September 15, 2022

L-2022-151
10 CFR 50.36
10 CFR 50, Appendix E, Section IV.4

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

Re: Turkey Point Units 3 and 4
Dockets 50-250 and 50-251
10 CFR 50 Appendix E Evacuation Time Estimate Study for Turkey Point Nuclear Plant

Pursuant to Part 50.4 of Title 10 of the Code of Federal Regulations (10 CFR Part 50.4), Florida Power & Light (FPL) hereby submits the evacuation time estimate study (ETE) for Turkey Point. This study is submitted in accordance with the requirements of Appendix E, Section IV.4 to Part 50 of Title 10 of the Code of Federal Regulations.

The regulation requires the licensee to submit an updated study “within 365 days of the later of availability of the most recent decennial census data from the U.S. Census Bureau or December 23, 2011.”

The Turkey Point ETE was developed in accordance with the federal guidance in NUREG/CR-7002, Rev. 1, "Criteria for Development of Evacuation Time Estimate Studies" published February 2021.

The enclosure contains the Turkey Point ETE study. Note that Appendix N of the ETE Study contains the completed NUREG/CR 7002 Appendix B, Table B-1 ETE Review Criteria Checklist for the Turkey Point ETE.

This letter contains no new Regulatory Commitments and no revision to existing Regulatory Commitments.

The enclosed ETE study provides the methods used to derive, for planning purposes, the time for public evacuation. The study provides an important part of the bases for development of protective action recommendations in coordination with the applicable offsite state/local emergency response agencies.

Should you have any questions or if additional information is needed regarding this submittal, please contact Ken Mack, Fleet Licensing Manager, at (561) 904-3635.

Very truly yours,

Dianne Strand
General Manager, Regulatory Affairs
Florida Power & Light Company

Enclosure: 2022 Turkey Point EPZ ETE Study

cc: Ms. Cindy Becker, Florida Department of Health
USNRC Project Manager, Turkey Point
USNRC Regional Administrator, Turkey Point
USNRC Senior Resident Inspector, Turkey Point

# ENCLOSURE

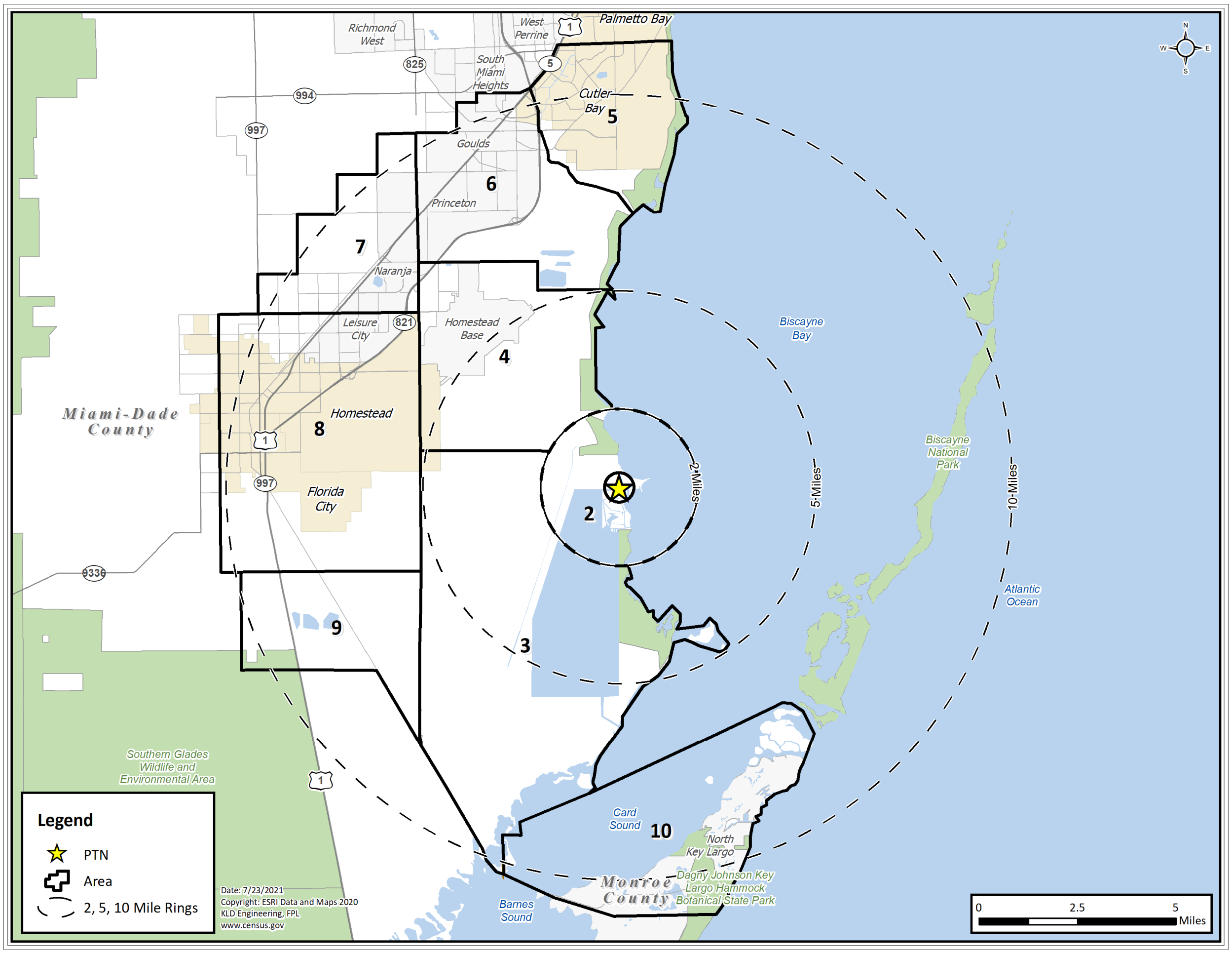
## FLORIDA POWER & LIGHT COMPANY
## TURKEY POINT NUCLEAR PLANT, UNITS 3 AND 4

## DEVELOPMENT OF EVACUATION TIME ESTIMATES AND COMPLETED TABLE B-1 EVACUATION TIME ESTIMATES REVIEW CRITERIA CHECKLIST

*(394 pages follow)*

# *Turkey Point Nuclear Power Plant*

# *Development of Evacuation Time Estimates*



## *Work performed for Florida Power and Light, by:*

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**September 14, 2022** **Final Report, Rev. 0** **KLD TR – 1283**

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*Note: Appendix I intentionally skipped*

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## EXECUTIVE SUMMARY

This report describes the analyses undertaken and the results obtained by a study to develop Evacuation Time Estimates (ETE) for the Turkey Point Nuclear Power Plant (PTN) located in Miami-Dade County, Florida. This ETE study provides Florida Power and Light (FPL) and offsite response organizations (OROs) with site-specific information needed for protective action decision-making.

In the performance of this effort, guidance is provided by documents published by federal governmental agencies. Most important of these are:

- Title 10, Code of Federal Regulations, Appendix E to Part 50 (10CFR50), Emergency Planning and Preparedness for Production and Utilization Facilities, NRC, 2011.
- Criteria for Development of Evacuation Time Estimate Studies, NUREG/CR-7002, Rev. 1, February 2021.
- Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants, NUREG 0654/Radiological Emergency Preparedness Program Manual, FEMA P-1028, December 2019.

Project Activities

This project began in March 2021 and extended over a period of 17months. The major activities performed are briefly described in chronological sequence:

- Conducted a virtual kick-off meeting with FPL personnel and emergency management personnel representing state and county governments.
- Accessed U.S. Census Bureau data files for the year 2020.
- Studied Geographic Information Systems (GIS) maps of the area in the vicinity of the PTN, then conducted a detailed field survey of the highway network in the study area.
- Developed an analysis network representing the highway system topology and capacities within the Emergency Planning Zone (EPZ), plus a Shadow Region covering the region between the EPZ boundary and approximately 15 miles radially from the plant.
- Conducted a random-sample online demographic survey of residents within the EPZ to gather focused data needed for this ETE study that were not contained within the census database. The survey instrument was reviewed and modified by FPL and ORO personnel prior to conducting the survey.
- A data needs matrix (requesting data) was provided to FPL, the state and the county OROs at the kick-off meeting. The data for major employers, transients, and special facilities (schools, medical facilities and correctional facilities) gathered for the previous ETE study were reviewed and either confirmed or updated accordingly by the OROs. If updated information was not provided and could not be obtained from online sources, data gathered for the previous (2015) ETE study was utilized to supplement the data.

- Estimated the number of employees commuting into the EPZ based on the US Census Longitudinal Employer-Household Dynamics (WAC) data from the OnTheMap Census analysis tool[1].
- The traffic demand and trip-generation rates of evacuating vehicles were estimated from the gathered data. The trip generation rates reflected the estimated mobilization time (i.e., the time required by evacuees to prepare for the evacuation trip) computed using the results of the demographic survey of EPZ residents.
- Following federal guidelines, the existing EPZ is subdivided into 10 Areas. These Areas are then grouped within circular areas or "keyhole" configurations (circles plus radial sectors) that define a total of 17 Evacuation Regions (numbered R01 through R17).
- The time-varying external circumstances are represented as Evacuation Scenarios, each described in terms of the following factors: (1) Season (Summer, Winter); (2) Day of Week (Midweek, Weekend); (3) Time of Day (Midday, Evening); and (4) Weather (Good, Rain). One special event scenario – the NASCAR championship race at the Homestead -Miami Speedway – was considered. One roadway impact scenario was considered wherein a single lane was closed on the Florida Turnpike northbound from the interchange with U.S. Highway 1 to the end of the study area at the split of the Florida Turnpike and the Don Shula Expressway for the duration of the evacuation.
- Staged evacuation was considered for those regions wherein the 2-Mile Region and downwind to 5 miles evacuate.
- As per NUREG/CR-7002, Rev. 1, the Planning Basis for the calculation of ETE is:
    - A rapidly escalating accident at the PTN that quickly assumes the status of a general emergency wherein evacuation is ordered promptly, and no early protective actions have been implemented such that the Advisory to Evacuate (ATE) is virtually coincident with the siren alert.
    - While an unlikely scenario, this planning basis will yield ETE, measured as the elapsed time from the ATE until the stated percentage of the population exits the impacted Region, that represent "upper bound" estimates. This conservative Planning Basis is applicable for all initiating events.
- If the emergency occurs while schools are in session, the ETE study assumes that the children will be evacuated by bus directly to designated host schools or reception centers located outside the EPZ. Parents, relatives, and neighbors are advised to not pick up their children at school prior to the arrival of the buses dispatched for that purpose. The ETE for schoolchildren are calculated separately.
- Evacuees who do not have access to a private vehicle will either ride-share with relatives, friends or neighbors, or be evacuated by buses provided by the counties in the EPZ. Medical facilities must have comprehensive emergency plans and provide transportation

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[1] http://onthemap.ces.census.gov/

resources for evacuation as per Florida state law. Thus, patients at medical facilities will be evacuated by buses, wheelchair buses, or ambulances owned or contracted by the medical facilities. Separate ETE are calculated for the transit-dependent evacuees, for access and/or functional needs population, and for those evacuated from medical facilities and correctional facilities.

- Attended a virtual final project meeting with FPL personnel and the OROs to present the final results of the study.

Computation of ETE

A total of 204 ETE were computed for the evacuation of the general public. Each ETE quantifies the aggregate evacuation time estimated for the population within one of the 17 Evacuation Regions to evacuate from that Region, under the circumstances defined for one of the 12 Evacuation Scenarios (17 x 12 = 204). Separate ETE are calculated for transit-dependent evacuees, including schoolchildren for applicable scenarios.

Except for Region R03, which is the evacuation of the entire EPZ, only a portion of the people within the EPZ would be advised to evacuate. That is, the ATE applies only to those people occupying the specified impacted region. It is assumed that 100% of the people within the impacted region will evacuate in response to the ATE. The people occupying the remainder of the EPZ outside the impacted region may be advised to take shelter.

The computation of ETE assumes that 20% of the population within the EPZ but outside the impacted region, will elect to "voluntarily" evacuate. In addition, 20% of the population in the Shadow Region will also elect to evacuate. These voluntary evacuees could impede those who are evacuating from within the impacted region. The impedance that could be caused by voluntary evacuees is considered in the computation of ETE for the impacted region.

Staged evacuation is considered wherein those people within the 2-Mile Region (R01) of PTN evacuate immediately, while those beyond 2 miles, but within the EPZ, shelter-in-place. Once 90% of R01 is evacuated, those people beyond 2 miles begin to evacuate. As per federal guidance, the study assumed 20% of people beyond 2 miles evacuate (non-compliance) even though they are advised to shelter-in-place.

The computational procedure is outlined as follows:

- A link-node representation of the highway network is coded. Each link represents a unidirectional length of highway; each node usually represents an intersection or merge point. The capacity of each link is estimated based on the field survey observations and on established traffic engineering procedures.
- The evacuation trips are generated at locations called "zonal centroids" located within the EPZ and Shadow Region. The trip generation rates vary over time reflecting the mobilization process, and from one location (centroid) to another depending on population density and on whether a centroid is within, or outside, the impacted area.
- The evacuation model computes the routing patterns for evacuating vehicles that are compliant with federal guidelines (outbound relative to the location of the plant), then

simulates the traffic flow movements over space and time. This simulation process estimates the rate that traffic flow exits the impacted region.

The ETE statistics provide the elapsed times for 90% and 100%, respectively, of the population within the impacted region, to evacuate from within the impacted region. These statistics are presented in tabular and graphical formats. The 90th percentile ETE have been identified as the values that should be considered when making protective action decisions because the 100th percentile ETE are prolonged by those relatively few people who take longer to mobilize. This is referred to as the “evacuation tail” in Section 4.0 of NUREG/CR-7002, Rev. 1.

Traffic Management

This study reviewed and modeled the existing traffic management plan (combination of Traffic Control Points – TCPs – and Access Control Points – ACPs – designed to help the flow of evacuating traffic leaving the EPZ and restrict the flow of external traffic trying to enter the EPZ) within the EPZ provided by the OROs. Nearly all of the traffic signals in the study area are actuated signals which will adapt their timing to the changing traffic patterns during evacuation. No additional TCPs or ACPs were identified as the results of this ETE study. See Section 9 and Appendix G.

Selected Results

A compilation of selected information is presented on the following pages in the form of figures and tables extracted from the body of the report; these are described below:

- Table 3-1 presents the estimates of permanent resident population in each Area based on the 2020 Census data.
- Table 6-1 defines each of the 17 Evacuation Regions in terms of their respective groups of Areas.
- Table 6-2 lists the 12 Evacuation Scenarios.
- Tables 7-1 and 7-2 are compilations of ETE for the general population. These data are the times needed to clear the indicated regions of 90% and 100% of the population occupying these regions, respectively. These computed ETE include consideration of mobilization time and of estimated voluntary evacuations from other regions within the EPZ and from the Shadow Region.
- Tables 7-3 and 7-4 present ETE for the 2-Mile Region for un-staged (concurrent) and staged evacuations for the 90th and 100th percentiles, respectively.
- Table 8-2 presents ETE for the children at schools in good weather.
- Table 8-4 presents ETE for the transit-dependent population in good weather.
- Table 8-6 presents ETE for the medical facilities in good weather.
- Figure 6-1 presents displays a map of the PTN EPZ showing the layout of the 10 Areas that comprise, in aggregate, the EPZ.
- Figure H-8 presents an example of an Evacuation Region (Region R08) to be evacuated under the circumstances defined in Table 6-1. See Appendix H for maps of all Regions.

Conclusions

- General population ETE were computed for 204 unique cases – a combination of 17 unique Evacuation Regions and 12 unique Evacuation Scenarios. Table 7-1 and Table 7-2 document these ETE for the 90th and 100th percentiles. These ETE range from 1:35 (hr:min) to 9:10 at the 90th percentile and 2:15 to 12:20 at the 100th percentile.
- The comparison of Table 7-1 and Table 7-2 indicates that the ETE for the 100th percentile are significantly longer than those for the 90th percentile. This is the result of the pronounced traffic congestion within the EPZ. When the roadway system becomes congested, traffic exits the EPZ at rates somewhat below capacity until some evacuation routes have cleared. As more routes clear, the aggregate rate of egress slows since many vehicles have already left the EPZ. Towards the end of the process, relatively few evacuation routes service the remaining demand. See Figures 7-10 through 7-21.
- Inspection of Table 7-3 and Table 7-4 indicates that a staged evacuation provides no benefits to evacuees from within the 2-Mile Region (compare the ETE for Region R01 with the remainder of the Regions shown in the table in Tables 7-3 and 7-4). See Section 7.6 for additional discussion. Staged evacuation is not recommended for the PTN EPZ.
- Comparison of Scenarios 8 (winter, weekend, midday, good weather) and 11 (winter, weekend, midday, good weather, special event) in Table 7-1 and Table 7-2 indicates that the special event (a NASCAR race at the Homestead-Miami Speedway) has a significant impact on the 90th percentile ETE (up to 2 hour and 10 minute increases in ETE for some cases) and even more significant impact on the 100th percentile ETE (up to 3 hour and 15 minute increases for some cases). See Section 7.5 for additional discussion.
- Comparison of Scenarios 1 and 12 in Table 7-1 and Table 7-2 indicates that the roadway closure – one lane northbound on Florida Turnpike from the interchange with U.S. Highway 1 to the split with the Don Shula Expressway – increases the 90th percentile ETE by up to 1 hour and 5 minutes and the 100th percentile ETE by at most 1 hour and 15 minutes – both significant impacts. See Section 7.5 for additional information.
- U.S. Highway 1, Krome Ave, the Florida Turnpike and roadways accessing the ramps to the Florida Turnpike are the most congested areas during an evacuation. The last route in the EPZ to exhibit traffic congestion is along U.S. Highway 1 northbound which clears at 10 hours and 25 minutes after the ATE. See Section 7.3 and Figures 7-3 through Figure 7-9.
- Separate ETE were computed for schools, medical facilities, correctional facilities, transit-dependent persons and access and/or functional needs persons. The average single-wave ETE for all these facilities are lower than the general population ETE at the 90th percentile. The average two-wave ETE for some special facilities and transit-dependent population do exceed the 90th percentile ETE for the general population and could affect protective action decision making. See Section 8.
- Table 8-1 indicates there are insufficient transportation resources available to evacuate the special facilities and the transit-dependent population within the EPZ in a single wave. Second wave ETE are computed for all special facilities (excluding correctional facilities)

and transit-dependent people in the event there is a shortfall of buses and/or drivers during an emergency. See Sections 8.1 and 8.2.

- A reduction in the base trip generation time by two hours increases the 90th percentile ETE by 5 minutes and increases the 100th percentile ETE by 55 minutes (significant impact). As discussed in Section 7.3, traffic congestion persists within the EPZ for about 10 hours and 25 minutes. When evacuees mobilize more quickly, they overwhelm the capacity of the roadway system by having vehicles get on the road sooner, thereby increasing congestion and causing the 90th percentile and 100th percentile ETE to increase. See Table M-1 in Appendix M.
- The general population ETE is significantly impacted by the voluntary evacuation of vehicles in the Shadow Region. The Shadow Region for PTN is densely populated to the north of the plant (South Miami Heights and Palmetto Bay) and experiences significant traffic congestion as shown in Figure 7-3 through Figure 7-9. Quadrupling (80%) the shadow evacuation percentage increases 90th percentile ETE by 50 minutes and 100th percentile ETE by 1 hour and 5 minutes. See Table M-2 in Appendix M.
- A 5% or greater increase in the full EPZ permanent resident population (includes 20% of the Shadow Region permanent resident population) results in ETE changes (30 minutes or 25%, whichever is less) which meet the NRC criteria for updating ETE between decennial Censuses. See Section M.3 in Appendix M.

**Table 3-1. EPZ Permanent Resident Population**

| Area | 2010 Population | 2020 Population |
|---|---|---|
| **1** | 0 | 0 |
| **2** | 0 | 0 |
| **3** | 0 | 0 |
| **4** | 7,506 | 10,293 |
| **5** | 44,816 | 50,197 |
| **6** | 43,313 | 61,746 |
| **7** | 20,153 | 30,848 |
| **8** | 89,322 | 111,666 |
| **9** | 116 | 0 |
| **10** | 1,103 | 1,269 |
| **EPZ TOTAL:** | **206,329** | **266,019** |
| **EPZ Population Growth (2010-2020):** | | **28.93%** |

## Table 6-1. Description of Evacuation Regions

**Radial Regions**

| Region | Description | Area | | | | | | | | | | EAS Message |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| **R01** | 2-Mile Region | 🟥 x | 🟥 x | | | | | | | | | E14/E18/E19/E21/E22/E23 |
| **R02** | 5-Mile Region | 🟥 x | 🟥 x | 🟥 x | 🟥 x | | | | | | | E16 |
| **R03** | Full EPZ | 🟥 x | 🟥 x | 🟥 x | 🟥 x | 🟥 x | 🟥 x | 🟥 x | 🟥 x | 🟥 x | 🟥 x | N/A |

**Evacuate 2-Mile Region and Downwind to 5-Mile Region**

| Region | Wind Direction From: | Area | | | | | | | | | | EAS Message |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| **R04** | SSE, S, SSW | 🟥 x | 🟥 x | | 🟥 x | | | | | | | E17 |
| **N/A** | SW, WSW, W, WNW, NW | **Refer to Region 01** | | | | | | | | | | E14/E18/E19/E21/E22/E23 |
| **R05** | NNW, N, NNE, NE, ENE | 🟥 x | 🟥 x | 🟥 x | | | | | | | | E15/E20/E25/E26 |
| **N/A** | E, ESE, SE | **Refer to Region 02** | | | | | | | | | | E16 |

**Evacuate 2-Mile Region and Downwind to EPZ Boundary**

| Region | Wind Direction From: | Area | | | | | | | | | | EAS Message |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| **R06** | S, SSW | 🟥 x | 🟥 x | | 🟥 x | 🟥 x | 🟥 x | | | | | E24 |
| **N/A** | SW, WSW, W, WNW | **Refer to Region 01** | | | | | | | | | | E14/E18/E19/E21/E22/E23 |
| **R07** | NW | 🟥 x | 🟥 x | | | | | | | | 🟥 x | E14/E18/E19/E21/E22/E23 plus Monroe County |
| **R08** | NNW, N, NNE | 🟥 x | 🟥 x | 🟥 x | | | | | | | 🟥 x | E15/E20/E25/E26 plus Monroe County |
| **R09** | NE | 🟥 x | 🟥 x | 🟥 x | | | | | | 🟥 x | | E08 |
| **R10** | ENE | 🟥 x | 🟥 x | 🟥 x | | | | | 🟥 x | 🟥 x | | E09 |
| **R11** | E | 🟥 x | 🟥 x | 🟥 x | 🟥 x | | | | 🟥 x | 🟥 x | | E10 |
| **R12** | ESE | 🟥 x | 🟥 x | 🟥 x | 🟥 x | | | 🟥 x | 🟥 x | | | E11 |
| **R13** | SE | 🟥 x | 🟥 x | 🟥 x | 🟥 x | | 🟥 x | 🟥 x | 🟥 x | | | E12 |
| **R14** | SSE | 🟥 x | 🟥 x | | 🟥 x | 🟥 x | 🟥 x | 🟥 x | | | | E13 |

**Staged Evacuation - 2-Mile Region Evacuates, then Evacuate Downwind to 5-Mile Region**

| Region | Wind Direction From: | Area | | | | | | | | | | EAS Message |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| **R15** | 5-Mile Region, E, ESE, SE | 🟥 x | 🟥 x | 🟦 x | 🟦 x | | | | | | | E16, staged |
| **R16** | SSE, S, SSW | 🟥 x | 🟥 x | | 🟦 x | | | | | | | E17, staged |
| **N/A** | SW, WSW, W, WNW, NW | **Refer to Region 01** | | | | | | | | | | E14/E18/E19/E21/E22/E23 |
| **R17** | NNW, N, NNE, NE, ENE | 🟥 x | 🟥 x | 🟦 x | | | | | | | | E15/E20/E25/E26, staged |

| | | |
|---|---|---|
| 🟥 Area(s) Evacuate | ⬜ Area(s) Shelter-in-Place | 🟦 Shelter-in-Place until 90% ETE for R01, then Evacuate |

**Table 6-2. Evacuation Scenario Definitions**

| Scenarios | Season[2] | Day of Week | Time of Day | Weather | Special |
|---|---|---|---|---|---|
| 1 | Summer | Midweek | Midday | Good | None |
| 2 | Summer | Midweek | Midday | Rain | None |
| 3 | Summer | Weekend | Midday | Good | None |
| 4 | Summer | Weekend | Midday | Rain | None |
| 5 | Summer | Midweek, Weekend | Evening | Good | None |
| 6 | Winter | Midweek | Midday | Good | None |
| 7 | Winter | Midweek | Midday | Rain | None |
| 8 | Winter | Weekend | Midday | Good | None |
| 9 | Winter | Weekend | Midday | Rain | None |
| 10 | Winter | Midweek, Weekend | Evening | Good | None |
| 11 | Winter | Weekend | Midday | Good | Special Event – NASCAR Race at Homestead-Miami Speedway |
| 12 | Summer | Midweek | Midday | Good | Roadway Impact – Single Lane Closure on the Florida Turnpike Northbound |

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[2] Winter means that school is in session at normal enrollment levels (also applies to spring and autumn). Summer means that school is in session at summer school enrollment levels (lower than normal enrollment).

## Table 7-1. Time to Clear the Indicated Area of *90* Percent of the Affected Population

|  | Summer |  | Summer |  | Summer | Winter |  | Winter |  | Winter | Winter | Summer |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | Midweek |  | Weekend |  | Midweek Weekend | Midweek |  | Weekend |  | Midweek Weekend | Weekend | Midweek |  |
| **Scenario:** | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | **Scenario:** |
| **Region** | Midday |  | Midday |  | Evening | Midday |  | Midday |  | Evening | Midday | Midday | **Region** |
|  | Good Weather | Rain | Good Weather | Rain | Good Weather | Good Weather | Rain | Good Weather | Rain | Good Weather | Special Event | Roadway Impact |  |
| **Entire 2-Mile Region, 5-Mile Region, and EPZ** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **R01** | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | **R01** |
| **R02** | 3:00 | 3:00 | 2:25 | 2:35 | 2:25 | 2:50 | 2:50 | 2:35 | 2:35 | 2:25 | 2:35 | 3:00 | **R02** |
| **R03** | 8:15 | 8:55 | 7:55 | 8:45 | 7:45 | 8:25 | 9:10 | 8:15 | 8:55 | 7:45 | 10:00 | 9:20 | **R03** |
| **2-Mile Region and Keyhole to 5 Miles** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **R04** | 3:00 | 3:00 | 2:25 | 2:35 | 2:25 | 2:50 | 2:50 | 2:35 | 2:35 | 2:25 | 2:35 | 3:00 | **R04** |
| **R05** | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:40 | 1:35 | 1:35 | 1:35 | **R05** |
| **2-Mile Region and Keyhole to EPZ Boundary** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **R06** | 5:15 | 5:40 | 5:15 | 5:40 | 5:05 | 5:15 | 5:40 | 5:20 | 5:50 | 5:15 | 5:25 | 5:40 | **R06** |
| **R07** | 3:50 | 4:30 | 3:50 | 4:25 | 1:55 | 4:25 | 5:05 | 4:05 | 4:45 | 2:05 | 4:05 | 3:55 | **R07** |
| **R08** | 3:50 | 4:30 | 3:50 | 4:25 | 1:55 | 4:25 | 5:05 | 4:05 | 4:45 | 2:05 | 4:05 | 3:55 | **R08** |
| **R09** | 2:40 | 3:00 | 2:45 | 3:00 | 2:05 | 2:40 | 3:00 | 2:45 | 3:00 | 2:05 | 2:45 | 2:40 | **R09** |
| **R10** | 5:10 | 5:45 | 5:05 | 5:25 | 4:45 | 5:25 | 5:45 | 5:00 | 5:25 | 4:45 | 7:10 | 6:00 | **R10** |
| **R11** | 5:25 | 5:50 | 5:10 | 5:45 | 4:55 | 5:35 | 6:05 | 5:20 | 5:50 | 5:00 | 7:00 | 6:05 | **R11** |
| **R12** | 6:50 | 7:30 | 6:35 | 7:05 | 6:20 | 7:05 | 7:35 | 6:35 | 7:00 | 6:30 | 8:45 | 7:35 | **R12** |
| **R13** | 7:50 | 8:20 | 7:35 | 8:30 | 7:25 | 8:05 | 8:50 | 7:35 | 8:05 | 7:25 | 9:40 | 8:50 | **R13** |
| **R14** | 6:00 | 6:15 | 5:35 | 6:10 | 5:25 | 5:45 | 6:25 | 5:45 | 6:10 | 5:30 | 6:00 | 6:05 | **R14** |
| **Staged Evacuation - 2-Mile Region and Keyhole to 5 Miles** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **R15** | 3:00 | 3:00 | 2:45 | 2:55 | 2:50 | 3:00 | 3:00 | 2:45 | 2:55 | 2:45 | 2:55 | 3:05 | **R15** |
| **R16** | 3:00 | 3:00 | 2:45 | 2:55 | 2:50 | 3:00 | 3:00 | 2:45 | 2:55 | 2:45 | 2:55 | 3:05 | **R16** |
| **R17** | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:40 | 1:35 | 1:35 | 1:35 | **R17** |

## Table 7-2. Time to Clear the Indicated Area of *100* Percent of the Affected Population

|  | Summer | | Summer | | Summer | Winter | | Winter | | Winter | Winter | Summer |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | Midweek | | Weekend | | Midweek Weekend | Midweek | | Weekend | | Midweek Weekend | Weekend | Midweek |  |
| **Scenario:** | **(1)** | **(2)** | **(3)** | **(4)** | **(5)** | **(6)** | **(7)** | **(8)** | **(9)** | **(10)** | **(11)** | **(12)** | **Scenario:** |
| **Region** | Midday | | Midday | | Evening | Midday | | Midday | | Evening | Midday | Midday | **Region** |
|  | Good Weather | Rain | Good Weather | Rain | Good Weather | Good Weather | Rain | Good Weather | Rain | Good Weather | Special Event | Roadway Impact |  |
| **Entire 2-Mile Region, 5-Mile Region, and EPZ** | | | | | | | | | | | | | |
| **R01** | 2:20 | 2:20 | 2:15 | 2:15 | 2:15 | 2:20 | 2:20 | 2:15 | 2:15 | 2:15 | 2:15 | 2:20 | **R01** |
| **R02** | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | **R02** |
| **R03** | 10:45 | 12:20 | 10:50 | 11:55 | 10:20 | 10:50 | 12:15 | 10:55 | 12:00 | 10:10 | 12:50 | 11:55 | **R03** |
| **2-Mile Region and Keyhole to 5 Miles** | | | | | | | | | | | | | |
| **R04** | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | **R04** |
| **R05** | 2:25 | 2:30 | 2:15 | 2:15 | 2:15 | 2:30 | 2:30 | 2:15 | 2:20 | 2:15 | 2:20 | 2:25 | **R05** |
| **2-Mile Region and Keyhole to EPZ Boundary** | | | | | | | | | | | | | |
| **R06** | 7:10 | 7:50 | 7:10 | 7:45 | 7:05 | 7:10 | 8:05 | 7:15 | 8:00 | 7:05 | 7:35 | 7:30 | **R06** |
| **R07** | 5:25 | 5:25 | 5:25 | 5:25 | 5:25 | 5:25 | 5:40 | 5:25 | 5:25 | 5:25 | 5:25 | 5:25 | **R07** |
| **R08** | 5:25 | 5:25 | 5:25 | 5:25 | 5:25 | 5:25 | 5:40 | 5:25 | 5:25 | 5:25 | 5:25 | 5:25 | **R08** |
| **R09** | 3:10 | 3:35 | 3:10 | 3:35 | 2:30 | 3:10 | 3:35 | 3:10 | 3:30 | 2:30 | 3:10 | 3:10 | **R09** |
| **R10** | 7:25 | 8:30 | 7:35 | 8:35 | 7:05 | 7:50 | 8:45 | 7:45 | 8:15 | 7:00 | 10:25 | 8:40 | **R10** |
| **R11** | 7:50 | 8:45 | 7:35 | 9:00 | 7:05 | 8:05 | 9:10 | 7:50 | 8:50 | 7:10 | 10:40 | 8:40 | **R11** |
| **R12** | 8:55 | 10:05 | 8:35 | 9:40 | 8:40 | 9:20 | 9:55 | 8:35 | 9:30 | 8:30 | 11:50 | 9:45 | **R12** |
| **R13** | 10:25 | 11:30 | 9:55 | 11:35 | 10:00 | 10:30 | 12:15 | 9:50 | 11:10 | 9:45 | 12:20 | 11:20 | **R13** |
| **R14** | 8:05 | 8:40 | 7:55 | 8:50 | 7:40 | 8:10 | 9:00 | 7:55 | 8:50 | 7:55 | 8:30 | 8:15 | **R14** |
| **Staged Evacuation - 2-Mile Region and Keyhole to 5 Miles** | | | | | | | | | | | | | |
| **R15** | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | **R15** |
| **R16** | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | **R16** |
| **R17** | 2:30 | 2:30 | 2:15 | 2:15 | 2:25 | 2:30 | 2:30 | 2:20 | 2:20 | 2:15 | 2:20 | 2:30 | **R17** |

## Table 7-3. Time to Clear *90 Percent* of the *2-Mile Region* within the Indicated Region

| | Summer | | Summer | | Summer | Winter | | Winter | | Winter | Winter | Summer | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Midweek | | Weekend | | Midweek Weekend | Midweek | | Weekend | | Midweek Weekend | Weekend | Midweek | |
| **Scenario:** | **(1)** | **(2)** | **(3)** | **(4)** | **(5)** | **(6)** | **(7)** | **(8)** | **(9)** | **(10)** | **(11)** | **(12)** | **Scenario:** |
| **Region** | Midday | | Midday | | Evening | Midday | | Midday | | Evening | Midday | Midday | **Region** |
| | Good Weather | Rain | Good Weather | Rain | Good Weather | Good Weather | Rain | Good Weather | Rain | Good Weather | Special Event | Roadway Impact | |
| **Unstaged Evacuation - 2-Mile Region, 5-Mile Region, 2 Mile Region and Keyhole to 5-Miles** | | | | | | | | | | | | | |
| **R01** | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | **R01** |
| **R02** | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | **R02** |
| **R04** | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | **R04** |
| **R05** | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | **R05** |
| **Staged Evacuation - 2-Mile Region and Keyhole to 5-Miles** | | | | | | | | | | | | | |
| **R15** | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | **R15** |
| **R16** | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | **R16** |
| **R17** | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | **R17** |

### Table 7-4. Time to Clear ***100 Percent*** of the ***2-Mile Region*** within the Indicated Region

|  | Summer |  | Summer |  | Summer | Winter |  | Winter |  | Winter | Winter | Summer |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | Midweek |  | Weekend |  | Midweek Weekend | Midweek |  | Weekend |  | Midweek Weekend | Weekend | Midweek |  |
| **Scenario:** | **(1)** | **(2)** | **(3)** | **(4)** | **(5)** | **(6)** | **(7)** | **(8)** | **(9)** | **(10)** | **(11)** | **(12)** | **Scenario:** |
| **Region** | **Midday** |  | **Midday** |  | **Evening** | **Midday** |  | **Midday** |  | **Evening** | **Midday** | **Midday** | **Region** |
|  | **Good Weather** | **Rain** | **Good Weather** | **Rain** | **Good Weather** | **Good Weather** | **Rain** | **Good Weather** | **Rain** | **Good Weather** | **Special Event** | **Roadway Impact** |  |
| **Unstaged Evacuation - 2-Mile Region, 5-Mile Region, 2 Mile Region and Keyhole to 5-Miles** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **R01** | 2:20 | 2:20 | 2:15 | 2:15 | 2:15 | 2:20 | 2:20 | 2:15 | 2:15 | 2:15 | 2:15 | 2:20 | **R01** |
| **R02** | 2:20 | 2:20 | 2:15 | 2:15 | 2:15 | 2:20 | 2:20 | 2:15 | 2:15 | 2:15 | 2:15 | 2:20 | **R02** |
| **R04** | 2:20 | 2:20 | 2:15 | 2:15 | 2:15 | 2:20 | 2:20 | 2:15 | 2:15 | 2:15 | 2:15 | 2:20 | **R04** |
| **R05** | 2:20 | 2:20 | 2:15 | 2:15 | 2:15 | 2:20 | 2:20 | 2:15 | 2:15 | 2:15 | 2:15 | 2:20 | **R05** |
| **Staged Evacuation - 2-Mile Region and Keyhole to 5-Miles** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **R15** | 2:20 | 2:20 | 2:15 | 2:15 | 2:15 | 2:20 | 2:20 | 2:15 | 2:15 | 2:15 | 2:15 | 2:20 | **R15** |
| **R16** | 2:20 | 2:20 | 2:15 | 2:15 | 2:15 | 2:20 | 2:20 | 2:15 | 2:15 | 2:15 | 2:15 | 2:20 | **R16** |
| **R17** | 2:20 | 2:20 | 2:15 | 2:15 | 2:15 | 2:20 | 2:20 | 2:15 | 2:15 | 2:15 | 2:15 | 2:20 | **R17** |

### Table 8-2. School Evacuation Time Estimates – Good Weather

| SCHOOLS IN | Driver Mobilization Time (min) | Loading Time (min) | Dist. To EPZ Bdry (mi) | Average Speed (mph) | Travel Time to EPZ Bdry (min) | ETE (hr:min) | Dist. EPZ Bdry to H.S (mi.) | Travel Time from EPZ Bdry to H.S. (min) | ETA to H.S. (hr:min) |
|---|---|---|---|---|---|---|---|---|---|
| MIAMI-DADE COUNTY SCHOOLS | | | | | | | | | |
| AREA 4 | 105 | 15 | 8.7 | 2.0 | 260 | **6:20** | 6.4 | 25 | **6:45** |
| AREA 5 | 105 | 15 | 4.0 | 3.5 | 69 | **3:10** | 9.1 | 36 | **3:50** |
| AREA 6 | 105 | 15 | 3.6 | 2.2 | 99 | **3:40** | 9.4 | 38 | **4:20** |
| AREA 7 | 105 | 15 | 9.4 | 1.6 | 356 | **8:00** | 9.2 | 37 | **8:40** |
| AREA 8 | 105 | 15 | 13.7 | 2.1 | 392 | **8:35** | 12.4 | 50 | **9:25** |
| MONROE COUNTY SCHOOLS | | | | | | | | | |
| AREA 10 | 105 | 15 | 3.4 | 2.3 | 87 | **3:30** | 10.5 | 42 | **4:15** |
| **Maximum for EPZ:** | | | | | | **8:35** | **Maximum:** | | **9:25** |
| **Average for EPZ:** | | | | | | **5:35** | **Average:** | | **6:15** |

### Table 8-4. Transit-Dependent Evacuation Time Estimates – Good Weather

| | | One-Wave | | | | | | Two-Wave | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Route Number | Bus Number | Mobilization (min) | Route Length (miles) | Speed (mph) | Route Travel Time (min) | Pickup Time (min) | ETE (hr:min) | Distance to R. C. (miles) | Travel Time to R. C. (min) | Unload (min) | Driver Rest (min) | Route Travel Time (min) | Pickup Time (min) | ETE (hr:min) |
| **33030** | 1-11 | 150 | 14.4 | 8.4 | 103 | 30 | **4:45** | 12.4 | 50 | 5 | 10 | 71 | 30 | **7:35** |
| | 12-22 | 180 | 14.4 | 10.1 | 85 | 30 | **4:55** | 12.4 | 50 | 5 | 10 | 71 | 30 | **7:45** |
| | 22-31 | 210 | 14.4 | 12.7 | 68 | 30 | **5:10** | 12.4 | 50 | 5 | 10 | 71 | 30 | **8:00** |
| **33032** | 1-16 | 150 | 8.9 | 5.7 | 94 | 30 | **4:35** | 12.4 | 50 | 5 | 10 | 94 | 30 | **7:45** |
| | 17-32 | 180 | 8.9 | 5.6 | 96 | 30 | **5:10** | 12.4 | 50 | 5 | 10 | 83 | 30 | **8:10** |
| | 33-51 | 210 | 8.9 | 6.0 | 89 | 30 | **5:30** | 12.4 | 50 | 5 | 10 | 67 | 30 | **8:15** |
| | 52-62 | 240 | 8.9 | 6.7 | 80 | 30 | **5:50** | 12.4 | 50 | 5 | 10 | 55 | 30 | **8:20** |
| **33033** | 1-18 | 150 | 9.6 | 4.2 | 137 | 30 | **5:20** | 12.5 | 50 | 5 | 10 | 75 | 30 | **8:10** |
| | 19-36 | 180 | 9.6 | 4.4 | 132 | 30 | **5:45** | 12.5 | 50 | 5 | 10 | 60 | 30 | **8:20** |
| | 37-54 | 210 | 9.6 | 4.8 | 121 | 30 | **6:05** | 12.5 | 50 | 5 | 10 | 78 | 30 | **9:00** |
| | 55-72 | 240 | 9.6 | 5.3 | 109 | 30 | **6:20** | 12.5 | 50 | 5 | 10 | 73 | 30 | **9:10** |
| **33034** | 1-13 | 150 | 18.8 | 12.1 | 93 | 30 | **4:35** | 12.4 | 50 | 5 | 10 | 175 | 30 | **9:05** |
| | 14-26 | 180 | 18.8 | 15.4 | 73 | 30 | **4:45** | 12.4 | 50 | 5 | 10 | 169 | 30 | **9:10** |
| **33157** | 1-9 | 150 | 3.6 | 5.0 | 42 | 30 | **3:45** | 12.4 | 50 | 5 | 10 | 31 | 30 | **5:55** |
| | 10-17 | 180 | 3.6 | 5.5 | 39 | 30 | **4:10** | 12.4 | 50 | 5 | 10 | 31 | 30 | **6:20** |
| | | | | | | **Maximum for EPZ:** | **6:20** | | | | | | **Maximum:** | **9:10** |
| | | | | | | **Average for EPZ:** | **5:10** | | | | | | **Average:** | **8:05** |

## Table 8-6. Medical Facility Evacuation Time Estimates – Good Weather

| Medical Facility | Patient | Mobilization (min) | Loading Rate (min per person) | People | Total Loading Time (min) | Dist. To EPZ Bdry (mi) | Travel Time to EPZ Boundary (min) | ETE (hr:min) |
|---|---|---|---|---|---|---|---|---|
| **MIAMI-DADE COUNTY** | | | | | | | | |
| AREA 4 | Ambulatory | 90 | 1 | 38 | 30 | 8.7 | 260 | **6:20** |
| | Wheelchair bound | 90 | 5 | 7 | 35 | 8.7 | 259 | **6:25** |
| AREA 5 | Ambulatory | 90 | 1 | 516 | 30 | 4.0 | 69 | **3:10** |
| | Wheelchair bound | 90 | 5 | 71 | 75 | 4.0 | 63 | **3:50** |
| | Bedridden | 90 | 15 | 17 | 15 | 4.0 | 73 | **3:00** |
| AREA 6 | Ambulatory | 90 | 1 | 297 | 30 | 5.5 | 62 | **3:05** |
| | Wheelchair bound | 90 | 5 | 44 | 75 | 5.5 | 61 | **3:50** |
| | Bedridden | 90 | 15 | 6 | 15 | 5.5 | 64 | **2:50** |
| AREA 7 | Ambulatory | 90 | 1 | 147 | 30 | 9.4 | 356 | **8:00** |
| | Wheelchair bound | 90 | 5 | 21 | 75 | 9.4 | 335 | **8:20** |
| | Bedridden | 90 | 15 | 5 | 15 | 9.4 | 360 | **7:45** |
| AREA 8 | Ambulatory | 90 | 1 | 1,023 | 30 | 13.7 | 392 | **8:35** |
| | Wheelchair bound | 90 | 5 | 137 | 75 | 13.7 | 377 | **9:05** |
| | Bedridden | 90 | 15 | 40 | 15 | 13.7 | 403 | **8:30** |
| | | | | | | | **Maximum ETE:** | **9:05** |
| | | | | | | | **Average ETE:** | **5:55** |

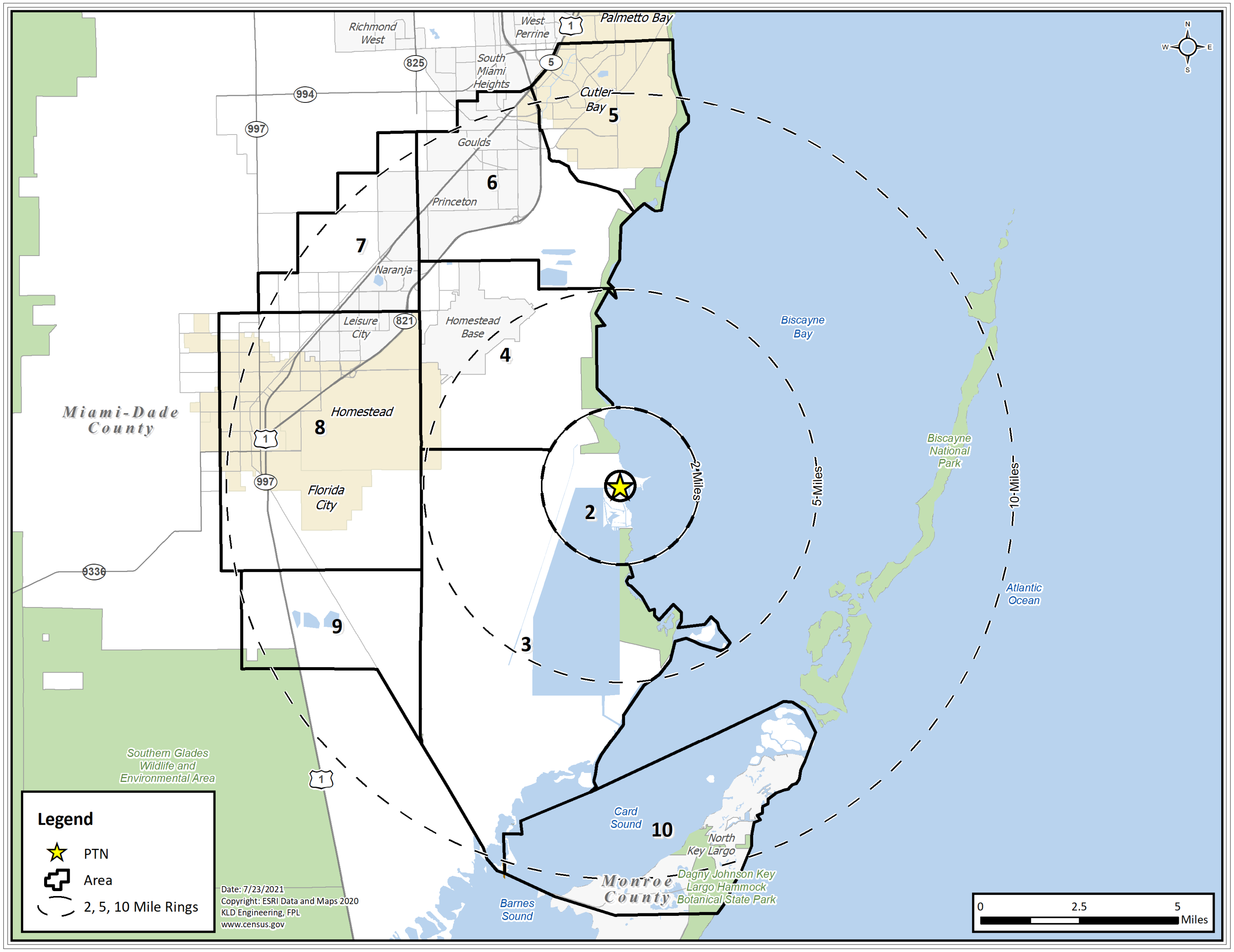

Figure 6-1. Areas Comprising the PTN EPZ

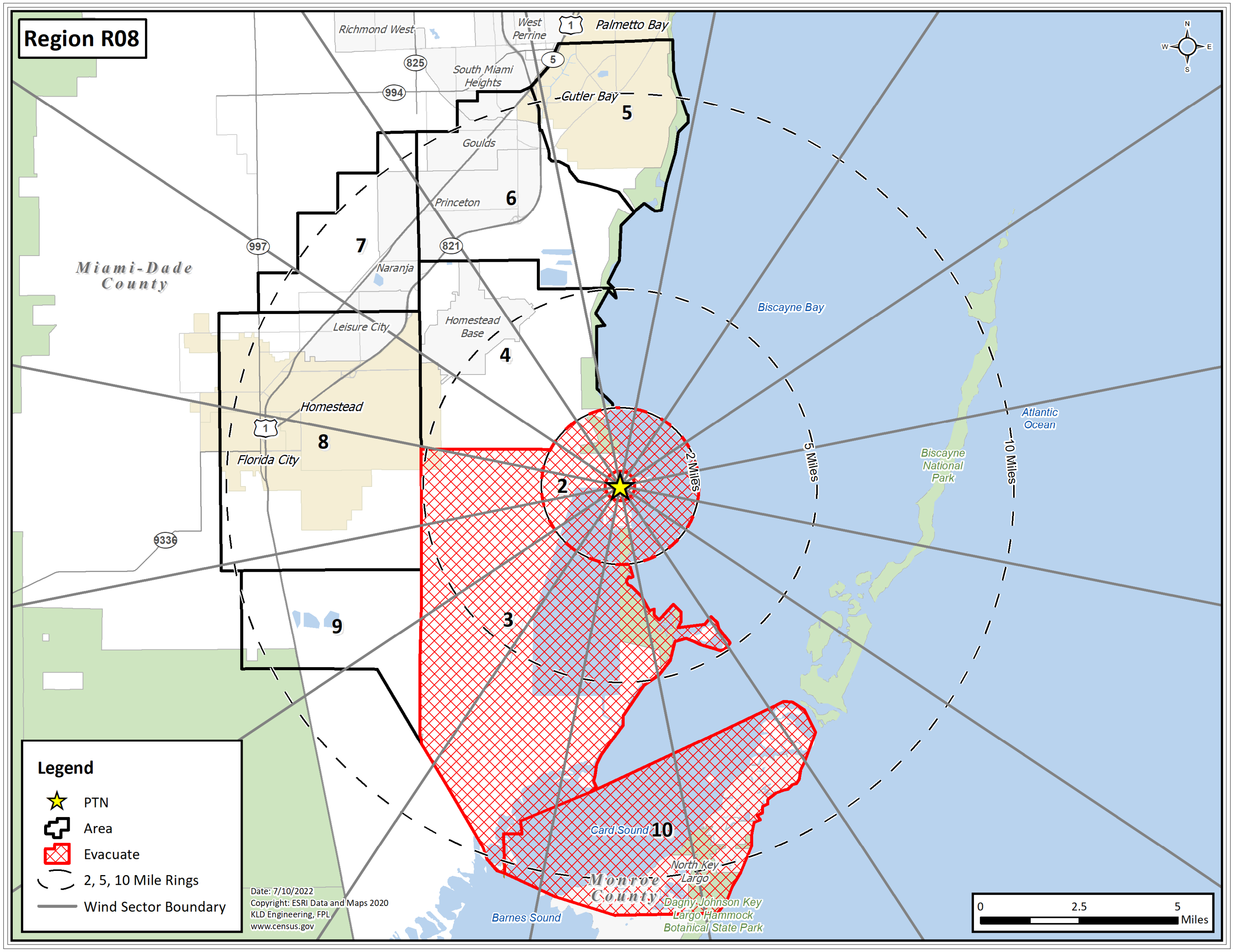

**Figure H-8. Region R08**

# 1 INTRODUCTION

This report describes the analyses undertaken and the results obtained by a study to develop Evacuation Time Estimates (ETE) for the Turkey Point Nuclear Power Plant (PTN), located in Miami-Dade County, Florida. This ETE study provides Florida Power and Light (FPL), state and local governments with specific information needed for Protective Action Decision-making.

