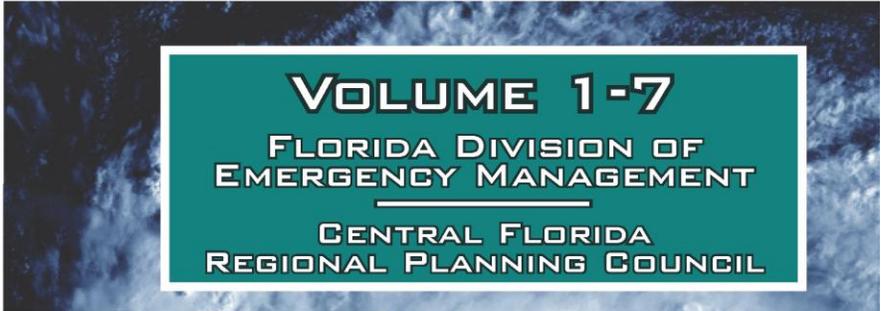


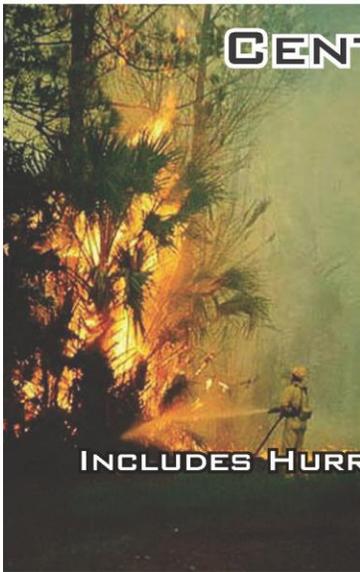


FLORIDA STATEWIDE REGIONAL EVACUATION STUDY PROGRAM

TECHNICAL DATA REPORT

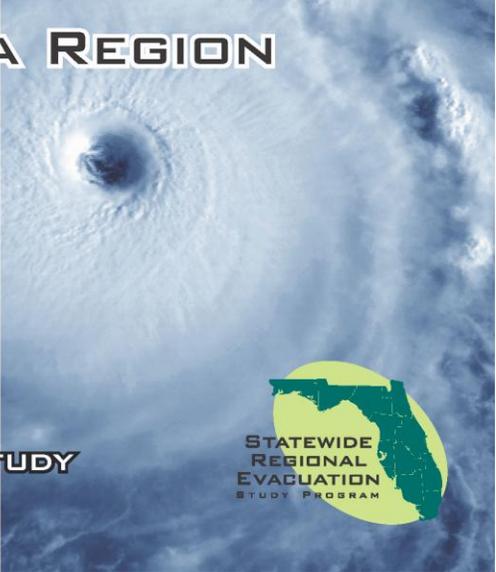


VOLUME 1-7
FLORIDA DIVISION OF
EMERGENCY MANAGEMENT
CENTRAL FLORIDA
REGIONAL PLANNING COUNCIL



CENTRAL FLORIDA REGION

INCLUDES HURRICANE EVACUATION STUDY



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Central Florida Region Statewide Regional Evacuation Study Program

**For
DeSoto, Hardee, Highlands, Okeechobee and Polk
Counties**

Prepared by:
Central Florida Regional Planning Council
for the
Division of Emergency Management



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CREDITS & ACKNOWLEDGEMENTS



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The Statewide Regional Evacuation Study Program was completed by regional planning council staff in all eleven regions of the State. Oversight was provided by a small group in order to facilitate an overall review of the program. Subject matter expertise was provided by section leads for the major portions of the Study. It was these leaders who ensured that the accepted methodology was utilized across the State and that each section was completed in a consistent manner.

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In addition, sincere thanks for all those staff members, both past and present, of the Florida Division of Emergency Management (FDEM), whose contributions of time, interest and knowledge in all aspect of this project have made it a success.



The Central Florida Regional Planning Council (CFRPC), (Region 7), is one of 11 regional planning councils in Florida established under the authority of Chapter 186, Florida Statutes. It has been in operation since 1973 assisting public, private, and institutional sectors in a five-county area to address regional scale issues. The Central Florida Regional Planning Council offers services to the five counties of DeSoto, Hardee, Highlands, Okeechobee and Polk.

The Council is comprised of local government elected officials and private citizen representatives within the region.

There are two distinct components of the RPC:

- The RPC's Governing Board, or Council: a body of representatives that governs the agency.
- The staff: the professionals who provide technical support for Council decision-making and services for local governments throughout the region.

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Statewide Regional Evacuation Study Program List of Volumes

Volume 1 – Technical Data Report

The *Technical Data Report (TDR)* is the primary document of the Statewide Regional Evacuation Study Program. The TDR contains the summary analysis of all other supporting research, survey data and modeling.

Volume 2 – Regional Behavioral Analysis

The *Regional Behavioral Analysis* was produced by behavioral specialist Dr. Earl J. Baker, Hazards Management Group. The report includes a summary of the behavioral survey data and analysis which includes the regional behavioral assumptions incorporated in the calculation of evacuation population, evacuation participation rate (transportation analysis) and anticipated shelter demand.

Volume 3 – Regional Behavioral Survey Report

The *Regional Behavioral Survey Report*, produced by Kerr and Downs, Inc., provides the survey data from the more than 2,500 behavioral surveys conducted in 2009 as part of the Statewide Regional Evacuation Study Program.

Volume 4 – Evacuation Transportation Analysis

The *Evacuation Transportation Analysis* is produced by the evacuation transportation team at Wilbur Smith Associates. It includes a summary description of the evacuation transportation model, study methodologies and assumptions, and growth management impact assessments on evacuation. The analysis includes the evacuation clearance times for the counties and the region for 2010 and 2015 under different planning and operational scenarios.

Volume 5 – Evacuation Transportation Supplemental Data Report

The *Evacuation Transportation Supplemental Data Report*, prepared by Wilbur Smith Associates, contains the model run inputs and outputs and serves as the source data for the *Evacuation Transportation Analysis*.

Volume 6 – Emergency Management Evacuation Tool Kit

The *Emergency Management Evacuation Tool Kit* includes locally-selected data pertinent to the county emergency management agency. It is meant to be used as a quick-reference guide for operations.

Volume 7 – Storm Tide Atlas

The *Storm Tide Atlas* provides the storm tide boundaries based on the new Sea, Lake and Overland Surges from Hurricanes (SLOSH) Analysis, including the boundaries of the Coastal High Hazard Area (CHHA). It is provided in several formats including GIS files, PDF files and printed copy. There is one Book for each county in the region which has a potential for storm tide flooding.

Volume 8 – Methodology of Evacuation Transportation Modeling for the Statewide Regional Evacuation Study Program, 2010

This Volume provides a detailed description of the methodologies, model assumptions and the Transportation Interface for Modeling Evacuations (TIME) developed and utilized in the Statewide Regional Evacuation Study Program.

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Chapter VI. Regional Evacuation Transportation Analysis

Glossary of Terms/Definitions

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PREFACE

A. About the Region

The Central Florida region has changed immensely over the past 150 years since Florida became part of the United States in 1845. Central Florida is mostly flatland with over 1,500 lakes and ponds. Explosive growth has fueled Central Florida for the past thirty years, but this trend plateaued in 2009.

Growth in Polk County is driven by nearness to both the Tampa and Orlando metropolitan areas along the Interstate 4 corridor. Recent growth has been heaviest in Lakeland (closest to Tampa) and the Northeast areas near Haines City (nearest to Orlando). From 1990 to 2000, unincorporated areas grew 25%, while incorporated areas grew only 11%.

Tourism is an economic driver in the area, but far less so than most of the rest of the state. The lack of development and amenities results in fewer tourists visiting the area, and there are no oceanfront beaches to attract nearby residents. The largest tourist attraction is the Sebring International Raceway, located southeast of Sebring in Highlands County. There, the 12 Hours of Sebring, an American Le Mans Series race usually held in the second week of March, drew a "paying crowd" of more than 169,000 in 2006. Major attractions in the area include Bok Tower Gardens and Lego Land (scheduled to open 2011/12). The region also boasts an extensive network of recreational trails (jogging, biking, equestrian, etc.). While many connections are already in place, construction continues and will link all of the trails and greenways.



