Florida Statewide Regional Evacuation Study Program

Technical Data Report

Volume 1-9

Florida Division of Emergency Management

Southwest Florida Regional Planning Council

Southwest Florida Region

Includes Hurricane Evacuation Study

Partial Update

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Statewide Regional Evacuation Study Program

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Volume 1-9
Southwest Florida Region
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CHAPTER V

REGIONAL SHELTER ANALYSIS

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CHAPTER V
REGIONAL SHELTER ANALYSIS

A. Overview

An essential element of any evacuation plan is the ability to shelter the relocated residents throughout the duration of the event. Evacuees will seek several alternative forms of shelter at various distances from their origin. These alternatives may include a local public shelter, a hotel or motel, a friend or relative's home, and destinations in an adjacent county or outside of the region. Shelter destination tendencies of potential evacuees must be identified for two major reasons. First, so that adequate public shelter facilities can be provided for the numbers of evacuees expected to seek them. Secondly, the shelter analysis is needed to more accurately simulate the expected destination assignments and vehicle volume movement in the quantification of evacuation times.

Shelter preparedness is a very crucial element in the Statewide Regional Evacuation Study (RES) because of the vast numbers of evacuees and the potential number of vulnerable residents seeking shelter. While other types of hazards (flooding, wildfire, hazardous materials and terrorism/civil disturbances) may result in the need for mass care and shelter operations, the event which is both the most probable and potentially most challenging is an approaching hurricane.

Historically, major disasters result in large scale shelter operations. For example, operations during the Hurricane Andrew evacuation in August 1992 resulted in the largest county shelter operation in US history (approximately 200,000 sheltered). One of the largest regional evacuation shelter operations in the U.S. occurred in the Tampa Bay region in response to Hurricane Elena in 1985 (350,000 sheltered). In 2005 when hurricanes threatened the Gulf Coast, Red Cross disaster relief workers and local governments were preparing hundreds of evacuation shelters. The organization pre-positioned supplies, including kitchens, prepackaged meals and emergency response vehicles (ERVs). Nearly 500,000 evacuees of Hurricanes Katrina, Rita and Wilma stayed in Red Cross shelters (www.redcross.org).

Pre-storm evacuation shelter demand has significantly decreased in Southwest Florida as well as other areas. Public education in Florida has stressed to evacuees that the choice to go to a public shelter should not be the first choice in destinations. Other options – especially the homes of friends and relatives and hotel/motels in non-evacuation zones – provide a more comfortable alternative for most residents. According to the behavioral surveys conducted in 2006 and 2008 for the Statewide Regional Evacuation Study Program, part of that message is getting across to residents. The majority of evacuees go to the homes of friends or relatives (36 – 37%). Approximately 18% - 20% will seek a hotel or motel for refuge depending on age, income and other demographic characteristics. Hotel availability will also be a key factor.

B. Hotel Availability

In the Southwest Florida Region there are a total of 52,210 hotel/motel rooms (2010). These facilities are identified in the Critical facility Inventory database and their locations within vulnerable areas (tropical storms and hurricanes, flood zone, wildfire and hazardous materials) are identified.

More than half of the inventory in Charlotte, Collier and Lee counties is within Evacuation Level A Category 1 storm surge area so it would not be available for any hurricane evacuation scenario. Regionally, in a category 5 hurricane threat, only approximately 2,449 rooms should be available. (See Table V-1 below)

Some of the Tourist and Visitors Bureaus in major metropolitan areas currently have a mechanism in place to track available units throughout a regional evacuation. This capability is essential to assist those evacuees looking for hotel/motel units. (Although it should be strongly recommended that families seeking accommodations make those reservations before they begin their evacuation trip.) In a major evacuation, the State Tourism and Development Council will seek to consolidate and augment this local information in real time. The second major challenge is to then communicate hotel/motel availability within the region and the state to evacuees locally as well as those on the road. This may reduce the trip of those searching for hotel/motels in the vicinity; thereby, hopefully reducing the evacuation congestion and clearance times.

Table V-1: Hotel Availability in Hurricane Evacuation Scenarios

Storm Surge Area (Category)	Charlotte Room Availability	Collier Room Availability	Glades Room Availability	Hendry Room Availability	Lee Room Availability	Sarasota Room Availability	Regional Room Availability
A	1,748	5,343	244	605	7,318	9,285	24,543
B	523	2,873	215	586	3,593	5,866	13,656
C	335	859	211	586	913	4,025	6,929
D	NA	668	148	563	189	3,065	4,633
E	NA	668	120	549	154	958	2,449

Source: Florida Dept. of Professional and Business Regulations, 2010

C. Providing Public Shelter

Although there are other options for most evacuees, there will always be a demand for public shelter. The demand for public shelter has the potential to be significant in the Southwest Florida region because of the magnitude of the evacuation population, the demographics of the population and limited ability to evacuate out of the region.

Public shelter demand is the result of several factors:

- Evacuees may not have friends or relatives in a safe location.
- Evacuees may not have the means to evacuate to a hotel/motel or out of the region.
- Evacuees may not be able to locate vacant hotel/motel rooms outside of evacuation zones in the region. (Space is limited and demand will be high.)
- Evacuees may not plan ahead or understand their options.
- Some evacuees choose public shelter because they feel it is safer there than in their home.
- Some evacuees may wish to be with others.
- Evacuees may not evacuate in a timely fashion or may get stuck in evacuation traffic and may have to seek public shelter at the last minute as a last resort.

D. Criteria for Hurricane Evacuation Shelter Selection

Shelter selection involves a number of factors - structural and non-structural - and requires close coordination with local officials responsible for public safety. Technical information contained in evacuation studies, storm surge and flood mapping, and other data can now be used to make informed decisions about the suitability of shelters. Accordingly, an interagency group under American Red Cross leadership, has prepared criteria for the selection of shelters and printed as *ARC 4496, July 1992*.

In the experience of the Red Cross and emergency management officials, the majority of people evacuating because of a hurricane threat generally provide for themselves and seek hotels or motels or stay with friends and relatives. However, for those who do seek public shelter, safety from hazards associated with hurricanes is paramount. These hazards include surge inundation, rainfall flooding, high winds, and hazardous materials.

Recommended guidelines for each of these hazards follow:

1. Storm Surge Inundation

In general, hurricane evacuation shelters should not be located in areas vulnerable to hurricane surge inundation. The National Hurricane Center New SF1 SLOSH model for the Southwest Florida Region is very helpful in determining the potential level of surge inundation in this area. Within ARC 4496, the guidelines state the following:

- *Carefully review inundation maps in order to locate all hurricane evacuation shelters outside (Category 4) storm surge inundation zones, if possible.*

- *Avoid buildings subject to isolation by surge inundation in favor of equally suitable buildings not subject to isolation. Confirm that ground elevations for all potential shelter facilities and access routes obtained from topographic maps are accurate.*
- *Do not locate hurricane evacuation shelters on barrier islands.*

To determine whether particular public shelter structures are vulnerable to future potential storm surge, an analysis of each structure's elevation and geographic location in relation to surge was conducted utilizing the New SF1 SLOSH model.

The results of this analysis for each county are presented on Tables V-8A – V-8F. The magnitude of the storm surge values shown in each hurricane category column on the tables are in relation to mean sea level. They represent the predicted maximum height of surge from that particular category of hurricane on the Saffir-Simpson Scale. Additionally, the surge height values were increased by one-foot for the expected tidal anomaly as well as a one-foot addition for a potential high astronomical tide (total 2 feet).

Although most sites were not projected to receive storm surge flooding under any evacuation scenario, in some areas, because of potential shelter shortage, shelters remain on primary shelter inventories even though they will not be utilized in the most severe of storms (evacuation levels D and E).

2. Freshwater Flooding

While it is not historically considered life-threatening, rainfall flooding should be considered in the hurricane evacuation shelter selection process. Riverine inundation areas shown on Flood Insurance Rate Maps (FIRMs), as prepared by the National Flood Insurance Program, should be reviewed. FIRMs should also be reviewed in locating shelters in inland areas. ARC Guidelines state:

- *Avoid, where possible, hurricane evacuation shelters within the 100-year floodplain.*
- *Avoid hurricane evacuation shelters in areas likely to be isolated due to riverine inundation of roadways.*
- *Make sure a hurricane evacuation shelter's first floor elevation is equal to or higher than that of the base flood elevation level for the FIRM area.*
- *Consider the proximity of shelters to any dams and reservoirs to assess flow upon failure of containment following hurricane-related flooding.*

The appropriate flood plain designation is identified on the tables along with the storm surge analysis. While locating facilities outside of the 100-year floodplain is a priority, this is very difficult in the Southwest Florida region. Therefore, measures such as documenting the elevation of the first floor above the base flood elevation (BFE), meeting NFIP regulations and the provision of adequate emergency supplies sufficient to

meet the immediate response needs until flood waters recede, etc. are ensured. Please note: The ARC 4496 guidelines also recommend avoiding the 500-year floodplain.

3. Wind Hazards Vulnerability

Consideration of any facility for use as a hurricane evacuation shelter must take into account wind hazards. Both design and construction problems may preclude a facility from being used as a shelter. Structural Considerations identified in ARC 4496 include:

Avoid uncertified buildings of the following types:

- *Buildings with long or open roof spans, i.e., gymnasiums and cafeterias*
- *Un-reinforced masonry buildings*
- *Pre-engineered (steel pre-fabricated) buildings built before the mid-1980s*
- *Buildings that will be exposed to the full force of hurricane winds*
- *Buildings with flat or lightweight roofs*

Give preference to the following:

- *Buildings with steep-pitched, hipped roofs, or with heavy concrete roofs*
- *Buildings more than one story high (if lower stories are used for shelter)*
- *Buildings in sheltered areas not subject to "lay down" hazards*
- *Buildings whose access routes are not tree lined nor subject to flooding*

The State of Florida has an aggressive survey program for all structures considered for public shelter use. State and County work with local school boards and emergency management agencies to identify structures for retrofit and to implement the requirements of the Enhanced Hurricane Protection Areas (EHPA) in new school construction. The requirements and retrofit projects have dramatically increased the public shelter capacity in the region since 2000.

4. Hazardous Materials

The possible impact from a spill or release of hazardous materials should be taken into account when considering any potential hurricane evacuation shelter. All facilities manufacturing, using, or storing hazardous materials (in reportable quantities) are required to submit Material Safety Data Sheets (emergency and hazardous chemical inventory forms) to the Local Emergency Planning Committee (LEPC) and the local fire department. These sources can assist in determining the suitability of a potential hurricane evacuation shelter or determining precautionary zones (safe distances) for facilities near potential shelters that manufacture, use, or store hazardous materials.

- *Facilities that store certain types or quantities of hazardous materials may be inappropriate for use as hurricane evacuation shelters.*
- *Hurricane evacuation shelters should not be located within the ten-mile emergency planning zone (EPA) of a nuclear power plant (not applicable in Southwest Florida region).*

- *Service delivery units must work with local emergency management officials to determine if hazardous materials present are a concern for potential hurricane evacuation shelters.*

Those (Section 302) facilities with extremely hazardous materials on-site have been identified in relation to schools and hospitals. This information is contained in the Critical Facilities Inventory database.

E. Hurricane Evacuation Shelter Selection Process

General procedures for investigating the suitability of a building or facility for use as a hurricane evacuation shelter are as follows:

1. Identify potential sites. Evacuation and transportation route models must be considered.

2. Complete a risk assessment for each potential site. Gather all pertinent data from the New SF1 SLOSH model (storm surge), FIRM (flood hazard), facility base elevation, hazardous materials information, and previous studies concerning each building's suitability.

3. Inspect the facility and complete a *Red Cross Facility Survey Form* and a *Self-Inspection Work Sheet/Off-Premises Liability Checklist* in accordance with ARC 3031. Note all potential liabilities and the type of construction. Consider the facility as a whole; one weak section may seriously jeopardize the integrity of the building.

4. Have a structural engineer review the facility and rate its suitability.

5. Ensure that an exhaustive search for shelter space has been completed. Work with local emergency management officials and others to identify additional potential sites.

6. Review, on a regular basis, all approved hurricane evacuation shelters. Facility improvements, additions, or deterioration may change the suitability of a selected facility as a hurricane evacuation shelter. Facility enhancements may also enable previously rejected facilities to be used as hurricane evacuation shelters.

7. If possible, work with officials, facility managers, and school districts on mitigation opportunities. Continue to advocate that the building program for new public buildings, such as schools, should include provisions to make them more resilient to possible wind damage. It may also be possible to suggest a minor modification of a municipal, community, or school building, such as the addition of window protection in the planning stages, to make for a more useful hurricane evacuation shelter site.

F. Least Risk Decision Making

Safety is the primary consideration in providing hurricane evacuation shelters. When anticipated demands for hurricane evacuation shelter spaces exceed suitable capacity as defined by the preceding criteria, there may be a need to utilize *marginal* facilities. It is critical that these decisions are made carefully by a team including representatives from county emergency management agencies, the local chapter of the American Red Cross, School Board and engineering professionals.

1. The Selection Process

The process should include the following considerations:

- All hurricane evacuation shelters should be located outside of storm surge inundation areas. Certain exceptions may be necessary but only if there is a high degree of confidence that the level of wind, rain, and surge activities will not surpass established shelter safety margins.

- When a potential hurricane evacuation shelter is located in a flood zone, it is important to consider its viability. By comparing elevations of sites with FIRMs, one can determine if the shelter and a major means of egress are in any danger of flooding. It is essential that elevations be carefully checked to avoid unnecessary problems.

- In the absence of certification or ranking by a structural engineer, any building selected for use as a hurricane evacuation shelter must be in compliance with all local building and fire codes.

- The Red Cross and State of Florida use the planning guideline of 20 square feet of space per shelter resident. During hurricane conditions, on a short-term basis, shelter space requirements may be reduced. Ideally, this requirement should be determined using no less than 20 square feet per person; however, some counties use 10-15 square feet as the standard. Before and after the hurricane strike, evacuees will be allowed to use gymnasiums, auditoriums, etc. However, once a hurricane is affecting the area, all evacuees will be moved to safer areas of the shelter. For the duration of the storm, 8-10 hours, the 10-15 square foot per person may have to be adequate until additional shelter space becomes available. In addition, sufficient space must be set aside for registration, health services, and safety and fire considerations. On a long-term recovery basis, shelter space requirements should follow guidelines established in ARC 3031, *Mass Care: Preparedness and Operations*.

2. Interior Building Safety Criteria During Hurricane Conditions

Based on storm data such as the arrival of tropical force winds (sustained 40 mph winds), a notification procedure developed with local emergency managers is implemented as to when to move the shelter population to pre-determined safer areas within the facility. The following guidelines are considered:

- *Do not use rooms attached to, or immediately adjacent to, un-reinforced masonry walls or buildings.*
- *Do not use gymnasiums, auditoriums, or other large open areas with long roof spans during hurricane conditions.*
- *Avoid areas near glass, unless the glass surface is protected by an adequate shutter. Assume that windows and roof will be damaged and plan accordingly.*
- *Use Interior corridors or rooms.*
- *In multi-story buildings use only the lower floors and avoid corner rooms. Avoid basements if there is any chance of flooding.*
- *Avoid any wall section that has portable or modular classrooms in close proximity, if these are used in the community.*

G. Special Needs Shelters

A special needs shelter is a temporary emergency facility capable of providing care to residents whose medical condition exceeds the capabilities of the Red Cross Shelter but is not severe enough to require hospitalization. Health Department medical staff support these shelters.

The State of Florida Division of Emergency Management, Department of Health, local emergency management agencies, health care agencies have worked together over the last decade to establish Special Needs Shelter standards, protocols and technical assistance that can be integrated into the Florida Emergency Management System. [1]

The mission is to develop a standardized, comprehensive, county and regional approach to Special Needs Shelter operation that ensures continuity in services and quality care to clients, caregivers and staff during their stay in a Special Needs Shelter.

1. Florida Statutes related to Special Needs Shelters

a. F.S. Ch. 252.355 - Registry of persons with special needs; notice.

[1] http://www.doh.state.fl.us/PHNursing/SpNS/SpecialNeedsShelter.html

This has been recently updated (2015) and includes language that the Florida Division of Emergency Management, in coordination with each local emergency management agency in the state, shall maintain a registry of persons with special needs.

b. F.S. Ch. 252.356 - Emergency and disaster planning provisions to assist persons with disabilities or limitations.
c. F.S. Ch. 381.0303- Healthcare Practitioner Recruitment for Special Needs Shelters
d. FAC 64-3 - Florida Administrative Code related to Special Needs Shelter

2. Special Needs Registration

In order to accommodate residents who need evacuation assistance to a Special Needs Shelter, **it is most important that they register prior to June 1st in advance of hurricane season**. This will help in determining which shelter they should go to and what, if any, assistance they require to evacuate. This would include transportation disadvantaged residents who need transportation assistance only.

Residents who feel they may qualify are instructed to complete a Special Needs Evaluation form. The forms should be mailed, e-mailed or faxed to the county office designated to maintain the special needs registration list.

When residents fill out a registration form the County Health Department determines if the special needs shelter is the most appropriate level of care and advises the resident directly or through the local emergency management or fire department.

3. Special Needs Population Criteria

a. The individual meets the medical criteria for assignment to the Special Needs Shelters if:

- They are unable to administer their own frequently required or daily injectable medicines.
- They require daily or more frequent dressing changes because of moderate or copious drainage from ulcers, fistulas, or other similar problems.
- They need assistance with ostomy management and indwelling catheters of any kind.
- Activities of daily living are so restricted by immobility that others provide assistance to meet there basic needs and those people are unavailable at this time. Please note that special needs shelters cannot accept bedbound patients.

- They require daily assessment of a (stable) medical condition by professional nursing personnel or other similar conditions.
- They have a respiratory condition which requires special equipment such as monitors or oxygen. Counties may have a limit to the number of liters of oxygen at shelters.
- They have a terminal illness but are ambulatory and in need of professional assistance in administering heavy doses of pain medicine (HOSPICE).
- In some counties, individuals will receive notification by the County Health Department, assigning them to a Special Needs Shelter. *People assigned to the Special Needs Shelter will need to take any medication, equipment or articles of comfort they routinely use*.
- They are elderly, homebound or alone and need assistance in relocating to a shelter.

b. The following people SHOULD NOT go to a special needs shelter; unless otherwise stated, they should go to a hospital:

- Pregnant woman within six weeks of estimated day of delivery, or who are in labor.
- Individuals suffering from acute infection or infestation.
- Those having an immediate medical or emergency condition.
- Bedridden patients
- Individuals with a tracheotomy that requires frequent suctioning
- Individuals on a ventilator

c. When evacuating to a shelter, evacuees are told to bring the following:

- **All Required Medications and Medical Support Equipment**: Wheel chair/walker, oxygen, dressings, feeding equipment, ostomy supplies, etc. Any specific medication or care instructions. Name, phone number of physician/home health agency/hospital where they receive care.
- **Special Dietary Needs**: Only regular meals will be provided.
- **Sleeping Gear**: Pillows, blankets, portable cot or air mattress, folding chairs.
- **Important Papers**: Insurance papers, doctors' orders.
- **Identification**: With photo and current address.
- **Cash**: Check cashing/credit card services may not be available for several days after the storm. However, please remember that there will be nowhere to secure money or valuables at the shelter.

- **Comfort items**: Personal hygiene items, snacks, small games, cards, etc.
- **Extra Items**: An extra set of comfortable clothing and a few extra sets of underwear, socks, towel, washcloths, soap, toothbrush and adult diapers.

4. Transportation Assistance for Special Needs

Once enrolled, residents with medical special needs are the first to be evacuated. Timing is crucial during the first phases of an emergency and plays a critical role in assuring they get out long before disaster strikes. The type of evacuation transportation assistance is determined when the resident is registered.

5. Standards for Hurricane Evacuation and Disaster Event Special Needs Shelter (Special Needs Shelter) Selection[2]

Facilities selected as special needs shelters should meet additional structural criteria as well as shelter management standards. New legislation has identified special criteria for Special Needs Shelters which prove to be a challenge for local governments. In addition to meeting the ARC 4496 hurricane safety criteria, Special Needs Shelters should have emergency power supported air-conditioning and have capacities based upon 60 square feet per client. The State Division of Emergency Management and local agencies are working together to address the challenges of the transition to meeting these expectations as well as the resolving problems related to Special Needs Shelter.

a. Special Needs Shelter Design Criteria

Department of Health (DOH) guidance for design and selection of facilities to be used as a Special Needs Shelters (Special Needs Shelter) in a hurricane/disaster event shall be consistent with the American Red Cross publication “MASS CARE—Preparedness and Operations (ARC 3041)” and “Mass Care Facility Form 6564.” The Special Needs Shelter facility must also meet all Florida Building Code (FBC) and Americans with Disabilities Act (ADA) accessibility requirements.

b. Special Needs Shelter Occupancy Period

For planning purposes it is assumed that the Special Needs Shelter will be occupied at its maximum occupant capacity for, at a minimum, a continuous seventy-two (72) hour period during and post impact by a major hurricane (i.e., Category 3 or higher). It should also be assumed that the Special Needs Shelter may be occupied for 12 hours in advance of arrival of hurricane force winds.

