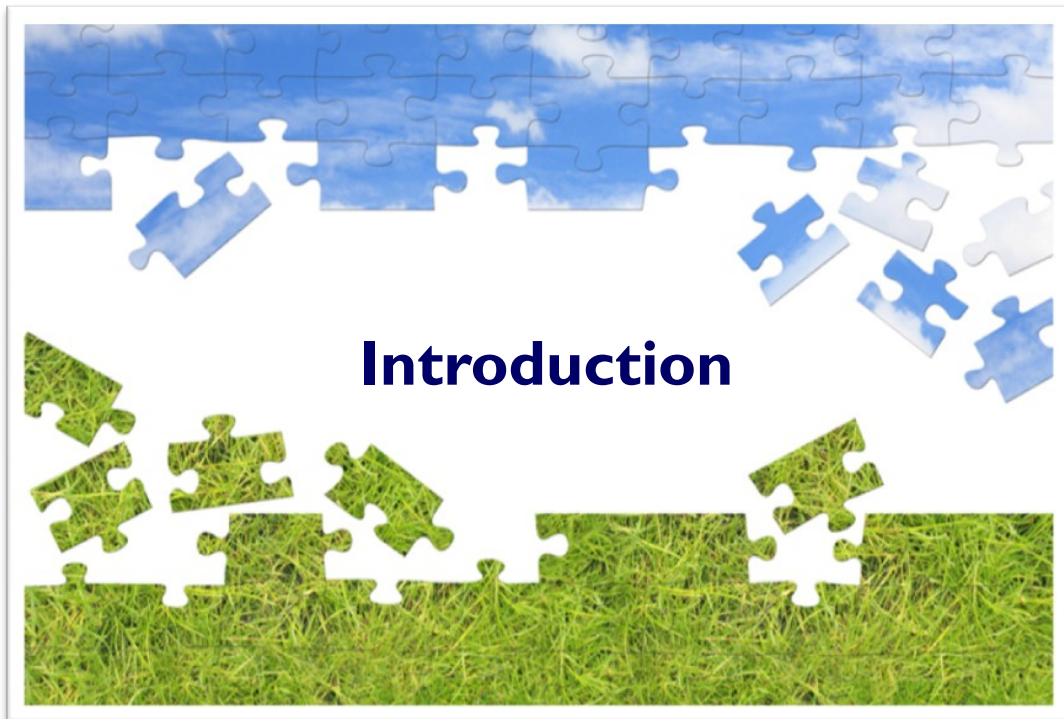


Miami-Dade County Roadmap for Adapting to Coastal Risk

Vulnerability Assessment & Planning Workshop Results & Recommendations



GreenPrint is Miami-Dade County's design for a sustainable future, serving as an overarching plan to reaffirm, establish and synchronize community sustainability goals, initiatives and measures. One critical element of the County's sustainability is its overall resilience capacity—the ability to effectively absorb and rebound from the impacts of hazards. Actions such as improving hurricane response and recovery planning, reducing damages from routine flooding, and minimizing threats from projected sea level rise, all contribute to community resilience, either by mitigating existing vulnerabilities or adapting to future conditions.

To ensure that GreenPrint's recommendations address priority hazard and climate issues and are based on the best available information resources, Miami-Dade County partnered with the National Oceanic and Atmospheric Administration (NOAA) and the National Association of Counties (NACo) through Digital Coast to demonstrate a new community assessment process. The Roadmap for Adapting to Coastal Risk is a participatory assessment process designed to:

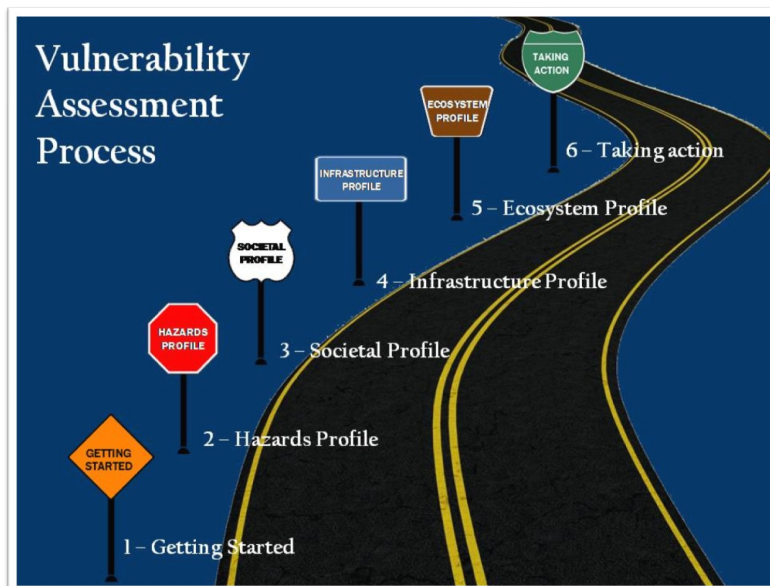
- Engage key staff and stakeholders in a comprehensive, yet rapid, assessment of local vulnerabilities.
- Use existing information resources to evaluate potential hazard and climate impacts.
- Collaborate across disciplines to better understand and plan for impacts.
- Identify opportunities for improving resilience to current and future hazard risks.

This document provides an overview of Miami-Dade County's Roadmap process and outcomes. The information also provides case study materials for use in future Roadmap training and

technical assistance activities in the Digital Coast Inundation Toolkit. The main body of this report focuses on key findings and recommendations resulting from the Roadmap process in Miami-Dade County. The appendices contain additional supporting documentation and information resources. The sections in this report coincide with the recommended steps in the Roadmap process.

These six steps include:

1. Getting Started—define community goals and objectives and highlight priority issues and drivers for consideration throughout the assessment.
2. Hazards Profile—explore relevant hazards, climate trends and potential impacts as a starting point for considering community vulnerabilities.
3. Societal Profile—evaluate strengths and vulnerabilities of local population through analysis of demographics combined with local knowledge and expertise.
4. Infrastructure Profile—identify the strengths and vulnerabilities of the built environment through geographic analysis combined with local knowledge.
5. Ecosystem Profile—consider the strengths and vulnerabilities of important natural resources through data assessment combined with local expertise.
6. Taking Action—explore opportunities and challenges for risk-reduction through education, planning and regulatory processes.



Step I— Getting Started (Community Profile)



I.1 Scoping

An initial scoping session for the Roadmap activities was conducted by the Miami-Dade County Office of Sustainability and NOAA Coastal Services Center in November, 2009. The session agenda included 1) providing an overview of the Roadmap process for key stakeholders and 2) soliciting input about ongoing local issues, activities and partnerships. The following outcomes resulted from the scoping meeting:

- Relevant Ongoing Efforts—There were numerous planning and implementation efforts underway that were determined to be relevant to the proposed assessment. The highest priority connection for the Roadmap effort was identified as the County’s GreenPrint Sustainability Plan that was in the early stages of development. In particular, the Roadmap community assessment process was seen as an opportunity for helping to inform adaptation recommendations in the GreenPrint Climate Action Plan.

Additional ongoing activities with important relationships to the Roadmap process included the Climate Change Advisory Task Force, the South Florida Climate Change Compact, and the County’s Comprehensive Plan Evaluation and Appraisal Report (EAR) update. The Roadmap assessment process would need to include information and stakeholders associated with these ongoing efforts.

- Roadmap Assessment Workshop—It was determined that the proposed Roadmap process, including an intensive two-day workshop, would provide an ideal opportunity for key County staff and stakeholders to contribute to a participatory assessment with multiple benefits. By engaging in a targeted assessment process, staff across various departments and disciplines could contribute to the identification of general issues and priorities across the County while also gaining specific hazard risk knowledge and resources for use in their individual areas of responsibility. The objectives established for a County Roadmap Workshop included:



- ⇒ Understand key local issues and drivers related to hazards, local planning, and decision processes.
- ⇒ Identify how targeted hazards impact day-to-day operations.
- ⇒ Evaluate strengths and vulnerabilities associated with local infrastructure, housing, ecosystems and local populations
- ⇒ Identify strategic approaches for addressing hazard risks and vulnerabilities.
- ⇒ Position the County to continue planning for and adapting to coastal risks and vulnerabilities.



- **Regional Coordination Needs**—One of the major challenges identified across the four counties in the South Florida Climate Change Compact was the lack of a common consistent method for mapping sea level rise projections across the region. The need to address mapping inconsistencies across jurisdictional boundaries through a regional technical mapping workshop was defined as a high priority for informing all future vulnerability assessment and planning efforts. The objectives established for a South Florida Inundation Mapping Workshop were:

- ⇒ Determine best available elevation source data for sea level rise inundation mapping in Broward, Miami-Dade, Palm Beach, and Monroe counties
- ⇒ Agree on consistent methodologies for creating digital elevation models
- ⇒ Agree on consistent methodologies for creating water surfaces.
- ⇒ Identify common options for visualizing risk and expressing uncertainty associated with sea level rise inundation mapping



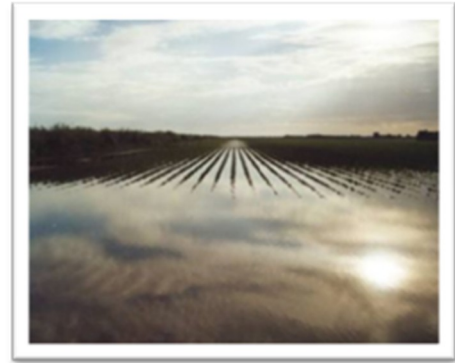
1.2 Targeted Outcomes

The following outcomes served as drivers for the Roadmap Workshop, helping shape the assessment process, outcomes and recommendations.

- Identify likely impacts associated with climate trends, building on relatable information about current hazard threats, resource vulnerabilities, and operational concerns.
- Include the two highest priority vulnerabilities related to sea level rise—1) salt water intrusion into the aquifer and 2) increased flooding/storm surge risks associated with higher water levels.
- Support prioritization of “no-regrets” adaptation options— those addressing multiple

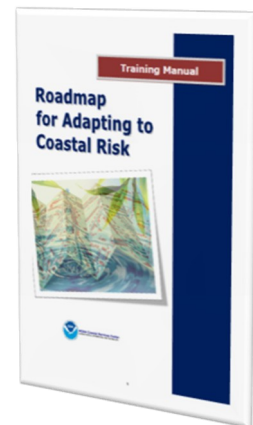
risks and producing cost-effective benefits regardless of climate uncertainties.

- Support adaptation strategies that institutionalize hazard and climate risk considerations in long-term planning, capital investments and infrastructure replacement programs.



I.3 Mapping Resources

An important objective for NOAA in the pilot implementation of the Roadmap process was to demonstrate effective uses of geographic information system (GIS) resources in a participatory vulnerability assessment. The GIS Division of Miami-Dade County's Enterprise Technology Services Department worked closely with NOAA to identify and provide the most appropriate and relevant geospatial information available to support the County's Roadmap effort.



The GIS Division generated a series of printed maps that were used by the workshop participants for hands-on assessment and visualization activities. These products were also used to create a case study and exercise materials for NOAA's "Roadmap for Adapting to Coastal Risk" training course, and are being used by coastal communities around the country as a model for the vulnerability assessment process. Some of the key mapping resources used included:

- High Hazard Area Maps (flooding, sea level rise, hurricane storm surge)
- Demographic Maps (population density, elderly, poverty, societal vulnerabilities)
- Capital Improvements Maps (planned facilities & infrastructure)
- Critical Facilities Maps (emergency, police, fire, hospitals, shelters)
- Water & Sewer Maps (service areas, facilities, wellfield protection)
- Land Use Maps (existing & planned land uses)

- Land Cover Maps (wetlands, natural areas, open space)
- Planning Area Maps (recreation master plan, water & sewer master plans, land acquisition plan)

I.4 Information Resources—Plans, Studies & Other Documents

Another goal for the pilot Roadmap effort was to demonstrate potential connections across a wide range of community programs and activities. By leveraging with ongoing efforts, the participatory vulnerability assessment process efficiently builds off of existing information resources, adding valuable local knowledge and expertise. Planning for the Roadmap workshop included efforts to identify key information sources and compile them into a relevant and useful “media gallery” for workshop participants. Some of the key information resources used included:



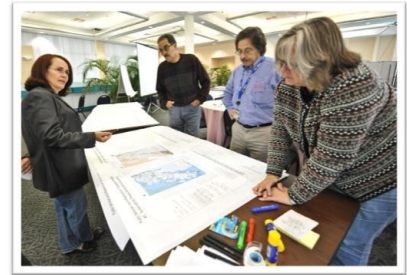
- Sustainability Assessment
- Climate Change Advisory Task Force Recommendations
- Miami-Dade County Flood Management Task Force Recommendations
- Local Hazard Mitigation Strategy
- Comprehensive Plan (Evaluation and Appraisal Report)
- Comprehensive Social Services Master Plan
- Parks & Open Space Systems Master Plan
- Climate Change and Water Management in South Florida
- Urban Ecosystem Analysis
- Water Use Efficiency Plan
- South Florida Ecosystem Region Task Force Natural Lands Report

I.5 Multi-Disciplinary Perspectives & Participatory Process

Roadmap workshop participants were selected across a wide range of disciplines based on their likely contributions to the overall workshop goals. The participatory workshop process was

designed to solicit and build upon the input and expertise of the attendees. Participant categories included:

- Public Safety (emergency management, floodplain management, hazard mitigation)
- Transportation (roads, transit, port)
- Planning (building officials, long-range planning, permitting)
- Public Works (engineering, water, wastewater, operations & maintenance)
- Housing & Community Development
- Environment (land conservation, wildlife management, sustainability, coastal management)
- Recreation & Cultural Resources
- Human & Social Services



I.6 Community Profile—Local Priorities

The initial activities during the Roadmap Workshop served to “ground-truth” participant perspectives on local vulnerability issues and priorities. The following points summarize key issues and emphasize input from the workshop participants:

- ***Connecting climate adaptation strategies to relevant ongoing management efforts:***

Coastal flooding is a continuous ongoing problem that is also highly susceptible to significant negative consequences of changing climate conditions (sea level rise, changing precipitation patterns). Coastal flooding probabilities are not only affected by climate conditions but are also impacted by physical changes to infrastructure and the environment. Vulnerabilities to the impacts of coastal flooding are also constantly changing with development patterns, design standards, and population and economic trends. It will take a comprehensive and dynamic approach to coordinate and manage these diverse factors effectively.

- ***Monitoring and managing threats to local freshwater resources:***

The most urgent climate-related concern for workshop participants was identified as the need to ensure the future of the region’s drinking water supply. Numerous factors contribute to both short-term and long-term threats to the area’s freshwater resources, requiring far-sighted and proactive approaches to water management. There is a need to better understand the long-term effects of salt intrusion into the freshwater aquifer and predict how



these impacts might unfold under different sea level rise scenarios. It is important to integrate this information into broader assessment, planning and management of water resources (e.g. exploration of alternative sources, implementation of water conservation measures, evaluation of impacts of policy scenarios).



- **Monitoring and managing threats to public health and safety:**

The health and safety of the public continue to be top priorities for the County. In an area that is highly susceptible to impacts from hurricanes, storms, intense rainfall and tidal flooding, even the most subtle changes in short-term climate conditions such as El Nino or long-term climate trends such as sea level rise can significantly affect health and safety. Increased exposure to hazards raises public safety risks to both direct and indirect impacts. While certain locations or individuals may be more at risk than others to direct hazard damages, broader public safety risks associated with operational impacts can affect nearly anyone. Some examples include preventing emergency access, impeding evacuation, disrupting critical life support services, creating dangerous driving or working conditions, and tainting food or water supplies.

- **Ensuring sustainability and cost-effectiveness of public investments:**

sustainable and integrated approach to planning, designing, and maintaining public infrastructure and natural resources is critical to addressing the three issues above. Based on comprehensive assessments of risks and vulnerabilities, priorities need to be identified for public investments in land acquisition and natural resource protection that can also meet hazard and climate adaptation needs. Plans for future public investments in critical infrastructure for water, wastewater, transit, transportation and emergency services should be integrated more fully into sustainability planning and provide explicit linkages to hazard management and climate adaptation strategies.

- **Pursuing effective public awareness and engagement strategies:**

Public backing and support are essential to implementing effective long-range adaptation strategies. Developing and communicating consistent, clear, concise, and actionable messages should be a major focus of this effort throughout the process and should be initiated from the very beginning. The strategy should reach out public officials and average citizens and clearly identify what it is they can or should be doing.



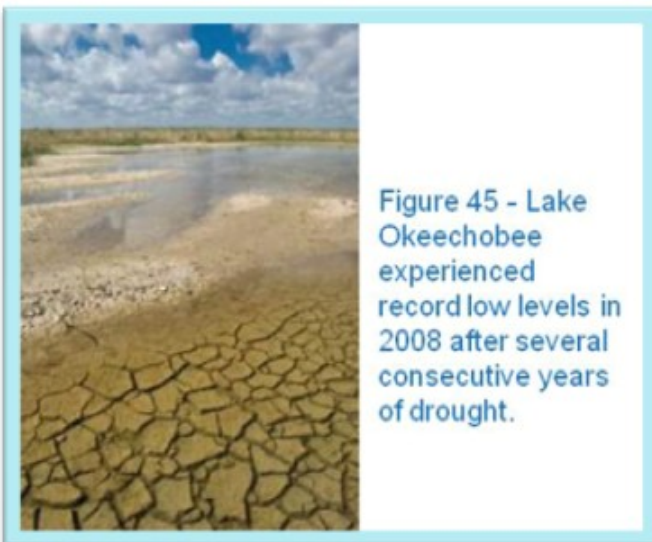
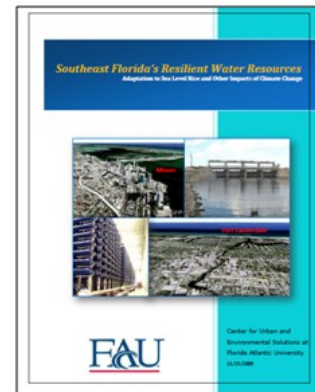
Step 2 – Hazards Profile

2.1 Hazards Information

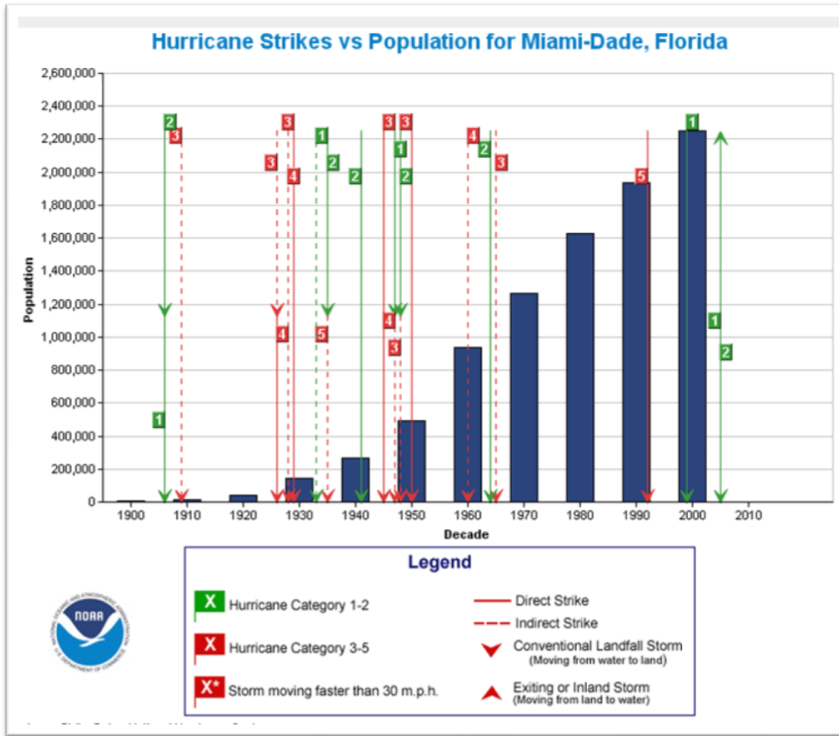
The graphics below include a hazard risk assessment table from the Local Mitigation Strategy. It provides a summary of the main hazards considered in the development and prioritization of local hazard mitigation projects. Many of these hazards also have the potential to be exacerbated or influenced by changing climate conditions. The high frequency and extensive severity of flood hazards make it a high priority for risk reduction. Flooding due to storm surge is also a major component of the catastrophic loss potential associated with hurricane hazards.

