. The plan will aim to improve the quality of life for the over six million residents in the seven-county region by developing strategies for: greater opportunities for sustained job creation, access to affordable housing, a better menu of transportation options, and more people-friendly, environmentally-friendly places to live. The plan is intended to be a blueprint for growing a more prosperous, more desirable Southeast Florida during the next 50 years and beyond.

6. Interagency Coordination

The creation of a sustainable, climate resilient community takes many hands. In truth, almost every governmental agency, municipality, business, and resident will play a role. GHG emissions do not stay within jurisdictional boundaries. Neither do climate change impacts. Our community will have to work together in order to create the economically and environmentally resilient future we envision through this Element.

While it is impossible and impractical to list every potential partner in this endeavor, below is a list of some of the agencies expected to take a major role in helping to move the goals and objectives of this Element forward.

Broward County:

1. Environmental Protection and Growth Management Department
2. Transportation Department
3. Public Works Department
4. Aviation Department
5. Port Everglades Department
6. Parks and Recreation Division
7. School Board of Broward County
8. Broward County Water Advisory Board
9. Broward Metropolitan Planning Organization
10. Broward County's 31 municipalities
11. Broward Municipal Services District

Regional Agencies:

1. The South Florida Water Management District
2. The South Florida Regional Planning Agency
3. South Florida Regional Transportation Authority
4. The Southeast Florida Regional Partnership (Seven50)

State and Federal Partners:

1. Florida Department of Environmental Protection
2. United States Geological Survey
3. Florida Department of Transportation
4. Florida Department of Economic Opportunity
5. Florida Division of Emergency Management
6. National Oceanic and Atmospheric Administration
7. U.S. Department of Energy
8. U.S. Army Corps of Engineers
9. Florida Fish and Wildlife Conservation Commission

Other:

1. Local institutions of higher learning (FAU, FIU, Nova, BC, UM)
2. Public Health Agencies
3. Professional and not-for profit organizations (SGP, USGBC, BAPA, CLEO)

Reviewed Literature

Adaptation Advisory Group to the Alaska Climate Change Sub-Cabinet (2010). *Alaska's Climate Change Strategy: Addressing Impacts in Alaska* [pdf document]. Retrieved from: http://www.climatechange.alaska.gov/aag/docs/aag_all_rpt_27jan10.pdf

Adelsman, Hedia, et. al. (2012). Preparing for a Changing Climate: Washington State's Integrated Climate Response Strategy [pdf document]. Retrieved from: http://www.ecy.wa.gov/climatechange/ipa_responsestrategy.htm

Alameda County (2011). *Climate Action Plan* [pdf document]. Retrieved from: http://www.acgov.org/cda/planning/documents/Community_Climate_Action_Plan_June_2011.pdf

Alaska, Department of Fish & Game (2008). *Climate Change Strategy* [pdf document]. Retrieved from: http://www.adfg.alaska.gov/static/lands/ecosystems/pdfs/climatechangestrategy.pdf

Ammon, Kenneth, et. al. (2009). *Climate Change & Water Management in South Florida* [pdf document]. Retrieved from: www.sfwmd.gov

American Planning Association (2008). *Policy Guide on Planning and Climate Change* [pdf document]. Retrieved from: http://www.planning.org/policy/guides/pdf/climatechange.pdf

American Security Project (2011). *Pay Now, Pay Later: Florida* [pdf document]. Retrieved from: www.americansecurityproject.org

Beever III, James W., et. al. (2009). *Comprehensive Southwest Florida/Charlotte Harbor Climate Change Vulnerability Assessment* [pdf document]. Retrieved from: http://www.swfrpc.org/content/Natural_Resources/Ecosystem_Services/Vulnerability_Assessment_Final.pdf

Beever III, James W., et. al. (2009). *City of Punta Gorda Adaptation Plan* [pdf document]. Retrieved from: http://sealevel.climatecentral.org/responses/plans/

Bhatt, Neha, Peppard, Colin, & Potts, Stephanie. *Getting Back on Track: Aligning State Transportation Policy with Climate Change Goals*. Retrieved from: http://smartgrowthamerica.org/documents/getting-back-on-track.pdf

Broward County Climate Change Government Operations Workgroup (2012). *Broward County Government Operations Climate Change Fourth Annual Progress Report* [pdf document]. Retrieved from: http://www.broward.org/NaturalResources/ClimateChange/Pages/GovernmentWorkgroup.aspx

Broward County Climate Change Task Force (2010). *Broward County Climate Change Action Plan: Addressing our Climate Changing* [pdf document]. Retrieved from:

http://www.broward.org/NaturalResources/ClimateChange/Documents/FinalCCActionPlan_forBCBCCappdxB.pdf

Broward County Commissioners (2010). *Charter of Broward County, Florida* [pdf document]. Retrieved from: http://www.miamidade.gov/charterreview/library/charter_broward_county.pdf

Broward County Emergency Management (2009). *Comprehensive Emergency Management Plan (CEMP)* [pdf document]. Retrieved from: http://floridadisaster.org/cemp.htm

Broward County Emergency Management (2012). *DRAFT Enhanced Local Mitigation Strategy (eLMS)* [pdf document]. Accessed on Broward County ftp site June 28, 2012.

Broward County Environmental Protection and Growth Management Department (2011). *Proposed 2011 Evaluation and Appraisal Report* [pdf document]. Retrieved from: http://www.broward.org/PlanningAndRedevelopment/Pages/2011EAR.aspx

Broward County Planning and Redevelopment Division (2011). *Planning for Climate Change, Chapter 3.1. Major Issues- Planning for Climate Change* [pdf document]. Broward County, Florida.