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[2] Created: 10/14/05
Revised: 11/16/05; 01/20/06
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c. Special Needs Shelter Structural Requirements

Special Needs Shelter Structural Requirements shall at a minimum be consistent with the *American Red Cross publication "Standards for Hurricane Evacuation Shelter Selection (ARC 4496)."* Preference shall be given to school facilities designed, constructed and inspected to comply with the public shelter design criteria, *Enhanced Hurricane Protection Area (EHPA)* requirements as set forth in section 423.25, Florida Building Code.

d. Location and Site Requirements- Emergency Access

Each Special Needs Shelter should have at least two (2) major means of access for emergency vehicles. The additional need for access is due to the potential for medical emergencies associated with the fragile health conditions of the Special Needs Shelter client population. The Special Needs Shelter openings provide a means of emergency access and/or evacuation. These openings should be well supervised to monitor for safety and/or security threat to the Special Needs Shelter occupants. All occupants of the building should be within a reasonable distance from these access/exit points, providing a choice in direction of escape in case of fire. All exits should be clearly marked and visible.

e. Special Needs Shelter Capacity

Calculations to determine the capacity of a Special Needs Shelter are identical to the EHPA calculations except that the number of square feet required for each occupant is 60 square feet.

f. Plumbing and Sanitation

(1) **Potable Water.** Given the planning assumption that the Special Needs Shelter will be open for a minimum of 72 hours during and post impact by a major hurricane, the Special Needs Shelter should have a minimum of five (5) gallons of potable water per person per day for all uses (i.e., drinking water, hygiene, food preparation, etc.)

(2) **Toilets, Sinks, Showers, Waste Water and Garbage Disposal.** Requirement criteria remain equal to ARC 3041 and EHPA requirements, with the exception of the waste water reservoir capacity and garbage disposal plan shall be based on a 72-hour design occupant capacity.

(3) **Electrical and Emergency Power Systems.** It should be assumed that utility power outages will occur and may continue for the duration of Special Needs Shelter operation. Due to the fragile health and medical condition of the Special Needs Shelter clients, it is imperative that the Special Needs Shelter have back-up emergency electric power system.

- The emergency electric power system shall be capable of supporting life safety, branch outlet and lighting circuits, air conditioning and other systems that are critical to the well-being of the clients, staff and caregivers. The absence of air conditioning can result in the deterioration of the Special Needs Shelter client's health status. Clients with chronic lung disease deteriorate at a rapid pace as the increase of temperature leads to increased breathing difficulty.

- The power grid and backup emergency electric power capability must also be sufficient to power receptacles utilized to run oxygen concentrators, oxygen nebulizers and other medical equipment. (Note: Oxygen concentrators draw an average of 3.5-5.5 amps per unit. Nebulizers are used intermittently and have a negligible power draw.) Additional lighting (fixed or mobile) may be needed for providing client care (i.e., wound care, dressing change, etc.) and should be considered when determining power capacity.

- Appropriately trained and equipped personnel should be present and on site at all times during the Special Needs Shelter occupancy to operate, maintain and repair the generator(s). Sufficient supplies chosen by appropriately trained personnel must be available to route the power to where it is needed, (i.e., extension cords of adequate size, plug strips, tape to secure cords to the floor, etc.).

- Sufficient fuel stores should be available for 72-96 hours of continuous generator use at full load.

- Generators should be tested after each significant incident and on a monthly basis or as recommended by manufacturer if more frequent. Sites on facility grounds (i.e., lift stations) should have quick connects (as appropriate) to provide for utilization of backup power generation equipment.

g. Emergency Management Considerations

(1) **Posting Special Needs Shelter floor plan.** A copy of the floor plan must be posted for planning purposes.

(2) **Food service planning** should provide for the assumption of a minimum of 72 hours for Special Needs Shelter occupancy. Additional consideration for clients with special dietary/metabolic health issues should be factored into food service planning; however it is very difficult

to predict all the different types of dietary restrictions. Residents are told to bring their own food supply if they have a special or restrictive diet.

(3) **Supplemental Space Allocations.** Additional space allocations should be considered for the following:

- Safe play areas for children.
- Special Needs Shelter clients with ambulatory difficulties may need additional space for assistive devices (i.e., wheelchairs and walkers). These clients may also need to be provided space allocation on the ground floor or in areas free from level changes.
- Special Needs Shelter clients with service animals may need to be provided a separate area or away from the general Special Needs Shelter client population.
- Quarantine areas for clients requiring isolation precautions. Respiratory isolation areas to be designated and assigned at each Special Needs Shelter prior to occupancy by appropriately trained/experienced personnel.
- Appropriate space should be provided for the safe storage and movement of compressed gasses (i.e., oxygen tanks, liquid oxygen) or other Special Needs Shelter equipment and supplies.

6. Estimating Special Needs Shelter Demand

Estimating the demand for special needs shelter space is challenging for state and local emergency management officials. Certain key assumptions must be made and complexities addressed:

a. County and Regional Profiles

The demographics of the county and region must be considered, especially age, disability and income. Typically, the older the overall population of the county/region, the older the shelter population and greater the demand for public shelter. Historically, the demographics of the general and special needs shelter populations have been skewed based on age, disability and income. Therefore, the shelter populations may reflect trends but will not match the overall demographic profile of the county or region. Both the general shelter population and, more definitively, the special needs population, will tend to be much older, with more disabilities and with fewer financial resources.

Below is a table which reflects the demographics of the county and region (See Chapter I Population and Demographics). Please note the differences between counties in the region. The differences in age and percentage with disabilities will impact the potential demand for special needs shelter.

Table V-2
Population Demographics Affecting Special Needs Shelter Demand

Jurisdiction	Percentage 65+ 2010[3]	Percentage 65+ 2015[4]	Percentage with Disabilities[5]	Percentage with Disabilities age 65 +	Percentage with Disabilities age 75+
Charlotte	33.67%	34.94%	20.16%	20.55%	49.98%
Collier	23.83%	25.55%	12.90%	17.44%	36.57%
Glades	18.06%	18.92%	NA	NA	NA
Hendry	10.38%	10.86%	NA	NA	NA
Lee	23.69%	25.54%	13.83%	20.16%	42.66%
Sarasota	31.09%	33.31%	18.37%	18.63%	42.74%
Region	26.19%	27.92%	NA	NA	NA

b. Special Needs Population Data from the Behavioral Survey

The behavioral survey of Florida residents completed as part of the Statewide Regional Evacuation Study contained four questions designed to elicit information regarding the prevalence of "special needs" households:

- In an evacuation, would you or anyone in your household require assistance in order to evacuate?
- Would the person just need transportation, or do they have a disability or medical problem that would require special assistance?
- Would that assistance be provided by someone within your household, by an outside agency, or by a friend or relative outside your household?

[3] EDR1a
[4] EDR1a
[5] The data on disability status were derived from answers to two long-form questionnaire items. The first was a two-part question that asked about the existence of the following long-lasting conditions: (a) blindness, deafness, or a severe vision or hearing impairment (sensory disability) and (b) a condition that substantially limits one or more basic physical activities, such as walking, climbing stairs, reaching, lifting, or carrying (physical disability). This question was asked of a sample of the population 5 years old and over. The second was a four-part question that asked if the individual had a physical, mental, or emotional condition lasting 6 months or more that made it difficult to perform certain activities. The four activity categories were: (a) learning, remembering, or concentrating (mental disability); (b) dressing, bathing, or getting around inside the home (self-care disability); (c) going outside the home alone to shop or visit a doctor's office (going outside the home disability); and (d) working at a job or business (employment disability). Categories (a) and (b) were asked of a sample of the population 5 years old and over; (c) and (d) were asked of a sample of the population 16 years old and over. For data products that use a disability status indicator, individuals were classified as having a disability if any of the following three conditions were true: (1) they were 5 years old and over and had a response of "yes" to a sensory, physical, mental or self-care disability; (2) they were 16 years old and over and had a response of "yes" to going outside the home disability; or (3) they were 16 to 64 years old and had a response of "yes" to employment disability.

- Is that person registered with the County as a person who would have special needs during a hurricane evacuation?

Responses to all four questions are reported in the Statewide Regional Evacuation Study Behavioral Survey Reports for each planning region of Florida. In those reports responses are shown by region, county, evacuation zone, and housing type. The tables below show responses for the entire statewide sample. However, the responses do not constitute a statewide random sample of households. In every coastal county, regardless of population, 400 interviews were completed. In every non-coastal county 150 interviews were completed. Therefore smaller counties were "over-represented" statistically when the data is aggregated statewide.

(1) Households with Special Needs

Statewide 6.1% of the interviewees said that someone in their home had a disability or medical problem that would require special assistance, beyond requiring just transportation (Table V-3). The figure included people with those needs but who also needed transportation. Those needs were greater in mobile homes than in site-built homes. In site-built homes the needs were lower in category 1 evacuation areas than in other evacuation zones.

Table V-3
Percentage of households having someone with a disability or medical condition requiring assistance in order to evacuate (by evacuation zone and housing)

Type of Housing	Evacuation Zone						
	Cat 1	Cat 2	Cat 3	Cat 4-5	Coastal Non-Surge	Non-Coastal	All Zones
Site Built Homes	4.4	6.3	6.0	6.1	5.9	6.5	5.6
Mobile Homes	8.7	6.3	13.9	8.1	8.1	8.2	8.6
All Housing	5.0	5.8	7.4	6.3	6.3	6.9	**6.1**

(2) Households Registered as Having Special Needs

Approximately 2.2% of the surveyed households indicated that anyone in the home was registered with their county as a person with special needs in a hurricane evacuation (Table V-4). The figure was higher for mobile home residents than site-built residents, but there was no clear trend with respect to evacuation zone. **However, from the list of registrants with the county emergency management agencies or county departments of health, there are less than 1% of the general population registered for special needs and transportation assistance. In fact, the actual number of registrants is less than 24% of the number answering that they are registered as a person with (medical) special needs.**

Table V-4
Percentage of households having someone with a disability or medical condition requiring assistance in order to evacuate AND registered with county as special needs (by evacuation zone and housing)

Type of Housing	Evacuation Zone						
	Cat 1	Cat 2	Cat 3	Cat 4-5	Coastal Non-Surge	Non-Coastal	All Zones
Site Built Homes	1.6	2.1	1.3	2.5	1.8	2.5	2.0
Mobile Homes	3.6	1.9	3.7	4.0	4.1	3.0	3.3
All Housing	1.9	2.0	1.7	2.7	2.2	2.6	**2.2**

(3) Households Needing Agency Assistance

Two percent of all households said that assistance from an agency (rather than assistance from a friend or relative) would be needed to help a person with a disability or medical problem evacuate (Table V-5). Some respondents said they didn't know who would provide the assistance. Both calculations were higher for mobile homes than for site-built homes.

Table V-5
Percentage of households having someone with a disability or medical condition requiring assistance in order to evacuate AND requiring assistance from an agency (by evacuation zone and housing)

Type of Housing	Evacuation Zone						
	Cat 1	Cat 2	Cat 3	Cat 4-5	Coastal Non-Surge	Non-Coastal	All Zones
Site Built Homes	1.4	1.8	1.6	1.8	2.0	2.5	1.9
Mobile Homes	3.2	1.3	3.3	3.0	3.9	2.2	2.7
All Housing	1.6	1.7	1.9	1.9	2.3	2.4	**2.0**

(4) Households with Special Needs Using Public Shelters

One of the questions asked specifically about special needs sheltering. However, all respondents were asked if they would go to a public shelter when they evacuated. 1.4% of the interviewees said BOTH that they would evacuate to a public shelter AND that they had someone in the home with a disability or medical problem who would require evacuation assistance. Residents in mobile homes were twice as likely as residents in site-built homes to reply affirmatively to both questions. Among those in site-built homes the rate increased as evacuation zones progressed inland. Among people mobile homes the spatial trend was less consistent but the rate was greater inland of the category 1 and 2 zones.

Table V-6
Percentage of households having someone with a disability or medical condition requiring assistance in order to evacuate AND intends to evacuate to a public shelter

Type of Housing	Evacuation Zone						
	Cat 1	Cat 2	Cat 3	Cat 4-5	Coastal Non-Surge	Non-Coastal	All Zones
Site Built Homes	.7	.8	1.5	1.3	1.4	1.9	1.2
Mobile Homes	1.4	1.3	3.7	3.0	2.0	3.2	2.5
All Housing	.8	.9	1.8	1.5	1.5	2.2	**1.4**
Charlotte County							3.0
Collier County							2.2
Glades County							.7
Hendry County							3.3
Lee County							1.5
Sarasota County							3.5

It is difficult to determine the most appropriate way to use these survey results. While the study provided an estimate of demand for special needs shelter for the first time based on a statewide survey, there are concerns:

- The general public interviewed in the statewide survey does not understand the complexities of the concept of "special needs" as used in emergency shelter planning. While residents may have medical needs, they would need to be screened in order to determine the most appropriate type and level of care. For example, a hospital, nursing home, ALF, etc. may be a more appropriate setting.
- Historically, respondents over-estimate the demand for any public shelter option.
- Demand will vary by storm severity and evacuation rates.
- Demand will be higher based on housing type (MH), age and income.
- The number of respondents to these questions was very low at the county level.

7. Other considerations

A report was generated after the 2004 and 2005[6] hurricane seasons which identified that a significant portion of the registered special needs populations found alternative shelter and/or elected not to go to the special needs shelter during the event. This trend has been identified in many recent evacuations. The report stated that "the statewide total of registrants is about 38,500, but local emergency managers estimate that only about 14,000 clients will actually seek public Special Needs Shelters. In 2004 the DOH's maximum census (summation of all individual counties' highest single day totals, plus the Orlando super shelter and a SWF regional shelter) was 6,364 or about half of local emergency managers' best estimate of demand."

However, when an event threatens, local emergency management agencies and the Department of Health are typically flooded with additional requests for special needs

[6] ***2005 Special Needs Shelter Report***, June 2005, DEM and DOH

shelter and transportation. This puts an additional burden on emergency management and responders to follow up with these clients to determine the most appropriate level of care and shelter option. Complicating the situation is the availability of appropriate space in assisted living facilities, skilled nursing facilities and hospitals immediately prior to the event. In prior (Frances and Jeanne) evacuations, the Governor issued an executive order waiving occupancy limits in those facilities in order to provide for continuity of care for those residents who require a higher level of care. This is a critically important element in special needs planning.

What was not reflected in the 2005 report or the table below was the impact of special needs population in the general shelter population. Depending on the demographics in the community, a significant portion of the general shelter population may have or develop (as the event proceeds and stress levels increase) serious health issues.

It is estimated that in the 2004 and 2005 shelter operations from 30-60% of the general shelter population either arrived at the shelter with conditions which warranted a higher level of health care or developed health issues which warranted care associated with a Special Needs Shelter or higher levels of care. There were reports of school principals administering oxygen, monitoring health issues and even changing adult diapers. For the most part, many of these citizens had driven themselves to the shelter and found their health deteriorate given the stress of the event and shelter environment. This situation is not unique to the 2004 or 2005 hurricane season. It has been documented in many other historical events. In addition the DOH reported that many caregivers began to experience health issues as the event progressed.

It was noted that while people may be able to care for themselves or their spouse in their home, combine a stressful evacuation, shelter environment (cots or air mattresses, lack of privacy, etc.) and storm conditions and the situation can become traumatic.

These issues may be mitigated through a continued push to pre-register special needs clients through an aggressive outreach program in the community. Coordination with local home health agencies and health care professionals has reduced this impact, but it remains an issue.

As indicated earlier, each county emergency management agency is responsible for maintaining the registry of persons with special needs. The names on those lists are protected; however, the number of registrants is available and reflects a starting point for determining demand within the county. It should be noted that the registry is fluid. It varies day to day (as does the clientele receiving home health care). It also varies by month as many special needs clients are seasonal residents.

Demographics within the community as well as hazard vulnerability, available health care resources, the extent and duration of power outages and presence of extended family support all impact the potential demand for Special Needs Shelter capacity The table below identifies the current (October 2010) registrants, current primary ARC 4496 compliant special needs shelter capacities at 60 square feet per client and estimate of

demand based on the survey findings balanced with knowledge of the county demographics and evacuee options.

Table V-7
Special Needs Shelter Demand Guidance (2010 Base Scenarios)

County	Number of Registrants (Medical April 2010)	Planning Percentage (Assumed 25% Respondents indicating need)	Existing Capacity (2009)	EVACUATION SCENARIO (Demand based on percentage of evacuation population in Base Scenarios)				
				A	B	C	D	E
Charlotte	549	.75%	300	673	1164	1332	1351	1352
Collier	945	.55%	2344	879	1429	1766	1805	1812
Glades	0	.18%	60	12	13	14	15	16
Hendry	6	.83%	26	179	189	208	216	225
Lee	1,000	.38%	1,282	1014	1716	2134	2284	2379
Sarasota	2,788	.88%	3,413	955	1359	2308	2846	3076
Region	2,500	-	6,081	3712	5870	7762	8517	8860

Obviously, most counties are transitioning toward the new requirements for Special Needs Shelters including the space requirement of 60 sq. ft. per person and the emergency power supported air-conditioning. As indicated, additional space must be provided for caregivers, family members, pets, medical equipment and supplies. Relocation of special needs clients' long distances is dangerous as well as taxing on local resources; therefore, if there is not sufficient capacity within a county, a regional solution must be sought.

8. Public Private Partnerships

It was hoped that legislation in 2006 would bring more support to the local efforts to meet the challenges of addressing special needs in the community. Home health care agencies which provide care to special needs populations throughout the region have been tasked to provide continuity of care during disasters. It is hoped that this requirement will (1) provide earlier registration/ evaluation of special needs populations; (2) provide additional support for Departments of Health staff in the special needs shelters and (3) provide an overall benefit through private-public partnerships to ensure no one is "left behind."

While the courts interpreted the requirement for "continuity of care" to be provided by the home health agencies in disasters as the time contracted prior to the event, i.e., 2-4 hours a week, it was a step forward.

The legislation also recommended the identification of pediatric and other special units, provided funding for retrofit and generators at designated special needs shelters, where

required, and brought together a host of state, local and private sector agencies to address the needs of their clients in a disaster situation.

H. Pets and Evacuees

1. Pet Issues are People Issues

- Fifty-eight percent of U.S. households own animals.
- The media often reports the needs of animals, both domestic and wild, affected by disasters. Following Katrina thousands of pets were rescued although many did not survive.
- Some people are more concerned for their animals in disasters than they are for themselves. This may impair their ability to make sensible decisions about their own safety and that of rescue workers. Examples include evacuation failures and re-entry attempts, and unsafe rescue attempts.
- Following Hurricane Katrina some abandoned pets, hungry, disoriented and frightened became dangerous to rescue workers and returning residents. Packs of dogs – once beloved pets – had to be destroyed

In 2006, the Florida Legislature sought to address this serious concern. Chapter 252.3568, F.S. Emergency sheltering of persons with pets.--In accordance with s. 252.35*, the division shall address strategies for the evacuation of persons with pets in the shelter component of the state comprehensive emergency management plan and shall include the requirement for similar strategies in its standards and requirements for local comprehensive emergency management plans. The Department of Agriculture and Consumer Services shall assist the Division in determining strategies regarding this activity.*

Therefore, the Division of Emergency Management has put forward the following policies:

2. Implementation Strategies

- Step One: Establish Policy Guidelines
- Step Two: Develop Standard Operating Guides, Procedures, and Best Practices
- Step Three: Training & Implementation

3. Policy Guidance to Residents

- Residents must include pets in family disaster plans.
- Take your pets with you when ordered to evacuate.
    - The best plan is to evacuate with your pets to friends and/or family.
    - Identify and promote pet friendly policies of hotels and motels during emergencies.
    - Shelters are life boats for both you and/or your pets.
- Evacuation support should include people with pets
    - Evacuation Routes
    - Buses
    - Special Needs
- Sheltering: no one with pets should be turned away from a shelter
    - Options
    - Co-located Pet Friendly Shelters
    - Centralized Pet Shelters
    - Boarding facilities and animal shelters, volunteer groups
- Shelters: Service animals should never be turned away or separated from their owner.
- Animal rescue teams should be integrated in ESF 9 - Search and Rescue (SAR)
- Animal SAR teams should be typed and credentialed for the level of service of which they are capable.

I. Shelter Inventories

At the time of the Southwest Florida Hurricane Evacuation Study, updated in 2005, shelter capacity across the Region was limited. Over the last five years, shelter capacity has nearly doubled due to almost **126,500** shelter spaces as indicated by this Study. Mitigation dollars have been spent to protect exterior windows and doors and install generators. New school construction, meeting the requirements of the Enhanced Hurricane Protection Areas (EHPA) has increased capacity in the region's counties.

It should be noted that the shelters listed are dynamic and their capacities are estimates. Shelter inventories change annually as facilities are added or drop out for retrofit, construction or repairs. They are constantly being evaluated to ensure that the safest facilities are used. The capacities are based on useable space and an estimated 20 sq. ft. per person. However, these estimates are, in fact, estimates and people never fit neatly into a 20 sq. ft. area.

Tables on the following pages, Table V-8A through V-8F, reveal the 2015 reported status of shelter space availability for each county in the Southwest Florida region. This data is being used in the current transportation evacuation model, but as the data is dynamic, updates can be made in future county-specific transportation modeling runs.