Risk Assessment by Hazard for Miami-Dade County

Hazard	Frequency	Severity/Potential Loss
Agricultural Hazards	Medium	Extensive
Drought	Low	Serious
Extreme Heat	Low	Moderate
Flood	High	Extensive
Hard Freeze	Low	Extensive
Hazardous Materials	Medium	Serious
Hurricane Wind & Surge	Medium	Catastrophic
Mass Migration	Medium	Moderate
Nuclear Power Plant	Low	Catastrophic
Tornado	Medium	Extensive
Thunderstorm/lightening	High	Serious
Tsunami	Low	Moderate
Wildfire	Medium	Moderate



On October 3, 2000, a tropical low pressure center moved over South Florida, dumping over 15 inches of rainfall on the Miami International Airport in less than 15 hours. Miami-Dade County was the most severely flooded with an estimated 94,350 homes and 500 businesses affected, and 15 schools closed. Standing water became contaminated with sewage and fuel, creating a serious public health threat in many parts of the community. Damages to the infrastructure have been estimated at \$100,000,000, and agricultural losses will exceed \$219,000,000.



The graphic above provides an interesting look at the frequency of hurricanes in the area. From this graphic, you can see that the County has experienced fewer hurricanes during the last 50 years than were experienced in the 50 years prior. There has also been a massive increase in the County's population during this "quieter" hurricane period, leading to a significant rise in the area's overall vulnerability to impacts.

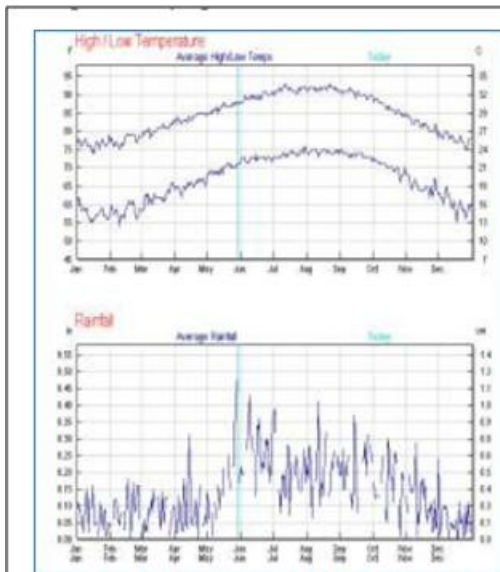


Figure 16 - Southeast Florida rainfall pattern is highly seasonal with relatively dry winter and spring and rainy summer and autumn. Approximately 70% of its rainfall occurs during the rainy season. (SFWMMD)

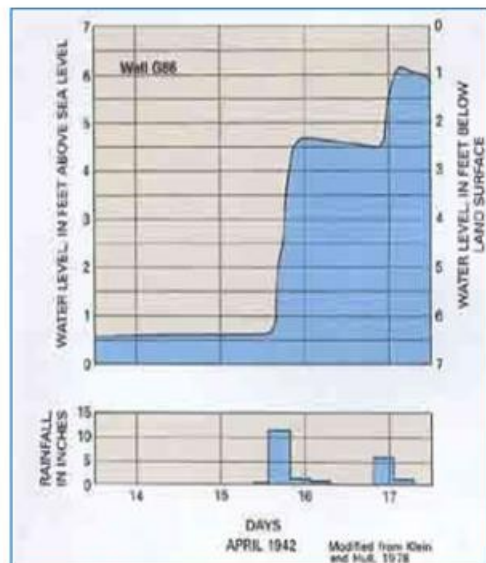
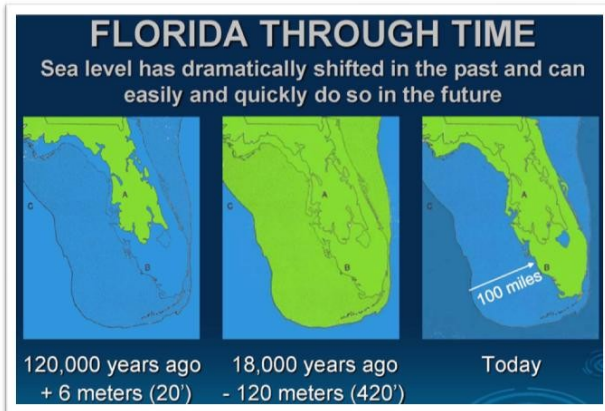
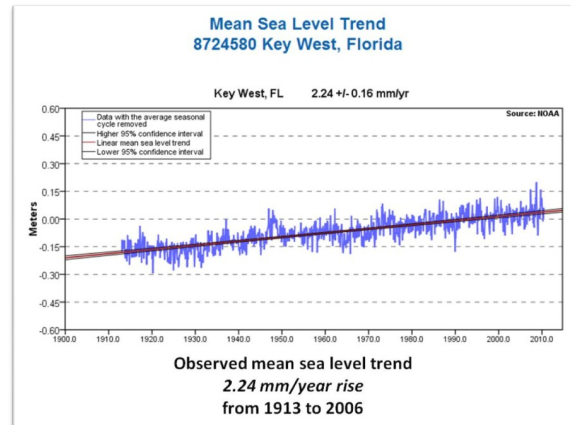


Figure 15 - Water table in Biscayne Aquifer responds rapidly to rainfall. (USGS)

The information below identifies some of the potential impacts associated with projected changes in local climate conditions. This information was used by workshop participants to explore connections between current hazards and future risks.



"Previous defense projects have shown that implementing coastal protections infrastructure typically has a lead time of 30 years or more."³

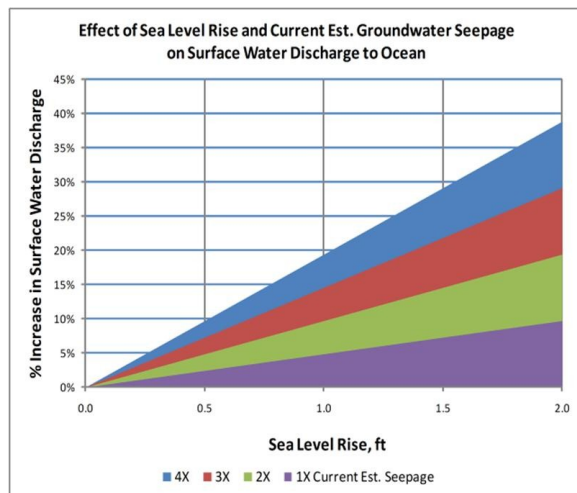


Beach Erosion Control Activities
From 26 St to 35 St



Sea Level Rise Impacts

- **Flooding**
 - Population Displacement
 - Land-use Changes
- **Infrastructure Damage**
 - Buildings
 - Utilities
- **Saltwater Intrusion**
 - Water Supply
 - Storm Water vs. Water Supply
- **Beach Erosion**
 - Tourism Impacts
 - Decreased Coastal Protection
 - Increased Restoration Costs
- **Loss of Coastal Wetlands**
 - Fisheries
 - Biodiversity
 - Coastal Armoring



Changing Weather Patterns

- **Increase in Temperature**

- Heat-related Illnesses
- Infectious Diseases
- Agricultural Impacts

- **Drought**

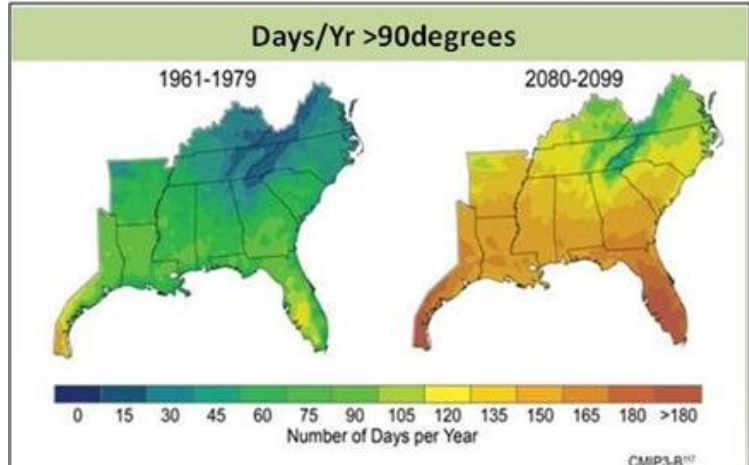
- Agriculture
- Water Supply

- **Intense Rain Events**

- Storm Water vs. Water Supply
- Infectious Diseases

- **More Intense and/or Frequent Hurricanes**

- Infrastructure Damage
- Population Displacement



What is known:

The majority of climate models predict an increase in temperature during the next 50 years. In addition, evaporation from open water and soil and transpiration from plants will likely increase.

What is known:

Rainfall amounts and intensities will likely change, but projections vary greatly. Some scientists predict rainfall increases while others forecast decreases compared to historical observed normal amounts.

What is probable:

Rainfall amounts in South Florida are projected to either increase or decrease by as much as 20 percent. This could result in longer stretches of wet and dry periods with droughts more likely to occur.



What is known:

Hurricane frequency and strength have increased dramatically since 1995. Much of the change is attributed to natural cycles.

What is probable:

Hurricane and tropical storm frequency will continue to change in comparison to the historical record.



2.2 Hazard Maps

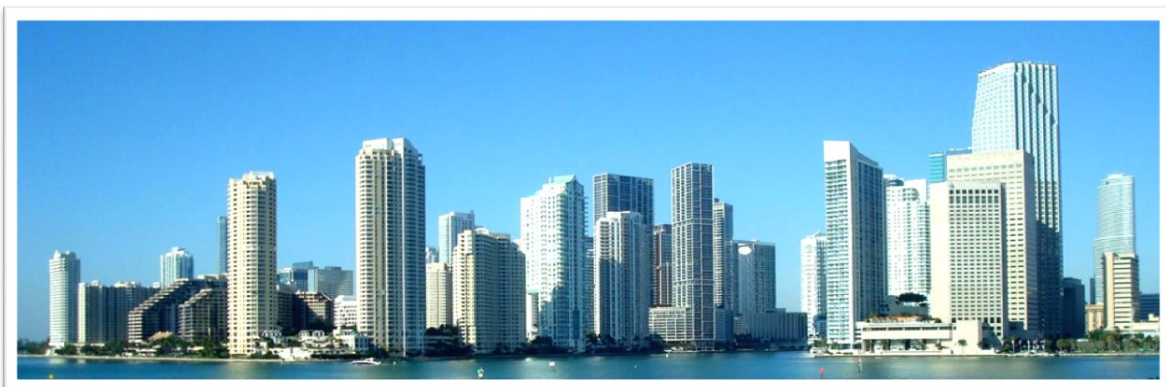
The following pages contain images of the Hazard Profile map products used during the Roadmap Workshop:

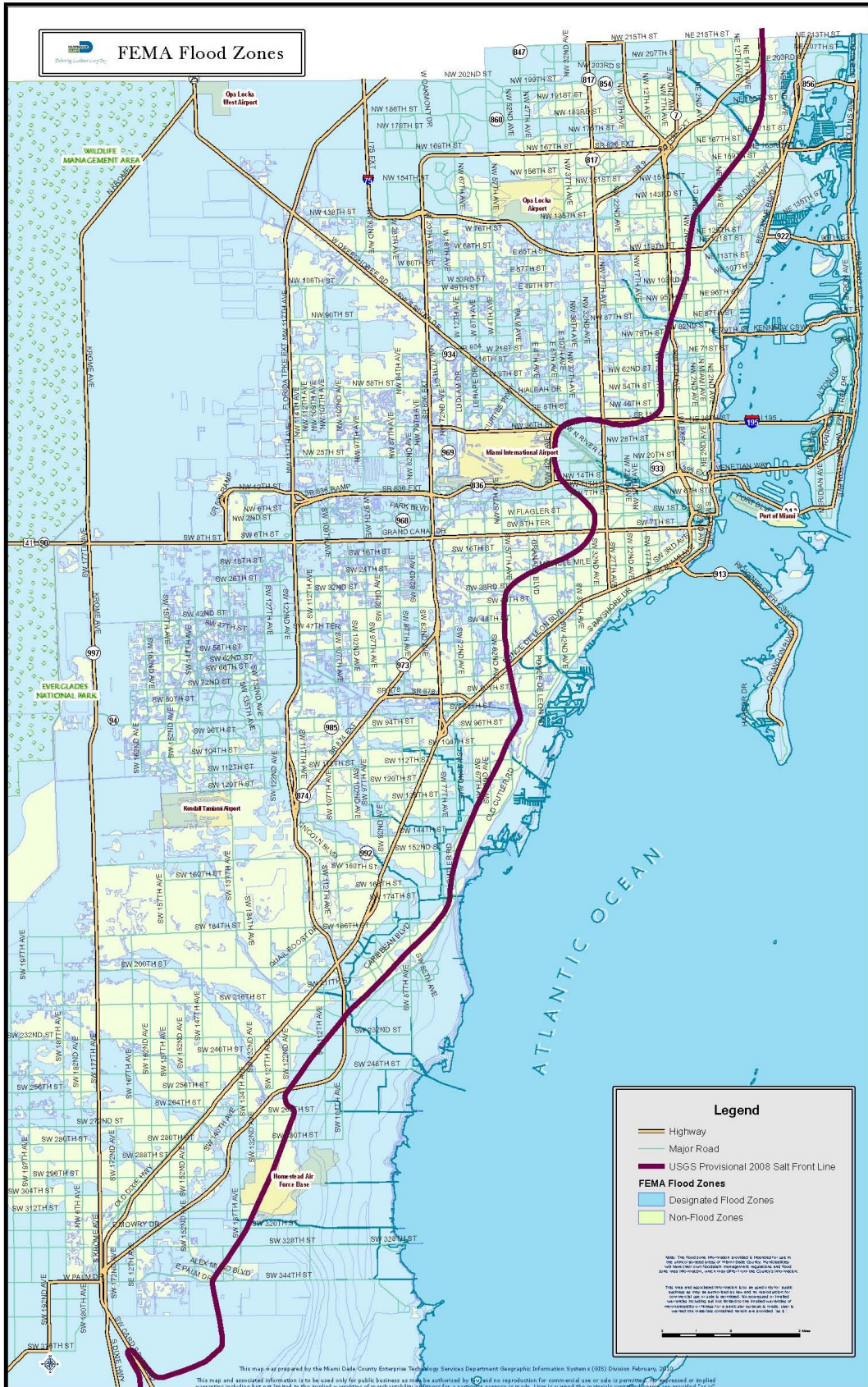
- FEMA Flood Zones
- Potential Sea Level Rise Zones
- Hurricane Evacuation Zones
- Groundwater Wellhead Protection Areas

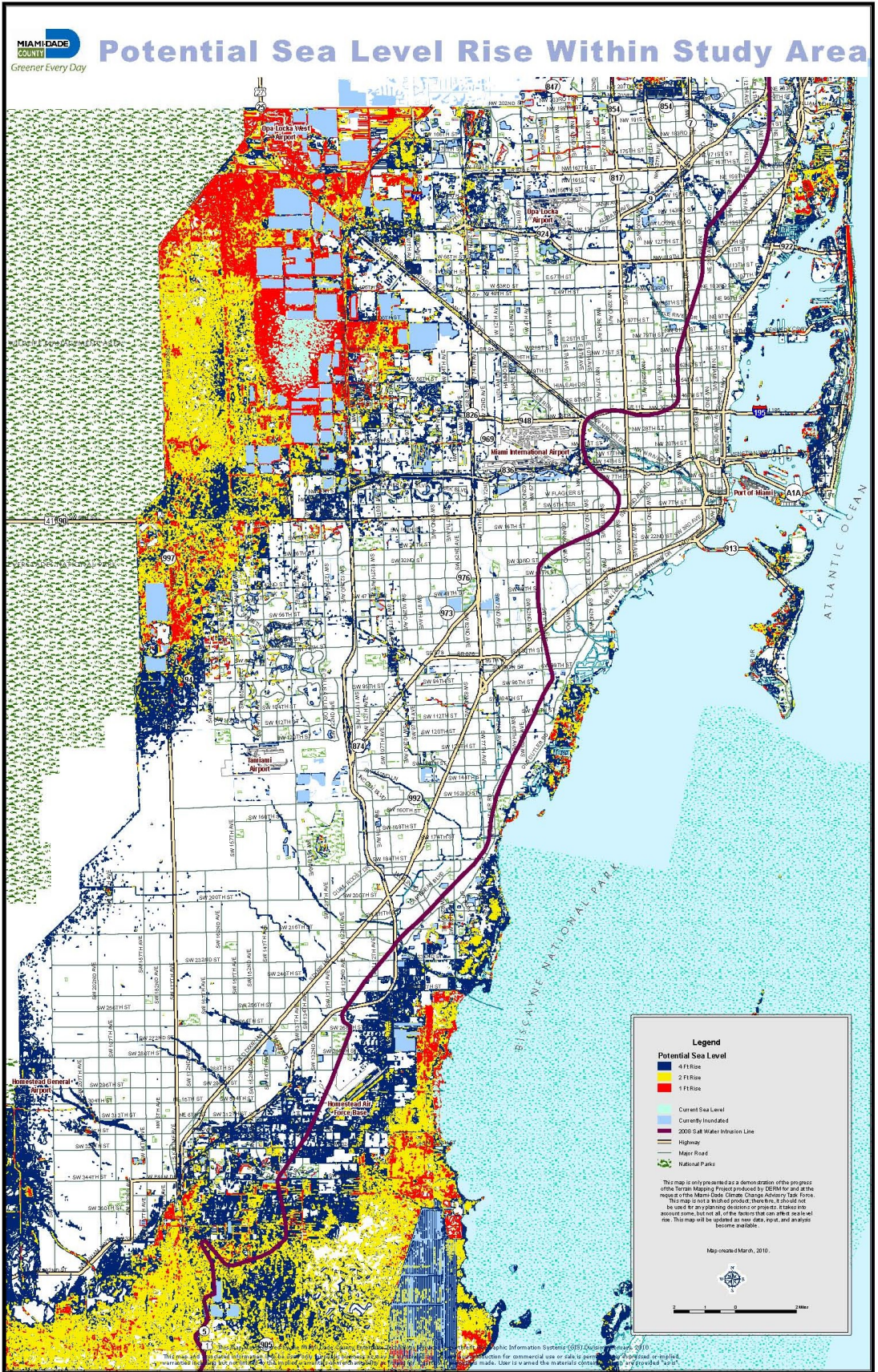


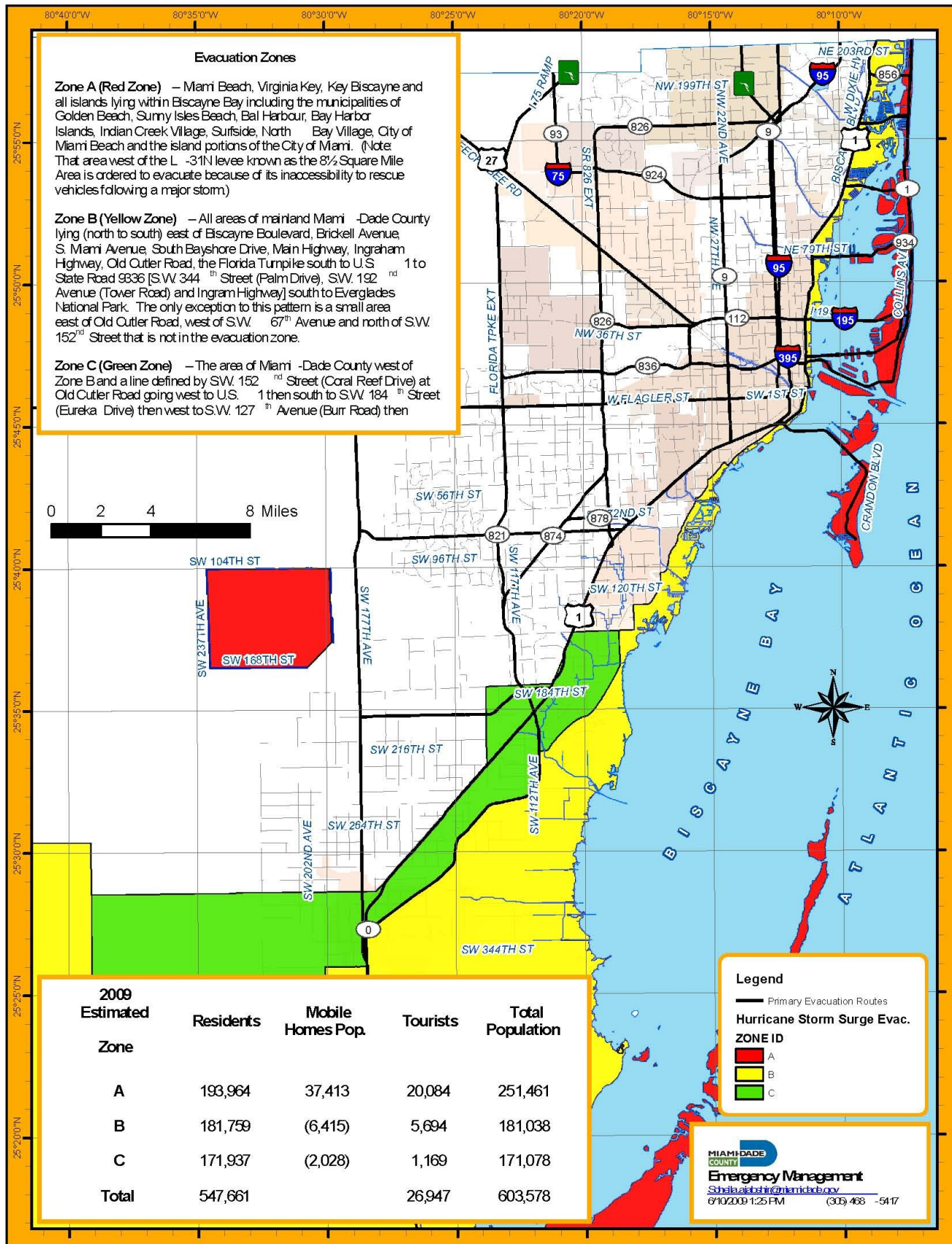
Workshop participants used the maps and profile information as resources to explore hazards and climate-related concerns and priorities. Some of the considerations groups were encouraged to discuss in the Hazards Profile discussions included:

- Looking at the hazards maps and data, what locations, impacts, and/or issues are you most concerned about?
- Considering climate trends and their projected effects on hazards, what locations, impacts, and/or issues are you most concerned about?
- Considering our main concerns and responsibilities, what are some of the key decision-making processes that need to be better informed about risks?
- What are some of the data and information gaps for improving risk-based decisions?



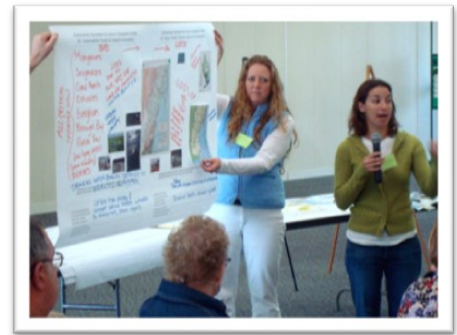




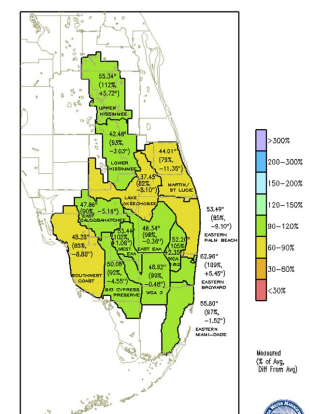


2.3 Hazards Issues & Opportunities

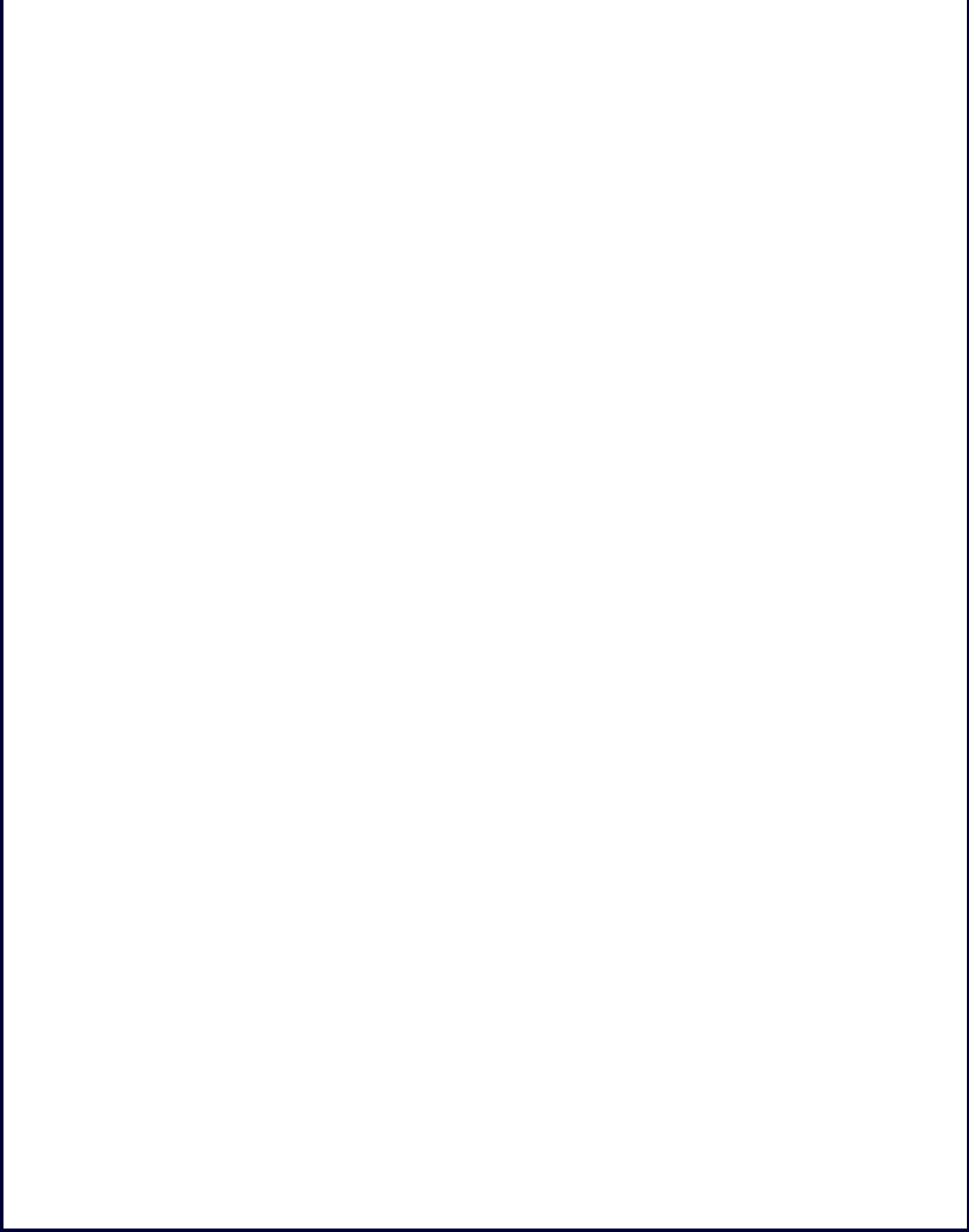
During the Roadmap Workshop, participants used the preceding Hazards Profile information, along with additional information products to identify key issues and opportunities. The following points summarize group priorities:



- There is a lack of awareness throughout County departments about the existence and availability of hazards data, information and mapping products. Most participants agreed that the information products used in the workshop had the potential for significant value throughout the diverse operations. The availability of a data inventory and links to relevant resources would be a great start.
- This venue provided excellent opportunities for staff to explore the science behind the hazards and how they impact resources. Most of the learning took place among the staff sharing with each other. Need to figure out how to provide these types of venues to share relevant expertise.
- There is a need for significantly improved information on projected inundation from the various sea level rise scenarios. Combining downscaled modeling with more accurate topographical data is critical for developing and displaying information that is locally relevant and understandable.
- Combining potential property damages and losses would make the information even more meaningful and providing the capability to zoom in and explore details in certain areas would also make it more relevant to many people.
- The single most important factor for reducing risks is to incorporate considerations of scientifically defensible risk information into ongoing decision processes. Without the processes in place or the information resources widely available, these actions will not be pursued. Specifically, there is a need for a trustworthy, reliable, and consistent information resource that provides current, relevant and useable information about hazards and climate indicators and conditions.
- Some key data sets need to be added to the hazard risk maps to make them more useful in planning and management activities. Adding the Urban Growth Boundary to these maps would help communicate the underlying risks and associated costs of development beyond the existing boundary. Adding elevation or topographic information to these maps would also help in more fully communicating about risks.



DISTRICT-WIDE: 48.48" (93%, -3.39")
4/023 2008-10-21-19:02



Step 3 – Societal Profile

3.1 Societal Information

The graphics below provide a snapshot of the County’s demographic information. This information was used during the workshop to help identify key societal issues and priorities related to short-term hazards and long-term climate adaptation planning.

Population by Age and Sex 2007*

Total population	2,467,583	
Male	1,196,715	48%
Female	1,270,868	52%
Under 5 years	162,511	7%
5 to 19 years	471,869	19%
20 to 44 years	851,117	34%
45 to 64 years	617,994	25%
65 years and over	364,092	15%
Median age (years)	38.7	

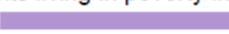
Sources: * Pop. Total: Miami-Dade P & Z Research Section. Distribution percentages: 2007 ACS.

Population by Race and Ethnicity 2007*

Total	2,467,583	
Not Hispanic or Latino	937,682	38.0%
White alone	436,762	17.7%
Black or African American alone	444,165	18.0%
American Indian and Alaska Native alone	2,468	0.1%
Asian alone	34,546	1.4%
Some other race or Two or more races	22,208	0.4%
Hispanic or Latino (of any race)	1,529,901	62.0%

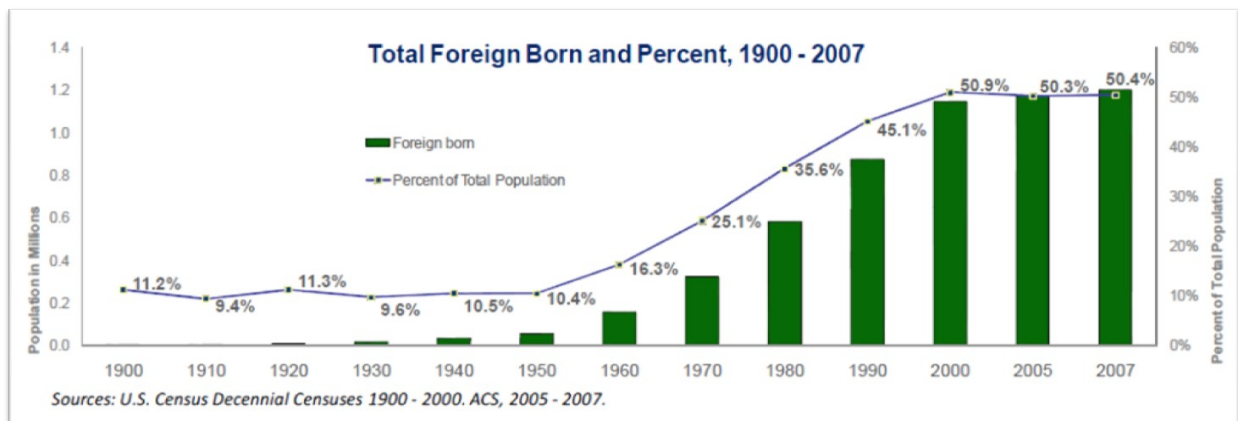
Source: * Pop. Total from Miami-Dade P & Z Research Section. Distribution percentages from : 2007 American Community Survey (ACS).

Percentage of residents living in poverty in 2008: 16.3%

Miami-Dade County:  16.3%

Florida:  13.2%

(9.1% for White Non-Hispanic residents, 23.1% for Black residents, 16.6% for Hispanic or Latino residents, 18.6% for other race residents, 9.7% for two or more races residents)



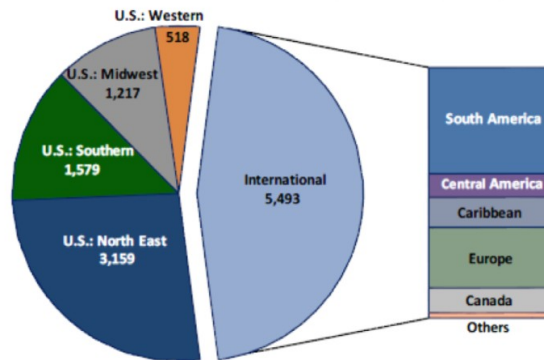
Additional considerations in the societal profile included information about local employment, economic conditions and housing. The following graphics were included as references for the workshop discussions.

Change in GDP by Metropolitan Area

10 Largest MSA's	Change 2001-2006	Population
Houston	49.5%	5,542,048
Miami-Fort Lauderdale	38.7%	5,463,857
Washington DC	38.6%	5,288,670
Los Angeles	34.3%	12,950,129
Dallas-Fort Worth	32.7%	6,006,094
Philadelphia	28.9%	5,826,742
Atlanta	26.8%	5,134,871
New York	25.1%	18,818,536
Chicago	22.4%	9,506,859
Detroit	8.8%	4,468,966

Source: U.S. Department of Commerce, Bureau of Economic Analysis (BEA).

Miami-Dade Visitor's Origins, 2007 ('000s)



Source: Synovate for the Greater Miami Convention & Visitors Bureau.
Note: Study included visitors staying at least 1 night in the Greater Miami Area



Port of Miami Quarterly Cruise Ship Passengers

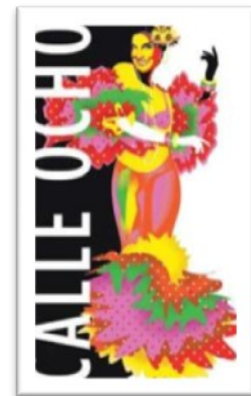
	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Annual (YTD)	Yr/Yr Change
2002	1,071,683	855,334	817,481	980,893	3,725,391	
2003	1,233,670	937,743	808,308	892,203	3,871,924	3.9%
2004	1,051,339	847,408	705,169	905,578	3,509,494	-9.4%
2005	1,070,464	878,507	747,699	911,948	3,608,618	2.8%
2006	1,102,130	936,626	780,755	1,002,578	3,822,089	5.9%
2007	1,129,436	894,865	760,531	1,021,131	3,805,963	-0.4%
2008	1,262,397	949,100	905,577	1,102,447	4,219,521	10.9%
2009	1,263,765	-	-	-	1,263,765	

Sources: GMCVB, Port of Miami.

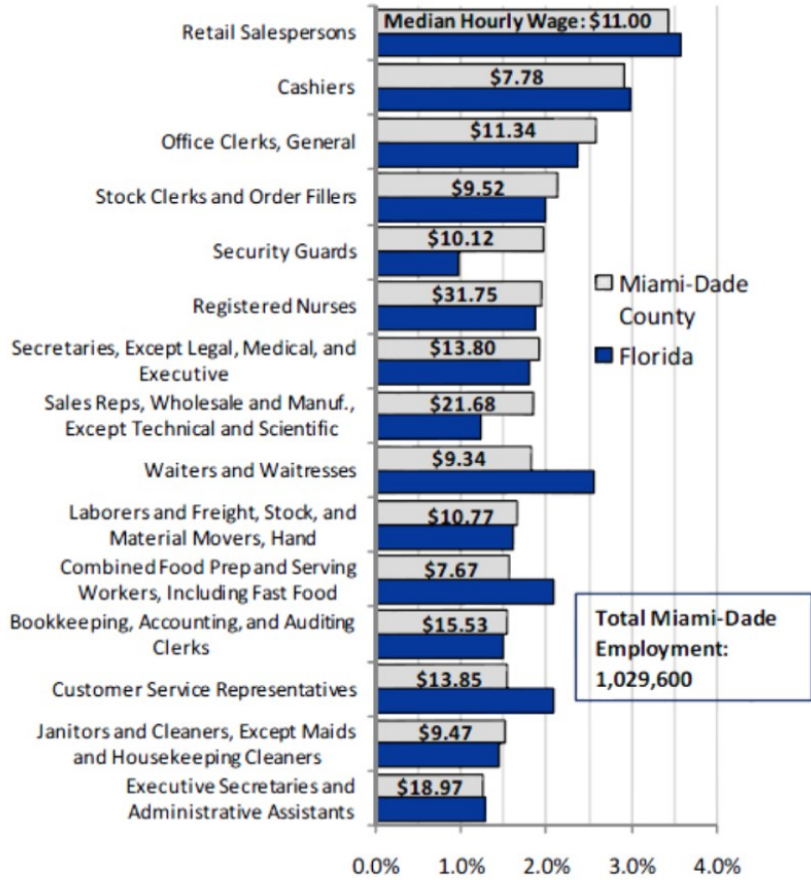
Housing Characteristics 2007

Total housing units	971,608		Value of Owner-occupied units		
	Owner-occupied units	501,722	Owner-occupied units	501,722	
Occupied housing units	833,199	86%	Less than \$100k	19,025	4%
Owner-occupied	501,722	60%	\$100k to \$149.9k	23,912	5%
Renter-occupied	331,477	40%	\$150k to \$199.9k	53,014	11%
			\$200k to \$299.9k	134,916	27%
Vacant housing units	138,409	14%	\$300k to \$499.9k	175,343	35%
Homeowner vacancy rate	3.8		\$500k to \$999.9k	95,512	15%
Rental vacancy rate	7.9		\$1,000,000 or more	22,946	5%
			Median (dollars)	\$ 318,100	

Source: 2007 American Community Survey.



Top 15 Occupations in Miami-Dade
 % of Total Employment & Median Hourly Wage



Source: Agency for Workforce Innovation, 2008



Miami-Dade County Homeless Trust safeguards homeless people against impending cold front (Miami-Dade County, FL) –


In an effort to safeguard homeless people against the cold front impacting all of South Florida, the Miami-Dade County Homeless Trust is in cold weather outreach mode. More than 40 homeless outreach workers are on the streets. These workers fan the community engaging homeless people on the streets, under bridges and other areas and encouraging them to go to a homeless shelter. "We are working with our outreach teams to make sure everyone on the streets is able to get to a shelter before the temperatures drop to life-threatening levels," said Homeless Trust Chairman Ron Book. Temperatures of 35 degrees or less can be life threatening. All partners were asked to make maximum use of space especially this week. Homeless people in temporary emergency shelters will not be discharged until Monday if weather permits.

The following information includes highlighted priorities from Miami-Dade County's

Comprehensive Social Services Master Plan. As part of the Societal Profile, participants explored opportunities for integrating public safety and public health considerations into social services activities and programs.

Priority: Support for cross-system collaboration and service partnerships at the neighborhood level.


Service partnership and neighborhood resource center projects currently in place have shown that neighborhood-based service delivery is the most effective and highly specialized way of targeting a population. It inherently offers a comprehensive approach to service delivery and it can be applied in all cluster areas facilitating an atmosphere of collaboration and cooperation among service providers.