Brugmann, Jeb (2011). *Financing the Resilient City* [pdf document]. Retrieved from: http://www.environmental-finance.com/download.php?files/pdf/4e1c155b960f6/Report-Financing_Resilient_City-Final.pdf

Bureau of Beaches and Coastal Systems, Division of Water Resource Management, Department of Environmental Protection, State of Florida (2007). *Critically Eroded Beaches in Florida* [pdf document]. Retrieved from: http://bcs.dep.state.fl.us/reports/crit_ero.pdf

Cahill, Maria & Leonard, Barry. *Development of a Methodology for the Assessment of Sea Level Rise Impacts on Florida's Transportation Modes and Infrastructure* [pdf document]. Retrieved from: http://trid.trb.org/view.aspx?id=1136305

Carbon Solutions America. *Fort Lauderdale Sustainability Action Plan* [pdf document]. Retrieved from: http://www.ci.ftlaud.fl.us/recovery/pdf/FTL_Sustainability_Action_Plan.pdf

Center for Climate Strategies (2008). *Adaptation (ADP) Planning Framework for Florida, Appendix F*. Retrieved from: www.flclimatechange.us

Center for Science in the Earth System, et. al. (2007). *Preparing for Climate Change: A Guidebook for Local, Regional and State Governments* [pdf document]. Retrieved from: http://cses.washington.edu/cig/fpt/guidebook.shtml

City of Chula Vista, Climate Change Working Group (2011). *Climate Adaptation Strategies: Implementation Plans* [pdf document]. Retrieved from: http://www.ci.chula-

vista.ca.us/clean/conservation/Climate/documents/ClimateAdaptationStrategiesPlans_FINAL_000.pdf

City of Issaquah, WA (2009). *2009 Comprehensive Plan Amendments, #8 Sustainable Development and Climate Change* [pdf document]. Retrieved from: http://www.ci.issaquah.wa.us/Files/Ex%20A4%20Climate%20Change.pdf

City of Santa Cruz (2012). *City of Santa Cruz Climate Adaptation Plan* [pdf document]. Retrieved from: http://www.cityofsantacruz.com/index.aspx?page=1680

City of Seattle Department of Planning & Development (2005). *Seattle's Comprehensive Plan: Toward a Sustainable Seattle, Environment Element* [pdf document]. Retrieved from: http://www.seattle.gov/DPD/Planning/Seattle_s_Comprehensive_Plan/ComprehensivePlan/default.asp

City of Tamarac (2010). *City of Tamarac Climate Action Plan* [pdf document]. Retrieved from: http://publicagenda.tamarac.org/AttachmentViewer.aspx?AttachmentID=4923&ItemID=2301

Climate Change and Energy Planning for MPOs (2011) [PowerPoint slide]. Retrieved from: http://www.ampo.org/

Climate Protection Campaign (2008). *Sonoma County Community Climate Action Plan: Blueprint for the Future* [pdf document]. Retrieved from:http://www.ci.rohnert-park.ca.us/index.aspx?page=514

Coconut Creek (2009). *City Green Plan* [pdf document]. Retrieved from: http://www.coconutcreek.net/green/city_green_plan.pdf

Collier County Planning Services Department (1997). *County Growth Management Plan, Conservation and Coastal Management Element* [pdf document]. Retrieved from: http://www.colliergov.net/Modules/ShowDocument.aspx?documentid=29472

Council of Fresno County Governments (2011). *2011 Regional Transportation Plan, Chapter 5, Climate Change Element* [pdf document]. Retrieved from: http://www.fresnocog.org/files/RTP/2011%20RTP%20Final/8%20Chapter%205.pdf

Economics of Climate Adaptation Working Group (2009). *Shaping Climate-Resilient Development: a Framework for Decision-Making* [pdf document]. Retrieved from: http://mckinseyonsociety.com/shaping-climate-resilient-development/

Feliciano, Maribel (2009). *Incorporating "Energy Conservation and Climate Change" into the Conservation Element of the Broward County Comprehensive Plan* [unpublished Planning Project]. Florida Atlantic University, Florida.

Florida Action Team (2007). *Florida's Energy and Climate Action Plan*. Retrieved from: http://www.flclimatechange.us/documents.cfm

French Wetmore, French & Associates, et. al. (2003). *No Adverse Impact: A Toolkit for Common Sense Floodplain Management* [pdf document]. Retrieved from: http://www.floods.org/NoAdverseImpact/NAI_Toolkit_2003.pdf

Grannis, Jessica (2011). *Adaptation Tool Kit: Sea Level Rise & Coastal Land Use, How Governments Can Use Land Use Practices to Adapt to Sea Level Rise* [pdf document]. Retrieved from: http://www.georgetownclimate.org/resources/adaptation-tool-kit-sea-level-rise-and-coastal-land-use

Hastings, Alcee, Deutch, Ted, Wasserman-Schultz, Debbie & Wilson, Frederica (May 13, 2011). *Letter to Chairman Frelinghuysen and Ranking Member Visclosky in regards to Sea Level Rise.* Congress of the United States.

HDR Engineering, Inc. (2010). *Solid Waste and Recycling Collection Efficiencies Workshops* [pdf document]. Broward County Waste and Recycling Services.

ICLEI-Local Governments for Sustainability USA (2009). *Sustainability Planning Toolkit: A Comprehensive Guide to Help Cities and Counties Develop a Sustainability Plan* [pdf document]. Retrieved from: http://www.icleiusa.org/sustainabilitytoolkit

ICLEI-Local Governments for Sustainability USA and The Institute for Market Transformation (2011). *Case Study: New York City's Greener, Greater Buildings Plan* [pdf document]. Retrieved from: http://www.icleiusa.org/action-center/learn-from-others/ICLEI_NYC_GGBP_Case_Study_final2.pdf

ICLEI-Local Governments for Sustainability USA (2012). *Sea Level Rise Adaptation Strategy for San Diego Bay* [pdf document]. Retrieved from: http://www.icleiusa.org/climate_and_energy/Climate_Adaptation_Guidance/san-diego-bay-sea-level-rise-adaptation-strategy-1/san-diego-bay-sea-level-rise-adaptation-strategy