Color Code on Shelter Inventory Tables:

Green = May not be available for ALL categories of hurricane events
Orange = Special Needs

In Function Column:
ARC = American Red Cross
HD = County Health Department
SD = County School District

Table V-8a
Charlotte County Shelter Inventory and Surge Analysis

NAME	ADDRESS	CITY	Risk Cap	Sp. Needs Cap.	Pet Friendly	Agency Support	Function	Vulnerability			
								SURGE	Evac Zone	Flood	Wild-fire
KINGSWAY ELEMENTARY SCHOOL	23300 QUASAR BLVD	PORT CHARLOTTE	2000		No		SCHOOL	4	C	OUT	N
LIBERTY ELEM SCHOOL	370 ATWATER ST.	PORT CHARLOTTE	1000		No		SCHOOL	3	C	OUT	N
NEW DAY CHRISTIAN CHURCH	20212 PEACHLAND BLVD	PORT CHARLOTTE	300	300	No		CHURCH	3	C	OUT	Y
PORT CHARLOTTE H.S.	18200 COCHRAN BLVD	PORT CHARLOTTE	1000		No		SCHOOL	2	B	OUT	Y
TOTAL CAPACITY			**4300**	300							

Table V-8b
Collier County Shelter Inventory and Surge Analysis

NAME	ADDRESS	CITY	RISK CAP	SP. NEEDS CAP	Pet Friendly	Agency Support	Function	Vulnerability			
								Surge	Evac Zone	Flood	Wild -fire
BARRON COLLIER H.S.	5600 COUGAR DR.	NAPLES	2311		NO		SCHOOL	3	C	OUT	N
BIG CYPRESS ELEMENTARY	3250 GOLDEN GATE BLVD	NAPLES	267		NO		SCHOOL	4	D	OUT	Y
CALUSA PARK ELEMENTARY	4600 SANTA BARBARA BLVD	NAPLES	332		NO		SCHOOL	3	C	OUT	Y
CORKSCREW ES/MS	1165 OIL WELL ROAD (VICTORY LN -CR 858)	NAPLES	335		NO		SCHOOL	5	E	OUT	Y
CYPRESS PALM MS	4255 18TH AV. NE	NAPLES	1675		NO		SCHOOL	4	D	OUT	Y
EDEN PARK ES	3655 WESTCLOX ST.	GOLDEN GATE	487		NO		SCHOOL	NA		OUT	Y
ESTATES ELEMENTARY	5945 EVERGLADES BLVD N	GOLDEN GATE	332		NO		SCHOOL	5	E	OUT	Y

GOLDEN GATE HIGH SCHOOL	2925 MAGNOLIA POND DR. (TITAN LN)	NAPLES	2164		NO		SCHOOL	4	D	OUT	Y
GOLDEN GATE INTERMEDIATE SCHOOL	5055 20TH PL SW	GOLDEN GATE	278		NO		SCHOOL	4	C	OUT	N
GOLDEN GATE MIDDLE SCHOOL	2701 48TH TERR SW	NAPLES	740		NO		SCHOOL	3	C	OUT	Y
GOLDEN TERRACE INTERMEDIATE SCHOOL	2965 44TH TER SW	GOLDEN GATE	263		NO		SCHOOL	4	C	OUT	N
GULF COAST H.S.	7878 IMMOKALEE ROAD	NAPLES	1948		NO		SCHOOL	4	D	OUT	Y
HIGHLANDS ELEM SCHOOL	1101 LAKE TRAFFORD RD	IMMOKALEE	304		NO		SCHOOL	NA		OUT	Y
IMMOKALEE FRIENDSHIP HOUSE	602 W. MAIN ST	IMMOKALEE	127		NO		SHELTER	NA		OUT	Y
IMMOKALEE H.S.	710 IMMOKALEE RD.	IMMOKALEE	1018		NO		SCHOOL	NA		OUT	N
IMMOKALEE MIDDLE SCHOOL	401 N. 9TH ST.	IMMOKALEE	581		NO		SCHOOL	NA		OUT	Y
IMMOKALEE TECH CENTER	508 N 9TH ST, IMMOKALEE	IMMOKALEE	265		NO		SCHOOL	NA		OUT	Y
LAKE TRAFFORD ELEM SCHOOL	3500 LAKE TRAFFORD RD.	IMMOKALEE	270		NO		SCHOOL	NA		OUT	Y
LAUREL OAKS ELEM SCHOOL	7800 IMMOKALEE RD.	IMMOKALEE	288		NO		SCHOOL	4	D	OUT	Y
LELY ELEM	8125 LELY CULTURAL PKWY	NAPLES	297		NO		SCHOOL	3	B	OUT	Y
LELY H.S.	1 LELY HIGH SCHOOL BLVD	EAST NAPLES	2142		NO		SCHOOL	2	A	OUT	Y
MIKE DAVIS ELEM	3215 MAGNOLIA POND DR	NAPLES	250		NO		SCHOOL	3	C	OUT	Y
N.COLLIER REG. PARK	15000 LIVINGSTON RD	NAPLES	760		YES		PARK	3	C	OUT	Y
NAPLES H.S.	1100 22ND AVE., NORTH	NAPLES	1428		NO		SCHOOL	2	B	OUT	N
NORTH NAPLES	16165 LIVINGSTON RD	NAPLES	1031		NO		SCHOOL	3	C	OUT	Y

MIDDLE SCHOOL											
OAK RIDGE MIDDLE SCHOOL	151 COUNTY RD. 951	GOLDEN GATE	740		NO		SCHOOL	4	D	OUT	Y
PALMETTO RIDGE HIGH SCHOOL	1655 VICTORY LN	NAPLES	741	200	NO		SCHOOL	5	D	OUT	Y
PARKSIDE ELEMENTARY	5322 TEXAS AVE	NAPLES	616		NO		SCHOOL	2	B	IN	Y
PELICAN MARSH ELEM SCHOOL	9480 AIRPORT RD	WEST NAPLES	339		NO		SCHOOL	2	B	OUT	Y
PINECREST ELEMENTARY SCHOOL	213 S 9TH ST	IMMOKALEE	315		NO		SCHOOL	NA		OUT	Y
SABLE PALM ES	4095 18TH AVE,NE	NAPLES	721		NO		SCHOOL	4	D	OUT	Y
ST. MATTHEWS HOUSE	2001 AIRPORT PULLING S	NAPLES	222		NO		SHELTER	1	A	IN	N
TOM GOLISAN FIELD HOUSE	4810 KELLEHER ST.	AVE MARIA	0		NO		SCHOOL	NA		OUT	N
VETERANS COMM. PARK	1900 IMMOKALEE ROAD	NORTH NAPLES	585		NO		PARK	2	A	IN	Y
VETERANS MEMORIAL ELEMENTARY	15960 VETERANS MEMORIAL PKWY	NAPLES	332		NO		SCHOOL	3	C	OUT	Y
VILLAGE OAKS ELEMENTARY SCHOOL	1501 SR 29	IMMOKALEE	434		NO		SCHOOL	NA		OUT	N
VINEYARDS ELEMENTARY SCHOOL	6225 ARBOR BLVD	GOLDEN GATE	255		NO		SCHOOL	4	D	OUT	Y
TOTAL CAPACITY			**25193**	**200**							

Table V-8c
Glades County Shelter Inventory

NAME	ADDRESS	CITY	Risk Cap	Sp. Needs Cap	Pet Friendly	Agency Support	Function	Vulnerability					
								16Ft Surge	Evac Zone	20Ft Surge	Evac Zone	Flood	Wild -fire
AMERICAN LEGION HALL	600 RIVER RD	MOORE HAVEN	70		NO		PRIVATE	4	D	4	D	OUT	N
BUCKHEAD RIDGE COM. CTR. I & II	682 E SR 78	BUCKHEAD RIDGE	100		NO		PRIVATE	2	B	3	C	OUT	Y
BUCKHEAD RIDGE VFW	29012 E SR78	BUCKHEAD RIDGE	60		NO		PRIVATE	NA		NA		IN	Y
DOYLE CONNER BLDG	900 US HIGHWAY 27	MOORE HAVEN	500		NO		GOV	NA		NA		OUT	N
MAPLE GROVE BAPTIST CHURCH	120 E STATE ROAD 78 W	LAKEPORT	343		NO		CHURCH	5	E	4	D	IN	N
MOORE HAVEN ELEM SCHOOL	800 AVENUE K	MOORE HAVEN	160		NO		SCHOOL	NA		NA		OUT	Y
MUSE COMMUNITY CENTER	3897 LOBLOLLY RD	MUSE	46		NO		PRIVATE	NA		NA		OUT	Y
WEST GLADES ELEMENTARY	2500 SOUTH CR 731 SW	LABELLE	594	60	NO		SCHOOL	NA		NA		OUT	N
TOTAL CAPACITY			**1873**	**60**									

Table V-8d
Hendry County Shelter Inventory and Surge Analysis

NAME	ADDRESS	CITY	Risk Cap	Sp. Needs Cap	Pet Friendly	Agency Support	Function	Vulnerability			
								Surge 16Ft	Surge 20Ft	Flood	Wild -fire
CLEWISTON CENTRAL ELEM SCHOOL	1000 S. DEAN DUFF AVE.	CLEWISTON	686		NO		SCHOOL	OUT	OUT	OUT	Y
CLEWISTON EASTSIDE ELEM SCHOOL	201 W. ARROYO AVE.	CLEWISTON	156		NO		SCHOOL	OUT	OUT	OUT	N
CLEWISTON WESTSIDE ELEM SCHOOL	205 W. ARROYO AVE.	CLEWISTON	338		NO		SCHOOL	OUT	OUT	OUT	N
CLEWISTON H.S.	1501 SOUTH FRANCISCO	CLEWISTON	546		NO		SCHOOL	OUT	OUT	IN	N
CLEWISTON MIDDLE SCHOOL	601 WEST OSCEOLA	CLEWISTON	472		NO		SCHOOL	OUT	OUT	OUT	N
LABELLE COUNTRY OAKS ELEM SCHOOL	2025 NW EUCALYPTUS BLVD.	LABELLE	191		NO		SCHOOL	OUT	OUT	OUT	N
LABELLE HS	4050 EAST COWBOY WAY	LABELLE	777		NO		SCHOOL	OUT	OUT	IN	N
LABELLE MS	8000 EAST COWBOY WAY	LABELLE	366		NO		SCHOOL	OUT	OUT	OUT	N
LABELLE ES	150 WEST COWBOY WAY	LABELLE	101		NO		SCHOOL	OUT	OUT	OUT	N
UPTHEGROVE ES	280 NORTH MAIN STREET	LABELLE	368		NO		SCHOOL	4	4	OUT	Y
WEST GLADES ELEMENTARY	2500 SOUTH CR 731 SW	LABELLE	594	60	NO		SCHOOL	NA		NA	
TOTAL CAPACITY			**4595**	**60**							

Table V-8e
Lee County Shelter Inventory and Surge Analysis

NAME	ADDRESS	CITY	Risk Cap.	Sp. Needs Cap.	Pet Friendly	Agency Support	Function	Vulnerability			
								Surge	Evac Zone	Flood	Wild -fire
ALICO ARENA (FLORIDA GULF COAST	10501 FGCU BLVD S.	FORT MYERS	1685		NO		SCHOOL	4	D	OUT	N
ALVA ELEMENTARY SCHOOL	21290 PARK STREET	ALVA	250		NO		SCHOOL	4	D	OUT	N
BONITA SPRINGS YMCA	27200 KENT RD	BONITA SPRINGS	400		NO		SCHOOL	3	B	IN	Y
COLONIAL ELEM SCHOOL	3800 SCHOOLHOUSE RD. EAST	FT MYERS	1400		NO		SCHOOL	4	C	IN	N
DIPLOMAT ELEM SCHOOL	1115 NE 16TH TER	CAPE CORAL	2100		NO		SCHOOL	4	B	OUT	Y
DIPLOMAT MIDDLE SCHOOL	1039 NE 16TH TER	CAPE CORAL	500		NO		SCHOOL	4	B	OUT	N
EAST LEE COUNTY HS	715 THOMAS SHERWIN	LEHIGH ACRES	3267	3267	YES		SCHOOL	NA	E	OUT	N
ESTERO COMMUNITY CENTER	CORKSCREW PALM RD	ESTERO	500		NO			3	C	OUT	Y
ESTERO HIGH SCHOOL	21900 RIVER RANCH ROAD	ESTERO	600		NO		SCHOOL	4	C	OUT	Y
GERMAIN ARENA	11000 EVERBLADES PKWY	ESTERO	4300		NO			4	C	IN	N
HARNS MARSH ELEMENTARY SCHOOL	1800 UNICE AVE N	LEHIGH ACRES	2146		NO		SCHOOL	5	D	OUT	Y
HARNS MARSH MIDDLE SCHOOL	1820 UNICE AVE N	LEHIGH ACRES	1360		NO		SCHOOL	4	D	OUT	N
ISLAND COAST HS	GATOR RD	CAPE CORAL	3866		NO		SCHOOL	4	C	OUT	N
JOHN COLIN ELEM SCHOOL	120 PINE ISLAND RD	N FT MYERS	800		NO		SCHOOL	3	B	OUT	N
JAMES STEPHENS INTERNATIONAL ACADEMY	1333 MARSH AV	FORT MYERS	0				SCHOOL	4	C	OUT	N
LEHIGH HIGH SCHOOL	801 GUNNERY ROAD NORTH	LEHIGH ACRES	850		NO		SCHOOL	NA	E	OUT	N
LITTLETON ELEMENTARY SCHOOL	700 HUTTO RD	N FT MYERS	1425		NO		SCHOOL	4	C	OUT	Y
MARINER MIDDLE SCHOOL	425 CHIQUITA BLVD	CAPE CORAL	650		NO		SCHOOL	3	B	OUT	N
MIRROR LAKES ELEMENTARY SCHOOL	525 CHARWOOD AVENUE SOUTH	LEHIGH ACRES	2318		NO		SCHOOL	NA	E	OUT	N
NORTH FT MYERS ACADEMY FOR THE A	1856 ARTS WAY	N FT MYERS	1753		NO		SCHOOL	4	C	OUT	Y

NORTH FORT MYERS COMMUNITY CENTER	2000 NORTH RECREATION PARK WAY	N FT MYERS	500		NO		COMM CENT	3	B	IN	N
OAK HAMMOCK MS	5321 TICE ST	FORT MYERS	2365		NO		SCHOOL	4	C	OUT	N
RAY V. PORTORF ES	4600 CHANLLENGER BLVD	FORT MYERS	800	800	NO		SCHOOL	4	C	OUT	N
RIVERDALE HIGH SCHOOL	2600 BUCKINGHAM RD	FORT MYERS	500		NO		SCHOOL	3	B	OUT	N
ROYAL PALM EXCEPTIONAL CENTER	1817 HIGH STREET	FORT MYERS	150		NO		SCHOOL	4	C	OUT	N
SOUTH FT. MYERS HS	14020 PLANTATION ROAD	FORT MYERS	3106		YES		SCHOOL	3	C	IN	N
THREE OAKS ELEM SCHOOL	19600 CYPRESS VIEW DR	SAN CARLOS	1715		NO		SCHOOL	4	C	OUT	N
THREE OAKS MIDDLE SCHOOL	18500 THREE OAKS PARKWAY	SAN CARLOS	300		NO		SCHOOL	4	C	OUT	Y
VARSITY LAKES MS	801 GUNNERY RD	LEHIGH ACRES	2331		NO		SCHOOL	NA	E	OUT	N
VETERENS PARK ES	49 HOMESTEAD RD	LEHIGH ACRES	722		NO		SCHOOL	NA	C	OUT	Y
TOTAL CAPACITY			**42659**	**4067**							

Table V-8f
Sarasota County Shelter Inventory and Surge Analysis

Name	Address	City	Risk Cap	Sp. Needs Cap	Pet Friendly	Agency Support	Function	Vulnerability			
								Surge	Evac Zone	Flood	Wild-fire
ASHTON ELEM SCHOOL	5110 ASHTON ROAD	SARASOTA	1588		NO		SCHOOL	NA		OUT	N
ATWATER ELEMENTARY	4701 HUNTSVILLE AVE	NORTH PORT	3500		NO		SCHOOL	4	D	OUT	N
BISHOP NEVINS ACADEMY	4830 FRUITVILLE RD	SARASOTA	1052		NO		SCHOOL	NA		OUT	N
BOOKER HIGH SCHOOL	3201 N ORANGE AVE	SARASOTA	2400		NO		SCHOOL	4	D	OUT	N
BOOKER MIDDLE SCHOOL	2250 MYRTLE STREET	SARASOTA	1417		NO		SCHOOL	NA		OUT	N
BRENTWOOD ELEMENTARY	2500 VINSON AVE	SARASOTA	1125		NO		SCHOOL	5	E	OUT	N
BROOKSIDE MIDDLE SCHOOL	3636 S. SHADE AVE.	SARASOTA	2324		YES		SCHOOL	5	D	OUT	N
CRANBERRY ELEMENTARY	2775 SHALIMAR TER	NORTH PORT	1047	1047	NO		SCHOOL	4	D	OUT	N
GLENALLEN ELEM	7050 GLENALLEN BLVD.	NORTH PORT	1002		NO		SCHOOL	4	D	OUT	Y

SCHOOL											
GULF GATE ELEM SCHOOL	6500 LOCKWOOD RIDGE ROAD	SARASOTA	2933		NO		SCHOOL	4	D	OUT	N
HERON CREEK MS	6501 W. PRICE	NORTH PORT	3548		YES		SCHOOL	4	D	OUT	Y
NORTH PORTH HIGH SCHOOL	6400 WEST PRICE BLVD	NORTH PORT	4653		YES		SCHOOL	4	D	OUT	Y
PHILLIPPI SHORES ELEMENTARY	4747 S. TAMIAMI TRAIL	SARASOTA	1835		NO			5	D	OUT	N
PINEVIEW SCHOOL	501 OLD VENICE ROAD	OSPREY	1101		YES		SCHOOL	4	C	OUT	Y
RIVERVIEW HIGH SCHOOL	1 RAM WAY	SARASOTA	2364		YES		SCHOOL	3	C	OUT	N
SARASOTA HIGH SCHOOL	1000 S. TAMIAMI TRAIL	SARASOTA	4658		NO		SCHOOL	2	C	OUT	N
SOUTHSIDE ELEMENTARY	1901 WEBBER	SARASOTA	1346		NO		SCHOOL	4	D	OUT	N
TATUM RDG ELEMENTARY	4100 TATUM RIDGE RD	SARASOTA	1091	1091	NO		SCHOOL	NA		OUT	N
TAYLOR RANCH ELEM SCHOOL	2500 TAYLOR RANCH ROAD	VENICE	1248		NO		SCHOOL	4	C	OUT	Y
TOLEDO BLADE ES	1201 GERANIUM AVENUE	NORTH PORT	1939		NO		SCHOOL	5	D	OUT	N
TUTTLE ELEMENTARY SCHOOL	925 N BRINK AVENUE	SARASOTA	1883		NO		SCHOOL	NA		OUT	N
VENICE COMMUNITY CENTER	326 NOKOMIS AVE SOUTH	VENICE	922		NO		COMM CEN	4	C	OUT	N
WOODLAND MIDDLE SCHOOL	2700 PANACEA BLVD	NORTH PORT	2959		YES		SCHOOL	NA	E	OUT	N
TOTAL CAPACITY			**47935**	**2138**							

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J. Public Shelter Demand

The general response model, post-hurricane behavioral surveys of residents in the Southwest Florida region and past experience was 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 home 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 were applied to the projected Hurricane Evacuation Population estimates.

There are several different assumptions regarding the evacuation population (See Chapter VI Evacuation Transportation Analysis):

- The **Base Scenarios** – which are used for planning and growth management purposes assume that 100% of the population-at-risk evacuates plus a (smaller) percentage of non-vulnerable population (shadow evacuation).
- The **Operational Scenarios** used in operations use the planning assumptions determined by the behavioral analysis which are assumed to be a more realistic set of assumptions. Although they do not reflect 100% evacuation of vulnerable residents, there is a significant percentage of shadow evacuation especially in the major storm threats.