COMPREHENSIVE SOCIAL SERVICES MASTER PLAN 2005-2007
FOR MIAMI-DADE COUNTY
Building a Livable Community for ALL

Implementation Strategies October 2006

Alliance For Human Services
3250 S.W. 3rd Avenue
Miami, FL 33129
305.646.7138
305.646.7139 fax
www.alliancefhs.org




Priority: Increase and expand outreach efforts targeting hard-to-reach and underserved populations.

Many are concerned at the lack of efficiency in outreach efforts, and want to ensure that attention is paid not only to the quality of services delivered, but also to the overall awareness of their availability among consumers. The use of culturally competent outreach materials, as well as appropriate information sessions and collaboration among service providers is necessary to ensure the word reaches the public. It is also suggested that, especially in the cases of neighborhood-based service delivery, funding be combined and distributed among partners to get the word out to targeted residents.

3.2 Societal Maps

The following pages contain images of the Societal Profile map products used during the Roadmap Workshop:

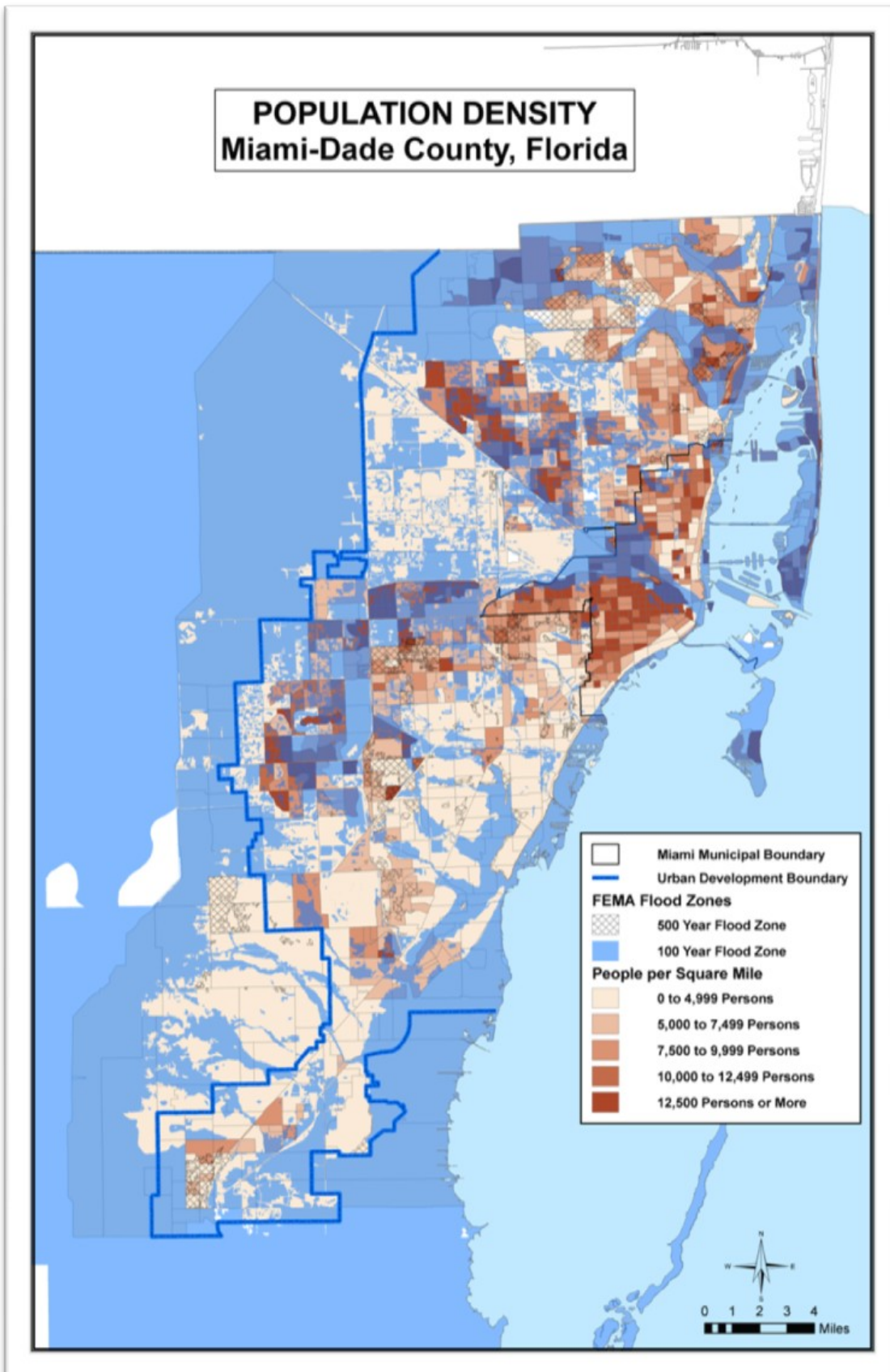
- Population Density in Flood Zones
- Elderly Concentrations in Flood Zones
- Poverty Concentrations in Flood Zones
- Societal Vulnerability Index (SoVI) in Flood Zones

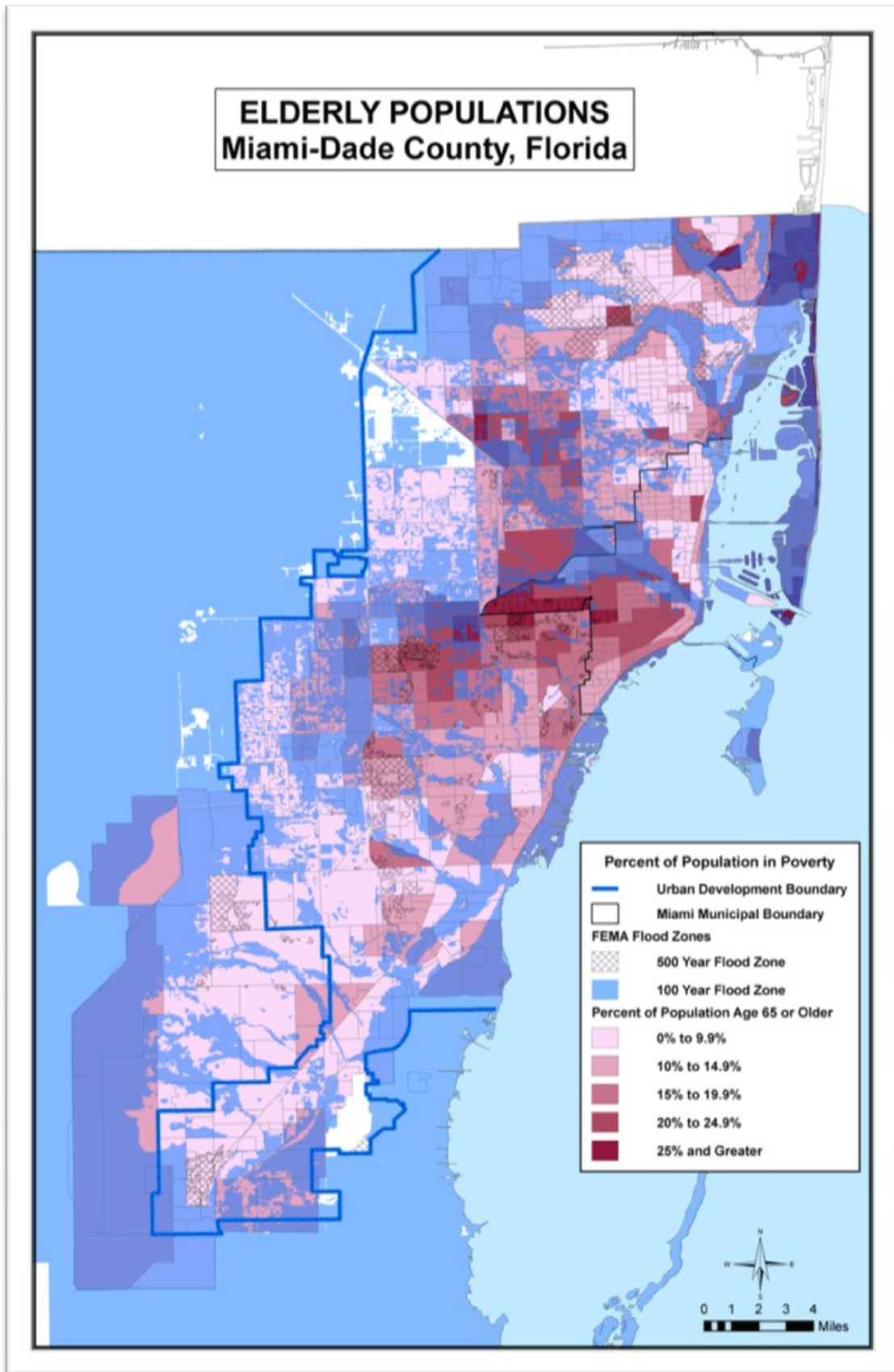


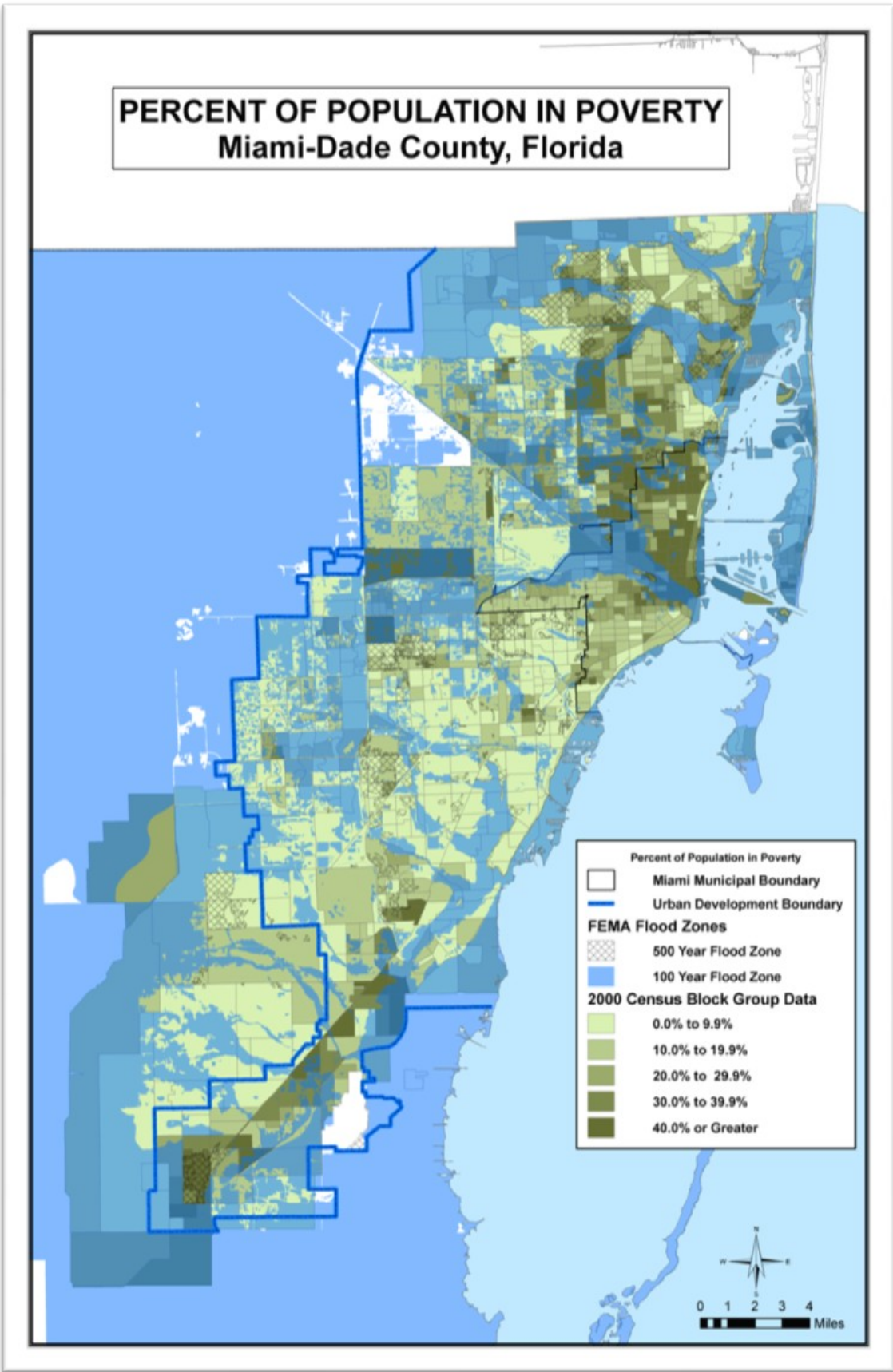
Workshop participants used the maps and profile information to help focus discussions and priorities on issues related to living in high risk areas. Some of the considerations in the Societal Profile included:

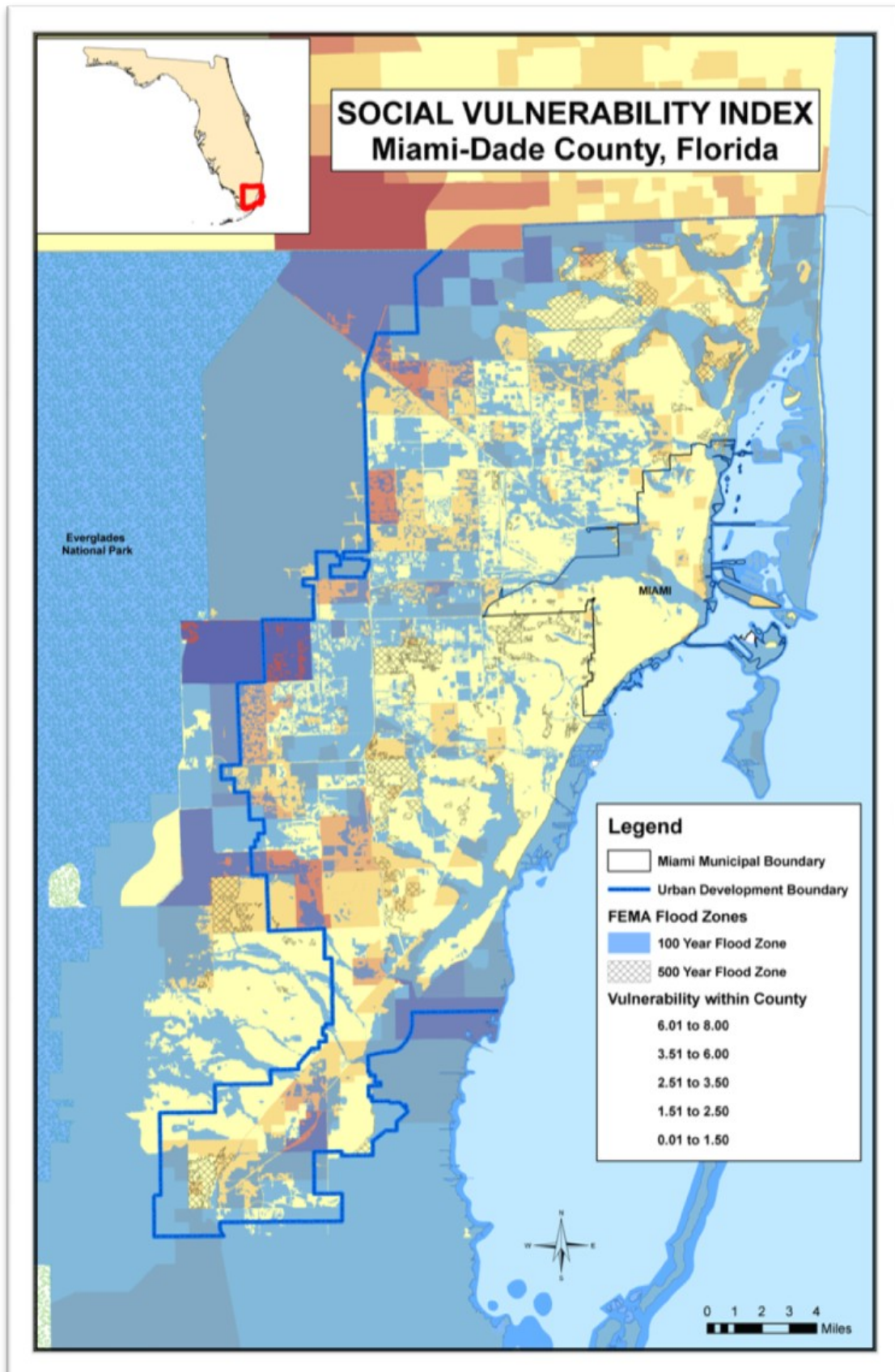
- How well do we handle emergency services for vulnerable populations and how will future hazard risks affect our plans and priorities?
- Are there adequate facilities (shelters, human services, etc.) to handle the needs of vulnerable populations?
- Where do highest concentrations of elderly live? How might their lives be affected by hazards?
- What are other potential population issues and what considerations need to be taken into account when planning for hazards response and long-term adaptation?
- What cultural considerations need to be taken into account when planning? – Consider subsistence populations that live off the land. How do our planning decisions impact populations?
- What are some of the community strengths that future programs could be built upon – social networks, community centers, programs, religious networks, etc.?
- How and where can strong social networks help offset societal vulnerabilities?
- How might societal vulnerability and risk information be used in societal service programs?
- How can this information be useful to increase effectiveness of communication about hazard and climate threats?