In the performance of this effort, guidance is provided by documents published by federal governmental agencies. Most important of these are:

- Title 10, Code of Federal Regulations, Appendix E to Part 50 (10CFR50), Emergency Planning and Preparedness for Production and Utilization Facilities, NRC, 2011
- Revision 1 of the Criteria for Development of Evacuation Time Estimate Studies, NUREG/CR-7002, February 2021.
- FEMA, "Radiological Emergency Preparedness Program Manual" (FEMA P-1028), December 2019.

The work effort reported herein was supported and guided by local stakeholders who contributed suggestions, critiques, and the local knowledge base required. Table 1-1 presents a summary of stakeholders and interactions.

## 1.1 Overview of the ETE Process

The following outline presents a brief description of the work effort in chronological sequence:

1. Information Gathering:
    a. Defined the scope of work in discussions with representatives from FPL.
    b. Attended a project kickoff meeting with emergency planners from Miami-Dade County, Monroe County and the Florida Division of Emergency Management to discuss methodology, project assumptions and to identify resources available.
    c. Conducted a detailed field survey of the highway system and of area traffic conditions within the Emergency Planning Zone (EPZ) and Shadow Region (extends radially from the EPZ boundary to a distance of 15 miles from PTN).
    d. Obtained demographic data from the 2020 Census (see Section 3.1).
    e. Conducted a random sample demographic survey of EPZ residents (see Appendix F).
    f. Estimated the number of non-EPZ employees using data obtained from the US Census Longitudinal Employer-Household Dynamics from the OnTheMap Census analysis tool[1] (see Section 3.4).
    g. Obtained data (to the extent available) to update the database of schools, colleges, medical facilities, correctional facilities, transient attractions, major employers, access and/or functional needs residents, transportation resources available and the special event.

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[1] http://onthemap.ces.census.gov/ ; the latest data available using the OnTheMap census tool is for the year 2019.

2. Estimated distributions of trip generation times representing the time required by various population groups (permanent residents, employees, and transients) to prepare (mobilize) for the evacuation trip and updated where necessary. These estimates are primarily based upon the results of the random sample demographic survey.

3. Defined Evacuation Scenarios. These scenarios reflect the variation in demand, in trip generation distribution and in highway capacities, associated with different seasons, day of week, time of day and weather conditions.

4. Reviewed the existing traffic management plan (Traffic Control Points – TCPs – and Access Control Points – ACPs) to be implemented by local and state police in the event of an incident at the plant. See Section 9 and Appendix G.

5. Used existing Areas to define Evacuation Regions. The EPZ is partitioned into 10 Areas along jurisdictional and geographic boundaries. "Regions" are groups of contiguous Areas for which ETE are calculated. The configurations of these Regions reflect wind direction and the radial extent of the impacted area. Each Region, other than those that approximate circular areas, approximates a "key-hole section" within the EPZ and three adjoining sectors, each with a central angle of 22.5 degrees, as recommended by NUREG/CR-7002, Rev. 1.

6. Estimated demand for transit services for persons at special facilities and for transit-dependent persons at home.

7. Prepared the input streams for the DYNEV II system:
    a. Estimated the evacuation traffic demand, based on the available information derived from Census data, and from data provided by the county agencies, FPL and from the demographic survey.
    b. Applied the procedures specified in the 2016 Highway Capacity Manual (HCM[2]) to the link-node analysis network to estimate the capacity of highway segments comprising the evacuation routes.
    c. Updated the link-node representation of the evacuation network, which is used as the basis for the computer analysis that calculates the ETE.
    d. Calculated the evacuating traffic demand for each Region and for each Scenario.
    e. Specified selected candidate destinations for each "origin" (location of each "source" where evacuation trips are generated over the mobilization time) to support evacuation travel consistent with outbound movement relative to the location of the plant.

8. Executed the DYNEV II system to determine optimal evacuation routing and compute ETE for all residents, transients and employees ("general population") with access to private vehicles. Generated a complete set of ETE for all specified Regions and Scenarios.

9. Documented ETE in formats in accordance with NUREG/CR-7002, Rev. 1.

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[2] Highway Capacity Manual (HCM 2016), Transportation Research Board, National Research Council, 2016.

10. Calculated the ETE for all transit activities including those for special facilities (schools, medical facilities, and correctional facilities), for the transit-dependent population and for the access and/or functional needs population.

## 1.2 The Turkey Point Nuclear Power Plant

The Turkey Point Nuclear Power Plant is located along the shores of Biscayne Bay in Miami-Dade County, Florida. The site is approximately 25 miles south of Miami, FL. The EPZ consists of parts of Miami-Dade and Monroe Counties in Florida. Figure 1-1 displays the area surrounding the PTN, identifying the communities in the area and the major roads.

## 1.3 Preliminary Activities

Field Survey of the Highway Network

In 2021, KLD personnel drove the entire highway system within the EPZ and the shadow region. The characteristics of each section of highway were recorded. These characteristics are listed in Table 1-2.

Video and audio recording equipment were used to capture a permanent record of the highway infrastructure. No attempt was made to meticulously measure such attributes as lane width and shoulder width; estimates of these measures based on visual observation and recorded images were considered appropriate for the purpose of estimating the capacity of highway sections. For example, Exhibit 15-7 in the HCM 2016 indicates that a reduction in lane width from 12 feet (the “base” value) to 10 feet can reduce free flow speed (FFS) by 1.1 mph – not a material difference – for two-lane highways. Exhibit 15-46 in the HCM 2016 shows little sensitivity for the estimates of service volumes at level of service (LOS) E (near capacity), with respect to FFS, for two-lane highways.

The data from the audio and video recordings were used to create detailed geographic information systems (GIS) shapefiles and databases of the roadway characteristics and of the traffic control devices observed during the road survey; this information was referenced while preparing the input stream for the DYNEV II System.

Roadway types were assigned based on the following criteria:

- Freeway: limited access highway, 2 or more lanes in each direction, high free flow speeds
- Freeway Ramp: ramp on to or off of a limited access highway
- Major Arterial: 3 or more lanes in each direction
- Minor Arterial: 2 lanes in each direction
- Collector: single lane in each direction
- Local Roadway: single lane in each direction, local road with low free flow speeds

As documented on page 15-6 of the HCM 2016, the capacity of a two-lane highway is 1,700 passenger cars per hour in one direction. For freeway sections, a value of 2,250 vehicles per hour per lane is assigned, as per Exhibit 12-37 of the HCM 2016. The road survey identified several segments which are characterized by adverse geometrics on two-lane highways which are reflected in reduced values for both capacity and speed. These estimates are consistent with the service volumes for LOS E presented in HCM 2016 Exhibit 15-46. Link capacity is an input to DYNEV II which computes the ETE. Further discussion of roadway capacity is provided in Section 4 of this report.

Traffic signals are either pre-timed (signal timings are fixed over time and do not change with the traffic volume on competing approaches) or are actuated (signal timings vary over time based on the changing traffic volumes on competing approaches). Actuated signals require detectors to provide the traffic data used by the signal controller to adjust the signal timings. These detectors are typically magnetic loops in the roadway or video cameras mounted on the signal masts and pointed toward the intersection approaches. If detectors were observed on the approaches to a signalized intersection during the road survey, detailed signal timings were not collected as the timings vary with traffic volume. TCPs at locations which have control devices are represented as actuated signals in the DYNEV II system.

If no detectors were observed, the signal control at the intersection was considered pre-timed, and detailed signal timings were gathered for several signal cycles. These signal timings were input to the DYNEV II system used to compute ETE, as per NUREG/CR-7002 guidance.

Figure 1-2 presents the link-node analysis network that was constructed to model the evacuation roadway network in the EPZ and shadow region. The directional arrows on the links and the node numbers have been removed from Figure 1-2 to clarify the figure. The detailed figures provided in Appendix K depict the analysis network with directional arrows shown and node numbers provided. The observations made during the field survey were used to calibrate the analysis network.

### Demographic Survey

A demographic survey was undertaken in 2021/2022 to gather information needed for the evacuation study. Appendix F presents the survey instrument, the procedures used, and tabulations of data compiled from the survey responses.

These data were utilized to develop estimates of vehicle occupancy to estimate the number of evacuating vehicles during an evacuation and to estimate elements of the mobilization process. This database was also referenced to estimate the number of transit dependent residents.

### Computing the Evacuation Time Estimates

The overall study procedure is outlined in Appendix D. Demographic data were obtained from several sources, as detailed later in this report. These data were analyzed and converted into vehicle demand data. The vehicle demand was loaded onto appropriate “source” links of the analysis network using GIS mapping software. The DYNEV II system was then used to compute ETE for all regions and scenarios.

### Analytical Tools

The DYNEV II System that was employed for this study is comprised of several integrated computer models. One of these is the DYNEV (DYnamic Network EVacuation) macroscopic simulation model, a new version of the IDYNEV model that was developed by KLD under contract with the Federal Emergency Management Agency (FEMA).

DYNEV II consists of four sub-models:

- A macroscopic traffic simulation model (for details, see Appendix C).
- A trip distribution (TD), model that assigns a set of candidate destination (D) nodes for each “origin” (O) located within the analysis network, where evacuation trips are “generated” over time. This establishes a set of O-D tables.
- A dynamic traffic assignment (DTA), model which assigns trips to paths of travel (routes) which satisfy the O-D tables, over time. The TD and DTA models are integrated to form the DTRAD (Dynamic Traffic Assignment and Distribution) model, as described in Appendix B.
- A myopic traffic diversion model which diverts traffic to avoid intense, local congestion, if possible.

Another software product developed by KLD, named UNITES (UNIfied Transportation Engineering System) was used to expedite data entry and to automate the production of output tables.

The dynamics of traffic flow over the network are graphically animated using the software product, EVAN (EVacuation ANimator), developed by KLD. EVAN is GIS based, and displays statistics such as LOS, vehicles discharged, average speed, and percent of vehicles evacuated, output by the DYNEV II System. The use of a GIS framework enables the user to zoom in on areas of congestion and query road name, town name and other geographical information.

The procedure for applying the DYNEV II System within the framework of developing ETE is outlined in Appendix D. Appendix A is a glossary of terms.

For the reader interested in an evaluation of the original model, I-DYNEV, the following references are suggested:

- NUREG/CR-4873 – Benchmark Study of the I-DYNEV Evacuation Time Estimate Computer Code
- NUREG/CR-4874 – The Sensitivity of Evacuation Time Estimates to Changes in Input Parameters for the I-DYNEV Computer Code

The evacuation analysis procedures are based upon the need to:

- Route traffic along paths of travel that will expedite their travel from their respective points of origin to points outside the EPZ.
- Restrict movement toward the plant to the extent practicable and disperse traffic demand so as to avoid focusing demand on a limited number of highways.
- Move traffic in directions that are generally outbound relative to the location of PTN.

DYNEV II provides a detailed description of traffic operations on the evacuation network. This description enables the analyst to identify bottlenecks and to develop countermeasures that are designed to represent the behavioral responses of evacuees. The effects of these countermeasures may then be tested with the model.

## 1.4 Comparison with Previous ETE Study

Table 1-3 presents a comparison of the present ETE study with the previous (2015) ETE study (KLD TR-793 Rev. 0, dated November 2015). The 90th percentile and the 100th percentile ETE for the full EPZ (Region 3) increased by as much 1 hour and 45 minutes and 1 hour and 15 minutes, respectively. An analysis of potential causes of the increase in ETE is provided below:

- The permanent resident population increased significantly (17%) in this study which could lead to more evacuating vehicles and longer ETE.
- The permanent resident vehicle occupancy decreased by 12% in this study. A lower resident vehicle occupancy results in more evacuating vehicles (resident population divided by resident vehicles occupancy = resident vehicles evacuating). More evacuating vehicles could increase ETE.
- The shadow population did not significantly change; however, the number of evacuating vehicles in the shadow region increased by 12% (resident vehicle occupancy decrease) which could increase the ETE.
- Revision 1 to NUREG/CR-7002 increased the threshold for a major employer from 50 or more employees during the maximum shift to 200 or more employees during the maximum shift. This change was aimed at reducing the double counting of residents as employees. The number of employee vehicles decreased by 34%. A decrease in employee vehicles will decrease the 100th percentile ETE but could also increase the 90th percentile ETE as employee vehicles mobilize quickly and help to reduce the 90th percentile ETE. Less employee vehicles equals less quickly mobilizing vehicles which could lead to longer 90th percentile ETE.
- The transient population in the EPZ decreased by 20% resulting in fewer evacuating transient vehicles. A decrease in transient vehicles will decrease the 100th percentile ETE, but could also increase the 90th percentile ETE as transient vehicles mobilize quickly and help to reduce the 90th percentile ETE. Less transient vehicles equals less quickly mobilizing vehicles which could lead to longer 90th percentile ETE.
- The mobilization time for residents with returning commuters decreased by 2 hour and 45 minutes, while the mobilization time for residents with no returning commuters decreased by 2 hours and 15 minutes. The roadways in the EPZ are highly congested (see Section 7.3) during an evacuation. Reducing the mobilization time causes more vehicles to begin evacuating during peak times (see Section 7.6 and Figure 5-5) which intensifies traffic congestion and could prolong ETE.

The various factors discussed above that can increase ETE outweigh those that can decrease ETE, thereby explaining why the 90th and 100th percentile ETE have significantly increased in this study relative to the 2015 ETE study. The significant increase in permanent resident and shadow population coupled with significantly shorter mobilization times greatly increase traffic congestion and are the most significant contributors to the increase in ETE.

Table 1-1. Stakeholder Interaction

| Stakeholder | Nature of Stakeholder Interaction |
|---|---|
| Florida Power & Light Company | Attended kick-off meetings to define data requirements, set up contacts with local government agencies. Provided recent PTN employee data. Reviewed and approved all project assumptions. Engaged in the ETE development and were informed of the study results. |
| Miami-Dade County and Monroe County Offices of Emergency Management | Attended kick-off meeting to define data requirements and set up contacts with local government agencies. Obtained local emergency plans, traffic management plans, special facility data, and transient data. Reviewed and approved all project assumptions. Engaged in the ETE development and were informed of the study results. |
| Florida Division of Emergency Management | Provided the State of Florida Radiological Emergency Preparedness Annex. Reviewed and approved all project assumptions. Engaged in the ETE development and were informed of the study results. |

Table 1-2. Highway Characteristics

- Number of lanes
- Lane width
- Shoulder type & width
- Interchange geometries
- Lane channelization & queuing capacity (including turn bays/lanes)
- Geometrics: curves, grades (>4%)
- Posted speed
- Actual free speed
- Abutting land use
- Control devices
- Intersection configuration (including roundabouts where applicable)
- Traffic signal type
- Unusual characteristics: Narrow bridges, sharp curves, poor pavement, flood warning signs, inadequate delineations, toll booths, etc.

**Table 1-3. ETE Study Comparisons**

| Topic | Previous ETE Study | Current ETE Study |
|---|---|---|
| **Permanent Residents** | ArcGIS software using 2010 US Census blocks and projecting out to 2015 using 2014 population changes published by the US Census; area ratio method used.<br>Population = 227,910<br>Vehicles = 99,762 | ArcGIS software using 2020 US Census blocks published by the US Census; area ratio method used.<br>Population = 266,019<br>Vehicles = 132,222 |
| **Resident Population Vehicle Occupancy** | 3.13 persons/household, 1.37 evacuating vehicles/household yielding: 2.28 persons/vehicle. | 2.82 persons/household, 1.41 evacuating vehicles/household yielding: 2.00 persons/vehicle. |
| **Shadow Population** | ArcGIS software using 2010 US Census blocks and projecting out to 2015 using 2014 population changes published by the US Census; area ratio method used.<br>20% Population = 37,850<br>20% Vehicles = 16,571 | ArcGIS software using 2020 US Census blocks; area ratio method used.<br>20% Population = 37,833<br>20% Vehicles = 18,488 |
| **Employees** | 1.09 employees per vehicle based on telephone survey results. Employee data obtained from US Census Longitudinal Employer-Household Dynamics tool.<br>Employees = 13,541<br>Employee vehicles = 12,510 | 1.11 employees per vehicle based on demographic survey results. Employee data obtained from US Census Longitudinal Employer-Household Dynamics tool.<br>Employees = 9,102<br>Employee vehicles = 8,199 |
| **Transit-Dependent Population** | Estimates based upon 2010 U.S. Census data and the results of the telephone survey. A total of 9,604 people who do not have access to a vehicle, requiring 321 buses to evacuate.<br>An additional 207 people with access and/or functional needs for special transportation to evacuate (117 required a bus, 57 required a wheelchair-accessible vehicle, and 33 required an ambulance). | Estimates based upon 2020 U.S. Census data and the results of the demographic survey. A total of 6,078 people who do not have access to a vehicle, requiring 206 buses to evacuate.<br>An additional 268 people with access and/or functional needs for special transportation to evacuate (19 required a bus, 107 required a wheelchair-accessible vehicle, and 142 required an ambulance). |

| Topic | Previous ETE Study | Current ETE Study |
|---|---|---|
| **Transient Population** | Transient estimates based upon information provided by the EPZ counties about transient attractions in the EPZ, supplemented by phone calls to the facilities and from aerial photography.<br>Transients = 32,264<br>Transient Vehicles = 13,050 | Transient estimates based upon information provided by the EPZ counties about transient attractions in the EPZ, supplemented by phone calls to the facilities and from aerial photography.<br>Transients = 27,813<br>Transient Vehicles = 10,429 |
| **Medical and Correctional Facilities** | Medical facility population based on information provided by each county within the EPZ.<br>Current census = 1,367<br>Buses Required = 93<br>Wheelchair Buses Required = 73<br>Ambulances Required = 49<br>Correctional facilities not considered. | Medical facility population based on information provided by each county within the EPZ.<br>Current census = 2,369<br>Buses Required = 141<br>Wheelchair Buses Required = 108<br>Ambulances Required = 66<br>Correctional Facilities:<br>Inmate Population = 100<br>Buses required = 4 |
| **Schools** | School population based on information provided by each county within the EPZ.<br>School enrollment = 43,618<br>Buses required = 693 | School population (including commuter colleges) based on information provided by each county within the EPZ.<br>School enrollment = 55,227<br>Buses required = 799<br>Personal vehicles (college) = 720 |
| **External Traffic** | US-1, Florida Turnpike, Don Shula Expressway<br>6,312 vehicles | US-1, Florida Turnpike, Don Shula Expressway<br>7,274 vehicles |
| **Voluntary evacuation from within EPZ in areas outside region to be evacuated** | 20% of the population within the EPZ, but not within the evacuation region (see Figure 2-1) | 20% of the population within the EPZ, but not within the evacuation region (see Figure 2-1) |
| **Shadow Evacuation** | 20% of people outside of the EPZ within the shadow region<br>(see Figure 7-2) | 20% of people outside of the EPZ within the shadow region<br>(see Figure 7-2) |
| **Network Size** | 1,581 links; 827 nodes | 1,964 links; 1024 nodes |

| Topic | Previous ETE Study | Current ETE Study |
|---|---|---|
| **Roadway Geometric Data** | Field surveys conducted in June 2015. Roads and intersections were video archived.<br>Road capacities based on 2010 HCM. | Field surveys conducted in February 2021. Roads and intersections were video archived.<br>Road capacities based on 2016 HCM. |
| **School Evacuation** | Direct evacuation to designated reception center/host school. | Direct evacuation to designated reception center/host school. |
| **Ridesharing** | 50% of transit-dependent persons will evacuate with a neighbor, relative or friend per federal guidance | 67% of transit-dependent persons will evacuate with a neighbor, relative or friend per demographic survey results. |
| **Trip Generation (Mobilization Time) for Evacuation** | Based on residential telephone survey of specific pre-trip mobilization activities:<br>Residents with commuters returning leave between 30 minutes and 8 hours.<br>Residents without commuters returning leave between 5 minutes and 6 hours and 30 minutes.<br>Employees and transients leave between 5 minutes and 2 hours<br>All times measured from the advisory to evacuate. | Based on demographic survey of specific pre-trip mobilization activities:<br>Residents with commuters returning leave between 30 minutes and 5 hours 15 minutes.<br>Residents without commuters returning leave between 5 minutes and 4 hours.<br>Employees and transients leave between 15 minutes and 2 hours and 15 minutes<br>All times measured from the advisory to evacuate. |
| **Weather** | Normal, or Rain. The capacity and free flow speed of all links in the network are reduced by 10% in the event of rain. | Normal, or Rain. The capacity and free flow speed of all links in the network are reduced by 10% in the event of rain. |
| **Modeling** | DYNEV II System – Version 4.0.19.2 | DYNEV II System – Version 4.0.21.0 |
| **Special Events** | NASCAR Race at Homestead-Miami Speedway<br>Special event population = 100,000 additional transients<br>32,600 vehicles | NASCAR Race at Homestead-Miami Speedway<br>Special event population = 100,000 additional transients<br>32,600 vehicles |
| **Evacuation Cases** | 27 regions (central sector wind direction and each adjacent sector technique used) and 12 scenarios producing 324 unique cases. | 17 regions (central sector wind direction and each adjacent sector technique used) and 12 scenarios producing 204 unique cases. |
| **Evacuation Time Estimates Reporting** | ETE reported for 90th and 100th percentile population. Results presented by region and scenario. | ETE reported for 90th and 100th percentile population. Results presented by region and scenario. |

| Topic | Previous ETE Study | Current ETE Study |
|---|---|---|
| **Evacuation Time Estimates for the entire EPZ, (Region R03), 90th Percentile** | Winter, Midweek, Midday,<br>Good Weather (Scenario 6): 7:15<br>Summer, Weekend, Midday,<br>Good Weather (Scenario 3): 6:25 | Winter, Midweek, Midday,<br>Good Weather (Scenario 6): 8:25<br>Summer, Weekend, Midday,<br>Good Weather (Scenario 3): 7:55 |
| **Evacuation Time Estimates for the entire EPZ, (Region R03), 100th Percentile** | Winter, Midweek, Midday,<br>Good Weather (Scenario 6): 10:30<br>Summer, Weekend, Midday,<br>Good Weather (Scenario 3): 9:35 | Winter, Midweek, Midday,<br>Good Weather (Scenario 6): 10:50<br>Summer, Weekend, Midday,<br>Good Weather (Scenario 3): 10:50 |

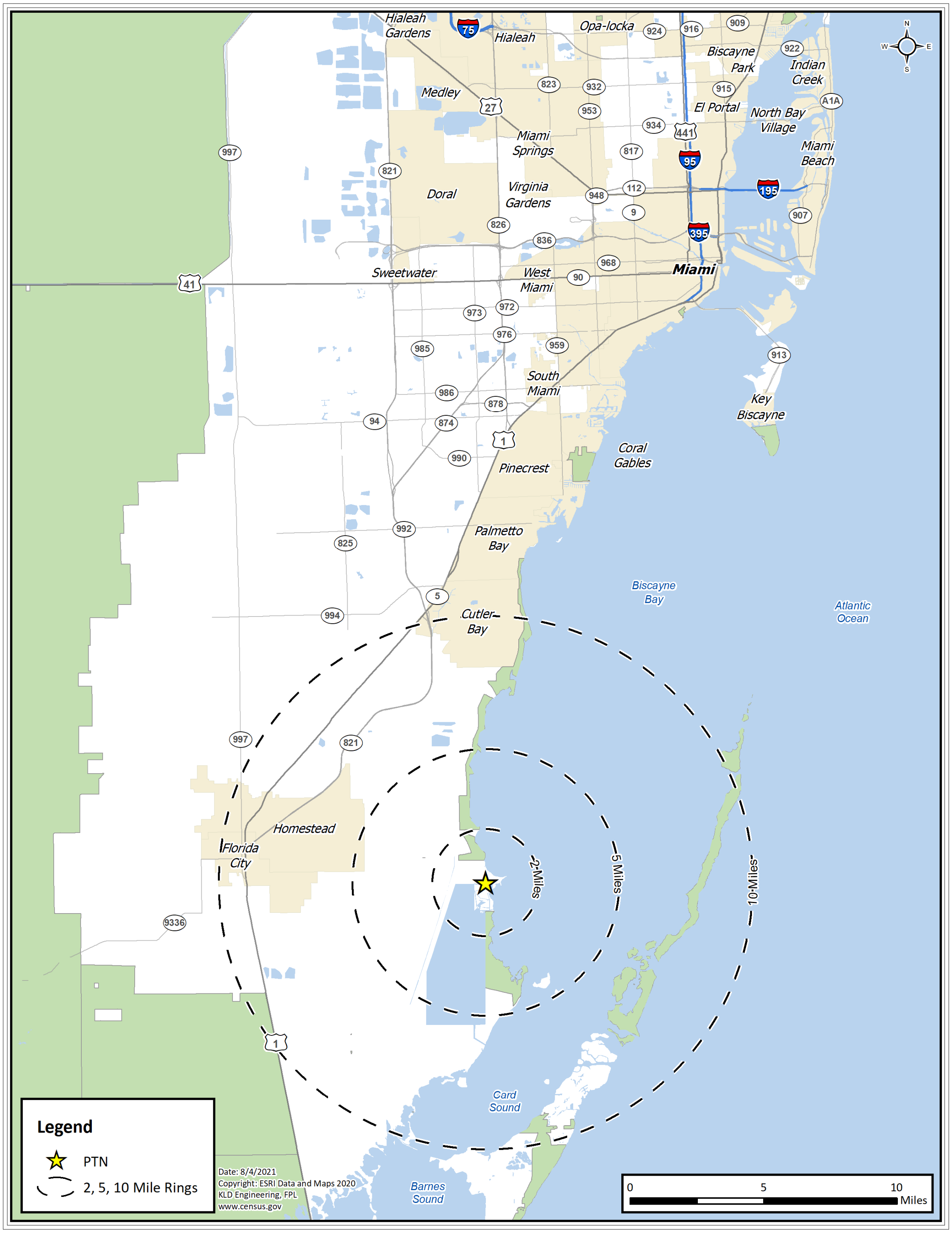

Figure 1-1. PTN Location

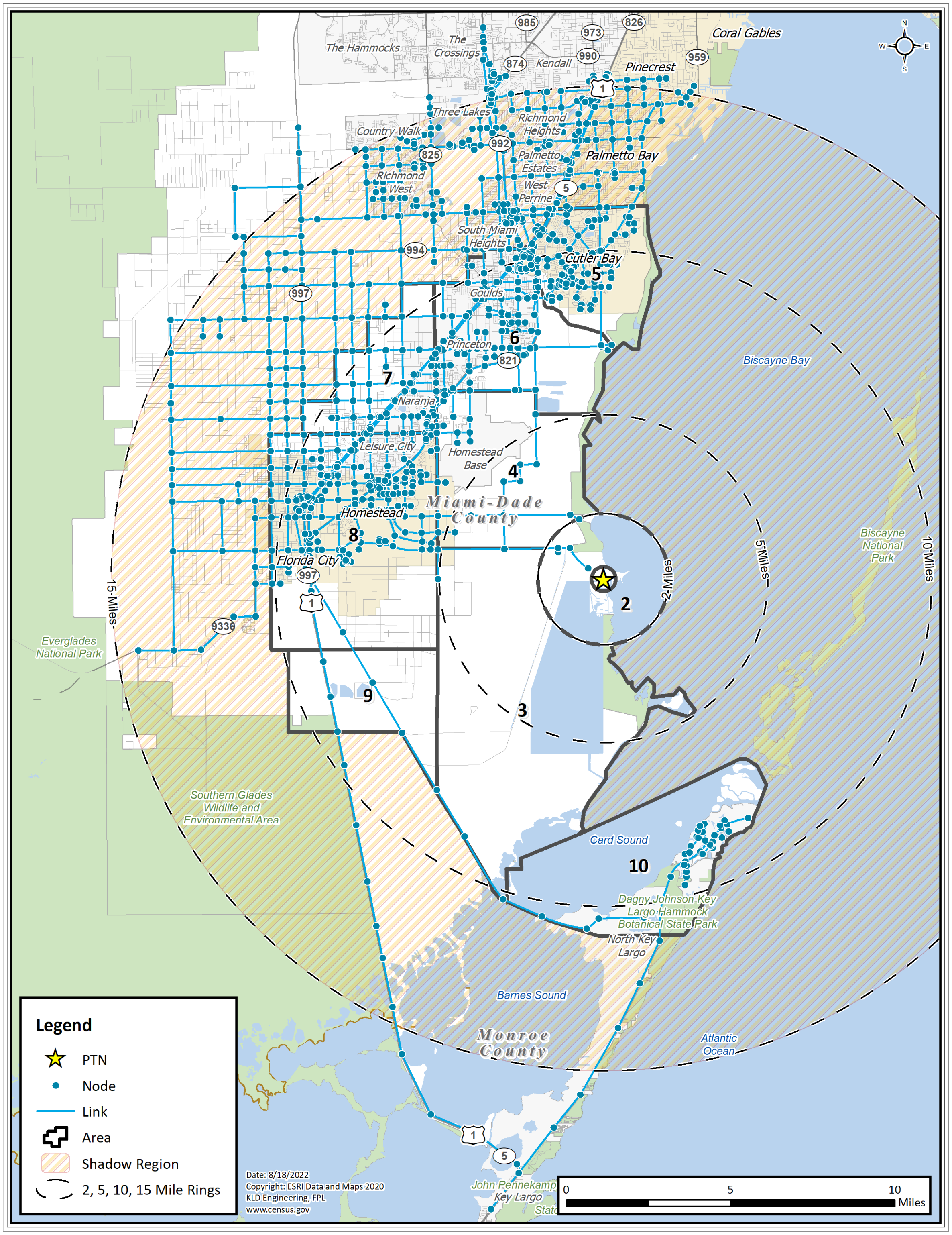

Figure 1-2. PTN Link-Node Analysis Network

# 2 STUDY ESTIMATES AND ASSUMPTIONS

This section presents the estimates and assumptions utilized in the development of the ETE.

## 2.1 Data Estimate Assumptions

1. The permanent resident population are based on the 2020 U.S. Census population from the Census Bureau website[1]. A methodology, referred to as the "area ratio method", is employed to estimate the population within portions of census blocks that are divided by Area boundaries. It is assumed that the population is evenly distributed across a census block in order to employ the area ratio method (See Section 3.1.)
2. Estimates of employees who reside outside the EPZ and commute to work within the EPZ are estimated based upon data obtained from the US Census Longitudinal Employer-Household Dynamics OnTheMap Census analysis tool[2], supplemented with data provided by FPL and by the Ocean Reef Club (ORC) Association (see Section 3.4).
3. Population estimates at transient and special facilities are based on the data received from the county emergency management agencies, ORC Association, supplemented with phone calls, aerial imagery, and internet searches where data was missing.
4. The relationship between permanent resident population and evacuating vehicles was based on the results of the online demographic survey (see Appendix F). Values of 2.82 persons per household and 1.41 evacuating vehicles per household are used for permanent resident population.
5. Seasonal Transient Population are seasonal residents that enter the EPZ during the winter months and stay considerably longer than the standard transient. The primary source for estimating seasonal transient population is the 2020 Census of Population and Housing. The U.S. Census Bureau[1] provides the number of vacant housing units at the Census block level. An average household size of 2.82 persons per household are multiplied by the number of vacant housing units to determine the seasonal transient population, and 1.41 evacuating vehicles per seasonal household are used to determine the number of seasonal transient vehicles.
6. The average household size will be assumed to be the vehicle occupancy rate for transient facilities where vehicle data was not provided.
7. Employee vehicle occupancies are based on the results of the demographic survey; 1.11 employees per vehicle are used in the study (see Appendix F, sub-section F.3.1 and Figure F-10). In addition, it is assumed there are two people per carpool, on average.
8. The maximum bus speed assumed within the EPZ is 45 mph based on Florida State laws[3] for buses and average posted speed limits on major roadways within the EPZ.

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[1] www.census.gov

[2] http://onthemap.ces.census.gov/

[3] http://www.leg.state.fl.us/statutes/index.cfm?mode=View%20Statutes&SubMenu=1&App_mode=Display_Statute&Search_String=s

9. Roadway capacity estimates are based on field surveys performed in February 2021 (verified by aerial imagery), and the application of the Highway Capacity Manual 2016.
    a. In accordance with NUERG/CR-7002, Rev. 1, only those roadway construction projects that will be completed prior to the finalization of the report will be considered in this study. Based on discussions with FPL and the county emergency management agencies, no roadway improvement projects will be considered for this study.

## 2.2 Methodological Assumptions

1. The Planning Basis assumption for the calculation of ETE is a rapidly escalating accident that requires evacuation, and includes the following[4] (as per NRC guidance):
    a. The Advisory to Evacuate (ATE) is announced coincident with the Alert and Notification system.
    b. Mobilization of the general population will commence within 15 minutes after the notification.
    c. ETE are measured relative to the ATE.
2. The center-point of the plant is located at the geometric center of the containment buildings for Units 1 and 2 at 25°26'04.2" N and 80°19'51.8" W.
3. The DYNEV II[5] system is used to compute ETE in this study.
4. Evacuees will drive safely, travel radially away from the plant to the extent practicable given the highway network, and obey all traffic control devices and traffic guides. All major evacuation routes are used in the analysis.
5. The existing EPZ and Area boundaries are used. See Figure 3-1.
6. The Shadow Region extends to 15 miles radially from the plant or approximately 5 miles radially from the EPZ boundary, as per NRC guidance. See Figure 7-2.
7. One hundred percent (100%) of the people within the impacted keyhole will evacuate. Twenty percent (20%) of the population within the Shadow Region and within Areas of the EPZ not advised to evacuate will voluntarily evacuate, as shown in Figure 2-1, as per NRC guidance. Sensitivity studies explore the effect on ETE of increasing the percentage of voluntary evacuees in the Shadow Region (see Appendix M).

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peed+limit&URL=0300-0399/0316/Sections/0316.183.html

[4] It is emphasized that the adoption of this planning basis is not a representation that these events will occur within the indicated time frame. Rather, these assumptions are necessary in order to:
1. Establish a temporal framework for estimating the Trip Generation distribution in the format recommended in Section 2.13 of NUREG/CR-6863.
2. Identify temporal points of reference that uniquely define "Clear Time" and ETE.

It is likely that a longer time will elapse between the various stages of an emergency.

[5] The models of the I-DYNEV System were recognized as state of the art by the Atomic Safety & Licensing Board (ASLB) in past hearings. (Sources: Atomic Safety & Licensing Board Hearings on Seabrook and Shoreham; Urbanik). The models have continuously been refined and extended since those hearings and were independently validated by a consultant retained by the NRC. The DYNEV II model incorporates the latest technology in traffic simulation and in dynamic traffic assignment.

8. Shadow population characteristics (household size, evacuating vehicles per household, and mobilization time) are assumed to be the same as that of the permanent resident population within the EPZ.

9. The ETE are presented at the 90th and 100th percentiles in graphical and tabular format, as per NRC guidance. The percentile ETE is defined as the elapsed time from the ATE issued to a specific Region of the EPZ to the time that Region is clear of the indicated percentile of evacuees.

10. This study does not assume that roadways are empty at the start of the evacuation. Rather, there is an initialization period (often referred to as "fill time" in traffic simulation) wherein the anticipated traffic volumes from the beginning of the evacuation are loaded onto roadways in the study area. The amount of initialization/fill traffic that is on the roadways in the study area at the start of the evacuation depends on the scenario and the region being evacuated. See Section 3.12.

11. To account for boundary conditions (roadway conditions outside the study area that are not specifically modeled due to the limited radius of the study area) beyond the study area, this study assumes a 25% reduction in capacity on two-lane roads and multi-lane highways for roadways that have traffic signals downstream. The 25% reduction in capacity is based on the prevalence of actuated traffic signals in the study area and the fact that the evacuating traffic ("main street") volume will be more significant than the competing ("side street") traffic volume at any downstream signalized intersections, thereby warranting a more significant percentage (75% in this case) of the signal green time. There is no reduction in capacity for freeways due to boundary conditions.

12. The ETE also include consideration of "through" (External-External traffic that originates its trips outside of the study area and has its destination outside the study area) trips during the time that such traffic is permitted to enter the evacuated Region (see Section 3.11).

## 2.3 Assumptions on Mobilization Times

1. Trip generation time (also known as mobilization time, or the time required by evacuees to prepare for the evacuation) is based upon the results of the online demographic survey (See Section 5 and Appendix F). It is assumed that stated events take place in sequence such that all preceding events must be completed before the current event can occur.

2. One hundred percent (100%) of the EPZ population can be notified within 45 minutes, in accordance with the 2019 Federal Emergency Management Agency (FEMA) Radiological Emergency Preparedness Program Manual.

3. Commuter percentages (and percentage of residents awaiting the return of a commuter) are based on the results of the demographic survey. According to the survey results, 59% of the households in the EPZ have at least 1 commuter; 54% of those households with commuters will await the return of a commuter before beginning their evacuation trip

(see Section F.3.2.). Therefore, 32% percent (59% x 54% = 32%) of EPZ households will await the return of a commuter, prior to beginning their evacuation trip.

## 2.4 Transit Dependent Assumptions

1. The percentage of transit-dependent people who will rideshare with a neighbor, relative or friend is based on the results of the demographic survey. According to the survey results, 67% of the transit-dependent population will rideshare.
2. Transit vehicles are used to transport those without access to private vehicles:
    a. Schools
        i. If schools are in session, transport (buses) will evacuate students directly to the designated host schools or reception centers.
        ii. For the schools that are evacuated via buses, it is assumed no children will be picked up by their parents prior to the arrival of the buses.
        iii. It is assumed parents will pick up children at preschools and day care centers prior to evacuation and buses for these facilities will not be considered in the ETE study.
        iv. Schoolchildren, if school is in session, are given priority in assigning transit vehicles.
    b. Medical Facilities
        i. Florida state law requires medical facilities to have a comprehensive emergency management plan (CEMP) which identifies mutual aid agreements, emergency resources, and transportation needs for an emergency which will require a possible evacuation of the residents to a similar facility outside of the area to be evacuated. As such, buses, wheelchair vans and ambulances (provided by or contracted by the medical facilities) will evacuate patients at medical facilities.
    c. Transit-dependent permanent residents:
        i. Transit-dependent (do not own or have access to a private vehicle) general population are evacuated to reception centers.
        ii. Access and/or functional needs population may require county assistance (ambulance, bus or wheelchair transport) to evacuate. This is considered separately from the general population ETE, as per NRC guidance.
        iii. Households with 3 or more vehicles were assumed to have no need for transit vehicles.
    d. Correctional Facilities:
        i. Inmates at detention centers (Miami-Dade Police Department and Dade Juvenile Residential Facility) are evacuated to the Miami-Dade County Intake Facility.
    e. Analysis of the number of required round-trips ("waves") of evacuating transit vehicles is presented.
    f. Transport of transit-dependent evacuees from reception centers to permanent shelters is not considered in this study.

3. Transit vehicle capacities:
    a. School buses = 70 students per bus for elementary schools and 50 students per bus for middle/high schools
    b. Ambulatory transit-dependent persons and medical facility patients = 30 persons per bus
    c. Ambulances = 1 person
    d. Wheelchair buses = 15 persons
4. Transit vehicles mobilization times:
    a. School buses will arrive at schools to be evacuated 105 minutes after the ATE.
    b. Transit dependent buses are mobilized when approximately 90% of residents with no commuters have completed their mobilization at 150 minutes after the ATE. If necessary, multiple waves of buses will be utilized to pick up transit dependent people who mobilize more slowly.
    c. Vehicles will arrive at hospitals, medical facilities, and senior living facilities to be evacuated 90 minutes after the ATE.
    d. Buses will arrive at correctional facilities to be evacuated 90 minutes after the ATE.
5. Transit Vehicle loading times:
    a. School buses are loaded in 15 minutes.
    b. Transit Dependent buses require 1 minute of loading time per passenger.
    c. Ambulances are loaded in 15 minutes.
    d. Buses for medical facilities require 1 minute of loading time per ambulatory passenger.
    e. Wheelchair transport vehicles require 5 minutes of loading time per passenger.
    f. Concurrent loading on multiple buses/transit vehicles is assumed.
6. Drivers for all transit vehicles are available.

## 2.5 Traffic and Access Control Assumptions

1. Traffic Control Points (TCP) as defined in the approved county and state emergency plans are considered in the ETE analysis, as per NRC guidance. TCP will be staffed overtime, beginning at the ATE. Their number and location will depend on the Region to be evacuated and resources available. See Appendix G.

2. All the transit vehicles and other responders entering the EPZ to support the evacuation are unhindered by personnel staffing TCPs.

3. External traffic will utilize Don Shula Expressway, Florida Turnpike and US-1 to pass through the EPZ. Access Control Points (ACPs) will be activated (through the use of roadblocks and barricades strategically positioned outside of the EPZ at logical diversion points to attempt to divert traffic away from the area at risk) at 120 minutes after the ATE. It is assumed that no external traffic will enter the EPZ after this 120-minute time period.

## 2.6 Scenarios and Regions

1. A total of 12 “Scenarios” representing different temporal variations (season, time of day, day of week) and weather conditions are considered. Scenarios to be considered are defined in Table 2-1. Two special scenarios are considered in accordance with federal guidance:
   a. A NASCAR race at the Homestead-Miami Speedway, located in Area 8, is considered as the special event (single or multi-day event that attracts a significant population into the EPZ) for Scenario 11.
   b. One of the top 5 highest volume roadways must be closed or one lane outbound on a freeway must be closed for a roadway impact scenario. This study considers the closure of one lane on the Florida Turnpike northbound from the interchange with US-1 in Florida City to the interchange with Don Shula Expressway as the roadway impact scenario for Scenario 12.
2. One type of adverse weather scenario is considered. Rain may occur for either winter or summer scenarios. It is assumed that the rain begins at about the same time the evacuation advisory is issued. Thus, no weather-related reduction in the number of transients who may be present in the EPZ is assumed. It is assumed that roads are passable albeit at lower speeds and capacities.
3. Adverse weather scenarios affect roadway capacity and the free flow highway speeds. Transportation research indicates capacity and speed reductions of about 10% for rain The capacity and free flow speed are reduced by 10% for rain for this study, in accordance with NUREG/CR-7002, Rev. 1. The factors are shown in Table 2-2.
4. Mobilization and loading times for transit vehicles are slightly longer in adverse weather. Mobilization times are 10 minutes longer in rain. Loading times are 5 minutes longer in rain for school buses and 10 minutes longer in rain for transit buses. Refer to Table 2-2.
5. Employment is reduced slightly (4% reduction) in the summer for vacations.
6. Regions are defined by the underlying “keyhole” or circular configurations as specified in Section 1.4 of NUREG/CR-7002, Rev. 1, in the PAR procedure provided by FPL, and in the Protective Action Decision (PAD) procedure provided by Miami-Dade County. These Regions, as defined, display irregular boundaries reflecting the geography of the Areas included within these underlying configurations. All 16 cardinal and intercardinal wind direction keyhole configurations are considered. Three adjoining sectors (as per federal guidance and as per the PAR) are considered with the central sector defined by the wind direction and one adjoining sector on either side. The Regions to be considered are defined in Table 6-1. Everyone within the group of Areas forming a Region that is issued an ATE will, in fact, respond and evacuate in general accord with the planned routes.
7. Due to the irregular shapes of the Areas, there are instances where a small portion of an Area (a “sliver”) is within the keyhole and the population within that small portion is low (less than 500 people or 10% of the Area population, whichever is less). Under those circumstances, the Area is not included in the Region so as to not evacuate large

numbers of people outside of the keyhole for a small number of people that are actually in the keyhole, unless otherwise stated in FPL PAR or Miami-Dade County PAD procedures.

8. Only those residents of Areas 9 and 10 are routed southbound on Route 1 out of the EPZ. All other EPZ residents are routed northbound out of the EPZ.
9. Staged evacuation is considered as defined in NUREG/CR-7002, Rev. 1 – those people between the 2-Mile Region and 5-Mile Region will shelter-in-place until 90% of the 2-Mile Region has evacuated, then they will evacuate. See Regions R15 through R17 in Table 6-1.

**Table 2-1. Evacuation Scenario Definitions**

| Scenarios | Season[6] | Day of Week | Time of Day | Weather | Special |
|---|---|---|---|---|---|
| 1 | Summer | Midweek | Midday | Good | None |
| 2 | Summer | Midweek | Midday | Rain | None |
| 3 | Summer | Weekend | Midday | Good | None |
| 4 | Summer | Weekend | Midday | Rain | None |
| 5 | Summer | Midweek, Weekend | Evening | Good | None |
| 6 | Winter | Midweek | Midday | Good | None |
| 7 | Winter | Midweek | Midday | Rain | None |
| 8 | Winter | Weekend | Midday | Good | None |
| 9 | Winter | Weekend | Midday | Rain | None |
| 10 | Winter | Midweek, Weekend | Evening | Good | None |
| 11 | Winter | Weekend | Midday | Good | NASCAR Race at Homestead-Miami Speedway |
| 12 | Summer | Midweek | Midday | Good | One Lane Closed on Florida Turnpike Northbound |

**Table 2-2. Model Adjustment for Adverse Weather**

| Scenario | Highway Capacity* | Free Flow Speed* | Mobilization Time for General Population | Mobilization Time for Transit Vehicles | Loading Time for Transit Buses | Loading Time for School Buses |
|---|---|---|---|---|---|---|
| Rain | 90% | 90% | No Effect | 10-minute increase | 10-minute increase | 5-minute increase |
| *Adverse weather capacity and speed values are given as a percentage of good weather conditions. Roads are assumed to be passable. | | | | | | |

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[6] Winter means that school is in session at normal enrollment levels (also applies to spring and autumn). Summer means that school is in session at summer school enrollment levels (lower than normal enrollment).

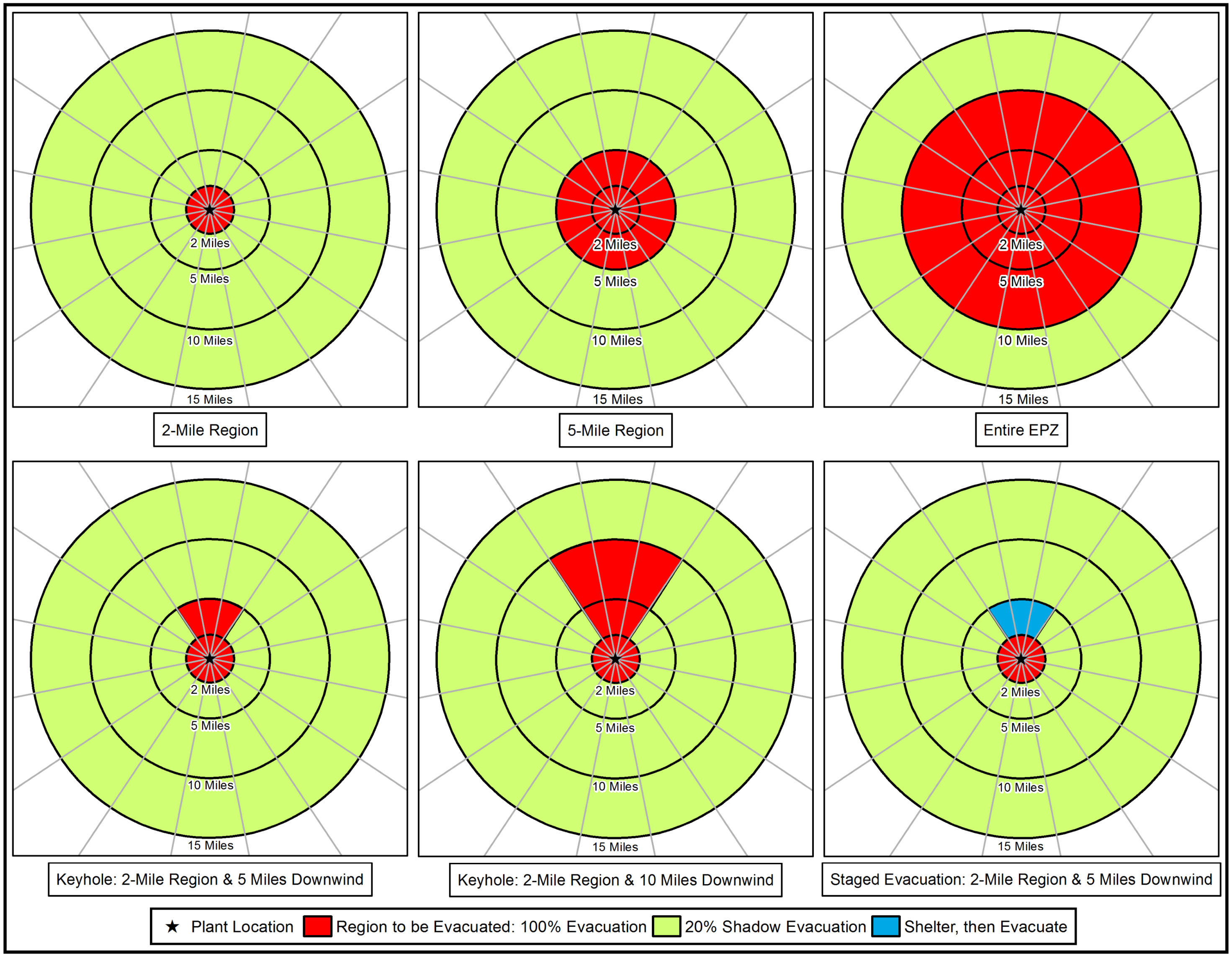

Figure 2-1. Voluntary Evacuation Methodology

# 3 DEMAND ESTIMATION

The estimates of demand, expressed in terms of people and vehicles, constitute a critical element in developing an evacuation plan. These estimates consist of three components:

1. An estimate of population within the EPZ, stratified into groups (e.g., resident, employee, transient, special facilities, etc.).
2. An estimate, for each population group, of mean occupancy per evacuating vehicle. This estimate is used to determine the number of evacuating vehicles.
3. An estimate of potential double-counting of vehicles.