Central Florida is an important distribution center and transportation hub. There are three freight lines operating in the Florida Heartland, with approximately 190 miles of track: CSX Transportation, Seminole Gulf Railway, and South Central Florida Express. Amtrak service operates on CSX tracks, with stops in Sebring and Okeechobee and Orlando. Central Florida is developing a regional commuter and high-speed rail network. The first of these initiatives, SunRail, is a commuter rail line that will run from Deland south to Kissimmee. The first phase should be complete by 2013, with the full system in place by 2015. The second is a Florida High Speed Rail line that will run from the Orlando International Airport to downtown Tampa, with future lines eventually connecting to downtown Orlando, Jacksonville, and Miami. President Obama announced in 2010 that Federal funding will be awarded to Florida to begin construction on the Orlando to Tampa route in 2011.

There are no seaports, as there is neither a seacoast nor navigable rivers, but the Okeechobee Waterway is a navigable canal which crosses the region, connecting the Gulf of Mexico to the Atlantic Ocean through Lake Okeechobee.

The region is primarily rural in nature, with the primary economic driver being agriculture. Important products grown in this area include tomatoes, beef, sugarcane, cucumbers, citrus products including oranges and grapefruit. In Hardee County and southwestern Polk County, phosphate mining is a substantial industry, particularly along the Peace River basin. Mosaic Corporation, one of the world's largest producers of phosphate products, has several facilities throughout the region. Polk County is the headquarters of Publix Supermarkets, a regional grocery chain and Polk's top private employer, as well as W. S. Badcock Corporation, Watkins Motor Lines, Saddle Creek Corporation, and IMC Agrico. Polk County's location along the I-4 corridor is attracting warehouse and fulfillment center development in the north part of the County. Winter Haven is best known as the home of Cypress Gardens, a theme park which is going through renovations to become Lego Land and is projected to open in 2011/12. Winter Haven was also home to the first Publix supermarket, circa 1930.

The City of Bartow was named in honor of Francis S. Bartow, the first Confederate officer to die in the American Civil War. Fort Fraser was a United States Army fortification constructed in November, 1837, between the modern cities of Lakeland and Bartow in Polk County. The fort's name was inspired by Upton S. Fraser, a Captain in the U.S. Army who was killed by Seminole Indians in the March to Fort King on December 28, 1835. Colonel Zachary Taylor, who would later become the President of the United States, served at Fort Fraser as commander of two companies of the 1st U.S. Infantry. The fort was abandoned by the Army in May 1838, only to be informally used later as a shelter during the American Civil War.

The Circle B Bar Reserve is located in Polk County. It comprises 1,267 acres in Lakeland, Florida, and is managed as part of the Southwest Florida Water Management District. It is named after the cattle ranch that once occupied the site, and was purchased to help maintain the Banana Creek marsh area. It hosts the Polk County Nature Discovery Center, completed in 2008, and is home to an impressive array of birds since undergoing a wetland restoration effort.





The Avon Park Air Force Range (APAFR) is a United States Air Force bombing range and air-to-ground training complex, located east of the City of Avon Park. APAFR was first opened during World War II under the name of Avon Park Army Air Field. The

airfield was used for training B-17 air crews in air-to-ground bombing and for antisubmarine patrols. After World War II ended, the base was closed and placed in a caretaker status. In 1956, the base was renamed to Avon Park Air Force Range (APAFR), and a major improvement program was begun.

APAFR consists of approximately 106,000 acres of land, of which about 82,000 acres are open to the public for recreation, provided there are no ongoing military missions. APAFR includes Avon Park Air Force Auxiliary Field (also known as MacDill AFB Auxiliary Field). The airfield consists of an 8,000 ft. main runway, a limited-operational control tower, an aircraft rescue and firefighting facility and limited ramp and hangar facilities. The airfield is limited to military aircraft operations and is currently closed but open to military aircraft emergencies.

The host unit for the APAFR is the Deployed Unit Complex, 23rd Wing, Detachment 1, which is a unit of the 23rd Wing, an Air Combat Command composite fighter and rescue wing located at Moody Air Force Base, in Georgia. In addition to the Avon Park Air Force Range, the Complex also oversees a flight line facility at nearby MacDill AFB for transient military flight crews, maintenance crews and aircraft utilizing APAFR. This permits visiting squadrons to have ready access to APAFR while concurrently taking advantage of the more robust maintenance support capabilities at MacDill. This combination of facilities provides extensive, diversified and convenient training airspace and ranges with unique training capabilities for military air, ground, and air-to-ground training.



B. Background

This study is a first time effort in creating a statewide standardized study and methodology across Florida. In addition to focusing on hurricane hazards and evacuation, the study addresses issues concerning other hazards which may warrant an evacuation, thus affecting the region. Other hazards addressed are tornadoes, freshwater flooding, and wildfires. Using the most up to shelter and state critical facility data, population data, transportation data and new behavioral survey data, the Statewide Regional Evacuation Study for the Central Florida Region will be used in not only emergency management planning, but transportation and land use planning as well.

C. Objective and Scope

A major hurricane making landfall reaches beyond county lines and affects areas not even directly hit by the storm. Jurisdictions and counties can share one bay or estuary which can experience drastic storm surge. Evacuation routes can bring residents from one town or county into a completely different jurisdiction or even state. Therefore, it is important for local governments to communicate across governmental lines in order to plan for the potential impacts neighboring jurisdictions may have on safely evacuating the threatened population.



The primary purpose of this study was to coordinate a statewide, regionally consistent, comprehensive and quantitative evacuation study, primarily for hurricanes. The major components of the study consisted of the following:

- Hazards Analysis – A comprehensive analysis of potential hurricane hazards in the Central Florida Region utilizing the Sea, Lake and Overland Surges from Hurricanes (SLOSH) model and new topographic data, Light Detection and Ranging (LiDAR).
- Vulnerability Analysis – Identification of the vulnerable areas and population to hurricane, wind and flooding hazards.
- Demographic and Land Use Analysis – Describes population and demographics for the region and counties using current socio-economic data for 2006, 2010 and 2015.
- Behavioral Analysis – A survey and analysis to determine how vulnerable evacuees may respond to a hurricane threat as well as other hazards.

- Shelter Analysis – A quantitative analysis of shelter availability, deficit, and special needs (medical and pets).
- Transportation Analysis – Development of hurricane evacuation clearance times for each county and storm scenario associated with the movement of the current and projected vulnerable population from specific evacuation areas to specific evacuation destinations for a Year 2006 base year and projected for years 2010 and 2015.
- Ensure consistency in evacuating population and routes with adjacent regions.
- Update and standardize the Division of Emergency Management (DEM) facilities database to provide all counties with consistent, accurate and standardized emergency management data.
- Establish standardized analysis and methodology for use in deriving impacts and determining mitigation needs as required in Section 163.3178, F.S.

As a result of this study, an abbreviated model called "TIME" was developed that can be used by local emergency management officials, city and county planning staff, state emergency preparedness officials, and others to recalculate clearance times based upon land use and transportation system changes.

The *Central Florida Statewide Regional Evacuation Study* is not intended to serve as the detailed operations plan for each unit of local government in the region. Rather, it is intended to provide the data needed to develop local and state plans. The implementation of any evacuation plan is a local function. Therefore, the actual deployment and assignment of manpower and equipment to carry out the evacuation is best planned for at the local level. The data provided by this report will enable the local governments of the region to update specific operating procedures for the relocation of their vulnerable populations and recovery from a hurricane strike.

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EXECUTIVE SUMMARY

This Executive Summary is provided to state and local governments, volunteer organizations, the media and interested residents to highlight the results of the Statewide Regional Evacuation Study (SRES) for the Central Florida Region and to quantify and to illustrate the challenges of evacuation response in the Central Florida Region.

A. Demographic and Land Use Analysis

Located in the heart of Florida, the Central Florida region covers an area of approximately 5,286 square miles (land area) with an additional 335 square miles of water area. Okeechobee County is home to Lake Okeechobee. At a size of approximately 700 square miles, Lake Okeechobee is the largest lake in the State of Florida, and the 2nd largest freshwater lake in the United States.