The results are presented below:

Table V-9a
Public Shelter Demand for Hurricane Evacuation Base Scenarios 2017

County	Capacity*	A	B	C	D	E
Charlotte	4,300	6,408	11,270	13,041	13,357	13,366
Collier	25,193	13,906	18,100	26,516	32,316	32,566
Glades	1,873	1,252	1,339	1,469	1,565	1,613
Hendry	4,595	2,666	2,464	3,176	3,336	3,489
Lee	42,659	18,648	27,443	34,358	38,191	40,393
Sarasota	47,935	12,617	15,416	22,994	30,305	32,375
Region	126,555	55,497	76,032	101,554	119,070	123,802

**Capacity based on Primary Risk ARC4496 Compliant shelters.*

Table V-9b
Public Shelter Demand for Hurricane Evacuation Operational Scenarios 2017

County	Capacity*	A	B	C	D	E
Charlotte	4,300	0	6,399	7,718	9,555	11,235
Collier	25,193	10,029	9,363	18,779	24,054	26,346
Glades	1,873	716	716	919	1,112	1,260
Hendry	4,595	1,480	1,480	2,098	2,631	2,738
Lee	42,659	12,930	16,330	23,730	29,461	33,219
Sarasota	47,935	0	10,417	10,417	17,261	29,276
Region	126,555	25,155	44,705	63,661	84,074	104,074

**Capacity based on Primary Risk ARC4496 Compliant shelters.*

Table V-9c
Public Shelter Demand for Hurricane Evacuation Base Scenarios 2020

County	Capacity*	A	B	C	D	E
Charlotte	4,300	6,806	12,032	13,938	14,275	14,286
Collier	25,193	15,620	20,554	30,211	36,697	36,972
Glades	1,873	1,321	1,412	1,548	1,652	1,702
Hendry	4,595	2,753	2,544	3,280	3,445	3,602
Lee	42,659	21,691	31,918	40,117	44,491	47,018
Sarasota	47,935	13,688	16,720	24,944	32,910	35,187
Region	126,555	61,879	85,180	114,038	133,470	138,767

**Capacity based on Primary Risk ARC4496 Compliant shelters.*

Table V-9d
Public Shelter Demand for Hurricane Evacuation Operational Scenarios 2020

County	Capacity*	A	B	C	D	E
Charlotte	4,300	4,619	6,908	8,336	10,277	8,336
Collier	25,193	0	13,751	13,751	21,665	13,751
Glades	1,873	753	753	9,689	1,173	1,330
Hendry	4,595	0	1,528	1,972	2,716	3,097
Lee	42,659	15,214	19,331	28,079	34,604	28,079
Sarasota	47,935	9,293	9,293	18,827	27,112	18,827
Region	126,555	29,879	51,564	80,654	97,547	73,420

**Capacity based on Primary Risk ARC4496 Compliant shelters.*

K. Dealing with Shelter Shortfalls and Challenges

Strategies have been implemented at the state and local level to address the shelter issues for the past ten years. Some additional funding for shelter retrofit and generators for special needs shelters was allocated in 2006; however, the economic downturn has taxed federal, state and local resources.

- Public information, both before the emergency and during the evacuation, should stress that while evacuation out of the most vulnerable areas is critical, (1) residents should seek alternative types of refuge before and during the emergency if feasible; and (2) that persons on high ground offer their homes as refuge to friends/relatives in hurricane vulnerable areas.

- Impact fees for development within the Coastal High Hazard Area (CHHA) and Hurricane Vulnerability Zone (Level C), Wildfire Urban Interface and the 100-year flood zone should be used to mitigate the impacts of further development in hurricane prone areas.

- Growth management strategies should minimize development which would increase allowable density or put people with special needs (critical facilities) in designated vulnerable areas.

- Both local governments and local school boards, in cooperation with local emergency management, should ensure that new schools are sited, designed and constructed to be disaster-resistant and appropriate for shelter use. In addition, windows in existing facilities should be protected/retrofitted to mitigate damage and provide more suitable

public shelter. Funding to cover additional construction costs to the School Boards to upgrade to EHPA standards should be sought.

- Continue to encourage the State Legislature to fund the necessary retrofits (for both public and private facilities (particularly schools, hospitals and nursing homes) and mandate appropriate design/construction standards.

- Public outreach should stress that persons with pets prepare ahead for their pets and recognize the extremely limited capacity for pets at public shelters. Emergency management and local school boards need to continue to address this issue.

- Public outreach should stress that persons with special needs speak to their physician/ health care provider and register with county emergency management if they require additional assistance.

- In a major evacuation and where necessary, the Governor's Office should, through Executive Order, waive capacity limits in assisted living facilities and nursing homes to ensure appropriate continuity of care and level of care is maintained in the region.

- It should be recognized that providing the appropriate level of care and continuity of care will take ongoing cooperation and communications between and among the public and private sector health care providers. Emergency management, the local health departments and health care providers should partner to develop the plans and shelter locations for our residents with special needs.

- Phase shelter openings: The shelter demand estimates may be high depending on the strength and projected track of the threatening hurricane as well as the response of local government and State officials. The American Red Cross chapters, local emergency management agencies and local school boards developed strategies to phase the opening of selected public shelters depending on the evacuation level and projected shelter demand.

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CHAPTER VI

REGIONAL TRANSPORTATION ANALYSIS

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Chapter VI
Regional Transportation Analysis

The evacuation transportation analysis discussed in this volume documents the methodology, analysis and results of the transportation component of the Statewide Regional Evacuation Study Program (SRESP). Among the many analyses required for the SRESP study, 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.

A. Background and Purpose

Over the years, different planning agencies have used different modeling approaches with varying degrees of complexity and mixed success. Some have used full-blown conventional transportation models such as the standard Florida model FSUTMS; others have used a combination of a simplified conventional model and a spreadsheet program, such as the Abbreviated Transportation Model (ATM). These models have different data requirements, use different behavioral assumptions, employ different traffic assignment algorithms, and produce traffic analysis results with different levels of detail and accuracy. These differences make it difficult for planning agencies to share information and data with each other. They also may produce undesirable conditions for staff training and knowledge sharing.

One of the objectives of the SRESP is to create consistent and integrated regional evacuation data and mapping, and by doing so, to facilitate knowledge sharing between state, regional, county and local partners. To achieve this objective, it is important for all Regional Planning Councils to adopt the same data format and to use the same modeling methodologies for their transportation analyses. The primary purpose of the transportation component of the SRESP is to develop a unified evacuation transportation modeling framework that can be implemented with the data collected by the Regional Planning Councils.

B. Study Area

The study area for this analysis includes the six county Southwest Florida Regional Planning Council area. The transportation modeling methodology includes some processes that are performed at the statewide level in order to determine the impacts of evacuations from other regions impacting the evacuation clearance times in the Southwest Florida region. While the impact of other regions is included in the Southwest Florida analysis, it is important to note that the results of the transportation analysis presented in this document are only reported for the six counties included in the Southwest Florida RPC. Transportation analysis results for other regions and counties are reported in the corresponding Volume 4 report for those regions.

C. Input and Coordination

The SRESP transportation methodology and framework was developed during 2008 and 2009 in coordination with all eleven regional planning councils in Florida, along with the Division of Emergency Management, Department of Transportation, Department of Economic Opportunity (formerly the Department of Community Affairs), and local county emergency management teams with CDM Smith serving as the transportation consultant.

During the updates to SRESP in 2015, two meetings were held at the local and regional level to receive updated input from local county emergency management and the regional planning council. The two meetings held in the region included the following:

Regional Meeting No. 1 – Scenario Development Update Meeting
The first regional meeting for the Southwest Florida region was held on March 20, 2015 at 1:30 PM. The purpose of the scenario development update meeting was to review the Southwest Florida small area data, discuss the base scenarios for the region for growth management purposes, and discuss and receive input on the operational scenarios to be evaluated for emergency management purposes.

Regional Meeting No. 2 – Transportation Analysis Update Meeting
The second and final regional meeting for the Southwest Florida region was held on August 10, 2015 at 2:00 PM. The purpose of the transportation analysis meeting was to review the draft results of the transportation analysis and receive feedback on the draft final report.

D. Study Comparisons

It is important to note that this study contains significant updates and revisions in comparison to the 2010 SRESP study for the SWFRPC region. These revisions include updates to population projections based on the 2010 census, new evacuation zones based on updated topography data, modifications to the roadway network due to recently completed and planned construction projects, and changes to the location and size of available shelters. These revisions have significant impacts on evacuating vehicle behavior for the region and caused changes to the calculated clearance times in each county. These updates and revisions make comparisons to the previous 2010 study difficult.

E. Evacuation Modeling Methodology and Framework

The evacuation modeling methodology and framework was developed during 2008 and 2009 in coordination with all eleven Regional Planning Councils and the Division of Emergency Management. The methodology used in the Southwest Florida RPC Evacuation Transportation Analysis is identical to the methodology used for all eleven Regional Planning Councils and includes the following components:

1. Behavioral Assumptions

In 2008, the Statewide Regional Evacuation Study Program (SRESP) commissioned a survey of Florida residents. The purpose of this survey was to develop an understanding of the behavior of individuals when faced with the prospect of an impending evacuation. These

data were used to develop a set of "planning assumptions" that describe the way people respond to an order to evacuate and are an important input to the SRESP Evacuation Model. The behavioral data provides insights into how people respond to the changing conditions leading up to and during an evacuation. The primary application of the survey data was to help anticipate how people would respond with respect to five behaviors:

- How many people would evacuate?
- When they would leave?
- What type of refuge they would seek?
- Where they would travel for refuge?
- How many vehicles would they use?

These evacuation behaviors are distinguished based on several descriptive variables as listed below:

- Type of dwelling unit (site-built home versus mobile home);
- The evacuation zone in which the evacuee reside; and,
- The intensity of the evacuation that has been ordered.

2. Zone System and Highway Network

The SRESP evacuation model relies upon data that covers the entire State of Florida as well as areas covering the States of Georgia, Alabama, Mississippi, South Carolina, North Carolina and Tennessee. While the primary focus of the model is with evacuation behavior within Florida, areas outside of the state had to be considered in order to allow a more precise routing of evacuation traffic. This allows the model to measure the flow of traffic across the state line if needed.

The data included in this system contain the demographic information crucial to modeling evacuation traffic. The demographic information is labeled as "small area data". These data provide population and dwelling unit information that will identify where the individuals in the region reside. The planning assumptions developed from the behavioral analysis conducted for this study were applied to these demographic data. The result is a set of evacuation trips generated by the evacuation model. The number of these trips will vary depending on the hazard conditions that prompt the evacuation. Small area data geographies were aggregated into larger units known as Traffic Evacuation Zones (TEZ). These TEZ form the basic unit of analysis in the evacuation model. The final TEZ system for the State of Florida has 17,328 zones. This number provides sufficient detail to accurately accommodate the assignment of evacuation trips onto an evacuation network.

3. Background Traffic

The traffic that consumes the roadway capacity of a transportation system during an evacuation can be divided into two groups. The first group is the evacuation traffic itself. Once the evacuation demand is determined, this information is converted into a number of vehicles evacuating over time. These evacuation trips are then placed on a representation of the highway network by a model. The model determines the speed at which these trips can move and proceeds to move the evacuation trips accordingly. The result is a set of clearance times.

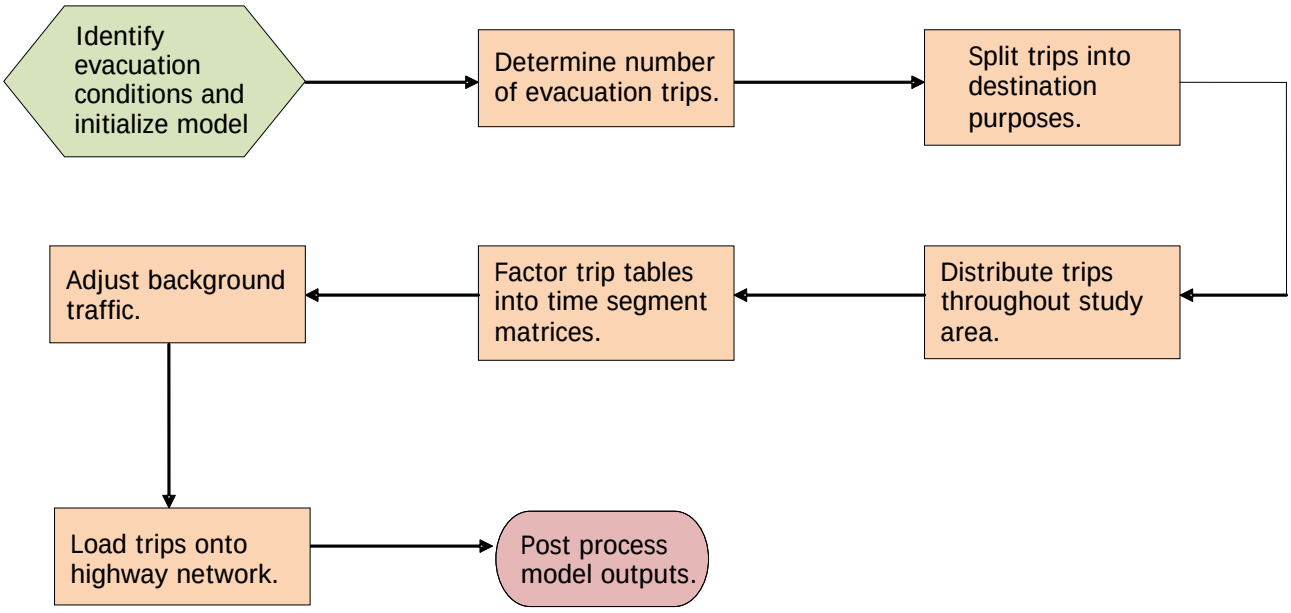
The second group of traffic is known as background traffic. Background traffic, as its name implies, is not the primary focus of an evacuation transportation analysis and is accounted for primarily to impede the movement of evacuation trips through the network. These trips represent individuals going about their daily business mostly unconcerned with the evacuation event. For the most part, background traffic represents trips that are relatively insensitive to an order to evacuate and are thus said to be occurring in the "background." Even though background traffic is relatively insensitive to evacuation orders, it is important to account for background traffic since it can have a dramatic impact on available roadway capacity. This, in turn, can severely affect evacuation clearance times.

4. Evacuation Traffic

The model flow for the evacuation model is divided into a total of eight modeling steps. The following eight steps are represented graphically in the flowchart in **Figure VI-1**:

1. Identify evacuation conditions and initialize model;
2. Determine number of evacuation trips;
3. Split trips into destination purposes;
4. Distribute trips throughout study area;
5. Factor trip tables into time segment matrices;
6. Adjust background traffic;
7. Load trips onto highway network; and,
8. Post process model outputs.

Figure VI-1: General Model Flow



5. Dynamic Traffic Assignment

Dynamic traffic assignment (DTA) was utilized in the evacuation methodology because it is sensitive to individual time increments. DTA works by assigning a certain number of vehicles to the highway network in a given interval of time. The model then tracks the progress of these trips through the network over the interval. Another set of vehicles is assigned during the following time interval. The model then tracks the progress of these trips through the network along with the progress of the trips loaded in the previous time interval. As vehicles begin to arrive at the same segments of roadway, they interact with one another to create congestion. When vehicles that were loaded to the network in subsequent intervals of time arrive at the congested links, they contribute to the congestion as well. This results in a slowing down of the traffic and eventually spill-backs and queuing delays. It is this time dependent feature of DTA that makes it well suited to evacuation modeling. By dynamically adjusting the travel times and speeds of the vehicles moving through the network as they respond to congestion, the model is able to do the following:

- The evacuation model is able to estimate the critical clearance time statistics needed for this study;
- The model takes into account the impact of compounded congestion from multiple congestion points;
- The model is able to adjust the routing of traffic throughout the network as a function of congestion as it occurs throughout the evacuation; and,
- The model is capable of adjusting its capacities from time segment to time segment, making it possible to represent such phenomena as reverse lane operations and background traffic.

6. Prototype Model Development

CDM Smith developed the prototype model to test the modeling methodology used to calculate evacuation clearance times. The prototype model demonstrated the viability of the methodology developed for this study. This included the use of dynamic traffic assignment, background traffic curves, regional sub-area trip balancing, the use of survey rates, the use of 100% participation rates, response curves, and county-by-county phasing of evacuations.

The prototype model served as the backbone for all regional evacuation models that have been developed for this study. The models implemented for each RPC use a structure similar to the prototype with identical methodology.

The SRESP evacuation model relies upon data that covers the entire State of Florida as well as areas covering the States of Georgia, Alabama, Mississippi, South Carolina, North Carolina, and Tennessee. While the primary focus of the model is with evacuation behavior within Florida, areas outside of the state had to be considered in order to allow a more precise routing of evacuation traffic. This allows the model to measure the flow of traffic across the state line if needed.

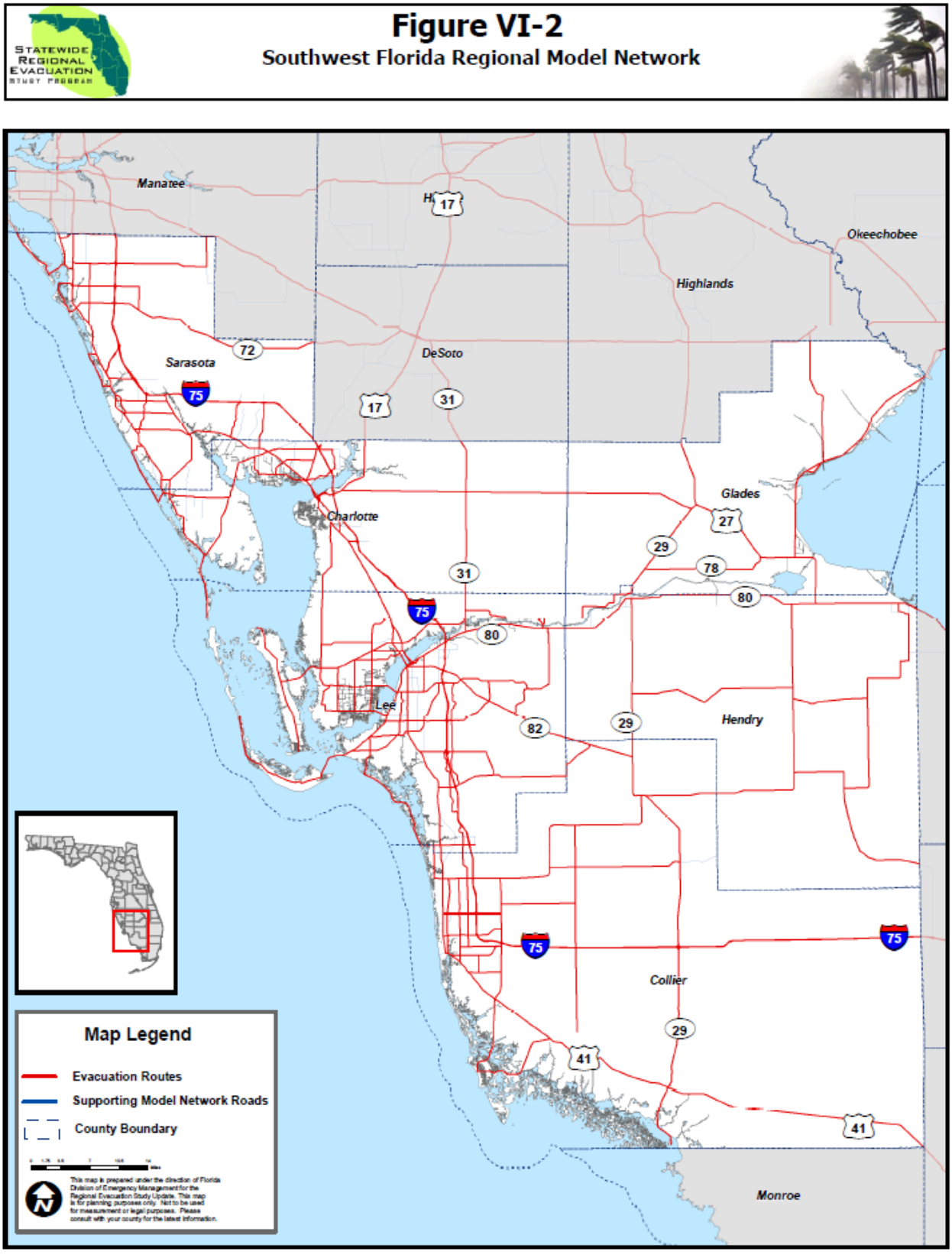
F. Regional Model Implementation

The regional model developed for the Southwest Florida Region used a series of input data provided by the RPC, including the following:

1. Regional Model Network

The road network is a key component of the evacuation model. The roadway variables in the network include area type, functional class, number of through lanes, capacity, speed, and several others. The regional model network consists of the RPC designated evacuation routes as well as a supporting roadway network that facilitates movement of evacuation traffic. The 2005 Florida Department of Transportation (FDOT) Statewide Model Network was used as a basis for developing the regional model network, while the evacuation routes were obtained from the Southwest Florida RPC. The RPC relied on the emergency managers of its constituent counties to provide it with information on which roads were to be included as evacuation routes. The resulting model network was updated to 2015 conditions and is referred to as the base model network. **Figure VI-2** identifies the model network and evacuation routes for the SWFRPC. County level details of the regional model network are provided in the Volume 5-9 report. The regional model network for the Southwest Florida region includes key roadways within the six county region, including I-75, US 41, US 27, US 17, US 301, SR 29, SR 78, SR 74, SR 72, SR 31, SR 82 and US 80.