Interagency Climate Change Adaptation Task Force (2011). *Federal Actions for a Climate Resilient Nation* [pdf document]. Retrieved from: http://www.whitehouse.gov/sites/default/files/microsites/ceq/2011_adaptation_progress_report.pdf

King County (2007). *King County 2007 Climate Plan* [pdf document]. Retrieved from: http://your.kingcounty.gov/exec/news/2007/pdf/climateplan.pdf

King County (2010). *2010 King County Energy Plan* [pdf document]. Retrieved from: http://your.kingcounty.gov/dnrp/library/dnrp-directors-office/climate/energy/2010-energy-plan-adopted.pdf

Kopytko, Natalie and Perkins, John (2010). *Climate change, nuclear power, and the adaptation-mitigation dilemma* [pdf document]. Retrieved from: http://www.mendeley.com/research/climate-change-nuclear-power-1/

Land Use Law Center, Pace University School of Law. *Local Land Use Response to Sea Level Rise* [pdf document]. Retrieved from: http://www.csc.noaa.gov/digitalcoast/_/pdf/Pace_Final_Report.pdf

Larsen, Larissa, et. al. (2011). *Green Building and Climate Resilience: Understanding impacts and preparing for changing conditions* [pdf document]. Retrieved from: http://www.preventionweb.net/english/professional/publications/v.php?id=25515

Lowe, Ashley, Foster, Josh, & Winkelman, Steve (2009). *Ask the Climate Question: Adapting to Climate Change Impacts in Urban Regions* [pdf document]. Retrieved from: http://www.ccap.org/docs/resources/674/Urban_Climate_Adaptation-FINAL_CCAP%206-9-09.pdf

Macadangdang, Krystle and Newmons, Melissa (2010). *Sea Level Rise Ready: Model Comprehensive Plans, Goals, Objectives and Policies, to address Sea Level Rise Impacts in Florida* [PowerPoint slides]. Retrieved from: www.law.ufl.edu/conservation/projects/sea_level_rise.ppt

Maryland Commission on Climate Change, et. al. (2011). *Comprehensive Strategy for Reducing Maryland's Vulnerability to Climate Change, Phase II: Building societal, economic and ecological resilience* [pdf document]. Retrieved from: http://www.dnr.state.md.us/climatechange/

Montgomery County Sustainability Working Group (2009*). Montgomery County, Maryland: Climate Protection Plan* [pdf document]. Retrieved from: http://www.montgomerycountymd.gov/content/dep/downloads/2009mococlimprotplan.pdf

National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center (2010). *Local Strategies for Addressing Climate Change*, Vol 2 [pdf document]. Retrieved from: http://www.csc.noaa.gov/magazine/climatechangestrategiesVol2.pdf

National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center (2011). *Flood Exposure Snapshot: Broward County, Florida* [pdf document]. Retrieved from: http://www.csc.noaa.gov/snapshots/

National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center (2011). *Ocean and Great Lakes Jobs Snapshot: Broward County, Florida* [pdf document]. Retrieved from: http://www.csc.noaa.gov/snapshots/

National Oceanic and Atmospheric Administration (NOAA) National Ocean Service (2010). *Adapting to Climate Change: A Planning Guide for State Coastal Managers* [pdf document]. Retrieved from: http://coastalmanagement.noaa.gov/climate/docs/adaptationguide.pdf

National Research Council (2011). *America's Climate Choices* [pdf document]. Retrieved from: http://www.nap.edu/catalog.php?record_id=12781

New York State Climate Action Council (2010). *Climate Action Plan Interim Report* [pdf document]. Retrieved from: http://nyclimatechange.us/InterimReport.cfm

New York State, Department of Environmental Protection, et. al. *NYC Green Infrastructure Plan: A Sustainability Strategy for Clean Waterways* [pdf document]. Retrieved from: http://www.nyc.gov/html/dep/html/stormwater/nyc_green_infrastructure_plan.shtml

NYC Mayor's Office of Long-Term Planning & Sustainability (2009). *Climate Change Adaptation: New York City's Approach* [pdf document]. Retrieved from: http://www.pewclimate.org/docUploads/Panel7%20Freed_0.pdf

NYC Mayor's Office of Long-Term Planning & Sustainability (2010). *Climate Change Progress as of April 22, 2010* [pdf document]. Retrieved from: http://www.nyc.gov/html/planyc2030/html/home/home.shtml

Palm Beach County (1989). Comprehensive Plan: Utility Element [pdf document]. Retrieved from: http://www.co.palm-beach.fl.us/pzb/Planning/LoxGroves/Complan/Utilities_110105.pdf

Parkinson, Randall W., et. al. (2010). *Towards the Formulation of an Adaptive Management Plan to Address Sea-Level Rise, City of Satellite Beach, Florida* [PowerPoint document]. Retrieved from: http://www.tbrpc.org/events/workshops/EAR_Workshop_07302010/presentations/Sea%20Level%20Rise_RWParkinson_07292010.pdf

Preston, Benjamin L., Yuen, Emma J., and Westaway, Richard M. (2011). Putting vulnerability to climate change on the map: a review of approaches, benefits and risks. *Sustainability Science*. Retrieved from: http://www.mendeley.com/research/putting-vulnerability-climate-change-map-review-approaches-benefits-risks/

Public Health Law & Policy. *An Action Plan for Public Health: Initial Recommendations for Involving Public Health in Climate Change Policy* [pdf document]. Retrieved from: http://www.phlpnet.org/healthy-planning/products/climate-change-action-plan

Public Health Law & Policy (2009). *Establishing Land Use Protections for Farmer's Markets* [pdf document]. Retrieved from: http://www.nplanonline.org/nplan/products/establishing-land-use-protections-farmers-markets

Rosenzweig, Cynthia, et. al. (2011). *Responding to Climate Change in New York State: Synthesis Report* [pdf document]. Retrieved from: www.nyserda.ny.gov