The Central Florida region consists of five counties: DeSoto, Hardee, Highlands, Okeechobee and Polk, as well as their 25 municipalities. It is bounded on the west by Hillsborough, Manatee, Pasco and Sarasota counties; on the north by Indian River, Lake, Orange, Osceola and Sumter counties; on the east by Indian River, Martin, Osceola, Palm Beach and St. Lucie counties; and on the south by Charlotte, Glades and Martin counties. Due to its size and central location in the state, Polk County shares borders with more counties than any other county in the state. The Central Florida region does not have any coastal communities.

An explosive growth rate had been experienced, fueled by people seeking the combination of ample, quality land opportunities and consistent sun that the Central Florida region has to offer. With the economic downturn, this trend has slowed.

Chapter I provides a demographic profile of the region and the counties themselves. Specific socio-economic characteristics that may have an impact on evacuation vulnerability, response and mass care were identified using Census data, including recent American Community Survey data. This information includes:

1. Overall Population
2. Group Quarters Population
3. Housing Units by Type
4. Occupied Housing Units (Households)
5. Household Size
6. Seasonal Dwelling Units
7. Vehicles per Household
8. Age Composition
9. Race/Ethnicity
10. Place of Birth and Citizenship
11. Linguistic Isolation
12. Labor Force
13. Poverty Status
14. Small Area Dwelling Unit and Population Data

The Central Florida region Future Land Use Map illustrates the Statewide Generalized Land Use Categories, and is found in Chapter I. This map identifies eleven categories which represent a consolidation of land use categories which are identified in the region's (45) local government comprehensive plans (see **Table I-17**). The categories are:

- AG - Agriculture
- COM - Commercial/Office
- CONS - Conservation
- IND - Industrial
- MU - Mixed-Use
- PUB - Institutional, Government
- REC - Recreation/Open Space
- RH - Residential High Density
- RL - Residential Low Density
- RM - Residential Medium Density
- WAT - Water Bodies

B. Regional Hazards Analysis

The Hazards Analysis was the first step in the development of the regional evacuation study. The Hazards Analysis identifies type, extent and probability of those hazards which may confront our region and necessitate a regional evacuation. The Statewide Regional Evacuation Study took an "all-hazards" approach to this evacuation study. The hazards which could necessitate an evacuation at a regional level were identified as: (1) coastal storms and hurricanes, (2) floods, (3) hazardous materials and (4) wildfire.



1. Tropical Storms and Hurricanes

Risks from coastal storms and hurricanes include storm surge, high winds, tornadoes and inland flooding. Storm surge, considered the most deadly hazard, was quantified using the National Oceanic and Atmospheric Administration (NOAA) numerical storm surge model, SLOSH.¹ The SLOSH modeling system consists of the model source code and model basin, or grid. SLOSH model grids must be developed for each specific geographic coastal area, individually incorporating the unique local bay and river configuration, water depths, bridges, roads and other physical features. In addition to open coastline heights, one of the most valuable outputs of the SLOSH model for evacuation planning is its prediction of surge heights over land, which predicts the degree of propagation of the surge into inland areas.

¹ Sea, Lake and Overland Surges from Hurricanes (SLOSH)

The newest generation of the SLOSH model basin incorporated in the 2010 Statewide Regional Evacuation Study reflects major improvements, including higher resolution basin data and grid configurations. Faster computer speeds allowed additional hypothetical storms to be run for creation of the MOMs (maximum potential storm surge) values for each category of storm. Storm tracks were run in ten different directions. For each set of tracks in a specific direction, storms were run at forward speeds of 5, 10, 15 and 25 mph. For each direction, at each speed, storms were run at two different sizes (20 statute miles radius of maximum winds and 35 statute miles radius of maximum winds). Finally, each scenario was run at both mean tide and high tide. Both tide levels are now referenced to North American Vertical Datum of 1988 (NAVD88), as opposed to the National Geodetic Vertical Datum of 1929 (NGVD29).

SLOSH and SLOSH-related products reference storm surge heights relative to the model vertical datum, in this case NAVD88. In order to determine the inundation depth of surge flooding at a particular location, the ground elevation at that location must be subtracted from the potential surge height. As part of the Statewide Regional Evacuation Study, all coastal areas, as well as areas surrounding Lake Okeechobee, were mapped using remote-sensing laser terrain mapping (LIDAR),² providing the most comprehensive, accurate and precise topographic data for this analysis. As a general rule, the vertical accuracy of the laser mapping is within a 15 centimeter tolerance.

The LIDAR data was incorporated into the SLOSH basin data and was used to subtract the land elevation from the storm surge height to develop the storm tide limits. The result of this storm surge hazard analysis is graphically portrayed in the Storm Tide Atlas, which illustrates the storm tide limits based on the maximum storm surge for landfalling categories 1, 2, 3, 4 and 5. The Atlas maps and GIS files are available online at www.cfrpc.org.

While all residents would be susceptible to some extent from the effects of hurricane-force winds, mobile home residents are far more vulnerable than residents in site-built homes. Mobile home and RV park data was updated using information from the State of Florida Department of Health, property appraiser data and county planning departments.

Tornadoes are another hazard of tropical storm activity. Because it is impossible to identify where a tornado embedded in the hurricane wind bands will strike, evacuation does not consider tornado activity, per se. It is recognized, however, that mobile home residents are much more vulnerable to this severe weather event. Therefore, with the evacuation of mobile homes for hurricane winds, it is anticipated that severe injury will also be reduced from any tornado activity. In addition, the public information campaign will include a recommendation that tornado safe rooms (www.fema.gov) be considered by residents.

² Light Imaging Detection and Ranging (LIDAR)

While inland flooding had not been considered to be life-threatening in the past, it had, over the last twenty years, become a leading cause of hurricane-related deaths until Hurricane Katrina in 2005. The 100-year flood zone, as designated by the Federal Emergency Management Agency (FEMA) National Flood Insurance Program (NFIP), is identified and addressed separately under the Flooding Hazard.

While Florida counties do not typically evacuate for inland flooding for a hurricane, it is recognized that this may become a major problem during a hurricane evacuation, after a tropical storm passes or after prolonged rainfall. Evacuation routes within the flood zone are identified in an effort to find alternative routes, if necessary. Public information will stress that after the storm: (1) residents do NOT attempt to drive on flooded roadways and (2) children are NOT permitted to swim or play in flood waters.

2. Flooding

Both coastal and inland flooding are addressed through FEMA's NFIP. The 100-year and 500-year floodplain was identified within the region to illustrate the regional and county-level vulnerability to the flood hazard. In addition, communities with repetitive loss properties were identified by building type to provide an overall assessment of the risk. The areas' risk, historical frequency and estimated population at risk were identified in the hazards and vulnerability analyses. Also identified were dams which could pose a risk to the population which lives below them.



3. Wildfires and the Urban Interface

Florida is home to millions of residents who enjoy the state's beautiful scenery and warm climate. But few people realize that these qualities also create severe wildfire conditions. Each year, thousands of acres of wildland and many homes are destroyed by fires that can erupt at any time of the year from a variety of causes, including arson, lightning and debris burning. Adding to the fire hazard is the growing number of people living in new communities built in areas that were once wildland. This growth places even greater pressure on the state's wildland firefighters. As a result of this growth, fire protection becomes everyone's responsibility (Florida Division of Emergency Management, 2008 <http://www.floridadisaster.org/bpr/EMTOOLS/wildfire/wildfire.htm>).



A wildfire is any fire occurring in the wildlands (i.e., grasslands, forest, brushland, etc.). Wildfires have burned across the woodlands of Florida for centuries and are part of the natural management of much of Florida's ecosystems (Statewide Hazard Mitigation Plan, 2009).

The risk of potential wildfire to the region's population was identified using the data provided by the Florida Division of Forestry (FlamMap) and the population living in the high/very high risk areas was estimated.

4. Hazardous Materials

A hazardous material is generally considered as any item or agent (biological, chemical, or physical) which has the potential to cause harm to humans, animals or the environment, either by itself or through interaction with other factors. Almost every community deals with hazardous materials on a daily basis through transport, use, storage and/or disposal. The benefits chemicals bring into our lives through their designed uses have become vital to our standard of living. Although major chemical emergencies are extremely rare, there always remains a chance that one will occur. In the State of Florida, the county emergency management agencies plan for hazardous material incidents and coordinate regionally for response through the Local Emergency Planning Committees (LEPCs). While the facilities with extremely hazardous materials were identified, the evacuation planning for incidents involving hazardous materials is addressed in the *Regional Hazardous Material Emergency Response Plan*.