Appendix E presents much of the source material for the population estimates. Our primary source of population data, the 2020 Census, is not adequate for directly estimating some transient groups.

Throughout the year, vacationers and tourists enter the EPZ. These non-residents may dwell within the EPZ for a short period (e.g., a few days or one or two weeks), or may enter and leave within one day. Estimates of the size of these population components must be obtained, so that the associated number of evacuating vehicles can be ascertained.

The potential for double-counting people and vehicles must be addressed. For example:

- A resident who works and shops within the EPZ could be counted as a resident, again as an employee and once again as a shopper.
- A visitor who stays at a hotel and spends time at a park, then goes shopping could be counted three times.

Furthermore, the number of vehicles at a location depends on time of day. For example, motel parking lots may be full at dawn and empty at noon. Similarly, parking lots at area parks, which are full at noon, may be almost empty at dawn. Estimating counts of vehicles by simply adding up the capacities of different types of parking facilities will tend to overestimate the number of transients and can lead to ETE that are too conservative.

Analysis of the population characteristics of the PTN EPZ indicates the need to identify three distinct groups:

- Permanent residents - people who are year-round residents of the EPZ.
- Transients - people who reside outside of the EPZ who enter the area for a specific purpose (shopping, recreation) and then leave the area. Transients also include seasonal residents who may spend several weeks or months in the EPZ.
- Employees - people who reside outside of the EPZ and commute to work within the EPZ on a daily basis.

Estimates of the population and number of evacuating vehicles for each of the population groups are presented for each Area and by polar coordinate representation (population rose). The PTN EPZ is subdivided into 10 Areas. The Areas comprising the EPZ are shown in Figure 3-1.

## 3.1 Permanent Residents

The primary source for estimating permanent population is the 2020 U.S. Census data with an availability date of September 16, 2021. The average household size (2.82 persons/household – See Appendix F, Sub-section F.3.1) and the number of evacuating vehicles per household (1.41 vehicles/household – See Appendix F, Sub-section F.3.2) were adapted from the demographic survey.

The permanent resident population is estimated by cutting the census block polygons by Area and EPZ boundaries using GIS software. A ratio of the original area of each census block and the updated area (after cutting) is multiplied by the total block population to estimate the population within the EPZ. The methodology (referred to as the "area ratio method") assumes that the population is evenly distributed across a census block. Table 3-1 provides the permanent resident population within the EPZ, by Area, for 2010 and 2020 (based on the methodology above). As indicated, the permanent resident population within the EPZ has increased by 28.93% since the 2010 Census.

To estimate the number of vehicles, the year 2020 permanent resident population is divided by the average household size and then multiplied by the average number of evacuating vehicles per household. Permanent resident population and vehicle estimates are presented in Table 3-2. Figure 3-2 and Figure 3-3 present the permanent resident population and permanent resident vehicle estimates by sector and distance from the PTN. This "rose" was constructed using GIS software. Note, the 2020 Census includes residents living in group quarters, such as skilled nursing facilities, group homes, college/university student housing, prisons, etc. These people are transit dependent (will not evacuate in personal vehicles) and are included in the special facility evacuation demand estimates. To avoid double counting vehicles, the vehicle estimates for these people have been removed. The resident vehicles in Table 3-2 and Figure 3-3 have been adjusted accordingly.

### 3.1.1 Homestead Air Reserve Base (Homestead ARB)

Homestead ARB is located in Area 4, northwest of the PTN. This base employs over 3,200 full-time and part-time employees who live in the Homestead and South Dade communities, including 1,300 Air Force reservists who drill monthly at the base[1]. The full-time employees are already counted as permanent residents as the Homestead and South Dade communities are within the EPZ. The 2020 Census indicates no military personnel live on the installation. As documented in the previous ETE study, many reservists stay off base in Homestead and Florida City during monthly unit training assemblies. As indicated in Table E-5, approximately 11,300 transients (approximately 4,500 of which are in Monroe County at Ocean Reef Club) have already been accounted for at lodging facilities within the PTN EPZ. Therefore, the transient reservists training at Homestead ARB are also accounted for in this study.

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[1] https://www.homestead.afrc.af.mil/About-Us/Fact-Sheets/Display/Article/700488/homestead-air-reserve-base-economic-impact/

## 3.2 Shadow Population

A portion of the population living outside the evacuation area extending to 15 miles radially from the PTN may elect to evacuate without having been instructed to do so. This area is called the Shadow Region. Based upon NUREG/CR-7002, Rev. 1 guidance, it is assumed that 20 percent of the permanent resident population, based on U.S. Census Bureau data, in the Shadow Region will elect to evacuate.

Shadow population characteristics (household size, evacuating vehicles per household, mobilization time) are assumed to be the same as that for the EPZ permanent resident population. Table 3-3, Figure 3-4 and Figure 3-5 present estimates of the shadow population and vehicles, by sector. Similar to the EPZ resident vehicle estimates, resident vehicles at group quarters have been removed from the shadow population vehicle demand in Table 3-3 and Figure 3-5.

## 3.3 Transient Population

Transient population groups are defined as those people (who are not permanent residents, nor commuting employees) who enter the EPZ for a specific purpose (shopping, recreation). Transients may spend less than one day or stay overnight at camping facilities, hotels and motels. Data for these facilities were provided by Miami-Dade County and by Monroe County. Where data was not provided, the number of transient vehicles was estimated based on the parking lot capacity or accommodation capacity obtained from aerial imagery and facility websites. It is assumed that transients would travel to the recreational areas and facilities as a family/household. As such, the average household size (2.82 – See Section 3.1) was used to estimate the transient population for those facilities in which exact data could not be obtained. The transient attractions, within the PTN study area, are summarized as follows:

- Camp Owaissa Bauer – 150 transients and 3 buses; 50 transients per bus (Note, campers at Camp Owaissa Bauer will be evacuated by buses which are represented as two vehicles in the ETE simulations due to their larger size and more sluggish operating characteristics.)
- Marinas – 4,613 transients and 1,371 vehicles; 3.36 transients per vehicle
- Parks – 6,715 transients and 2,649 vehicles; 2.53 transients per vehicle
- Other Recreational Facilities – 5,071 transients and 1,586 vehicles; 3.20 transients per vehicle
- Lodging Facilities – 6,828 transients and 2,274 vehicles; 3.00 transients per vehicle

### 3.3.1 Ocean Reef Club (ORC) Transient Population

The ORC is a private club community in Key Largo that offers rental homes and lodging facilities for transients. It is located in Area 10, south-southeast of the PTN. According to the ORC Association Department of Public Safety, the ORC has an estimate of 5,000 residents, including 1,187 year-round residents who have been included in the 2020 Census. To avoid double counting transient vehicles, the permanent residents were removed from the data. The remaining 3,813 (5,000 – 1,187) people are considered seasonal residents in this study. In addition, the ORC Association states there are 623 guests staying at rental homes and hotels. In total, the ORC contributes 4,436 (3,813 + 623) additional transients to the EPZ transient population.

The distribution of the transients at the ORC is based on 2020 Census block data. Each census block includes information regarding the number of vacant and occupied households. The transients in each census block were estimated using the total number of transients (4,436) multiplied by the ratio of vacant housing units in each census block to the total vacant housing units in the ORC.

To estimate the seasonal resident vehicles, the average household size and the number of evacuating vehicles per household were first computed using the Monroe County portion of demographic survey results. Then, these values (2.10 persons/household and 1.24 vehicles/household – See Appendix F, Sub-sections F.3.1 and F.3.2) were applied to the seasonal residents in each census block, resulting in a total of 2,248 transient vehicles.

Regarding the additional 623 transients staying at the rental homes and hotels, it is assumed that these transients travel as a family/household in one vehicle per household. Applying the average household size above (2.10) to the transients in each census block, there are 295 vehicles for the additional transients. A total of 4,436 transients and 2,543 (2,248 + 295) transient vehicles were assigned to the ORC.

Appendix E summarizes the transient data that was estimated for the PTN study area. Table E-4 presents the number of transients visiting recreational areas, while Table E-5 presents the number of transients at lodging facilities within the EPZ. As shown in the tables, the ORC has several transient attractions, including golf courses, marinas, hotels, etc. Since the ORC is a private club community, transients at those facilities have been included as the transients and guests discussed above. Therefore, no additional transients or transient vehicles were assigned to those facilities.

In summary, there are 27,813 transients in the study area at peak times, evacuating in 10,429 vehicles (an average vehicle occupancy of 2.67 transients per vehicle). Table 3-4 presents transient population and transient vehicle estimates by Area. Figure 3-6 and Figure 3-7 present these data by sector.

## 3.4 Employees

The estimate of employees commuting into the EPZ is based on the 2019 Workplace Area Characteristic (WAC) data provided by the U.S. Census Bureau's OnTheMap Census analysis tool[2] extrapolated to 2020 using the short-term employment projection for the State of Florida[3], supplemented by data provided by FPL and by the ORC Association.

The WAC data provides the employee counts by industry sector for each census block within the PTN EPZ. The employee count of each industry sector was then extrapolated 2020 for each

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[2] http://onthemap.ces.census.gov/ OnTheMap is an interactive map displaying workplace and residential distributions by user-defined geographies at census block level detail. It also reports the work characteristics detail on age, and earnings industry groups.

[3] https://www.floridajobs.org/workforce-statistics/data-center/statistical-programs/employment-projections

census block using the statewide short-term employment projections. Since not all employees are working at facilities within the EPZ at one time, a maximum shift reduction was applied to each census block. Assuming maximum shift employment occurs Monday through Friday between 9 AM and 5 PM, the following jobs take place outside the typical 9-5 workday:

- Manufacturing – takes place in shifts over 24 hours
- Arts, Entertainment, and Recreation – takes place in evenings and on weekends
- Accommodations and Food Services – peaks in the evenings

Therefore, the number of extrapolated employees working in these three industry sectors was subtracted from the total number for each census block to represent the maximum number of employees present in the EPZ at any one time. As per the NUREG/CR-7002, Rev. 1, employers with 200 or more employees working in a single shift are considered as the major employers. As such, the census blocks with less than 200 extrapolated employees (during the maximum shift) are not included in this study.

Employees who work within the EPZ fall into two categories:

- Those who live and work in the EPZ
- Those who live outside of the EPZ and commute to jobs within the EPZ.

Those of the first category are already counted as part of the permanent resident population. To avoid double counting, we focus only on those employees commuting from outside the EPZ who will evacuate along with the permanent resident population. The 2019 LEHD (Longitudinal Employer-Household Dynamics) Origin-Destination Employment Statistics (LODES) data[4] from OnTheMap website was then used to estimate the percent of employees that work within the EPZ but live outside. This value, 56.9%, was applied to the maximum shift employee values to compute the number of employees commuting into the EPZ at peak times. Note, the plant employment data for the PTN and ORC were provided by FPL and by the ORC Association, respectively, and were supplemented for the census blocks in Areas 1 and 10. As such, the plant employment data is reflected in the Miami-Dade County employment subtotal in Appendix E, Table E-3, while the ORC employees are reflected in the Monroe County employment subtotal.

There is a total of 9,102 employees commuting into the EPZ on a daily basis. To estimate the evacuating employee vehicles, a vehicle occupancy of 1.11 employees per vehicle obtained from the demographic survey (see Appendix F, Sub-section F.3.1) was used for the major employers. Table 3-5 presents the estimates of employees and employee vehicles commuting into the EPZ, by Area. Figure 3-8 and Figure 3-9 present these data by sector.

## 3.5 Medical Facilities

The capacity, current census and general information for each medical facility were provided by the Miami-Dade County Office of Emergency Management. Residential healthcare facilities, with the exception of hospitals, have their own emergency plans and transportation resources.

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[4] The LODES data is part of the LEHD data products from the U.S. Census Bureau. This dataset provides detailed spatial distributions of workers' employment and residential locations and the relation between the two at the census block level. For detailed information, please refer to this site: https://lehd.ces.census.gov/data/

There are no inpatient medical facilities within the Monroe County portion of the EPZ. Table E-2 in Appendix E summarizes the data gathered for medical facilities.

Table 3-6 presents the census of medical facilities located in the EPZ. A total of 2,369 people have been identified as living in, or being treated in, these facilities. This data includes the number of ambulatory, wheelchair-bound and bedridden patients at each facility.

The transportation resources required for the evacuation of the medical facility population are also presented in Table 3-6. The number and type of evacuating vehicles that need to be provided depend on the patients' state of health. It is estimated that buses can transport up to 30 ambulatory patients; wheelchair buses up to 15 wheelchair bound patients; and an ambulance can accommodate 1 bedridden patient. A total of 141 buses, 108 wheelchair buses and 66 ambulances are required to evacuate the medical facility population, as shown in Table 3-6. Buses and wheelchair buses are represented as two vehicles in the ETE simulations due to their larger size and more sluggish operating characteristics.

## 3.6 Transit Dependent Population

The demographic survey (see Appendix F) results were used to estimate the portion of the population requiring transit service, including:

- Those persons in households that do not have a vehicle available.
- Those persons in households that do have vehicle(s) that would not be available at the time the evacuation is advised.

In the latter group, the vehicle(s) may be used by a commuter(s) who does not return (or is not expected to return) home to evacuate the household.

Table 3-7 presents the estimated calculations of transit-dependent people. Note the following:

- Estimates of persons requiring transit vehicles include schoolchildren. For those evacuation scenarios where children are at school when an evacuation is ordered, separate transportation is provided for the schoolchildren. The actual need for transit vehicles by residents is thereby less than the given estimates. However, estimates of transit vehicles are not reduced when schools are in session.
- It is reasonable and appropriate to consider that many transit-dependent persons will evacuate by ridesharing with neighbors, friends or family. For example, nearly 80% of those who evacuated from Mississauga, Ontario[5] who did not use their own cars, shared a ride with neighbors or friends. Other documents report that approximately 70% of transit dependent persons were evacuated via ride sharing. **Based on the results of the demographic survey, 67.2% of the transit-dependent population will rideshare.**

The estimated number of bus trips needed to service transit-dependent persons is based on an estimated average bus occupancy of 30 persons at the conclusion of the bus run. Transit vehicle

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[5] Institute for Environmental Studies, University of Toronto, THE MISSISSAUGA EVACUATION FINAL REPORT, June 1981. The report indicates that 6,600 people of a transit-dependent population of 8,600 people shared rides with other residents; a ride share rate of 77% (Page 5-10)."

seating capacities typically equal or exceed 60 children on average (roughly equivalent to 40 adults). If transit vehicle evacuees are two thirds adults and one third children, then the number of “adult seats” taken by 30 persons is 20 + (2/3 x 10) = 27. On this basis, the average load factor anticipated is (27/40) x 100 = 68%. Thus, if the actual demand for service exceeds the estimates of Table 3-7 by 50%, the demand for service can still be accommodated by the available bus seating capacity.

$$\left[20+\left(\frac{2}{3}\times 10\right)\right]\div 40\times 1.5=1.00$$

Table 3-7 indicates that transportation must be provided for 6,078 people. Therefore, a total of 203 bus runs are required to transport this population to reception centers. In order to service all of the transit dependent population and have a least one bus drive through each of the Areas picking up transit dependent people, **206 bus runs** are used in the ETE calculations (even though only 203 buses are needed from a capacity standpoint). These buses are represented as two vehicles in the ETE simulations due to their larger size and more sluggish operating characteristics.

To illustrate this estimation procedure, we calculate the number of persons, P, requiring public transit or ride-share, and the number of buses, B, required for the PTN EPZ:

$$P = No. of\ HH\ \times \sum_{i=0}^{n}\{(\%\ HH\ with\ i\ vehicles)\times[(Average\ HH\ Size)-i]\}\times A^{i}C^{i}$$

Where,

A = Percent of households with commuters

C = Percent of households who will not await the return of a commuter

$$\begin{aligned}P = 94{,}333\times[&0.0406\times 2.25+0.294\times(2.03-1)\times 0.592\times 0.457\\ &+0.4160\times(2.76-2)\times(0.592\times 0.457)^{2}]=18{,}529\end{aligned}$$

$B=((1-0.672)\times P)\div 30=(0.328\ \times 18{,}529)\div 30=203$ (Rounded up)

These calculations are explained as follows:

- The number of households (HH) is computed by dividing the EPZ population by the average household size (266,019 ÷ 2.82) and is 94,333.
- The total number of persons requiring public transit is the sum of such people in HH with no vehicles, or with 1 or 2 vehicles that are away from home.
- All members (2.25 avg.) of households (HH) with no vehicles (4.06%) will evacuate by public transit or rideshare. The term 94,333 x 0.0406 x 2.25, accounts for these people.
- The members of HH with 1 vehicle away (29.40%), who are at home equals (2.03-1). The number of HH where the commuter will not return home is equal to (94,333 x 0.294 x 1.03 x 0.592 x 0.457), as 59.2% of EPZ households have a commuter, 45.7%

of which would not return home in the event of an emergency. The number of persons who will evacuate by public transit or ride-share is equal to the product of these two terms.

- The members of HH with 2 vehicles that are away (41.6%), who are at home, equals (2.76 – 2). The number of HH where neither commuter will return home is equal to 94,333 x 0.416 x 0.76 x $(0.592 \times 0.457)^2$. The number of persons who will evacuate by public transit or ride-share is equal to the product of these two terms (the last term is squared to represent the probability that neither commuter will return).
- Households with 3 or more vehicles are assumed to have no need for transit vehicles.
- The number of buses needed is the product of the total people requiring transport (18,529) and the percentage of people who do not rideshare (1 – 0.672) divided by 30 people per bus.

The estimate of transit-dependent population in Table 3-7 far exceeds the number of registered transit-dependent persons in the EPZ as provided by the counties (discussed below in Section 3.9). This is consistent with the findings of NUREG/CR-6953, Volume 2, in that a large majority of the transit-dependent population within the EPZs of U.S. nuclear plants does not register with their local emergency response agency.

## 3.7 School Population Demand

Table 3-8 presents the school population and transportation requirements for the direct evacuation of all schools within the study area for the 2020-2021 school year (55,227 students, 799 buses). This information was provided by the county emergency management agencies. The column in Table 3-8 entitled “Buses Required” specifies the number of buses required for each school under the following set of assumptions and estimates:

- No students will be picked up by their parents prior to the arrival of the buses.
- Children at preschools and day care centers will be picked up by parents prior to evacuation and buses for these facilities are not considered in the ETE study.
- While many high school students commute to school using private automobiles (as discussed in Section 2.4 of NUREG/CR-7002, Rev. 1), the estimate of buses required for school evacuation does not consider the use of these private vehicles.
- Bus capacity, expressed in students per bus, is set to 70 for elementary schools and 50 for middle and high schools, unless noted differently within the county emergency management plans.
- Those staff members who do not accompany the students will evacuate in their private vehicles.
- No allowance is made for student absenteeism, which is typically 3% daily.
- No buses are provided for schools, preschools and daycares that have their own evacuation plans.

It is recommended that the counties in the EPZ implement a process to confirm individual school transportation needs prior to bus dispatch which may improve bus utilization. In this way, the number of buses dispatched to the schools will reflect the actual number needed. The need for buses would be reduced by any high school students who have evacuated using private automobiles (if permitted by school authorities). Those buses originally allocated to evacuate schoolchildren that are not needed due to children being picked up by their parents, can be gainfully assigned to service other facilities or those persons who do not have access to private vehicles or to ridesharing.

School buses are represented as two vehicles in the ETE simulations due to their larger size and more sluggish operating characteristics.

### 3.7.1 Commuter Colleges

There are two commuter colleges within the PTN EPZ: Miami Dade College – Homestead Campus and South Dade Technical College. Neither school has on-campus student housing. It is assumed the students will evacuate in private vehicles. The information for these two colleges is summarized as follows:

Miami Dade College – Homestead Campus

- Located in Area 8 and is 9.4 miles west-northwest radially from the PTN.
- According to Miami-Dade County, this college has a total enrollment of 4,651 students. Note, not all students attend classes on campus at one time.
- The aerial imagery shows the parking lots at Homestead Campus can accommodate up to 630 vehicles. As such, the maximum number of evacuating vehicles on campus is 630. It is conservatively assumed that all the vehicles are from outside of the EPZ, and therefore, 630 evacuating vehicles were assigned to this college.

South Dade Technical College

- Located in Area 8 and is 9.5 miles west-northwest radially from the PTN.
- The enrollment data for South Dade Technical College is unavailable. As such, the student population was estimated based on the parking lot capacity. As shown in aerial imagery, South Dade Technical College has a capacity of approximately 90 parking spaces. The commuter vehicle occupancy rate (1.11 – see Appendix F, Sub-Section F.3.1) obtained from the demographic survey was used to estimate that 100 (90 x 1.11) students would evacuate from South Dade Technical College in 90 vehicles.

## 3.8 Special Event

A special event can attract large numbers of transients to the EPZ for short periods of time, creating a temporary surge in demand as per Section 2.5.1 of NUREG/CR-7002, Rev. 1. The county and state emergency management agencies were polled regarding potential special events in the EPZ. The only potential special event (Scenario 11) identified by FPL and the county agencies is a NASCAR Race at the Homestead-Miami Speedway with a maximum population of 100,000 people, which occurs on a Sunday in November (winter, weekend, midday, good weather) located within Area 8.

The Miami-Dade County Office of Emergency Management Indicated the current capacity of the grandstands at the Speedway is 53,000 people; however, 100,000 people typically show up for the race with many remaining in the parking lots tailgating during the race. The facility provides parking for approximately 30,000 passenger vehicles and a separate lot has the capacity for 1,300 recreational vehicles.

Aerial imagery was used to determine the boundaries of the parking lots for the speedway and GIS software was used to estimate the square footage of each parking lot. Table 3-9 estimates the capacity of each lot by multiplying the ratio of square footage of the lot to the total square footage of all lots and the total capacity of 30,000 vehicles. A recreational vehicle is represented as two passenger car equivalents in the simulation model based on its larger size and more sluggish operating characteristics. A total of 32,600 vehicles would evacuate from the speedway during this event. It is conservatively assumed that none of the people attending the race are EPZ residents. The special event vehicle trips were generated utilizing the same mobilization distributions for transients (see Section 5).

A detailed traffic control manual *On the road to "THE Championship Track*" was created in November 2009 to help facilitate the flow of traffic to and from the speedway. The traffic management procedures outlined in the manual and provided on the facility's website[6] are used for major events at the speedway. Sixty intersections are identified as traffic control points in the plan. The control tactic at each of these intersections was input to the simulation model for the special event. Special lane treatments are also used on the roads surrounding the speedway, based on discussions with the county and local police:

- Contra-flow is used on a small section of Canal Drive (SW 328th Street) to facilitate vehicles traveling northbound on Tallahassee Rd (SW 137th Avenue) after the race.
    - Lots C and D are forced to exit northbound on SW 142nd Avenue and turn right onto Canal Drive eastbound towards Speedway Blvd.
    - Vehicles along Tallahassee Rd can access the turnpike northbound at the entrance ramp from SW 137th Avenue north of SW 288th Street
- The shoulder of the Florida Turnpike northbound is used as an additional lane from the entrance ramps from Campbell Drive to the toll booths north of Exit 9.
    - All inbound and outbound tolls are lifted on the Florida Turnpike for the Sunday NASCAR Race.
- Contra-flow is used on Tallahassee Rd (SW 137th Ave) from the Speedway to the Florida Turnpike access ramp just south of SW 272nd St (Exit 6)

The Speedway deploys approximately 150 off-duty Florida Highway Patrol and Municipal Police Officers to work the "Traffic Detail" during the Sunday NASCAR Event. These off-duty Florida Highway Patrol Officers provide directional traffic assistance to manage the inbound and outbound traffic for spectator arrival and departure. Each officer at each intersection is given specific instructions on where to direct traffic for inbound and outbound motorists.

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[6] http://www.homesteadmiamispeedway.com/Guest-Info/Parking-and-Directions/Outbound.aspx

The aforementioned lane treatments are indicated in the 2009 manual and are used in this study for the special event. For details of the traffic control tactics at each intersection, refer to the Traffic Management Practices of Homestead-Miami Speedway's Transportation Attachment VII and the Homestead Miami Speedway website[6].

## 3.9 Access and/or Functional needs Population

The county emergency management agencies have a combined registration for transit-dependent and access and/or functional needs persons. Miami-Dade County indicated there are 268 access and/or functional needs people registered within the Miami-Dade County portion of the EPZ who would require transportation assistance to evacuate. These 268 people are comprised of 19 ambulatory persons, 107 wheelchair-bound persons and 142 bedridden persons (see Table 3-10). The Monroe County portion of the EPZ has only one registered access and/or functional needs person and they have their own evacuation plans and hence are not included in the access and/or functional needs population. Buses and wheelchair buses needed to evacuate the access and/or functional needs population are represented as two vehicles in the ETE simulations due to their larger size and more sluggish operating characteristics.

## 3.10 Correctional Facilities

As detailed in Table E-6 and Table 3-11, there are two correctional facilities within the EPZ – the Miami Dade Police Department (temporary holding facility) and the Dade Juvenile Residential Facility. The correctional facility data was provided by Miami Dade County. The current inmate population at Miami Dade Police Department was not available, so the maximum capacity of 45 inmates was considered in this study. The current inmate population at Dade Juvenile Residential facility is 55 inmates. According to the Miami-Dade County Emergency Management Plan and the State of Florida Radiological Emergency Preparedness Plan, the inmates at these two facilities would be evacuated to the Miami-Dade County Intake Facility. A total of 4 buses would be needed to evacuate the facilities based on a capacity of 30 inmates per bus. Buses needed to evacuate the inmates are represented as two vehicles in the ETE simulations due to their larger size and more sluggish operating characteristics.

## 3.11 External Traffic

Vehicles will be traveling through the EPZ (external-external trips) at the time of an accident. After the ATE is announced, these pass-through travelers will also evacuate. Based on discussions with Miami-Dade County and Monroe County personnel, external traffic will utilize the Florida Turnpike, the Don Shula Expressway and US-1. Dynamic and variables message signs will be strategically positioned outside of the EPZ at logical diversion points to attempt to divert traffic away from the area at risk. As such, it is assumed this external traffic will stop at 2 hours after the ATE.

Average Annual Daily Traffic (AADT) data was obtained from the Florida Department of Transportation (FDOT) to estimate the number of vehicles per hour on the aforementioned routes. The AADT was multiplied by the K-Factor, which is the proportion of the AADT on a roadway segment or link during the design hour, resulting in the design hour volume (DHV). The design hour is usually the 30th highest hourly traffic volume of the year, measured in vehicles per hour (vph). The DHV is then multiplied by the D-Factor, which is the proportion of the DHV occurring in the peak direction of travel (also known as the directional split). The resulting values are the directional design hourly volumes (DDHV) and are presented Table 3-12, for each of the routes considered. The DDHV is then multiplied by 2 hours (dynamic messaging signs – are assumed to be activated within the 2 hours of the ATE; no vehicles have diverted during this time) to estimate the total number of external vehicles loaded on the analysis network..

As shown in Table 3-12, there are a total of 7,274 vehicles entering the EPZ as external-external trips prior to any diversion of traffic. This number is reduced by 60% for evening scenarios (Scenarios 5 and 10). Note, the Florida Turnpike, the Don Shula Expressway and US 1 southbound all merge into one road within the EPZ traveling toward the Florida Keys. As such, the D-Factor of 0.5 for southbound traffic has been distributed equally (0.5 ÷ 3 = 0.167) to these three roads in Table 3-12

## 3.12 Background Traffic

Section 5 discusses the time needed for the people in the EPZ to mobilize and begin their evacuation trips. As shown in Table 5-8, there are 14 time periods during which traffic is loaded on to roadways in the study area to model the mobilization time of people in the EPZ. Note, there is no traffic generated during the 15th time period, as this time period is intended to allow traffic that has already begun evacuating to clear the study area boundaries.

This study does not assume that roadways are empty at the start of Time Period 1. Rather, there is an initialization time period (often referred to as "fill time" in traffic simulation) wherein the anticipated traffic volumes from the start of the evacuation (Time Period 1) are loaded onto roadways in the study area. The amount of initialization/fill traffic that is on the roadways in the study area at the start of the evacuation depends on the scenario and the region being considered (see Section 6). There are approximately 3,000 vehicles on the roadways in the study area at the end of fill time for an evacuation of the entire EPZ (Region R03) under Scenario 6 (winter, midweek, midday, good weather) conditions.

## 3.13 Summary of Demand

A summary of population and vehicle demand is provided in Table 3-13 and Table 3-14, respectively. This summary includes all population groups described in this section. A total of 504,541 people and 212,514 vehicles are considered in this study.

**Table 3-1. EPZ Permanent Resident Population**

| Area | 2010 Population | 2020 Population |
|---|---|---|
| **1** | 0 | 0 |
| **2** | 0 | 0 |
| **3** | 0 | 0 |
| **4** | 7,506 | 10,293 |
| **5** | 44,816 | 50,197 |
| **6** | 43,313 | 61,746 |
| **7** | 20,153 | 30,848 |
| **8** | 89,322 | 111,666 |
| **9** | 116 | 0 |
| **10** | 1,103 | 1,269 |
| **EPZ TOTAL:** | **206,329** | **266,019** |
| **EPZ Population Growth (2010-2020):** | | **28.93%** |

**Table 3-2. Permanent Resident Population and Vehicles by Area**

| Area | 2020 Population | Resident Vehicles |
|---|---|---|
| **1** | 0 | 0 |
| **2** | 0 | 0 |
| **3** | 0 | 0 |
| **4** | 10,293 | 5,075 |
| **5** | 50,197 | 24,900 |
| **6** | 61,746 | 30,771 |
| **7** | 30,848 | 15,393 |
| **8** | 111,666 | 55,452 |
| **9** | 0 | 0 |
| **10** | 1,269 | 631 |
| **EPZ TOTAL:** | **266,019** | **132,222** |

**Table 3-3. Shadow Population and Vehicles by Sector**

| Sector | Population | Evacuating Vehicles |
|---|---|---|
| **N** | 60,754 | 30,190 |
| **NNE** | 0 | 0 |
| **NE** | 0 | 0 |
| **ENE** | 0 | 0 |
| **E** | 0 | 0 |
| **ESE** | 0 | 0 |
| **SE** | 0 | 0 |
| **SSE** | 0 | 0 |
| **S** | 33 | 0[7] |
| **SSW** | 0 | 0 |
| **SW** | 0 | 0 |
| **WSW** | 50 | 25 |
| **W** | 9,141 | 3,525 |
| **WNW** | 10,472 | 5,233 |
| **NW** | 7,233 | 3,552 |
| **NNW** | 101,481 | 49,914 |
| **TOTAL:** | **189,164** | **92,439** |

**Table 3-4. Summary of Transients and Transient Vehicles**

| Area | Transients | Transient Vehicles |
|---|---|---|
| **1** | 0 | 0 |
| **2** | 0 | 0 |
| **3** | 0 | 0 |
| **4** | 2,400 | 570 |
| **5** | 0 | 0 |
| **6** | 10,836 | 3,420 |
| **7** | 165 | 60 |
| **8** | 8,466 | 2,910 |
| **9** | 0 | 0 |
| **10** | 4,436 | 2,543 |
| **EPZ TOTAL:** | **26,303** | **9,503** |
| **Shadow Region[8]** | 1,510 | 926 |
| **STUDY AREA TOTAL:** | **27,813** | **10,429** |

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[7] Residents living on Elliot Key in Sector S are assumed to evacuate by boat since there are no roads on the island. Thus, there are no vehicles for this sector.

[8] As per Miami-Dade County Office of Emergency Management, Camp Owaissa Bauer and Larry & Penny Thompson Memorial Park, both located in the Shadow Region, will be evacuated in the event of an incident at the PTN due to their proximity to the EPZ boundary.

**Table 3-5. Summary of Employees and Employee Vehicles Commuting into the EPZ**

| Area | Employees | Employee Vehicles |
|---|---|---|
| **1** | 800[9] | 721 |
| **2** | 0 | 0 |
| **3** | 0 | 0 |
| **4** | 610 | 550 |
| **5** | 1,836 | 1,654 |
| **6** | 764 | 688 |
| **7** | 133 | 120 |
| **8** | 3,468 | 3,123 |
| **9** | 0 | 0 |
| **10** | 1,491 | 1,343 |
| **EPZ TOTAL:** | **9,102** | **8,199** |

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[9] In order to accurately depict the evacuation of the PTN site and the 2-mile region, it is conservatively assumed that all plant employees are not EPZ residents. Thus, the employee population in Area 1 represents the maximum shift employment at the PTN.

## Table 3-6. Medical Facility Transit Demand[10]

| Area | Facility Name | Municipality | Capacity | Current Census | Ambu-latory | Wheel-chair Bound | Bed-ridden | Bus Runs | Wheel- chair Bus Runs | Ambulance Runs |
|---|---|---|---|---|---|---|---|---|---|---|
| MIAMI-DADE COUNTY, FL | | | | | | | | | | |
| 4 | Open Arms ALF, Inc | Homestead | 7 | 7 | 6 | 1 | 0 | 1 | 1 | 0 |
| 4 | Merline's Place | Homestead | 6 | 6 | 5 | 1 | 0 | 1 | 1 | 0 |
| 4 | A Senior Living Dream | Homestead | 6 | 6 | 5 | 1 | 0 | 1 | 1 | 0 |
| 4 | M J Quality Care | Homestead | 8 | 8 | 7 | 1 | 0 | 1 | 1 | 0 |
| 4 | Mother Golden Years III | Miami | 6 | 6 | 5 | 1 | 0 | 1 | 1 | 0 |
| 4 | Health Paradise ALF1 | Homestead | 6 | 6 | 5 | 1 | 0 | 1 | 1 | 0 |
| 4 | Diaz Home Care ALF | Homestead | 6 | 6 | 5 | 1 | 0 | 1 | 1 | 0 |
| 5 | Blue Point Home Care | Miami | 6 | 6 | 5 | 1 | 0 | 1 | 1 | 0 |
| 5 | Paradise Home ALF, CORP. | Cutler Bay | 7 | 7 | 6 | 1 | 0 | 1 | 1 | 0 |
| 5 | M & Y ALF, INC. | Cutler Bay | 8 | 8 | 7 | 1 | 0 | 1 | 1 | 0 |
| 5 | Old Cutler Retirement Home | Miami | 8 | 8 | 7 | 1 | 0 | 1 | 1 | 0 |
| 5 | Living Well ALF Corporation | Cutler Bay | 6 | 6 | 5 | 1 | 0 | 1 | 1 | 0 |
| 5 | Paradise Villa ALF, Inc. | Cutler Bay, | 8 | 8 | 7 | 1 | 0 | 1 | 1 | 0 |
| 5 | Cutler Bay Village | Miami | 47 | 47 | 40 | 5 | 2 | 2 | 1 | 2 |
| 5 | Harmony Family Home | Miami | 7 | 7 | 6 | 1 | 0 | 1 | 1 | 0 |
| 5 | Guardian Angel ALF | Cutler Bay, | 8 | 8 | 7 | 1 | 0 | 1 | 1 | 0 |
| 5 | Encompass Health Rehabilitation Hospital of Miami | Miami | 60 | 57 | 49 | 6 | 2 | 2 | 1 | 2 |
| 5 | Laugh to Live ALF Inc. | Cutler Bay | 6 | 6 | 5 | 1 | 0 | 1 | 1 | 0 |
| 5 | Rodeck One Inc | Miami | 8 | 8 | 7 | 1 | 0 | 1 | 1 | 0 |
| 5 | Marlin Retirement ALF | Miami | 8 | 8 | 7 | 1 | 0 | 1 | 1 | 0 |
| 5 | Kenneth Home Inc | Miami | 8 | 8 | 7 | 1 | 0 | 1 | 1 | 0 |
| 5 | Caribbean ALF | Miami | 6 | 6 | 5 | 1 | 0 | 1 | 1 | 0 |
| 5 | Wellness Advantage Home Care, Inc. | Miami | 6 | 6 | 5 | 1 | 0 | 1 | 1 | 0 |
| 5 | Isabella's Paradise ALF LLC | Cutler Bay | 7 | 7 | 6 | 1 | 0 | 1 | 1 | 0 |
| 5 | Jackson Memorial Perdue Medical Center | Cutler Bay | 163 | 163 | 139 | 18 | 6 | 5 | 2 | 6 |
| 5 | Precious Moments ALF, INC | Cutler Bay | 7 | 7 | 6 | 1 | 0 | 1 | 1 | 0 |
| 5 | East Ridge Retirement Village | Miami | 195 | 195 | 166 | 22 | 7 | 6 | 2 | 7 |
| 5 | Jean Carlos ALF, Inc. | Cutler Bay | 6 | 6 | 5 | 1 | 0 | 1 | 1 | 0 |

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[10] According to the counties' emergency plans, all residential health care facilities have their own emergency plans and transportation resources.

| Area | Facility Name | Municipality | Capacity | Current Census | Ambu-latory | Wheel-chair Bound | Bed-ridden | Bus Runs | Wheel- chair Bus Runs | Ambulance Runs |
|---|---|---|---|---|---|---|---|---|---|---|
| 5 | Bella Luna Retirement Home | Miami | 9 | 9 | 8 | 1 | 0 | 1 | 1 | 0 |
| 5 | *Bel Air ALF* | Miami | 7 | 7 | 6 | 1 | 0 | 1 | 1 | 0 |
| 5 | Cutler Bay Assisted Living Corp | Cutler Bay | 6 | 6 | 5 | 1 | 0 | 1 | 1 | 0 |
| 6 | Diaz Home Care ALF II Inc. | Homestead | 6 | 6 | 5 | 1 | 0 | 1 | 1 | 0 |
| 6 | Vicky's ALF | Homestead | 7 | 7 | 6 | 1 | 0 | 1 | 1 | 0 |
| 6 | Duran Home Care Corp | Homestead | 7 | 7 | 6 | 1 | 0 | 1 | 1 | 0 |
| 6 | Meadow Wood Homes LLC | Homestead | 7 | 7 | 6 | 1 | 0 | 1 | 1 | 0 |
| 6 | RC Dreams Home Care Inc | Homestead | 10 | 10 | 9 | 1 | 0 | 1 | 1 | 0 |
| 6 | God Is First ALF, Inc | Miami | 6 | 6 | 5 | 1 | 0 | 1 | 1 | 0 |
| 6 | Del Real Home Care, Inc. | Homestead | 7 | 7 | 6 | 1 | 0 | 1 | 1 | 0 |
| 6 | Living Well ALF, Co. | Homestead | 6 | 6 | 5 | 1 | 0 | 1 | 1 | 0 |
| 6 | Blanca Azuzena Homecare | Homestead | 8 | 8 | 7 | 1 | 0 | 1 | 1 | 0 |
| 6 | United Lives Leisure Facilities, Inc. | Homestead | 8 | 8 | 7 | 1 | 0 | 1 | 1 | 0 |
| 6 | Beyond Our Dreams ALF, Corp. | Homestead | 6 | 6 | 5 | 1 | 0 | 1 | 1 | 0 |
| 6 | Sunny Hills of Homestead ALF | Homestead | 120 | 120 | 102 | 12 | 6 | 4 | 1 | 6 |
| 6 | St. Mary Adult Care II | Miami | 7 | 7 | 6 | 1 | 0 | 0 | 0 | 0 |
| 6 | ACC Sunshine ALF | Miami | 8 | 8 | 7 | 1 | 0 | 1 | 1 | 0 |
| 6 | Silver Palm ALF, Corp. | Miami | 6 | 6 | 5 | 1 | 0 | 1 | 1 | 0 |
| 6 | Sylvia's Senior Home | Miami | 10 | 10 | 9 | 1 | 0 | 1 | 1 | 0 |
| 6 | Osmani M ALF LLC | Miami | 7 | 7 | 6 | 1 | 0 | 1 | 1 | 0 |
| 6 | Rick and Dauvy ALF Inc. | Miami | 6 | 6 | 5 | 1 | 0 | 1 | 1 | 0 |
| 6 | Biscayne Villa Assisted Living | Miami | 6 | 6 | 5 | 1 | 0 | 1 | 1 | 0 |
| 6 | Santos ALF Corp | Miami | 8 | 8 | 7 | 1 | 0 | 1 | 1 | 0 |
| 6 | Ive Home II ALF | Cutler Ridge | 8 | 8 | 7 | 1 | 0 | 1 | 1 | 0 |
| 6 | Ifa Lola ALF | Cutler Ridge | 6 | 6 | 5 | 1 | 0 | 1 | 1 | 0 |
| 6 | Blessing Time ALF, Inc. | Miami | 6 | 6 | 5 | 1 | 0 | 1 | 1 | 0 |
| 6 | ABC Adult Day Care Center, LLC | Cutler Bay | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6 | Vereda Nueva, INC | Miami | 7 | 7 | 6 | 1 | 0 | 1 | 1 | 0 |
| 6 | Margreg Facilities, Corp. | Miami | 8 | 8 | 7 | 1 | 0 | 1 | 1 | 0 |
| 6 | SarriaMachin Corp | Miami | 6 | 6 | 5 | 1 | 0 | 1 | 1 | 0 |
| 6 | B&B Home Care, Inc. | Miami | 7 | 7 | 6 | 1 | 0 | 1 | 1 | 0 |
| 6 | Rafaela's Home ALF II | Miami | 8 | 8 | 7 | 1 | 0 | 1 | 1 | 0 |

| Area | Facility Name | Municipality | Capacity | Current Census | Ambu-latory | Wheel-chair Bound | Bed-ridden | Bus Runs | Wheel- chair Bus Runs | Ambulance Runs |
|---|---|---|---|---|---|---|---|---|---|---|
| 6 | My Sweet Home | Miami | 8 | 8 | 7 | 1 | 0 | 1 | 1 | 0 |
| 6 | Belen Sweet Home ALF | Miami | 7 | 7 | 6 | 1 | 0 | 1 | 1 | 0 |
| 6 | Suany's Home | Miami | 6 | 6 | 5 | 1 | 0 | 1 | 1 | 0 |
| 6 | Ive Home | Miami | 8 | 8 | 7 | 1 | 0 | 1 | 1 | 0 |
| 6 | Jimenez Senior Care | Miami | 6 | 6 | 5 | 1 | 0 | 1 | 1 | 0 |
| 7 | Advance ALF | Homestead | 6 | 6 | 5 | 1 | 0 | 1 | 1 | 0 |
| 7 | San Rafael Home Health Inc. | Homestead | 7 | 7 | 6 | 1 | 0 | 1 | 1 | 0 |
| 7 | Maria Home Care Corp. | Miami | 7 | 7 | 6 | 1 | 0 | 1 | 1 | 0 |
| 7 | Family Welfare, LLC | Homestead | 7 | 7 | 6 | 1 | 0 | 1 | 1 | 0 |
| 7 | Mis Abuelitos Felices Adult Day Care INC | Homestead | 45 | 45 | 38 | 5 | 2 | 0 | 0 | 0 |
| 7 | Naranja Group Home | Homestead | 12 | 12 | 10 | 1 | 1 | 1 | 1 | 1 |
| 7 | Superior ALF II | Homestead | 6 | 6 | 5 | 1 | 0 | 1 | 1 | 0 |
| 7 | Los Abuelos Felices LLC | Homestead | 62 | 62 | 53 | 7 | 2 | 2 | 1 | 2 |
| 7 | Por Una Vida Mejor | Homestead | 8 | 8 | 7 | 1 | 0 | 1 | 1 | 0 |
| 7 | Serenity Adult Home Care Services | Homestead | 6 | 6 | 5 | 1 | 0 | 0 | 0 | 0 |
| 7 | Loving Heart Corp | Homestead | 7 | 7 | 6 | 1 | 0 | 1 | 1 | 0 |
| 8 | Casa de Campo ALF, LLC | Homestead | 6 | 6 | 5 | 1 | 0 | 1 | 1 | 0 |
| 8 | El Viejo Sol ALF Corp | Homestead | 6 | 6 | 5 | 1 | 0 | 1 | 1 | 0 |
| 8 | Homestead Hospital | Homestead | 147 | 140 | 119 | 16 | 5 | 4 | 2 | 5 |
| 8 | The Palace At Homestead | Homestead | 208 | 208 | 178 | 23 | 7 | 6 | 2 | 7 |
| 8 | New Horizon Assisted Living | Homestead | 7 | 7 | 6 | 1 | 0 | 1 | 1 | 0 |
| 8 | Mi Renacer ALF | Homestead | 8 | 8 | 7 | 1 | 0 | 1 | 1 | 0 |
| 8 | Mother Golden Years II | Homestead | 6 | 6 | 5 | 1 | 0 | 1 | 1 | 0 |
| 8 | Superior ALF Inc | Homestead | 6 | 6 | 5 | 1 | 0 | 1 | 1 | 0 |
| 8 | Heaven Assisted Living Facility | Homestead | 7 | 7 | 6 | 1 | 0 | 1 | 1 | 0 |
| 8 | Warm Embrace Retirement Home | Homestead | 6 | 6 | 5 | 1 | 0 | 1 | 1 | 0 |
| 8 | Pina & Fuerte Adult Care | Homestead | 7 | 7 | 6 | 1 | 0 | 0 | 0 | 0 |
| 8 | Angele's Assisted Living Facility | Homestead | 7 | 7 | 6 | 1 | 0 | 1 | 1 | 0 |
| 8 | Brookwood Gardens Convalescent Center | Homestead | 120 | 120 | 102 | 12 | 6 | 4 | 1 | 6 |
| 8 | Happy Life ALF Inc | Homestead | 7 | 7 | 6 | 1 | 0 | 1 | 1 | 0 |
| 8 | Emanuel Adult ALF Inc. | Homestead | 7 | 7 | 6 | 1 | 0 | 0 | 0 | 0 |
| 8 | Alita and John Haran ALF | Homestead | 6 | 6 | 5 | 1 | 0 | 1 | 1 | 0 |

| Area | Facility Name | Municipality | Capacity | Current Census | Ambu- latory | Wheel- chair Bound | Bed- ridden | Bus Runs | Wheel- chair Bus Runs | Ambulance Runs |
|---|---|---|---|---|---|---|---|---|---|---|
| 8 | MD ALF | Miami | 6 | 6 | 5 | 1 | 0 | 1 | 1 | 0 |
| 8 | Orulmila Care ALF | Homestead | 6 | 6 | 5 | 1 | 0 | 1 | 1 | 0 |
| 8 | Casa Bonita ALF, LLC` | Homestead | 6 | 6 | 5 | 1 | 0 | 1 | 1 | 0 |
| 8 | Sweet Mansion ALF Inc | Homestead | 7 | 7 | 6 | 1 | 0 | 1 | 1 | 0 |
| 8 | Las Mercedes Adult Day Care VI, Inc. | Homestead | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8 | Sara Home Care | Homestead | 16 | 16 | 14 | 2 | 0 | 1 | 1 | 0 |
| 8 | Sol Radiante Inc. | Homestead | 6 | 6 | 5 | 1 | 0 | 1 | 1 | 0 |
| 8 | New Era Comm Health Center LLC | Homestead | 210 | 210 | 179 | 23 | 8 | 6 | 2 | 8 |
| 8 | Krome Apartments - Sunrise Community Inc. | Homestead | 12 | 12 | 10 | 1 | 1 | 1 | 1 | 1 |
| 8 | Swankridge Holistic Research & Care Center | Homestead | 12 | 12 | 10 | 1 | 1 | 1 | 1 | 1 |
| 8 | Homestead Manor | Homestead | 88 | 88 | 75 | 10 | 3 | 3 | 1 | 3 |
| 8 | Long Life ALF,LLC | Homestead | 8 | 8 | 7 | 1 | 0 | 1 | 1 | 0 |
| 8 | Swankridge Care Center | Homestead | 12 | 12 | 10 | 1 | 1 | 1 | 1 | 1 |
| 8 | Aprea Home Health Inc | Florida City | 8 | 8 | 7 | 1 | 0 | 1 | 1 | 0 |
| 8 | Homestead Adult Day Care Center | Homestead | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8 | South Florida Evaluation and Treatment Center | Homestead | 249 | 237 | 203 | 26 | 8 | 7 | 2 | 8 |
| 8 | High Tower ALF LLC | Homestead | 6 | 6 | 5 | 1 | 0 | 1 | 1 | 0 |
| 8 | Loreto Homes, INC | Homestead | 6 | 6 | 5 | 1 | 0 | 1 | 1 | 0 |
| | | ***Miami-Dade County Subtotal:*** | **2,391** | **2,369** | **2,021** | **280** | **68** | **141** | **108** | **66** |
| | | **MONROE COUNTY, FL** | | | | | | | | |
| 10 | The Medical Center at Ocean Reef | Key Largo | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | ***Monroe County Subtotal:*** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| | | **EPZ Total:** | **2,391** | **2,369** | **2,021** | **280** | **68** | **141** | **108** | **66** |

**Table 3-7. Transit-Dependent Population Estimates**

| 2020 EPZ Population | Survey Average HH Size with Indicated No. of Vehicles | | | Estimated No. of Households | Survey Percent HH with Indicated No. of Vehicles | | | Survey Percent HH with Commuters | Survey Percent HH with Non-Returning Commuters | Total People Requiring Transport | Estimated Ridesharing Percentage | People Requiring Public Transit | Percent Population Requiring Public Transit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | | 0 | 1 | 2 | | | | | | |
| 266,019 | 2.25 | 2.03 | 2.76 | 94,333 | 4.06% | 29.4% | 41.6% | 59.2% | 45.7% | 18,529 | 67.2% | 6,078 | 2.3% |

### Table 3-8. School Population Demand Estimates

| Area | School Name | Enrollment | Buses Required |
|---|---|---|---|
| **MIAMI-DADE COUNTY, FL** | | | |
| 4 | South Dade Center[11] | N/A | 0 |
| 4 | Migrant Education Program | 16 | 1 |
| 4 | Mandarin Lakes K-8 Academy | 1,508 | 22 |
| 4 | AcadeMir Charter School of Math & Science | 150 | 3 |
| 4 | Villa Preparatory Academy | 164 | 0 |
| 4 | Air Base K-8 Center for International Education | 1,268 | 19 |
| 5 | Mater Academy Bay | 864 | 18 |
| 5 | Dr. E.L. Whigham Elementary | 898 | 13 |
| 5 | Cutler Bay Senior High School | 1,530 | 31 |
| 5 | Gulfstream Elementary | 897 | 13 |
| 5 | Cutler Ridge Christian Academy | 238 | 0 |
| 5 | Cutler Ridge Elementary | 982 | 15 |
| 5 | Golden Horizon Academy | 60 | 0 |
| 5 | Cutler Bay Middle School | 1,659 | 34 |
| 5 | Bel-Aire Elementary | 616 | 9 |
| 5 | Whispering Pines Elementary | 724 | 11 |
| 5 | Our Lady of the Holy Rosary | 460 | 0 |
| 6 | Advantage Academy of Math and Science at Summerville | 552 | 8 |
| 6 | Goulds Elementary School | 824 | 12 |
| 6 | Coconut Palm K-8 Academy | 1,499 | 22 |
| 6 | Somerset Academy Silver Palms at Princeton | 511 | 8 |
| 6 | Somerset Academy at Silver Palms - Elementary | 1,766 | 26 |
| 6 | Somerset Academy at Silver Palms - High School | 236 | 5 |
| 6 | Palm Glades Preparatory High School | 389 | 8 |
| 6 | Coral Reef Montessori Academy | 511 | 8 |
| 6 | Pine Villa Elementary | 834 | 12 |
| 6 | Arthur & Polly Mays Conservatory of the Arts | 955 | 20 |
| 6 | Caribbean K-8 Center | 896 | 13 |
| 7 | William A. Chapman Elementary | 620 | 9 |
| 7 | SIA Tech (Homestead Job Corps Center) | 357 | 8 |
| 7 | Corporate Academy South | 63 | 2 |
| 7 | Miami MacArthur South Senior High | 714 | 15 |
| 7 | South Dade Skill Center | 282 | 0 |
| 7 | South Point Academy | 48 | 0 |
| 7 | Promised Land Academy and Therapy | 81 | 0 |
| 7 | South Dade Senior High School | 3,302 | 67 |
| 8 | The Charter School at Waterstone | 1,117 | 16 |
| 8 | Keys Gate Charter School | 1,143 | 17 |
| 8 | Discovery Montessori Academy | 81 | 0 |
| 8 | Irving & Beatrice Peskoe K-8 Center | 866 | 13 |
| 8 | Gateway Environmental K-8 | 1,690 | 25 |
| 8 | Everglades Preparatory Academy | 461 | 10 |
| 8 | Center For International Education | 1,010 | 21 |
| 8 | Leisure City K-8 Center | 1,213 | 18 |

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[11] Enrollment data for South Dade Center and Reef Club Kids was not available.

| Area | School Name | Enrollment | Buses Required |
|---|---|---|---|
| 8 | Campbell Drive K-8 Center | 1,220 | 18 |
| 8 | Lincoln Marti School | 270 | 0 |
| 8 | Homestead Senior High School | 2,894 | 58 |
| 8 | Redland Center[11] | N/A | 0 |
| 8 | Mavericks High of South Miami Dade County | 338 | 7 |
| 8 | Hope Academy | 383 | 0 |
| 8 | Lincoln-Marti Charter Schools International Campus | 197 | 3 |
| 8 | Somerset Academy South Homestead | 536 | 8 |
| 8 | Miami Dade College - Homestead Campus | 4,651 | 0 |
| 8 | Avocado Elementary | 869 | 13 |
| 8 | Colonial Christian School | 183 | 0 |
| 8 | South Dade Technical College | 100 | 0 |
| 8 | Saint John's Episcopal School | 138 | 0 |
| 8 | Ebenezer Christian School | 53 | 0 |
| 8 | First United Methodist Christian School | 233 | 0 |
| 8 | The Thinking Child Academy | 85 | 0 |
| 8 | Neva King Cooper Educational Center | 107 | 3 |
| 8 | Laura C. Saunders Elementary | 819 | 12 |
| 8 | Florida City Elementary | 848 | 13 |
| 8 | Barrington Academy | 300 | 0 |
| 8 | Somerset Arts Academy | 243 | 4 |
| 8 | Homestead Middle | 834 | 17 |
| 8 | Advanced Achievers Academy | 113 | 0 |
| 8 | Somerset Academy Charter Middle School at Country Palms | 405 | 9 |
| 8 | Medical Academy For Science and Technology | 1,108 | 23 |
| 8 | Avant Schools of Excellence | 79 | 0 |
| 8 | Shepherd of God Christian Academy | 43 | 0 |
| 8 | Miami Community Charter School | 1,022 | 15 |
| 8 | Redondo Elementary School | 749 | 11 |
| S.R. | Redland Middle[12] | 497 | 10 |
| S.R. | Redland Christian Academy[12] | 250 | 0 |
| S.R. | Redland Elementary[12] | 747 | 11 |
| S.R. | West Homestead Elementary[12] | 778 | 12 |
| | *Miami-Dade County Subtotal:* | *55,147* | *799* |
| **MONROE COUNTY** | | | |
| 10 | Reef Club Kids[11] | N/A | 0 |
| 10 | Academy at Ocean Reef | 80 | 0 |
| | *Monroe County Subtotal:* | *80* | *0* |
| | **EPZ TOTAL:** | **55,227** | **799** |

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[12] Redland Middle, Redland Christian Academy, Redland Elementary and West Homestead Elementary are evacuated due to their proximity to the EPZ boundary although they are technically located in the Shadow Region.