Rotterdam Climate Initiative (2010). *Rotterdam Climate Proof: Adaptation Programme 2010* [pdf document]. Retrieved from: www.rotterdamclimateinitiative.nl

South Florida Regional Planning Council (2004). *Strategic Regional Policy Plan for South Florida* [pdf document]. Retrieved from: http://sfrpc.com/

South Florida Water Management District (2011). *Past and Projected Trends in Climate and Sea Level for South Florida, Hydrologic and Environmental Systems Modeling Technical Report* [pdf document]. Retrieved from: http://my.sfwmd.gov/portal/page/portal/xrepository/sfwmd_repository_pdf/ccireport_publicationversion_14jul11.pdf

Southeast Florida Regional Climate Change Compact Inundation Mapping and Vulnerability Assessment Work Group (2011). *Analysis of the Vulnerability of Southeast Florida to Sea Level Rise.* Retrieved from: http://www.ces.fau.edu/files/projects/climate_change/SE_Florida_SLR_Vulnerability_May2011.pdf

Southeast Florida Regional Climate Compact (2011). *A Unified Sea Level Rise Projection for Southeast Florida* [pdf document]. Retrieved from: http://www.ces.fau.edu/files/projects/climate_change/SE_Florida_SeaLevelRise_April2011.pdf

Stafeychuk, Inna (2011). *Regional Sea Level Rise Adaption Land Use Strategies* [unpublished Planning Project]. Florida Atlantic University, Florida.

Titus, James G. (2011). Rolling Easements [pdf document]. Retrieved from: www.epa.gov/cre/downloads/rollingeasementsprimer.pdf\

Tompkins County Planning Department (2009). *Tompkins County Comprehensive Plan: Energy and Greenhouse Gas Emissions Element* [pdf document]. Retrieved from: http://www.tompkins-co.org/planning/compplan/index.htm

Tompkins County Planning Department (2010). *Tompkins County 2020 Energy Strategy: Interim Actions toward Achieving the Community 2050 Greenhouse Gas Emissions Reduction Goal* [pdf document]. Retrieved from: http://www.tompkins-co.org/planning/energyclimate/documents/EnergyStrategy20208-20-10_2.pdf

U.S. Environmental Protection Agency Office of Solid Waste and Emergency Reponse (2009). *Opportunities to Reduce Greenhouse Gas Emissions through Materials and Land Management Practices* [pdf document]. Retrieved from: http://www.epa.gov/oswer/docs/ghg_land_and_materials_management.pdf

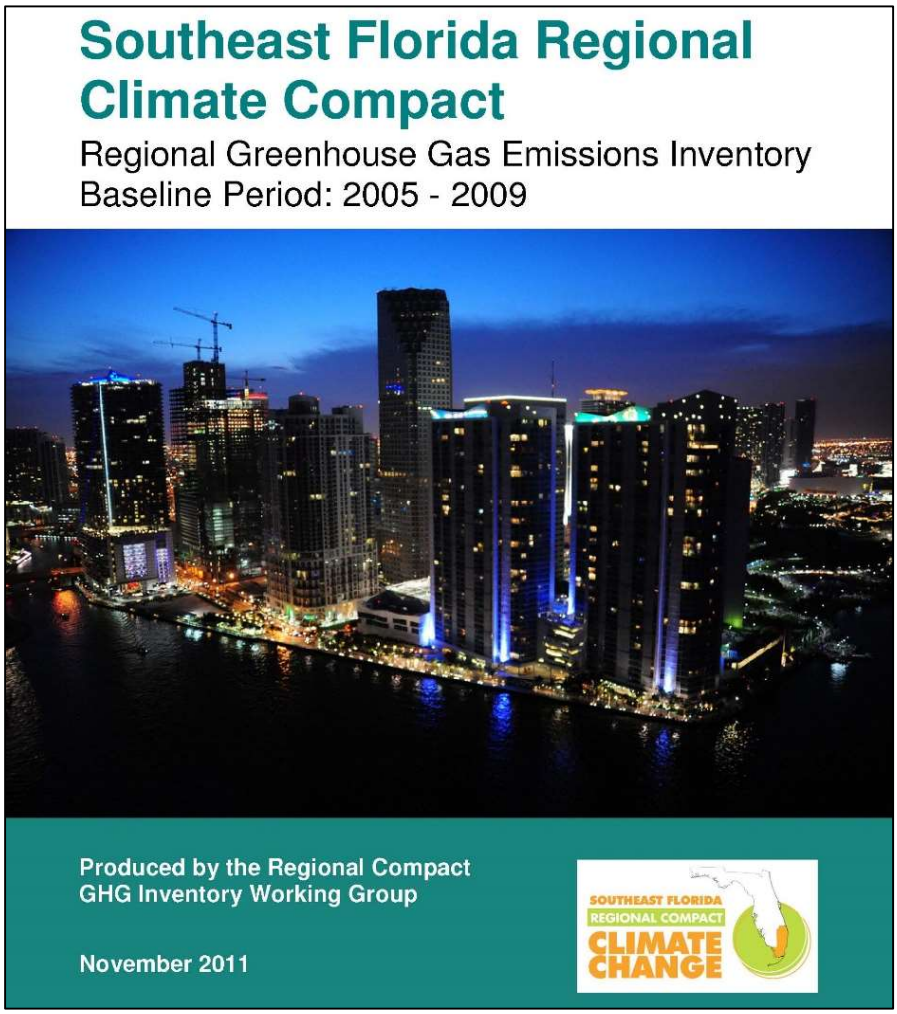
U.S. Green Building Council, South Florida Chapter. *Broward 2030: A Roadmap Empowering South Florida Leaders* [pdf document]. Retrieved from: http://usgbcsouthfloridachapter.cloverpad.org/resources/Documents/Broward%202030%20--%20Final%20--%20Small.pdf