No specific emergency sequence can be isolated as the model for which to plan, because each emergency could have different consequences both in nature and degree. As an alternative to defining a specified emergency, the regional plan identifies various parameters for planning which are based upon knowledge of the possible consequences, timing, and release characteristics of a spectrum of emergencies. The *Regional Hazardous Material Emergency Response Plan* then establishes the appropriate response for each level of threat. Therefore, the Statewide Regional Evacuation Study did not specifically address hazardous material incidents.

C. Vulnerability Analysis & Population-At-Risk

Depending upon the strength of the storm, the regional evacuation study calls for the complete evacuation of successively more surge-vulnerable zones inland in addition to all mobile home residents. Using information from the Metropolitan Planning Organizations (MPOs) and the local planning commissions/departments, the population, dwelling unit counts, and vehicle data for each zone was developed (see Chapter IV, Regional Vulnerability and Population Analysis). County/Regional population-at-risk for the years 2010 and 2015 are presented in **Tables ES-1 and ES-2** below.

**Table ES-1
Population-at-Risk from Hurricanes by Evacuation Level 2010**

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
DeSoto County					
Site-Built Homes	994	227	947	1,589	0
Mobile/Manufactured Homes	665	90	339	580	0
TOTAL	1,659	317	1,286	2,169	0
Highlands County					
Site-Built Homes	0	0	0	4	11
Mobile/Manufactured Homes	0	0	0	8	25
TOTAL	0	0	0	12	36
Okeechobee County					
Site-Built Homes	5,233	5,202	11,097	0	0
Mobile/Manufactured Homes	7,548	2,398	6,816	0	0
TOTAL	12,781	7,600	17,913	0	0

Note: Vulnerable population determined using SRESP behavioral data and county-provided evacuation zones. Vulnerable population numbers are not inclusive, meaning population numbers listed for a higher zone are not included in the lower zone. For example, vulnerable population listed for Evacuation Zone B does not include vulnerable population listed for Evacuation Zone A.

**Table ES-2
Population-at-Risk from Hurricanes by Evacuation Level 2015**

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
DeSoto County					
Site-Built Homes	1,432	305	1,189	2,021	0
Mobile/Manufactured Homes	691	94	352	603	0
TOTAL	2,123	399	1,541	2,624	0
Highlands County					
Site-Built Homes	0	0	0	5	14
Mobile/Manufactured Homes	0	0	0	8	25
TOTAL	0	0	0	13	39
Okeechobee County					
Site-Built Homes	5,579	5,587	13,375	0	0
Mobile/Manufactured Homes	7,548	2,398	7,613	0	0
TOTAL	13,127	7,985	20,985	0	0

Note: Vulnerable population determined using SRESP behavioral data and county-provided evacuation zones. Vulnerable population numbers are not inclusive, meaning population numbers listed for a higher zone are not included in the lower zone. For example, vulnerable population listed for Evacuation Zone B does not include vulnerable population listed for Evacuation Zone A.

If everyone who was ordered to evacuate did so, and those who were not ordered to evacuate secured their homes and stayed put, emergency management could use the population-at-risk statistics. This, however, is not the case.

Post-hurricane behavioral studies conducted along the Atlantic and Gulf coasts illustrate that many people ordered to evacuate will not, and conversely, people who live in site-built homes far outside the coastal areas will pack up and try to "outrun" the storm ("*shadow evacuation*"). How we quantify this behavior is key to an accurate transportation analysis. This study used the general response model (HMG, 2010) as

well as the surveys conducted in 2009 (see Chapter III, Regional Behavioral Analysis Summary). Volume 2 of the Statewide Regional Evacuation Study Program provides the Regional Behavioral Assumptions based upon the General Response Model and the survey results presented in Volume 3, Behavioral Survey Report.

Using the behavioral assumptions discussed in Chapter III, two scenarios were developed. The **Base Scenario** population assumes that 100% of the population-at-risk evacuate, plus the anticipated "shadow evacuation" from outside the surge-vulnerable areas. The scenario is considered the most "conservative" estimate and will be used for growth management purposes. **Tables ES-3 and ES-4** present these evacuation population estimates for 2010 and 2015.

The second **Operational Scenario** population estimates apply the participation rates presented in the regional behavioral assumptions. They do not assume that 100% of the population-at-risk evacuate, but do include the "shadow evacuation" expected, depending on the strength of the hurricane. **Tables ES-5 and ES-6** present the evacuation population estimates and projections for 2010 and 2015.

**Table ES-3
Hurricane Evacuation Population by Evacuation Level
Base Planning Scenarios 2010**

	Evacuation Level A Base Scenario	Evacuation Level B Base Scenario	Evacuation Level C Base Scenario	Evacuation Level D Base Scenario	Evacuation Level E Base Scenario
DeSoto County					
Site-Built Homes	1,959	3,128	4,885	7,059	7,886
Mobile/Manufactured Homes	13,270	13,270	13,270	13,270	13,270
Tourists	0	0	0	0	0
TOTAL	15,229	16,398	18,155	20,329	21,156
Hardee County					
Site-Built Homes	1,850	1,850	2,775	3,700	4,625
Mobile/Manufactured Homes	9,592	9,592	9,592	9,592	9,592
Tourists	0	0	0	0	0
TOTAL	11,442	11,442	12,367	13,292	14,217
Highlands County					
Site-Built Homes	3,580	3,580	7,160	14,323	17,911
Mobile/Manufactured Homes	19,656	19,656	19,656	19,656	19,656
Tourists	0	0	0	0	0
TOTAL	22,3236	23,236	26,816	33,979	37,567
Okeechobee County					
Site-Built Homes	6,863	12,105	21,557	21,557	21,557
Mobile/Manufactured Homes	16,761	16,761	16,761	16,761	16,761
Tourists	133	177	202	202	202
TOTAL	23,757	29,043	38,520	38,520	38,520
Polk County					
Site-Built Homes	22,247	44,495	66,742	88,990	111,237
Mobile/Manufactured Homes	68,678	68,678	68,678	68,678	68,678
Tourists	0	0	0	0	0
TOTAL	90,925	113,173	135,420	157,668	179,915

**Table ES-4
Hurricane Evacuation Population by Evacuation Level
Base Planning Scenarios 2015**

	Evacuation Level A Base Scenario	Evacuation Level B Base Scenario	Evacuation Level C Base Scenario	Evacuation Level D Base Scenario	Evacuation Level E Base Scenario
DeSoto County					
Site-Built Homes	2,549	3,942	6,054	8,711	9,654
Mobile/Manufactured Homes	13,792	13,792	13,792	13,792	13,792
Tourists	0	0	0	0	0
TOTAL	16,341	17,734	19,846	22,503	23,446
Hardee County					
Site-Built Homes	2,571	2,571	3,856	5,141	6,427
Mobile/Manufactured Homes	9,592	9,592	9,592	9,592	9,592
Tourists	0	0	0	0	0
TOTAL	12,163	12,163	13,448	14,733	16,019
Highlands County					
Site-Built Homes	4,184	4,184	8,368	16,739	20,933
Mobile/Manufactured Homes	19,656	19,656	19,656	19,656	19,656
Tourists	0	0	0	0	0
TOTAL	23,840	23,840	28,024	36,395	40,589
Okeechobee County					
Site-Built Homes	7,491	13,191	24,588	24,588	24,588
Mobile/Manufactured Homes	17,563	17,563	17,563	17,563	17,563
Tourists	133	177	202	202	202
TOTAL	25,187	30,931	42,353	42,353	42,353
Polk County					
Site-Built Homes	25,132	50,265	75,397	100,530	125,662
Mobile/Manufactured Homes	68,111	68,111	68,111	68,111	68,111
Tourists	0	0	0	0	0
TOTAL	93,243	118,376	143,508	168,641	193,773