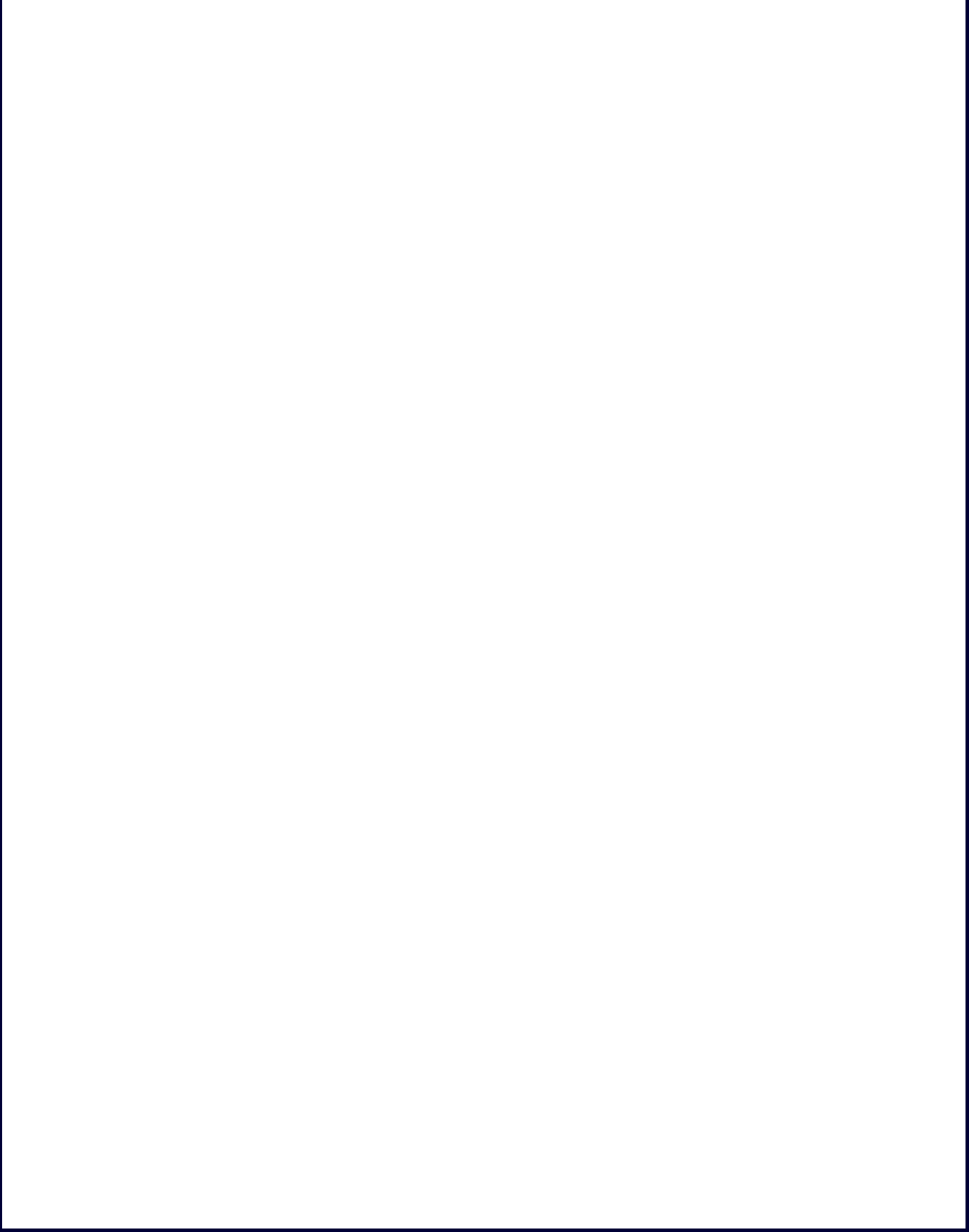












3.3 Societal Issues & Opportunities

During the Roadmap Workshop, participants used the preceding Societal Profile information, along with their own knowledge about the local population, economy and public services, to identify key societal vulnerability issues and opportunities. The following points highlight priority issues and identify key actions for moving forward:

- Miami-Dade County is widely accepted to have strong disaster planning and response capabilities that were developed through significant cooperation and coordination among departments and between public, private and non-profit sectors. This model can provide an excellent foundation for building similar adaptation partnerships.
- Disaster planning and response activities currently emphasize the special needs of vulnerable populations. Additional collaboration and engagement across departments can contribute to these efforts by helping to identify and register residents with special needs and by providing additional outreach opportunities for preparedness programs.
- There is a need across County departments to increase the understanding of how individual programs relate to societal vulnerability and how ongoing programmatic activities might effectively contribute to a comprehensive County-wide strategy.
- There is a need to improve our understanding of how various populations and cultural groups are impacted by changes in the environment. This includes the immediate direct effects on individuals (e.g. injury, property damage, loss of income), longer-term systemic issues (e.g. mental illness, relationship problems, homelessness), and broader cultural issues (environmental justice, culture loss, gentrification). Some examples in the area include:
 - ⇒ Miccosukee Native Americans—strong ties to land and interests in environmental management and restoration of everglades
 - ⇒ Agricultural Industry—livelihoods of workers and overall industry is highly susceptible to small shifts in weather, hazards and climate conditions.
 - ⇒ Commercial & Recreational Fisheries—livelihoods of workers across numerous sectors dependent on natural resources that are highly sensitive to ongoing environmental changes.



- Key societal health measures need to be identified and adopted to establish baseline conditions, set common goals for improving societal health and track collective progress across departments and programs. Working together across the County to measurably improve societal health will have multiple program-specific benefits but will also collectively increase our capacity to absorb hazard and climate impacts.
- An extremely powerful and well coordinated public information and communication strategy needs to be developed and implemented around the concept of “resilience”. Several important issues were raised about the public information strategy:



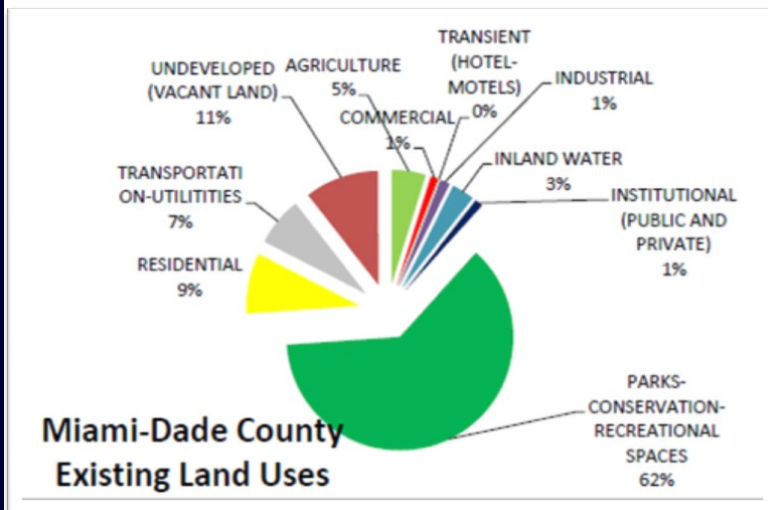
- ⇒ It should neither duplicate nor conflict with messages about disaster preparedness and response. The current emergency management framework is an effective approach for dealing with the “crisis” aspect of hazards.
- ⇒ People are overloading with doom and gloom messages about risks. The long-term nature and political aspects of climate change complicate it with uncertainties and scenarios. Instead of focusing on risks, public information should focus on positive and constructive actions. “Sustainability” should serve as the overarching goal, providing the foundation for a strategy that is more about what can be achieved than about what should be avoided.
- ⇒ Messaging around “resilience” is particularly appealing as it relates to messaging about societal vulnerability. Economic and demographic characteristics can help statistically and programmatically in identifying special needs, locating high concentration areas or targeting general priorities. Attributing “vulnerability” to all individuals within those demographics however is inaccurate, inappropriate and most importantly—not actionable. Communicating about achieving or improving individual and community resilience emphasizes actions and positive outcomes that might be considered otherwise unobtainable when looking at vulnerability factors such as age, race or income.



Step 4 - Infrastructure Profile

4.1 Infrastructure Information

The graphics below provide a snapshot look at the County's land uses and building stock.



Land Area and Existing Uses

- Land area inside the Urban Development Boundary (UDB) represented 17 percent of the County total.
- Residential development within the UDB represented 38 percent of its land area.
- Other important uses inside the UDB were transportation and utilities, undeveloped and water, parks, commercial, institutional and industrial in rank order.
- Outside the UDB, almost 60 percent of the land was used for recreation and open space.
- Agriculture represented 4.4 percent of land use outside the UDB, with the remainder primarily water and undeveloped land.

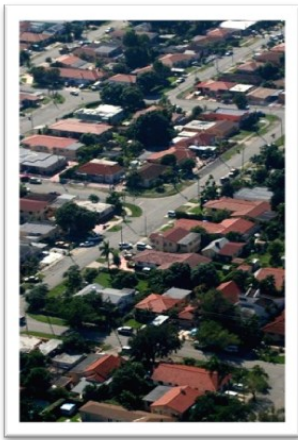
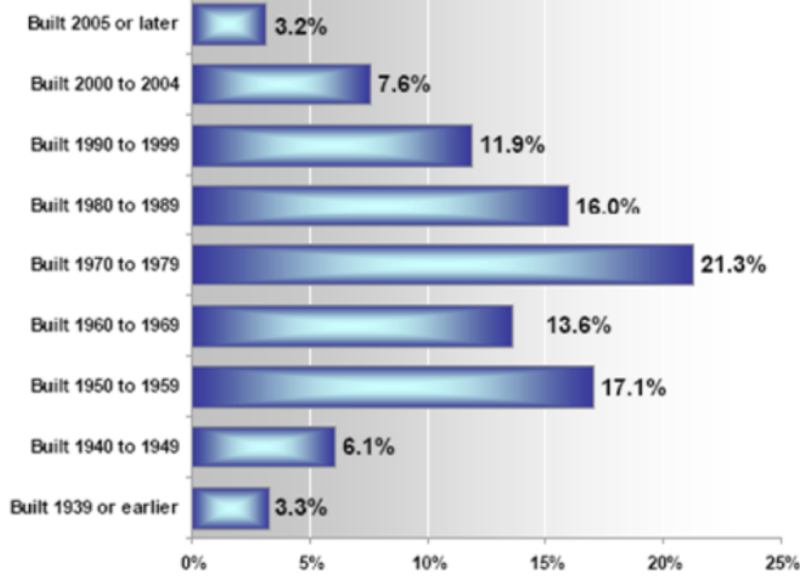


Figure 10: Building Types and Age

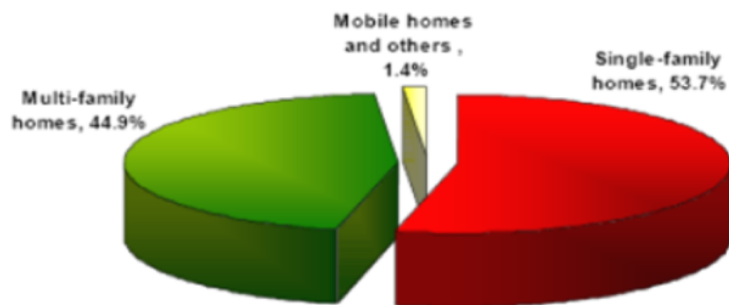
Building Type	Number	% of Total Buildings	Average Year Built	Average Age
Residential (Single Family)	314,442	82%	1965	44
Condo Buildings	6,043	2%	1983	26
Multi-Family	35,131	9%	1957	52
Commercial	15,054	4%	1965	44
Industrial	7,519	2%	1973	36
Agricultural	2,792	1%	1977	32
Institutional	2,244	1%	1962	47
Government	2,205	1%	1970	39
Total	385,430	100%		

Source: Property Appraiser Department



Source: U.S. Census Bureau, 2007 ACS

Figure 9: Housing Units by Structure Type 2007



Source: Miami-Dade Community Action Agency Comprehensive Needs Assessment 2008

The graphics on the next few several pages feature some of the infrastructure-related planning and policy frameworks in the County. Workshop participants used this information to identify possible connections and issues between infrastructure vulnerabilities and current and proposed policies guiding infrastructure development and improvements.

What is the Comprehensive Plan?

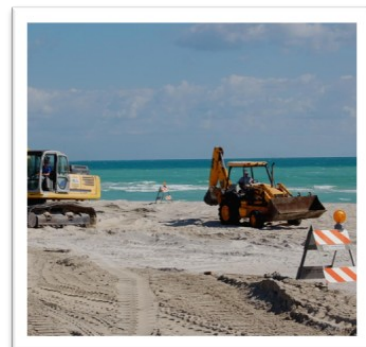
Purpose of the CDMP

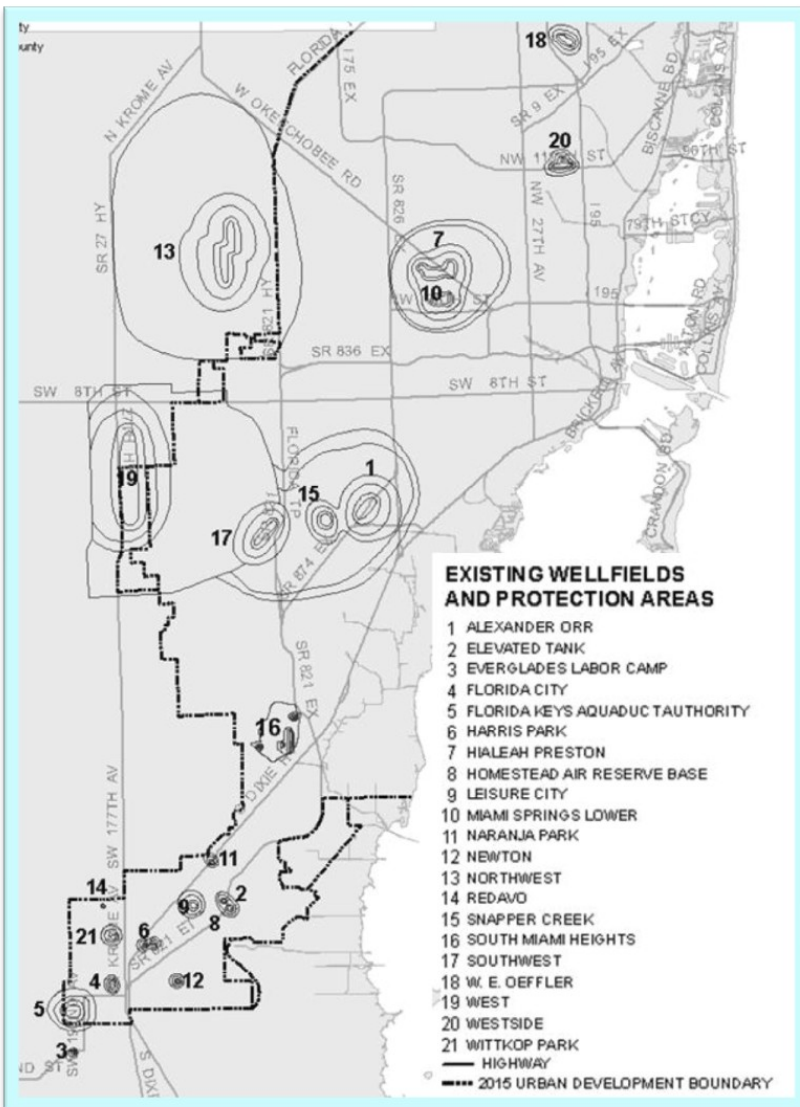
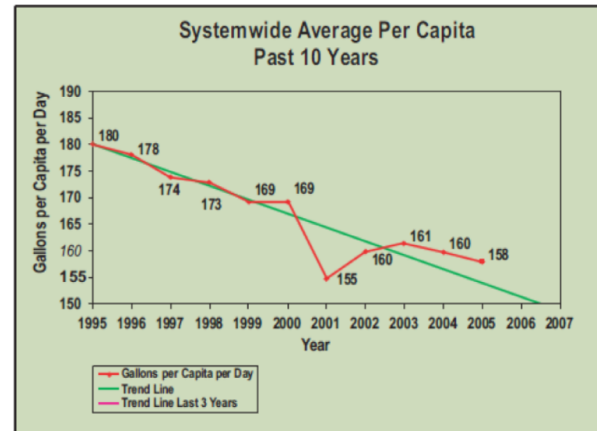
Establishes Goals, Policies and Objectives addressing:

- Land use & urban form
- Natural resources conservation and use
- Public services and facilities

Elements of the CDMP

- Land Use
- Transportation
- Housing
- Conservation, Aquifer Recharge and Drainage
- Water, Sewer and Solid Waste
- Recreation and Open Space
- Coastal Management
- Intergovernmental Coordination
- Capital Improvements
- Educational Element
- Economic Element





Second Report and Initial Recommendations
 Presented to
 The Miami-Dade
 Board of County Commissioners
 April 2008

Miami-Dade County
 Climate Change Advisory Task Force



CDMP ELEMENT CONSERVATION, AQUIFER RECHARGE AND DRAINAGE

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

What is Hazard Mitigation?

"Hazard Mitigation means any action taken to reduce or eliminate the long-term risk to human life and property from natural or manmade hazards."

Why Mitigation?

Miami-Dade County, in fact, all of South Florida, is vulnerable to disasters of all types affecting every part of our community; no one is immune. We've suffered hurricanes, tornadoes, severe flooding, lightening, wildfires, plane crashes, hard freezes, droughts, citrus canker, mass migration and more. Interested?

Want some details? How about this:

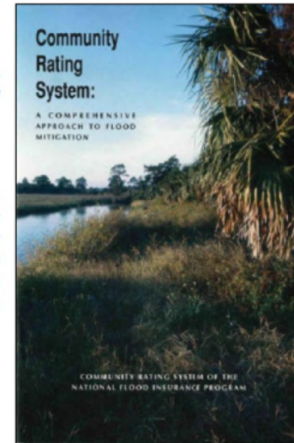
- Hurricane Andrew in 1992 – DR 955 – **\$30,000,000,000**
- Storm-of-the-Century in 1993 – DR 982 – **\$50,000,000**
- Tropical Storm Gordon in 1994 – USDA-FSA – **\$90,000,000**
- The Ground Hog Day storms in 1998 – DR 1204 – **\$50,000,000**
- Hurricane Georges in 1998 – ER 3131 – **\$12,500,000**
- Hurricane Irene in 1999 – DR 1306 – **\$800,000,000**
- The No-Name Storm in 2000 – DR 1345 – **\$500,000,000**
- Tornadoes in 2003 – DR 1460 – **\$15,000,000**
- Hurricanes Frances in 2004 – DR 1545 – **\$33,000,000**
- Hurricane Jeanne in 2004 – DR 1561 – **\$10,400,000**
- Hurricane Katrina in 2005 – DR 1602 – **\$500,000,000**
- Hurricane Wilma in 2005 – DR 1609 – **\$4,000,000,000**

National Flood Insurance Program

Miami-Dade County has a CRS rating of

5

and strives to have every municipality within the county take part in the Community Rating System



The Local Mitigation Strategy and the Department of Environment Resources Management



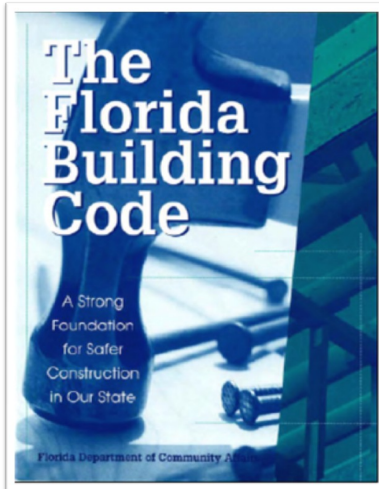
The Tamiami Canal (C-4) Forward Pump



Ready, Set, Mitigated!

The Completed Projects of The Local Mitigation Strategy

Disaster Resistant Universities



Flood Mitigation

The hydrological characteristics of South Florida are unique. Because it is so flat, we will never have huge volumes of water racing down the hillside destroying everything in its path. Flood damage here is much more subtle. We have just the opposite problem; the lack of slope means rainwater does not rapidly run off but must be absorbed into the ground. So, when the ground is saturated and the lakes and canals are full, there is nowhere for the rainfall to go hence, we flood.



The main substrate in South Florida is oolitic limestone that is extremely porous; in layman's terms, like a giant sponge and, like a sponge, works best when it's damp. Neither a totally dry sponge nor a sopping wet sponge works; the damp sponge is what absorbs water. This is why one of the major stormwater management methods in South Florida is the use of ground recharge systems more commonly referred to as French drains.