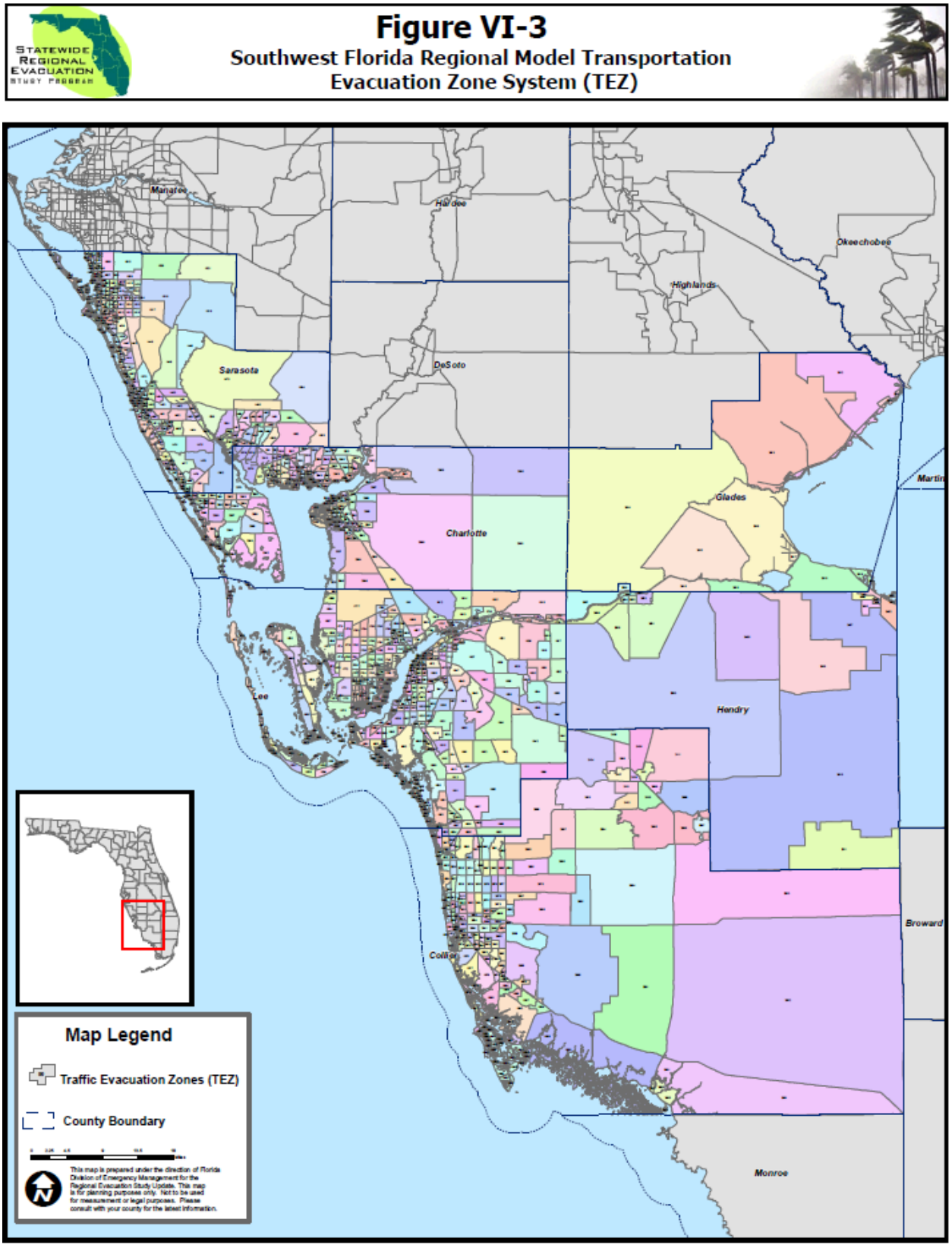
Figure VI-2: Southwest Florida Regional Model Network



2. Regional Zone System

The regional zone system is based on Traffic Evacuation Zones (TEZ) and contains the regional demographic information, which includes housing and population data that is essential to modeling evacuation traffic. There are 972 zones located within the six county Southwest Florida region, as illustrated in **Figure VI-3**. In the Southwest Florida region, Lee County has the largest number of TEZs with 337, and Sarasota County follows with 275 TEZs. Charlotte County contains 175 TEZs; Collier County, 156 TEZs. Hendry and Glades Counties have the lowest number of TEZs in the RPC with 21 and 8 zones, respectively. The larger number of TEZs generally reflects counties with denser urban structure and/or higher population densities.

Figure VI-3: Southwest Florida Model Transportation Evacuation Zone System



3. Regional Demographic Characteristics

Demographic data were developed for the following years: 2010, 2015 and 2020. A snapshot of the key demographic data for each county in the Southwest Florida RPC for 2010, 2015 and 2020 is summarized in **Table VI-1**. The tables list the number of occupied dwelling units for site-built homes, the permanent population in site-built homes, as well as the number of occupied dwelling units for mobile homes and the permanent population in mobile homes. The mobile home category includes RVs and boats and the permanent population in those housing options. The demographic characteristics summary also includes hotels and motels because many of these units are in or near vulnerable areas, and the proportion of seasonal units and hotel/motel units that are occupied at any point in time will have an important impact on the total population that may participate in an evacuation.

Lee County has the largest population in the region during all three time periods. The county is expected to reach over 762,000 people by 2020. Sarasota County has the second largest population in the region and is forecasted to have more than 415,000 people by 2020. Glades County has the smallest population in the region; the county is expected to have just more than 12,000 people by 2020.

Table VI-1: Southwest Florida Demographic Characteristic Summary

County	Characteristic	Year		
		2010	2015	2020
Charlotte	Occupied site-built homes	65,788	68,860	72,433
	Population in site-built homes	143,211	149,906	157,675
	Occupied mobile homes	7,582	7,937	8,345
	Population in mobile home	13,755	14,404	15,146
	Hotel/motel units	1,499	5,105	8,782
Collier	Occupied site-built homes	125,148	134,913	149,019
	Population in site-built homes	295,065	318,220	351,535
	Occupied mobile homes	8,031	8,646	9,551
	Population in mobile home	21,909	23,600	26,154
	Hotel/motel units	6,880	24,725	43,547
Glades	Occupied site-built homes	2,106	2,128	2,245
	Population in site-built homes	5,137	5,186	5,443
	Occupied mobile homes	2,427	2,455	2,587
	Population in mobile home	6,264	6,343	6,712
	Hotel/motel units	146	174	252
Hendry	Occupied site-built homes	7,433	7,301	7,548
	Population in site-built homes	21,702	21,320	22,044
	Occupied mobile homes	4,592	4,512	4,659
	Population in mobile home	15,496	15,224	15,721
	Hotel/motel units	384	917	1,549
Lee	Occupied site-built homes	234,977	259,284	293,723
	Population in site-built homes	563,518	621,873	704,312
	Occupied mobile homes	24,841	27,318	30,925
	Population in mobile home	46,748	51,473	58,496
	Hotel/motel units	11,487	33,810	58,158
Sarasota	Occupied site-built homes	161,390	168,313	179,553
	Population in site-built homes	350,438	365,473	389,893
	Occupied mobile homes	14,356	14,964	15,958
	Population in mobile home	23,388	24,374	25,992
	Hotel/motel units	4,778	18,943	33,587

Source: Southwest Florida Regional Planning Council

4. Planned Roadway Improvements

To correspond to the three different sets of demographic data, three model networks were ultimately developed. The base 2010 network and two future year networks to correspond to the 2015 demographic data and the 2020 demographic data. The 2010 base model network was updated to reflect roadway capacity improvement projects completed between 2011 and 2015 to create the 2015 network. The 2015 network was then updated to reflect planned roadway capacity improvement projects expected to be implemented between 2016 and 2020 to create the 2020 network.

The planned roadway improvements that were added to the network generally include only capacity improvement projects such as additional through lanes. **Table VI-2** identifies capacity improvement projects completed between 2011 and 2015 that were included in the 2015 network. Likewise, **Table VI-3** identifies capacity improvement projects planned for implementation between 2016 and 2020. The tables identify each roadway that will be improved as well as the extent of the improvement.

It is important to note that **Tables VI-2** and **VI-3** are not intended to be all inclusive of every transportation improvement project completed within the region. The tables only identify key capacity improvement projects that impact the evacuation model network and are anticipated to have an impact on evacuation clearance times.

Table VI-2: Southwest Florida Roadway Improvements, 2011-2015

County	Roadway	From	To	Number of Lanes
Charlotte	Toledo Blade Blvd	US 41	Hillsborough Blvd	4
	US 41	Enterprise Dr	Flamingo Blvd	4
	Burntstore Rd	Notre Dame Rd	US 41	4
Collier	SR 82	Hendry County Line	SR 29	4
Hendry	SR 80	CR 833	US 27	4
	SR 80	Birchwood Pkwy	Dalton Ln	4
	SR 29	Spencer	N of Cowboy Way	4
Lee	I-75	S of Colonial Blvd	S of SR 82	6
	I-75	S of SR 82	S of Luckett Rd	6
	I-75	S of Luckett Rd	S of SR 78	6
	I-75 @ Alico Rd			N/A
	I-75 Airport Access @ Southwest Florida Int'l Airport CD System			N/A
	US 41	Corkscrew Rd	San Carlos Blvd	6
	Del Prado Pkwy	NE 7th St	S of Diplomat Pkwy	6
	SR 82	Hendry County Line	Homestead Rd S	4
	SR 82	Homestead Rd S	Shawnee Rd	6
Sarasota	SR 78 (Pine Island)	Burnt Store Rd	W of Chiquita Blvd	4

	I-75 (SR 93) @ University Pkwy			N/A
	I-75 (SR 93)	N of Sumter Blvd	N of River Rd (CR 777)	6

Sources: FDOT SIS First Five Year Plan, FDOT SIS Second Five Year Plan, Northeast Florida Regional Council
Note: Projects included in this table are roadway improvement projects completed between 2011 and 2015 on roadways that are included in the regional transportation model network. Only projects which added roadway capacity, such as additional through lanes, were included. The list is not intended to be all inclusive of every transportation improvement project completed within the region. A list of historical projects completed during the last five years was included in this report because the base regional network developed for the study, along with the base demographic data, is for the year 2010.

Table VI-3: Southwest Florida Planned Roadway Improvements, 2016-2020

County	Roadway	From	To	Number of Lanes
Charlotte	I-75 (SR 93)	Lee County Line	S Tuckers Grade	6
	I-75 (SR 93)	S of Harborview Rd	N of Kings Hwy	6
Collier	I-75	SR 951	N of Golden Gate Pkwy	6
Hendry	SR 80	Dalton Ln	CR 833	4
	SR 82	Lee County Line	Collier County Line	4
Lee	SR 82	CR 884 (Lee Blvd)	Shawnee Rd	6
Sarasota	I-75 (SR 93)	Charlotte County Line	Sumter Blvd	6

Sources: FDOT SIS First Five Year Plan, FDOT SIS Second Five Year Plan, Northeast Florida Regional Council
Note: Projects included in this table are roadway improvement projects planned for completion between 2016 and 2020 on roadways that are included in the regional transportation model network. Only projects which are planned to add roadway capacity, such as additional through lanes, were included. The list is not intended to be all inclusive of every transportation improvement project planned for completion within the region.

5. Behavioral Assumptions

For the Southwest Florida Region, all six counties within the region have evacuation zones corresponding to different categories of storm surge. Evacuation rates for site-built homes and mobile/manufactured homes are provided by county and summarized in **Figure VI-4** through **Figure VI-15**. Other rates, such as out-of-county trip rates, vehicle use rates, public shelter use rates, friend/relative refuge use rates, hotel/motel refuge use rates, and other refuge use rates, are detailed by county, storm threat, and evacuation zone in Volume 5-9.

Please note that the original behavioral response rates provided by SRESP in Volume 2-9 were modified to fit the evacuation zones created for Glades and Hendry Counties. The original rates for Glades and Hendry were based on the assumption that those counties were inland areas with no evacuation zones; however, for the purpose of the transportation analysis, both counties utilize five zones.