**Table ES-5
Hurricane Evacuation Population by Evacuation Level
Operational Scenarios 2010**

	Evacuation Level A Base Scenario	Evacuation Level B Base Scenario	Evacuation Level C Base Scenario	Evacuation Level D Base Scenario	Evacuation Level E Base Scenario
DeSoto County					
Site-Built Homes	0	0	0	4,060	0
Mobile/Manufactured Homes	0	0	0	10,616	0
Tourists	0	0	0	0	0
TOTAL	0	0	0	14,676	0
Hardee County					
Site-Built Homes	1,850	1,850	1,850	3,700	0
Mobile/Manufactured Homes	3,837	5,755	5,755	7,673	0
Tourists	0	0	0	0	0
TOTAL	5,687	7,605	7,605	11,373	0
Highlands County					
Site-Built Homes	0	3,580	7,160	14,320	14,320
Mobile/Manufactured Homes	0	11,793	13,759	15,725	15,725
Tourists	0	0	0	0	0
TOTAL	0	15,373	20,919	30,045	30,045
Okeechobee County					
Site-Built Homes	0	0	4,311	0	5,389
Mobile/Manufactured Homes	0	0	12,570	0	14,247
Tourists	0	0	202	0	202
TOTAL	0	0	17,083	0	19,838
Polk County					
Site-Built Homes	22,247	44,495	44,495	66,742	66,742
Mobile/Manufactured Homes	27,471	41,207	41,207	48,075	48,075
Tourists	0	0	0	0	0
TOTAL	49,718	85,702	85,702	114,817	114,817

**Table ES-6
Hurricane Evacuation Population by Evacuation Level
Operational Scenarios 2015**

	Evacuation Level A Base Scenario	Evacuation Level B Base Scenario	Evacuation Level C Base Scenario	Evacuation Level D Base Scenario	Evacuation Level E Base Scenario
DeSoto County					
Site-Built Homes	2,380	0	0	0	0
Mobile/Manufactured Homes	8,275	0	0	0	0
Tourists	0	0	0	0	0
TOTAL	10,655	0	0	0	0
Hardee County					
Site-Built Homes	2,571	0	3,856	3,856	3,856
Mobile/Manufactured Homes	3,837	0	6,714	6,714	6,714
Tourists	0	0	0	0	0
TOTAL	6,408	0	10,570	10,570	10,570
Highlands County					
Site-Built Homes	4,184	4,184	0	16,736	16,736
Mobile/Manufactured Homes	7,862	11,793	0	15,725	15,725
Tourists	0	0	0	0	0
TOTAL	12,046	15,977	0	32,461	32,461
Okeechobee County					
Site-Built Homes	0	3,688	0	6,174	7,377
Mobile/Manufactured Homes	0	11,416	0	14,928	15,806
Tourists	0	177	0	202	202
TOTAL	0	15,281	0	21,277	23,385
Polk County					
Site-Built Homes	25,132	50,265	75,397	75,397	75,397
Mobile/Manufactured Homes	27,244	40,867	47,678	47,678	47,678
Tourists	0	0	0	0	0
TOTAL	52,376	91,132	123,075	123,075	123,075

Chapter IV also presents the vulnerability of critical facilities within the region to tropical storms and hurricanes, flooding (100-year and 500-year), and wildfire (high and very high). The County Appendices provide more detailed data and maps for selected critical facilities, including health care facilities (hospitals, nursing homes, etc.), assisted living facilities (ALFs), fire and police stations, and other identified facilities.

D. Public Shelter Demand

As part of the regional evacuation study, the anticipated demand for public shelter was quantified. The public shelter inventories and the capacities within each county were identified, and a comparison was made to determine the status within both the county and the region.

The general response model, post-hurricane behavioral surveys of residents in the Central Florida region, and past experience were used to determine public shelter demand. The number of evacuees who choose public shelter as their evacuation

destination is based on demographic characteristics of the population including income and age, risk area and housing (mobile homes vs. site-built homes). The planning assumptions regarding anticipated shelter use were presented in the Regional Behavioral Analysis (see Chapter III, Appendices III-A, III-B, III-C, III-D, and III-E), and were applied to the projected Hurricane Evacuation Population estimates for both the *Base Planning Scenarios* and the *Operational Scenarios*.

As discussed in Chapter IV, the Base Planning Scenarios assume 100% compliance of the vulnerable populations (surge-vulnerable and mobile home residents) plus the "shadow evacuation". The Operational Scenarios use the participation rates from the behavioral analysis to determine the evacuation rates.

Table ES-7
Public Shelter Demand for Hurricane Evacuation
Base Scenarios 2010

County	Capacity	A	B	C	D	E
DeSoto	1,810	2,551	2,710	2,953	3,608	3,730
Hardee	4,968	1,832	1,832	1,985	2,183	2,451
Highlands	6,473	5,465	5,465	5,988	7,803	8,366
Okeechobee	7,755	3,818	4,745	6,149	6,297	6,566
Polk	55,241	15,533	18,217	20,901	25,191	28,908
Region	76,247	29,199	32,969	37,976	45,082	50,021

Numbers in *Red* represent a shelter deficit.

Table ES-8
Public Shelter Demand for Hurricane Evacuation
Base Scenarios 2015

County	Capacity	A	B	C	D	E
DeSoto	1,810	2,721	2,914	3,204	3,952	4,090
Hardee	4,968	1,948	1,948	2,161	2,435	2,764
Highlands	6,473	5,554	5,554	6,164	8,181	8,837
Okeechobee	7,755	4,000	5,006	6,695	6,849	7,150
Polk	55,241	15,925	19,001	22,080	26,762	31,021
Region	76,247	30,148	34,423	40,304	48,179	53,862

Numbers in *Red* represent a shelter deficit.

Table ES-9
Public Shelter Demand for Hurricane Evacuation
Operational Scenarios 2010

County	Capacity	A	B	C	D	E
DeSoto	1,810	0	0	0	2,651	0
Hardee	4,968	918	1,223	1,223	1,880	0
Highlands	6,473	0	3,489	4,505	6,690	6,690
Okeechobee	7,755	0	0	2,551	0	3,102
Polk	55,241	7,824	13,078	13,078	17,046	17,046
Region	76,247	8,742	17,790	21,357	28,267	26,838

Numbers in *Red* represent a shelter deficit.

**Table ES-10
Public Shelter Demand for Hurricane Evacuation
Operational Scenarios 2015**

County	Capacity	A	B	C	D	E
DeSoto	1,810	1,750	0	0	0	0
Hardee	4,968	1,034	0	1,704	1,704	1,704
Highlands	6,473	2,588	3,576	0	7,067	7,067
Okeechobee	7,755	0	2,239	0	3,284	3,715
Polk	55,241	8,216	13,862	18,224	18,224	18,224
Region	76,247	13,588	19,677	19,928	30,279	30,710

Numbers in Red represent a shelter deficit.

Using the behavioral assumptions, based on the General Response Model, has a significant impact on the potential shelter demand calculations. As noted in Chapter III, Regional Behavioral Analysis, the use of public shelters for residents in site-built homes ranges from 5% - 10% depending on age and income. Traditionally, a public shelter use rate of between 10% - 25% was used for planning purposes. However, the trend for less reliance on public shelters has been recognized in past evacuations throughout the Gulf and Atlantic states.

As noted, there is no shelter deficit in Hardee, Okeechobee or Polk counties. Highlands County shows a deficit for the most intense storms. DeSoto County faces the most significant challenges.

Recognizing the trend toward a reduced reliance on public shelters, the emergency management community remains concerned that the assumption of such a drastic reduction in anticipated need does not take into consideration that many vulnerable residents will choose not to evacuate until there is no longer sufficient time to reach other destinations. This could logically result in a surge of evacuees to the public shelters in the closing hours of the evacuation. In addition, if a major hurricane were to impact the region, there would be less capacity in public shelters for those residents who have no home to which to return.

In terms of community resiliency, without the requirement of EHPA standards, new schools may not be built to standards which would ensure the schools would survive the hit of a major hurricane. In addition, the need for more special needs shelters must also be addressed in both state and local plans.

Therefore, local emergency management may use different assumptions for both public and special needs shelters within the operational plans, as reflected in the County Comprehensive Emergency Management Plans (CEMPs).

E. Evacuation Transportation Analysis

The Evacuation Transportation Analysis discussed in Chapter VI documents the methodology, analysis, and results of the transportation component of the Statewide Regional Evacuation Study Program. Among the many analyses required for the SRESP, transportation analysis is probably one of the most important components in the process. By bringing together storm intensity, transportation network, shelters and evacuation population, transportation analysis explicitly links people's behavioral responses to the regional evacuation infrastructure, and helps formulate effective and responsive evacuation policy options. Due to the complex calculations involved, and numerous evacuation scenarios that need to be evaluated, the best way to conduct the transportation analysis is through the use of computerized transportation simulation programs, or transportation models.