4.2 Infrastructure Maps

The following pages contain images of the Infrastructure Profile map products used during the Roadmap Workshop:

- Critical Facilities in Flood Zones
- Capital Improvements in Flood Zones
- Water and Sewer Pump Stations
- Groundwater Wellfield Protection Areas
- CDMP Land Use Plan

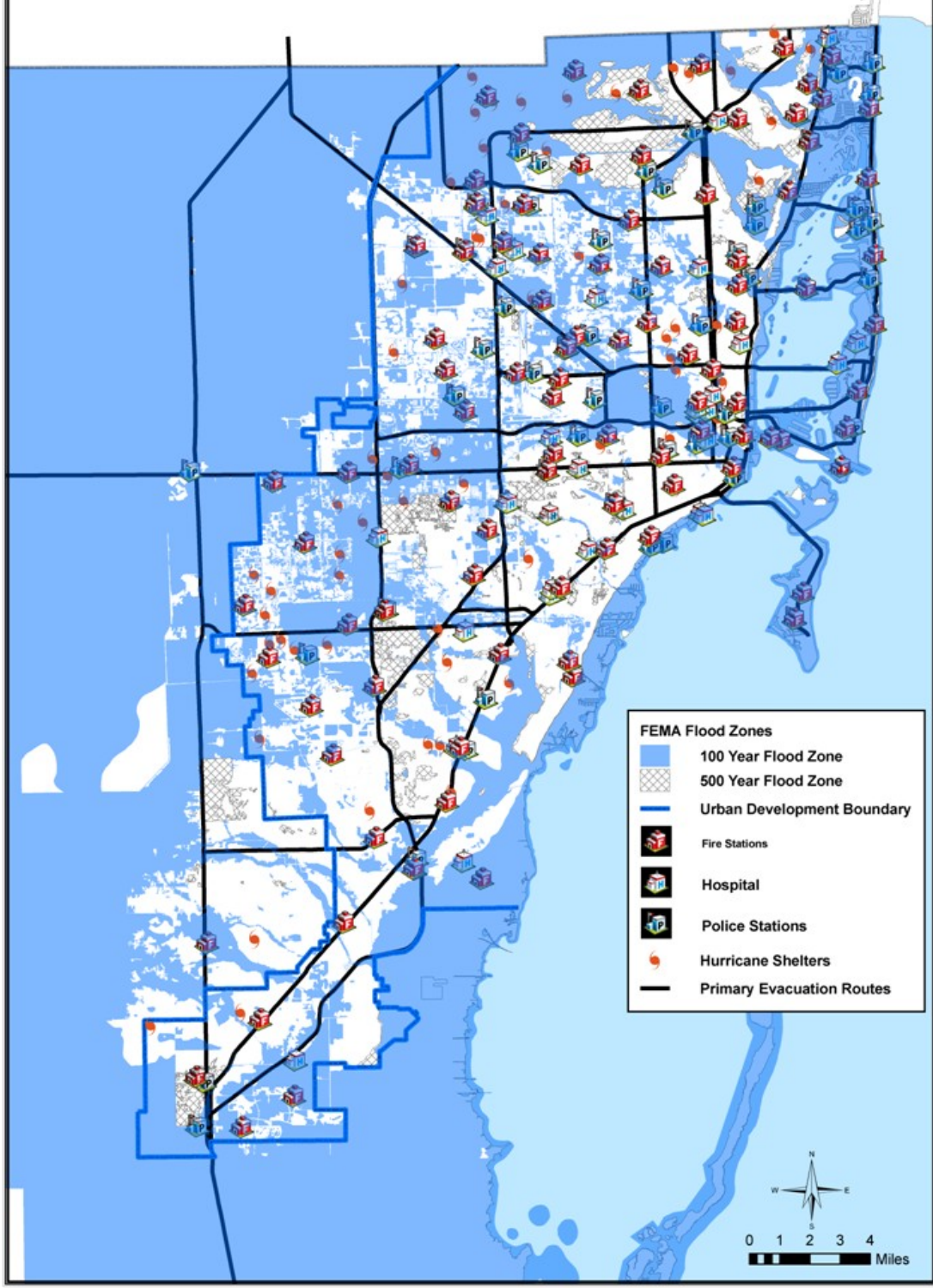


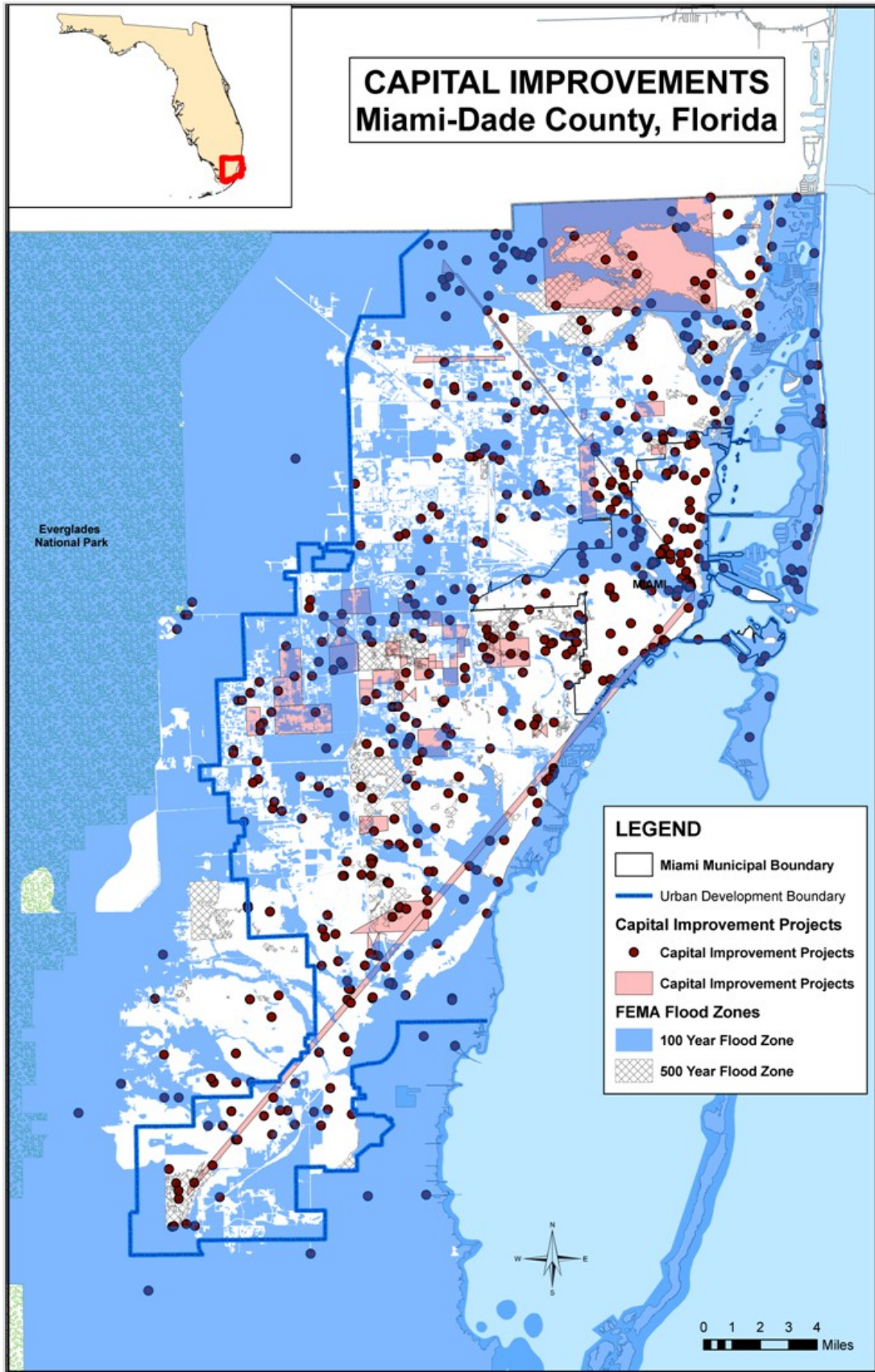
Workshop participants used the maps and profile information to help focus discussions and priorities on issues related to infrastructure in high risk areas. Some of the considerations in the Infrastructure Profile included:

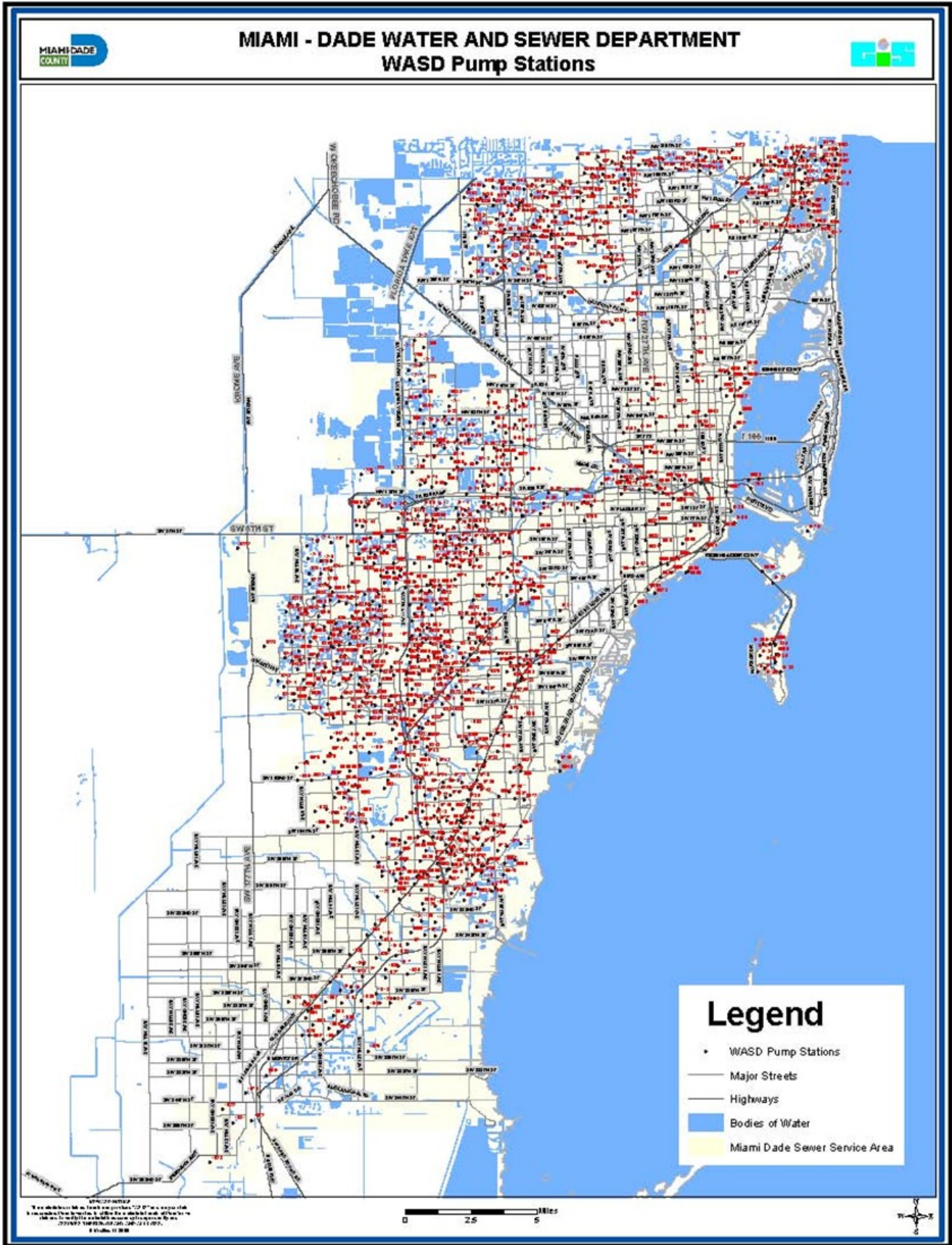
- What infrastructure is exposed to current hazard threats?
- How well do we expect key resources in transportation, transit, housing, water, sewer, emergency facilities, and special needs facilities to handle increased precipitation, SLR, temperature extremes?
- What factors make existing infrastructure vulnerable (Location, age, building codes, housing type, service demands, land use)?
- Can these vulnerabilities be improved with small incremental improvements?
- What are some cost-effective approaches to adjusting/adapting infrastructure over time?
- What are the challenges to adapting infrastructure to a new “normal”?
- Considering your main concerns and responsibilities, what are some of the planning and policy issues that need to be addressed?
- What are the key actions needed to address your concerns?



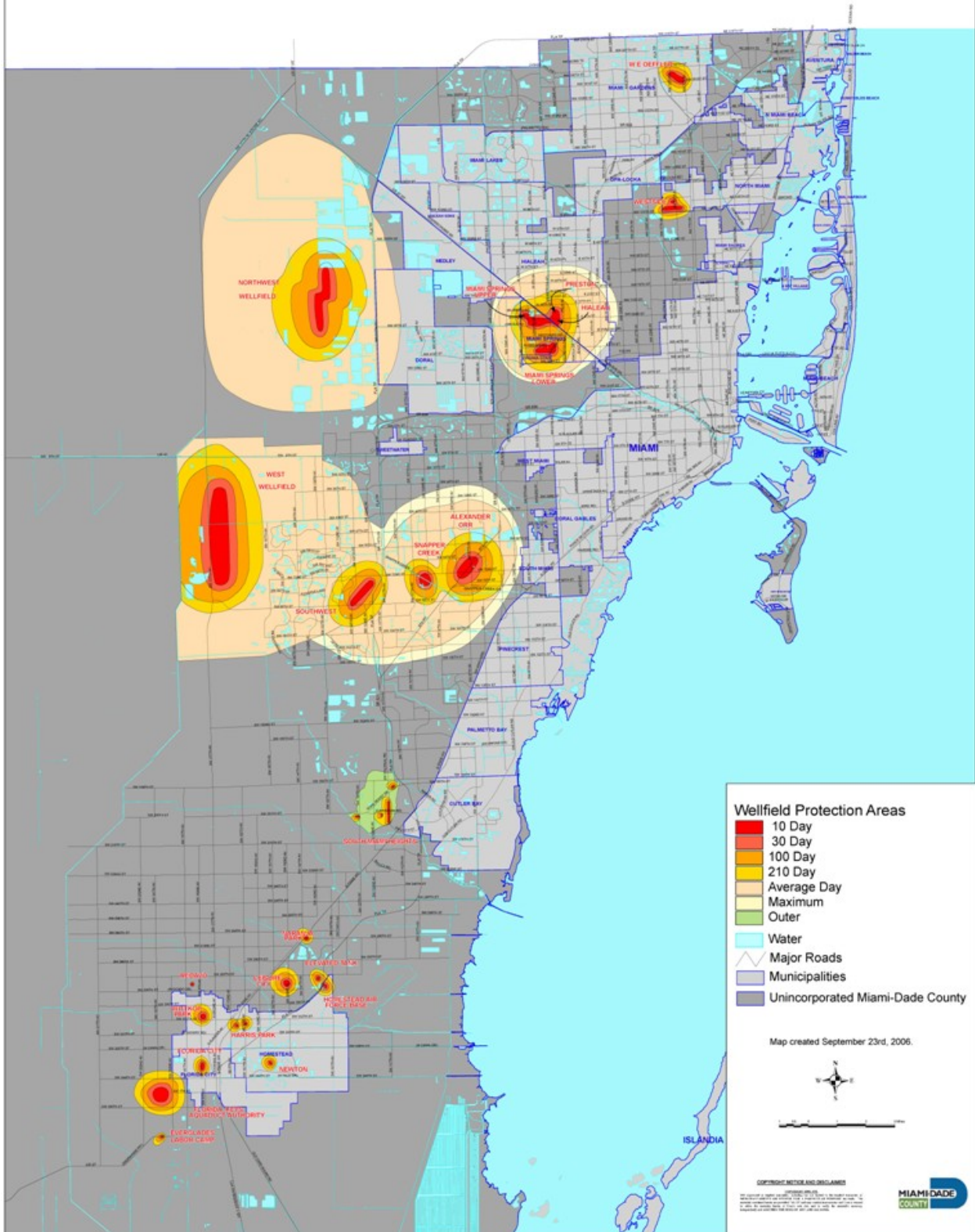
CRITICAL FACILITIES Miami-Dade County, Florida

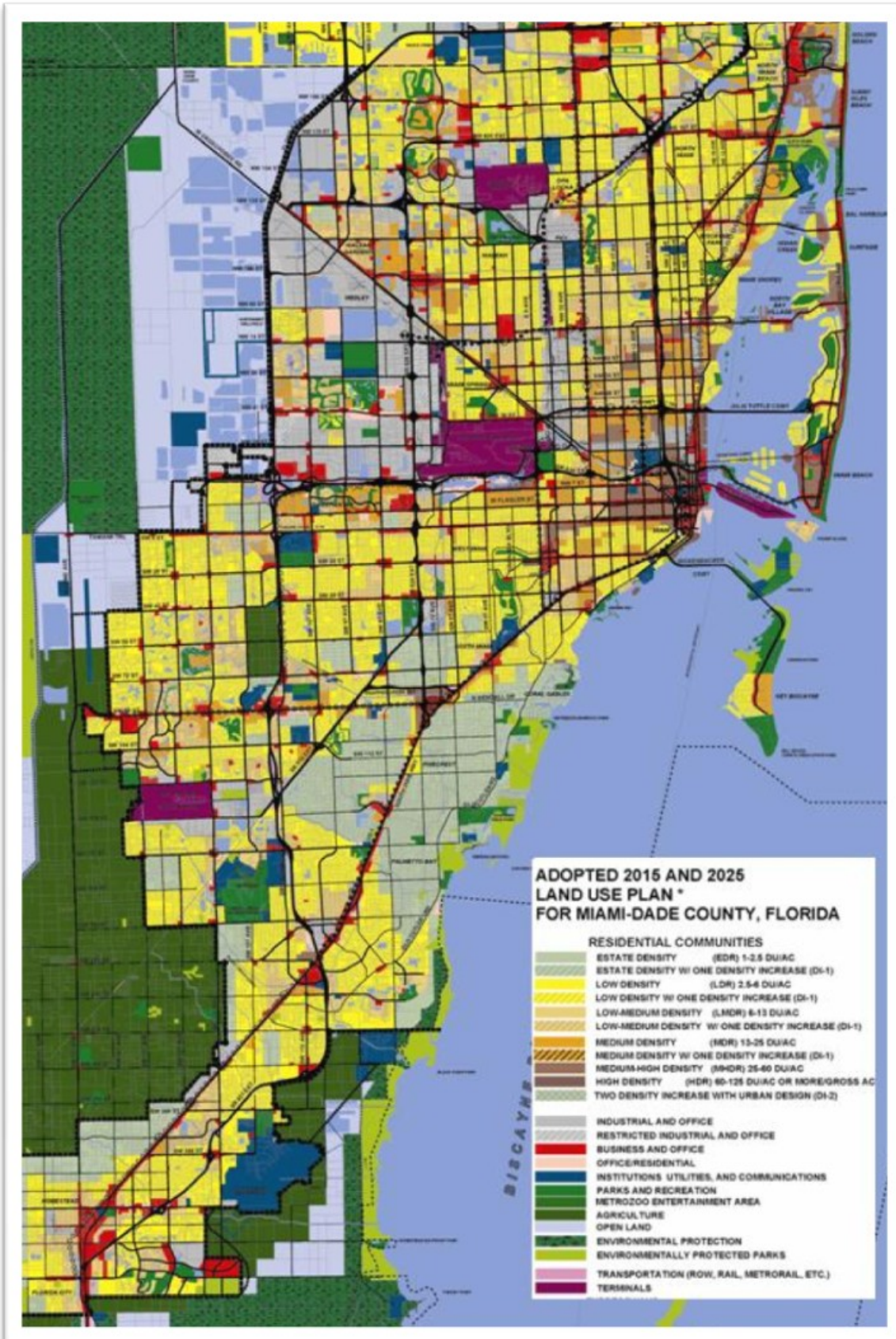






Miami-Dade County Wellfield Protection Areas





4.3 Infrastructure Issues & Opportunities

During the Roadmap Workshop, participants used the preceding Infrastructure Profile information to explore and discuss vulnerability concerns related to the built environment. Group activities led to the identification of overarching vulnerability issues and potential opportunities for reducing future impacts. The following points reflect priority issues and actions:

- Critical facilities and infrastructure are located throughout the County and most are exposed and potentially vulnerable to hazards and climate impacts. The evaluation and prioritization processes currently in place for hazard mitigation planning can serve as an effective model or starting point for a more detailed inventory and analysis. Additional criteria should be added to account for future conditions.
- Comprehensive Long-Range Planning—these are interconnected issues that need to be captured in numerous planning strategies including capital improvements, land use, transportation, coastal management, conservation, housing, and water and sewer. Many of these existing plans currently some hazard element but it is usually limited specifically to existing flood zones and hurricane evacuation areas. A more complete reworking of the hazards sections of these plans should incorporate a broader infrastructure “resilience” objective that is consistent throughout. Additional details can be further spelled out in specific policy recommendations. A more consistent long-range resilience framework will better accommodate actions to address current and long-range hazards.
- Engineering & design standards – a range of engineering and design standards need to be evaluated and updated to account for changing climate conditions. New methods and best practices should be established for
 - ⇒ incorporating climate impacts into life cycle costs
 - ⇒ incorporating future condition considerations and designs into maintenance and replacement cycles



⇒ adopting adaptive strategies and flexible criteria that allow for changes as additional data becomes available