### Table 3-9. Homestead-Miami Speedway Parking Lot Capacity PTN EPZ External Traffic

| LOT | Square Footage of Lot | Percent of Total Square Footage | Vehicle Capacity (PCE's) |
|---|---|---|---|
| A | 1,236,457 | 11.20% | 3,372 |
| B | 2,178,675 | 19.80% | 5,942 |
| C | 1,106,421 | 10.10% | 3,017 |
| D | 1,082,053 | 9.80% | 2,951 |
| E | 1,230,875 | 11.20% | 3,357 |
| I | 227,426 | 2.10% | 620 |
| J | 77,128 | 0.70% | 210 |
| K | 381,971 | 3.50% | 1,042 |
| L | 1,841,352 | 16.70% | 5,022 |
| Blue | 495,551 | 4.50% | 1,351 |
| Green/Red | 1,142,457 | 10.40% | 3,116 |
| RV | N/A | N/A | 2,600 |
| **Total** | **11,000,366** | **100%** | **32,600** |

### Table 3-10. Access and/or Functional Needs Population

| Population Group | Population | Vehicles deployed |
|---|---|---|
| Ambulatory | 19 | 5 buses |
| Wheelchair Bound | 107 | 25 wheelchair buses |
| Bedridden | 142 | 71 ambulances |
| **Total:** | **268** | **101** |

### Table 3-11. Correctional Facilities Population Estimates

| Area | Distance (miles) | Direction | Facility Name | Street Address | Municipality | Current Census | Bus Runs |
|---|---|---|---|---|---|---|---|
| **MIAMI-DADE COUNTY, FL** | | | | | | | |
| 6 | 9.7 | NNW | Miami-Dade Police Department[13] | 10800 SW 211 St | Cutler Bay | 45 | 2 |
| 9 | 10.2 | WSW | Dade Juvenile Residential Facility | 18500 SW 424th St | Florida City | 55 | 2 |
| | | | | | *Miami-Dade County Subtotal:* | *100* | *4* |
| | | | | | **EPZ TOTAL:** | **100** | **4** |

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[13] Miami-Dade Police Department has a temporary holding facility where detainees are held up to 3 hours before transfer to detention centers. Current data is not available. The facility capacity is assumed to be the current census.

### Table 3-12. PTN EPZ External Traffic

| Road Name | Direction | FDOT AADT[14] | K-Factor[15] | D-Factor[14] | Hourly Volume | External Traffic |
|---|---|---|---|---|---|---|
| Florida Turnpike | Southbound | 34,000 | 0.107 | 0.167 | 606 | 1,212 |
| Don Shula Expressway | Southbound | | | | 606 | 1,212 |
| US-1 | Southbound | | | | 606 | 1,212 |
| US-1 | Northbound | 34,000 | 0.107 | 0.5 | 1,819 | 3,638 |
| **TOTAL:** | | | | | | **7,274** |

### Table 3-13. Summary of Population Demand[16]

| Area | Residents | Transit-Dependent | Transients | Employees | Special Facilities[17] | Schools | Special Event NASCAR | College Students | Shadow Population[18] | External Traffic | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 0 | 0 | 0 | 800 | 0 | 0 | 0 | 0 | 0 | 0 | 800 |
| **2** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **3** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **4** | 10,293 | 235 | 2,400 | 610 | 45 | 3,106 | 0 | 0 | 0 | 0 | 16,689 |
| **5** | 50,197 | 1,147 | 0 | 1,836 | 604 | 8,928 | 0 | 0 | 0 | 0 | 62,712 |
| **6** | 61,746 | 1,411 | 10,836 | 764 | 392 | 8,973 | 0 | 0 | 0 | 0 | 84,122 |
| **7** | 30,848 | 705 | 165 | 133 | 173 | 5,467 | 0 | 0 | 0 | 0 | 37,491 |
| **8** | 111,666 | 2,551 | 8,466 | 3,468 | 1,200 | 21,650 | 100,000 | 4,751 | 0 | 0 | 153,752 |
| **9** | 0 | 0 | 0 | 0 | 55 | 0 | 0 | 0 | 0 | 0 | 55 |
| **10** | 1,269 | 29 | 4,436 | 1,491 | 0 | 80 | 0 | 0 | 0 | 0 | 7,305 |
| **Shadow** | 0 | 0 | 1,510 | 0 | 0 | 2,272 | 0 | 0 | 37,833 | 0 | 141,615 |
| **TOTAL:** | **266,019** | **6,078** | **27,813** | **9,102** | **2,469** | **50,476** | **100,000** | **4,751** | **37,833** | **0** | **504,541** |

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[14] Florida Department of Transportation (FDOT) – 2021 Data, https://tdaappsprod.dot.state.fl.us/fto/

[15] HCM 2016

[16] Since the spatial distribution of the access and/or functional needs population is unknown, access and/or functional needs population are not included in this table.

[17] Special facilities include medical facilities and correctional facilities.

[18] Shadow population has been reduced to 20%. Refer to Figure 2-1 for additional information.

## Table 3-14. Summary of Vehicle Demand[19]

| Area | Residents | Transit-Dependent[20] | Transients | Employees | Special Facilities[21] | Schools[22] | Special Event NASCAR | College Students | Shadow Vehicles[23] | External Traffic | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 0 | 0 | 0 | 721 | 0 | 0 | 0 | 0 | 0 | 0 | 721 |
| **2** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **3** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **4** | 5,075 | 16 | 570 | 550 | 28 | 90 | 0 | 0 | 0 | 0 | 6,329 |
| **5** | 24,900 | 78 | 0 | 1,654 | 139 | 288 | 0 | 0 | 0 | 0 | 27,059 |
| **6** | 30,771 | 96 | 3,420 | 688 | 144 | 284 | 0 | 0 | 0 | 0 | 35,403 |
| **7** | 15,393 | 48 | 60 | 120 | 41 | 202 | 0 | 0 | 0 | 0 | 15,864 |
| **8** | 55,452 | 172 | 2,910 | 3,123 | 216 | 668 | 32,600 | 720 | 0 | 0 | 95,861 |
| **9** | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 4 |
| **10** | 631 | 2 | 2,543 | 1,343 | 0 | 0 | 0 | 0 | 0 | 0 | 4,519 |
| **Shadow** | 0 | 0 | 926 | 0 | 0 | 66 | 0 | 0 | 18,488 | 7,274 | 26,754 |
| **TOTAL:** | **132,222** | **412** | **10,429** | **8,199** | **572** | **1,598** | **32,600** | **720** | **18,488** | **7,274** | **212,514** |

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[19] Since the spatial distribution of the access and/or functional needs population is unknown, vehicles needed to evacuate access and/or functional needs population are not included in this table.

[20] Transit dependent buses represented as two vehicles.

[21] Special facilities include medical facilities and correctional facilities.

[22] School buses are represented as two passenger vehicles.

[23] Shadow vehicles have been reduced to 20%. Refer to Figure 2-1 for additional information.

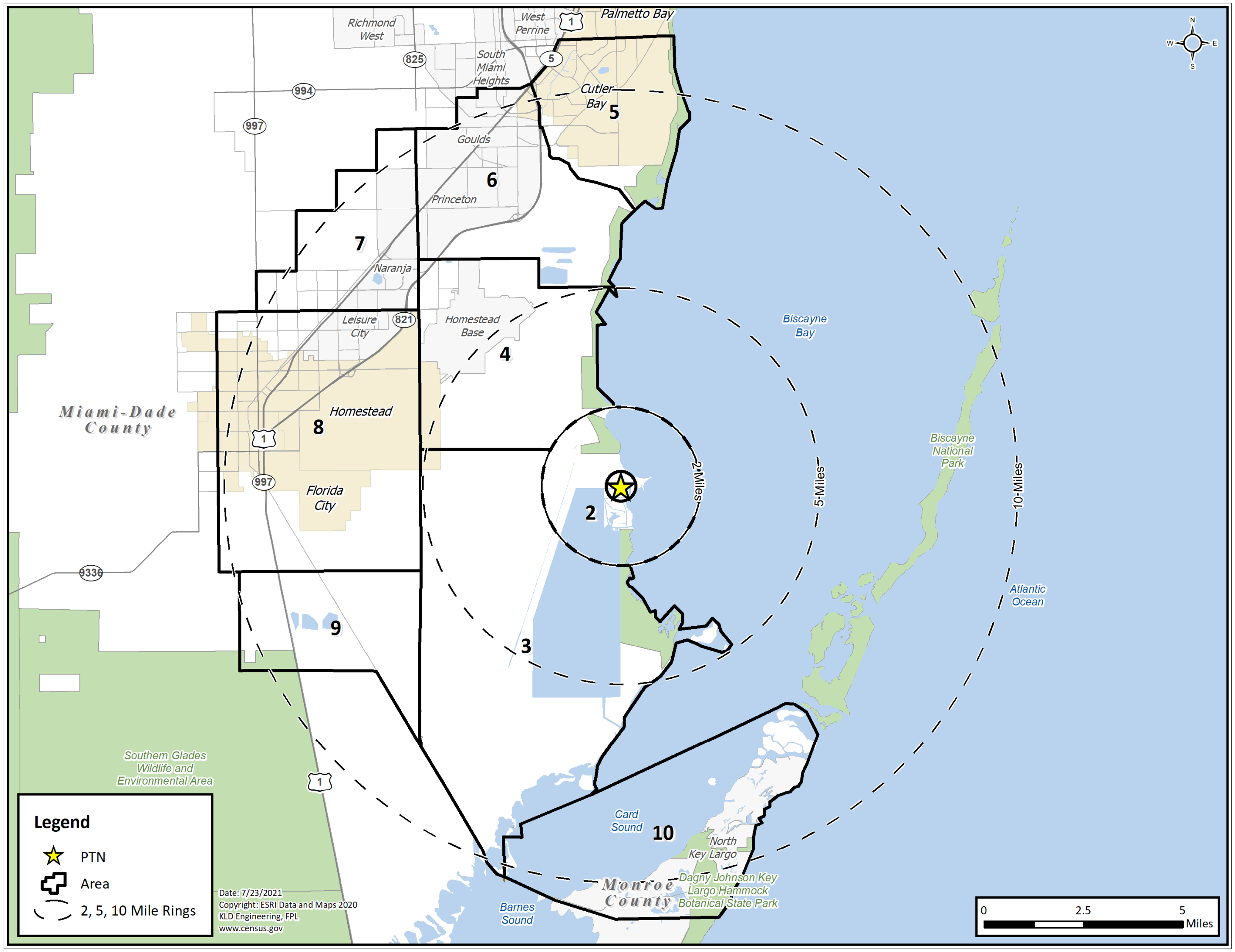
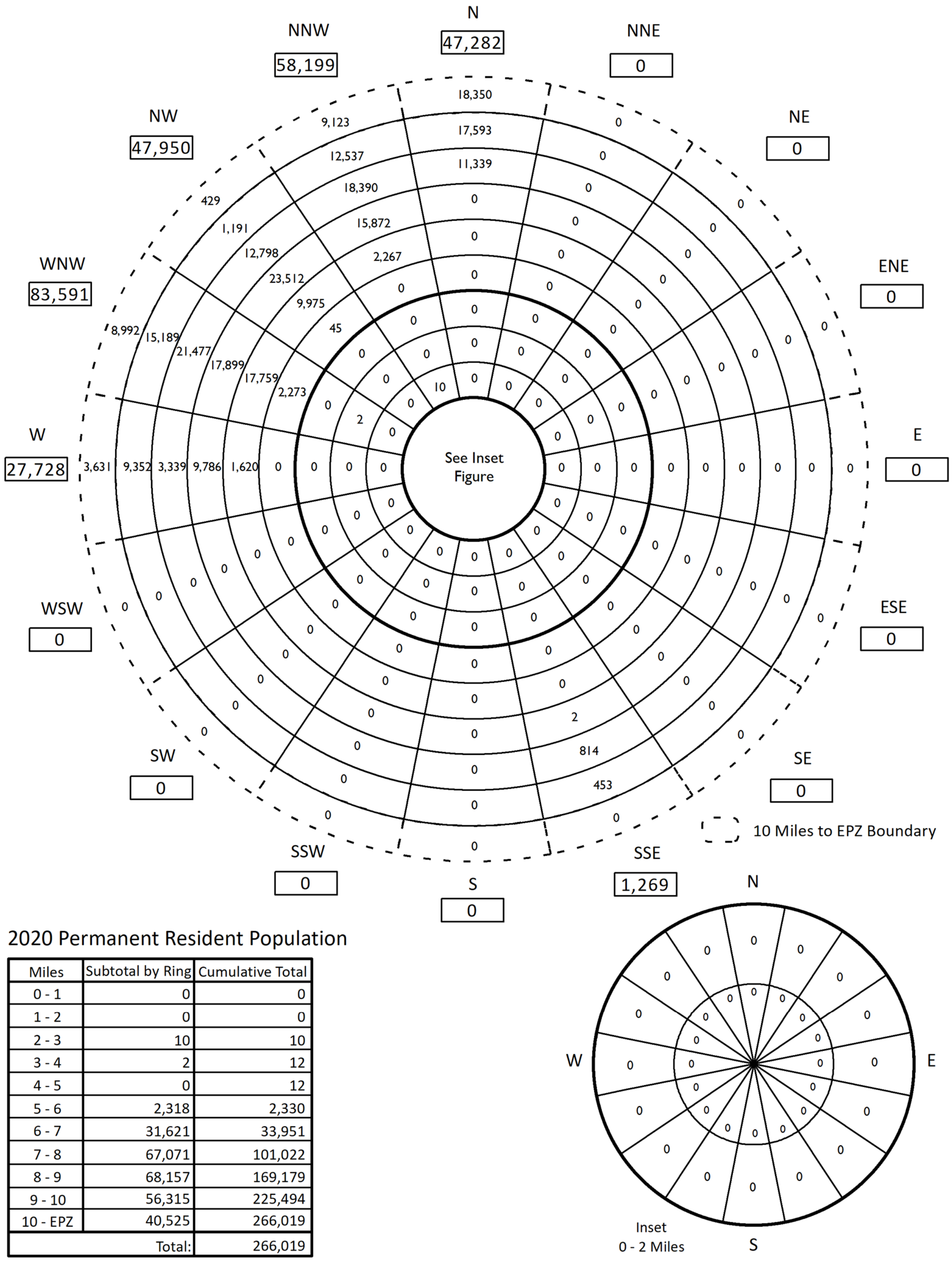


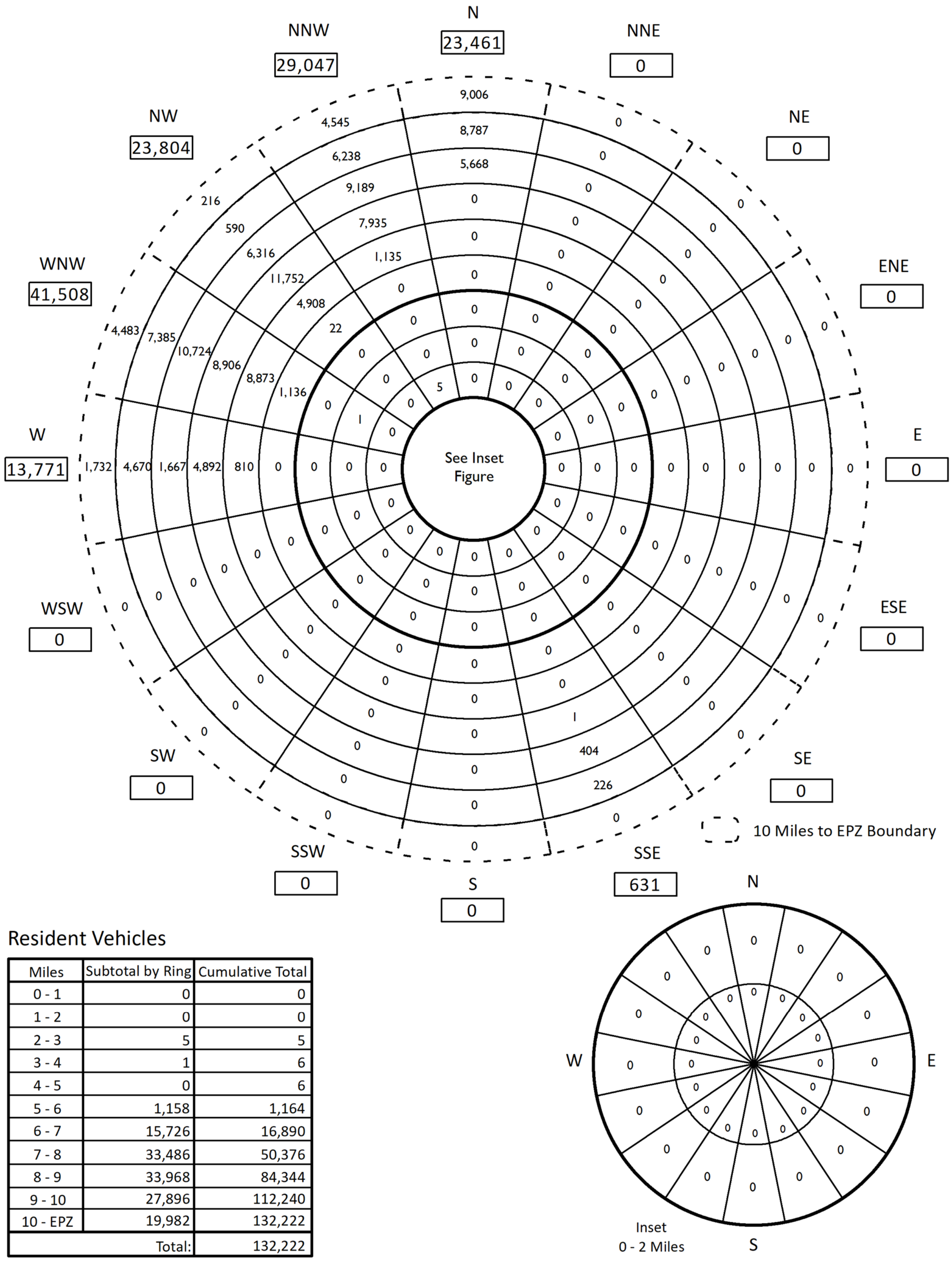
Figure 3-1. Areas Comprising the PTN EPZ



2020 Permanent Resident Population

| Miles | Subtotal by Ring | Cumulative Total |
|---|---|---|
| 0 - 1 | 0 | 0 |
| 1 - 2 | 0 | 0 |
| 2 - 3 | 10 | 10 |
| 3 - 4 | 2 | 12 |
| 4 - 5 | 0 | 12 |
| 5 - 6 | 2,318 | 2,330 |
| 6 - 7 | 31,621 | 33,951 |
| 7 - 8 | 67,071 | 101,022 |
| 8 - 9 | 68,157 | 169,179 |
| 9 - 10 | 56,315 | 225,494 |
| 10 - EPZ | 40,525 | 266,019 |
| | Total: | 266,019 |

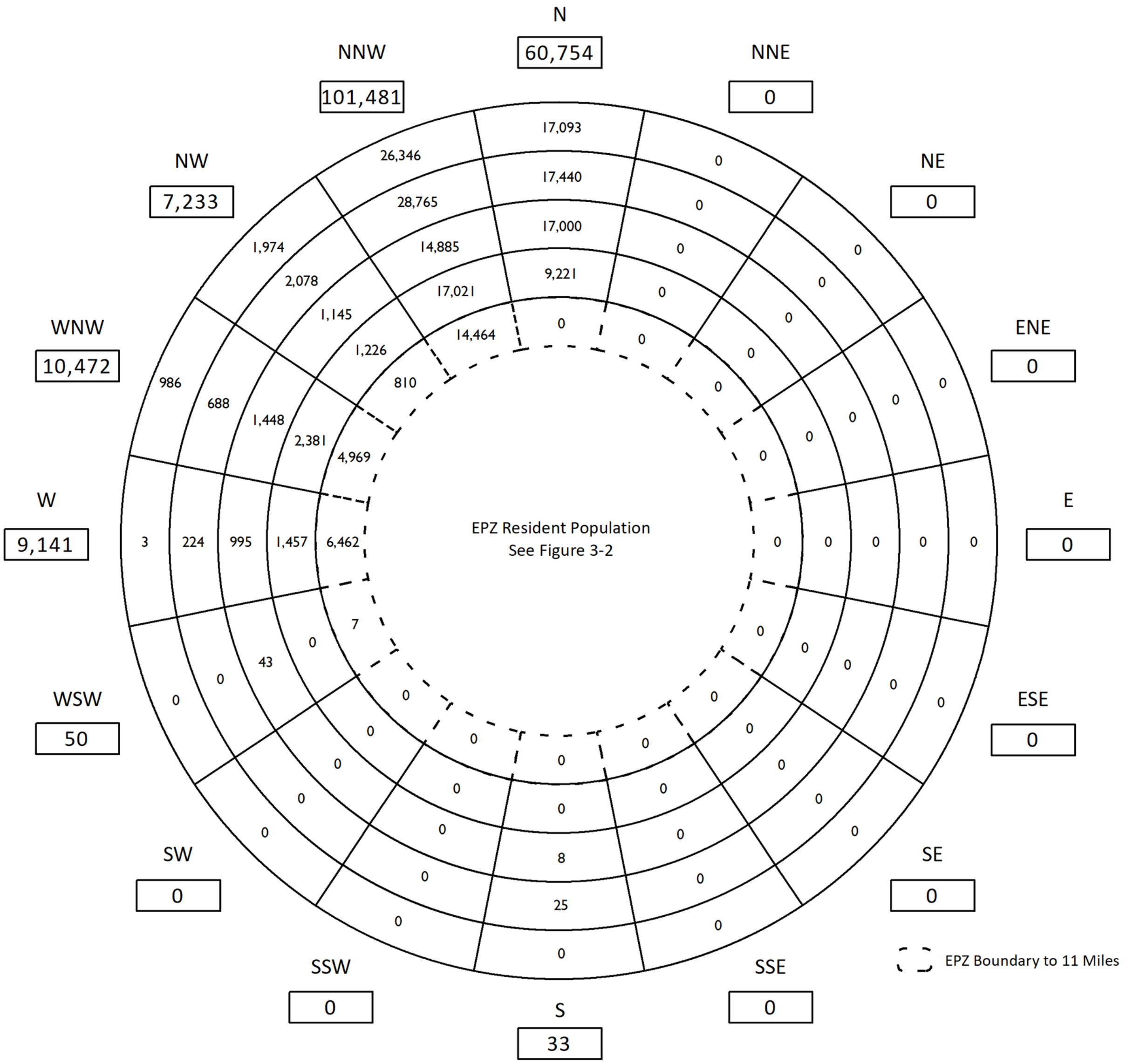
**Figure 3-2. Permanent Resident Population by Sector**



Resident Vehicles

| Miles | Subtotal by Ring | Cumulative Total |
|---|---|---|
| 0 - 1 | 0 | 0 |
| 1 - 2 | 0 | 0 |
| 2 - 3 | 5 | 5 |
| 3 - 4 | 1 | 6 |
| 4 - 5 | 0 | 6 |
| 5 - 6 | 1,158 | 1,164 |
| 6 - 7 | 15,726 | 16,890 |
| 7 - 8 | 33,486 | 50,376 |
| 8 - 9 | 33,968 | 84,344 |
| 9 - 10 | 27,896 | 112,240 |
| 10 - EPZ | 19,982 | 132,222 |
| | Total: | 132,222 |

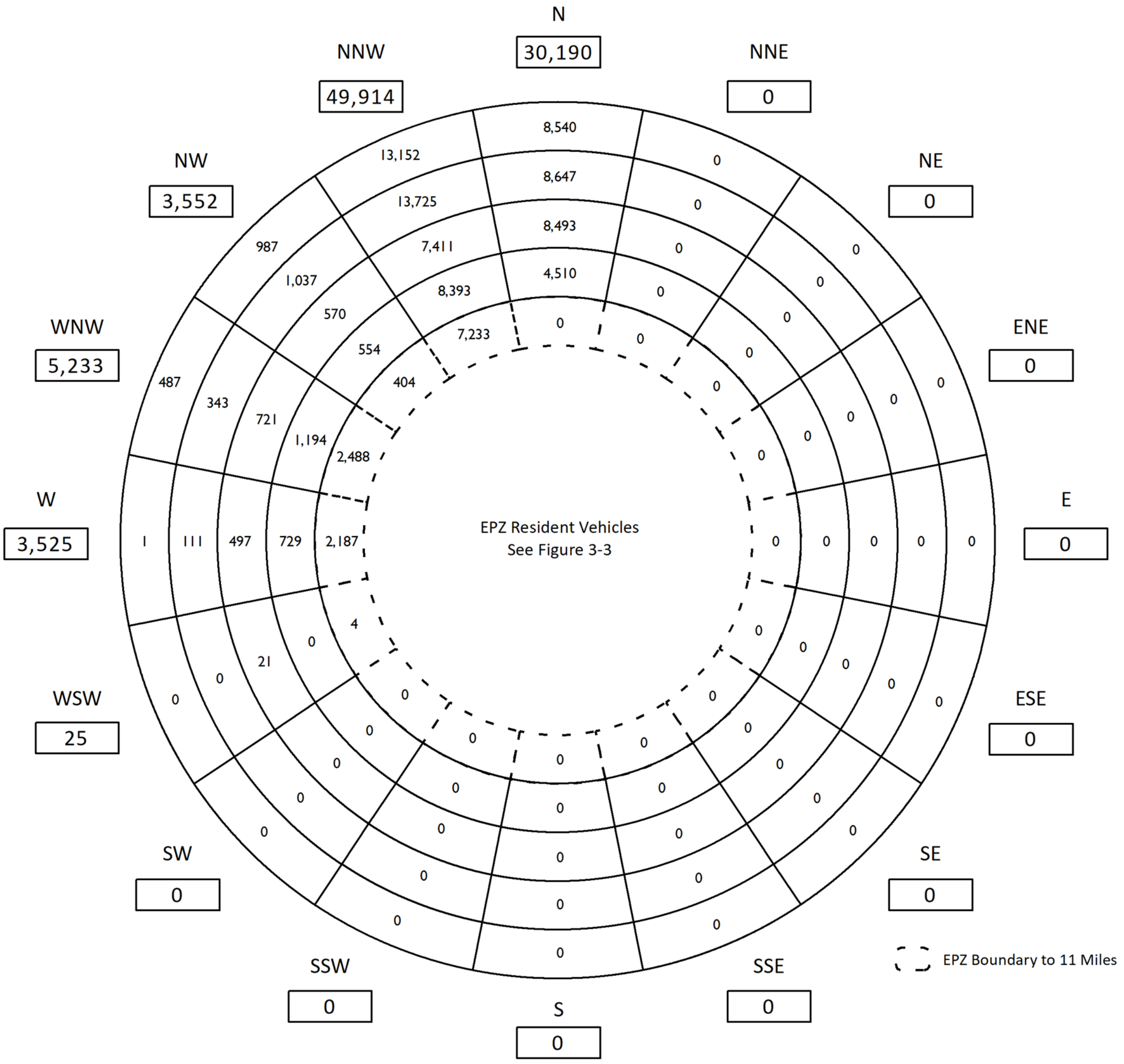
**Figure 3-3. Permanent Resident Vehicles by Sector**



2020 Shadow Population

| Miles | Subtotal by Ring | Cumulative Total |
|---|---|---|
| EPZ - 11 | 26,712 | 26,712 |
| 11 - 12 | 31,306 | 58,018 |
| 12 - 13 | 35,524 | 93,542 |
| 13 - 14 | 49,220 | 142,762 |
| 14 - 15 | 46,402 | 189,164 |
| | Total: | 189,164 |

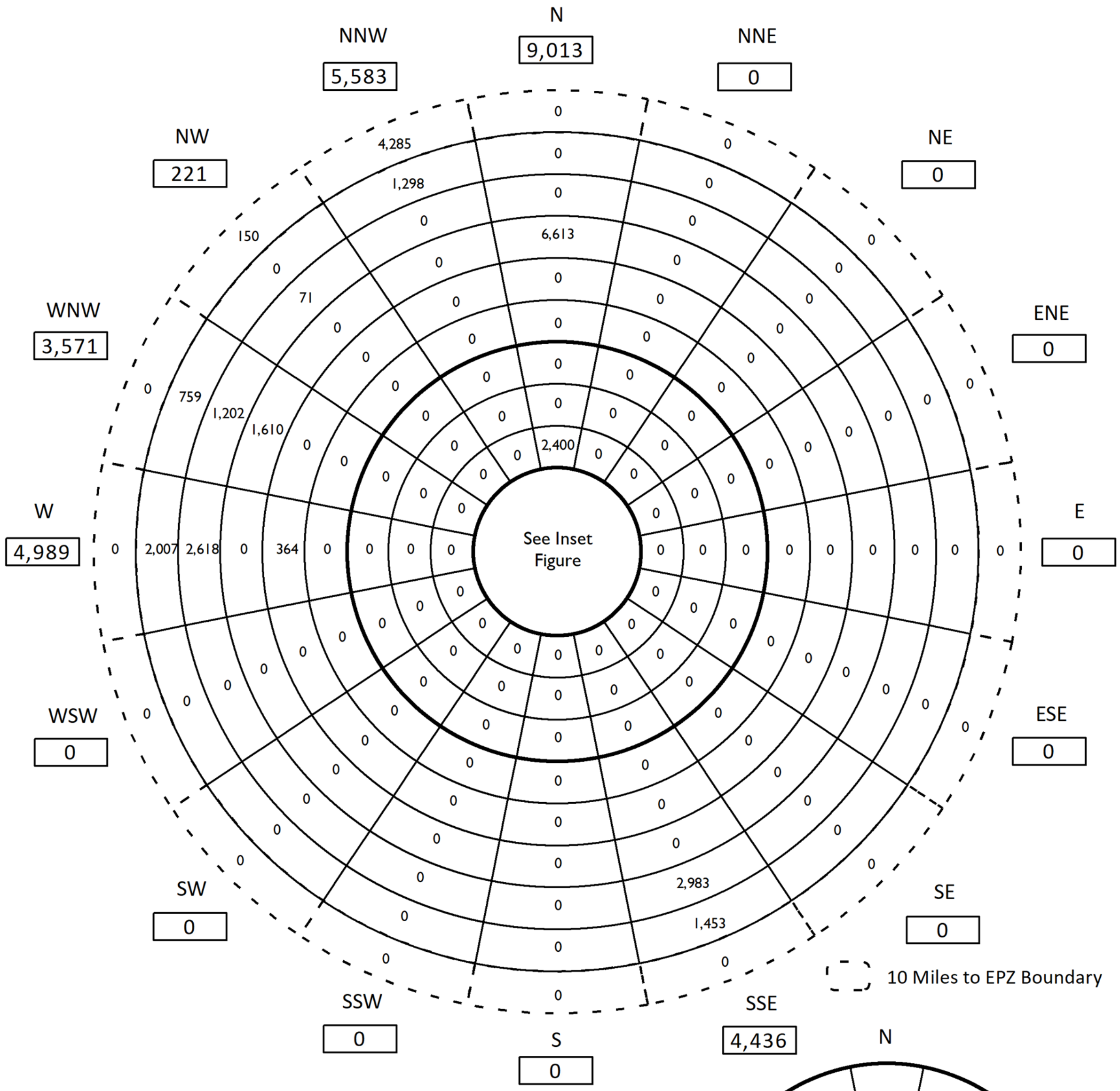
**Figure 3-4. Shadow Population by Sector**

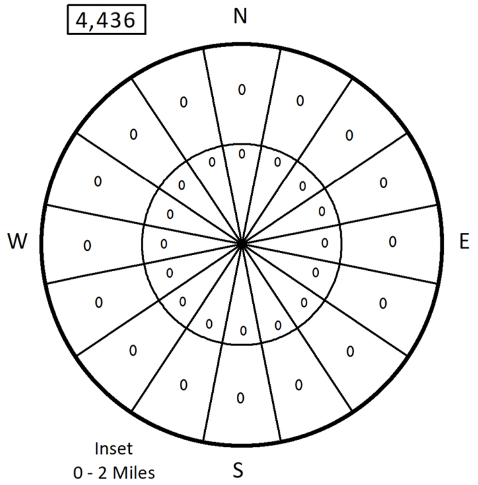


Shadow Vehicles

| Miles | Subtotal by Ring | Cumulative Total |
|---|---|---|
| EPZ - 11 | 12,316 | 12,316 |
| 11 - 12 | 15,380 | 27,696 |
| 12 - 13 | 17,713 | 45,409 |
| 13 - 14 | 23,863 | 69,272 |
| 14 - 15 | 23,167 | 92,439 |
| | Total: | 92,439 |

**Figure 3-5. Shadow Vehicles by Sector**

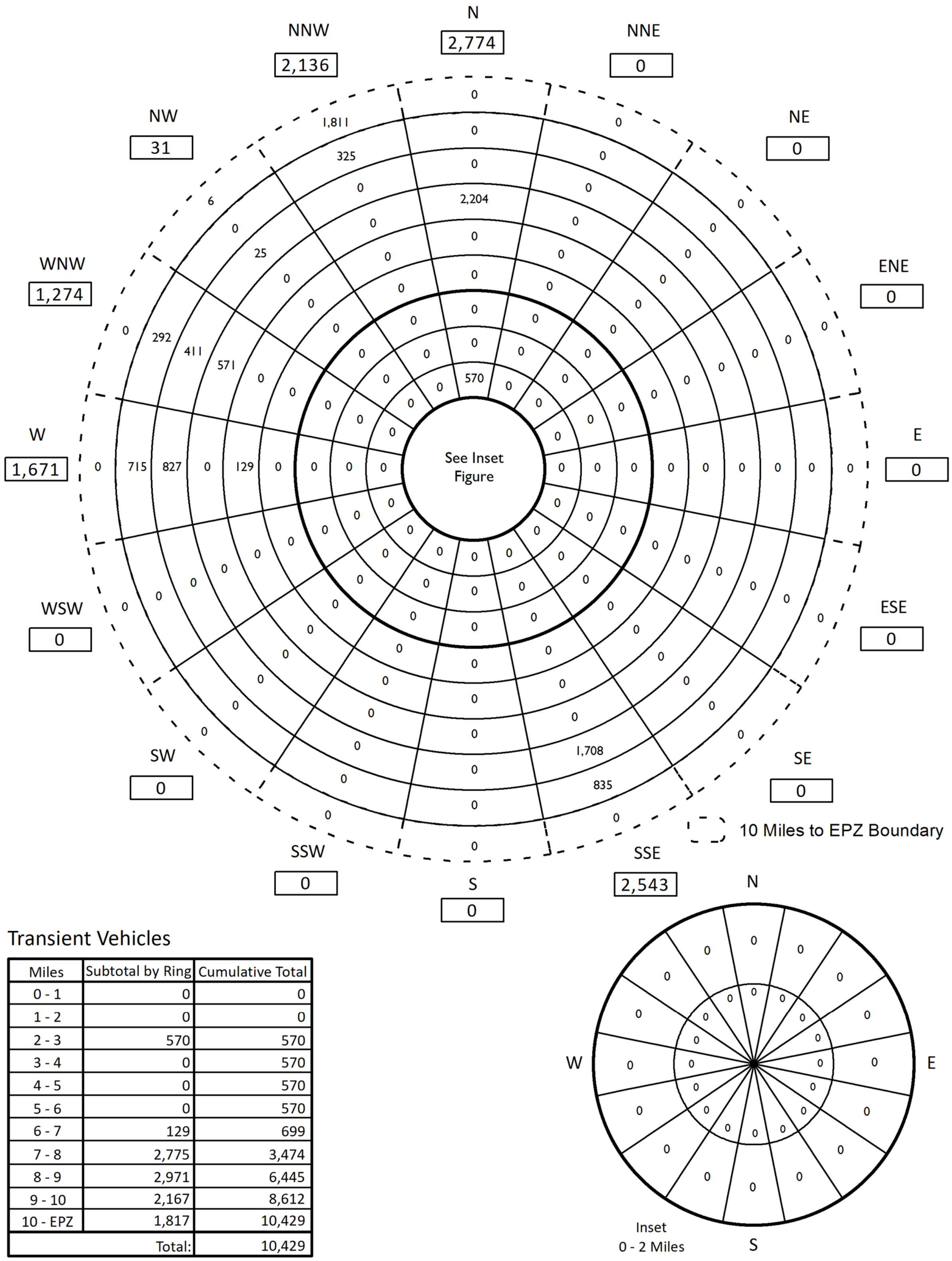




Transients

| Miles | Subtotal by Ring | Cumulative Total |
|---|---|---|
| 0 - 1 | 0 | 0 |
| 1 - 2 | 0 | 0 |
| 2 - 3 | 2,400 | 2,400 |
| 3 - 4 | 0 | 2,400 |
| 4 - 5 | 0 | 2,400 |
| 5 - 6 | 0 | 2,400 |
| 6 - 7 | 364 | 2,764 |
| 7 - 8 | 8,223 | 10,987 |
| 8 - 9 | 6,874 | 17,861 |
| 9 - 10 | 5,517 | 23,378 |
| 10 - EPZ | 4,435 | 27,813 |
| | Total: | 27,813 |

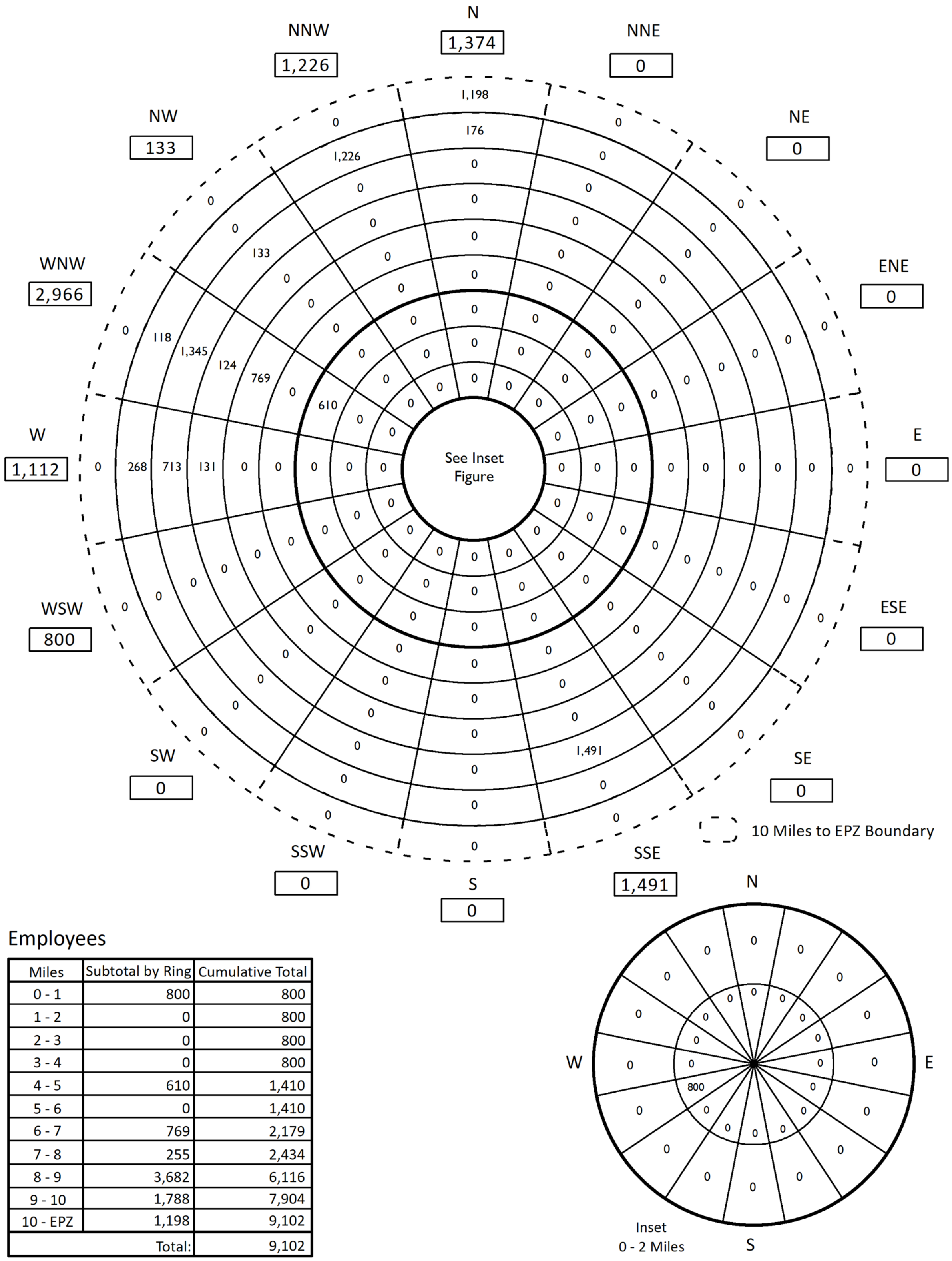
**Figure 3-6. Transient Population by Sector**



Transient Vehicles

| Miles | Subtotal by Ring | Cumulative Total |
|---|---|---|
| 0 - 1 | 0 | 0 |
| 1 - 2 | 0 | 0 |
| 2 - 3 | 570 | 570 |
| 3 - 4 | 0 | 570 |
| 4 - 5 | 0 | 570 |
| 5 - 6 | 0 | 570 |
| 6 - 7 | 129 | 699 |
| 7 - 8 | 2,775 | 3,474 |
| 8 - 9 | 2,971 | 6,445 |
| 9 - 10 | 2,167 | 8,612 |
| 10 - EPZ | 1,817 | 10,429 |
| | Total: | 10,429 |

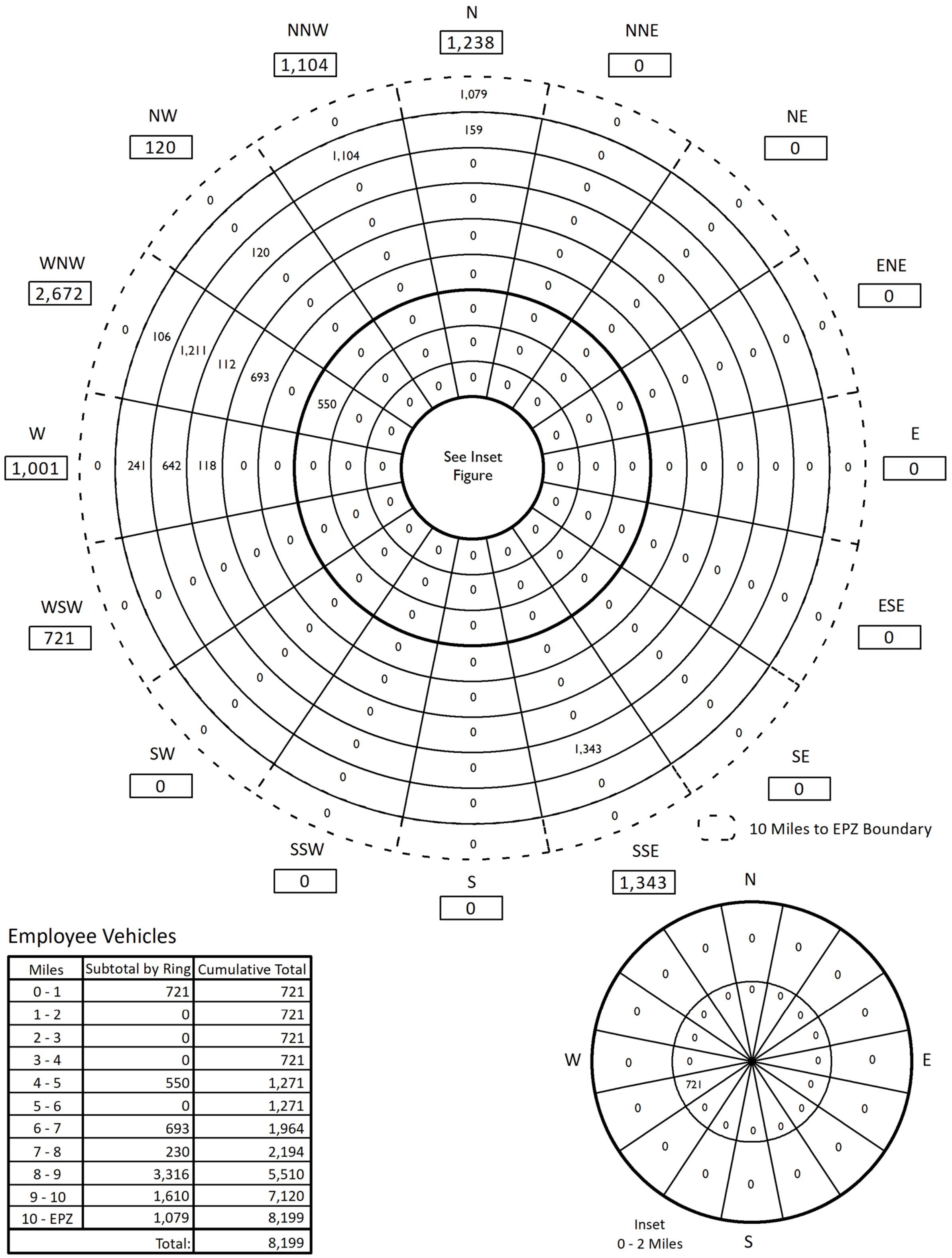
**Figure 3-7. Transient Vehicles by Sector**



Employees

| Miles | Subtotal by Ring | Cumulative Total |
|---|---|---|
| 0 - 1 | 800 | 800 |
| 1 - 2 | 0 | 800 |
| 2 - 3 | 0 | 800 |
| 3 - 4 | 0 | 800 |
| 4 - 5 | 610 | 1,410 |
| 5 - 6 | 0 | 1,410 |
| 6 - 7 | 769 | 2,179 |
| 7 - 8 | 255 | 2,434 |
| 8 - 9 | 3,682 | 6,116 |
| 9 - 10 | 1,788 | 7,904 |
| 10 - EPZ | 1,198 | 9,102 |
|  | Total: | 9,102 |

**Figure 3-8. Employee Population by Sector**



Employee Vehicles

| Miles | Subtotal by Ring | Cumulative Total |
|---|---|---|
| 0 - 1 | 721 | 721 |
| 1 - 2 | 0 | 721 |
| 2 - 3 | 0 | 721 |
| 3 - 4 | 0 | 721 |
| 4 - 5 | 550 | 1,271 |
| 5 - 6 | 0 | 1,271 |
| 6 - 7 | 693 | 1,964 |
| 7 - 8 | 230 | 2,194 |
| 8 - 9 | 3,316 | 5,510 |
| 9 - 10 | 1,610 | 7,120 |
| 10 - EPZ | 1,079 | 8,199 |
| | Total: | 8,199 |

**Figure 3-9. Employee Vehicles by Sector**

# 4 ESTIMATION OF HIGHWAY CAPACITY

The ability of the road network to service vehicle demand is a major factor in determining how rapidly an evacuation can be completed. The capacity of a road is defined as the maximum hourly rate at which persons or vehicles can reasonably be expected to traverse a point or uniform section of a lane of roadway during a given time period under prevailing roadway, traffic and control conditions, as stated in the 2016 Highway Capacity Manual (HCM 2016). This section discusses how the capacity of the roadway network was estimated.