The development of the transportation methodology and framework required coordination and input from all eleven regional planning councils in Florida, along with the Division of Emergency Management, Department of Transportation, Department of Community Affairs, and local county emergency management teams. At the statewide level, the transportation consultant, Wilbur Smith Associates, participated in SRESP Work Group Meetings which were typically held on a monthly basis to discuss the development of the transportation methodology and receive feedback and input from the State agencies and regional planning councils.

At the local and regional level, Wilbur Smith Associates conducted a series of four regional meetings to coordinate with and receive input from local county emergency management, the regional planning councils, local transportation planning agencies and groups, as well as other interested agencies.

1. Transportation Methodology

The methodology used in the Central Florida Regional Planning Council Evacuation Transportation Analysis is identical to the methodology used for all eleven regional planning councils and includes the following components:

- Behavioral Assumptions
- Zone System and Highway Network
- Background Traffic
- Evacuation Traffic
- Dynamic Traffic Assignment

The regional model developed for the Central Florida region used a series of input data provided by the regional planning council, including the following:

- Regional Model Network
- Regional Zone System
- Regional Demographic Characteristics

2. Clearance Times

The evacuation clearance times were defined and calculated as part of the Statewide Regional Evacuation Study Program and the evacuation transportation analysis, and represent a series of scenarios and points in time within the evacuation process. They are as follows:

- **Clearance Time to Shelter:** The time necessary to safely evacuate vulnerable residents and visitors to a “point of safety” within the county based on a specific hazard, behavioral assumptions and evacuation scenario. Calculated from the point in time when the evacuation order is given to the point in time when the last vehicle reaches a point of safety within the county.
- **In-County Clearance Time:** The time required from the point an evacuation order is given until the last evacuee can either leave the evacuation zone or arrive at safe shelter within the county. This does not include those evacuees leaving the county on their own.
- **Out of County Clearance Time:** The time necessary to safely evacuate vulnerable residents and visitors to a “point of safety” within the county based on a specific hazard, behavioral assumptions and evacuation scenario. Calculated from the point an evacuation order is given to the point in time when the last vehicle assigned an external destination exits the county.
- **Regional Clearance Time:** The time necessary to safely evacuate vulnerable residents and visitors to a “point of safety” within the regional planning council region based on a specific hazard, behavioral assumptions and evacuation scenario. Calculated from the point in time when the evacuation order is given to the point in time when the last vehicle assigned an external destination exits the region.

Based on the analysis, the Clearance Times for the Base Planning Scenarios and Operational Scenarios for 2010 and 2015 are provided below.

Table ES-11
2010 Clearance Times for Base Scenarios

	Evacuation Level A Base Scenario	Evacuation Level B Base Scenario	Evacuation Level C Base Scenario	Evacuation Level D Base Scenario	Evacuation Level E Base Scenario
Clearance Time to Shelter					
DeSoto County	12.5	13.0	16.5	22.0	30.0
Hardee County	10.0	10.5	10.5	9.5	11.0
Highlands County	12.5	12.5	12.5	12.5	12.5
Okeechobee County	12.5	12.5	0.0	0.0	0.0
Polk County	13.0	15.0	16.5	16.0	20.5
In-County Clearance Time					
DeSoto County	13.5	13.5	17.5	24.0	32.0
Hardee County	12.5	12.5	12.5	12.0	12.5
Highlands County	13.0	13.0	13.0	13.0	13.0
Okeechobee County	15.0	15.5	20.0	26.0	35.5
Polk County	13.5	15.5	17.0	16.5	21.0
Out of County Clearance Time					
DeSoto County	13.5	14.0	18.0	24.0	32.0
Hardee County	13.5	13.5	18.0	25.0	33.5
Highlands County	14.5	14.5	19.0	25.0	34.5
Okeechobee County	15.0	16.0	19.5	25.5	35.0
Polk County	14.5	21.0	24.0	36.5	44.5
Regional Clearance Time					
Central Florida	15.0	21.0	24.0	36.5	44.5

Table ES-12
2015 Clearance Times for Base Scenarios

	Evacuation Level A Base Scenario	Evacuation Level B Base Scenario	Evacuation Level C Base Scenario	Evacuation Level D Base Scenario	Evacuation Level E Base Scenario
Clearance Time to Shelter					
DeSoto County	12.5	13.5	14.5	29.5	38.5
Hardee County	10.0	10.5	11.0	11.0	38.0
Highlands County	12.5	12.5	12.5	12.5	12.5
Okeechobee County	12.5	12.5	0.0	0.0	0.0
Polk County	13.0	16.0	17.5	30.5	20.5
In-County Clearance Time					
DeSoto County	13.5	14.0	22.0	30.5	38.5
Hardee County	12.5	12.5	12.5	12.5	39.5
Highlands County	13.0	13.0	13.0	13.0	13.0
Okeechobee County	15.0	16.0	24.5	33.0	40.5
Polk County	13.5	16.5	18.0	31.0	21.0
Out of County Clearance Time					
DeSoto County	13.5	14.5	22.0	31.0	41.0
Hardee County	13.0	14.5	22.0	31.5	41.5
Highlands County	14.5	15.0	22.5	32.0	39.5
Okeechobee County	15.0	16.0	24.0	32.5	40.0
Polk County	16.0	18.5	32.0	35.0	48.5
Regional Clearance Time					
Central Florida	16.0	18.5	32.0	35.0	48.5

Table ES-13
2010 Clearance Times for Operational Scenarios

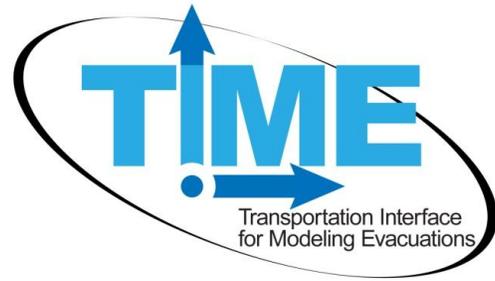
	Evacuation Level A Base Scenario	Evacuation Level B Base Scenario	Evacuation Level C Base Scenario	Evacuation Level D Base Scenario	Evacuation Level E Base Scenario
Clearance Time to Shelter					
DeSoto County	0.0	0.0	0.0	20.5	0.0
Hardee County	5.0	6.5	5.5	10.5	0.0
Highlands County	0.0	12.5	9.5	12.5	12.5
Okeechobee County	0.0	0.0	0.0	0.0	0.0
Polk County	10.0	13.0	10.0	13.0	13.0
In-County Clearance Time					
DeSoto County	0.0	0.0	0.0	27.0	0.0
Hardee County	8.5	10.5	8.5	12.5	0.0
Highlands County	0.0	13.0	10.0	13.0	13.0
Okeechobee County	0.0	0.0	14.5	0.0	14.5
Polk County	10.5	13.5	10.5	13.5	13.5
Out of County Clearance Time					
DeSoto County	10.0	12.5	14.0	27.5	13.5
Hardee County	10.0	11.5	15.0	27.5	13.5
Highlands County	9.0	13.0	15.0	27.0	15.0
Okeechobee County	9.0	13.5	14.0	26.0	14.0
Polk County	11.0	15.0	19.0	33.5	17.0
Regional Clearance Time					
Central Florida	11.0	15.0	19.0	33.5	17.0

Table ES-14
2015 Clearance Times for Operational Scenarios

	Evacuation Level A Base Scenario	Evacuation Level B Base Scenario	Evacuation Level C Base Scenario	Evacuation Level D Base Scenario	Evacuation Level E Base Scenario
Clearance Time to Shelter					
DeSoto County	11.5	0.0	0.0	0.0	0.0
Hardee County	6.0	0.0	9.0	9.0	9.5
Highlands County	9.5	12.5	0.0	9.5	12.5
Okeechobee County	0.0	12.5	0.0	3.0	0.5
Polk County	10.0	13.0	14.5	10.0	13.0
In-County Clearance Time					
DeSoto County	14.5	0.0	0.0	0.0	0.0
Hardee County	8.5	0.0	11.5	9.5	12.0
Highlands County	10.0	13.0	0.0	10.0	13.0
Okeechobee County	0.0	13.5	0.0	18.5	15.0
Polk County	10.5	13.5	15.0	10.5	13.5
Out of County Clearance Time					
DeSoto County	14.5	12.5	13.0	19.0	13.5
Hardee County	14.5	12.0	14.0	20.5	14.0
Highlands County	14.0	14.0	13.5	20.0	14.0
Okeechobee County	12.5	14.0	18.0	18.5	14.5
Polk County	16.5	15.0	23.5	23.5	15.5
Regional Clearance Time					
Central Florida	16.5	15.0	23.5	23.5	15.5

3. TIME User Interface

Wilbur Smith Associates developed the Transportation Interface for Modeling Evacuations (TIME) to make it easier for regional planning council staff and transportation planners to use the model and implement the evacuation methodology. The TIME interface is based on an ArcGIS platform and is essentially a condensed transportation model, which provides a user friendly means of modifying input variables that would change the clearance times for various evacuation scenarios.