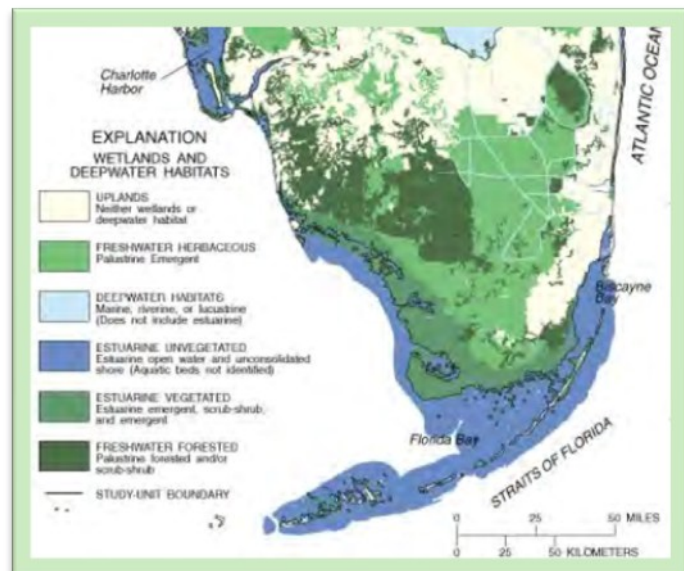
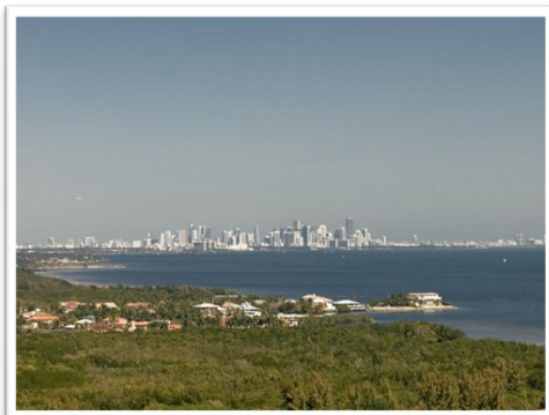
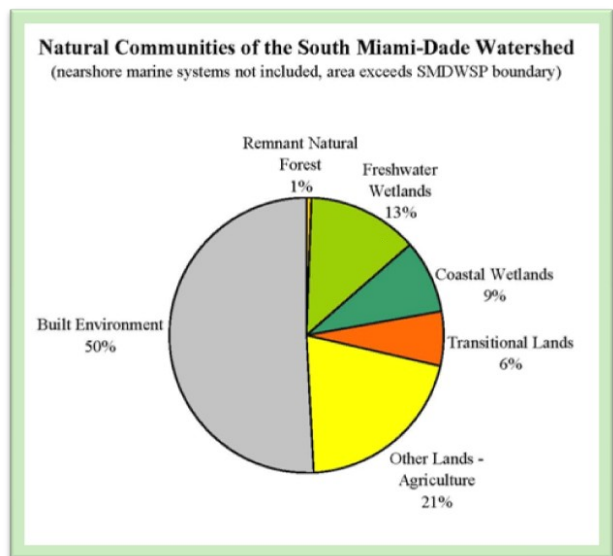
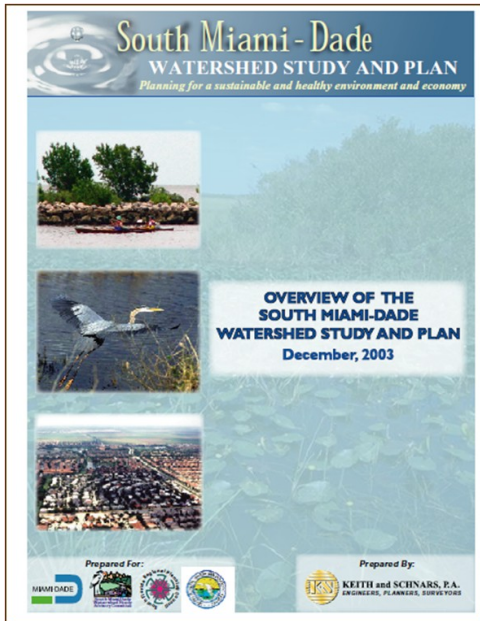
- Education and resources for decision makers – hazards and climate change are showing up in plans, but are not always enacted in decision making. There is a need to provide additional training and information resources, along with tools and job aids that can help empower decision makers at all levels. These issues can be very complex, especially when they involve complicated scenarios and various elements of uncertainty. If local decision-makers are expected to translate general plans into implementation details and actions, they need to fully understand and internalize the appropriate information.
- Pursue new alternatives for funding infrastructure adaptation measures. This includes combining and leveraging multiple funding sources across programs and identifying new program funding opportunities for meeting infrastructure resilience goals. Not only will we need to be creative and collaborative in pursuing potential funding opportunities, but we will need to proactively generate innovative implementation alternatives as a targeted strategy to help identify new funding options. These efforts may require us to push the boundaries of existing local, state and federal programs. Creative solutions will require broader partnerships as well as aggressive and innovative approaches to implementation.



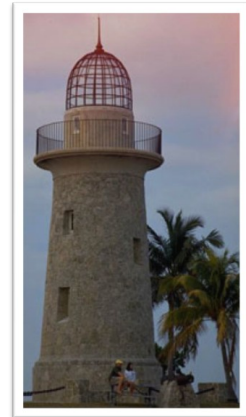
Step 5 - Ecosystem Profile

5.1 Ecosystem Information

The graphics below provide a general overview of natural resource issues related to hazards and climate change. This information was used during the workshop, along with additional resources, to help participants identify and highlight major vulnerability concerns and issues. It provided a starting point for workshop activities.



National Parks and Preserves of South Florida



Biscayne National Park's 172,000 acres play host to over 500,000 visitors per year.



The Miami-Dade County parks and open space system Master Plan

A 50-Year, unifying vision for a livable, sustainable Miami-Dade County

Guiding Principles: To Create a Model Park System



SUSTAINABILITY

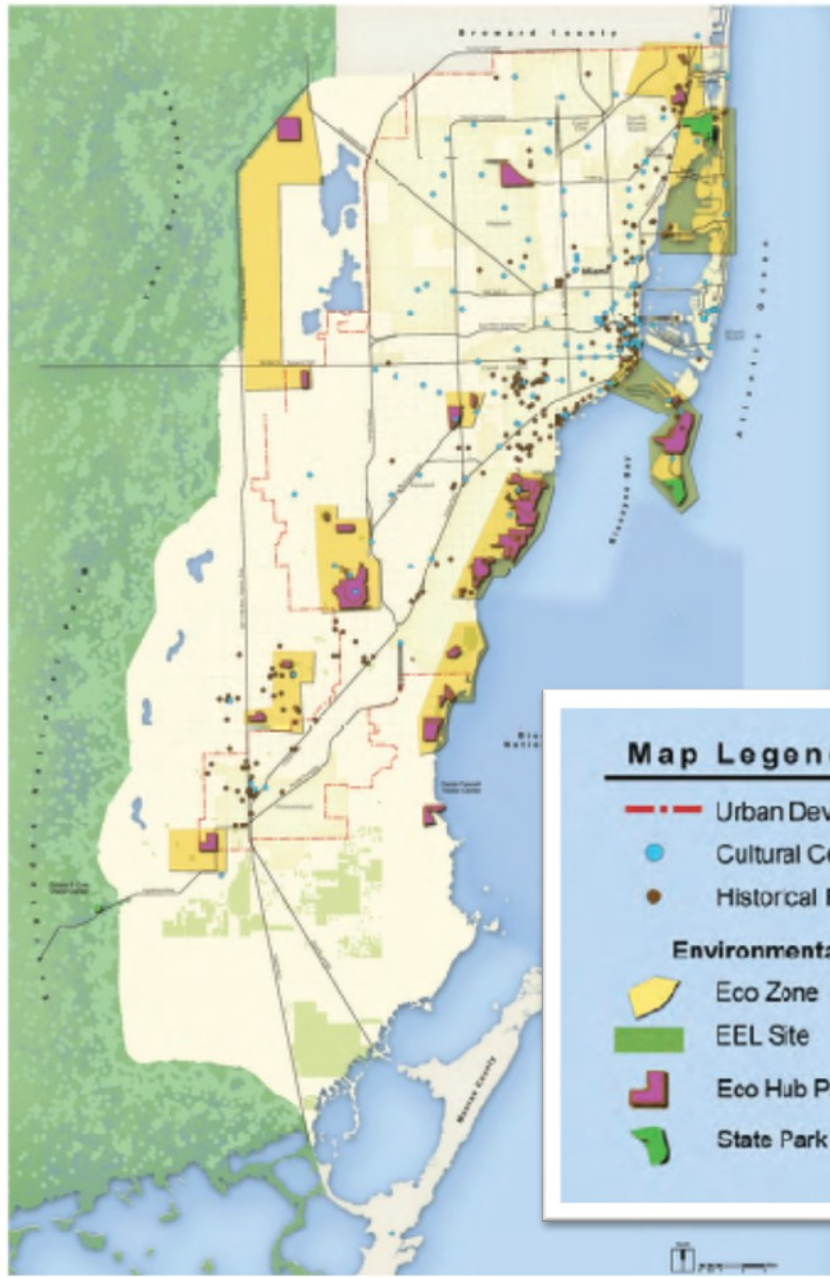
Every action and improvement of the Park System, including facilities, programs, operations and management, should contribute to the economic, social and environmental prosperity of the County.



MULTIPLE BENEFITS

Every single public action should generate multiple public benefits to maximize taxpayer dollars.

Great Natural and Cultural Areas Vision



Map Legend

- - - Urban Development Boundary
- Cultural Center
- Historical Preservation Site

Environmental & Endangered Lands

- Eco Zone
- EEL Site
- Eco Hub Park
- State Park

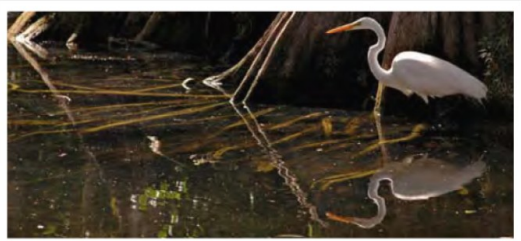
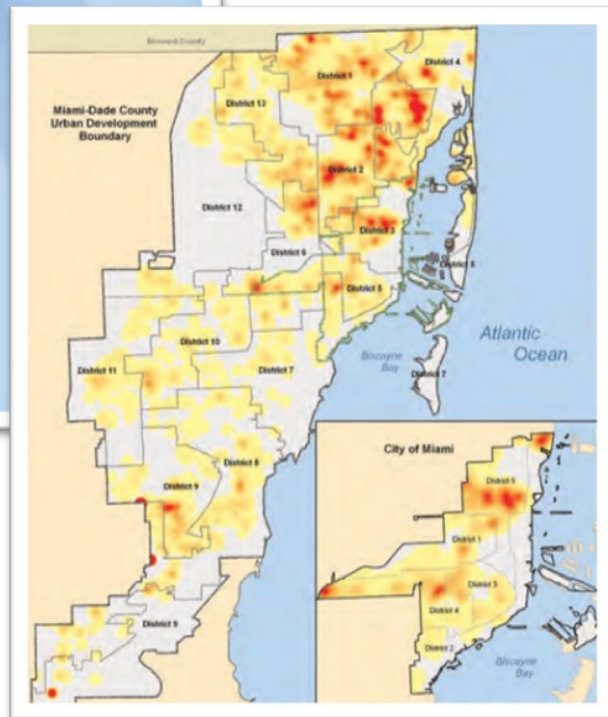


Environmental Zones Mission and Vision

An Eco-zone is a group of protected natural areas that are connected through greenways, blueways and biotic corridors that provide the community with experience that inspire, educate and foster stewardship of the natural environment of South Florida. Within an Eco-zone there shall be a series of connected Eco-hubs that provide resource-based education and recreation.

Western Greenway

This map illustrates the establishment of a Western Greenway connecting the Lake Belt Area to the north with the Southern Glades Wildlife Management Area to the south. The greenway alignment is conceptual and does not depict specific boundaries.



2004-2005 Citrus Tree loss due to Citrus Canker

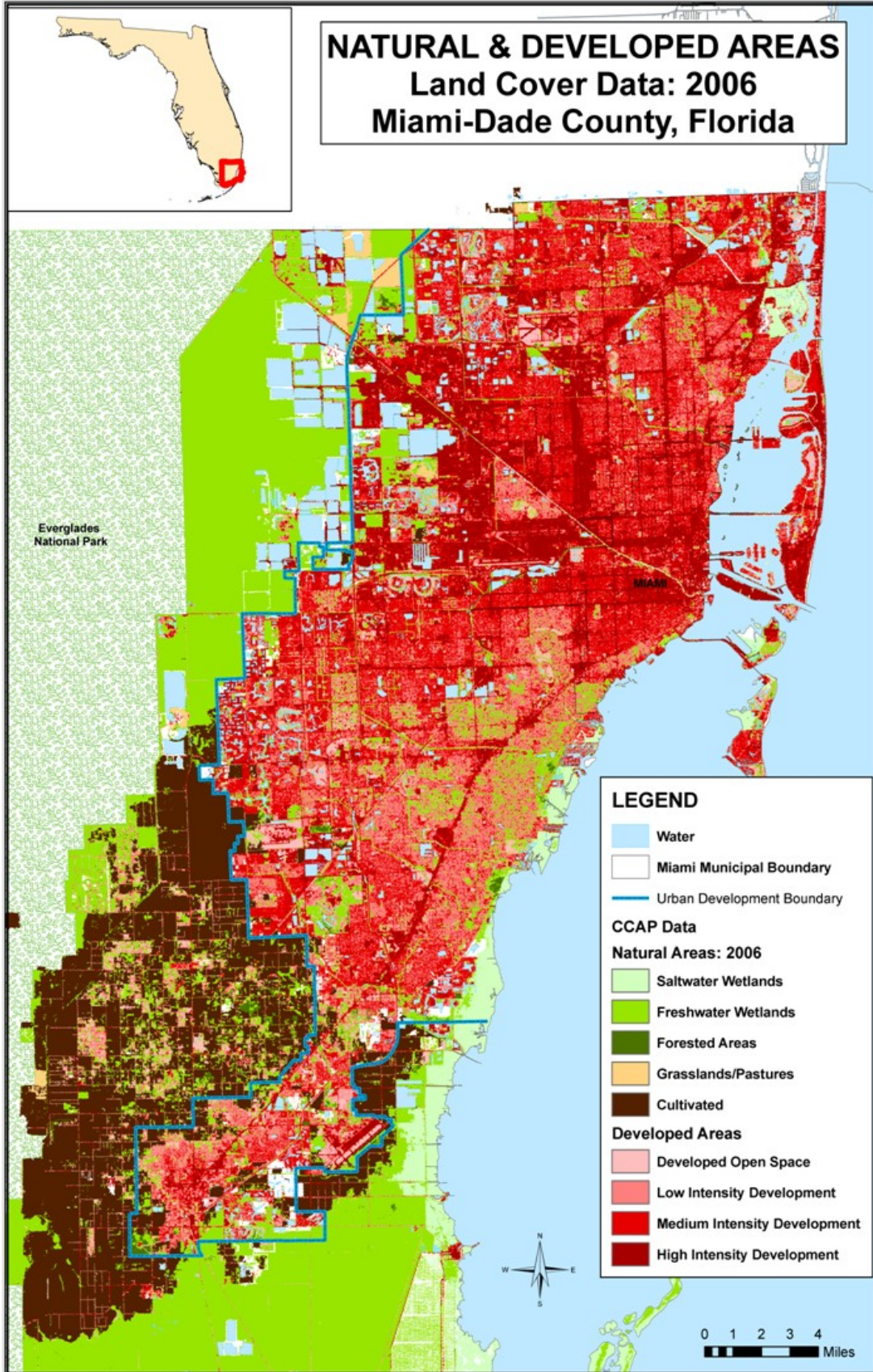
5.2 Ecosystem Maps

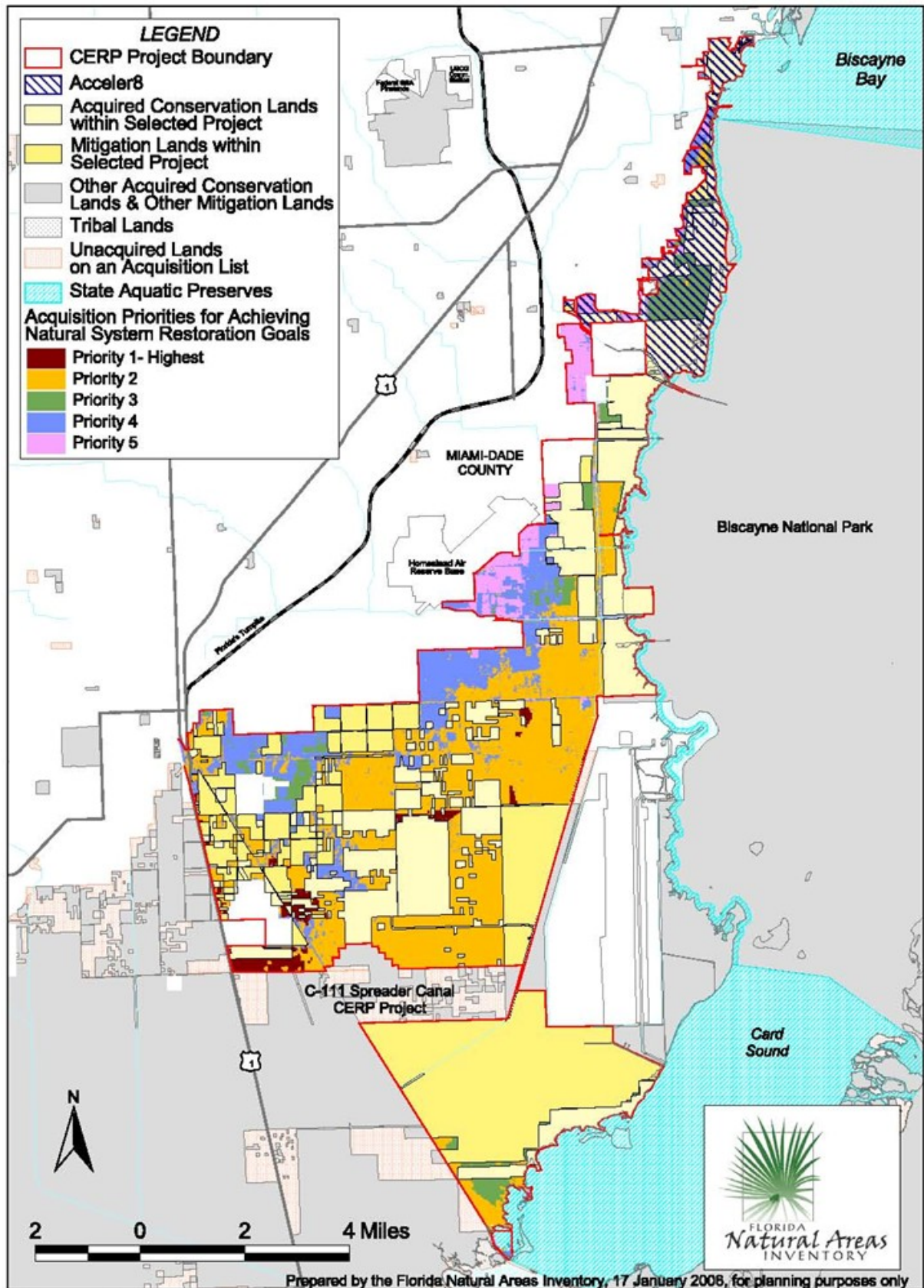
The following pages contain images of the Ecosystem Profile map products used during the Roadmap Workshop:

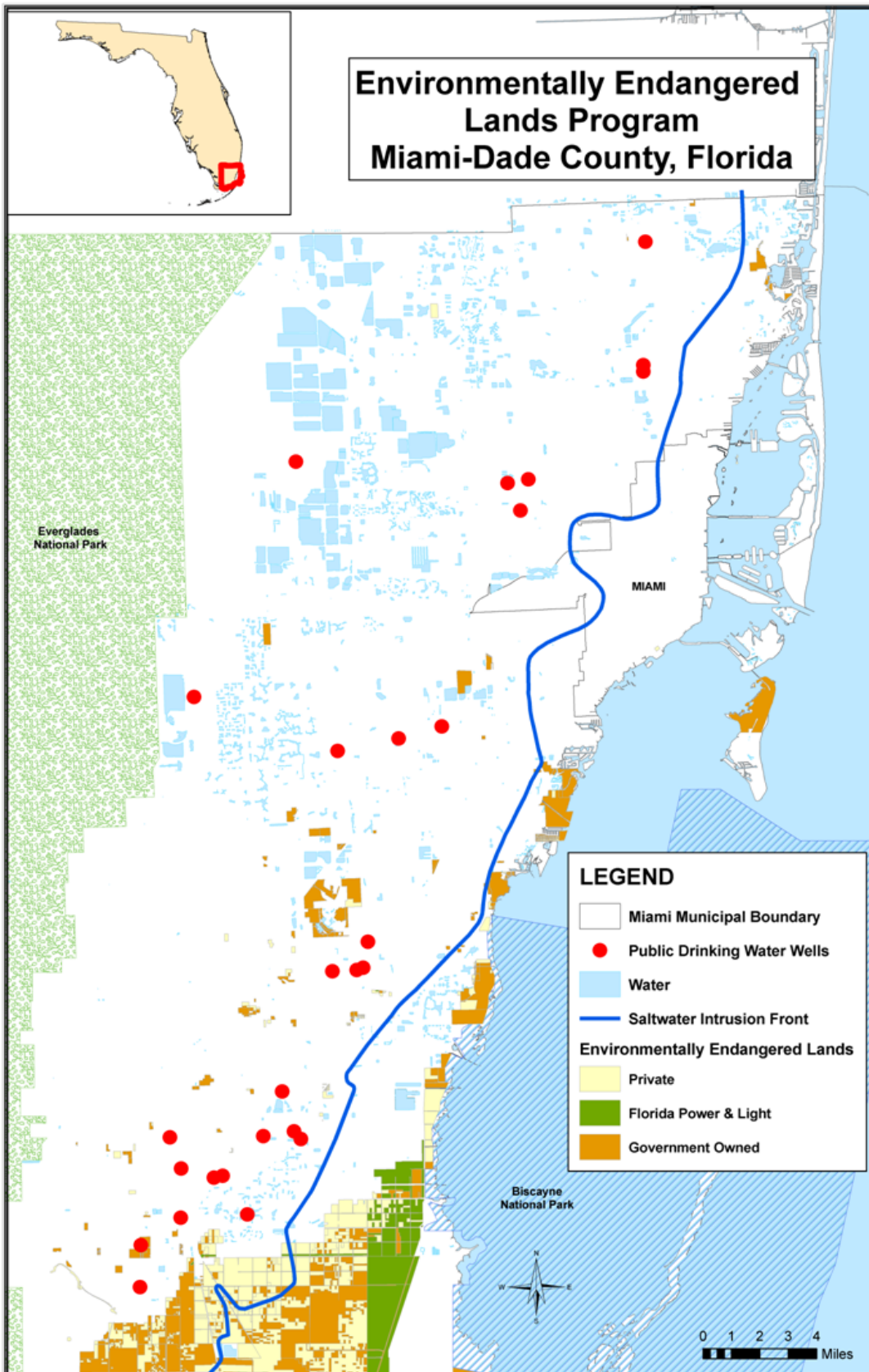
- Land Cover
- Natural Lands
- Environmentally Endangered Lands
- Biscayne Bay GreenPrint Priorities
- Brownfields
- Natural Areas Management

Workshop participants used the maps and profile information to help focus discussions and priorities on the relationships between natural resources and hazards resilience. Some of the key considerations in the Ecosystem Profile included:

- What values and benefits do the natural resources provide and who are the consumers and constituents most interested in maintaining and protecting these resources?
- What are the protective functions provided by the area's natural resources and where are these most critical? These functions can include things such as erosion control, storm surge buffering, flood buffering, etc.
- What are some of the key ecosystem stressors in the areas affecting critical natural resources? These stressors can include exposure and sensitivity to land development or use practices, habitat fragmentation, incompatible human uses, exposure to physical hazards, impacts from hazardous materials, etc.
- What are potential opportunities for improving resilience by protecting, restoring, or enhancing natural resources?
- What are some of the key programs and planning efforts that can be leveraged in pursuit of multi-benefit opportunities?







Biscayne Bay Greenprint

Biscayne National Park Adjacent Lands Protection

Overall Conservation Priorities

Compiled August 2006 using best available data;
 This map is subject to change as additional data becomes available and as land uses change.

Legend

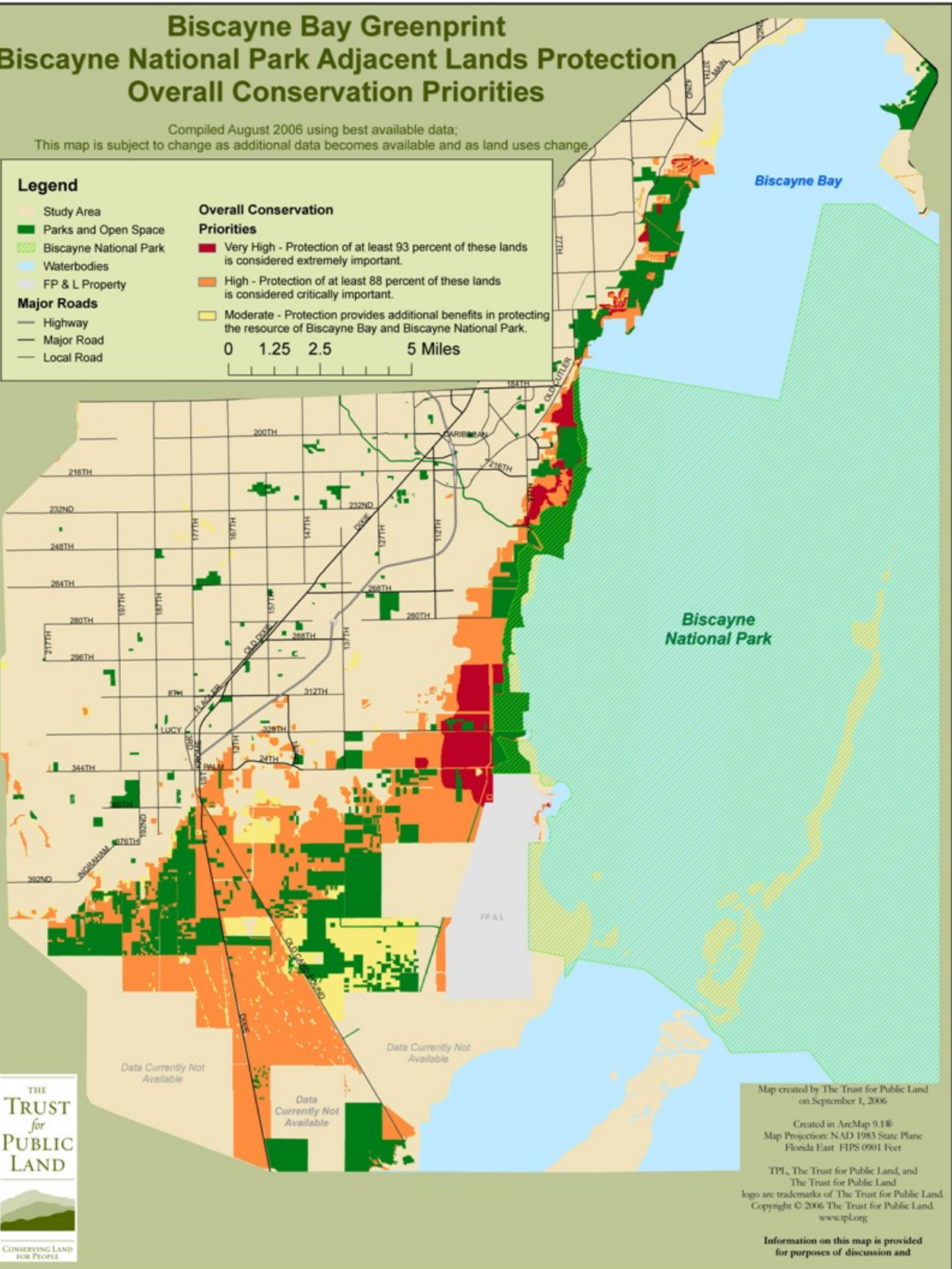
- Study Area
- Parks and Open Space
- Biscayne National Park
- Waterbodies
- FP & L Property
- Major Roads**
- Highway
- Major Road
- Local Road

Overall Conservation

Priorities

- Very High - Protection of at least 93 percent of these lands is considered extremely important.
- High - Protection of at least 88 percent of these lands is considered critically important.
- Moderate - Protection provides additional benefits in protecting the resource of Biscayne Bay and Biscayne National Park.

0 1.25 2.5 5 Miles



Map created by The Trust for Public Land on September 1, 2006

Created in ArcMap 9.1®
 Map Projection: NAD 1983 State Plane Florida East FIPS 0901 Feet

TPL, The Trust for Public Land, and The Trust for Public Land logo are trademarks of The Trust for Public Land. Copyright © 2006 The Trust for Public Land. www.tpl.org

Information on this map is provided for purposes of discussion and

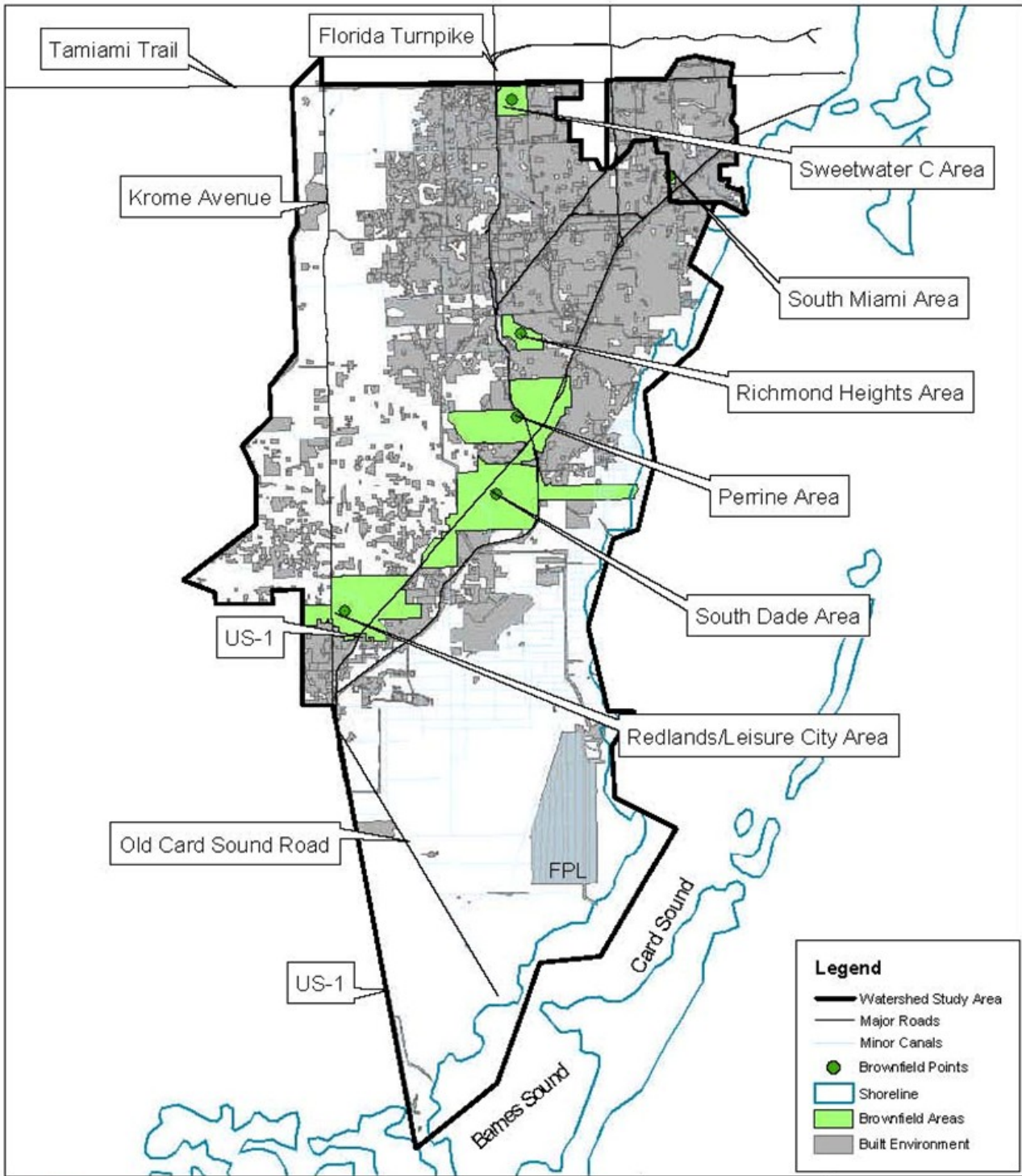


Figure A-2
Brownfields

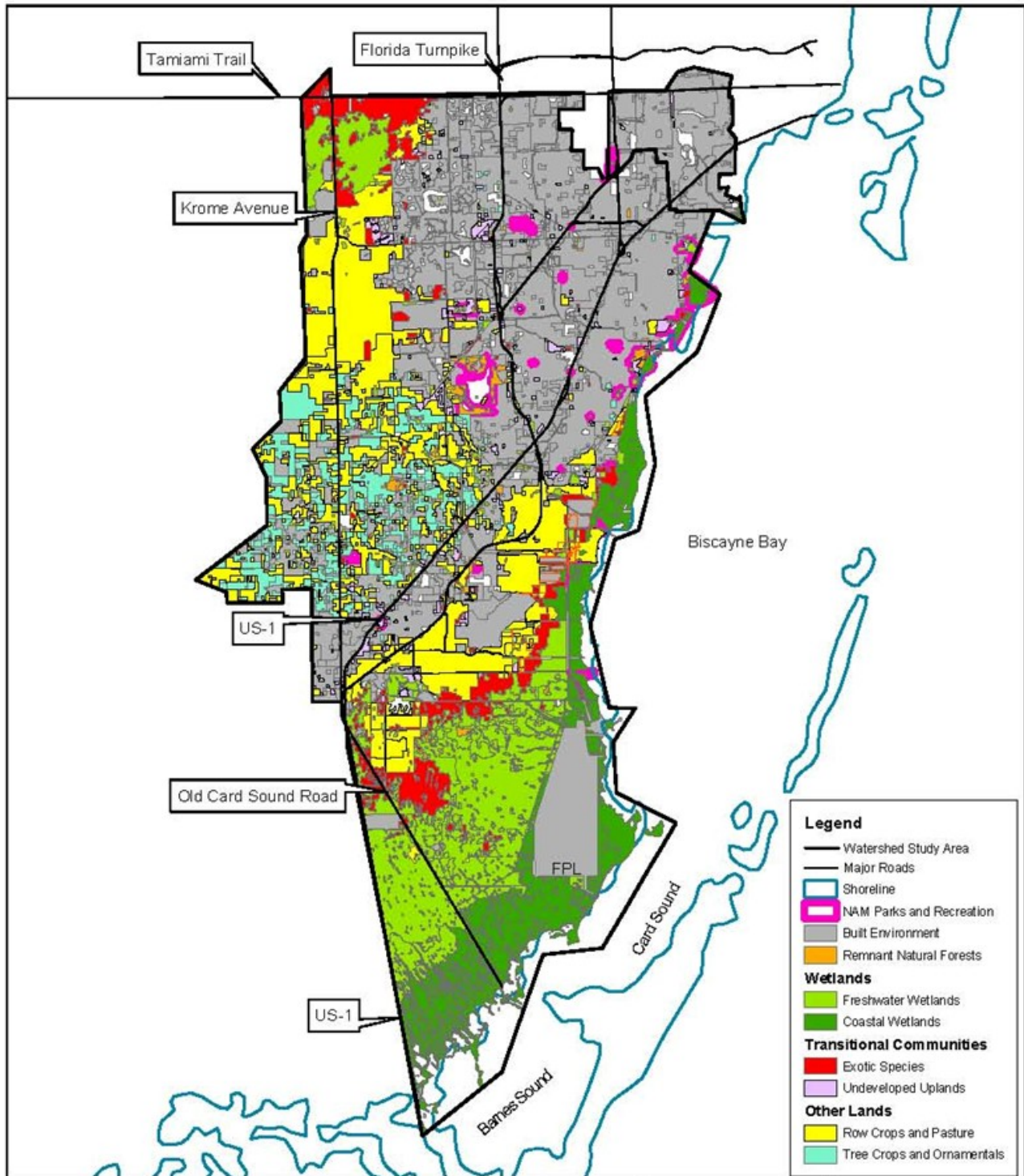
Source: FDEP 2001





South Miami-Dade
Watershed Study and Plan

0 1 2 4 Miles



KEITH and SCHNARS, P.A.
ENGINEERS, PLANNERS, SURVEYORS

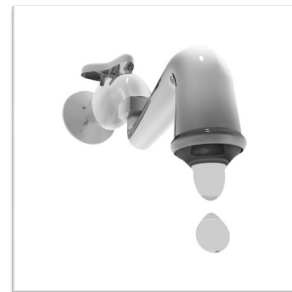


   KEITH and SCHNARS, P.A. ENGINEERS, PLANNERS, SURVEYORS	<p>Figure 17</p> <p>Natural Areas Management Miami-Dade Parks and Recreation</p> <p>South Miami-Dade Watershed Study and Plan</p>	<p>Source: FLUCCS 1994-95, Miami-Dade County</p> <p>0 1 2 4 Miles</p>	
---	---	---	---

5.3 Ecosystem Issues & Opportunities

During the Roadmap Workshop, participants used the Ecosystem Profile maps and information resources to identify areas of particular interest and value for protecting people and property. Group activities resulted in the identification of key natural resources, ecosystem stressors and vulnerabilities, and opportunities for linking resource management to adaptation benefits. The following points summarize priority issues and actions:

- The highest priority natural resource management and protection issues are related to the county's (and region's) water supply. The complexities associated with water management in the region, coupled with the risk uncertainty for hazards and climate impacts, necessitate the development a fully integrated regional water management vulnerability assessment and adaptation plan. The assessment should address the multiple interconnected stressors on water systems including those related to future scenarios for climate, population, economy and land use. Human-environment interactions and dependencies should be factored in and potential tipping points or thresholds should be identified and accounted for in adaptation options.



Row Crops



Tree Ornamentals

- There is a need to better understand and measure the economic relevance of the natural and managed land and water resources to help quantify consequences of anticipated changes (marsh migration, species migration, planting season and crop ranges, fisheries, wetlands, beaches, etc.). Priority sectors include agriculture, shipping/trade, and recreation/tourism. The identification of key affected resources, economic relevance, and social dependence/relevance will help to establish a quantitative framework for identifying the near- and long-term economic impacts of change. This information can also be incorporated into existing decision-making processes to evaluate economic tradeoffs associated with natural resource impacts.

- An emphasis should be placed on evaluating the adaptive capacity of ecosystem resources. First there is a need to better understand how current stressors are likely to impact natural resource responses to hazard and climate change threats (physical adaptive capacity). Second, resource management planning and policy frameworks should be evaluated for their institutional adaptive capacity. (Do they provide for regular monitoring and evaluation of changing conditions? Are there mechanisms for integration of evolving scientific information? Do they allow the flexibility to change when they are not producing intended results?)
- There is a significant opportunity to achieve “co-benefits” for climate adaptation, hazards management, and healthy livable communities through collaboration on the Parks & Open Space Master Plan implementation. The next phases of plan development and implementation should include a specific focus on supporting green infrastructure and open space planning networks that enhance adaptive capacity for managing hazards and climate impacts. Planning and design strategies should account for loss avoidance and reduction of structural infrastructure costs in the potential benefits associated with implementation.