Western Climate Initiative (2010). *Design for the WCI Regional Program* [pdf document]. Retrieved from: http://www.westernclimateinitiative.org/the-wci-cap-and-trade-program/program-design

Willows, Robert, et. al. (2003). *Climate adaptation: Risk, uncertainty and decision-making* [pdf document]. Retrieved from: http://www.sfrpc.com/Climate%20Change/2.pdf

Appendix

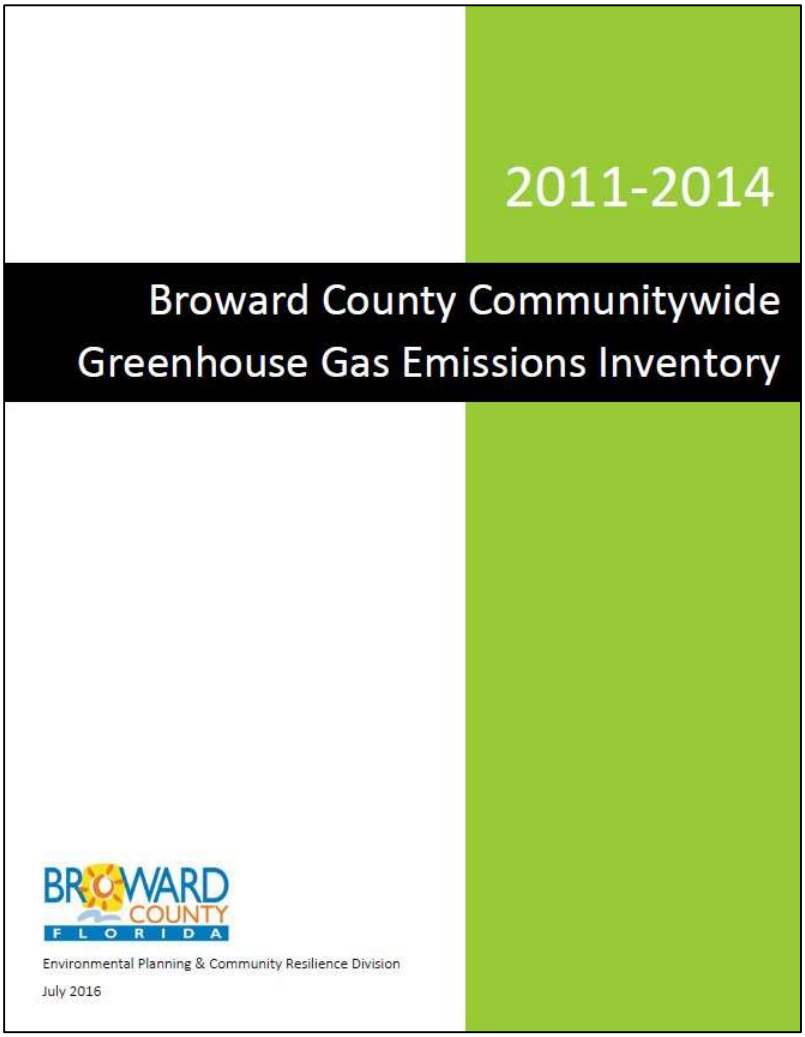
Appendix CC-A: Southeast Regional Climate Change Compact Regional Greenhouse Gas Emissions Inventory, 2011



Appendix CC-A can be found by clicking the hyperlink:

Southeast Florida Regional Climate Compact

Appendix CC-B: Broward County Communitywide Greenhouse Gas Emissions Inventory, 2016



Courtesy of Environmental Planning & Community Resilience Division, Appendix CC-B can be found by clicking on the hyperlink:

Broward County Communitywide Greenhouse Gas Emissions Inventory

Appendix CC-C: Broward County Government Operations Climate Change 4th Annual Progress Report, 2012

BROWARD COUNTY GOVERNMENT OPERATIONS CLIMATE CHANGE FOURTH ANNUAL PROGRESS REPORT

May 1, 2012

Introduction

On June 24, 2008, the Broward County Board of County Commissioners (Board) accepted the Broward County Government Operations Climate Change Report. The Report summarized early voluntary greenhouse gas (GHG) reduction actions implemented by the County from 1997 through 2007, and reiterated the County's GHG emission reduction goal of 7 percent below 1997 levels by 2015. On June 9, 2009, June 15, 2010, and May 13, 2011, the Board accepted subsequent Government Operations Progress Reports that described GHG reduction actions Broward County Government implemented during 2008, 2009, and 2010, respectively. Broward County government agencies exceeded annual reduction goals each of these years.

In FY2011 (October 2010 – September 2011), Broward County government agencies achieved a net reduction of 5,781 tonnes of GHG emissions from FY2010 levels. This is equivalent to the annual GHG emissions from 1,134 passenger vehicles.

This fourth annual progress report, developed by the Broward County Climate Change Workgroup (Workgroup), describes measures Broward County Government implemented during FY2011, and progress toward achieving the GHG reduction goal.

Greenhouse gases are expressed in tonnes of carbon dioxide equivalents (eCO_2): 1 tonne of eCO_2 is equal to the emissions from the combustion of 112 gallons of gasoline.

Broward County Government operations FY2011 carbon footprint is 250,255 tonnes eCO_2 (Figure 1). To meet the established 2015 GHG emission reduction target of 222,099 tonnes, Broward County government must reduce an additional 28,156 tonnes eCO_2 from 2011 emission levels (Figure 1, page 2). This represents an average annual reduction of 7,039 tonnes.

2011 Highlights

Broward County government agencies reported 58 GHG emission reduction measures in FY2011; 10 more than the previous year. A detailed description of the measures, cost savings, environmental benefits, and results are included in this report's ***APPENDIX***. The estimated GHG emissions reduction from the ten quantified measures totals 3,026 tonnes eCO_2 which resulted in an estimated annual cost saving of $555,160. The following are a few highlights of significant measures implemented:

Heating Ventilation and Air Conditioning (HVAC) Chiller Replacements at North Mass Transit and Central Homeless Assistance Center: The electricity use prior to the HVAC upgrades was 988,344 kWh and after, it decreased to 869,743 kWh, a difference of 118,601 kWh annually. This is equivalent to 71 tonnes eCO_2 and an annual cost savings of $11,860.