In discussing capacity, different operating conditions have been assigned alphabetical designations, A through F, to reflect the range of traffic operational characteristics. These designations have been termed "Levels of Service" (LOS). For example, LOS A connotes free-flow and high-speed operating conditions; LOS F represents a forced flow condition. LOS E describes traffic operating at or near capacity.

Another concept, closely associated with capacity, is "Service Volume". Service volume (SV) is defined as "The maximum hourly rate at which vehicles, bicycles or persons reasonably can be expected to traverse a point or uniform section of a roadway during an hour under specific assumed conditions while maintaining a designated level of service." This definition is similar to that for capacity. The major distinction is that values of SV vary from one LOS to another, while capacity is the SV at the upper bound of LOS E, only.

Thus, in simple terms, SV is the maximum traffic that can travel on a road and still maintain a certain perceived level of quality to a driver based on the A, B, C, rating system (LOS). Any additional vehicles above the SV would drop the rating to a lower letter grade

This distinction is illustrated in Exhibit 12-37 of the HCM 2016. As indicated there, the SV varies with Free Flow Speed (FFS), and LOS. The SV is calculated by the DYNEV II simulation model, based on the specified link attributes, FFS, capacity, control device and traffic demand.

Other factors also influence capacity. These include, but are not limited to:

- Lane width
- Shoulder width
- Pavement condition
- Horizontal and vertical alignment (curvature and grade)
- Percent truck traffic
- Control device (and timing, if it is a signal)
- Weather conditions (rain, fog, wind speed)

These factors are considered during the road survey and in the capacity estimation process; some factors have greater influence on capacity than others. For example, lane and shoulder width have only a limited influence on Base Free Flow Speed (BFFS[1]) according to Exhibit 15-7 of the HCM 2016. Consequently, lane and shoulder widths at the narrowest points were observed during the road survey and these observations were recorded, but no detailed

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[1] A very rough estimate of BFFS might be taken as the posted speed limit plus 10 mph (HCM 2016 Page 15-15).

measurements of lane or shoulder width were taken. Horizontal and vertical alignment can influence both FFS and capacity. The estimated FFS were measured using the survey vehicle's speedometer and observing local traffic, under free flow conditions. Free flow speeds ranged from 15 to 70 mph in the study area. Capacity is estimated from the procedures of the 2016 HCM. For example, HCM 2016 Exhibit 7-1(b) shows the sensitivity of SV at the upper bound of LOS D to grade (capacity is the SV at the upper bound of LOS E).

The amount of traffic that can flow on a roadway is effectively governed by vehicle speed and spacing. The faster that vehicles can travel when closely spaced, the higher the amount of flow. As discussed in Section 2.6 it is necessary to adjust capacity figures to represent the prevailing conditions. Adverse conditions like inclement weather, construction, and other incidents tend to slow traffic down and often, also increases vehicle-to-vehicle separation, thus decreasing the amount of traffic flow. Based on limited empirical data, weather conditions such as rain reduce the values of free-flow speed and of highway capacity by approximately 10 percent. Over the last decade new studies have been made on the effects of rain on traffic capacity. These studies indicate a range of effects between 5 and 20 percent depending on wind speed and precipitation rates. As indicated in Section 2.6, we employ a reduction in free-flow speed and in highway capacity of 10 percent for rain.

Since congestion arising from evacuation may be significant, estimates of roadway capacity must be determined with great care. Because of its importance, a brief discussion of the major factors that influence highway capacity is presented in this section.

Rural highways generally consist of: (1) one or more uniform sections with limited access (driveways, parking areas) characterized by "uninterrupted" flow; and (2) approaches to at-grade intersections where flow can be "interrupted" by a control device or by turning or crossing traffic at the intersection. Due to these differences, separate estimates of capacity must be made for each section. Often, the approach to the intersection is widened by the addition of one or more lanes (turn pockets or turn bays), to compensate for the lower capacity of the approach due to the factors there that can interrupt the flow of traffic. These additional lanes are recorded during the field survey and later entered as input to the DYNEV II system.

## 4.1 Capacity Estimations on Approaches to Intersections

At-grade intersections are apt to become the first bottleneck locations under local heavy traffic volume conditions. This characteristic reflects the need to allocate access time to the respective competing traffic streams by exerting some form of control. During evacuation, control at critical intersections will often be provided by traffic control personnel assigned for that purpose, whose directions may supersede traffic control devices. See Appendix G for more information.

The per-lane capacity of an approach to a signalized intersection can be expressed (simplistically) in the following form:

$$Q_{cap,m} = \left(\frac{3600}{h_m}\right) \times \left(\frac{G-L}{C}\right)_m = \left(\frac{3600}{h_m}\right) \times P_m$$

where:

| | | |
|---|---|---|
| $Q_{cap,m}$ | = | Capacity of a single lane of traffic on an approach, which executes movement, *m*, upon entering the intersection; vehicles per hour (vph) |
| $h_m$ | = | Mean queue discharge headway of vehicles on this lane that are executing movement, *m*; seconds per vehicle |
| $G$ | = | Mean duration of GREEN time servicing vehicles that are executing movement, *m*, for each signal cycle; seconds |
| $L$ | = | Mean "lost time" for each signal phase servicing movement, *m*; seconds |
| $C$ | = | Duration of each signal cycle; seconds |
| $P_m$ | = | Proportion of GREEN time allocated for vehicles executing movement, *m*, from this lane. This value is specified as part of the control treatment. |
| $m$ | = | The movement executed by vehicles after they enter the intersection: through, left-turn, right-turn, and diagonal. |

The turn-movement-specific mean discharge headway $h_m$, depends in a complex way upon many factors: roadway geometrics, turn percentages, the extent of conflicting traffic streams, the control treatment, and others. A primary factor is the value of "saturation queue discharge headway", $h_{sat}$, which applies to through vehicles that are not impeded by other conflicting traffic streams. This value, itself, depends upon many factors including motorist behavior. Formally, we can write,

$$h_m = f_m(h_{sat}, F_1, F_2, \ldots)$$

where:

| | | |
|---|---|---|
| $h_{sat}$ | = | Saturation discharge headway for through vehicles; seconds per vehicle |
| $F_1, F_2$ | = | The various known factors influencing $h_m$ |
| $f_m(\ )$ | = | Complex function relating $h_m$ to the known (or estimated) values of $h_{sat}$, $F_1$, $F_2$, … |

The estimation of $h_m$ for specified values of $h_{sat}, F_1, F_2, \ldots$ is undertaken within the DYNEV II simulation model by a mathematical model[2]. The resulting values for $h_m$ always satisfy the condition:

$$h_m \geq h_{sat}$$

That is, the turn-movement-specific discharge headways are always greater than, or equal to the saturation discharge headway for through vehicles. These headways (or its inverse equivalent, "saturation flow rate"), may be determined by observation or using the procedures of the HCM 2016.

The above discussion is necessarily brief given the scope of this ETE report and the complexity of the subject of intersection capacity. In fact, Chapters 19, 20 and 21 in the HCM 2016 address this topic. The factors, $F_1$, $F_2$, …, influencing saturation flow rate are identified in equation (19-8) of the HCM 2016.

The traffic signals within the EPZ and Shadow Region are modeled using representative phasing plans and phase durations obtained as part of the field data collection. Traffic responsive signal installations allow the proportion of green time allocated ($P_m$) for each approach to each intersection to be determined by the expected traffic volumes on each approach during evacuation circumstances. The amount of green time (G) allocated is subject to maximum and minimum phase duration constraints; 2 seconds of yellow time are indicated for each signal phase and 1 second of all-red time is assigned between signal phases, typically. If a signal is pre-timed, the yellow and all-red times observed during the road survey are used. A lost time (L) of 2.0 seconds is used for each signal phase in the analysis.

## 4.2 Capacity Estimation along Sections of Highway

The capacity of highway sections -- as distinct from approaches to intersections -- is a function of roadway geometrics, traffic composition (e.g., percent heavy trucks and buses in the traffic stream) and, of course, motorist behavior. There is a fundamental relationship which relates SV (i.e., the number of vehicles serviced within a uniform highway section in a given time period) to traffic density. The top curve in Figure 4-1 illustrates this relationship.

As indicated, there are two flow regimes: (1) Free Flow (left side of curve); and (2) Forced Flow (right side). In the Free Flow regime, the traffic demand is fully serviced; the SV increases as demand volume and density increase, until the SV attains its maximum value, which is the capacity of the highway section. As traffic demand and the resulting highway density increase beyond this "critical" value, the rate at which traffic can be serviced (i.e., the SV) can actually decline below capacity ("capacity drop"). Therefore, in order to realistically represent traffic performance during congested conditions (i.e., when demand exceeds capacity), it is necessary to estimate the service volume, $V_F$, under congested conditions.

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[2] Lieberman, E., "Determining Lateral Deployment of Traffic on an Approach to an Intersection", McShane, W. & Lieberman, E., "Service Rates of Mixed Traffic on the far Left Lane of an Approach". Both papers appear in Transportation Research Record 772, 1980. Lieberman, E., Xin, W., "Macroscopic Traffic Modeling for Large-Scale Evacuation Planning", presented at the TRB 2012 Annual Meeting, January 22-26, 2012

The value of $V_F$ can be expressed as:

$$V_F = R \times Capacity$$

where:

$R$ = Reduction factor which is less than unity

We have employed a value of R=0.90. The advisability of such a capacity reduction factor is based upon empirical studies that identified a fall-off in the service flow rate when congestion occurs at “bottlenecks” or “choke points” on a freeway system. Zhang and Levinson[3] describe a research program that collected data from a computer-based surveillance system (loop detectors) installed on the Interstate Highway System, at 27 active bottlenecks in the twin cities metro area in Minnesota over a 7-week period. When flow breakdown occurs, queues are formed which discharge at lower flow rates than the maximum capacity prior to observed breakdown. These queue discharge flow (QDF) rates vary from one location to the next and also vary by day of week and time of day based upon local circumstances. The cited reference presents a mean QDF of 2,016 passenger cars per hour per lane (pcphpl). This figure compares with the nominal capacity estimate of 2,250 pcphpl estimated for the ETE Appendix K for freeway links. The ratio of these two numbers is 0.896 which translates into a capacity reduction factor of 0.90.

Since the principal objective of ETE analyses is to develop a “realistic” estimate of evacuation times, use of the representative value for this capacity reduction factor (R=0.90) is justified. This factor is applied only when flow breaks down, as determined by the simulation model.

Rural roads, like freeways, are classified as “uninterrupted flow” facilities. (This is in contrast with urban street systems which have closely spaced signalized intersections and are classified as “interrupted flow” facilities.) As such, traffic flow along rural roads is subject to the same effects as freeways in the event traffic demand exceeds the nominal capacity, resulting in queuing and lower QDF rates. As a practical matter, rural roads rarely break down at locations away from intersections. Any breakdowns on rural roads are generally experienced at intersections where other model logic applies, or at lane drops which reduce capacity there. Therefore, the application of a factor of 0.90 is appropriate on rural roads, but rarely, if ever, activated.

The estimated value of capacity is based primarily upon the type of facility and on roadway geometrics. Sections of roadway with adverse geometrics are characterized by lower free-flow speeds and lane capacity. Exhibit 15-46 in the Highway Capacity Manual was referenced to estimate saturation flow rates. The impact of narrow lanes and shoulders on free-flow speed and on capacity is not material, particularly when flow is predominantly in one direction as is the case during an evacuation.

The procedure used here was to estimate "section" capacity, $V_E$, based on observations made traveling over each section of the evacuation network, based on the posted speed limits and travel behavior of other motorists and by reference to the HCM 2016. The DYNEV II simulation

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[3] Lei Zhang and David Levinson, “Some Properties of Flows at Freeway Bottlenecks,” Transportation Research Record 1883, 2004.

model determines for each highway section, represented as a network link, whether its capacity would be limited by the "section-specific" service volume, $V_E$, or by the intersection-specific capacity. For each link, the model selects the lower value of capacity.

## 4.3 Application to the Turkey Point Nuclear Power Plant Study Area

As part of the development of the link-node analysis network for the study area, an estimate of roadway capacity is required. The source material for the capacity estimates presented herein is contained in:

2016 Highway Capacity Manual (HCM 2016)
Transportation Research Board
National Research Council
Washington, D.C.

The highway system in the study area consists primarily of three categories of roads and, of course, intersections:

- Two-Lane roads: Local, State
- Multilane Highways (at-grade)
- Freeways

Each of these classifications will be discussed.

### 4.3.1 Two-Lane Roads

Ref: HCM 2016 Chapter 15

Two lane roads comprise the majority of highways within the study area (EPZ and Shadow Region). The per-lane capacity of a two-lane highway is estimated at 1,700 passenger cars per hour (pc/h). This estimate is essentially independent of the directional distribution of traffic volume except that, for extended distances, the two-way capacity will not exceed 3,200 pc/h. The HCM 2016 procedures then estimate LOS and Average Travel Speed. The DYNEV II simulation model accepts the specified value of capacity as input and computes average speed based on the time-varying demand: capacity relations.

Based on the field survey and on expected traffic operations associated with evacuation scenarios:

- Most sections of two-lane roads within the study area are classified as “Class I”, with "level terrain"; some are “rolling terrain”.
- “Class II” highways are mostly those within urban and suburban centers.

### 4.3.2 Multilane Highway

Ref: HCM 2016 Chapter 12

Exhibit 12-8 of the HCM 2016 presents a set of curves that indicate a per-lane capacity ranging from approximately 1,900 to 2,300 pc/h, for free-speeds of 45 to 60 mph, respectively. Based on observation, the multilane highways outside of urban areas within the study area service traffic with free speeds in this range. The actual time-varying speeds computed by the simulation model reflect the demand and capacity relationship and the impact of control at intersections. A conservative estimate of per-lane capacity of 1,900 pc/h is adopted for this study for multilane highways outside of urban areas.

### 4.3.3 Freeways

Ref: HCM 2016 Chapters 10, 12, 13, 14

Chapter 10 of the HCM 2016 describes a procedure for integrating the results obtained in Chapters 12, 13 and 14, which compute capacity and LOS for freeway components. Chapter 10 also presents a discussion of simulation models. The DYNEV II simulation model automatically performs this integration process.

Chapter 12 of the HCM 2016 presents procedures for estimating capacity and LOS for “Basic Freeway Segments". Exhibit 12-37 of the HCM 2016 presents capacity vs. free speed estimates, which are provided below.

| Free Speed (mph): | 55 | 60 | 65 | 70+ |
|---|---|---|---|---|
| Per-Lane Capacity (pc/h): | 2,250 | 2,300 | 2,350 | 2,400 |

The inputs to the simulation model are highway geometrics, free-speeds and capacity based on field observations. The simulation logic calculates actual time-varying speeds based on demand: capacity relationships. A conservative estimate of per-lane capacity of 2,250 pc/h is adopted for this study for freeways.

Chapter 13 of the HCM 2016 presents procedures for estimating capacity, speed, density and LOS for freeway weaving sections. The simulation model contains logic that relates speed to demand volume: capacity ratio. The value of capacity obtained from the computational procedures detailed in Chapter 13 depends on the "Type" and geometrics of the weaving segment and on the "Volume Ratio" (ratio of weaving volume to total volume).

Chapter 14 of the HCM 2016 presents procedures for estimating capacities of ramps and of "merge" areas. There are three significant factors to the determination of capacity of a ramp-freeway junction: The capacity of the freeway immediately downstream of an on-ramp or immediately upstream of an off-ramp; the capacity of the ramp roadway; and the maximum flow rate entering the ramp influence area. In most cases, the freeway capacity is the controlling factor. Values of this merge area capacity are presented in Exhibit 14-10 of the HCM

2016, and depend on the number of freeway lanes and on the freeway free speed. Ramp capacity is presented in Exhibit 14-12 and is a function of the ramp FFS. The DYNEV II simulation model logic simulates the merging operations of the ramp and freeway traffic in accord with the procedures in Chapter 14 of the HCM 2016. If congestion results from an excess of demand relative to capacity, then the model allocates service appropriately to the two entering traffic streams and produces LOS F conditions (The HCM 2016 does not address LOS F explicitly).

### 4.3.4 Intersections

Ref: HCM 2016 Chapters 19, 20, 21, 22

Procedures for estimating capacity and LOS for approaches to intersections are presented in Chapter 19 (signalized intersections), Chapters 20, 21 (un-signalized intersections) and Chapter 22 (roundabouts). The complexity of these computations is indicated by the aggregate length of these chapters. The DYNEV II simulation logic is likewise complex.

The simulation model explicitly models intersections: Stop/yield controlled intersections (both 2-way and all-way) and traffic signal controlled intersections. Where intersections are controlled by fixed time controllers, traffic signal timings are set to reflect average (non-evacuation) traffic conditions. Actuated traffic signal settings respond to the time-varying demands of evacuation traffic to adjust the relative capacities of the competing intersection approaches.

The model is also capable of modeling the presence of manned traffic control. At specific locations where it is advisable or where existing plans call for overriding existing traffic control to implement manned control, the model will use actuated signal timings that reflect the presence of traffic guides. At locations where a special traffic control strategy (continuous left-turns, contra-flow lanes) is used, the strategy is modeled explicitly. A list that includes the total number of intersections modeled that are unsignalized, signalized, or manned by response personnel is presented in Appendix K.

## 4.4 Simulation and Capacity Estimation

Chapter 6 of the HCM 2016 is entitled, “HCM and Alternative Analysis Tools.” The chapter discusses the use of alternative tools such as simulation modeling to evaluate the operational performance of highway networks. Among the reasons cited in Chapter 6 to consider using simulation as an alternative analysis tool is:

> *“The system under study involves a group of different facilities or travel modes with mutual interactions involving several HCM chapters. Alternative tools are able to analyze these facilities as a single system.”*

This statement succinctly describes the analyses required to determine traffic operations across an area encompassing a study area operating under evacuation conditions. The model utilized for this study, DYNEV II, is further described in Appendix C. It is essential to recognize that simulation models do not replicate the methodology and procedures of the HCM 2016 – they *replace* these procedures by describing the complex interactions of traffic flow and computing

Measures of Effectiveness (MOE) detailing the operational performance of traffic over time and by location. The DYNEV II simulation model includes some HCM 2016 procedures only for the purpose of estimating capacity.

All simulation models must be calibrated properly with field observations that quantify the performance parameters applicable to the analysis network. Two of the most important of these are: (1) FFS; and (2) saturation headway, $h_{sat}$. The first of these is estimated by direct observation during the road survey; the second is estimated using the concepts of the HCM 2016, as described earlier.

It is important to note that simulation is a mathematical representation of an assumed set of conditions using the best available knowledge and understanding of traffic flow and available inputs. Simulation should not be assumed to be a prediction of what will happen under any event because a real evacuation can be impacted by an infinite number of things – many of which will differ from these test cases – and many others cannot be taken into account with the tools available.

## 4.5 Boundary Conditions

As illustrated in Figure 1-2 and in Appendix K, the link-node analysis network used for this study is finite. The analysis network extends well beyond the 15-mile radial study area in some locations in order to model intersections with other major evacuation routes beyond the study area. However, the network does have an end at the destination (exit) nodes as discussed in Appendix C. Beyond these destination nodes, there may be signalized intersections or merge points that impact the capacity of the evacuation routes leaving the study area. Rather than neglect these “boundary conditions,” this study assumes a 25% reduction in capacity on two-lane roads (Section 4.3.1 above) and multilane highways (Section 4.3.2 above). There is no reduction in capacity for freeways due to boundary conditions. The 25% reduction in capacity is based on the prevalence of actuated traffic signals in the study area and the fact that the evacuating traffic volume (“main street”) will be more significant than the competing traffic volume (“side street”) at any downstream signalized intersections, thereby warranting a more significant percentage (75% in this case) of the signal green time.

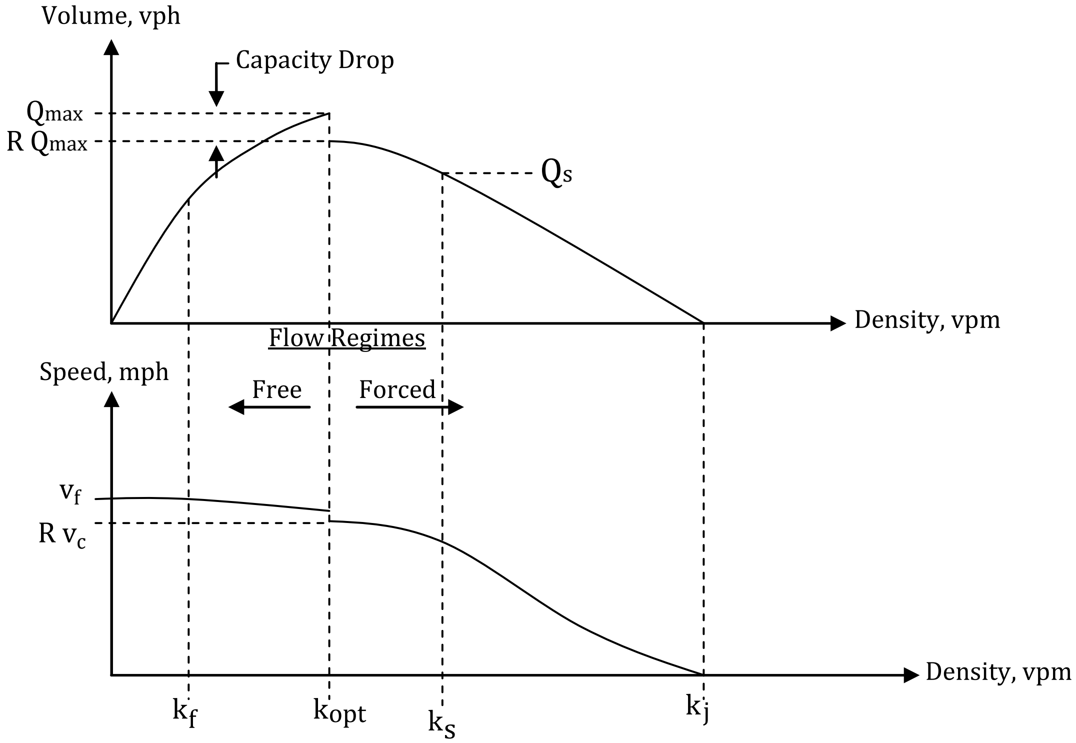

Figure 4-1. Fundamental Diagrams

# 5 ESTIMATION OF TRIP GENERATION TIME

Federal guidance (see NUREG CR-7002, Rev. 1) recommends that the Evacuation Time Estimate (ETE) study estimate the distributions of elapsed times associated with mobilization activities undertaken by the public to prepare for the evacuation trip. The elapsed time associated with each activity is represented as a statistical distribution reflecting differences between members of the public. The quantification of these activity-based distributions relies largely on the results of the demographic survey. We define the <u>sum</u> of these distributions of elapsed times as the Trip Generation Time Distribution.

## 5.1 Background

In general, an accident at a nuclear power plant is characterized by the following Emergency Classification Levels (see Section C of Part IV of Appendix E of 10 CFR 50 for details):

1. Unusual Event
2. Alert
3. Site Area Emergency
4. General Emergency

At each level, the Federal guidelines specify a set of <u>Actions</u> to be undertaken by the licensee, and by the state and local offsite agencies. As a <u>Planning Basis</u>, we will adopt a conservative posture, in accordance with Section 1.2 of NUREG/CR-7002 Rev.1., that a rapidly escalating accident at the plant wherein evacuation is ordered promptly and no early protective actions have been implemented will be considered in calculating the Trip Generation Time. We will assume:

1. The Advisory to Evacuate (ATE) will be announced coincident with the Alert and Notification System (ANS) which includes siren notification.
2. Mobilization of the general population will commence within 15 minutes after the siren notification.
3. The ETE are measured relative to the ATE.

We emphasize that the adoption of this planning basis is <u>not</u> a representation that these events will occur within the indicated time frame. Rather, these assumptions are necessary in order to:

1. Establish a temporal framework for estimating the Trip Generation distribution in the format recommended in Section 2.13 of NUREG/CR-6863.
2. Identify temporal points of reference that uniquely define "Clear Time" and ETE.

It is likely that a longer time will elapse between the various classes of an emergency. For example, suppose one-hour elapses from the siren alert to the ATE. In this case, it is reasonable to expect some degree of spontaneous evacuation by the public during this one-hour period. As a result, the population within the Emergency Planning Zone (EPZ) will be lower when the ATE is announced, than at the time of the siren alert. In addition, many will engage in preparation activities to evacuate, in anticipation that an Advisory will be broadcasted. Thus, the time needed to complete the mobilization activities and the number of people remaining to evacuate the EPZ after the ATE, will both be somewhat less than the estimates presented in this report. Consequently, the ETE presented in this report are higher than the actual evacuation time, if this hypothetical situation were to take place.

The notification process consists of two events:

1. Transmitting information using the alert and notification systems (ANS) available within the EPZ (e.g., sirens, EAS broadcasts – radio, television and NOAA Weather Radio, loud speakers).
2. Receiving and correctly interpreting the information that is transmitted.

The population within the EPZ is dispersed over an area of approximately 190 square miles and is engaged in a wide variety of activities. It must be anticipated that some time will elapse between the transmission and receipt of the information advising the public of an accident.

The amount of elapsed time will vary from one individual to the next depending on where that person is, what that person is doing, and related factors. Furthermore, some persons who will be directly involved with the evacuation process may be outside the EPZ at the time the emergency is declared. These people may be commuters, shoppers and other travelers who reside within the EPZ and who will return to join the other household members upon receiving notification of an emergency.

As indicated in Section 2.13 of NUREG/CR-6863, the estimated elapsed times for the receipt of notification can be expressed as a distribution reflecting the different notification times for different people within, and outside, the EPZ. By using time distributions, it is also possible to distinguish between different population groups and different day-of-week and time-of-day scenarios, so that accurate ETE may be computed.

For example, people at home or at work within the EPZ will be notified by siren, and/or tone alert and/or radio (if available). Those well outside the EPZ will be notified by telephone, radio, TV and word-of-mouth, with potentially longer time lags. Furthermore, the spatial distribution of the EPZ population will differ with time of day - families will be united in the evenings but dispersed during the day. In this respect, weekends will differ from weekdays.

As indicated in Section 4.3 of NUREG/CR-7002, Rev. 1, the information required to compute trip generation times is typically obtained from a demographic survey of EPZ permanent residents. Such a survey was conducted in support of this ETE study for this site. Appendix F discusses the survey sampling plan, the number of completed surveys obtained, documents the survey instrument utilized, and provides the survey results. It is important to note that the shape and duration of the evacuation trip mobilization distribution is important at sites where traffic congestion is not expected to cause the ETE to extend beyond the trip generation time period. The remaining discussion will focus on the application of the trip generation data obtained from the demographic survey to the development of the ETE documented in this report.

## 5.2 Fundamental Considerations

The environment leading up to the time that people begin their evacuation trips consists of a sequence of events and activities. Each event (other than the first) occurs at an instant in time and is the outcome of an activity.

Activities are undertaken over a period of time. Activities may be in "series" (i.e., to undertake an activity implies the completion of all preceding events) or may be in parallel (two or more activities may take place over the same period of time). Activities conducted in series are functionally dependent on the completion of prior activities; activities conducted in parallel are functionally independent of one another. The relevant events associated with the public's preparation for evacuation are:

| Event Number | Event Description |
|---|---|
| 1 | Notification |
| 2 | Awareness of Situation |
| 3 | Depart Work |
| 4 | Arrive Home |
| 5 | Depart on Evacuation Trip |

Associated with each sequence of events are one or more activities, as outlined in Table 5-1.

These relationships are shown graphically in Figure 5-1.

- An Event is a 'state' that exists at a point in time (e.g., depart work, arrive home)
- An Activity is a 'process' that takes place over some elapsed time (e.g., prepare to leave work, travel home)

As such, a completed Activity changes the 'state' of an individual (i.e., the activity, 'travel home' changes the state from 'depart work' to 'arrive home'). Therefore, an Activity can be described as an 'Event Sequence'; the elapsed times to perform an event sequence vary from one person to the next and are described as statistical distributions on the following pages.

An employee who lives outside the EPZ will follow sequence (c) of Figure 5-1. A household within the EPZ that has one or more commuters at work and will await their return before beginning the evacuation trip will follow the first sequence of Figure 5-1(a). A household within the EPZ that has no commuters at work, or that will not await the return of any commuters, will follow the second sequence of Figure 5-1(a), regardless of day of week or time of day.

Households with no commuters on weekends or in the evening/night-time, will follow the applicable sequence in Figure 5-1(b). Transients will always follow one of the sequences of Figure 5-1(b). Some transients away from their residence could elect to evacuate immediately without returning to the residence, as indicated in the second sequence.

It is seen from Figure 5-1, that the Trip Generation time (i.e., the total elapsed time from Event 1 to Event 5) depends on the scenario and will vary from one household to the next. Furthermore, Event 5 depends, in a complicated way, on the time distributions of all activities preceding that event. That is, to estimate the time distribution of Event 5, we must obtain estimates of the time distributions of all preceding events. For this study, we adopt the conservative posture that all activities will occur in sequence.

In some cases, assuming certain events occur strictly sequential (for instance, commuter returning home before beginning preparation to leave) can result in rather *conservative* (that is, longer) estimates of mobilization times. It is reasonable to expect that at least some parts of these events will overlap for many households, but that assumption is not made in this study.

## 5.3 Estimated Time Distributions of Activities Preceding Event 5

The time distribution of an event is obtained by "summing" the time distributions of all prior contributing activities. (This "summing" process is quite different than an algebraic sum since it is performed on distributions – not scalar numbers).

Time Distribution No. 1, Notification Process: Activity 1 → 2

Federal regulations (10CFR50 Appendix E, Item IV.D.3) stipulate, "[t]he design objective of the prompt public alert and notification system shall be to have the capability to essentially complete the initial alerting and initiate notification of the public within the plume exposure pathway EPZ within about 15 minutes". Furthermore, 2019 Federal Emergency Management Agency (FEMA) Radiological Emergency Preparedness (REP) Program Manual Pat V Section B.1 Bullet 3 states, "Notification methods will be established to ensure coverage within 45 minutes of essentially 100 percent of the population within the entire plume exposure pathway EPZ who may not have received the initial notification within the entire plume exposure ETE."

Given the federal regulations and guidance, and the assumed presence of sirens within the EPZ, it is assumed that 100 percent of population in the EPZ can be notified within 45 minutes. The assumed distribution for notifying the EPZ population is provided in Table 5-2. The distribution is plotted in Figure 5-2.

Distribution No. 2, Prepare to Leave Work: Activity 2 → 3

It is reasonable to expect that the vast majority of business enterprises within the EPZ will elect to shut down following notification and most employees would leave work quickly. Commuters, who work outside the EPZ could, in all probability, also leave quickly since facilities outside the EPZ would remain open and other personnel would remain. Personnel or farmers responsible for equipment/livestock would require additional time to secure their facility. The distribution of Activity 2 → 3 shown in Table 5-3 reflects data obtained by the demographic survey for employees working inside or outside of the EPZ who returns home prior to evacuating. This distribution is also applicable for residents to leave stores, restaurants, parks and other locations within the EPZ. This distribution is plotted in Figure 5-2.

Distribution No. 3, Travel Home: Activity 3 → 4

These data are provided directly by those households which responded to the demographic survey. This distribution is plotted in Figure 5-2 and listed in Table 5-4.

Distribution No. 4, Prepare to Leave Home: Activity 2, 4 → 5

These data are provided directly by those households which responded to the demographic survey. This distribution is plotted in Figure 5-2 and listed in Table 5-5.

## 5.4 Calculation of Trip Generation Time Distribution

The time distributions for each of the mobilization activities presented herein must be combined to form the appropriate Trip Generation Distributions. As discussed above, this study assumes that the stated events take place in sequence such that all preceding events must be completed before the current event can occur. For example, if a household awaits the return of a commuter, the work-to-home trip (Activity 3 → 4) must precede Activity 4 → 5.

To calculate the time distribution of an event that is dependent on two sequential activities, it is necessary to "sum" the distributions associated with these prior activities. The distribution summing algorithm is applied repeatedly to form the required distribution. As an outcome of this procedure, new time distributions are formed; we assign "letter" designations to these intermediate distributions to describe the procedure. Table 5-6 presents the summing procedure to arrive at each designated distribution.

Table 5-7 presents a description of each of the final trip generation distributions achieved after the summing process is completed.

### 5.4.1 Statistical Outliers

As already mentioned, some portion of the survey respondents answer "don't know" to some questions or choose to not respond to a question. The mobilization activity distributions are based upon actual responses. But, it is the nature of surveys that a few numeric responses are inconsistent with the overall pattern of results. An example would be a case in which for 500 responses, almost all of them estimate less than two hours for a given answer, but 3 say "four hours" and 4 say "six or more hours".

These "outliers" must be considered: are they valid responses, or so atypical that they should be dropped from the sample?

In assessing outliers, there are three alternatives to consider:

1) Some responses with very long times may be valid, but reflect the reality that the respondent really needs to be classified in a different population subgroup, based upon access and/or functional needs;

2) Other responses may be unrealistic (6 hours to return home from commuting distance, or 2 days to prepare the home for departure);

3) Some high values are representative and plausible, and one must not cut them as part of the consideration of outliers.

The issue of course is how to make the decision that a given response or set of responses are to be considered "outliers" for the component mobilization activities, using a method that objectively quantifies the process.

There is considerable statistical literature on the identification and treatment of outliers singly or in groups, much of which assumes the data is normally distributed and some of which uses non-parametric methods to avoid that assumption. The literature cites that limited work has been done directly on outliers in sample survey responses.

In establishing the overall mobilization time/trip generation distributions, the following principles are used:

1) It is recognized that the overall trip generation distributions are conservative estimates, because they assume a household will do the mobilization activities sequentially, with no overlap of activities;
2) The individual mobilization activities (prepare to leave work, travel home, prepare home) are reviewed for outliers, and then the overall trip generation distributions are created (see Figure 5-1, Table 5-6, Table 5-7);
3) Outliers can be eliminated either because the response reflects a special population (e.g., access and/or functional needs, transit dependent) or lack of realism, because the purpose is to estimate trip generation patterns for personal vehicles;
4) To eliminate outliers,
    a) the mean and standard deviation of the specific activity are estimated from the responses,
    b) the median of the same data is estimated, with its position relative to the mean noted,
    c) the histogram of the data is inspected, and
    d) all values greater than 3.0 standard deviations are flagged for attention, taking special note of whether there are gaps (categories with zero entries) in the histogram display.

    In general, flagged values more than 3.5 standard deviations from the mean are allowed to be considered outliers, with gaps in the histogram expected.

    When flagged values are classified as outliers and dropped, steps "a" to "d" are repeated.
5) As a practical matter, even with outliers eliminated by the above, the resultant histogram, viewed as a cumulative distribution, is not a normal distribution. A typical situation that results is shown in Figure 5-3.
6) In particular, the cumulative distribution differs from the normal distribution in two key aspects, both very important in loading a network to estimate evacuation times:
    a) Most of the real data is to the left of the "normal" curve, indicating that the network loads faster for the first 80-85% of the vehicles, potentially causing more (and earlier) congestion than otherwise modeled;

    b) The last 10-15% of the real data "tails off" slower than the comparable "normal" curve, indicating that there is significant traffic still loading at later times.

  Because these two features are important to preserve, it is the histogram of the data that is used to describe the mobilization activities, <u>not</u> a "normal" curve fit to the data. One could consider other distributions, but using the shape of the *actual* data curve is unambiguous and preserves these important features;

7) With the mobilization activities each modeled according to Steps 1-6, including preserving the features cited in Step 6, the overall (or total) mobilization times are constructed.

This is done by using the data sets and distributions under different scenarios (e.g., commuter returning, no commuter returning). In general, these are additive, using weighting based upon the probability distributions of each element; Figure 5-4 presents the combined trip generation distributions designated for each population group considered. These distributions are presented on the same time scale. (As discussed earlier, the use of strictly additive activities is a conservative approach, because it makes all activities <u>sequential</u> – preparation for departure follows the return of the commuter. In practice, it is reasonable that some of these activities are done in parallel, at least to some extent – for instance, preparation to depart begins by a household member at home while the commuter is still on the road.)

The mobilization distributions results are used in their tabular/graphical form as direct inputs to later computations that lead to the ETE.

The DYNEV II simulation model is designed to accept varying rates of vehicle trip generation for each origin centroid, expressed in the form of histograms. These histograms, which represent Distributions A, C, and D, properly displaced with respect to one another, are tabulated in Table 5-8 (Distribution B, Arrive Home, omitted for clarity).

The final time period (15) is 600 minutes long. This time period is added to allow the analysis network to clear, in the event congestion persists beyond the trip generation period. Note that there are no trips generated during this final time period.

### 5.4.2 Staged Evacuation Trip Generation

As defined in NUREG/CR-7002, Rev. 1, staged evacuation consists of the following:

1. Areas comprising the 2-Mile Region which encompasses the entire 2-mile radius are advised to evacuate immediately.
2. Areas comprising regions extending from 2 to 5 miles downwind are advised to shelter in-place while the 2-Mile Region is cleared.
3. As vehicles evacuate the 2-Mile Region, sheltered people from 2 to 5 miles downwind continue preparation for evacuation.

4. The population sheltering in the 2 to 5-Mile Region are advised to begin evacuating when approximately 90% of those originally within the 2-Mile Region evacuate across the 2-Mile Region boundary.
5. Non-compliance with the shelter recommendation is the same as the shadow evacuation percentage of 20%.

<u>Assumptions</u>

1. The EPZ population in Areas beyond 5 miles will shelter-in-place, with the exception of the 20% non-compliance.
2. The population in the Shadow Region beyond the EPZ boundary, extending to approximately 15 miles radially from the plant, will react as they do for all non-staged evacuation scenarios. That is 20% of these households will elect to evacuate with no shelter delay.
3. The transient population will not be expected to stage their evacuation because of the limited sheltering options available to people who may be at parks, on a beach, or at other venues. Also, notifying the transient population of a staged evacuation would prove difficult.
4. Employees will also be assumed to evacuate without first sheltering.

<u>Procedure</u>

1. Trip generation for population groups in the 2-Mile Region will be as computed based upon the results of the demographic survey and analysis.
2. Trip generation for the population subject to staged evacuation will be formulated as follows:
    a. Identify the 90th percentile evacuation time for the portion of Areas 1 and 2 comprising the 2-Mile Region. This value, $T_{Scen}^*$, is obtained from simulation results. It will become the time at which the region being sheltered will be told to evacuate for each scenario.
    b. The resultant trip generation curves for staging are then formed as follows:
        i. The non-shelter trip generation curve is followed until a maximum of 20% of the total trips are generated (to account for shelter non-compliance).
        ii. No additional trips are generated until time $T_{Scen}^*$
        iii. Following time $T_{Scen}^*$, the balance of trips are generated:
            1. by stepping up and then following the non-shelter trip generation curve (if $T_{Scen}^*$ is $\leq$ max trip generation time) or
            2. by stepping up to 100% (if $T_{Scen}^*$ is > max trip generation time)
    c. Note: This procedure implies that there may be different staged trip generation distributions for different scenarios; however, that was not the case for this site. NUREG/CR-7002, Rev. 1 uses the statement “approximately 90th percentile” as the time to end staging and begin evacuating.
    The “approximate “value of $T_{Scen}^*$ is 1:30 for all scenarios.

3. Staged trip generation distributions are created for the following population groups:
    a. Residents with returning commuters
    b. Residents without returning commuters

Figure 5-5 presents the staged trip generation distributions for both residents with and without returning commuters; the approximate 90th percentile 2-Mile Region evacuation time is 90 minutes for all scenarios. At $T_{Scen}$, 20% of the permanent resident population (who normally would have completed their mobilization activities for an un-staged evacuation) advised to shelter has nevertheless departed the area. These people do not comply with the shelter advisory. Also included on the plot are the trip generation distributions for these groups as applied to the regions advised to evacuate immediately.

Since the 90th percentile evacuation time occurs before the end of the trip generation time, after the sheltered region is advised to evacuate, the shelter trip generation distribution rises to meet the balance of the non-staged trip generation distribution. Following time $T_{Scen}^*$, the balance of staged evacuation trips that are ready to depart are released within 15 minutes. After 105 minutes, the remainder of evacuation trips are generated in accordance with the un-staged trip generation distribution.

Figure 5-5 and Table 5-9 provide the trip generation histograms for staged evacuation.

### 5.4.3 Trip Generation for Waterways and Recreational Areas

As discussed in Section 5.3 – Alert & Notification of the Public – of the Miami-Dade County, Florida Emergency Operations Centers Turkey Point Response Plan, boaters in the waters within the 10-mile EPZ will be notified of the emergency by VHF Radio and loudspeakers from boats and aircraft operated by Biscayne National Park Service, Florida Fish & Wildlife Conservation Commission, Miami-Dade Police Marine Patrol, and the United States Coast Guard. The Monroe County Turkey Point Response Plan reiterates this point.

As discussed in Section 2, this study assumes a rapidly escalating general emergency. As indicated in Table 5-2 and discussed in Section 2.3, this study assumes 100% notification in 45 minutes. Table 5-8 indicates that all transients will have mobilized within 2 hour and 15 minutes. It is assumed that this timeframe is sufficient time for boaters, campers and other transients to return to their vehicles or lodging facilities, pack their belongings and begin their evacuation trip.

Table 5-1. Event Sequence for Evacuation Activities

| Event Sequence | Activity | Distribution |
|---|---|---|
| 1 → 2 | Receive Notification | 1 |
| 2 → 3 | Prepare to Leave Work | 2 |
| 2,3 → 4 | Travel Home | 3 |
| 2,4 → 5 | Prepare to Leave to Evacuate | 4 |

Table 5-2. Time Distribution for Notifying the Public

| Elapsed Time (Minutes) | Percent of Population Notified |
|---|---|
| 0 | 0% |
| 5 | 7% |
| 10 | 13% |
| 15 | 27% |
| 20 | 47% |
| 25 | 66% |
| 30 | 87% |
| 35 | 92% |
| 40 | 97% |
| 45 | 100% |

Table 5-3. Time Distribution for Employees to Prepare to Leave Work

| Elapsed Time (Minutes) | Cumulative Percent Employees Leaving Work | Elapsed Time (Minutes) | Cumulative Percent Employees Leaving Work |
|---|---|---|---|
| 0 | 0% | 40 | 68.1% |
| 5 | 6.0% | 45 | 74.4% |
| 10 | 12.3% | 50 | 79.1% |
| 15 | 22.0% | 55 | 82.8% |
| 20 | 30.8% | 60 | 91.9% |
| 25 | 37.5% | 75 | 95.6% |
| 30 | 54.0% | 90 | 98.7% |
| 35 | 60.8% | 105 | 100.0% |

**NOTE:** The survey data was normalized to distribute the "Don't know" response. That is, the sample was reduced in size to include only those households who responded to this question. The underlying assumption is that the distribution of this activity for the “Don’t know” responders, if the event takes place, would be the same as those responders who provided estimates.

### Table 5-4. Time Distribution for Commuters to Travel Home

| Elapsed Time (Minutes) | Cumulative Percent Returning Home | Elapsed Time (Minutes) | Cumulative Percent Returning Home |
|---|---|---|---|
| 0 | 0% | 40 | 78.2% |
| 5 | 21.6% | 45 | 80.4% |
| 10 | 32.1% | 50 | 83.9% |
| 15 | 43.5% | 55 | 85.1% |
| 20 | 52.6% | 60 | 93.5% |
| 25 | 56.3% | 75 | 96.1% |
| 30 | 69.6% | 90 | 98.0% |
| 35 | 75.1% | 105 | 100.0% |

**NOTE:** The survey data was normalized to distribute the "Don't know" response

### Table 5-5. Time Distribution for Population to Prepare to Leave Home

| Elapsed Time (Minutes) | Cumulative Percent Ready to Evacuate | Elapsed Time (Minutes) | Cumulative Percent Ready to Evacuate |
|---|---|---|---|
| 0 | 0% | 120 | 89.3% |
| 15 | 7.3% | 135 | 94.4% |
| 30 | 32.3% | 150 | 95.5% |
| 45 | 42.8% | 165 | 96.8% |
| 60 | 63.4% | 180 | 97.4% |
| 75 | 74.7% | 195 | 99.8% |
| 90 | 79.9% | 210 | 100.0% |
| 105 | 83.3% | | |

**NOTE:** The survey data was normalized to distribute the "Don't know" response

**Table 5-6. Mapping Distributions to Events**

| Apply "Summing" Algorithm To: | Distribution Obtained | Event Defined |
|---|---|---|
| Distributions 1 and 2 | Distribution A | Event 3 |
| Distributions A and 3 | Distribution B | Event 4 |
| Distributions B and 4 | Distribution C | Event 5 |
| Distributions 1 and 4 | Distribution D | Event 5 |

**Table 5-7. Description of the Distributions**

| Distribution | Description |
|---|---|
| **A** | Time distribution of commuters departing place of work (Event 3). Also applies to employees who work within the EPZ who live outside, and to Transients within the EPZ. |
| **B** | Time distribution of commuters arriving home (Event 4). |
| **C** | Time distribution of residents with commuters who return home, leaving home to begin the evacuation trip (Event 5). |
| **D** | Time distribution of residents without commuters returning home, leaving home to begin the evacuation trip (Event 5). |

**Table 5-8. Trip Generation Histograms for the EPZ Population for Un-Staged Evacuation[1]**

| Time Period | Duration (Min) | Percent of Total Trips Generated Within Indicated Time Period | | | |
|---|---|---|---|---|---|
| | | Employees (Distribution A) | Transients (Distribution A) | Residents with Commuters (Distribution C) | Residents Without Commuters (Distribution D) |
| 1 | 15 | 1% | 1% | 0% | 0% |
| 2 | 15 | 10% | 10% | 0% | 5% |
| 3 | 30 | 50% | 50% | 2% | 32% |
| 4 | 30 | 31% | 31% | 12% | 30% |
| 5 | 15 | 5% | 5% | 10% | 9% |
| 6 | 15 | 2% | 2% | 12% | 5% |
| 7 | 15 | 1% | 1% | 12% | 5% |
| 8 | 15 | 0% | 0% | 11% | 5% |
| 9 | 30 | 0% | 0% | 18% | 5% |
| 10 | 30 | 0% | 0% | 11% | 2% |
| 11 | 30 | 0% | 0% | 6% | 2% |
| 12 | 30 | 0% | 0% | 4% | 0% |
| 13 | 30 | 0% | 0% | 1% | 0% |
| 14 | 15 | 0% | 0% | 1% | 0% |
| 15 | 600 | 0% | 0% | 0% | 0% |

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[1] Shadow vehicles are loaded onto the analysis network (Figure 1-2) using Distribution C. Special event vehicles are loaded using Distribution A.