The evacuation model variables include a set of distinguishing characteristics that could apply to evacuation scenarios as selection criteria. These following variables may be selected using the TIME interface and allow the user to retrieve the best results from various evacuation alternatives:

- Analysis time period
- Highway network
- Behavioral response
- One-way evacuation operations
- University population
- Tourist occupancy rates
- Shelters
- Counties evacuating
- Evacuation level
- Response curve hours
- Evacuation Phasing

It is anticipated that the regional planning councils and local governments will be able to use the TIME User Interface to simulate additional scenarios, varying behavioral assumptions, reflecting proposed growth in coastal areas, new transportation improvements, etc.

F. Glossary

The Glossary at the back of the Technical Data Report contains the definitions of the terms used throughout the document. In many cases, it represents the legal consensus of the definition of terms in statute pertaining to growth management. The Statewide Regional Evacuation Study Program represents a consistent and coordinated approach to provide tools for both the emergency management community, as well as the planning community in the State of Florida.

G. Conclusions and Recommendations

Obviously, the implementation of a successful hurricane evacuation in the Central Florida region will be complex and challenging. It will require a team effort - not just on the part of the emergency management and response personnel, but of the entire community. Complacency and apathy could have dire consequences.

The SRESP illustrates that there have been improvements in hurricane evacuation planning, including increased public shelter capacity, assistance for the transit dependent, alternatives for evacuees with pets, special needs shelters, route improvements and growth management mitigation strategies, helping to reduce the population-at-risk. However, there remain serious challenges in this region if we are to avoid the loss of life and property and human suffering witnessed in the 2005 hurricane season in Mississippi, Louisiana and Texas.

Over the past 30 years, Central Florida Regional Planning Council (CFRPC), the State of Florida, County Emergency Management agencies, the American Red Cross and many other agencies have worked together to prepare regionally for a disaster – not just the inevitable strike of a hurricane, but the impacts of flooding, hazardous material incidents and terrorist attacks.

Recent events have tragically demonstrated the power of nature and the horrific results if government and citizens fail to respond appropriately. As public servants and elected officials, it is imperative to address the concerns of our citizens and leaders regarding our ability to manage a major disaster.

1. Public Education

Our citizens' knowledge and understanding of personal risk and appropriate evacuation response remains a serious challenge. The behavioral surveys indicated that many residents – even those in the most surge-vulnerable areas and mobile homes – believe their home would be safe in a major hurricane, do not have a family disaster plan, and many will not evacuate regardless of the intensity of the storm or government actions. This fact means that those who choose to stay behind in mobile homes and areas vulnerable to storm surge and velocity wave action might not survive a storm.

In turn, many residents, even those well inland of storm surge and also in site-built homes, responded that they will try to evacuate - many out of the region or state. Because of the "shadow evacuation", resulting clearance times are exceedingly high, necessitating the planning of refuge shelters along critical evacuation routes, reverse laning of Interstate systems and the potential of evacuation problems seen in Houston, Texas, with Hurricane Rita (2005).

The hurricane public information program in the Central Florida region is a comprehensive program geared toward pre-storm information (Public Education) as well as prepared emergency public information for use during the emergency (Public Information). The major product of the public education program is the

Hurricane Guide, which is printed and distributed every year at the beginning of hurricane season. In addition, the guide is augmented by local (printed) information, interactive web sites, citizen information lines, public speaking engagements, and information relayed in schools, newspapers, the broadcast media and neighborhood associations throughout the season.

In order to elicit an immediate evacuation response, the population-at-risk must be clearly and conclusively convinced that (1) they are indeed residing in a vulnerable area, and (2) that a decision not to leave could mean their loss of life or injury. Post-hurricane studies have shown that the most vital piece of information is the information received from the emergency management personnel and local officials. For the most part, people will respond based upon the urgency and seriousness of the threat as conveyed by the emergency response personnel (HMG, 1999 and 2006).

Three key messages have been identified:

1. Know your risk (evacuation zone/mobile homes).
2. Make a family plan.
3. Obtain emergency supplies for at least 3-5 days.

The accurate formulation and comprehensive dissemination of these critical pieces of information to the public in a simple and understandable form is essential for implementation of an effective hurricane evacuation plan.

Hopefully, irrational emergency decision-making on the part of the population can be decreased if they determine their vulnerability to a hurricane before the emergency occurs. Residents in the Central Florida region are encouraged to become familiar with the county plans for evacuation and to make their "family plans" and business plans ahead of time. The State of Florida has partnered with the Florida Broadcasting Association to encourage the "culture of preparedness" including PSAs and billboards. Partnering at the local level is also needed.

Additional notification procedures (of evacuation level) is implemented and repeated throughout the season. The local governments in the region do have programs which provide these services to their residents, so it is unclear why so many residents do not know their evacuation level or understand their risk. These additional notification procedures are:

- Notification on utility bills (zone designation)
- Notification on tax bills (zone designation)
- Special mailings and deliveries
- Interactive websites (zone look up)
- Citizen information lines (zone look up)

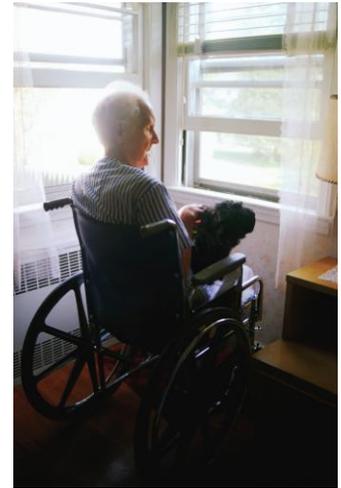
Perhaps the answer lies in a strengthened, continued initiative to partner with all levels of government, the private sector, civic and business associations, non-profit/volunteer agencies and the media to "get the word out" about

preparedness and mitigation. Businesses have been increasingly active in developing continuity plans and providing information to their employees. Churches and civic associations, neighborhood associations, crime watch and Community Emergency Response Teams (CERT) can provide direct contact and face-to-face communication.

2. Special Needs

Providing shelter for residents with special needs is a critical issue. Partners including the Department of Health, home health agencies, hospitals and skilled nursing facilities, to name just a few, must work with local agencies to (1) register and determine the appropriate level of care and appropriate shelter alternative for each resident and (2) provide the facility, staff, equipment, supplies and transportation assistance in an effective manner in a disaster situation.

Again, we need to develop strong partnerships with those entities in the community that work with our citizens with special needs on a daily basis to ensure they receive the information and support they need before, during and after a disaster.



3. Mitigation Message

As identified, the results of the Statewide Regional Evacuation Study for the Central Florida region highlight the challenges of the emergency management community in an area such as Central Florida. If people do not respond correctly when an evacuation order is given, there will be serious implications on the entire emergency response. For example, if residents who live in low-lying, surge-vulnerable areas or mobile homes do not evacuate, they are putting their safety at risk. Conversely, if residents who live in site-built homes outside the surge-vulnerable areas try to evacuate in significant numbers - as they did during the 1999 Hurricane Floyd evacuation and for Hurricane Rita in 2005, the resulting traffic congestion may prevent anyone from reaching safety.

The answer is consistent comprehensive public education which focuses on encouraging our residents to do the following: (1) know their risk; and (2) plan ahead. Again, key messages include:

- Individual Responsibility – Be disaster resilient. Know your risk, plan ahead and obtain needed supplies.