Mini-hybrid Engineered Machined Products (EMP) Retrofits on BCT buses: The Transit Division retrofitted mechanically/hydraulically driven cooling system components on 47 county buses with electrically powered devices in order to achieve fuel savings and reduce GHG emissions. EMP retrofits reduce the horsepower draw on the engine, thus improve fuel economy by a minimum of 5 percent. Collectively, the units reduced eCO_2 emissions by 498 tonnes, a cost savings of $170,511.

Recycling in County Facilities: During FY2011, approximately 1,469 tons of office paper, magazines, newspapers, file folders, cardboard, and food and beverage containers were recycled in County

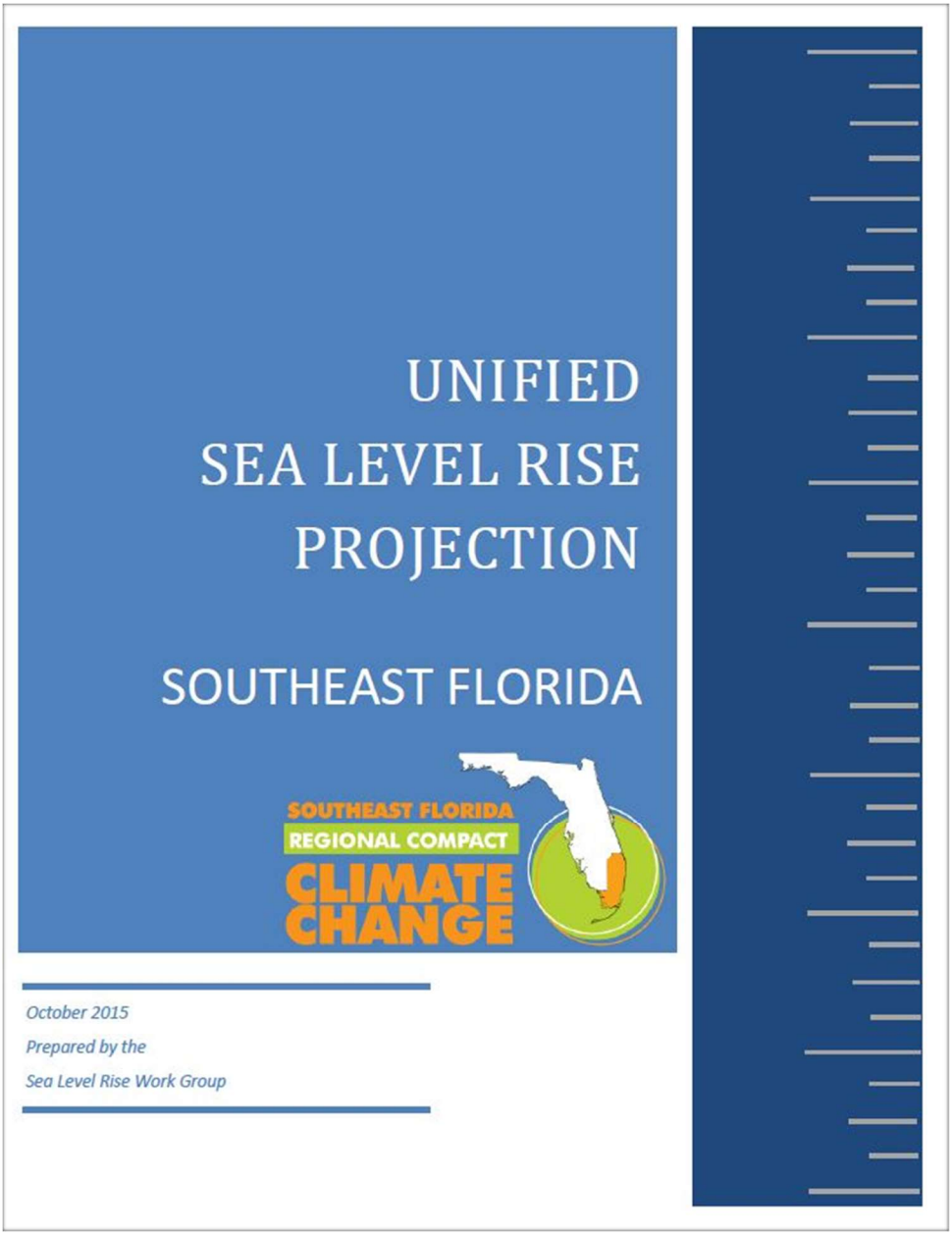
administrative facilities, including the airport connection center, and parks. By recycling these materials, the County saved more than $143,399 through avoided disposal. This represents a GHG reduction of 4,731 tonnes which is equivalent to the emissions of 530,381 gallons of gasoline consumed.

A Word on Greenhouse Gases

Burning of fossil fuels is the primary source of GHG emissions. A key element of any GHG reduction program is the quantification of GHG emissions and reduction measures. The International Council for Local Environmental Initiatives 2009 Clean Air Climate Protection software was used to calculate the GHG generated by energy use, fuel use, and solid waste. FY2011 GHG emissions from Broward County Government operations are shown below.