**Table 5-9. Trip Generation Histograms for the EPZ Population for Staged Evacuation**

| Time Period | Duration (Min) | Percent of Total Trips Generated Within Indicated Time Period[2] | |
|---|---|---|---|
| | | Residents with Commuters (Distribution C) | Residents Without Commuters (Distribution D) |
| 1 | 15 | 0% | 0% |
| 2 | 15 | 0% | 1% |
| 3 | 30 | 0% | 6% |
| 4 | 30 | 3% | 6% |
| 5 | 15 | 21% | 63% |
| 6 | 15 | 12% | 5% |
| 7 | 15 | 12% | 5% |
| 8 | 15 | 11% | 5% |
| 9 | 30 | 18% | 5% |
| 10 | 30 | 11% | 2% |
| 11 | 30 | 6% | 2% |
| 12 | 30 | 4% | 0% |
| 13 | 30 | 1% | 0% |
| 14 | 15 | 1% | 0% |
| 15 | 600 | 0% | 0% |

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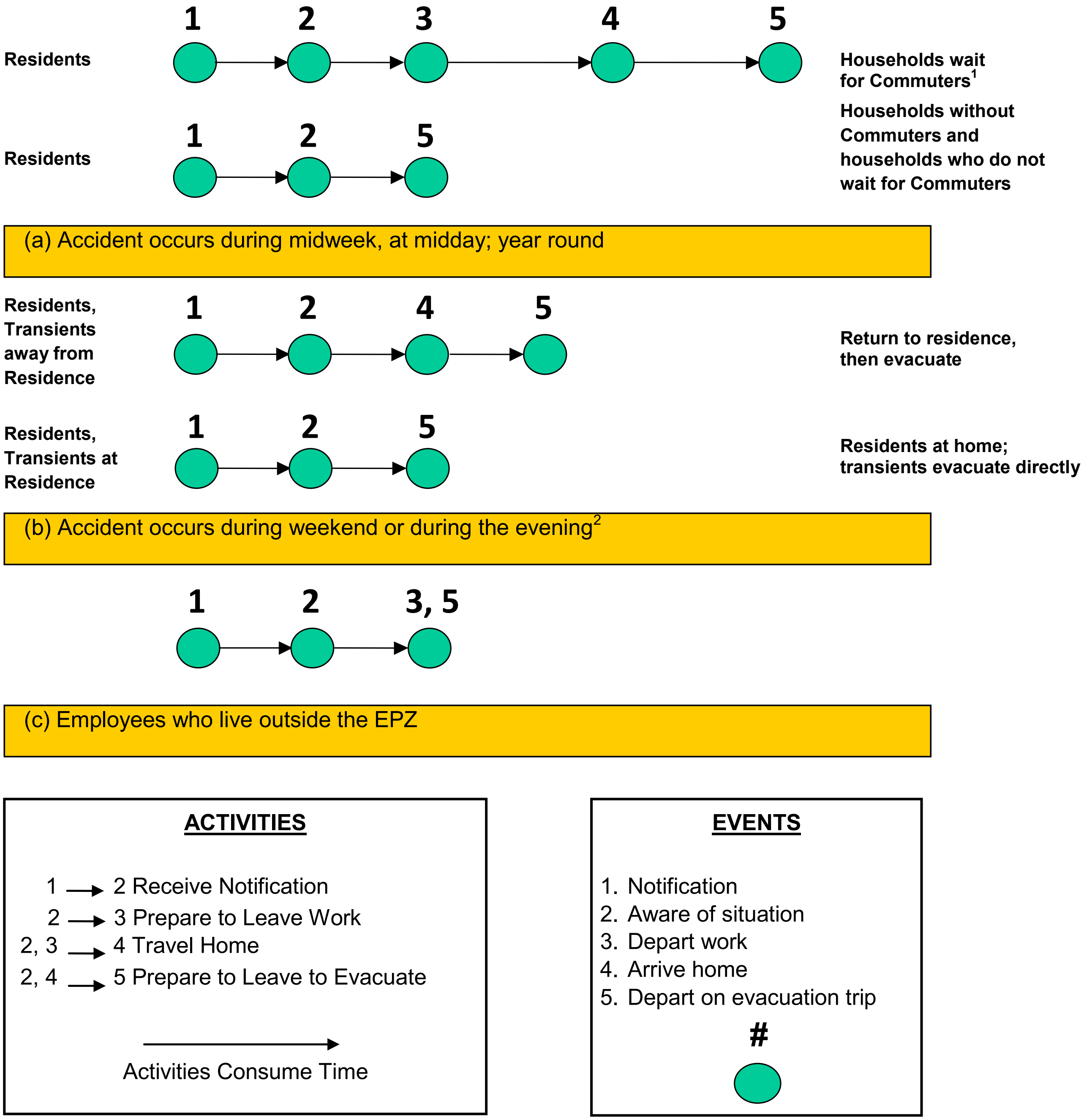
[2] Trip Generation for Employees and Transients (see Table 5-8) is the same for Un-Staged and Staged Evacuation.



[1] Applies for evening and weekends also if commuters are at work.

[2] Applies throughout the year for transients.

**Figure 5-1. Events and Activities Preceding the Evacuation Trip**

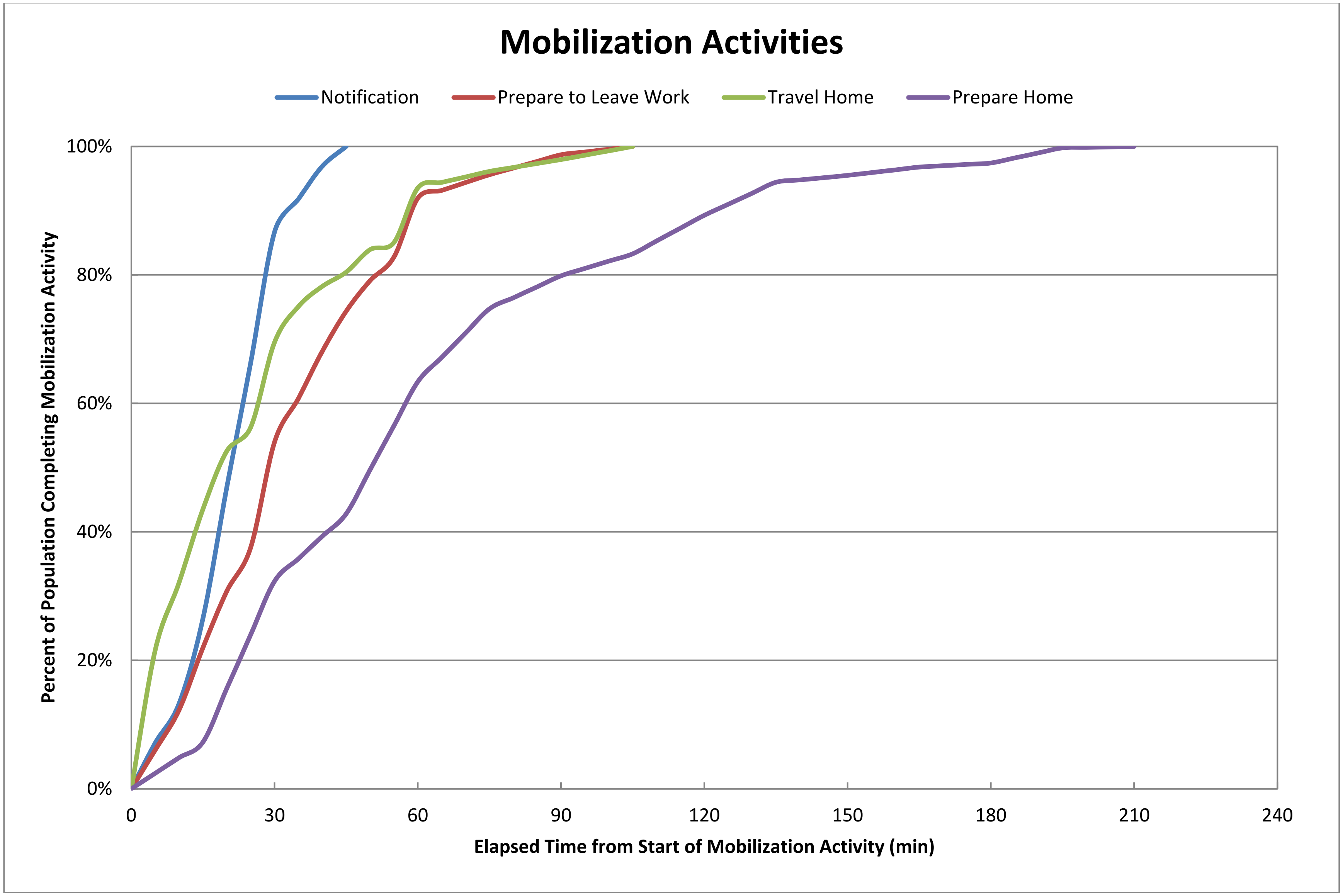


**Figure 5-2. Time Distributions for Evacuation Mobilization Activities**

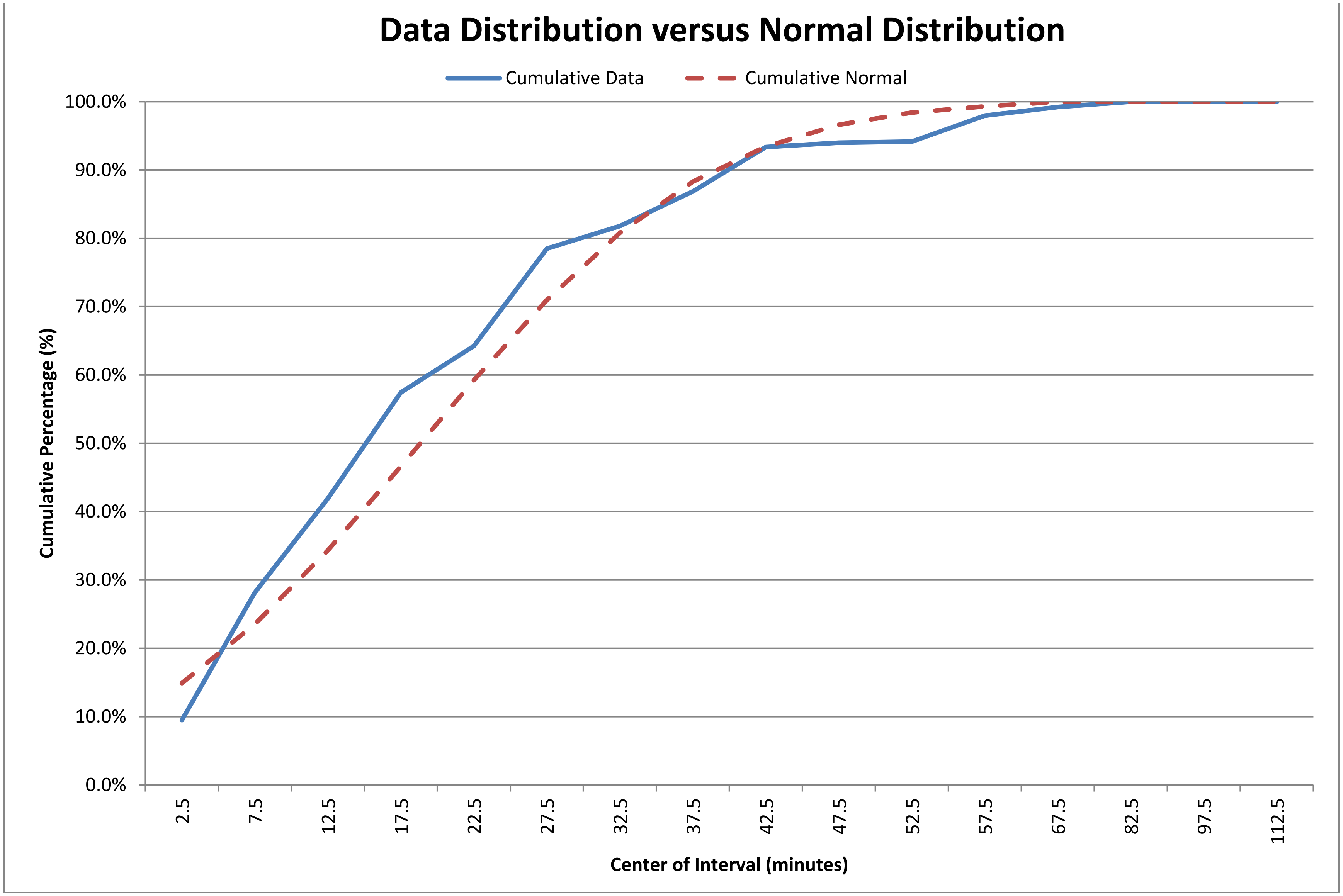


**Figure 5-3. Comparison of Data Distribution and Normal Distribution**

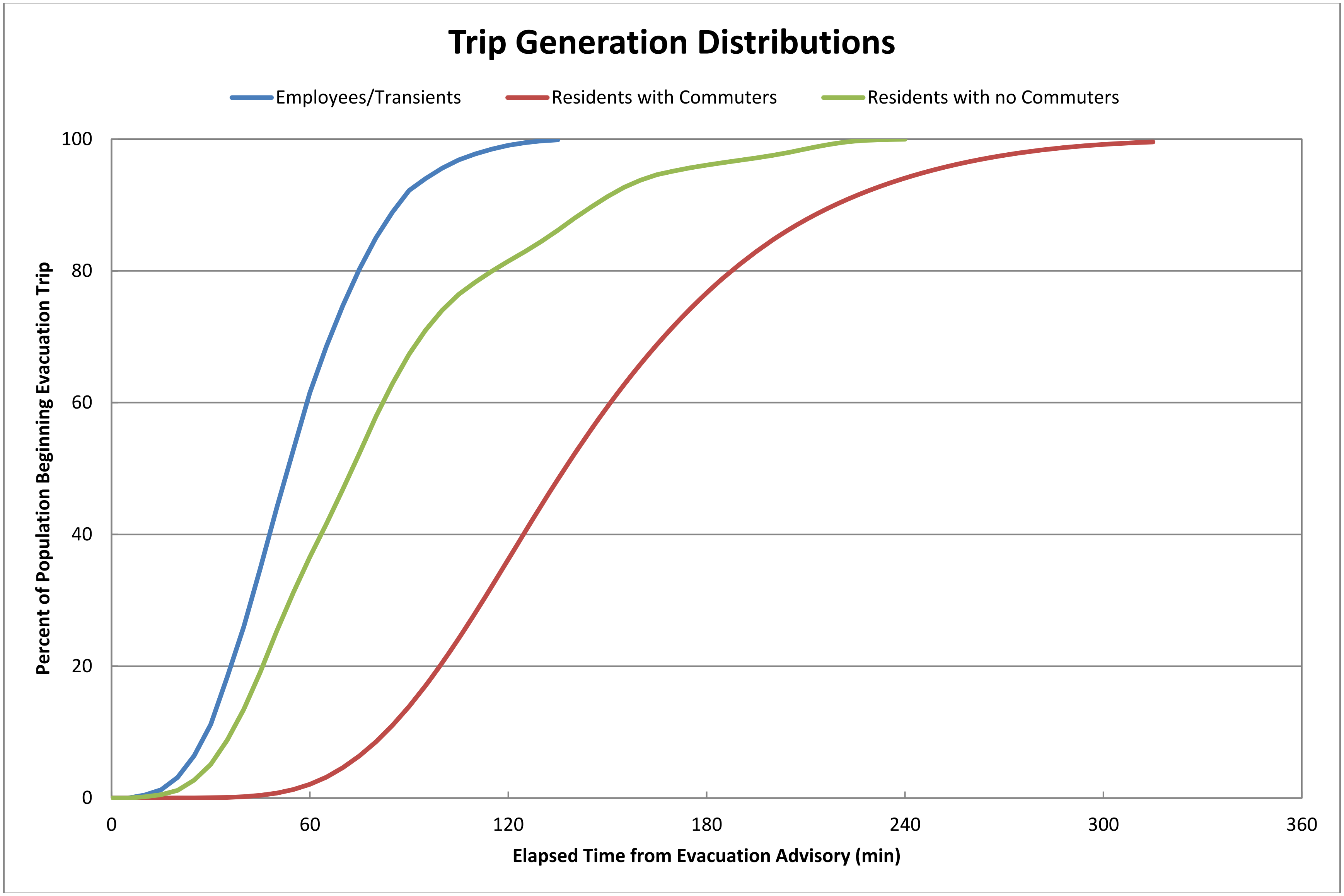


Figure 5-4. Comparison of Trip Generation Distributions

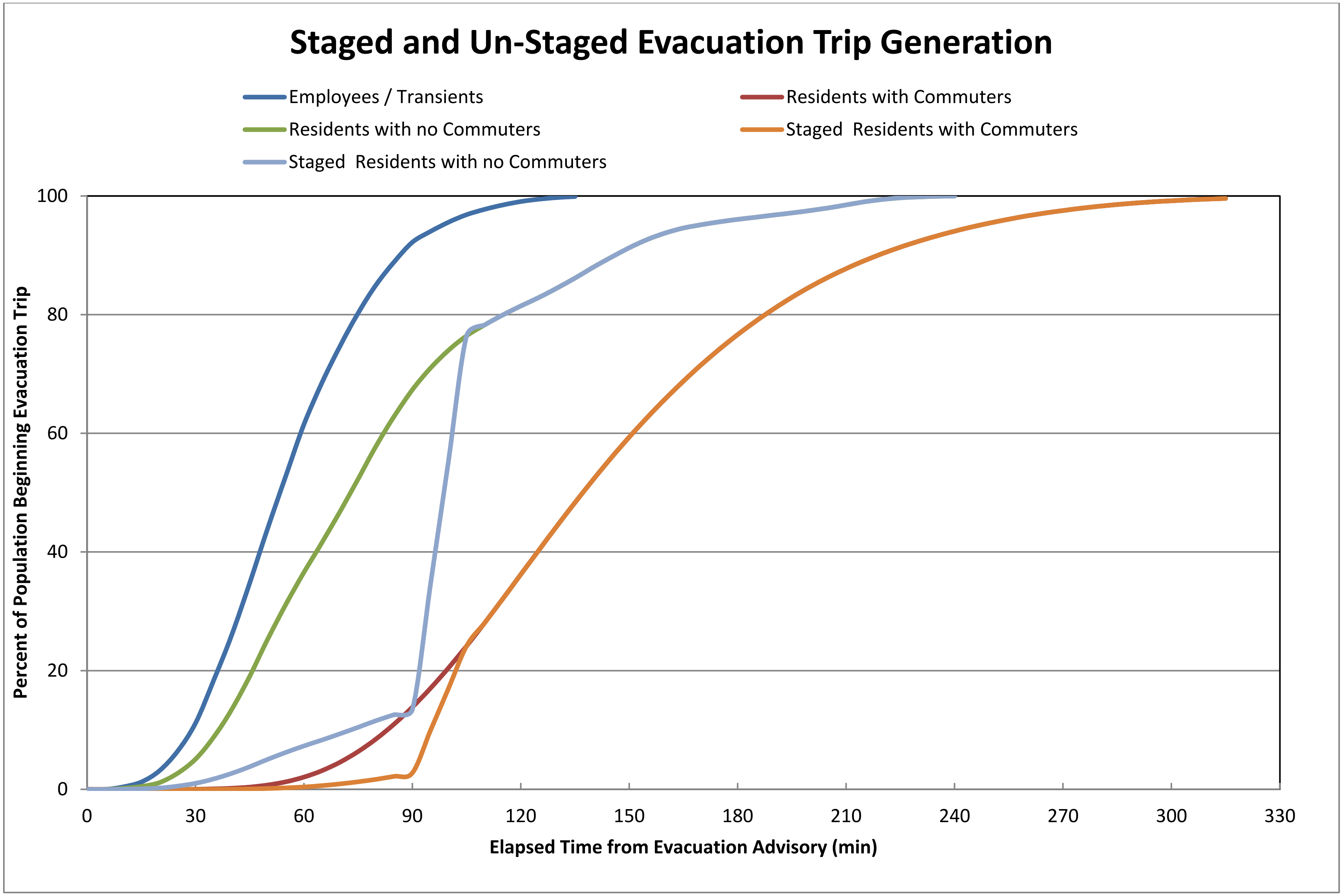


**Figure 5-5. Comparison of Staged and Un-Staged Trip Generation Distributions in the 2 to 5-Mile Region**

# 6 EVACUATION CASES

An evacuation "case" defines a combination of Evacuation Region and Evacuation Scenario. The definitions of "Region" and "Scenario" are as follows:

| | |
|---|---|
| **Region** | A grouping of contiguous evacuating Areas that forms either a "keyhole" sector-based area, or a circular area within the EPZ, that must be evacuated in response to a radiological emergency. |
| **Scenario** | A combination of circumstances, including time of day, day of week, season, and weather conditions. Scenarios define the number of people in each of the affected population groups and their respective mobilization time distributions. |

A total of 17 Regions were defined which encompass all the groupings of Areas considered. These Regions are defined in Table 6-1. The Area configurations are identified in Figure 6-1. (Note Area 1 is the PTN site and is not labeled in Figure 6-1; it is labeled as a star.) These regions were identified based on the EPZ County protective action decision (PAD) standard operating procedures (pages 120-122 in the Monroe County plan and Volume III, Chapter B, Subject 4 of the Miami-Dade County plan). Each keyhole sector-based area generally consists of a central circle centered at the power plant, and three adjoining sectors (some regions use 4 or 5 sectors based on county PAD procedures), each with a central angle of 22.5 degrees, as per NUREG/CR-7002, Rev. 1 guidance. The central sector coincides with the wind direction. These sectors extend to 5 miles from the plant (Regions R04 and R05) or to the EPZ boundary (Regions R06 through R14).

Regions R01, R02 and R03 represent evacuations of circular areas with radii of 2, 5 and 10 miles, respectively. Regions R15 through R17 are identical to Regions R02, R04, and R05, respectively; however, those Areas between 2 miles and 5 miles are staged until 90% of the 2-Mile Region (Region R01) has evacuated, as per NUREG/CR-7002, Rev. 1. The corresponding Emergency Alert System (EAS) message numbers identified in the county plans for each wind direction/regional configuration are provided in the last column of Table 6-1.

A total of 12 Scenarios were evaluated for all Regions. Thus, there are a total of 204 (12 x 17 = 204) evacuation cases. Table 6-2 provides a description of all Scenarios.

Each combination of Region and Scenario implies a specific population to be evacuated. The population group and the vehicle estimates presented in Section 3 and in Appendix E are peak values. These peak values are adjusted depending on the Scenario and Region being considered, using Scenario and Region-specific percentages, such that the average population is considered for each evacuation case. The Scenario percentages are presented in Table 6-3, while the Region percentages are provided in Table H-1.

Table 6-4 presents the vehicle counts for each scenario for an evacuation of Region R03 – the entire EPZ, based on the scenario percentages in Table 6-3. The percentages presented in Table 6-3 were determined as follows:

The number of residents with commuters during the week (when workforce is at its peak) is equal to 32%, which is the product of 59% (the number of households with at least one commuter – see Figure F-9) and 54% (the number of households with a commuter that would await the return of the commuter prior to evacuating – see Figure F-15). See assumption 3 in Section 2.3. It is estimated for weekend and evening scenarios that 10% of those households with returning commuters (32%) will have a commuter at work during those times, or 3% (10% x 32% = 3.2% rounded down to 3%) of households overall.

It can be argued that the estimate of permanent residents overstates, somewhat, the number of evacuating vehicles, especially during the summer. It is certainly reasonable to assert that some portion of the population would be on vacation during the summer and would travel elsewhere. A rough estimate of this reduction can be obtained as follows:

- Assume 50% of all households vacation for a period over the summer.
- Assume these vacations, in aggregate, are uniformly dispersed over 10 weeks, i.e., 10% of the population is on vacation during each two-week interval.
- Assume half of these vacationers leave the area.

On this basis, the permanent resident population would be reduced by 5% in the summer and by a lesser amount in the off-season. Given the uncertainty in this estimate, we elected to apply no reductions in permanent resident population for the summer scenarios to account for residents who may be out of the area.

Employment is assumed to be at its peak (100%) during the winter, midweek, midday scenarios. Employment is reduced slightly (96%) for summer, midweek, midday scenarios. This is based on the estimation that 50% of the employees commuting into the EPZ will be on vacation for a week during the approximate 12 weeks of summer. It is further estimated that those taking vacation will be uniformly dispersed throughout the summer with approximately 4% of employees vacationing each week. It is assumed that only 10% of the employees are working in the evenings and during the weekends.

Transient activity is estimated to be at its peak (100%) during winter weekends and less during the week (70%). Summer weekend transient activity is estimated to be 75% and less (40%) during the week. As shown in Appendix E, there are many lodging facilities and campgrounds offering overnight accommodations in the EPZ, offset by other transient facilities in which evening use is minimal (parks, beaches, historical sites and other recreational areas); thus, transient activity is estimated to be 60% for winter evenings and 45% for summer evenings.

As noted in the shadow footnote to Table 6-3, the shadow percentages are computed using a base of 20% (see assumption 7 in Section 2.2); to include the employees within the Shadow Region who may choose to evacuate, the voluntary evacuation is multiplied by a scenario-specific proportion of employees to permanent residents in the Shadow Region. For example, using the values provided in Table 6-4 for Scenario 6, the shadow percentage is computed as follows:

$$20\% \times \left(1 + \frac{8{,}199}{42{,}503 + 89{,}719}\right) = 21\%$$

One special event – a NASCAR race at the Homestead-Miami Speedway – was considered as Scenario 11 during the winter, weekend, midday with good weather. Thus, the special event traffic is 100% evacuated for Scenario 11, and 0% for all other scenarios. Transient activity is also assumed to peak during this scenario.

As discussed in Section 7, schools and colleges are in session during the winter season, midweek, midday and 100% of buses and private vehicles will be needed under those circumstances. It is estimated that summer school and college enrollment is approximately 10% of enrollment during the regular school year for summer, midweek, midday scenarios. Schools and colleges are not in session during weekends and evenings, thus no buses are needed to relocate schoolchildren and college students are not evacuating in private vehicles for those scenarios.

Transit buses for the transit-dependent population and transport vehicles for medical and correctional facilities are set to 100% for all scenarios as it is assumed that the transit-dependent, medical and correctional facility population are present in the EPZ at all times.

External traffic is estimated to be 100% for all midday scenarios, while it is significantly less (40%) during the evening scenarios (Scenario 5 and 10).

**Table 6-1. Description of Evacuation Regions**

| **Radial Regions** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Region** | **Description** | **Area** | | | | | | | | | | **EAS Message** |
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | |
| **R01** | 2-Mile Region | x | x | | | | | | | | | E14/E18/E19/E21/E22/E23 |
| **R02** | 5-Mile Region | x | x | x | x | | | | | | | E16 |
| **R03** | Full EPZ | x | x | x | x | x | x | x | x | x | x | N/A |
| **Evacuate 2-Mile Region and Downwind to 5-Mile Region** | | | | | | | | | | | | |
| **Region** | **Wind Direction From:** | **Area** | | | | | | | | | | **EAS Message** |
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | |
| **R04** | SSE, S, SSW | x | x | | x | | | | | | | E17 |
| **N/A** | SW, WSW, W, WNW, NW | **Refer to Region 01** | | | | | | | | | | E14/E18/E19/E21/E22/E23 |
| **R05** | NNW, N, NNE, NE, ENE | x | x | x | | | | | | | | E15/E20/E25/E26 |
| **N/A** | E, ESE, SE | **Refer to Region 02** | | | | | | | | | | E16 |
| **Evacuate 2-Mile Region and Downwind to EPZ Boundary** | | | | | | | | | | | | |
| **Region** | **Wind Direction From:** | **Area** | | | | | | | | | | **EAS Message** |
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | |
| **R06** | S, SSW | x | x | | x | x | x | | | | | E24 |
| **N/A** | SW, WSW, W, WNW | **Refer to Region 01** | | | | | | | | | | E14/E18/E19/E21/E22/E23 |
| **R07** | NW | x | x | | | | | | | | x | E14/E18/E19/E21/E22/E23 plus Monroe County |
| **R08** | NNW, N, NNE | x | x | x | | | | | | | x | E15/E20/E25/E26 plus Monroe County |
| **R09** | NE | x | x | x | | | | | | x | | E08 |
| **R10** | ENE | x | x | x | | | | | x | x | | E09 |
| **R11** | E | x | x | x | x | | | | x | x | | E10 |
| **R12** | ESE | x | x | x | x | | | x | x | | | E11 |
| **R13** | SE | x | x | x | x | | x | x | x | | | E12 |
| **R14** | SSE | x | x | | x | x | x | x | | | | E13 |
| **Staged Evacuation - 2-Mile Region Evacuates, then Evacuate Downwind to 5-Mile Region** | | | | | | | | | | | | |
| **Region** | **Wind Direction From:** | **Area** | | | | | | | | | | **EAS Message** |
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | |
| **R15** | 5-Mile Region, E, ESE, SE | x | x | 🟦 x | 🟦 x | | | | | | | E16, staged |
| **R16** | SSE, S, SSW | x | x | | 🟦 x | | | | | | | E17, staged |
| **N/A** | SW, WSW, W, WNW, NW | **Refer to Region 01** | | | | | | | | | | E14/E18/E19/E21/E22/E23 |
| **R17** | NNW, N, NNE, NE, ENE | x | x | 🟦 x | | | | | | | | E15/E20/E25/E26, staged |

| | | |
|---|---|---|
| 🟥 Area(s) Evacuate | ⬜ Area(s) Shelter-in-Place | 🟦 Shelter-in-Place until 90% ETE for R01, then Evacuate |

**Table 6-2. Evacuation Scenario Definitions**

| Scenarios | Season[1] | Day of Week | Time of Day | Weather | Special |
|---|---|---|---|---|---|
| 1 | Summer | Midweek | Midday | Good | None |
| 2 | Summer | Midweek | Midday | Rain | None |
| 3 | Summer | Weekend | Midday | Good | None |
| 4 | Summer | Weekend | Midday | Rain | None |
| 5 | Summer | Midweek, Weekend | Evening | Good | None |
| 6 | Winter | Midweek | Midday | Good | None |
| 7 | Winter | Midweek | Midday | Rain | None |
| 8 | Winter | Weekend | Midday | Good | None |
| 9 | Winter | Weekend | Midday | Rain | None |
| 10 | Winter | Midweek, Weekend | Evening | Good | None |
| 11 | Winter | Weekend | Midday | Good | NASCAR Race at Homestead – Miami Speedway |
| 12 | Summer | Midweek | Midday | Good | One Lane Closure on Florida Turnpike Northbound |

---

[1] Winter means that school is in session at normal enrollment levels (also applies to spring and autumn). Summer means that school is in session at summer school enrollment levels (lower than normal enrollment).

## Table 6-3.  Percent of Population Groups Evacuating for Various Scenarios

| Scenario | Households With Returning Commuters | Households Without Returning Commuters | Employees | Transients | Shadow | NASCAR Race | College Students | Special Facilities | School Buses | Transit Buses | External Through Traffic |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 32% | 68% | 96% | 40% | 21% | 0% | 10% | 100% | 10% | 100% | 100% |
| 2 | 32% | 68% | 96% | 40% | 21% | 0% | 10% | 100% | 10% | 100% | 100% |
| 3 | 3% | 97% | 10% | 75% | 20% | 0% | 0% | 100% | 0% | 100% | 100% |
| 4 | 3% | 97% | 10% | 75% | 20% | 0% | 0% | 100% | 0% | 100% | 100% |
| 5 | 3% | 97% | 10% | 45% | 20% | 0% | 0% | 100% | 0% | 100% | 40% |
| 6 | 32% | 68% | 100% | 70% | 21% | 0% | 100% | 100% | 100% | 100% | 100% |
| 7 | 32% | 68% | 100% | 70% | 21% | 0% | 100% | 100% | 100% | 100% | 100% |
| 8 | 3% | 97% | 10% | 100% | 20% | 0% | 0% | 100% | 0% | 100% | 100% |
| 9 | 3% | 97% | 10% | 100% | 20% | 0% | 0% | 100% | 0% | 100% | 100% |
| 10 | 3% | 97% | 10% | 60% | 20% | 0% | 0% | 100% | 0% | 100% | 40% |
| 11 | 3% | 97% | 10% | 100% | 20% | 100% | 0% | 100% | 0% | 100% | 100% |
| 12 | 32% | 68% | 96% | 40% | 21% | 0% | 10% | 100% | 10% | 100% | 100% |

**Households with Returning Commuters.........Households of EPZ residents who await the return of commuters prior to beginning the evacuation trip.**

**Households without Returning Commuters....Households of EPZ residents who do not have commuters or will not await the return of commuters prior to beginning the evacuation trip.**

**Employees ........................................................EPZ employees who live outside the EPZ**

**Transients..........................................................People who are in the EPZ at the time of an accident for recreational or other (non-employment) purposes.**

**Shadow............................................................. Residents and employees in the Shadow Region (outside of the EPZ) who will spontaneously decide to relocate during the evacuation. The basis for the values shown is a 20% relocation of shadow residents along with a proportional percentage of shadow employees.**

**NASCAR Race....................................................Additional vehicles in the EPZ due to the NASCAR Race at the Homestead-Miami Speedway.**

**College Students..............................................College students evacuating in private vehicles for Miami-Dade College – Homestead Campus and South Dade Technical College**

**Special Facilities, School and Transit Buses...Vehicle-equivalents present on the road during evacuation servicing schools, medical facilities, correctional facilities, and transit-dependent people (1 bus is equivalent to 2 passenger vehicles).**

**External Through Traffic .................................Traffic passing through the EPZ on interstates/freeways and major arterial roads throughout the evacuation. This traffic is diverted 2 hours after the ATE.**

### Table 6-4. Vehicle Estimates by Scenario[2]

| Scenario | Households With Returning Commuters | Households Without Returning Commuters | Employees | Transients | Shadow | NASCAR Race | College Students | Special Facilities | School Buses | Transit Buses | External Through Traffic | Total Scenario Vehicles |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 42,503 | 89,719 | 7,871 | 4,172 | 19,588 | 0 | 72 | 572 | 160 | 412 | 7,274 | 172,343 |
| 2 | 42,503 | 89,719 | 7,871 | 4,172 | 19,588 | 0 | 72 | 572 | 160 | 412 | 7,274 | 172,343 |
| 3 | 4,250 | 127,972 | 820 | 7,822 | 18,602 | 0 | 0 | 572 | 0 | 412 | 7,274 | 167,724 |
| 4 | 4,250 | 127,972 | 820 | 7,822 | 18,602 | 0 | 0 | 572 | 0 | 412 | 7,274 | 167,724 |
| 5 | 4,250 | 127,972 | 820 | 4,693 | 18,602 | 0 | 0 | 572 | 0 | 412 | 2,910 | 160,231 |
| 6 | 42,503 | 89,719 | 8,199 | 7,300 | 19,634 | 0 | 720 | 572 | 1,598 | 412 | 7,274 | 177,931 |
| 7 | 42,503 | 89,719 | 8,199 | 7,300 | 19,634 | 0 | 720 | 572 | 1,598 | 412 | 7,274 | 177,931 |
| 8 | 4,250 | 127,972 | 820 | 10,429 | 18,602 | 0 | 0 | 572 | 0 | 412 | 7,274 | 170,331 |
| 9 | 4,250 | 127,972 | 820 | 10,429 | 18,602 | 0 | 0 | 572 | 0 | 412 | 7,274 | 170,331 |
| 10 | 4,250 | 127,972 | 820 | 6,257 | 18,602 | 0 | 0 | 572 | 0 | 412 | 2,910 | 161,795 |
| 11 | 4,250 | 127,972 | 820 | 10,429 | 18,602 | 32,600 | 0 | 572 | 0 | 412 | 7,274 | 202,931 |
| 12 | 42,503 | 89,719 | 7,871 | 4,172 | 19,588 | 0 | 72 | 572 | 160 | 412 | 7,274 | 172,343 |

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[2] Vehicle estimates are for an evacuation of the entire EPZ (Region R03).

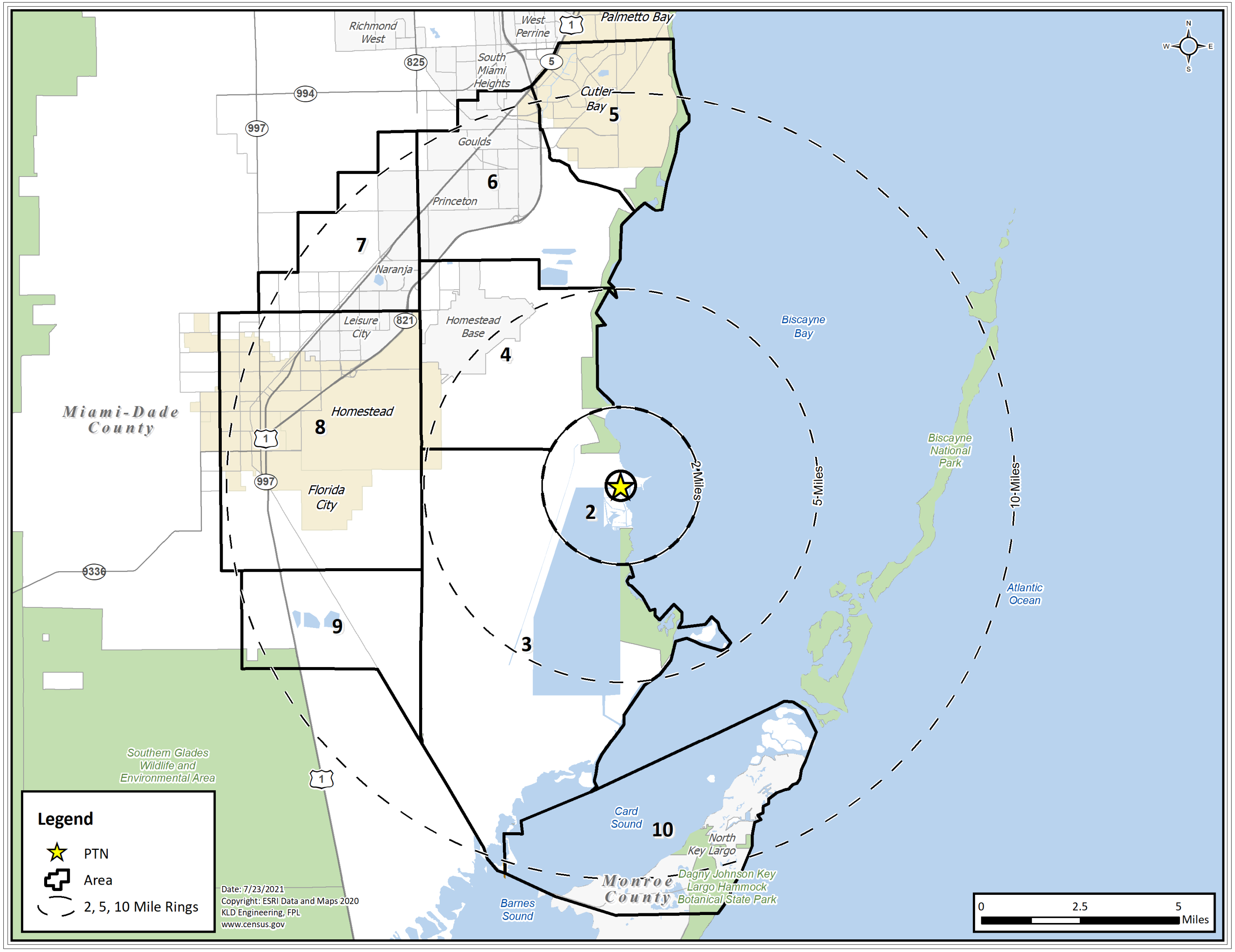

Figure 6-1. Areas Comprising the PTN EPZ

# 7 GENERAL POPULATION EVACUATION TIME ESTIMATES (ETE)

This section presents the ETE results of the computer analyses using the DYNEV II model described in Appendices B, C and D. These results cover 17 regions within the PTN EPZ and the 12 Evacuation Scenarios discussed in Section 6.

The ETE for all Evacuation Cases are presented in Table 7-1 and Table 7-2. These tables present the estimated times to clear the indicated population percentages from the Evacuation Regions for all Evacuation Scenarios. The ETE for the 2-Mile Region in both staged and un-staged regions are presented in Table 7-3 and Table 7-4. Table 7-5 defines the Evacuation Regions considered. The tabulated values of ETE are obtained from the DYNEV II model outputs which are generated at 5-minute intervals.

## 7.1 Voluntary Evacuation and Shadow Evacuation

"Voluntary evacuees" are permanent residents within the EPZ in Areas for which an ATE has not been issued, yet who elect to evacuate. "Shadow evacuation" is the voluntary outward movement of some permanent residents from the Shadow Region (outside the EPZ) for whom no protective action recommendation (PAR) has been issued. Both voluntary and shadow evacuations are assumed to take place over the same time frame as the evacuation from within the impacted Evacuation Region.

The ETE for the PTN EPZ addresses the issue of voluntary evacuees in the manner shown in Figure 7-1. Within the EPZ, 20% of permanent residents located in Areas outside of the evacuation region who are not advised to evacuate, are assumed to elect to evacuate. Similarly, it is assumed that 20% of those people in the Shadow Region will choose to leave the area.

Figure 7-2 presents the area identified as the Shadow Region. This region extends radially from the plant to cover a region between the EPZ boundary and approximately 15 miles. The population and number of evacuating vehicles in the Shadow Region were estimated using the same methodology that was used for permanent residents within the EPZ (see Section 3.1). As discussed in Section 3.2, it is estimated that a total of 189,164 people reside in the Shadow Region; 20% of them would evacuate. See Table 6-4 for the number of evacuating vehicles from the Shadow Region.

Traffic generated within this Shadow Region (including external-external traffic), traveling away from the PTN location, has the potential for impeding evacuating vehicles from within the Evacuation Region. All ETE calculations include this shadow traffic movement.

## 7.2 Staged Evacuation

As defined in NUREG/CR-7002, Rev. 1, staged evacuation consists of the following:

1. Residents within the 2-Mile Region are advised to evacuate immediately.
2. Population extending from 2 to 5 miles downwind are advised to shelter in-place while the 2-Mile Region is cleared.
3. As vehicles evacuate the 2-Mile Region, sheltered people from 2 to 5 miles downwind continue preparation for evacuation.
4. The population sheltering in the 2 to 5-Mile Region are advised to begin evacuating when approximately 90% of those originally within the 2-mile Region evacuate across the 2-Mile Region boundary.
5. Non-compliance with the shelter recommendation is the same as the shadow evacuation percentage of 20%.
6. The EPZ population in Areas beyond 5 miles will shelter-in-place, with the exception of the 20% non-compliance.

See Section 5.4.2 for additional information on staged evacuation.

## 7.3 Patterns of Traffic Congestion during Evacuation

Figure 7-3 through Figure 7-9 illustrate the patterns of traffic congestion that arise for the case when the entire EPZ (Region R03) is advised to evacuate during the winter, midweek, midday period under good weather conditions (Scenario 6).

Traffic congestion, as the term is used here, is defined as Level of Service (LOS) F. LOS F is defined as follows (HCM 2016, page 5-5):

> The HCM uses LOS F to define operations that have either broken down (i.e., demand exceeds capacity) or have reached a point that most users would consider unsatisfactory, as described by a specified service measure value (or combination of service measure values). However, analysts may be interested in knowing just how bad the LOS F condition is, particularly for planning applications where different alternatives may be compared. Several measures are available to describe individually, or in combination, the severity of a LOS F condition:
>
> > • *Demand-to-capacity ratios* describe the extent to which demand exceeds capacity during the analysis period (e.g., by 1%, 15%).
> >
> > • *Duration of LOS F* describes how long the condition persists (e.g., 15 min, 1 h, 3 h).
> >
> > • *Spatial extent measures* describe the areas affected by LOS F conditions. These include measures such as the back of queue and the identification of the specific intersection approaches or system elements experiencing LOS F conditions.

All highway "links" which experience LOS F are delineated in these figures by a thick red line; all others are lightly indicated. Congestion develops rapidly around concentrations of population and traffic bottlenecks.

Figure 7-3 displays the widespread traffic congestion within the study area at 1 hour after the ATE. Traffic congestion (LOS F) exists at this time within all major population centers within the EPZ (Florida City, Leisure City, Princeton, Goulds and Cutler Bay). Krome Ave (Florida State Route 997, FL-997) northbound is congested from the intersection with U.S. Highway 1 (US-1) in Florida City to the end of the study area. US Highway 1 northbound is congested throughout the study area and so are the east-west roadways accessing US-1. County Route 905 (CR-905) southbound in Monroe County is congested at the intersection with US-1 due to evacuating vehicles from the Ocean Reef Community (ORC) intersecting southbound traffic on US-1. There is no congestion within the 5 miles of the plant; all routes are operating at LOS C or better.

Figure 7-4 displays peak traffic congestion within the study area at 3 hours after the ATE. One hour prior to this (2 hours after the ATE), the external traffic passing through the EPZ was diverted. All roadways within 5 miles of the plant are operating at LOS A; however, the rest of the EPZ remains extremely congested. Nearly every roadway north of the plant is operating at LOS F. East-west and north-south routes are congested in a gridlock state due to the large demand and the limited roadway capacity as evacuees can only evacuate to the north to leave the EPZ towards reception centers. All northbound routes leaving the EPZ exhibit pronounced traffic congestion. Congestion exists northbound on the turnpike from the interchange with SW 312th Street (Campbell Dr) in Homestead to the split with the Don Shula Expressway. Krome Avenue is congested northbound from Florida City through most of the shadow region. US-1 is congested northbound from Florida City to SW 136th Street. Old Cutler Rd is congested northbound from the intersection with U.S. Highway 1 to SW 168th Street. CR-905 southbound leaving ORC is highly congested with queuing extending from the intersection with US-1 to well within the ORC.

Figure 7-5 displays the congestion patterns at 4 hours and 45 minutes after the ATE. At this point, nearly all (99%) vehicles have mobilized. The congestion patterns are similar to those at three hours. Congestion is beginning to dissipate on Old Cutler Road northbound in Area 5. The Florida Turnpike is now clear from Florida City to just south of 328th Street in Leisure City. Congestion on CR-905 persists at the intersection with US-1; however, there is no longer congestion in the EPZ along this route. US-1 and Krome Ave (FL-997) remain congested northbound throughout the study area.

Figure 7-7 presents the congestion patterns at 7 hours after the ATE. Most of the congestion in Areas 5 and 6 has dissipated. The Turnpike is now clear from Florida City to Leisure City, just south of SW 268th Street. US-1 and Krome Ave (FL-997) are clear of congestion from Florida City to just north of SW 312th Street in Homestead. Congestion along CR-905 southbound cleared at 5 hours and 35 minutes after the ATE. All roads in the Monroe County portion of the EPZ are free flowing. All evacuating vehicles have mobilized at this time.

Figure 7-8 presents the congestion patterns at 9 hours after the ATE. Congestion has dissipated signficantly at this time. The Florida Turnpike is completely clear of conesgtion. US-1 is congested from just north of Leisure City to the ramps to the Florida Turnpike northbound near Caribbean Blvd. Krome Ave (FL-997) northbound is congested from SW 288th Street to end of study area. Congestion in Area 6 has dissipated completely except for the stretch of Caribbean Blvd accessing the Florida Turnpike northbound. Congestion has also cleared in Area 8.

Figure 7-9 shows the last of the congestion within the EPZ at 10 hours and 15 minutes after the ATE. US-1 northbound is congested from SW 224th St to SW 216th St; this congestion clears 10 minutes later. All other congestion at this time is in the Shadow Region. Congestion persists along Krome Ave (FL-997) northbound from just north of SW 296th Street to FL-994. Side streets trying to access Krome Ave are also congested. Finally, FL-994 eastbound is congested as evacuees divert from Krome Ave towards the Florida Turnpike and US-1 because of the persistent congestion along Krome Ave.

Figure 7-9 shows of the last of the traffic congestion in the study area at 11 hours and 15 minutes after the ATE. The last of the congestion is along Krome Ave (FL-997) northbound and along FL-994 eastbound towards US-1 and the Florida Turnpike. Krome Ave clears 5 minutes later and FL-994 clears 20 minutes later at 11 hours and 35 minutes after the ATE.

## 7.4 Evacuation Rates

Evacuation is a continuous process, as implied by Figure 7-10 through Figure 7-21. These figures indicate the rate at which traffic flows out of the indicated areas for the case of an evacuation of the full EPZ (Region R03) under the indicated conditions. One figure is presented for each scenario considered.

As indicated in Figure 7-10 through Figure 7-21, there is typically a long “tail” to these distributions. Vehicles begin to evacuate an area slowly at first as people respond to the ATE at different rates. Then traffic demand builds rapidly (slopes of curves increase). When the system becomes congested, traffic exits the EPZ at rates somewhat below capacity until some evacuation routes have cleared. As more routes clear, the aggregate rate of egress slows since many vehicles have already left the EPZ. Towards the end of the process, relatively few evacuation routes service the remaining demand.

This decline in aggregate flow rate, towards the end of the process, is characterized by these curves flattening and gradually becoming horizontal. Ideally, it would be desirable to fully saturate all evacuation routes equally so that all will service traffic near capacity levels and all will clear at the same time. For this ideal situation, all curves would retain the same slope until the end – thus minimizing evacuation time. In reality, this ideal is generally unattainable reflecting the spatial variation in population density, mobilization rates and in highway capacity over the EPZ.

## 7.5 Evacuation Time Estimate (ETE) Results

Table 7-1 through Table 7-2 present the ETE values for all 17 Evacuation Regions and all 12 Evacuation Scenarios. Table 7-3 through Table 7-4 present the ETE values for the 2-Mile Region for both staged and un-staged keyhole regions downwind to 5 miles. The tables are organized as follows:

| Table | Contents |
|---|---|
| 7-1 | The ETE represents the elapsed time required for 90% of the population within a Region to evacuate from that Region. All Scenarios are considered, including Staged Evacuation scenarios. |
| 7-2 | The ETE represents the elapsed time required for 100% of the population within a Region to evacuate from that Region. All Scenarios are considered, including Staged Evacuation scenarios. |
| 7-3 | The ETE represents the elapsed time required for 90% of the population within the 2-Mile Region to evacuate from that Region with both Concurrent and Staged Evacuations of additional Areas downwind in the keyhole Region. |
| 7-4 | The ETE represents the elapsed time required for 100% of the population within the 2-Mile Region to evacuate from that Region with both Concurrent and Staged Evacuations of additional Areas downwind in the keyhole Region. |

The animation snapshots described in Section 7.3 reflect the ETE statistics for the concurrent (un-staged) evacuation scenarios and regions, which are displayed in Figure 7-3 through Figure 7-9. All of the congestion is located beyond the 5-mile radius (where nearly all of the EPZ population resides), which is reflected in the ETE statistics:

- The 90th percentile ETE for Region R01 (2-Mile Region), which is comprised solely of employees at PTN, is 1:35 (hr:min) for all scenarios. There is no congestion in this Region. The ETE parallels the time to mobilize 90% of employees.
- The 90th percentile ETE for Regions R02 (5-Mile Region) and R04 and R05 (which extend to 5 miles from PTN) generally range between 1:35 and 3:00 for non-special scenarios (higher in summer than in winter during weekdays). Again, there is no congestion for these Regions and the ETE parallels mobilization time.
- Regions R07 and R08 warrant special discussion. Region R07 is the 2-Mile Region plus evacuation of Zone 10 (Monroe County). Region R08 is the 2-Mile Region plus evacuation of Zone 3 (only has 2 buses for Dade Juvenile Residential Facility in it) and Zone 10. The 90th percentile ETE for these regions for daytime scenarios (non-special scenarios) range from 3:50 to 5:05, which is considerably higher than R01 and R02. The significant increase in ETE is caused by the evacuation of the ORC as pronounced congestion is exhibited at the intersection of CR-905 and US-1 as ORC evacuees merge with external traffic. The 90th percentile ETE for these Regions drops considerably (ranges from 1:55 to 2:05) for evening scenarios as external traffic is reduced by 60% in the evening resulting in much less congestion at the intersection of CR-905 and US-1.

- Region R09 also warrants special discussion. Region R09 is the 2-Mile Region plus evacuation of Zone 3 (no population or evacuating vehicles) and of Zone 9 which only has the Dade Juvenile Residential Facility (2 buses) in it. The ETE for Region R09 is higher than R01 because external traffic on US-1 flows through Zone 9 for the first 2 hours after the ATE.
- The 90th percentile ETE for Region R03 (full EPZ), R06, and R10 through R14 (which extend to the EPZ boundary) range between 4:45 and 9:10 for non-special scenarios. On average, the 90th ETE for Regions R03, R06, and R10 through R14 are 4 hours and 10 minutes longer than the 90th percentile ETE for Regions R02, R04 and R05 due to pronounced traffic congestion beyond the 5-mile radius.
- The 100th percentile ETE for all regions and scenarios within 5 miles and Regions R07 through R09 are comparable to mobilization time. This fact implies that the congestion within these Regions dissipates prior to the end of mobilization, as is displayed in Figure 7-5. However, for those evacuation regions that extend beyond 5 miles, ETE is significantly longer than mobilization time, implying that traffic congestion does not clear prior to the completion of mobilization time, as seen in Figure 7-6 through Figure 7-9. The congestion is pronounced in regions with wind blowing toward the north and west (R06 and R10 through R14) where ETE is on average 3 hours and 10 minutes (slightly higher in rain scenarios) longer that trip mobilization for non-special scenarios. This is expected as nearly all of the EPZ population is in the northwest quadrant of the EPZ between 5 and 10 miles from the plant.