Figure VI-4: Evacuation Participation Rates: Charlotte County Site-Built Homes

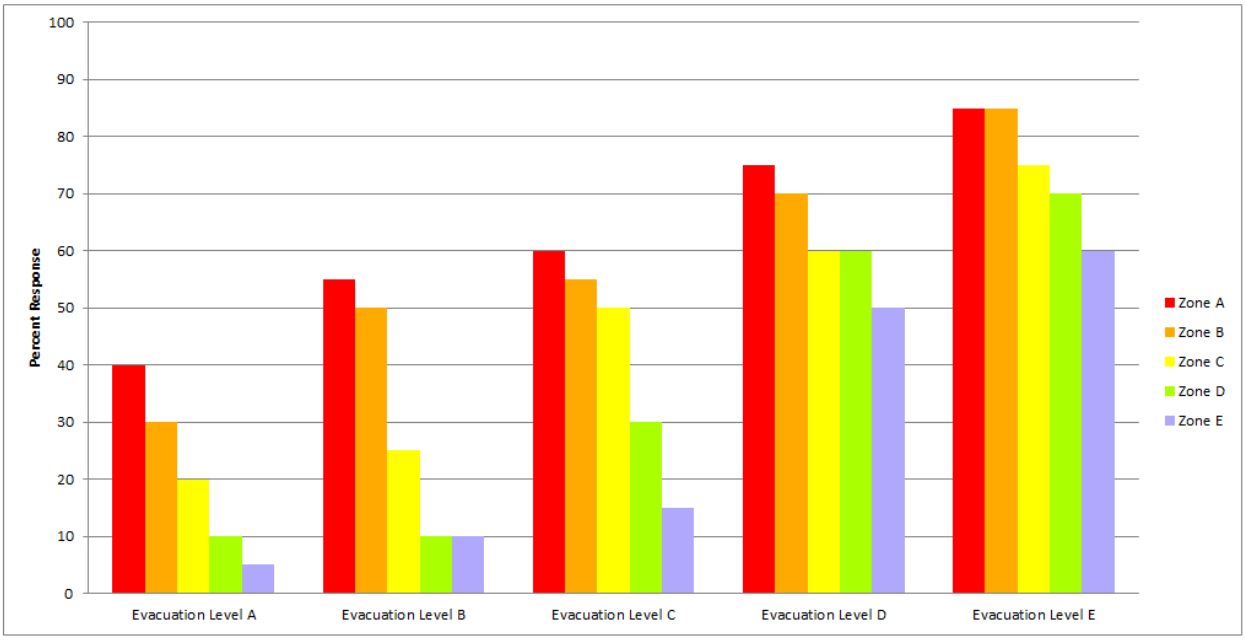


Figure VI-5: Evacuation Participation Rates: Charlotte County Mobile Homes

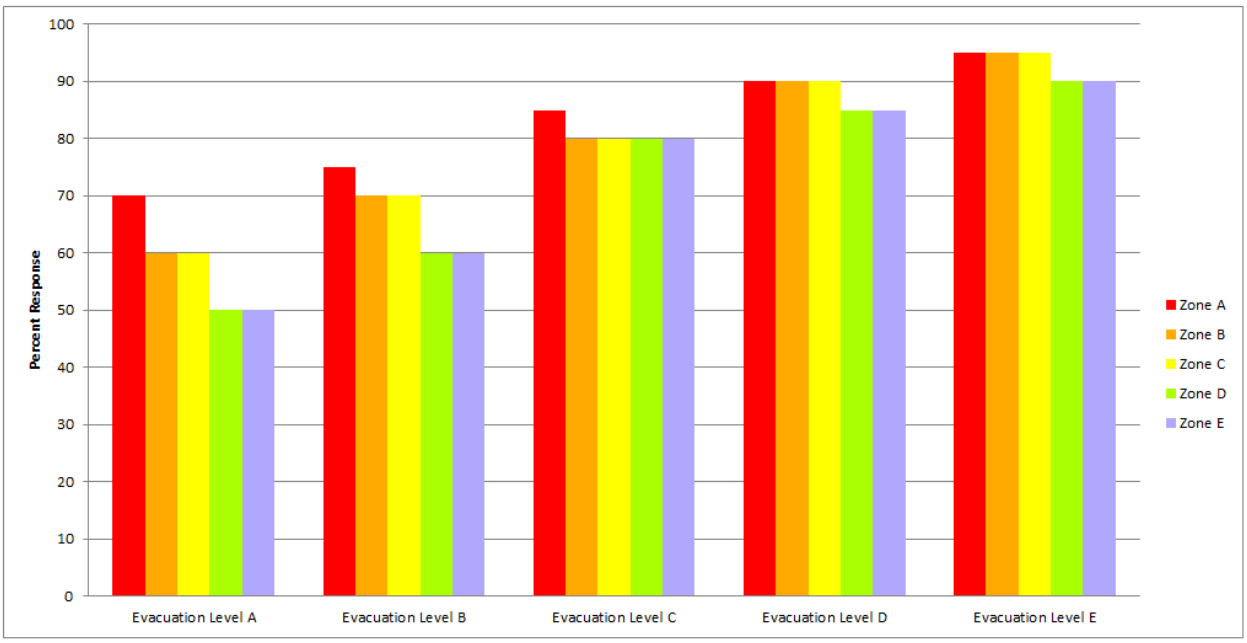


Figure VI-6: Evacuation Participation Rates: Collier County Site-Built Homes

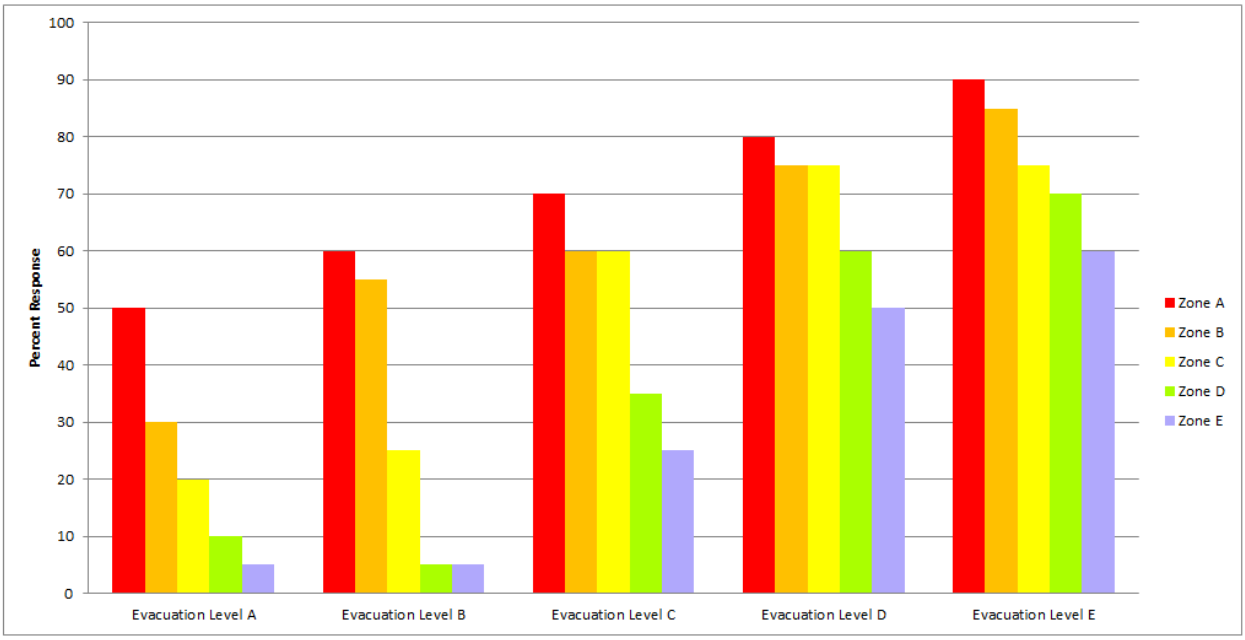


Figure VI-7: Evacuation Participation Rates: Collier County Mobile Homes

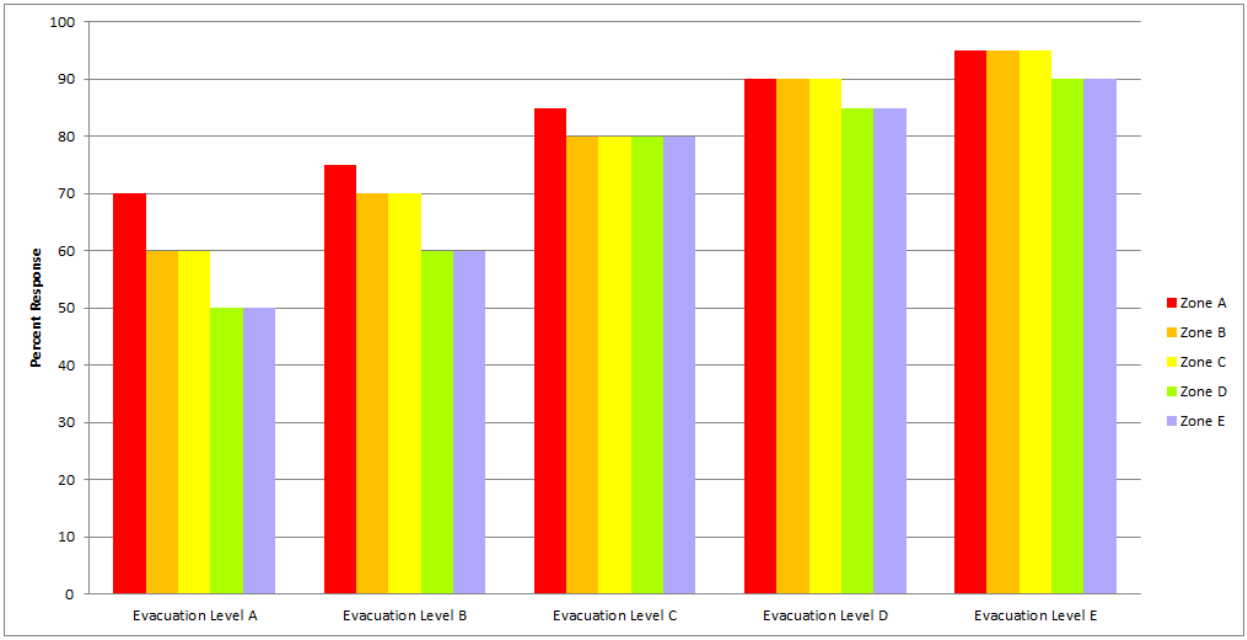


Figure VI-8: Evacuation Participation Rates: Glades County Site-Built Homes

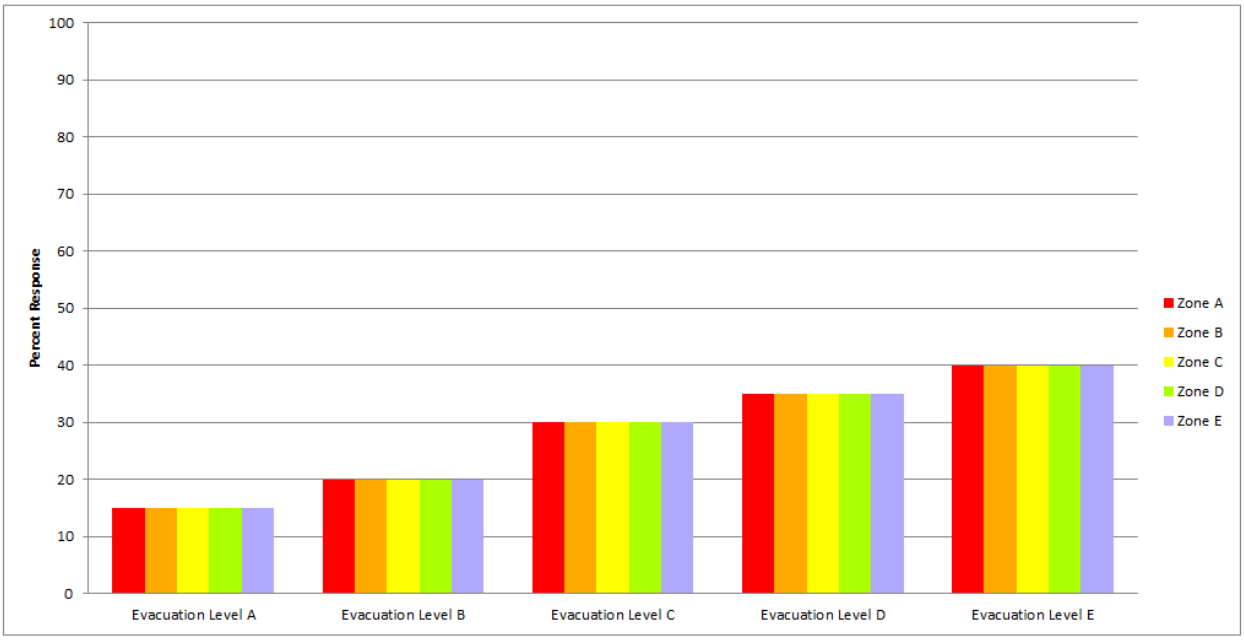


Figure VI-9: Evacuation Participation Rates: Glades County Mobile Homes

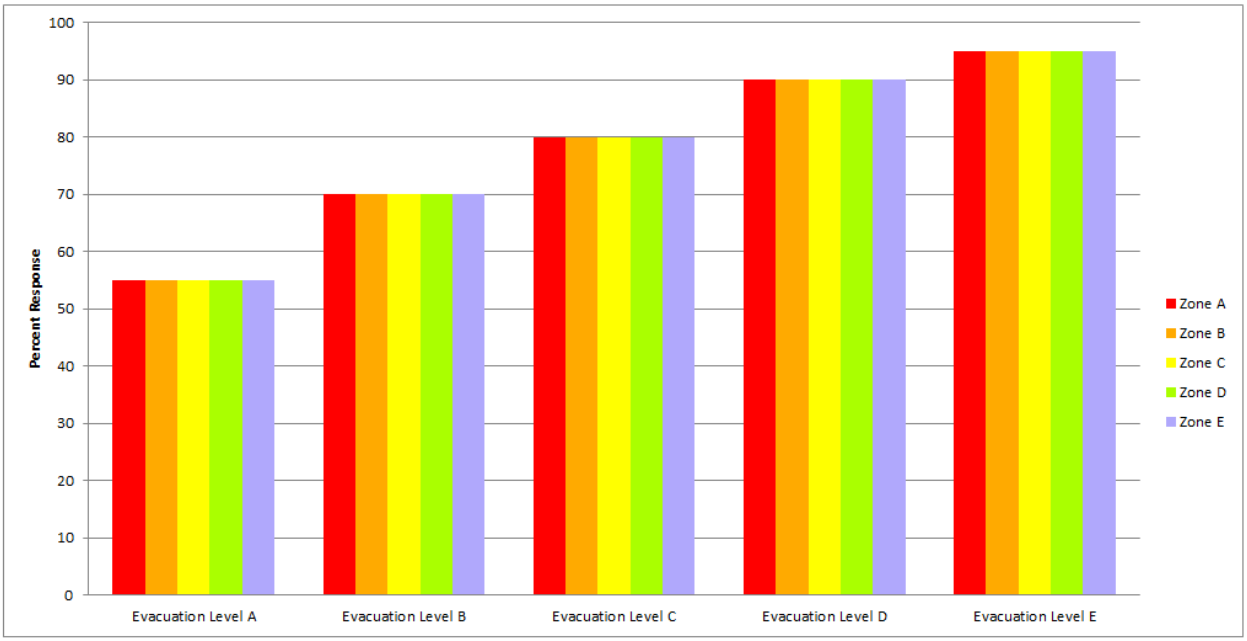


Figure VI-10: Evacuation Participation Rates: Hendry County Site-Built Homes

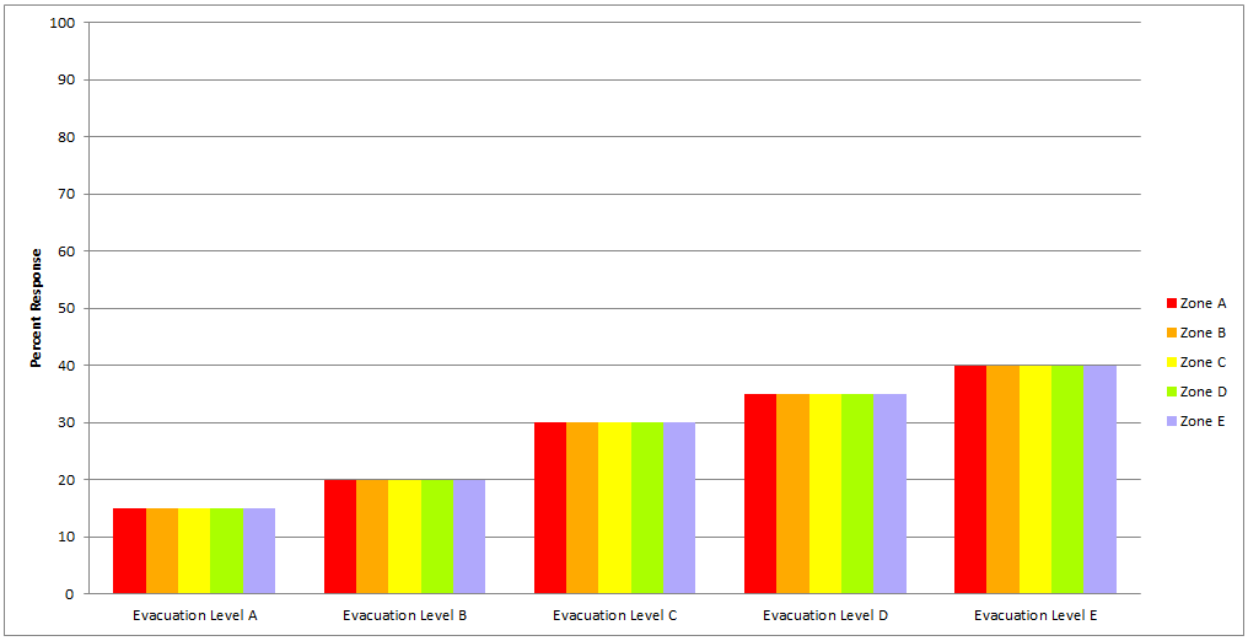


Figure VI-11: Evacuation Participation Rates: Hendry County Mobile Homes

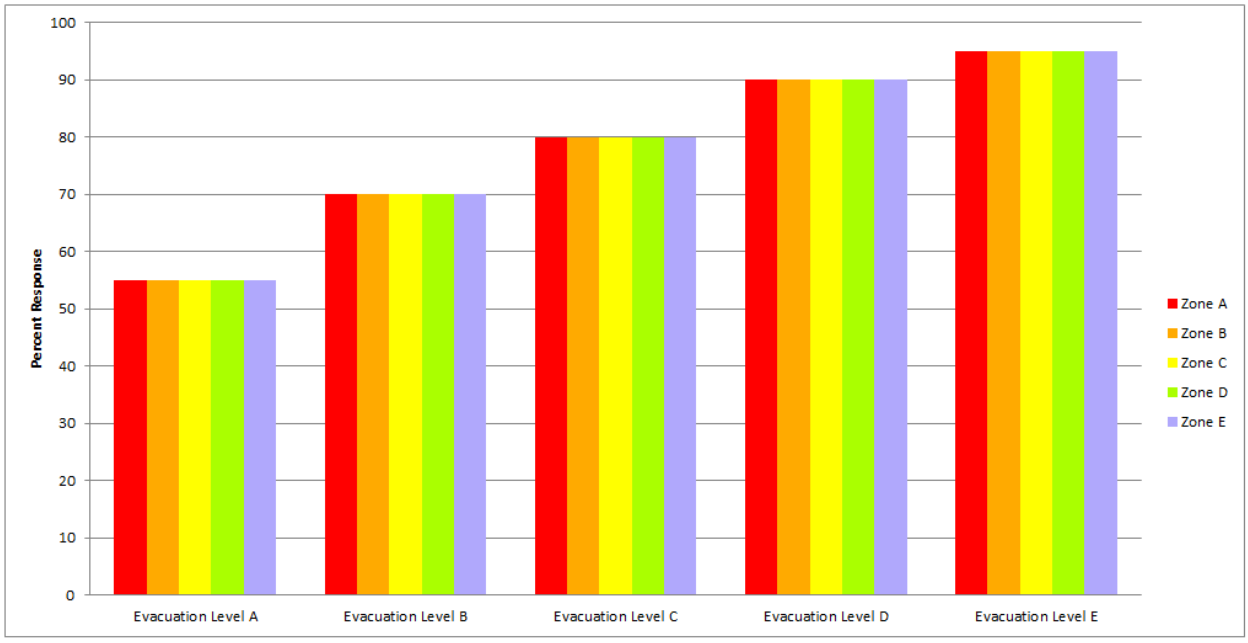


Figure VI-12: Evacuation Participation Rates: Lee County Site-Built Homes

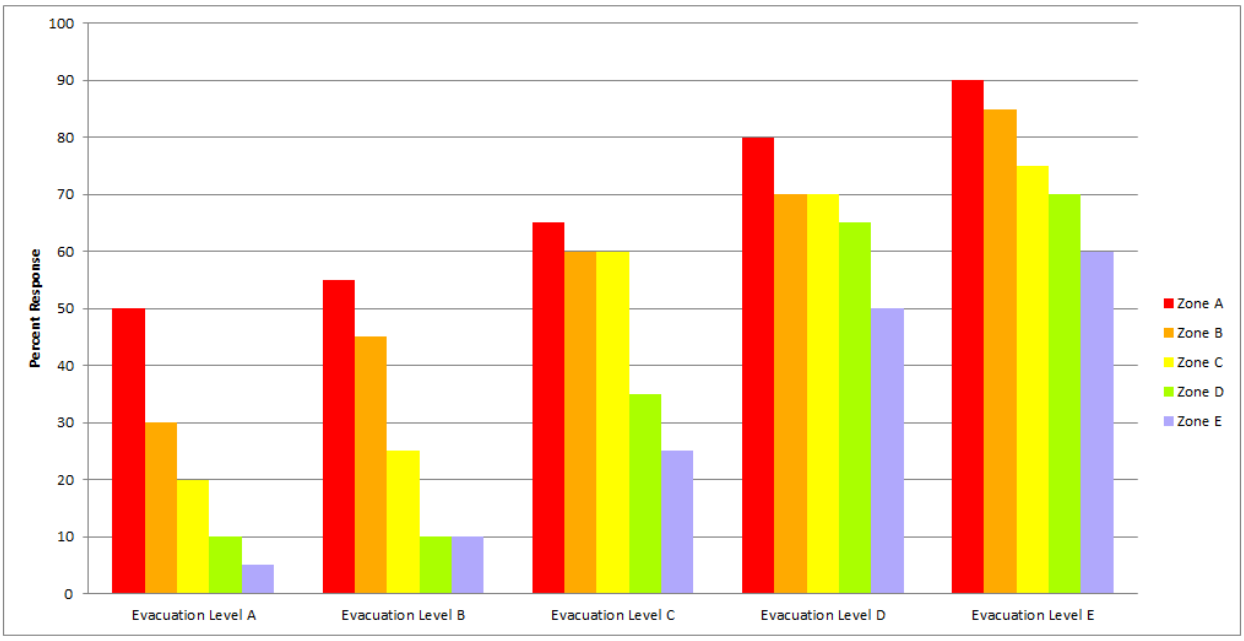


Figure VI-13: Evacuation Participation Rates: Lee County Mobile Homes

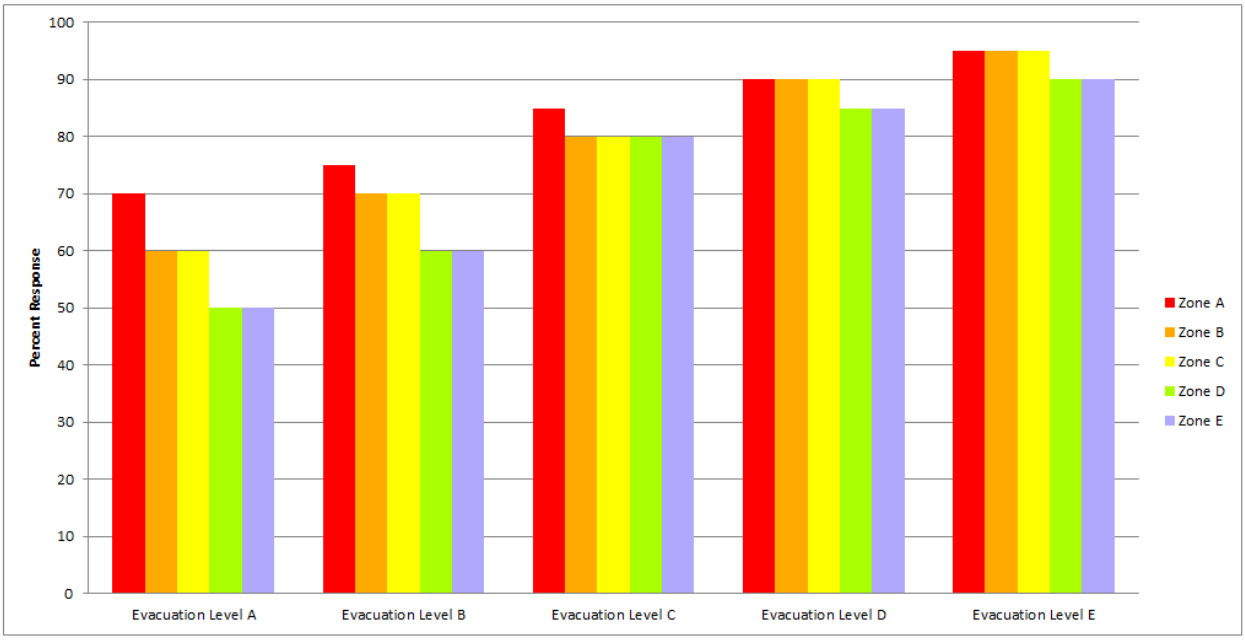


Figure VI-14: Evacuation Participation Rates: Sarasota County Site-Built Homes

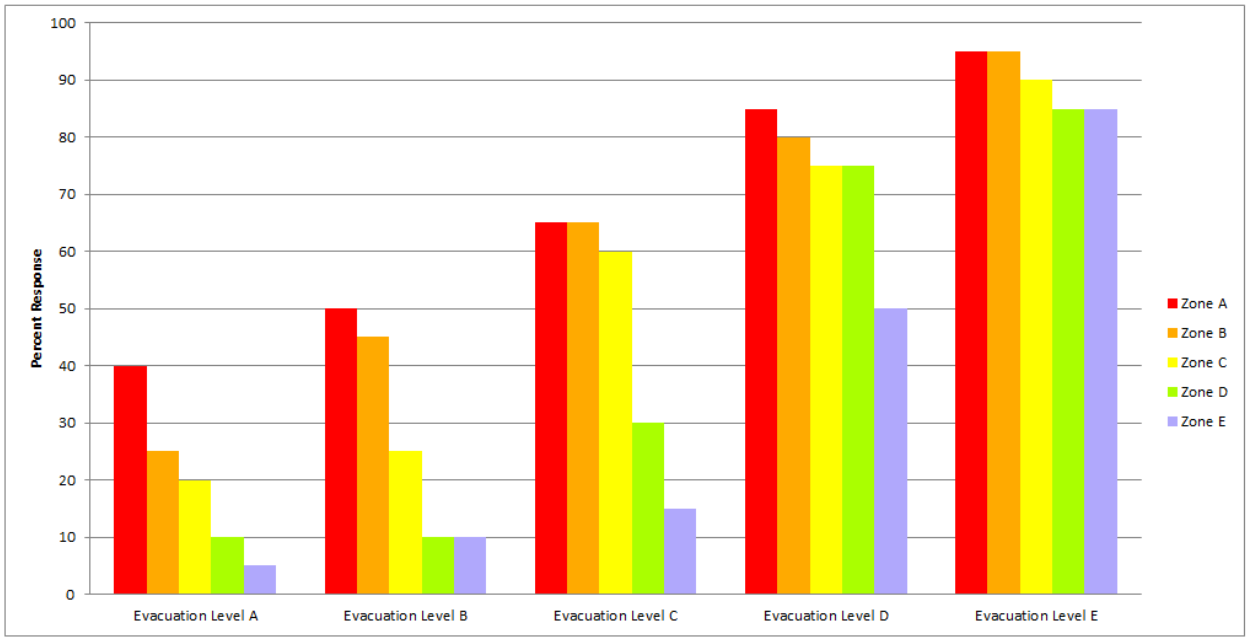
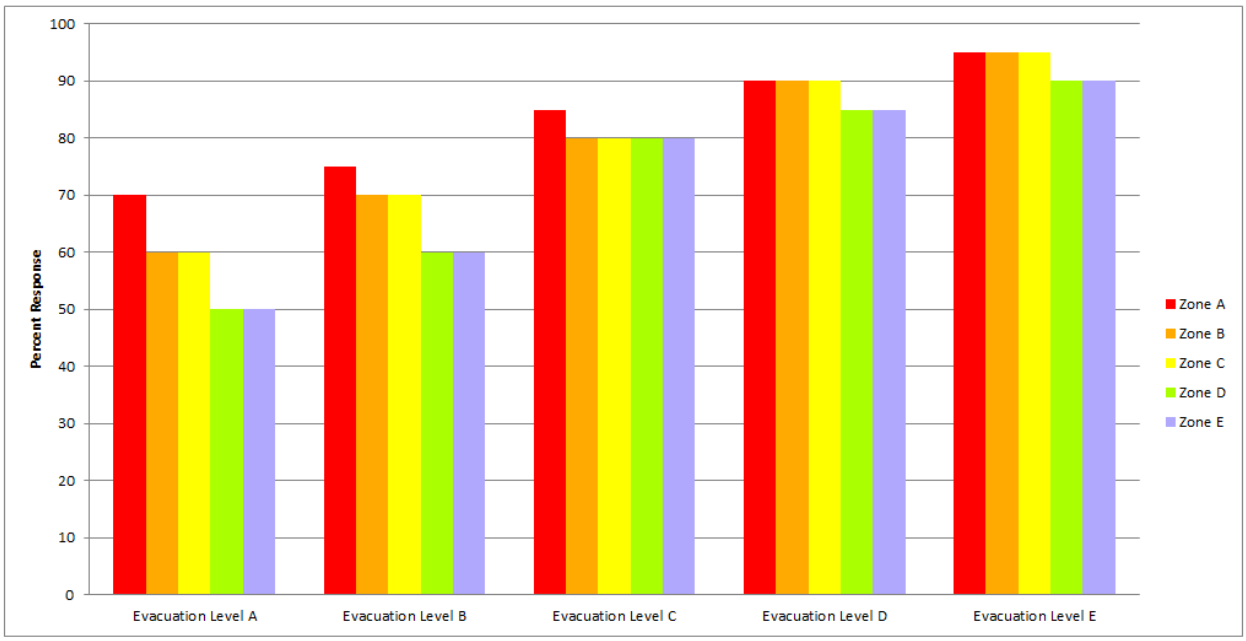


Figure VI-15: Evacuation Participation Rates: Sarasota County Mobile Homes



6. Shelters

In order for the transportation model to accurately assign public shelter trips to the correct location, a complete list of available public shelters needs to be available. The shelters were categorized as either primary or other, with primary indicating that the shelter is compliant with American Red Cross standards for a shelter and other indicating all other shelters.