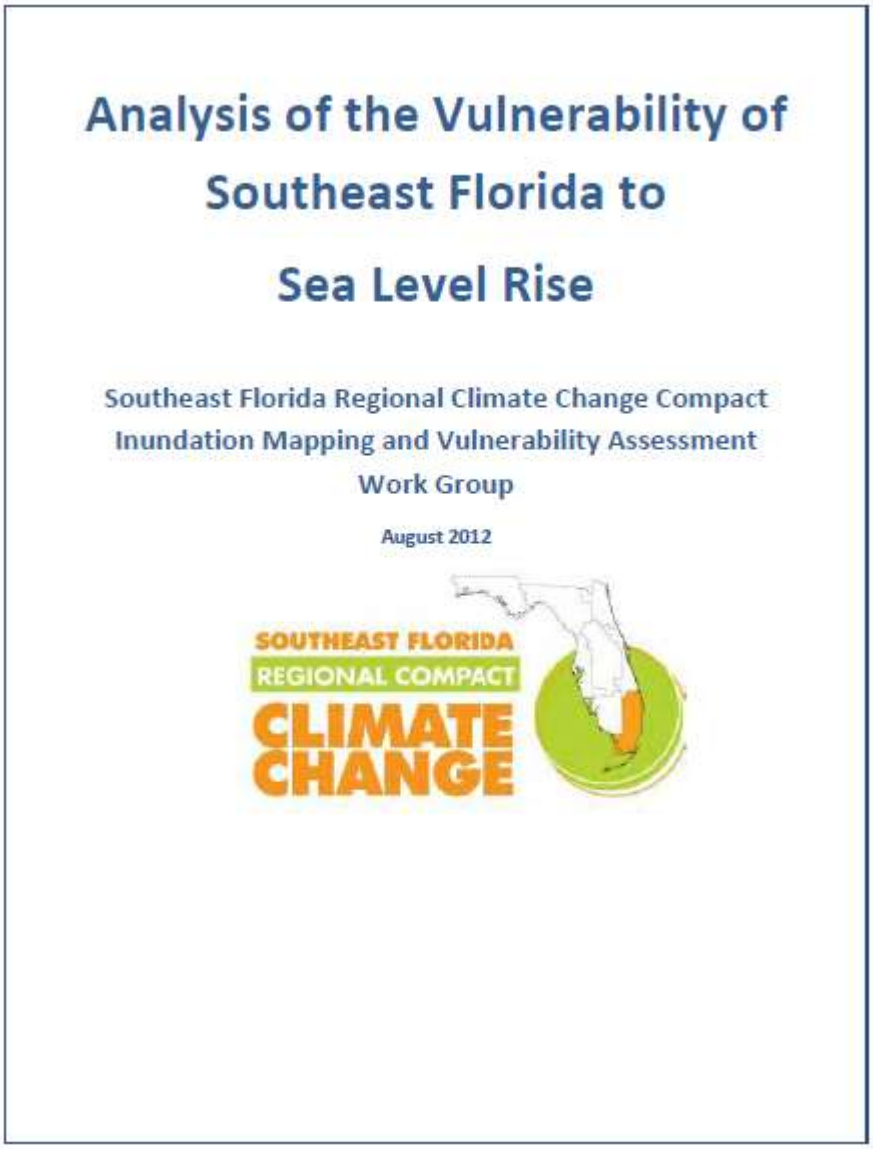
Broward County's Government operations FY2011 carbon footprint is 250,255 tonnes eCO_2, a net reduction of 5,781 tonnes eCO_2 compared to FY2010. Approximately 74 percent of the emissions are generated by electricity use at Port Everglades, the Fort Lauderdale-Hollywood International Airport, Wastewater Services, Streetlights and other County facilities; a net decrease of

Appendix CC-D: Unified Sea Level Rise Projection for Southeast Florida, 2015



Appendix CC-D can be found by clicking the hyperlink:

Unified Sea Level Rise Projection for Southeast Florida



Analysis of the Vulnerability of Southeast Florida to Sea Level Rise

Southeast Florida Regional Climate Change Compact
Inundation Mapping and Vulnerability Assessment
Work Group