Comparison of Scenarios 8 and 11 in Table 7-1 indicates that the Special Event – the NASCAR race at the Homestead-Miami Speedway – has a significant impact on the 90th percentile ETE with increases of up to 2 hours and 10 minutes for some cases. The 100th percentile ETE are more significantly impacted with increases of up to 3 hours and 15 minutes for some cases. Note that the ETE for the 5-mile region remains the same (2:35) at the 90th percentile because of the traffic control measures implemented during the NASCAR race. The Regions that are most significantly impacted are Regions R03 and R10 through R13 wherein Area 8 (the most populated Area of the EPZ and the location of the Homestead-Miami Speedway) evacuates.

Comparison of Scenarios 1 and 12 in Table 7-1 and in Table 7-2 indicates that the roadway closure – 1 lane northbound on the Florida Turnpike from the interchange with U.S. Highway 1 in Florida City to the end of the analysis-network at the split with the Don Shula Expressway – has a significant impact on 90th percentile ETE for keyhole regions with wind toward the north and west (regions R06 and R10 through R14) and for the full EPZ (region R03), with up to 1 hour and 5 minute increases in ETE. Wind towards the north and west carries the plume over the major population centers in the EPZ which utilize the Florida Turnpike northbound as their primary evacuation route. Closing a single lane on the Florida Turnpike northbound significantly reduces capacity, increasing congestion and prolonging ETE. The 100th percentile ETE increase by as much as 1 hour and 15 minutes.

The results of the roadway impact scenario indicate that events such as adverse weather or traffic accidents which could close a lane on the Florida Turnpike, could significantly impact ETE. State and local police could consider traffic management tactics such as using the shoulder of the roadway as a travel lane or re-routing of traffic along other evacuation routes (to the extent possible) to avoid overwhelming the Florida Turnpike. All efforts should be made to remove any blockages or incidents on the Florida Turnpike as expeditiously as possible.

### 7.5.1 Evacuation Time Estimates for Boaters Visiting Biscayne National Park

The Biscayne National Park Information Guide states, "The mangrove shoreline, crystal clear waters, emerald isles, and living coral reefs attract near 500,000 visitors a year." Winter weekends are peak times for transient activity. Assuming a peak transient season from October to February and that 75% of visitors are present during the peak, 375,000 transients visit the park during peak months (500,000 x 0.75). Assuming 75% of these transients visit on weekends, 14,063 people visit the park during weekends in the peak season ((375,000 x 0.75) ÷ (5 months x 4 weekends/month)). 9,013 of these visitors are at Convoy Point, Black Point Park and Marina, and Homestead Bayfront Park and Marina. The remaining 5,050 daily visitors (14,063 – 9,013) enter the park by boat and would, therefore, evacuate by boat as well. There are 2.82 people per boat on average (average household size – see Appendix F). Therefore, at peak times, there could be as many as 1,791 boats entering the park from outside the EPZ (5,050 ÷ 2.82). About 20% of these visitors are in sailboats, the other 80% are in powerboats. These transients include those that enter the park by boat and access Elliot Key, Sands Key, Boca Chita Key, Adams Key, Rubicon Keys, Reid Key, Porgy Key, Old Rhodes Key, and Totten Key for camping, fishing, picnicking, kayaking, canoeing, snorkeling, etc.

Most of the visitors entering Biscayne National Park enter the park by private boat. According to Section XII, Part E, Item Number 2f of Appendix I of The State of Florida Radiological Emergency Preparedness Annex (June, 2020) and the Marine Reception Center section under the Concept of Operations section of the Miami-Dade County Emergency Management Turkey Point Response Plan (February 2018), evacuees from Biscayne Bay and offshore areas in waterways off Miami-Dade County will be directed to Matheson Hammock Marina, the Marine Reception Center (MRC), for monitoring and decontamination as necessary.

It is assumed that the 2 hour and 15 minutes transient mobilization time, shown in Table 5-8, is sufficient time for these visitors to be notified, prepare to evacuate, and board their boats for evacuation.

A conservative evacuation speed of 5 mph (4.3 knots) is estimated to account for the presence of sailboats, and for the potential congestion caused by a large number of boats evacuating towards the same destination. Using a straight-line distance from the same longitude as PTN within each region to the Intracoastal Waterway and following the Intracoastal Waterway northbound towards Matheson Hammock Marina, the ETE for these transients is computed as:

ETE = Mobilization Time + (Distance to Intracoastal Waterway ÷ 5 mph) + (Distance to region boundary along the Intracoastal Waterway ÷ 5 mph)

**2-Mile Region** (taken from park boundary which is approximately 1 mile from the 2-mile radius): 2 hours 15 minutes + (0 miles ÷ 5 mph) + (1 mile ÷ 5 mph) = **2 hours 27 minutes**

**5-Mile Region** (taken from park boundary): 2 hours 15 minutes + (0 miles ÷ 5 mph) + (4 miles ÷ 5 mph) = **3 hours 3 minutes**

**Full EPZ** (taken from Elliot Key): 2 hours 15 minutes + (3 miles ÷ 5 mph) + (8 miles ÷ 5 mph) = **4 hours 27 minutes**

Assuming the last boat is mobilized at 2 hours 15 minutes, these values represent the 100th percentile ETE for this population. The 100th percentile ETE for boats for the 5-Mile Region and full EPZ (Scenario 8 – winter, weekend, midday, good weather) are less than the 100th percentile ETE for their respective regions in Table 7-2. The 100th percentile ETE for the boats evacuating the 2-Mile Region (R01) for Scenario 8 is 12 minutes longer (9%) than the ETE values represented in Table 7-2. Section IV, Item 6 in Appendix E to 10 CFR Part 50 indicates a significant change in ETE is a 25% or 30-minute increase, whichever is less. Thus, the difference of 9% or 12 minutes is in good agreement with the vehicular ETE of 2 hours 15 minutes.

As shown in Table 5-8, about 90% of transients mobilize in 1 hour and 30 minutes. Assuming the 90th percentile boat is mobilized at 1 hour and 30 minutes, the 90th percentile ETE for this population is computed as follows:

**2-Mile Region** (taken from the park boundary): 1 hour 30 minutes + (0 miles ÷ 5 mph) + (1 mile ÷ 5 mph) = **1 hours 42 minutes**

**5-Mile Region** (taken from park boundary): 1 hour 30 minutes + (0 miles ÷ 5 mph) + (4 miles ÷ 5 mph) = **2 hours 18 minutes**

**Full EPZ** (taken from Elliot Key): 1 hour 30 minutes + (3 miles ÷ 5 mph) + (8 miles ÷ 5 mph) = **3 hours and 42 minutes**

The 90th percentile ETE for the 5-Mile region and full EPZ are less than the 90th percentile ETE for their respective regions in Table 7-1 for Scenario 8. The 90th percentile ETE for the boats evacuating the 2-Mile Region (R01) for Scenario 8 is 7 minutes longer (7.4%), which is in good agreement with the vehicular ETE of 1 hour and 35 minutes.

## 7.6 Staged Evacuation Results

Table 7-3 and Table 7-4 present a comparison of the ETE compiled for the concurrent (un-staged) and staged evacuation cases. Note that Regions R15 through R17 are the same geographic areas as Regions R02, R04 and R05, respectively. The times shown in Table 7-3 and Table 7-4 are when the 2-Mile Region is 90% clear and 100% clear, respectively, when evacuating additional areas downwind to 5-miles.

The objective of a staged evacuation strategy is to ensure the ETE for the 2-Mile Region is not significantly increased (30 minutes or 25%, whichever is less) when evacuating areas beyond 2-miles. Additionally, staged evacuation should not significantly increase the ETE for people evacuating beyond 2-miles. In all cases, as shown in Table 7-3 and Table 7-4, the 90th and 100th percentile ETE for the 2-Mile Region remains the same when a staged evacuation is implemented for all scenarios. These results indicate that there is minimal congestion within the 2-Mile Region and when an evacuation out to 5 miles occurs, the congestion beyond 2 miles does not extend upstream to the extent that it penetrates to within 2 miles of the plant. Evacuees from within the 2-Mile Radius are not impacted by those evacuating beyond 2 miles out to 5 miles. Therefore, staging the evacuation provides no benefits to evacuees from within the 2-Mile Region. As discussed in Section 7.3, there is no congestion within 5 miles of the plant.

To determine the effect of a staged evacuation on residents beyond the 2-Mile Region, the ETE for Regions R02, R04 and R05 are compared to Regions R15 through R17 respectively, in Table 7-1 and Table 7-2. A comparison of ETE between these similar regions reveals that staging increases the ETE by up to 25 minutes for those in the 2 to 5-mile region (see Table 7-1) for the 90th percentile. The increase in the 90th percentile ETE is due to the evacuating vehicles, beyond the 2-Mile Region, sheltering and delaying the start of their evacuation. As shown in Figure 5-5, staging the evacuation causes a significant "spike" (sharp increase) in mobilization (trip-generation rate) of evacuating vehicles. This spike oversaturates evacuation routes, which increases traffic congestion and prolongs ETE. A comparison of the 100th percentile ETE between similar regions reveals that staging increases the ETE by at most 5 minutes (see Table 7-2).

In summary, staging evacuation provides no benefit to evacuees within 2 miles of the plant and adversely impacts many evacuees located beyond 2 miles from the plant. Based on the guidance in NUREG-0654, Supplement 3, this analysis would result in staged evacuation not being implemented for this site.

## 7.7 Guidance on Using ETE Tables

The user first determines the percentile of population for which the ETE is sought (The NRC guidance calls for the 90th percentile). The applicable value of ETE within the chosen table may then be identified using the following procedure:

1. Identify the applicable **Scenario**:
    - Season
        - Summer
        - Winter (also Autumn and Spring)
    - Day of Week
        - Midweek
        - Weekend
    - Time of Day
        - Midday
        - Evening
    - Weather Condition
        - Good Weather
        - Rain
    - Special Event
        - NASCAR race at Homestead-Miami Speedway

- Roadway Impact
  - Single Lane closed on the Florida Turnpike northbound from the interchange with U.S. Highway 1 in Florida City to the end of the analysis-network at the split with the Don Shula Expressway.
- Evacuation Staging
  - No, Staged Evacuation is not considered
  - Yes, Staged Evacuation is considered

While these Scenarios are designed, in aggregate, to represent conditions throughout the year, some further clarification is warranted:

- The conditions of a summer evening (either midweek or weekend) and rain are not explicitly identified in the tables. For these conditions, Scenarios (2) and (4) apply.
- The conditions of a winter evening (either midweek or weekend) and rain are not explicitly identified in the tables. For these conditions, Scenarios (7) and (9) for rain apply.
- The seasons are defined as follows:
  - Summer assumes that public schools are in summer session (lower enrollment than normal).
  - Winter (includes Spring and Autumn) considers that public schools are in session with full enrollment.
- Time of Day: Midday implies the time over which most commuters are at work or are travelling to/from work.

2. With the desired percentile ETE and Scenario identified, now identify the **Evacuation Region**:
   - Determine the projected azimuth direction of the plume (coincident with the wind direction). This direction is expressed in terms of compass orientation: from N, NNE, NE, …
   - Determine the distance that the Evacuation Region will extend from the plant. The applicable distances and their associated candidate Regions are given below:
     - 2 Miles (Region R01)
     - To 5 Miles (Region R02, R04 and R05)
     - To EPZ Boundary (Regions R03 and R06 through R14)
   - Enter Table 7-5 and identify the applicable group of candidate Regions based on the distance that the selected Region extends from the plant. Select the Evacuation Region identifier in that row, based on the azimuth direction of the plume, from the first column of the table.
3. Determine the **ETE Table** based on the percentile selected**.** Then, for the **Scenario** identified in Step 1 and the **Region** identified in Step 2, proceed as follows:
   - The columns of Table 7-1 through Table **7-4** are labeled with the Scenario numbers. Identify the proper column in the selected Table using the Scenario number defined in Step 1.
   - Identify the row in this table that provides ETE values for the Region identified in Step 2.

- The unique data cell defined by the column and row so determined contains the desired value of ETE expressed in Hours: Minutes.

Example

It is desired to identify the ETE for the following conditions:

- Sunday, August 14th at 10:00 PM (Summer, weekend, evening)
- It is raining.
- Wind direction is from the south (S).
- Wind speed is such that the distance to be evacuated is judged to be a 2-Mile Region around and downwind to 10 miles (to EPZ boundary).
- The desired ETE is that value needed to evacuate 90% of the population from within the impacted Region.
- A staged evacuation is not desired.

Table 7-1 is applicable because the 90th percentile ETE is desired. Proceed as follows:

1. Identify the Scenario as summer, weekend, evening and raining. Entering Table 7-1, it is seen that there is no match for these descriptors. However, the clarification given above assigns this combination of circumstances to Scenario 4.
2. Enter Table 7-5 and locate the Region described as “Evacuate 2-Mile Region and Downwind to EPZ Boundary” for wind direction from the S and read Region R06 in the first column of that row.
3. Enter Table 7-1 to locate the data cell containing the value of ETE for Scenario 4 and Region R06. This data cell is in column (4) and in the row for Region R06; it contains the ETE value of 5:40.

## Table 7-1. Time to Clear the Indicated Area of *90* Percent of the Affected Population

| | Summer | | Summer | | Summer | Winter | | Winter | | Winter | Winter | Summer | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Midweek | | Weekend | | Midweek Weekend | Midweek | | Weekend | | Midweek Weekend | Weekend | Midweek | |
| **Scenario:** | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | **Scenario:** |
| **Region** | Midday | | Midday | | Evening | Midday | | Midday | | Evening | Midday | Midday | **Region** |
| | Good Weather | Rain | Good Weather | Rain | Good Weather | Good Weather | Rain | Good Weather | Rain | Good Weather | Special Event | Roadway Impact | |
| **Entire 2-Mile Region, 5-Mile Region, and EPZ** | | | | | | | | | | | | | |
| **R01** | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | **R01** |
| **R02** | 3:00 | 3:00 | 2:25 | 2:35 | 2:25 | 2:50 | 2:50 | 2:35 | 2:35 | 2:25 | 2:35 | 3:00 | **R02** |
| **R03** | 8:15 | 8:55 | 7:55 | 8:45 | 7:45 | 8:25 | 9:10 | 8:15 | 8:55 | 7:45 | 10:00 | 9:20 | **R03** |
| **2-Mile Region and Keyhole to 5 Miles** | | | | | | | | | | | | | |
| **R04** | 3:00 | 3:00 | 2:25 | 2:35 | 2:25 | 2:50 | 2:50 | 2:35 | 2:35 | 2:25 | 2:35 | 3:00 | **R04** |
| **R05** | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:40 | 1:35 | 1:35 | 1:35 | **R05** |
| **2-Mile Region and Keyhole to EPZ Boundary** | | | | | | | | | | | | | |
| **R06** | 5:15 | 5:40 | 5:15 | 5:40 | 5:05 | 5:15 | 5:40 | 5:20 | 5:50 | 5:15 | 5:25 | 5:40 | **R06** |
| **R07** | 3:50 | 4:30 | 3:50 | 4:25 | 1:55 | 4:25 | 5:05 | 4:05 | 4:45 | 2:05 | 4:05 | 3:55 | **R07** |
| **R08** | 3:50 | 4:30 | 3:50 | 4:25 | 1:55 | 4:25 | 5:05 | 4:05 | 4:45 | 2:05 | 4:05 | 3:55 | **R08** |
| **R09** | 2:40 | 3:00 | 2:45 | 3:00 | 2:05 | 2:40 | 3:00 | 2:45 | 3:00 | 2:05 | 2:45 | 2:40 | **R09** |
| **R10** | 5:10 | 5:45 | 5:05 | 5:25 | 4:45 | 5:25 | 5:45 | 5:00 | 5:25 | 4:45 | 7:10 | 6:00 | **R10** |
| **R11** | 5:25 | 5:50 | 5:10 | 5:45 | 4:55 | 5:35 | 6:05 | 5:20 | 5:50 | 5:00 | 7:00 | 6:05 | **R11** |
| **R12** | 6:50 | 7:30 | 6:35 | 7:05 | 6:20 | 7:05 | 7:35 | 6:35 | 7:00 | 6:30 | 8:45 | 7:35 | **R12** |
| **R13** | 7:50 | 8:20 | 7:35 | 8:30 | 7:25 | 8:05 | 8:50 | 7:35 | 8:05 | 7:25 | 9:40 | 8:50 | **R13** |
| **R14** | 6:00 | 6:15 | 5:35 | 6:10 | 5:25 | 5:45 | 6:25 | 5:45 | 6:10 | 5:30 | 6:00 | 6:05 | **R14** |
| **Staged Evacuation – 2-Mile Region and Keyhole to 5 Miles** | | | | | | | | | | | | | |
| **R15** | 3:00 | 3:00 | 2:45 | 2:55 | 2:50 | 3:00 | 3:00 | 2:45 | 2:55 | 2:45 | 2:55 | 3:05 | **R15** |
| **R16** | 3:00 | 3:00 | 2:45 | 2:55 | 2:50 | 3:00 | 3:00 | 2:45 | 2:55 | 2:45 | 2:55 | 3:05 | **R16** |
| **R17** | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:40 | 1:35 | 1:35 | 1:35 | **R17** |

**Table 7-2. Time to Clear the Indicated Area of *100* Percent of the Affected Population**

| | Summer | | Summer | | Summer | Winter | | Winter | | Winter | Winter | Summer | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Midweek | | Weekend | | Midweek Weekend | Midweek | | Weekend | | Midweek Weekend | Weekend | Midweek | |
| **Scenario:** | **(1)** | **(2)** | **(3)** | **(4)** | **(5)** | **(6)** | **(7)** | **(8)** | **(9)** | **(10)** | **(11)** | **(12)** | **Scenario:** |
| **Region** | Midday | | Midday | | Evening | Midday | | Midday | | Evening | Midday | Midday | **Region** |
| | Good Weather | Rain | Good Weather | Rain | Good Weather | Good Weather | Rain | Good Weather | Rain | Good Weather | Special Event | Roadway Impact | |
| **Entire 2-Mile Region, 5-Mile Region, and EPZ** | | | | | | | | | | | | | |
| **R01** | 2:20 | 2:20 | 2:15 | 2:15 | 2:15 | 2:20 | 2:20 | 2:15 | 2:15 | 2:15 | 2:15 | 2:20 | **R01** |
| **R02** | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | **R02** |
| **R03** | 10:45 | 12:20 | 10:50 | 11:55 | 10:20 | 10:50 | 12:15 | 10:55 | 12:00 | 10:10 | 12:50 | 11:55 | **R03** |
| **2-Mile Region and Keyhole to 5 Miles** | | | | | | | | | | | | | |
| **R04** | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | **R04** |
| **R05** | 2:25 | 2:30 | 2:15 | 2:15 | 2:15 | 2:30 | 2:30 | 2:15 | 2:20 | 2:15 | 2:20 | 2:25 | **R05** |
| **2-Mile Region and Keyhole to EPZ Boundary** | | | | | | | | | | | | | |
| **R06** | 7:10 | 7:50 | 7:10 | 7:45 | 7:05 | 7:10 | 8:05 | 7:15 | 8:00 | 7:05 | 7:35 | 7:30 | **R06** |
| **R07** | 5:25 | 5:25 | 5:25 | 5:25 | 5:25 | 5:25 | 5:40 | 5:25 | 5:25 | 5:25 | 5:25 | 5:25 | **R07** |
| **R08** | 5:25 | 5:25 | 5:25 | 5:25 | 5:25 | 5:25 | 5:40 | 5:25 | 5:25 | 5:25 | 5:25 | 5:25 | **R08** |
| **R09** | 3:10 | 3:35 | 3:10 | 3:35 | 2:30 | 3:10 | 3:35 | 3:10 | 3:30 | 2:30 | 3:10 | 3:10 | **R09** |
| **R10** | 7:25 | 8:30 | 7:35 | 8:35 | 7:05 | 7:50 | 8:45 | 7:45 | 8:15 | 7:00 | 10:25 | 8:40 | **R10** |
| **R11** | 7:50 | 8:45 | 7:35 | 9:00 | 7:05 | 8:05 | 9:10 | 7:50 | 8:50 | 7:10 | 10:40 | 8:40 | **R11** |
| **R12** | 8:55 | 10:05 | 8:35 | 9:40 | 8:40 | 9:20 | 9:55 | 8:35 | 9:30 | 8:30 | 11:50 | 9:45 | **R12** |
| **R13** | 10:25 | 11:30 | 9:55 | 11:35 | 10:00 | 10:30 | 12:15 | 9:50 | 11:10 | 9:45 | 12:20 | 11:20 | **R13** |
| **R14** | 8:05 | 8:40 | 7:55 | 8:50 | 7:40 | 8:10 | 9:00 | 7:55 | 8:50 | 7:55 | 8:30 | 8:15 | **R14** |
| **Staged Evacuation – 2-Mile Region and Keyhole to 5 Miles** | | | | | | | | | | | | | |
| **R15** | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | **R15** |
| **R16** | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | 5:20 | **R16** |
| **R17** | 2:30 | 2:30 | 2:15 | 2:15 | 2:25 | 2:30 | 2:30 | 2:20 | 2:20 | 2:15 | 2:20 | 2:30 | **R17** |

## Table 7-3. Time to Clear *90 Percent* of the *2-Mile Region* within the Indicated Region

| | Summer | | Summer | | Summer | Winter | | Winter | | Winter | Winter | Summer | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Midweek | | Weekend | | Midweek<br>Weekend | Midweek | | Weekend | | Midweek<br>Weekend | Weekend | Midweek | |
| **Scenario:** | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | **Scenario:** |
| **Region** | Midday | | Midday | | Evening | Midday | | Midday | | Evening | Midday | Midday | **Region** |
| | Good Weather | Rain | Good Weather | Rain | Good Weather | Good Weather | Rain | Good Weather | Rain | Good Weather | Special Event | Roadway Impact | |
| **Unstaged Evacuation – 2-Mile Region, 5-Mile Region, 2 Mile Region and Keyhole to 5-Miles** | | | | | | | | | | | | | |
| **R01** | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | **R01** |
| **R02** | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | **R02** |
| **R04** | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | **R04** |
| **R05** | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | **R05** |
| **Staged Evacuation – 2-Mile Region and Keyhole to 5-Miles** | | | | | | | | | | | | | |
| **R15** | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | **R15** |
| **R16** | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | **R16** |
| **R17** | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | 1:35 | **R17** |

Table 7-4. Time to Clear ***100 Percent*** of the ***2-Mile Region*** within the Indicated Region

| | Summer | | Summer | | Summer | Winter | | Winter | | Winter | Winter | Summer | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Midweek | | Weekend | | Midweek Weekend | Midweek | | Weekend | | Midweek Weekend | Weekend | Midweek | |
| **Scenario:** | **(1)** | **(2)** | **(3)** | **(4)** | **(5)** | **(6)** | **(7)** | **(8)** | **(9)** | **(10)** | **(11)** | **(12)** | **Scenario:** |
| **Region** | Midday | | Midday | | Evening | Midday | | Midday | | Evening | Midday | Midday | **Region** |
| | Good Weather | Rain | Good Weather | Rain | Good Weather | Good Weather | Rain | Good Weather | Rain | Good Weather | Special Event | Roadway Impact | |
| **Unstaged Evacuation – 2-Mile Region, 5-Mile Region, 2 Mile Region and Keyhole to 5-Miles** | | | | | | | | | | | | | |
| **R01** | 2:20 | 2:20 | 2:15 | 2:15 | 2:15 | 2:20 | 2:20 | 2:15 | 2:15 | 2:15 | 2:15 | 2:20 | **R01** |
| **R02** | 2:20 | 2:20 | 2:15 | 2:15 | 2:15 | 2:20 | 2:20 | 2:15 | 2:15 | 2:15 | 2:15 | 2:20 | **R02** |
| **R04** | 2:20 | 2:20 | 2:15 | 2:15 | 2:15 | 2:20 | 2:20 | 2:15 | 2:15 | 2:15 | 2:15 | 2:20 | **R04** |
| **R05** | 2:20 | 2:20 | 2:15 | 2:15 | 2:15 | 2:20 | 2:20 | 2:15 | 2:15 | 2:15 | 2:15 | 2:20 | **R05** |
| **Staged Evacuation – 2-Mile Region and Keyhole to 5-Miles** | | | | | | | | | | | | | |
| **R15** | 2:20 | 2:20 | 2:15 | 2:15 | 2:15 | 2:20 | 2:20 | 2:15 | 2:15 | 2:15 | 2:15 | 2:20 | **R15** |
| **R16** | 2:20 | 2:20 | 2:15 | 2:15 | 2:15 | 2:20 | 2:20 | 2:15 | 2:15 | 2:15 | 2:15 | 2:20 | **R16** |
| **R17** | 2:20 | 2:20 | 2:15 | 2:15 | 2:15 | 2:20 | 2:20 | 2:15 | 2:15 | 2:15 | 2:15 | 2:20 | **R17** |

## Table 7-5. Description of Evacuation Regions

**Radial Regions**

| Region | Description | Area | | | | | | | | | | EAS Message |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| **R01** | 2-Mile Region | x | x | | | | | | | | | E14/E18/E19/E21/E22/E23 |
| **R02** | 5-Mile Region | x | x | x | x | | | | | | | E16 |
| **R03** | Full EPZ | x | x | x | x | x | x | x | x | x | x | N/A |

**Evacuate 2-Mile Region and Downwind to 5-Mile Region**

| Region | Wind Direction From: | Area | | | | | | | | | | EAS Message |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| **R04** | SSE, S, SSW | x | x | | x | | | | | | | E17 |
| **N/A** | SW, WSW, W, WNW, NW | **Refer to Region 01** | | | | | | | | | | E14/E18/E19/E21/E22/E23 |
| **R05** | NNW, N, NNE, NE, ENE | x | x | x | | | | | | | | E15/E20/E25/E26 |
| **N/A** | E, ESE, SE | **Refer to Region 02** | | | | | | | | | | E16 |

**Evacuate 2-Mile Region and Downwind to EPZ Boundary**

| Region | Wind Direction From: | Area | | | | | | | | | | EAS Message |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| **R06** | S, SSW | x | x | | x | x | x | | | | | E24 |
| **N/A** | SW, WSW, W, WNW | **Refer to Region 01** | | | | | | | | | | E14/E18/E19/E21/E22/E23 |
| **R07** | NW | x | x | | | | | | | | x | E14/E18/E19/E21/E22/E23 plus Monroe County |
| **R08** | NNW, N, NNE | x | x | x | | | | | | | x | E15/E20/E25/E26 plus Monroe County |
| **R09** | NE | x | x | x | | | | | | x | | E08 |
| **R10** | ENE | x | x | x | | | | | x | x | | E09 |
| **R11** | E | x | x | x | x | | | | x | x | | E10 |
| **R12** | ESE | x | x | x | x | | | x | x | | | E11 |
| **R13** | SE | x | x | x | x | | x | x | x | | | E12 |
| **R14** | SSE | x | x | | x | x | x | x | | | | E13 |

**Staged Evacuation – 2-Mile Region Evacuates, then Evacuate Downwind to 5-Mile Region**

| Region | Wind Direction From: | Area | | | | | | | | | | EAS Message |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| **R15** | 5-Mile Region, E, ESE, SE | x | x | 🟦 x | 🟦 x | | | | | | | E16, staged |
| **R16** | SSE, S, SSW | x | x | | 🟦 x | | | | | | | E17, staged |
| **N/A** | SW, WSW, W, WNW, NW | **Refer to Region 01** | | | | | | | | | | E14/E18/E19/E21/E22/E23 |
| **R17** | NNW, N, NNE, NE, ENE | x | x | 🟦 x | | | | | | | | E15/E20/E25/E26, staged |

| | | |
|---|---|---|
| 🟥 Area(s) Evacuate | ⬜ Area(s) Shelter-in-Place | 🟦 Shelter-in-Place until 90% ETE for R01, then Evacuate |