In the six county region there are a total of 113 shelters, including 4 in Charlotte County, 37 in Collier County, 8 in Glades County, 11 in Hendry County, and 30 in Lee County, and 23 in Sarasota County. The total number of shelters for Southwest Florida includes other shelters as well as those shelters compliant with ARC standards/risk shelters.

All together, the 113 shelters located within the six county region can host more than 126,000 persons during an evacuation event. Detailed lists of the primary and other shelters used in the transportation analysis are included in Volume 5-9. It is important to note that the shelter list used in the transportation analysis was developed early in the study process and may not match the latest available list of primary and other shelters from each county.

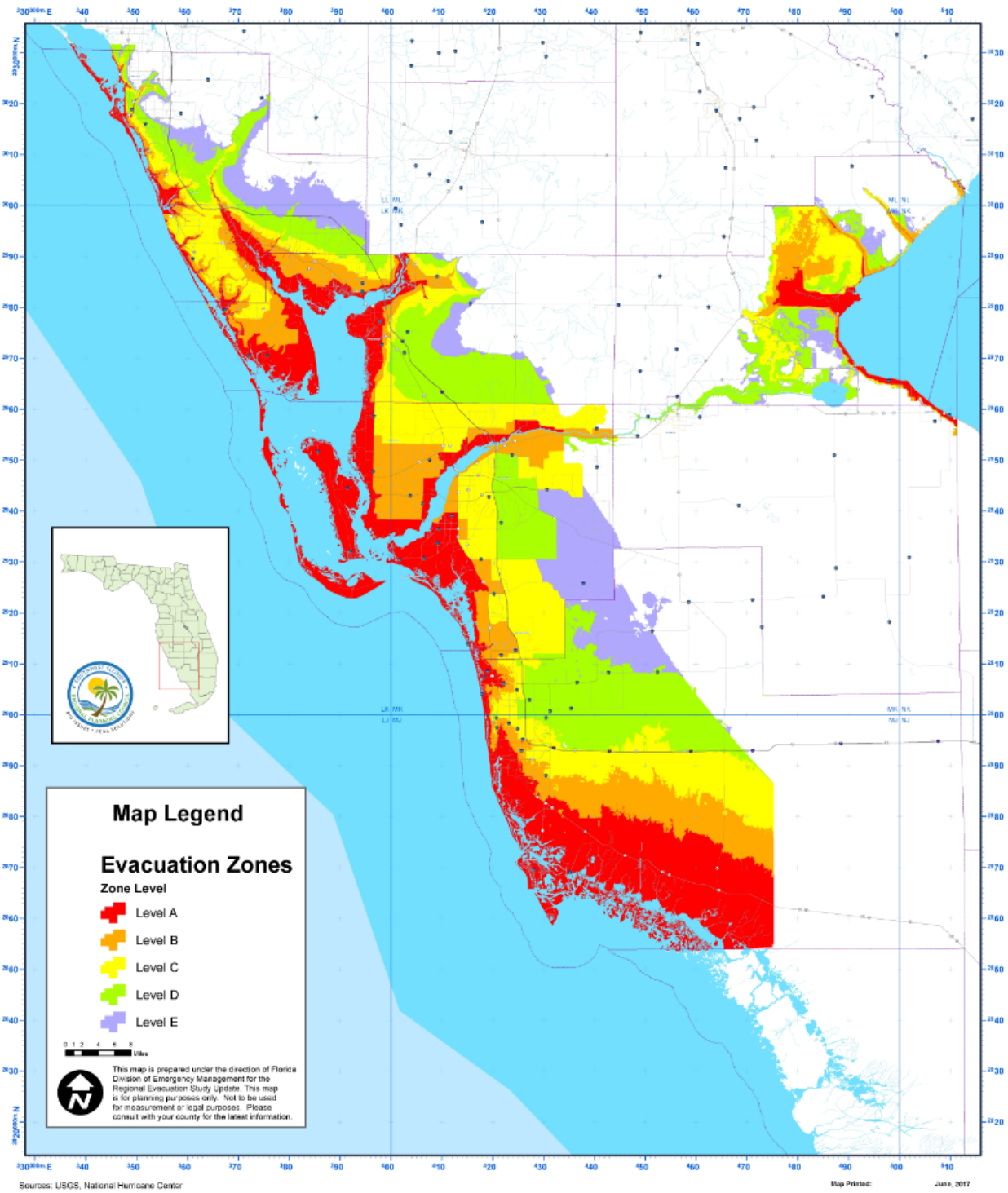
7. Evacuation Zones

The final input variable that is needed to complete the transportation evacuation model is the delineation of evacuation zones for all coastal counties. Local county emergency managers have the responsibility of identifying and defining evacuation zones for their county. Within the Southwest Florida region, Charlotte, Collier, Glades, Hendry, Lee and Sarasota Counties have updated and established their evacuation zones based on the results of the new data and information collected as part of the SRESP. Evacuation zones for the Southwest Florida Region are illustrated in **Figure VI-16.** County level evacuation zones are included in Volume 5-9.

Figure VI-16

Southwest Florida Regional Evacuation Zones

2017 Evacuation Study Summary Update



G. TIME User Interface

CDM Smith developed the Transportation Interface for Modeling Evacuations (TIME) to make it easier for RPC 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:

1. Analysis time period;
2. Highway network;
3. Behavioral response;
4. One-way evacuation operations;
5. University population;
6. Tourist occupancy rates;
7. Shelters;
8. Counties evacuating;
9. Evacuation level;
10. Response curve hours; and,
11. Evacuation Phasing.

H. Vulnerable Population

Using a combination of the demographic data, behavioral assumptions and evacuation zones, the vulnerable population in each county could be determined by evacuation level. For the purposes of the transportation analysis, the vulnerable population, or population-at-risk, is defined as the total population living within the county designated evacuation zones for each evacuation level. This population is living in an area that is at risk for severe flooding during a storm event. The vulnerable population for the Southwest Florida Region for 2017 is identified in **Table VI-4**, summarized by evacuation zone and split between site-built homes and mobile/manufactured homes. Vulnerable population for 2020 is summarized in **Table VI-5**.

Table VI-4: Vulnerable Population in the Southwest Florida Region for 2017

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Charlotte County					
Site-built Homes	30,919	84,890	28,602	3,556	113
Mobile/Manuf. Homes	3,655	5,651	2,066	2,556	32
TOTAL	34,574	90,541	30,667	6,112	145
Collier County					
Site-built Homes	95,085	52,851	78,967	71,201	4,780
Mobile/Manuf. Homes	8,405	4,644	1,708	810	1,063
TOTAL	103,491	57,495	80,675	72,011	5,843
Glades County					
Site-built Homes	441	273	541	696	193
Mobile/Manuf. Homes	205	392	450	883	285
TOTAL	646	666	991	1,578	478
Hendry County					
Site-built Homes	742	139	248	63	0
Mobile/Manuf. Homes	1,388	155	32	9	0
TOTAL	2,130	294	280	71	0
Lee County					
Site-built Homes	156,881	234,537	136,168	38,822	39,155
Mobile/Manuf. Homes	15,266	9,962	23,379	1,039	1,164
TOTAL	172,146	244,499	159,546	39,861	40,320
Sarasota County					
Site-built Homes	50,229	39,535	79,988	76,363	27,987
Mobile/Manuf. Homes	5,710	6,035	3,032	2,554	829
TOTAL	55,940	45,569	83,019	78,917	28,816

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 VI-5: Vulnerable Population in the Southwest Florida Region for 2020

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Charlotte County					
Site-built Homes	32,515	89,286	30,083	3,750	119
Mobile/Manuf. Homes	3,847	5,946	2,172	2,679	34
TOTAL	36,362	95,232	32,255	6,429	153
Collier County					
Site-built Homes	105,018	58,386	87,233	78,665	5,283
Mobile/Manuf. Homes	9,332	5,144	1,906	901	1,174
TOTAL	114,349	63,530	89,139	79,566	6,456
Glades County					
Site-built Homes	463	287	570	723	198
Mobile/Manuf. Homes	218	414	474	941	307
TOTAL	681	702	1,045	1,664	504
Hendry County					
Site-built Homes	767	143	256	65	0
Mobile/Manuf. Homes	1,434	160	34	9	0
TOTAL	2,201	304	290	74	0
Lee County					
Site-built Homes	177,728	265,694	154,091	43,980	44,347
Mobile/Manuf. Homes	17,290	11,288	26,655	1,176	1,329
TOTAL	195,018	276,982	180,746	45,155	45,676
Sarasota County					
Site-built Homes	53,584	42,176	85,333	81,458	29,858
Mobile/Manuf. Homes	6,092	6,436	3,234	2,729	884
TOTAL	59,676	48,612	88,566	84,187	30,742

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.

In addition, based again on the demographic data, behavioral assumptions and evacuation zones, the planned destinations of vulnerable population in each county could be determined by evacuation level. Destinations include friends and family, hotel/motel, public shelter and other locations. Vulnerable population destinations for the Southwest Florida Region are identified in **Table VI-6** for 2017 and in **Table VI-7** for 2020.

Table VI-6: Vulnerable Population by Destination for 2017

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Charlotte County					
To Friends and Family	19,381	50,363	17,074	3,617	83
To Hotel/ Motel	8,461	22,353	7,564	1,400	33
To Public Shelter	2,656	7,074	2,495	682	18
To Other Destination	4,076	10,752	3,535	412	11
Collier County					
To Friends and Family	60,012	33,643	47,305	42,288	3,343
To Hotel/ Motel	25,601	14,347	19,867	17,694	1,437
To Public Shelter	7,806	5,414	7,913	8,458	722
To Other Destination	10,072	4,091	5,590	3,571	341
Glades County					
To Friends and Family	377	380	572	903	273
To Hotel/ Motel	75	86	122	202	62
To Public Shelter	97	100	149	237	72
To Other Destination	97	100	149	237	72
Hendry County					
To Friends and Family	0	192	171	44	0
To Hotel/ Motel	144	22	0	7	0
To Public Shelter	426	59	0	14	0
To Other Destination	144	22	0	7	0
Lee County					
To Friends and Family	0	146,201	93,390	23,812	24,075
To Hotel/ Motel	43,037	61,125	39,887	8,024	8,064
To Public Shelter	8,607	12,225	9,146	4,762	4,873
To Other Destination	17,978	24,948	17,124	3,262	3,307
Sarasota County					
To Friends and Family	0	26,738	48,268	47,095	17,207
To Hotel/ Motel	13,699	9,114	17,100	15,783	5,763
To Public Shelter	3,368	4,370	7,501	9,674	3,524
To Other Destination	3,368	5,348	10,150	6,364	2,322

Note: Vulnerable population destinations 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 VI-7: Vulnerable Population by Destination for 2020

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Charlotte County					
To Friends and Family	20,384	52,972	17,958	3,804	87
To Hotel/ Motel	8,898	23,511	7,955	1,473	35
To Public Shelter	2,794	7,440	2,624	718	19
To Other Destination	4,287	11,309	3,719	434	11
Collier County					
To Friends and Family	66,308	37,174	52,267	46,724	3,694
To Hotel/ Motel	28,289	15,853	21,953	19,551	1,588
To Public Shelter	8,623	5,981	8,743	9,345	798
To Other Destination	11,129	4,521	6,177	3,946	376
Glades County					
To Friends and Family	398	400	603	951	287
To Hotel/ Motel	79	91	128	214	66
To Public Shelter	102	105	157	250	76
To Other Destination	102	105	157	250	76
Hendry County					
To Friends and Family	1,464	198	177	45	0
To Hotel/ Motel	148	22	0	7	0
To Public Shelter	440	61	0	15	0
To Other Destination	148	22	0	7	0
Lee County					
To Friends and Family	116,146	165,625	105,782	26,976	27,273
To Hotel/ Motel	48,755	69,246	45,186	9,090	9,135
To Public Shelter	9,751	13,849	10,370	5,395	5,521
To Other Destination	20,366	28,263	19,407	3,695	3,747
Sarasota County					
To Friends and Family	37,875	28,524	51,493	50,239	18,357
To Hotel/ Motel	14,614	9,722	18,242	16,837	6,148
To Public Shelter	3,593	4,661	8,002	10,321	3,760
To Other Destination	3,593	5,705	10,828	6,790	2,477

Note: Vulnerable population destinations 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.

The vulnerable shadow population is provided in **Table VI-8** for both 2017 and 2020. The vulnerable shadow population was determined using the behavioral assumptions for evacuating shadow population and is based on evacuation level (storm category), not evacuation zone.

Table VI-8: Vulnerable Shadow Evacuation Population

	Evacuation Level A	Evacuation Level B	Evacuation Level C	Evacuation Level D	Evacuation Level E
2017					
Charlotte County	44,568	18,158	11,469	8,210	8,213
Collier County	65,715	53,768	64,975	45,358	41,861
Glades County	6,835	6,626	6,512	5,590	5,454
Hendry County	17,069	17,916	19,855	20,836	21,843
Lee County	164,910	103,600	77,561	75,793	57,725
Sarasota County	66,437	57,909	65,022	55,287	46,976
2020					
Charlotte County	48,291	23,017	16,955	10,526	13,506
Collier County	79,025	73,047	94,158	74,381	70,514
Glades County	7,228	7,007	6,893	5,229	5,423
Hendry County	17,661	18,537	20,539	20,465	21,551
Lee County	201,095	138,185	117,618	72,463	70,752
Sarasota County	76,177	68,157	78,807	72,237	64,862

Note: Vulnerable shadow population determined using SRESP behavioral data and county provided evacuation zones.

I. Evacuation Model Scenarios

There are literally thousands of possible combinations of variables that can be applied using the evacuation transportation model, which will result in thousands of possible outcomes. For the purposes of this analysis, two distinct sets of analyses were conducted using the SRESP evacuation transportation model, including one set of analysis for growth management purposes and one set of analysis for emergency management purposes. The two sets of analysis include the following:

1. Base Scenarios

The base scenarios were developed to estimate a series of worst case scenarios and are identical for all eleven RPCs across the State. These scenarios assume 100 percent of the vulnerable population evacuates and includes impacts from counties outside of the RPC area. These scenarios are generally designed for growth management purposes in order to ensure that all residents that choose to evacuate during an event are able to do so. The base scenarios for the Southwest Florida region are identified in **Table VI-9**; and,

2. Operational Scenarios

The operational scenarios were developed by the RPCs in coordination with local county emergency managers and are designed to provide important information to emergency management personnel to plan for different storm events. These scenarios are different from region to region and vary for each evacuation level. The operational scenarios for the Southwest Florida region are identified in **Table VI-10**.

Because of the numerous possible combinations of variables that can be applied in the model, the evacuation transportation model is available for use through the Southwest Florida RPC to continue testing combinations of options and provide additional information to emergency managers.

J. Clearance Time Results

Each of the ten base scenarios and ten operational scenarios were modeled for the Southwest Florida Region using the regional evacuation model. Results were derived from the model to summarize the evacuating population, evacuating vehicles, clearance times and critical congested roadways. Detailed results are discussed in Chapter IV. Clearance times are presented in this executive summary since the determination of clearance time is one of the most important outcomes from the evacuation transportation analysis.

Calculated clearance times are used by county emergency managers as one input to determine when to recommend an evacuation order. This calculation can include the population-at-risk, shadow evacuees, as well as evacuees from other counties anticipated to pass through the county. Clearance time is developed to include the time required for evacuees to secure their homes and prepare to leave, the time spent by all vehicles traveling along the evacuation route network, and the additional time spent on the road caused by traffic and road congestion. Clearance time does not relate to the time any one vehicle spends traveling along the evacuation route network, nor does it guarantee vehicles will safely reach their destination once outside the County. The four clearance times that are calculated as part of the evacuation transportation analysis include the following:

Table VI-9: Base Scenarios

	Scenario 1 Level A 2017	Scenario 2 Level B 2017	Scenario 3 Level C 2017	Scenario 4 Level D 2017	Scenario 5 Level E 2017
Demographic Data	2015	2015	2015	2015	2015
Highway Network	2017	2017	2017	2017	2017
One-Way Operations	None	None	None	None	None
University Population	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring
Tourist Rate	Default	Default	Default	Default	Default
Shelters Open	Primary	Primary	Primary	Primary	Primary
Response Curve	12-hour	12-hour	12-hour	12-hour	12-hour
Evacuation Phasing	None	None	None	None	None
Behavioral Response	100%	100%	100%	100%	100%
Evacuation Zone	A	B	C	D	E
Counties Evacuating	Charlotte Collier Glades Hendry Lee Sarasota Manatee Monroe (ML)	Charlotte Collier Glades Hendry Lee Sarasota Manatee Monroe (ML)	Charlotte Collier Glades Hendry Lee Sarasota Manatee Monroe (ML)	Charlotte Collier Glades Hendry Lee Sarasota Manatee Monroe (ML)	Charlotte Collier Glades Hendry Lee Sarasota Manatee Monroe (ML)
	Scenario 6 Level A 2020	**Scenario 7 Level B 2020**	**Scenario 8 Level C 2020**	**Scenario 9 Level D 2020**	**Scenario 10 Level E 2020**
Demographic Data	2020	2020	2020	2020	2020
Highway Network	2020	2020	2020	2020	2020
One-Way Operations	None	None	None	None	None
University Population	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring
Tourist Rate	Default	Default	Default	Default	Default
Shelters Open	Primary	Primary	Primary	Primary	Primary
Response Curve	12-hour	12-hour	12-hour	12-hour	12-hour
Evacuation Phasing	None	None	None	None	None
Behavioral Response	100%	100%	100%	100%	100%
Evacuation Zone	A	B	C	D	E
Counties Evacuating	Charlotte Collier Glades Hendry Lee Sarasota Manatee Monroe (ML)	Charlotte Collier Glades Hendry Lee Sarasota Manatee Monroe (ML)	Charlotte Collier Glades Hendry Lee Sarasota Manatee Monroe (ML)	Charlotte Collier Glades Hendry Lee Sarasota Manatee Monroe (ML)	Charlotte Collier Glades Hendry Lee Sarasota Manatee Monroe (ML)

ML – includes mainland portion of Monroe County only.

Table VI-10: Operational Scenarios

	Scenario 1 Level A 2017	Scenario 2 Level B 2017	Scenario 3 Level C 2017	Scenario 4 Level D 2017	Scenario 5 Level E 2017
Demographic Data	2015	2015	2015	2015	2015
Highway Network	2017	2017	2017	2017	2017
One-Way Operations	None	None	None	None	None
University Population	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring
Tourist Rate	Default	Default	Default	Default	Default
Shelters Open	Primary	Primary	Primary	Primary	Primary
Response Curve	9-hour	12-hour	12-hour	18-hour	18-hour
Evacuation Phasing	None	None	None	None	None
Behavioral Response	Planning	Planning	Planning	Planning	Planning
Evacuation Level	A	B except as noted below	C except as noted below	D except as noted below	E except as noted below
Counties Evacuating	Collier Lee Monroe (ML) Hendry Glades Okeechobee Highlands	Sarasota Charlotte Lee DeSoto Glades (A) Hendry (A) Collier (A) Highlands (A)	Collier Lee Charlotte Sarasota (B) Monroe (ML-B) Glades (B) Hendry (B) Highlands (B) DeSoto (B)	Collier Lee Charlotte Sarasota (C) Monroe (ML-C) Glades (C) Hendry (C) Highlands (C) DeSoto (C) Okeechobee (B)	Collier Lee Charlotte Sarasota Monroe Manatee (D) Glades (D) Hendry (D) Highlands (C) DeSoto (C) Okeechobee (C) Hardee (C) Polk (C)
	Scenario 6 Level A 2020	**Scenario 7 Level B 2020**	**Scenario 8 Level C 2020**	**Scenario 9 Level D 2020**	**Scenario 10 Level E 2020**
Demographic Data	2020	2020	2020	2020	2020
Highway Network	2020	2020	2020	2020	2020
One-Way Operations	None	None	None	None	None
University Population	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring
Tourist Rate	Default	Default	Default	Default	Default
Shelters Open	Primary	Primary	Primary	Primary	Primary
Response Curve	9-hour	12-hour	12-hour	18-hour	18-hour
Evacuation Phasing	None	None	None	None	None
Behavioral Response	Planning	Planning	Planning	Planning	Planning
Evacuation Level	A	B except as noted below	C except as noted below	D except as noted below	E except as noted below
Counties Evacuating	Sarasota Lee Charlotte Manatee DeSoto Highlands Glades	Collier Charlotte Lee DeSoto Glades (A) Hendry (A) Sarasota (A) Highlands (A)	Sarasota Lee Charlotte Collier (B) Manatee (B) Glades (B) Hardee (B) Highlands (B) DeSoto (B) Hendry (B)	Sarasota Lee Charlotte Collier (C) Manatee (C) Glades (C) Hendry (C) Highlands (C) DeSoto (C) Hardee (C)	Broward Palm Beach Martin Highlands (D) Glades (D) Hendry (D) Okeechobee (D) Lee (C) Sarasota (C) Charlotte (C) DeSoto (C) Hardee (C) Collier (B)

(ML) – includes the mainland portion of Monroe County only.