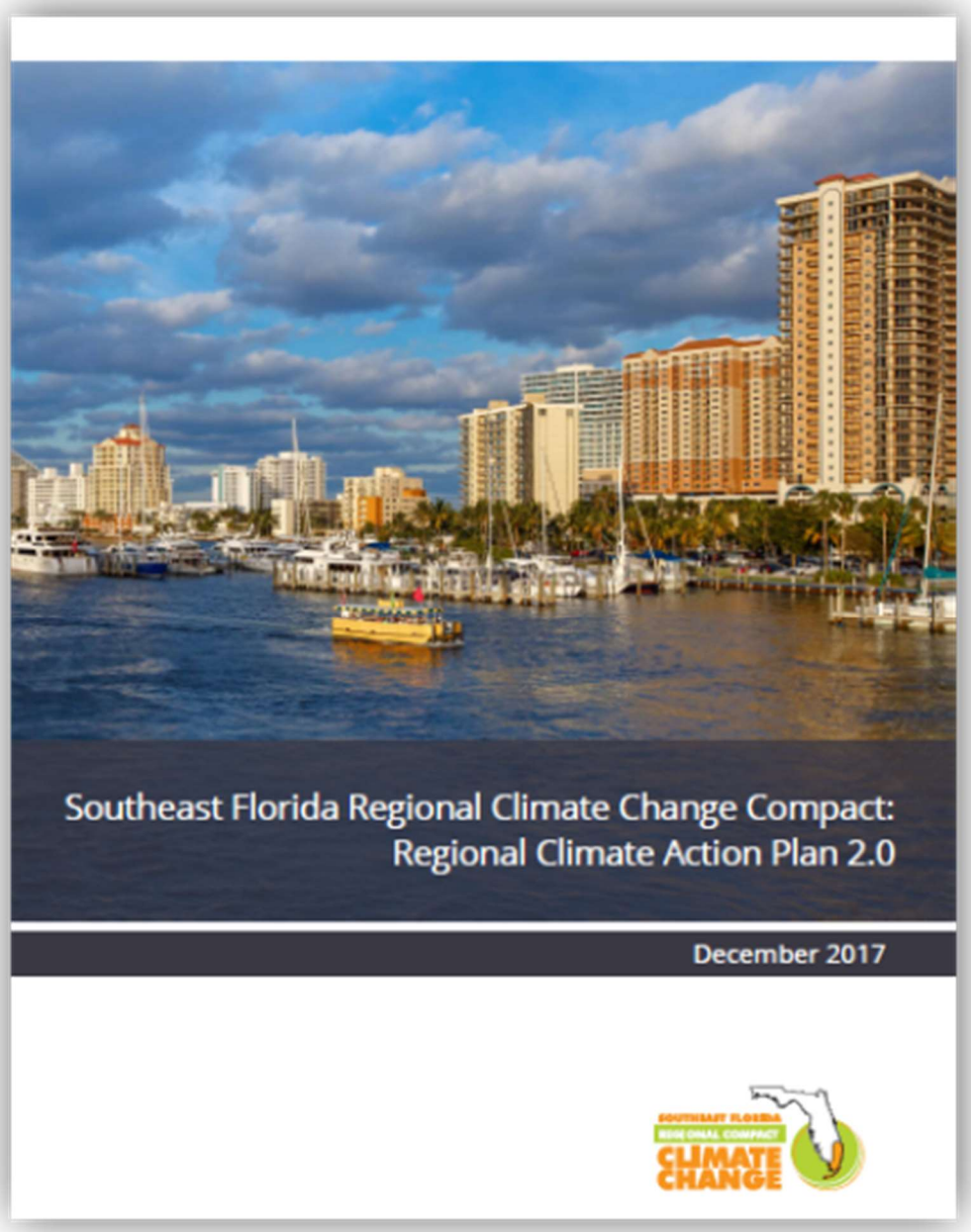
August 2012

SOUTHEAST FLORIDA
REGIONAL COMPACT
CLIMATE CHANGE

Appendix CC-E can be found by clicking the hyperlink:

Analysis of Vulnerability of Southeast Florida to Sea Level Rise

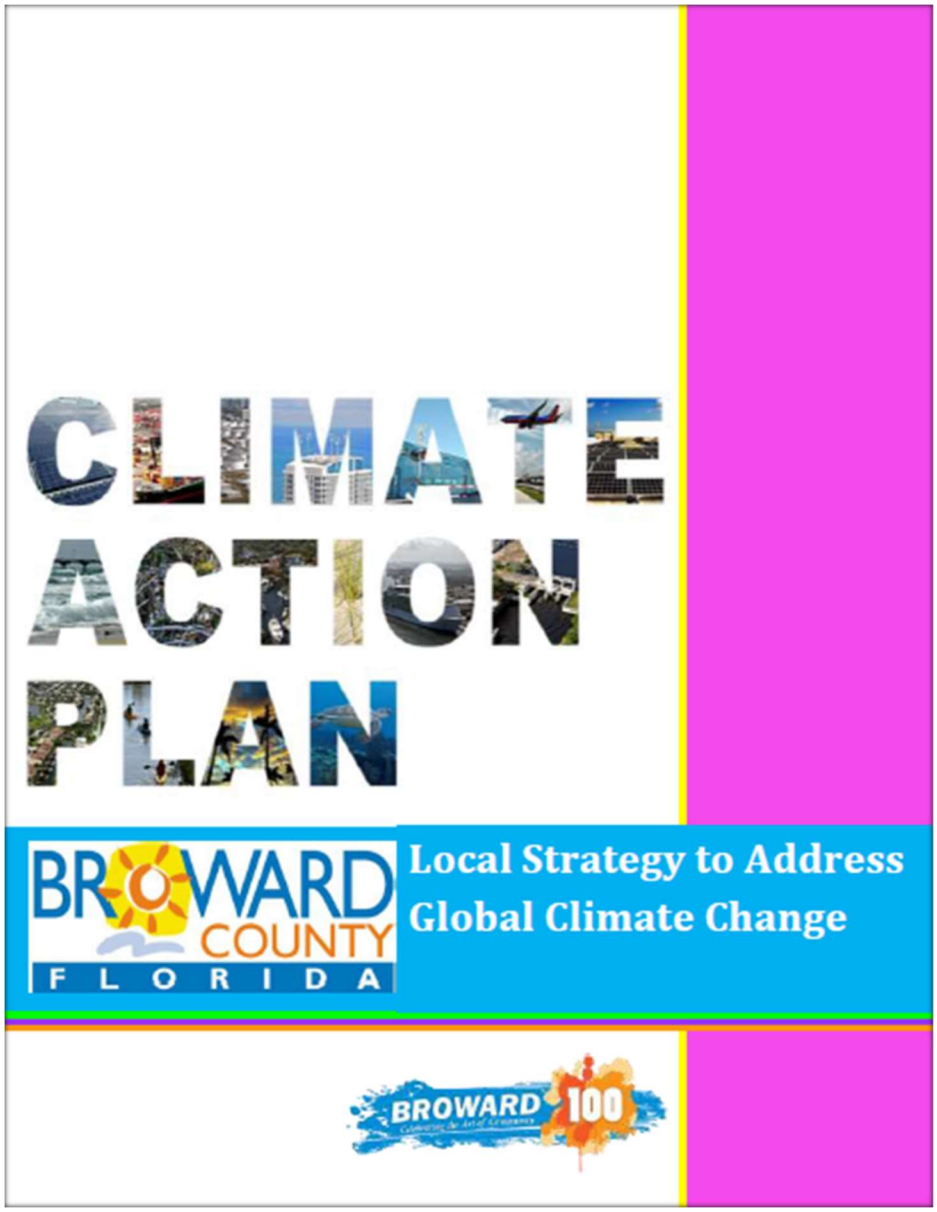
Appendix CC-F: Regional Climate Action Plan 2.0, 2017



Appendix CC-F can be found by clicking the hyperlink:

Regional Climate Action Plan 2.0

Appendix CC-G: Broward County Climate Change Action Plan, 2015



Appendix CC-G can be found by clicking the hyperlink:

Broward County Climate Action Plan