- Encourage residents to "*Flee from Flood; Hide from Wind*". Obviously, coastal residents in surge-vulnerable areas and mobile home residents must evacuate. However, the key message is to seek refuge within "tens of miles, not hundreds of miles".
- Strongly encourage all residents who live in site-built homes outside the surge-vulnerable areas to call and invite friends or relatives who must evacuate to come and stay with them if there is a hurricane threat. Once they have committed by inviting their friends or relatives, we will also encourage residents to prepare their homes and mitigate for the potential winds: window and door protection, braced gable end roofs, and garage doors.
- It is assumed if inland residents take action to protect their homes from wind, they will be less likely to try to "outrun" a hurricane.

4. The Coastal High Hazard Area (CHHA)

In 2006, the Florida Legislature passed a bill changing the definition of the Coastal High Hazard Area (CHHA) from the evacuation zone to the "area defined by the SLOSH model to be inundated from a category one hurricane". This change was welcome, as the definition was more defensible tying the land use regulations to a scientific model rather than the zone delineated by roadways and familiar landmarks. However, the limitations of the model must be recognized by the local governments now responsible for its regulation.

As discussed, the SLOSH model does not address wave height and other local processes. It also does not incorporate the danger of isolation in areas surrounded by storm surge with limited access such as barrier islands. These two issues are of serious concern and it is recommended that local governments address them within their comprehensive plans and land development regulations.

H. Use of SRES Data in Growth Management

While this study is primarily designed for the local emergency management agencies to utilize in the preparation of emergency response, evacuation, sheltering and mitigation plans, Chapter 163.3178 of the Florida Statutes directs growth management planners to this study to identify exceedances when determining the impacts of growth on the safety of the public. Therefore, this study is also designed with many features to address growth management issues. Key items included are Coastal High Hazard Areas (CHHA), clearance times, shelter capacity, and tools for determining impacts of growth.

1. Storm Tide Limits and the Coastal High Hazard Area

The Statewide Regional Evacuation Study (SRES) contains data which is directly referenced in growth management legislation in the State of Florida and

coastal/conservation elements of the Local Government Comprehensive Plans. The Storm Tide Atlas (Volume 7) and the storm tide limits it portrays for each county define the Coastal High Hazard Area (CHHA).³ Section 163.3178(9)(c), Florida Statutes, requires local governments to amend their future land use map and coastal management element to include the new definition of the Coastal High Hazard Area and to depict the CHHA on the County's Future Land Use Map.

As indicated in the Hazards Analysis chapter (Volume 1: Technical Data Report, Chapter II), the ultimate amount of storm surge at any given coastal location is determined by a number of factors. It has been demonstrated that storm parameters including the wind speed and profiles, angle of approach, size of radii of maximum winds and the forward speed of the system will have a complex and inter-related effect on the amount of surge at a particular site. For example, Hurricane Ike, which struck the Galveston area in 2009, was classified as a Category 2 Hurricane on the Saffir-Simpson Hurricane Wind Scale, yet it produced a 24 - 26 foot storm surge (often associated with a Category 5 Hurricane) due to its large wind fields (radius of maximum winds) and angle of approach.

2. Storm Tide Limits and Evacuation Zones

Emergency management officials use many factors in determining County Evacuation Zones, with storm tide limits being a major component. However, it is important to note that the storm tide boundaries are not the only data used in this determination. Local officials use their knowledge of the area and other data such as: areas of repetitive loss, surge depth, freshwater flooding, isolation issues, and debris hazards, and typically choose known landmarks to identify boundaries for public warning and information.

As a result, the Evacuation Zones largely correspond to the storm tide limits of the Category 1 - 5 hurricanes on the Saffir-Simpson Wind Scale. However, the degree to which any specific zone corresponds to storm tide limits is directly related to the effect other data factors have on the final determination of County Evacuation Zones by local officials. These factors may lead local officials to consolidate zones, add additional zones, expand, or contract zones to ensure those threatened by the hazards are appropriately included.

The 2010 SRES introduces alphabetic Evacuation Zones/Levels (A-E) across the State for the first time. A map (**Figure IV-2**) of these zones is located in Chapter IV: Regional Population and Vulnerability Analysis, found in Volume 1 of the Study. For purposes of growth management planning, the reference to areas to be evacuated from a Category 1 hurricane should use Evacuation Zone/Level A, reference to evacuation areas to be evacuated in advance of a

³ Section 163.3178(2)(h), F.S.: "the area below the elevation of the Category 1 storm surge line as established by a Sea, lake and Overland Surge from Hurricanes (SLOSH) computerized storm surge model."

Category 2 hurricane should use Evacuation Zone/Level B, and reference to areas to be evacuated from a Category 3 hurricane should use Evacuation Zone/Level C. Similarly, in policies which refer to evacuation areas from a Category 4 or 5 Hurricane, Evacuation Zones/Levels D or E should be used, respectively. Where there are consolidated zones or evacuation levels please refer to the detailed reference information (Chapter IV: Regional Population and Vulnerability Analysis, Volume 1).

3. Evacuation Transportation

Two types of scenarios (Base Scenarios and Operational Scenarios) were defined in the Evacuation Transportation Analysis (Volume 4) for use in the Regional Evacuation Model to derive the evacuating population, evacuation vehicles, clearance times and critical congested roadways. Most pertinent to growth management are the Base Scenarios, which were developed to estimate a worst-case scenario in which 100% of the vulnerable population (those found in evacuation zones) evacuate, plus the addition of "shadow evacuation". The standard assumptions utilized as the baseline were identified by the Division of Community Planning (DCP) as best suited for use in growth management analysis. The Base Scenarios (**Table VI-9**, Chapter VI: Evacuation Transportation Analysis Summary, Volume One) are provided to supply the anticipated time needed to evacuate all vulnerable populations (clearance times are found in **Tables VI-11 and VI-12**, Chapter VI: Evacuation Transportation Analysis Summary, Volume One). The Base Scenarios also supply the baseline data for planning purposes (maximum evacuation population found in **Tables VI-15 and VI-16**, chapter VI: Evacuation Transportation Analysis Summary, Volume One). This allows for the evaluation of growth management strategies and provides a consistent statewide measure for clearance time calculations.

The ability to alter scenarios is also available, allowing a planner to increase or decrease population, roadway capacities, shelter availability and more; then measure the variations to determine impacts of population, land use or infrastructure changes. The Transportation Interface for Modeling Evacuations (TIME) is the tool developed to allow users to run further scenarios. Built on the Cube Voyager and Cube Avenue software, this interface is a user-friendly interface which provides the ability to run variations on the transportation scenario, without being transportation planners. If needed, a transportation planner familiar with the model's underlying software can provide a more complex analysis.

4. Definitions

In addition to the data provided, the SRES also defines terms (Volume One: Technical Data Report, Glossary) that are referenced in Florida legislation, including various Evacuation Clearance Times (Clearance Time to Shelter, In-County Clearance Time, Out-of-County Clearance Time and Regional Clearance Time). These Clearance Time definitions better clarify the criterion in determining the compliance of Comprehensive Plan Amendments with State

coastal high hazard provisions as prescribed in Section 163.3178(9), Florida Statutes. Using the uniform assumptions from the Base Scenarios, the SRES supplies the information to provide a consistent statewide methodology to assess current conditions as well as quantify impacts that may need to be mitigated.

5. Sheltering

As indicated in the Hurricane Preparedness Policy Rule (Rule 9J-2.0256(4), F.A.C.), shelter space surplus and deficits are utilized to determine impacts of Developments of Regional Impacts (DRI). Chapter 5: Regional Shelter Analysis of the Technical Data Report provides general information on sheltering (general population, special needs and pet friendly), listings of all county shelters and their capacities, as well as specific public shelter demand (**Table V-9 through V-12**). Shelter surplus and deficits are outlined in these tables as well.

Important to note: shelters listed in the study are divided in two categories: "primary" and "other" shelters. Primary shelters are ARC 4496 compatible and may meet other requirements as well (Enhanced Hurricane Protection Areas). A County's shelter capacity is based upon these primary shelters. Each study may list "other shelter resources" that are within each County, but these shelters may or may not be utilized during an event.

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