1. 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. Key points to remember for clearance time to shelter include:

- All in-county trips reach their destination within the county; and,
- This definition does not include any out of county trips.

2. 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. Key points to remember for in-county clearance time include:

- All in-county trips reach their destination within the county;
- All out of county trips exit the evacuation zone, but may still be located in the county; and,
- This definition does not include out-of-county pass-through trips from adjacent counties, unless they evacuate through an evacuation zone.

3. 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. Key points to remember for out-of-county clearance time include:

- The roadway network within the county is clear;
- All out-of-county trips exit the county, including out-of-county pass-through trips from adjacent counties; and,
- All in-county trips reach their destination.

4. Regional Clearance Time

The time necessary to safely evacuate vulnerable residents and visitors to a "point of safety" within the (RPC) region based on a specific hazard, behavioral assumptions and evacuation scenario. Calculated from last vehicle assigned an external destination exits the region. Key points to remember for regional clearance time include:

- The roadway network within the RPC is clear;
- All out-of-county trips exit the RPC, including out of county pass-through trips from adjacent counties;
- All in-county trips reach their destination; and,
- Regional clearance time is equal to the largest out of county clearance time for a given scenario for any of the counties within the RPC, since the out of county clearance time includes out of county pass through trips from adjacent counties.

Calculated clearance times are used by county emergency managers as one input to determine when to recommend an evacuation order. Clearance times for each of the base scenarios are summarized in **Table VI-11** and **VI-12**, while clearance times for each of the operational scenarios are summarized in **Table VI-13** and **Table VI-14.** Clearance time includes several components, including the mobilization time for the evacuating population to prepare for an evacuation (pack supplies and personal belongings, load their vehicle, etc.), the actual time spent traveling on the roadway network, and the delay time caused by traffic congestion.

5. Base Scenarios

In-county clearance times for the base scenarios range from 18.5 hours in Collier County for the evacuation level A scenario 1 to 94.5 hours in Charlotte County for evacuation level E scenario 5 in 2017. Clearance Time to Shelter shows a similar pattern, with clearance times for the base scenarios ranging from 13.5 hours in Charlotte County for the evacuation level A scenario 1 to 84.5 hours for Lee County for evacuation level E scenario 5 in 2017.

In 2020, in-county clearance times for the base scenarios increase slightly to between 22 hours in Collier County for the evacuation level A scenario 7 and 96 hours for the evacuation level E scenario 12. Clearance Time to Shelter shows a similar pattern, with clearance times for the base scenarios ranging from 14.5 hours in Sarasota County for the evacuation level A scenario 7 to 96 hours for Lee County for evacuation level E scenario 12 in 2020.

In 2017, Out-of-county clearance times for the base scenarios range from 18.5 hours in Collier County for the base evacuation level A scenario 1 to 94.5 hours in Charlotte County for the evacuation level E scenario 5. Out-of-county clearance times remain relatively constant in 2020, with Collier County at 22 hours for evacuation level A scenario 7 and 96 hours for evacuation level E scenario 12.

Regional clearance time for the six county SWFRPC region ranges from 35.5 hours to 94.5 hours in 2017 and from 41 to 96 hours in 2020.

Table VI-11: 2017 Clearance Times for Base Scenario

	Evacuation Level A Base Scenario 1	**Evacuation Level B** Base Scenario 2	**Evacuation Level C** Base Scenario 3	**Evacuation Level D** Base Scenario 4	**Evacuation Level E** Base Scenario 5
Clearance Time to Shelter					
Charlotte County	13.5	19.0	31.0	45.5	73.5
Collier County	18.0	33.0	43.5	58.5	77.5
Glades County	16.5	17.5	17.5	15.5	17.5
Hendry County	14.5	16.5	22.5	15.5	15.5
Lee County	24.0	34.5	52.0	69.5	84.5
Sarasota County	14.0	23.0	41.5	62.5	78.5
In-County Clearance Time					
Charlotte County	35.5	44.5	63.5	76.0	94.5
Collier County	18.5	33.0	51.5	65.5	81.5
Glades County	26.0	38.5	55.5	67.5	82.5
Hendry County	24.0	35.5	53.5	67.5	82.5
Lee County	24.0	34.5	52.0	69.5	84.5
Sarasota County	33.5	38.0	56.0	68.5	89.0
Out-of-County Clearance Time					
Charlotte County	35.5	44.5	63.5	76.0	94.5
Collier County	18.5	33.0	51.5	65.5	81.5
Glades County	26.0	38.5	55.5	67.5	82.5
Hendry County	24.0	35.5	53.5	67.5	82.5
Lee County	24.0	34.5	52.0	69.5	84.5
Sarasota County	33.5	38.0	56.0	68.5	89.0
Regional Clearance Time					
Southwest	35.5	44.5	63.5	76.0	94.5

Table VI-12: 2020 Clearance Times for Base Scenario

	Evacuation Level A Base Scenario 6	**Evacuation Level B** Base Scenario 7	**Evacuation Level C** Base Scenario 8	**Evacuation Level D** Base Scenario 9	**Evacuation Level E** Base Scenario 10
Clearance Time to Shelter					
Charlotte County	18.5	20.0	52.5	75.0	87.5
Collier County	20.0	38.5	57.0	62.5	94.0
Glades County	16.0	18.5	17.5	18.0	17.5
Hendry County	15.0	15.5	15.5	15.5	15.5
Lee County	25.5	41.0	74.5	73.0	96.0
Sarasota County	14.5	23.5	58.0	90.5	89.0
In-County Clearance Time					
Charlotte County	39.5	47.0	76.5	89.5	96.0
Collier County	22.0	38.5	75.0	69.5	96.0
Glades County	27.0	43.5	77.0	75.5	96.0
Hendry County	26.0	39.5	75.5	76.0	96.0
Lee County	28.0	41.0	75.5	73.5	96.0
Sarasota County	41.0	44.5	78.0	90.5	96.0
Out-of-County Clearance Time					
Charlotte County	39.5	47.0	76.5	89.5	96.0
Collier County	22.0	40.0	75.0	69.5	96.0
Glades County	27.0	43.5	77.0	75.5	96.0
Hendry County	26.0	40.0	75.5	76.0	96.0
Lee County	28.0	41.0	75.5	73.5	96.0
Sarasota County	41.0	44.5	78.0	90.5	96.0
Regional Clearance Time					
Southwest	41.0	47.0	78.0	90.5	96.0

6. Operational Scenarios

In-county clearance times for the 2017 operational scenarios range from 14.5 hours to 61 hours depending upon the scenario. Clearance Time to Shelter shows a similar pattern, with clearance times for the operational scenarios ranging from 10 hours to 59 hours depending upon the county and the scenario.

In 2020, in-county clearance times for the operational scenarios vary from 17 hours to 51 hours for the level D evacuation in Charlotte County. The 2020 level E evacuation includes vehicle trips evacuating from the Treasure Coast region, which is why clearance times within the Southwest region are lower for the operational level E scenario than the operational level D scenario. Clearance Time to Shelter shows a similar pattern, with clearance times for the base scenarios ranging from 10 hours to 43.5 hours depending upon the scenario.

Out-of-county clearance times for the 2017 operational scenarios range from 14.5 hours to 61 hours for the evacuation level E scenario. Out-of-county clearance times for all counties in 2020 range from 17 to 51 hours depending upon the scenario. Regional clearance time for the six-county SWFRPC region ranges from 19 hours to 61 hours in 2017 and between 23.5 and 51 hours in 2020.

Table VI-13: 2017 Clearance Times for Operational Scenarios

	Evacuation Level A Operational Scenario	Evacuation Level B Operational Scenario	Evacuation Level C Operational Scenario	Evacuation Level D Operational Scenario	Evacuation Level E Operational Scenario
Clearance Time to Shelter					
Charlotte County	N/A	13.0	15.0	19.0	41.5
Collier County	12.0	14.0	31.0	33.0	48.0
Glades County	10.0	16.5	15.5	20.0	23.5
Hendry County	11.5	14.5	15.5	20.0	20.0
Lee County	18.0	19.0	31.5	36.0	59.0
Sarasota County	N/A	14.0	16.0	21.0	53.5
In-County Clearance Time					
Charlotte County	N/A	18.5	32.5	45.0	59.5
Collier County	14.5	16.5	31.0	33.5	57.5
Glades County	18.0	23.5	33.0	35.0	59.5
Hendry County	17.5	23.0	32.0	34.5	58.5
Lee County	18.0	19.0	32.0	36.0	59.0
Sarasota County	N/A	21.0	34.0	39.0	61.0
Out-of-County Clearance Time					
Charlotte County	N/A	19.0	32.5	45.0	59.5
Collier County	14.5	16.5	31.5	33.5	57.5
Glades County	18.0	23.5	33.0	35.0	59.5
Hendry County	17.5	23.0	32.0	34.5	58.5
Lee County	18.0	19.0	32.0	36.0	59.0
Sarasota County	N/A	21.0	34.0	39.0	61.0
Regional Clearance Time					
Southwest	19.0	23.5	33.5	45.0	61.0

Table VI-14: 2020 Clearance Times for Operational Scenarios

	Evacuation Level A Operational Scenario	Evacuation Level B Operational Scenario	Evacuation Level C Operational Scenario	Evacuation Level D Operational Scenario	Evacuation Level E Operational Scenario
Clearance Time to Shelter					
Charlotte County	12.5	13.5	18.5	26.0	19.0
Collier County	N/A	19.5	26.0	37.5	25.0
Glades County	10.0	16.0	16.0	19.0	22.0
Hendry County	N/A	14.5	15.0	21.0	29.5
Lee County	16.0	23.5	33.0	43.5	39.5
Sarasota County	10.5	14.5	19.5	32.5	22.0
In-County Clearance Time					
Charlotte County	17.5	26.5	36.0	51.0	46.0
Collier County	N/A	19.5	32.0	41.5	37.0
Glades County	17.5	28.0	34.5	44.0	44.5
Hendry County	N/A	25.0	32.0	44.0	41.5
Lee County	17.0	24.0	33.0	44.0	40.0
Sarasota County	23.5	30.5	36.0	46.0	46.5
Out-of-County Clearance Time					
Charlotte County	17.5	26.5	36.0	51.0	46.0
Collier County	N/A	19.5	32.0	41.5	37.0
Glades County	17.5	28.0	34.5	44.0	44.5
Hendry County	N/A	25.0	32.0	44.0	41.5
Lee County	17.0	24.0	33.0	44.0	40.0
Sarasota County	23.5	30.5	36.0	46.0	46.5
Regional Clearance Time					
Southwest	23.5	30.5	36.0	51.0	46.5

K. Maximum Evacuating Population Clearances

From an emergency management standpoint, it is important to get an understanding of the maximum proportion of the evacuating population that can be expected to evacuate at various time intervals during an evacuation. Should storm conditions change during an evacuation, emergency managers will need to be able to estimate what portion of the evacuating population is estimated to still remain within the county trying to evacuate.

Using the base scenarios, which assume 100% of the vulnerable population is evacuating, along with shadow evacuations and evacuations from adjacent counties, an estimate was made of the evacuating population actually able to evacuate out of each county by the time intervals of 12, 18, 24 and 36 hours. The estimated maximum evacuating population by time interval for 2017 is identified in **Table VI-15** and for 2020 in **Table VI-16**.

It is important to note that these estimates take into account many variables, including roadway capacity, in-county evacuating trips, out-of-county evacuating trips, evacuating trips from other counties, and background traffic that is impeding the evacuation trips. For this reason, the maximum evacuation population by time interval will vary slightly between evacuation level and either increase or decrease from one evacuation level to the next.

Table VI-15: Maximum Evacuating Population by Time Interval for 2017

	Evac Level A (Scenario 1)	Evac Level B (Scenario 2)	Evac Level C (Scenario 3)	Evac Level D (Scenario 4)	Evac Level E (Scenario 5)
Estimated Evacuating Population Clearing Charlotte County					
12-Hour	26,752	38,635	31,606	26,859	21,619
18-Hour	40,128	57,953	47,410	40,288	32,429
24-Hour	53,504	77,271	63,213	53,717	43,239
36-Hour	79,142	143,273	167,251	170,105	170,253
Estimated Evacuating Population Clearing Collier County					
12-Hour	109,755	78,092	71,449	65,776	53,209
18-Hour	164,633	117,139	107,174	98,665	79,813
24-Hour	169,206	156,185	142,898	131,553	106,417
36-Hour		214,754	306,636	359,030	361,376
Estimated Evacuating Population Clearing Glades County					
12-Hour	3,453	2,474	1,906	1,684	1,427
18-Hour	5,179	3,711	2,859	2,526	2,141
24-Hour	6,906	4,948	3,811	3,367	2,855
36-Hour	7,481	7,937	8,814	9,471	9,813
Estimated Evacuating Population Clearing Hendry County					
12-Hour	9,600	6,875	5,060	4,198	3,581
18-Hour	14,399	10,313	7,590	6,296	5,371
24-Hour	19,199	13,751	10,120	8,395	7,162
36-Hour	19,199	20,340	22,559	23,611	24,618
Estimated Evacuating Population Clearing Lee County					
12-Hour	168,528	180,955	150,866	119,455	101,410
18-Hour	252,792	271,432	226,299	179,183	152,115
24-Hour	337,056	361,910	301,732	238,911	202,820
36-Hour	337,056	520,245	653,752	691,845	714,097
Estimated Evacuating Population Clearing Sarasota County					
12-Hour	43,837	50,343	53,475	55,836	45,740
18-Hour	65,755	75,514	80,213	83,754	68,610
24-Hour	87,673	100,685	106,950	111,673	91,480
36-Hour	122,377	159,418	249,550	318,732	339,237

Note: These estimates take into account many variables, including roadway capacity, in-county evacuating trips, out-of-county evacuating trips, evacuating trips from other counties, and background traffic that is impeding the evacuation trips. For this reason, the maximum evacuation population by time interval will vary between evacuation level and either increase or decrease from one evacuation level to the next.

Table VI-16: Maximum Evacuating Population by Time Interval for 2020

	Evac Level A (Scenario 6)	Evac Level B (Scenario 7)	Evac Level C (Scenario 8)	Evac Level D (Scenario 9)	Evac Level E (Scenario 10)
Estimated Evacuating Population Clearing Charlotte County					
12-Hour	25,717	39,475	28,362	24,242	22,992
18-Hour	38,576	59,213	42,542	36,363	34,488
24-Hour	51,435	78,950	56,723	48,484	45,984
36-Hour	84,653	154,611	180,805	180,805	183,937
Estimated Evacuating Population Clearing Collier County					
12-Hour	105,477	75,278	57,788	72,685	52,944
18-Hour	158,215	112,917	86,682	109,027	79,417
24-Hour	210,953	150,556	115,576	145,369	105,889
36-Hour	193,374	250,926	361,176	420,965	423,555
Estimated Evacuating Population Clearing Glades County					
12-Hour	3,515	2,314	1,452	1,481	1,252
18-Hour	5,273	3,471	2,179	2,222	1,878
24-Hour	7,030	4,628	2,905	2,963	2,505
36-Hour	7,909	8,389	9,320	9,320	10,018
Estimated Evacuating Population Clearing Hendry County					
12-Hour	9,167	6,312	3,709	3,684	3,052
18-Hour	13,751	9,468	5,563	5,526	4,579
24-Hour	18,334	12,625	7,417	7,368	6,105
36-Hour	19,862	21,041	23,333	23,333	24,419
Estimated Evacuating Population Clearing Lee County					
12-Hour	169,763	178,591	122,442	125,774	101,791
18-Hour	254,644	267,887	183,663	188,661	152,687
24-Hour	339,525	357,182	244,884	251,548	203,583
36-Hour	396,113	610,186	770,365	770,365	814,330
Estimated Evacuating Population Clearing Sarasota County					
12-Hour	39,762	47,581	42,409	46,844	47,081
18-Hour	59,643	71,371	63,614	70,265	70,621
24-Hour	79,524	95,161	84,819	93,687	94,161
36-Hour	135,853	176,445	275,661	353,279	376,645

Note: These estimates take into account many variables, including roadway capacity, in-county evacuating trips, out-of-county evacuating trips, evacuating trips from other counties, and background traffic that is impeding the evacuation trips. For this reason, the maximum evacuation population by time interval will vary between evacuation level and either increase or decrease from one evacuation level to the next.

L. Sensitivity Analysis

As discussed previously, there are literally thousands of possible combinations of variables that can be applied using the evacuation transportation model, which will result in thousands of possible outcomes. As part of the analysis process, a sensitivity analysis was conducted using the prototype model to evaluate the effect of different response curves on the calculated evacuation clearance times. Calculated clearance times will never be lower than the designated response time since some evacuating residents will wait to evacuate until near the end of the response time window. For example, using a 12-hour response curve in the analysis means that all residents will begin their evacuation process within 12 hours, and some residents will choose to wait and begin evacuating more than 11.5 hours from when the evacuation was ordered. This will generate a clearance time of more than 12 hours.

The sensitivity analysis identified that clearance times will vary by scenario and by any of the numerous parameters that can be chosen in a particular scenario model run (demographics, student population, tourist population, different counties that are evacuating, response curve, phasing, shadow evacuations, etc.). A few general rules of thumb did emerge from the sensitivity analysis that can provide some guidance to the region regarding the sensitivity of the response curve to the calculated clearance times:

- For low evacuation levels A and B, clearance time will vary by as much as 40 percent depending on the response curve. Low evacuation levels A and B have fewer evacuating vehicles that can be accommodated more easily on the transportation network. In most cases, clearance times typically exceed the response curve by one to two hours. Thus, a 12 hour response curve may yield a clearance time of 13 or 14 hours while an 18 hour response curve may yield a clearance time of 19 or 20 hours. This leads to a higher level of variability than larger evacuations.

- For mid-level evacuations such as C and sometimes D, clearance time varied by as much as 25 percent during the sensitivity analysis. The number of evacuating vehicles is considerably higher than for levels A and B, and lower response curves tend to load the transportation network faster than longer response curves. The variability in clearance times is less in these cases than for low evacuation levels; and,

- For high-level evacuations such as some level D evacuations and all E evacuations, clearance time variability is reduced to about 10 to 15 percent. Large evacuations involve large numbers of evacuating vehicles, and the sensitivity test identified that clearance times are not as dependent on the response curve as lower level evacuations since it takes a significant amount of time to evacuate a large number of vehicles.

The counties within the Southwest Florida Region are encouraged to test additional scenarios beyond what has been provided in this study. Each model run will provide additional information for the region to use in determining when to order an evacuation. Due to advancements in computer technology and the nature of the developed transportation evacuation methodology, this study includes a more detailed and time consuming analysis process than used in previous years studies. Counties interested in testing various response curves for each scenario can easily do so using the TIME interface to calculate clearance times for different response curves.

M. Summary and Conclusions

Through a review of the results of the 20 different scenarios (10 base and 10 operational), several conclusions could be reached regarding the transportation analysis, including the following:

- Critical transportation facilities within the SWFRPC region include I-75, US 41, US 27, US 17, US 301, SR 29, SR 78, SR 74, SR 72, SR 31, SR 82 and US 80. For large storm events, such as level D and E evacuations, other State facilities also play an important role in evacuations;

- During the level A and B evacuation scenarios, the roadway segments with the highest vehicle queues are primarily concentrated along the major Interstate and State Highway system. During these levels of evacuation, State and County officials should coordinate personnel resources to provide sufficient traffic control at interchanges and major intersections along these routes;

- In contrast, for the higher level C, D, and E evacuation scenarios, many other roadway facilities, both within and outside of the region, will require personnel resources for sufficient traffic control at interchanges and major intersections;

- The SWFRPC counties, in coordination with the State, should continue public information campaigns to clearly define those that are vulnerable and should evacuate versus those who choose to evacuate on their own. Shadow evacuations in inland areas of the counties impact the ability of the vulnerable population to evacuate;

- The Florida Department of Transportation should continue to work with local counties on implementing intelligent transportation system (ITS) technology, which will provide enhanced monitoring and notification systems to provide evacuating traffic with up-to-date information regarding expected travel times and alternate routes;

- The State can use the data and information provided in this report (specifically the evacuating vehicle maps in Volume 5-9) to estimate fuel and supply requirements along major evacuation routes to aid motorists during the evacuation process;

- For major evacuation routes that have signalized traffic control at major intersections, traffic signal timing patterns should be adjusted during the evacuation process to provide maximum green time for evacuating vehicles in the predominate north and east directions; and,

- The counties within the Southwest Florida Region are encouraged to test additional transportation scenarios beyond what has been provided in this study. Each model run will provide additional information for the region to use in planning for an evacuation. Counties interested in testing various response curves for each scenario can easily do so using the TIME interface to calculate clearance times for different evacuation conditions, such as different evacuation levels, different behavioral response assumptions and different response curves.