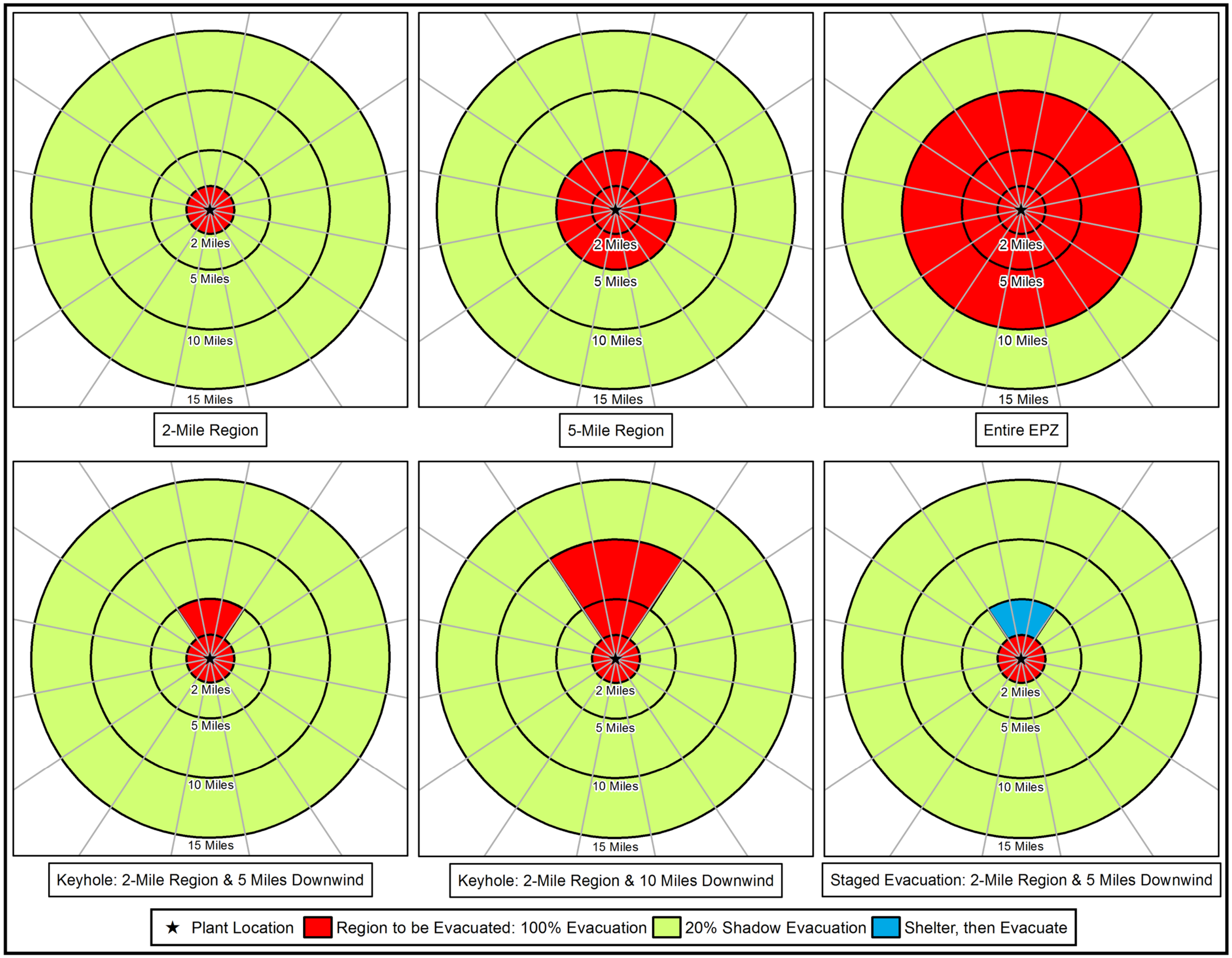

**Figure 7-1. Voluntary Evacuation Methodology**

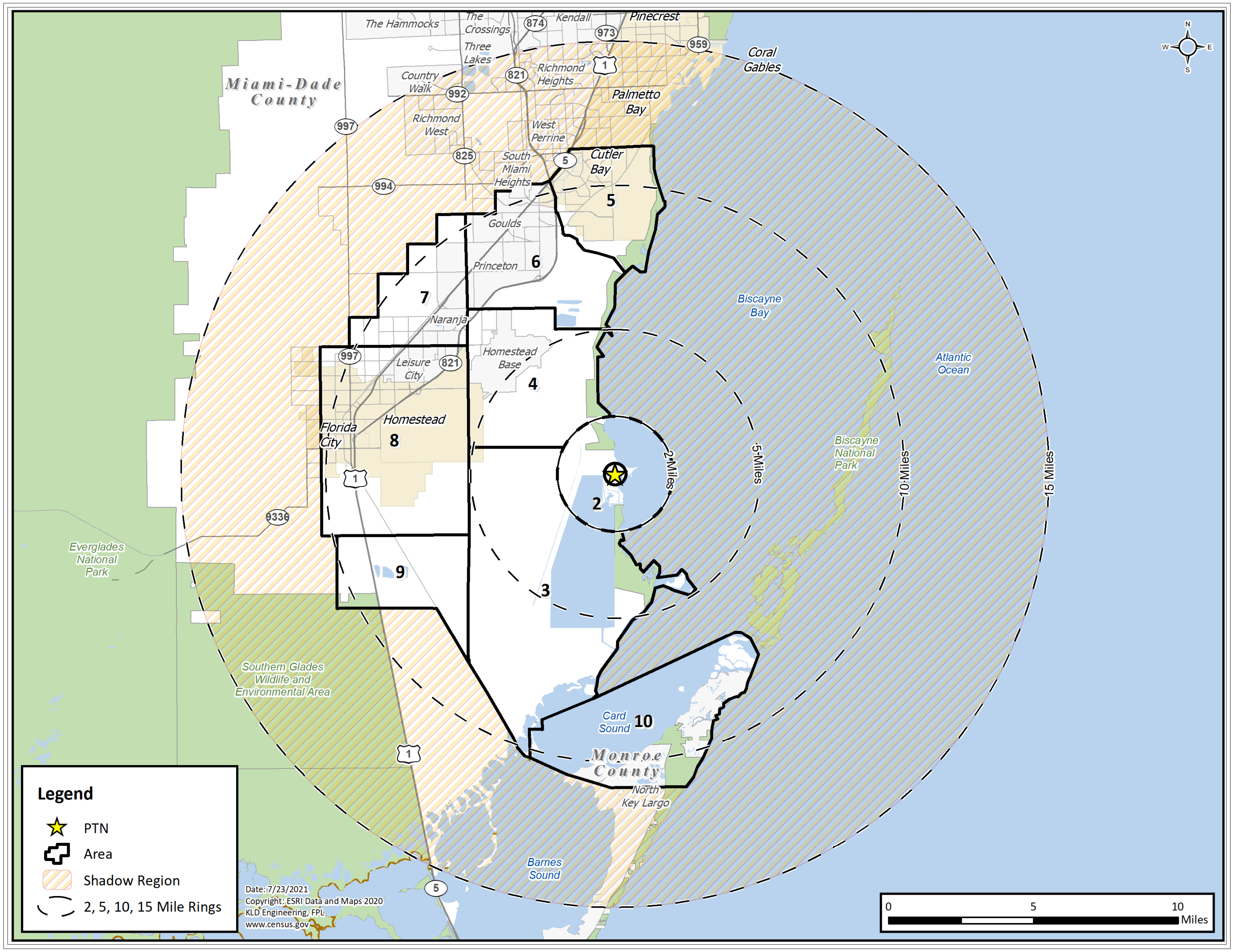

Figure 7-2. PTN Shadow Region

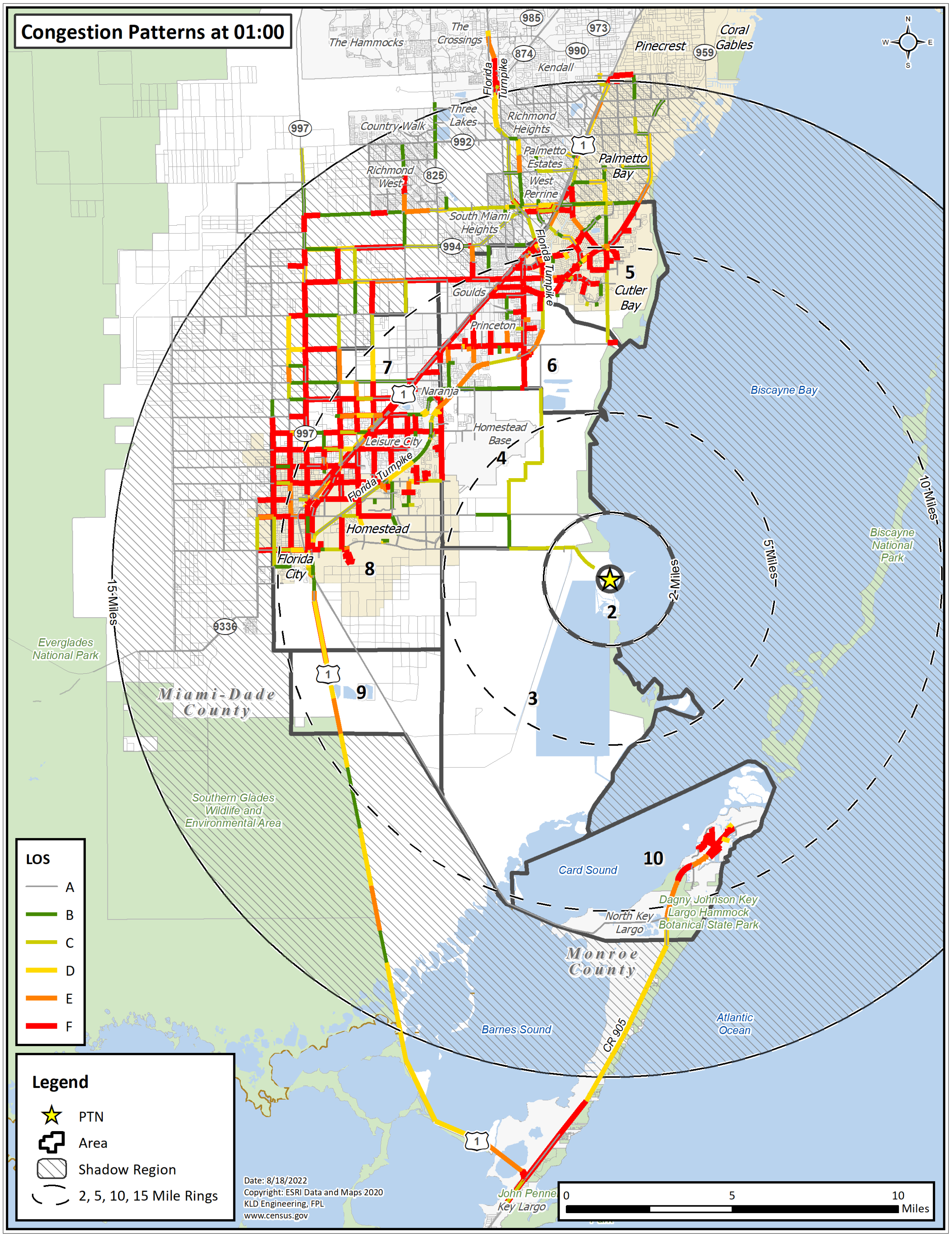

Figure 7-3. Congestion Patterns at 1 Hour after the Advisory to Evacuate

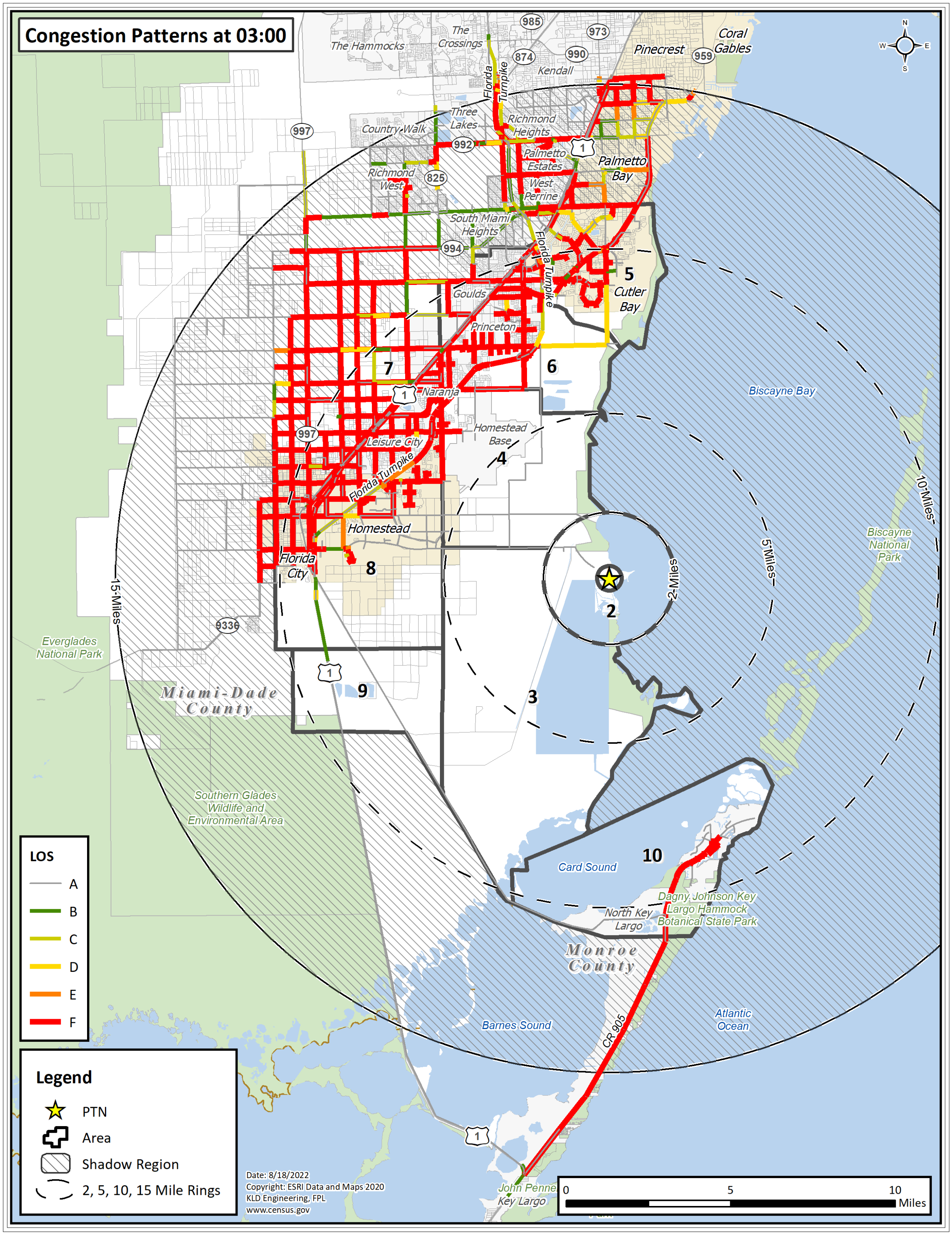

Figure 7-4. Congestion Patterns at 3 Hours after the Advisory to Evacuate

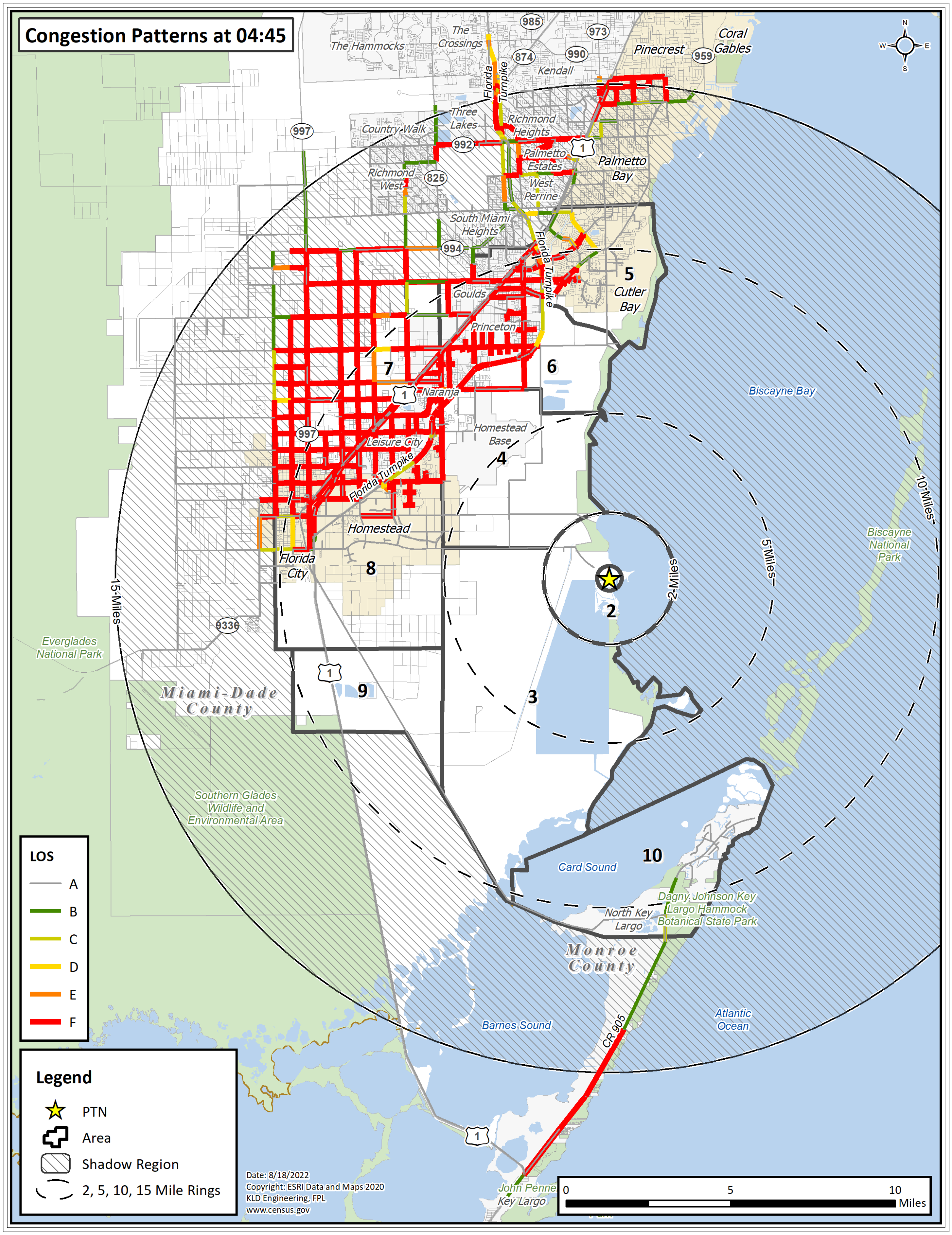

**Figure 7-5. Congestion Patterns at 4 Hours and 45 minutes after the Advisory to Evacuate**

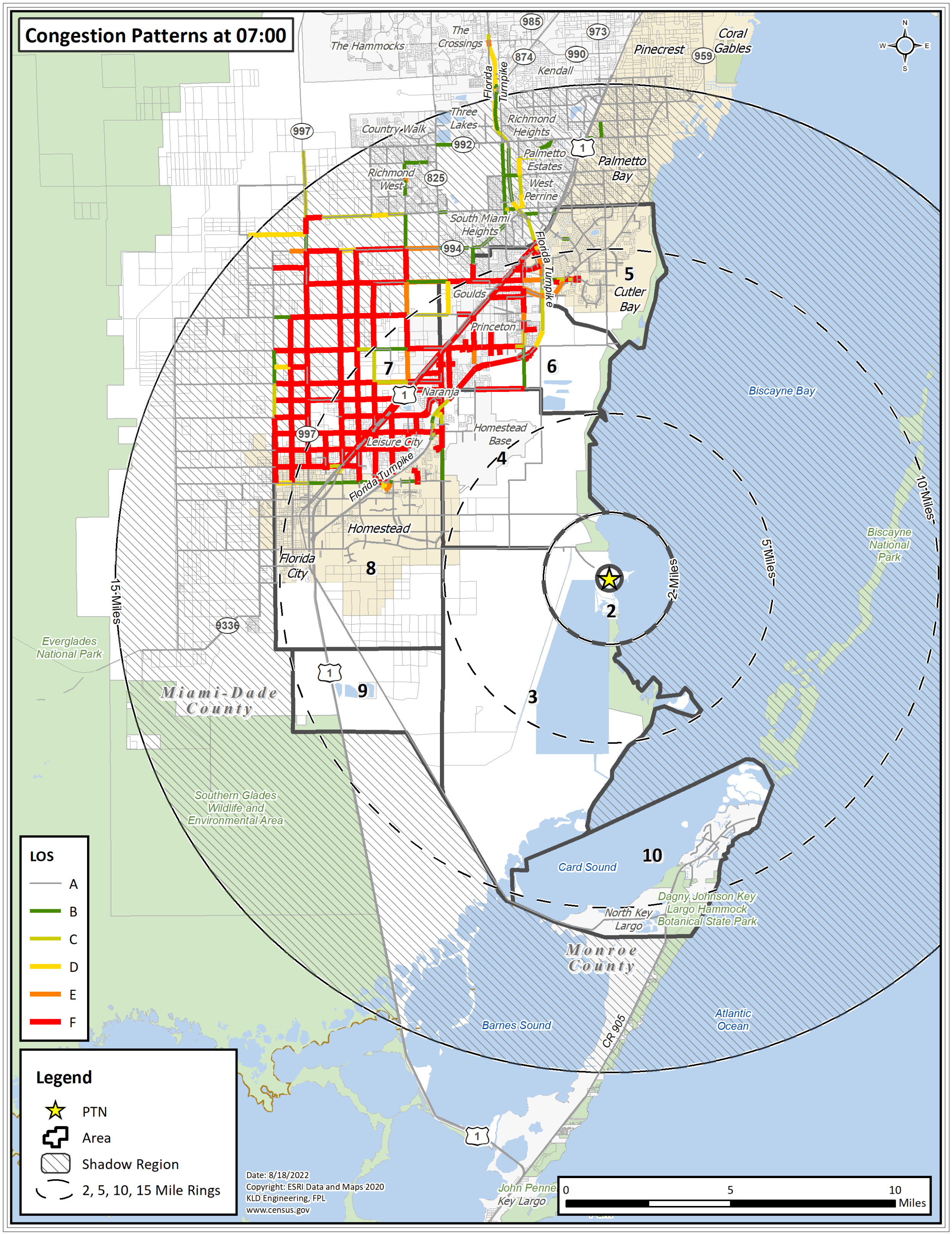

Figure 7-6. Congestion Patterns at 7 Hours after the Advisory to Evacuate

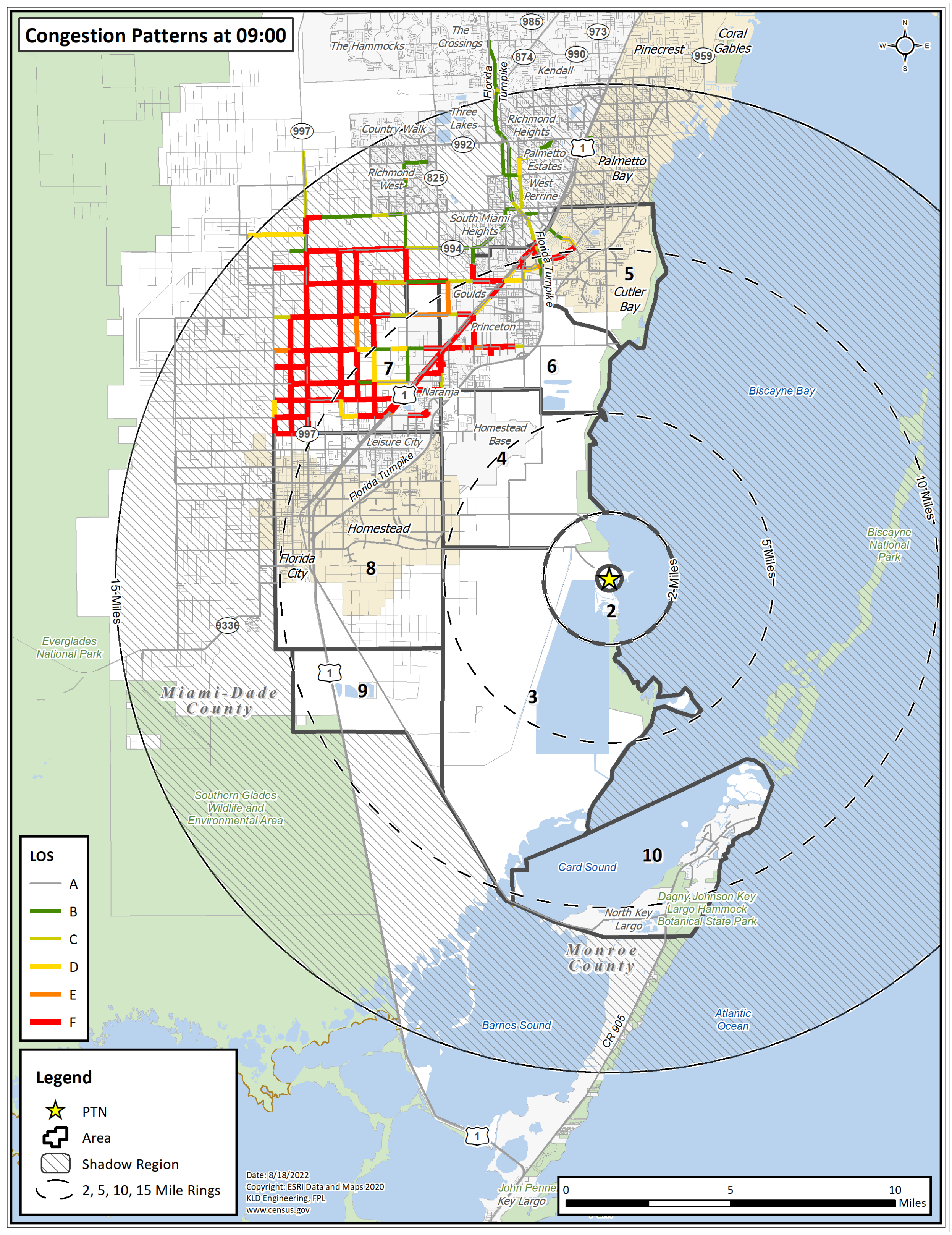

Figure 7-7. Congestion Patterns at 9 Hours after the Advisory to Evacuate

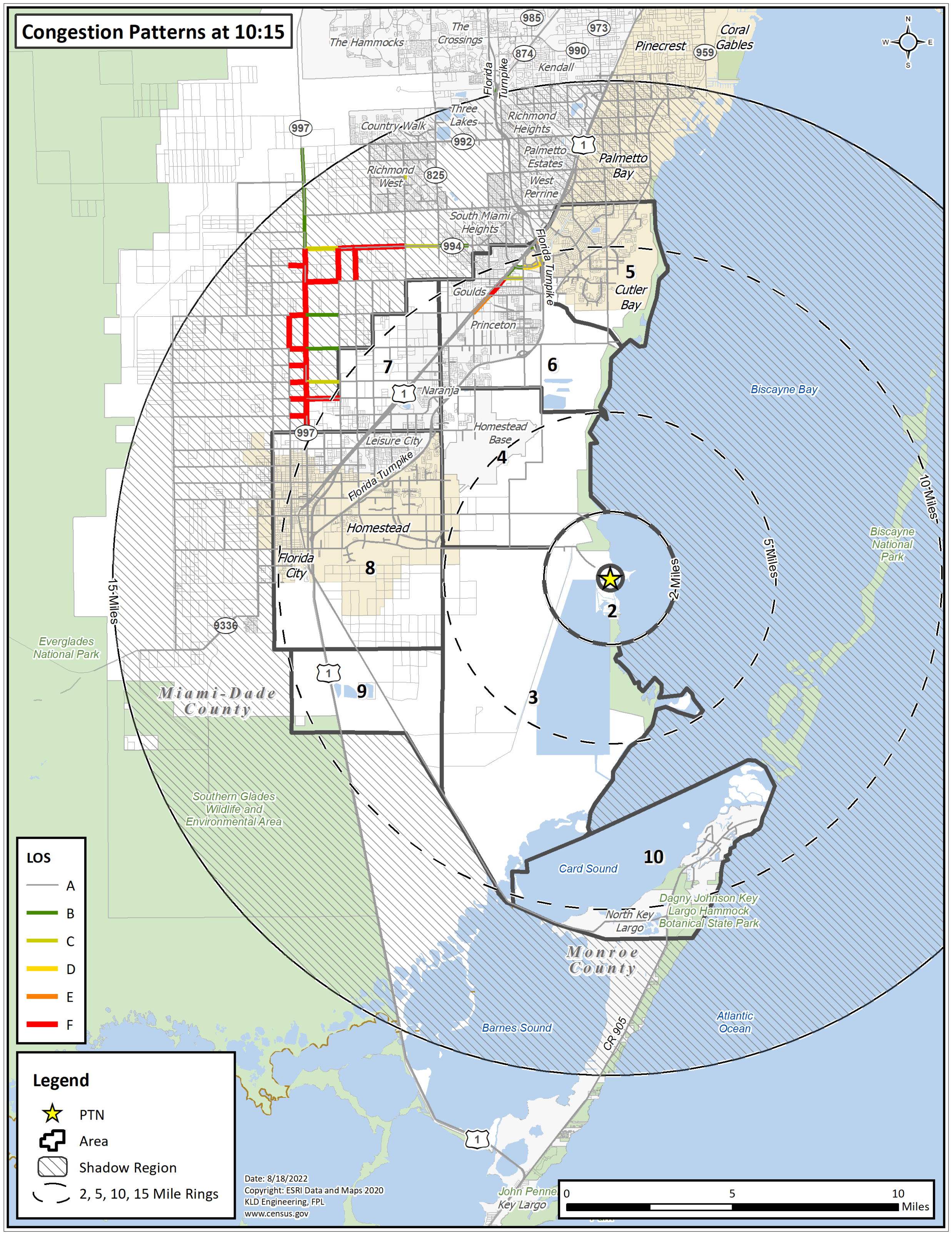

Figure 7-8. Congestion Patterns at 10 Hours and 15 minutes after the Advisory to Evacuate

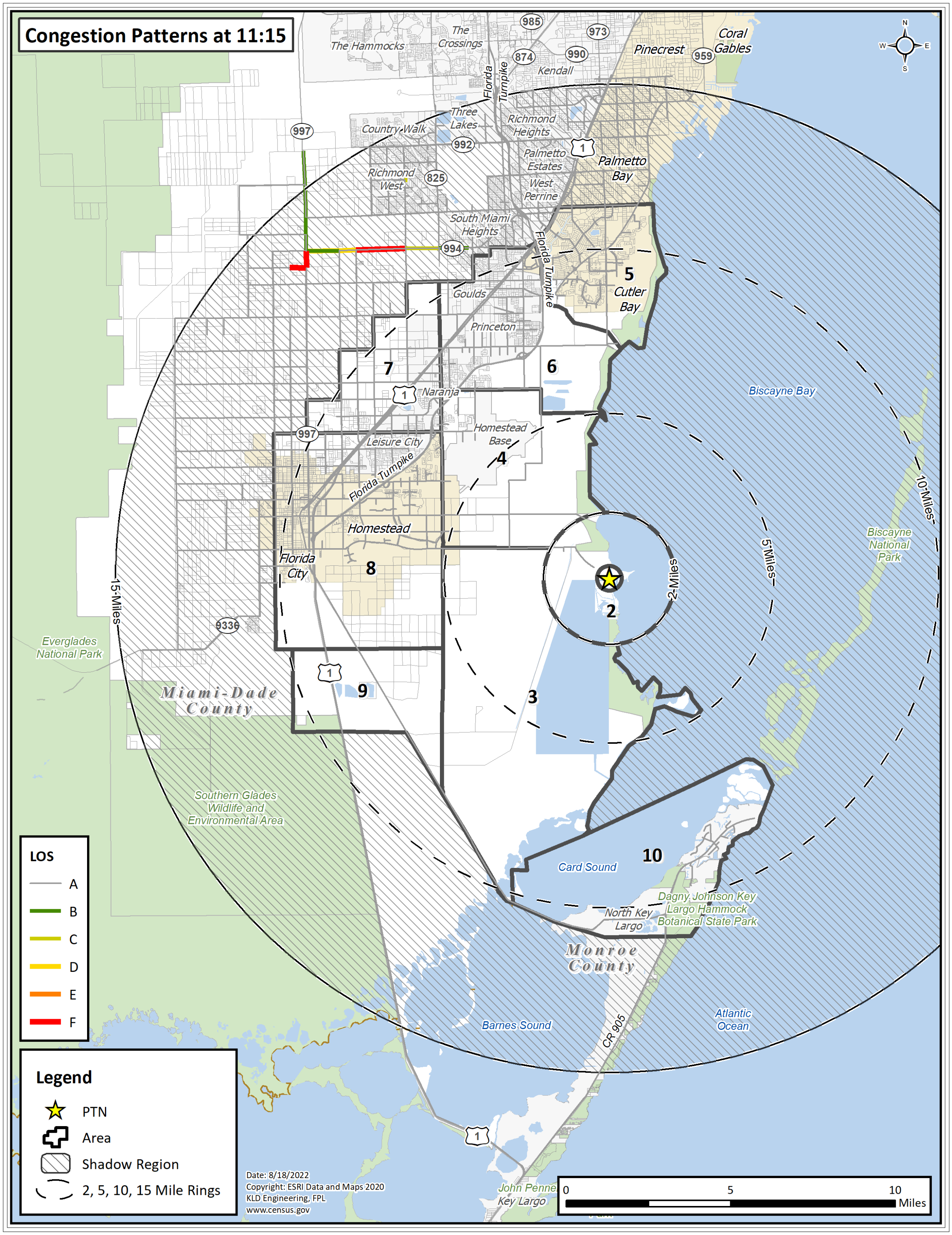

Figure 7-9. Congestion Patterns at 11 Hours and 15 minutes after the Advisory to Evacuate

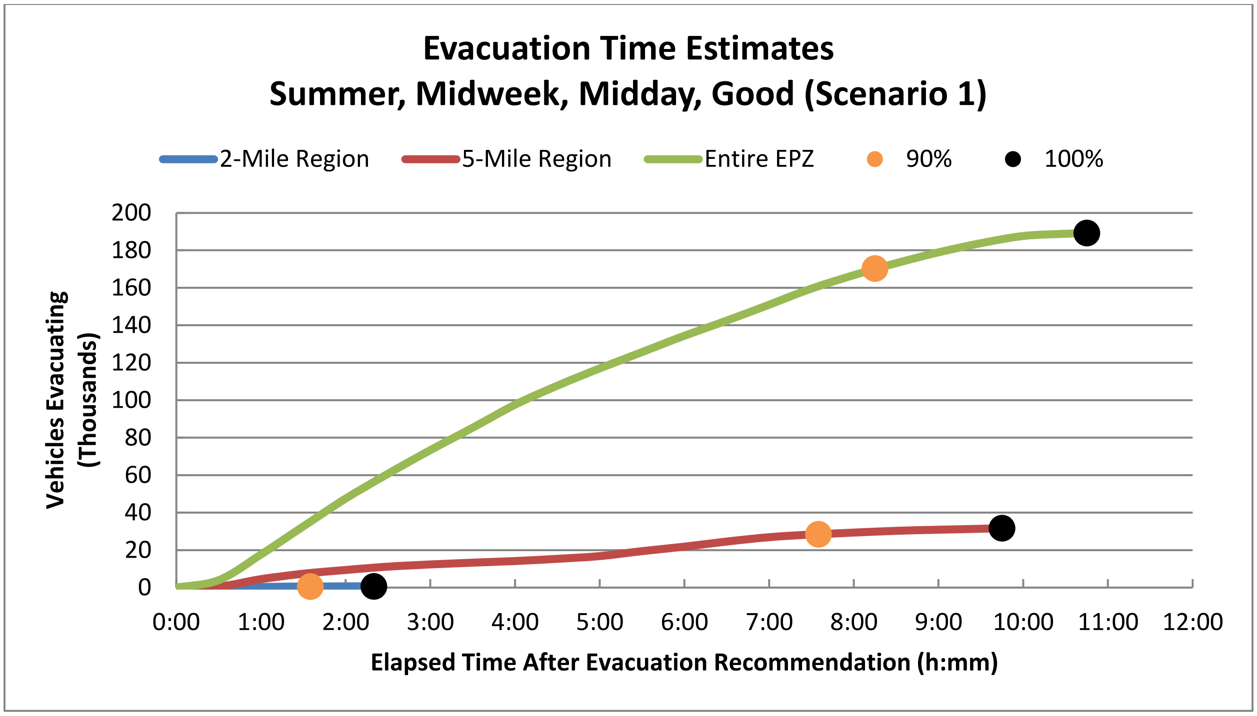

Figure 7-10. Evacuation Time Estimates – Scenario 1 for Region R03

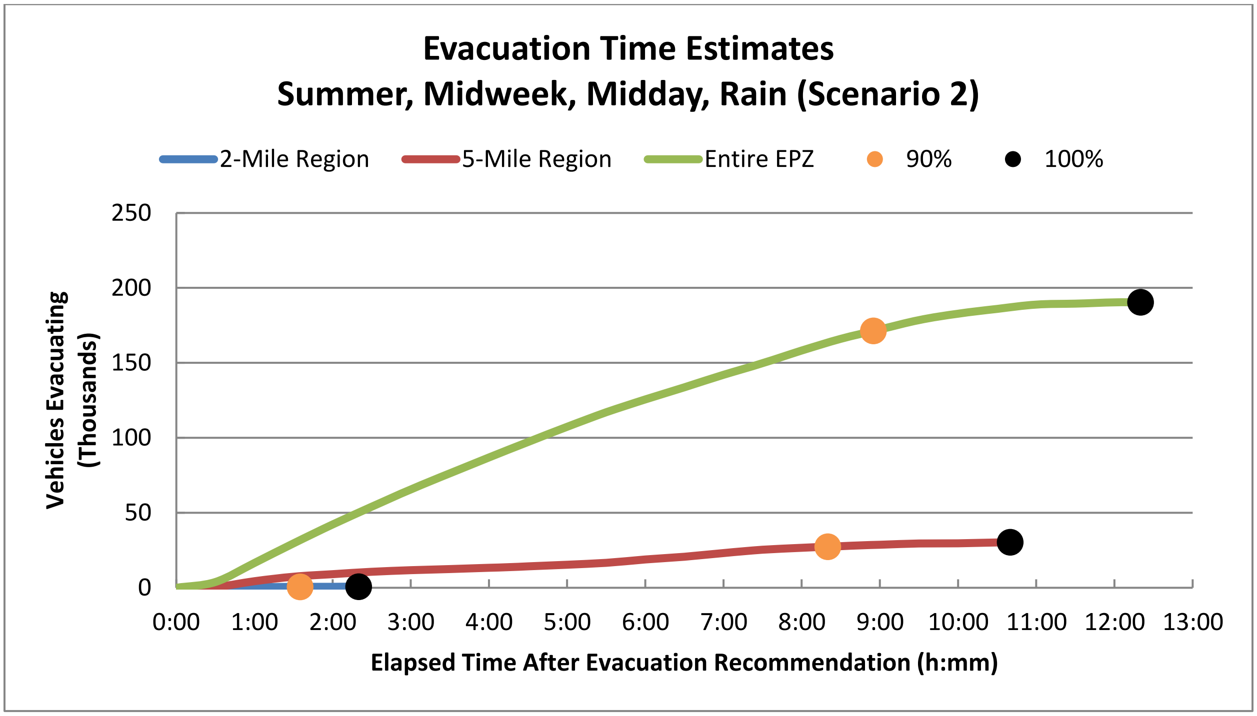

Figure 7-11. Evacuation Time Estimates – Scenario 2 for Region R03

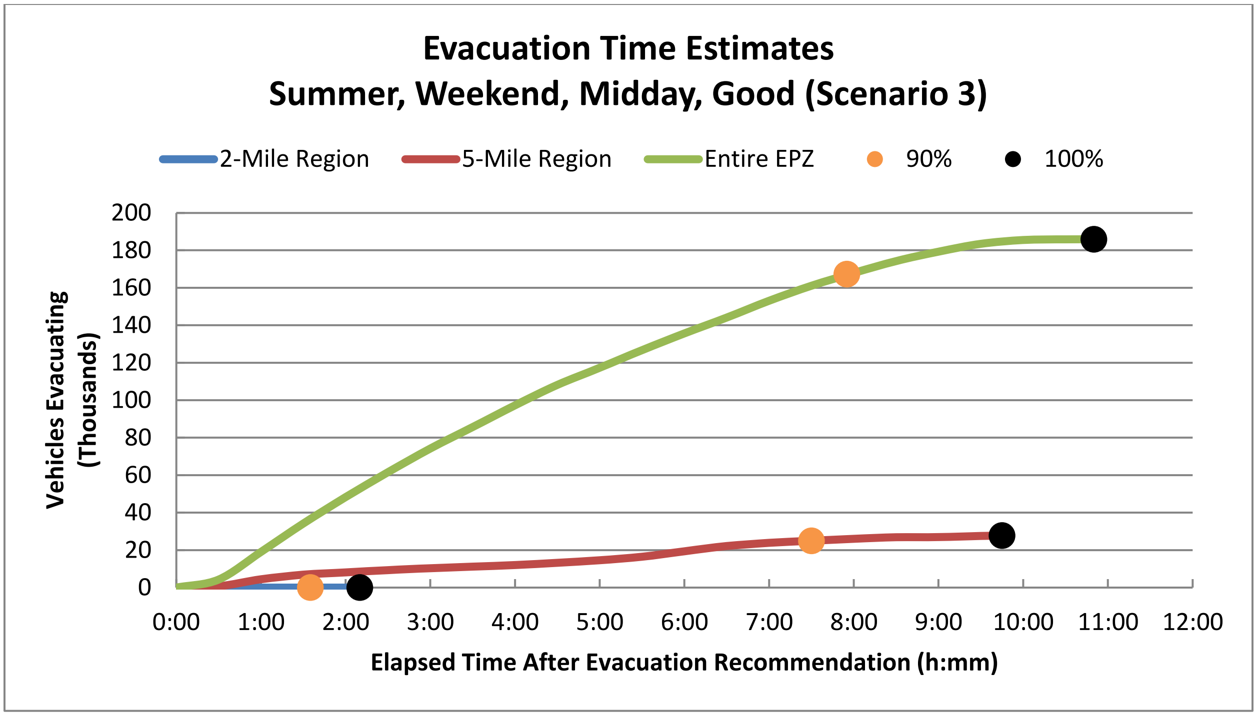

Figure 7-12. Evacuation Time Estimates – Scenario 3 for Region R03

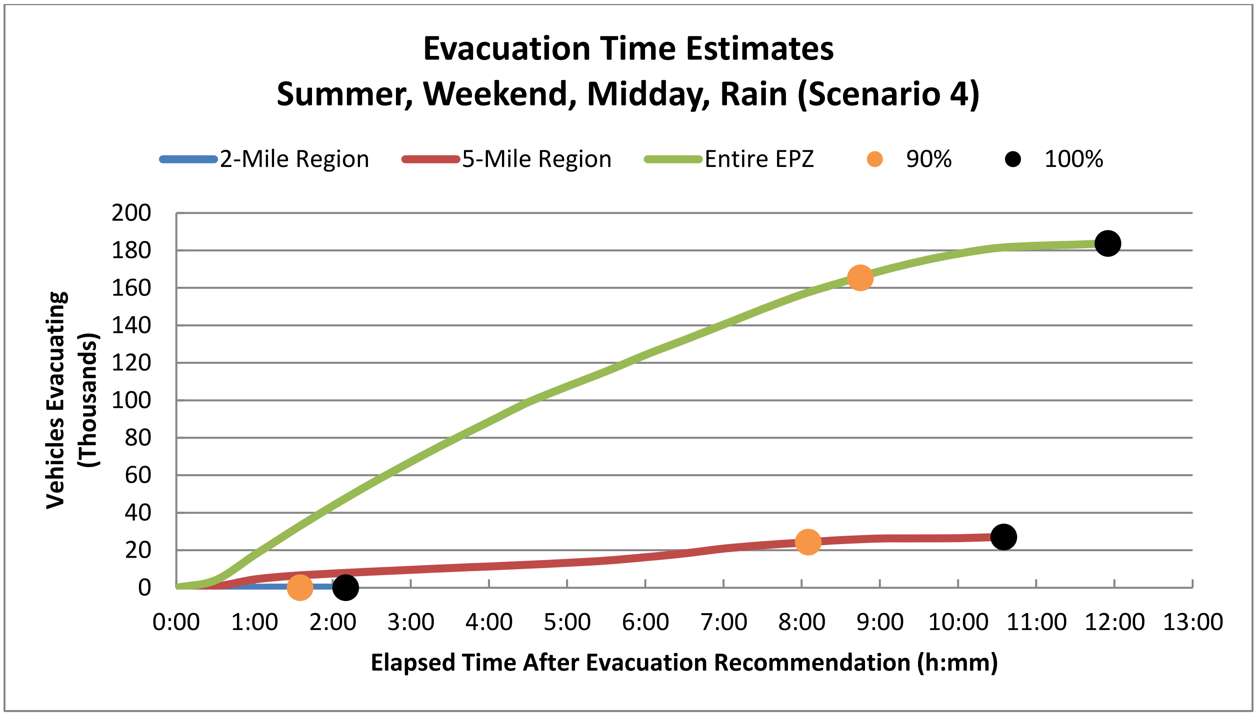

Figure 7-13. Evacuation Time Estimates – Scenario 4 for Region R03

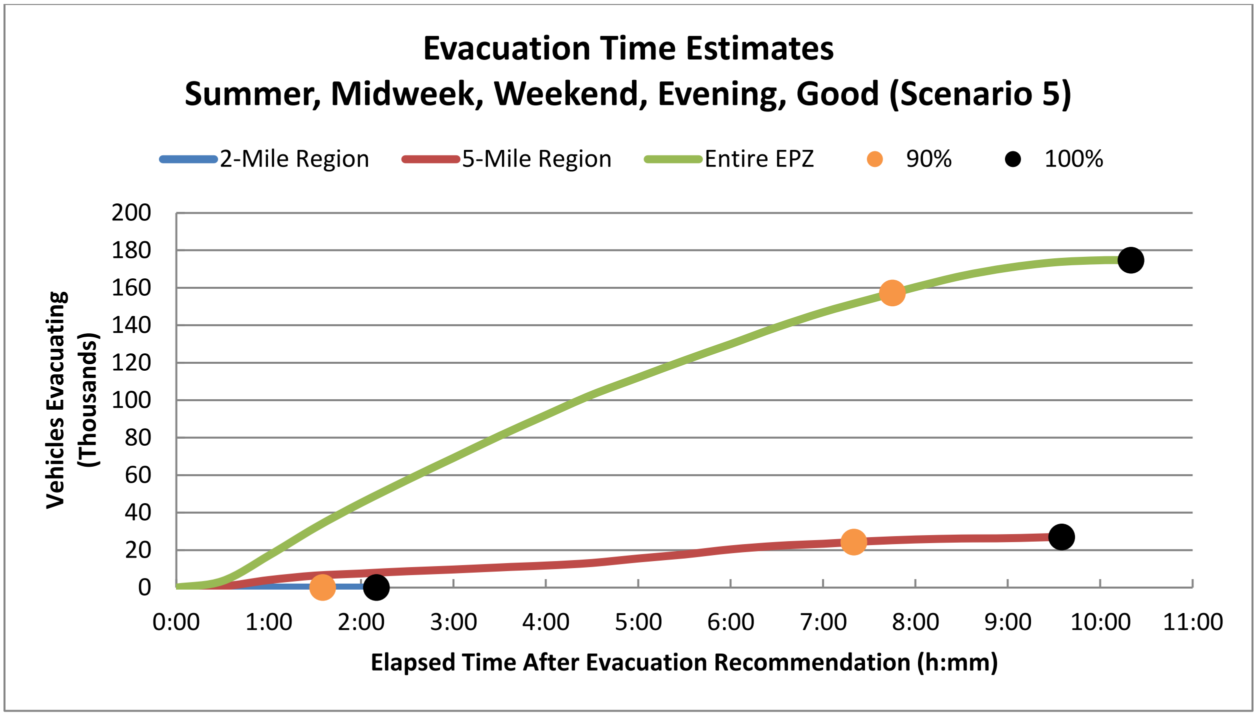

**Figure 7-14. Evacuation Time Estimates – Scenario 5 for Region R03**

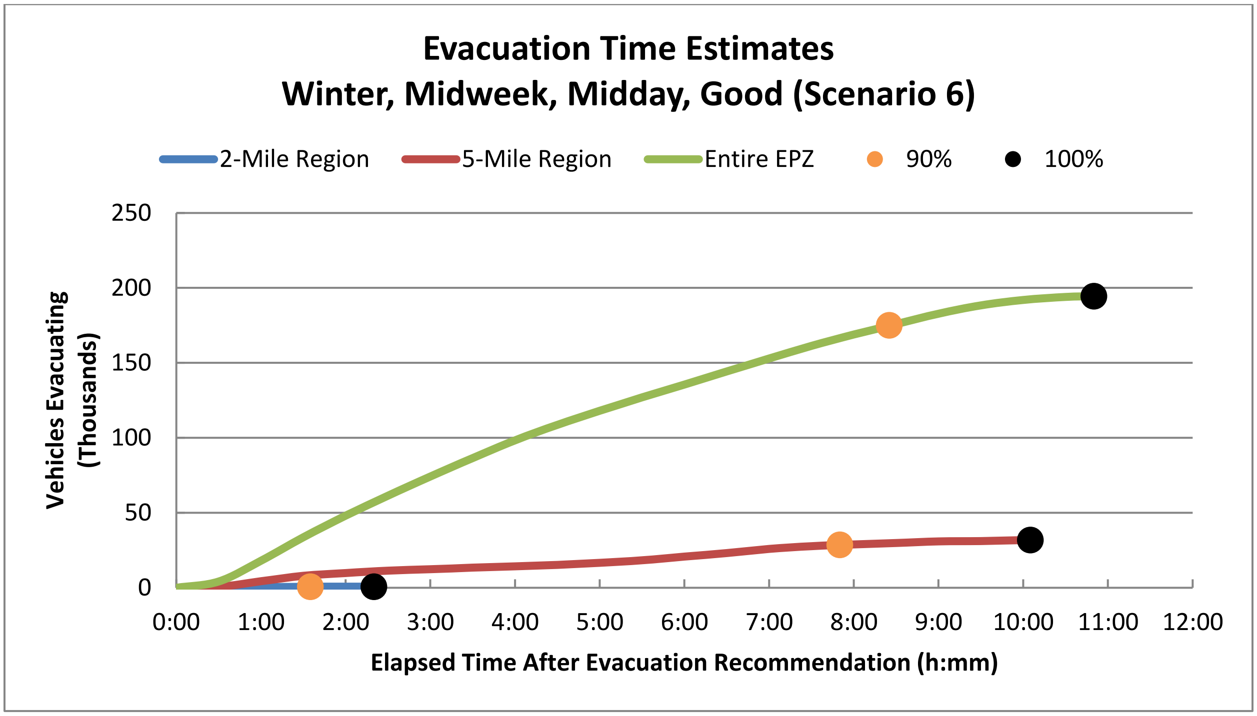

**Figure 7-15. Evacuation Time Estimates – Scenario 6 for Region R03**

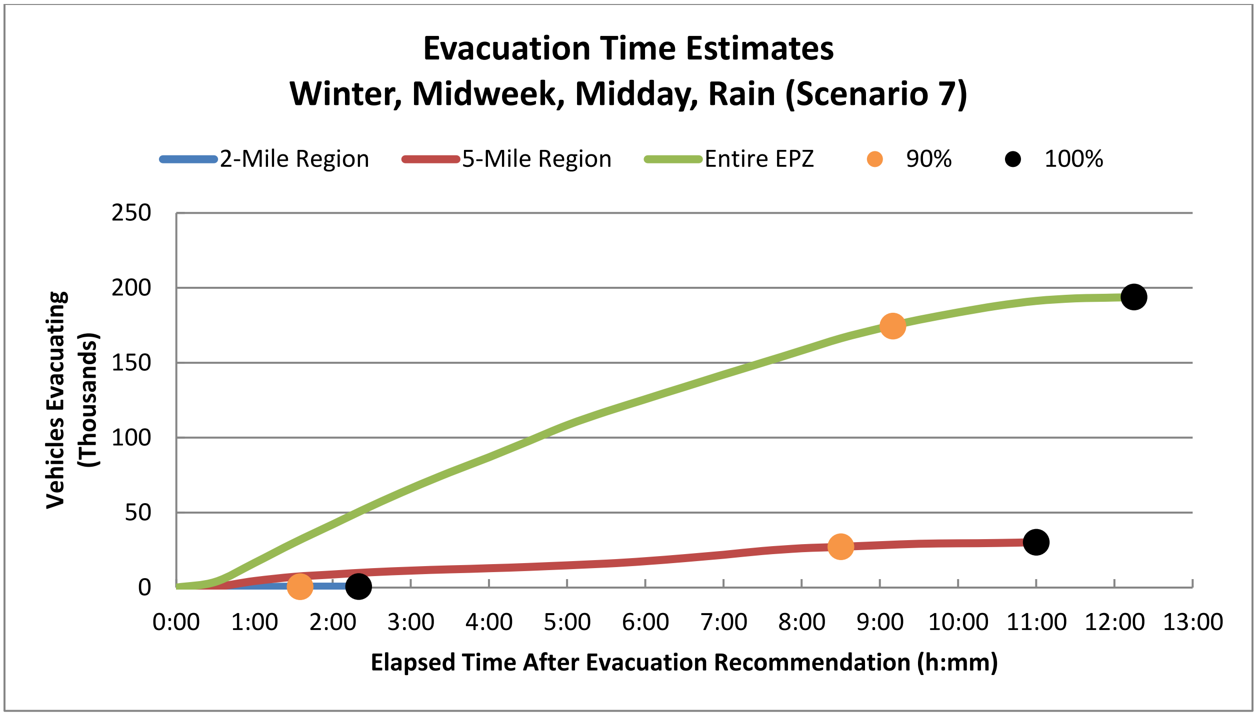

**Figure 7-16. Evacuation Time Estimates – Scenario 7 for Region R03**

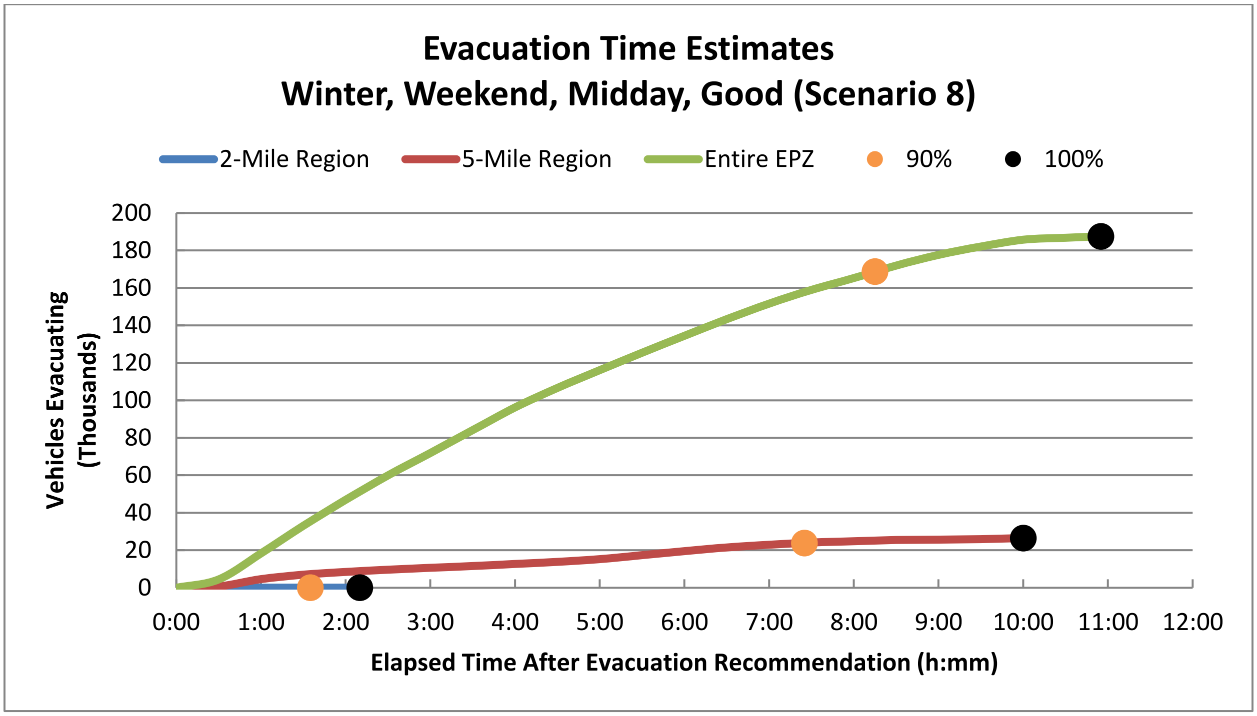

**Figure 7-17. Evacuation Time Estimates – Scenario 8 for Region R03**

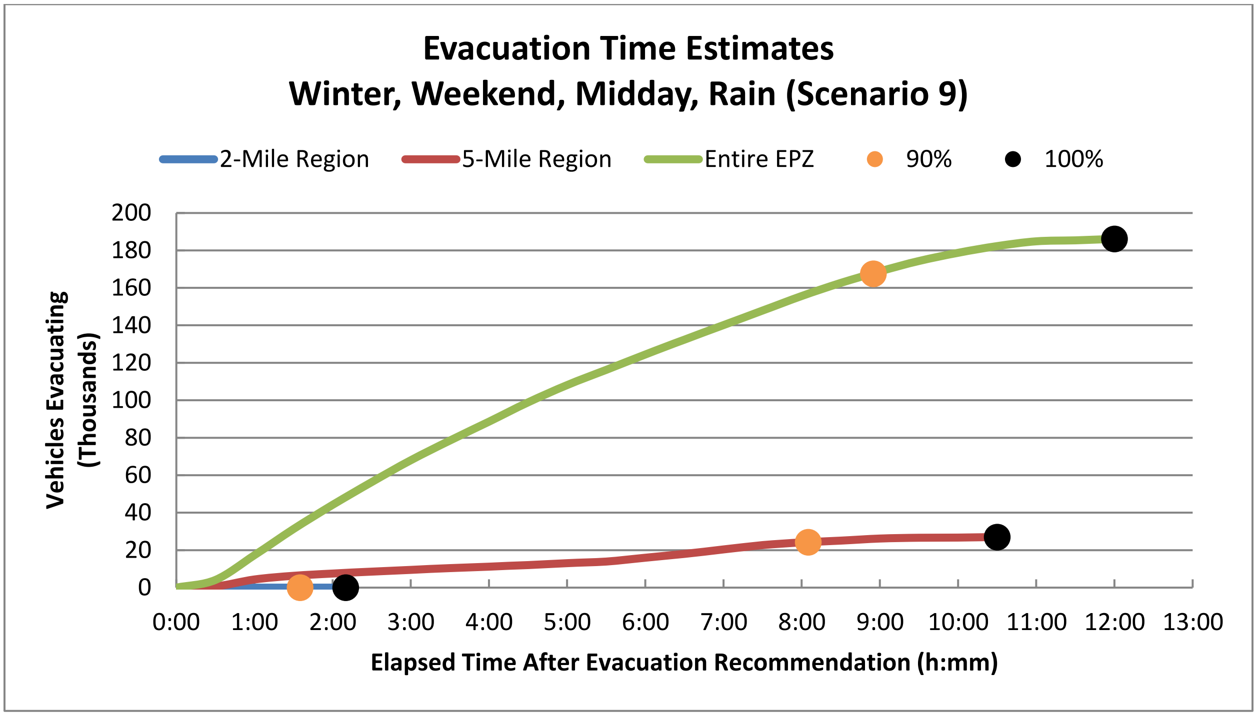

**Figure 7-18. Evacuation Time Estimates – Scenario 9 for Region R03**

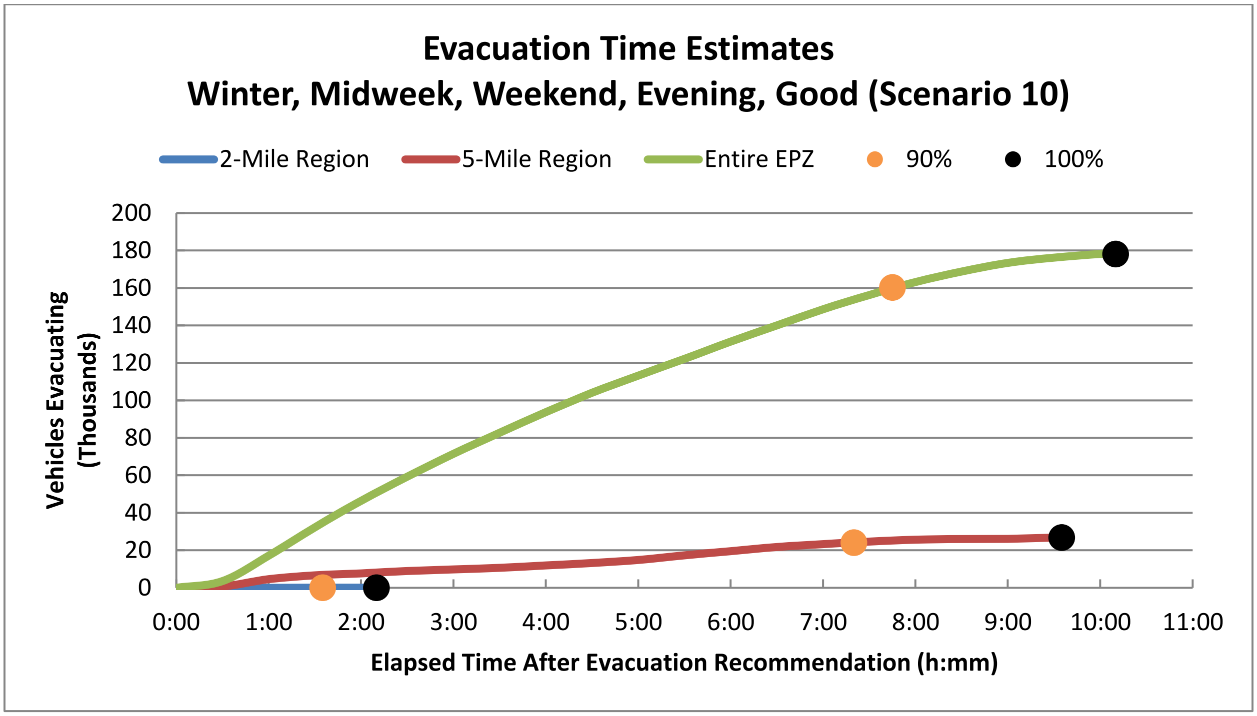

**Figure 7-19. Evacuation Time Estimates – Scenario 10 for Region R03**

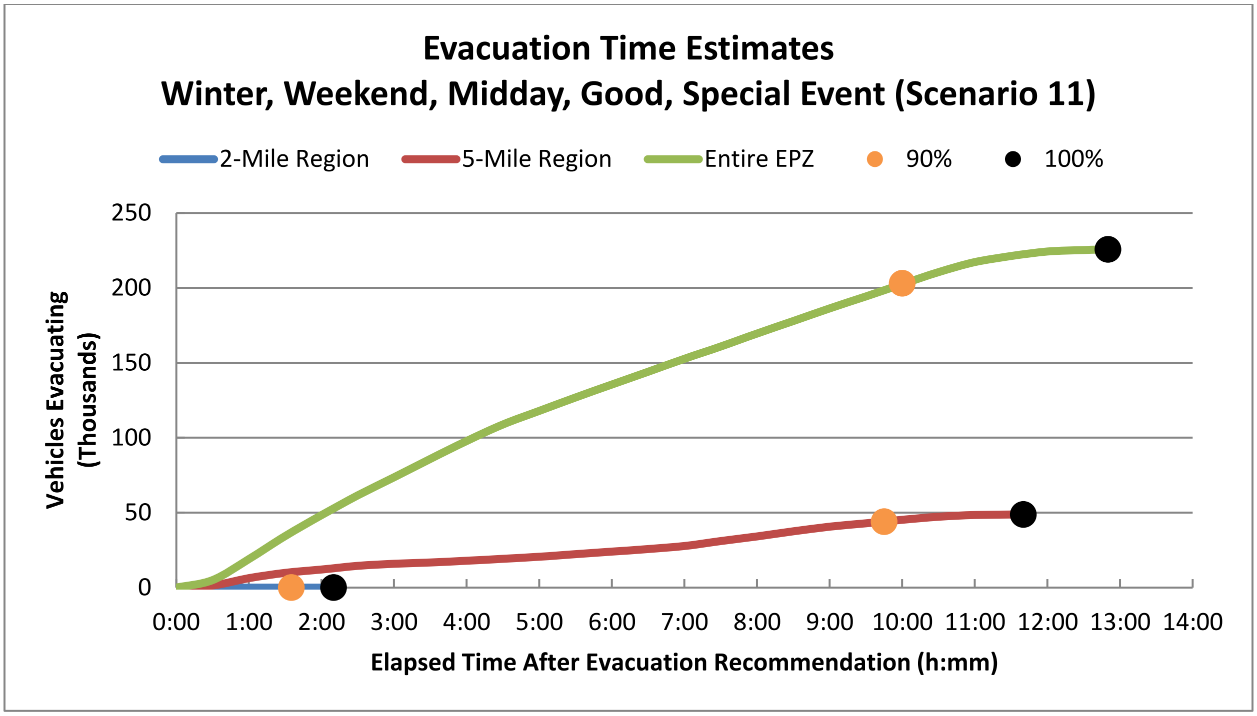

**Figure 7-20. Evacuation Time Estimates – Scenario 11 for Region R03**

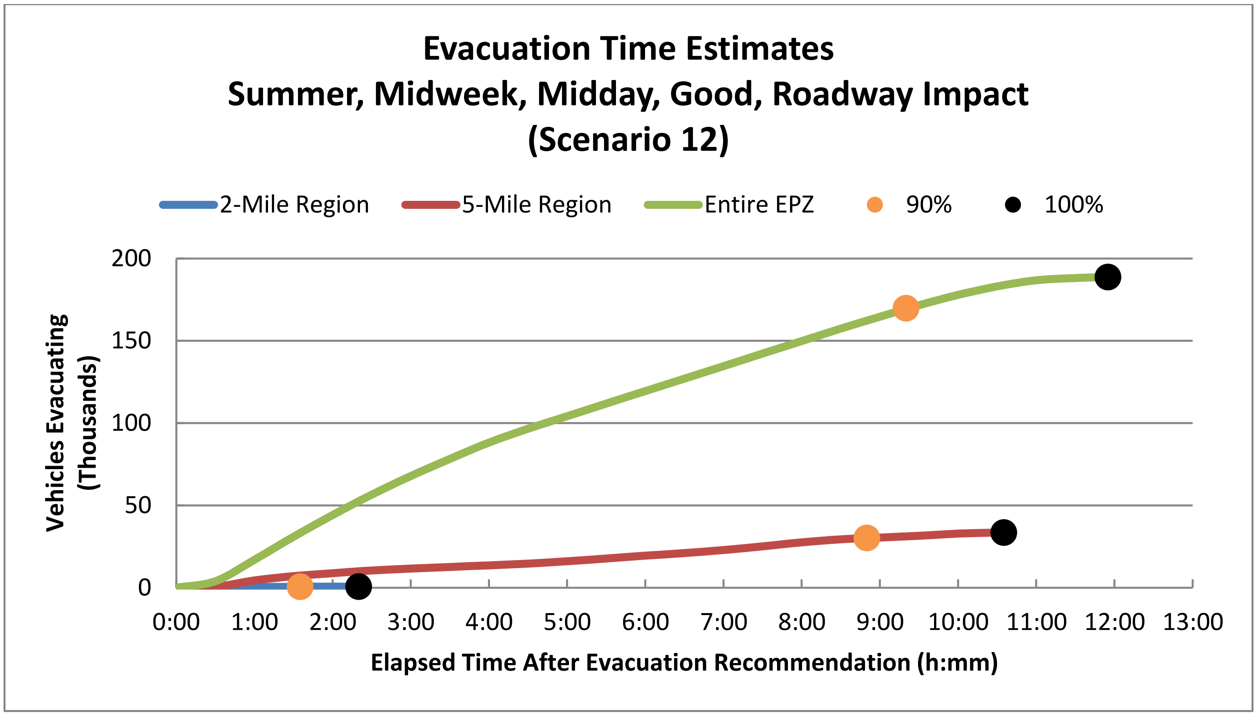

**Figure 7-21. Evacuation Time Estimates – Scenario 12 for Region R03**

# 8 TRANSIT-DEPENDENT AND SPECIAL FACILITY EVACUATION TIME ESTIMATES

This section details the analyses applied and the results obtained in the form of ETE for transit vehicles, buses, ambulances, and wheelchair transport vehicles. The demand for transit service reflects the needs of three population groups:

- residents with no vehicles available;
- residents of special facilities such as schools, medical facilities, and correctional facilities; and
- access and/or functional needs population.

These transit vehicles mix with the general evacuation traffic that is comprised mostly of "passenger cars" (pc's). The presence of each transit vehicle in the evacuating traffic stream is represented within the modeling paradigm described in Appendix D as equivalent to two pc's. This equivalence factor represents the larger size and more sluggish operating characteristics of a transit vehicle relative to those of a pc. Ambulances are considered one pc.

Transit vehicles must be mobilized in preparation for their respective evacuation missions. Specifically:

- Bus drivers must be alerted
- They must travel to the bus depot
- They must be briefed there and assigned to a route or facility

These activities consume time. Based on discussion with officials from Miami-Dade County Office of Emergency Management, it is estimated that mobilization time will average approximately 105 minutes for school buses, and 90 minutes for vehicles arriving at medical facilities and correctional facilities extending from the ATE to the time when vehicles first arrive at the facility to be evacuated.

During this mobilization period, other mobilization activities are taking place. One of these is the action taken by parents, neighbors, relatives and friends to pick up children from school prior to the arrival of buses, so that they may join their families. Virtually all studies of evacuations have concluded that this "bonding" process of uniting families is universally prevalent during emergencies and should be anticipated in the planning process. The current public information disseminated to residents of the Turkey Point Nuclear Power Plant EPZ indicates that schoolchildren (does not include private schools or daycares) may be evacuated to designated host schools (H.S.) prior to the evacuation of the general public, and that parents should pick schoolchildren up at the applicable H.S.

As discussed in Section 2, this study assumes a rapidly escalating event. Therefore, children are evacuated to the applicable H.S. Picking up children at school could add to traffic congestion at the schools, delaying the departure of the buses evacuating schoolchildren, which may have to return in a subsequent "wave" to the EPZ to evacuate the transit-dependent population. This report provides estimates of buses under the assumption that no children will be picked up by their parents (in accordance with NUREG/CR-7002, Rev. 1), to present an upper bound estimate of buses required. Based on the emergency plans provided by the off-site agencies, children at private schools and day cares are picked up by parents or guardians. It is assumed that the time to perform this activity is included in the trip generation times discussed in Section 5.

The procedure for computing transit-dependent ETE is to:

- Estimate demand for transit service (discussed in Section 3)
- Estimate time to perform all transit functions
- Estimate route travel times to the EPZ boundary and to the host school/general population reception centers.

ETE for transit trips were developed for both good weather and rain. Figure 8-1 presents the chronology of events relevant to transit operations. The elapsed time for each activity will now be discussed with reference to Figure 8-1. ETE are only presented for those facilities that are within the EPZ. The facilities that are in the Shadow Region or beyond are already out of the area at risk and, therefore, ETE need not be computed.

## 8.1 ETEs for Schools, Transit Dependent People, Medical Facilities and Correctional Facilities

The EPZ bus resources are assigned to evacuating schoolchildren (if school is in session at the time of the ATE) as the first priority in the event of an emergency. In the event that the allocation of buses dispatched from the depots to the various facilities and to the bus routes is somewhat inefficient, or if there is a shortfall of available drivers, then there may be a need for some buses to return to the EPZ from the reception centers after completing their first evacuation trip, to complete a "second wave" of providing transport service to evacuees. For this reason, the ETE for the transit-dependent population are calculated for both a one wave transit evacuation and for two waves. Of course, if the impacted Evacuation Region is other than R03 (the entire EPZ), then there will likely be ample transit resources relative to demand in the impacted Region and this discussion of a second wave would likely not apply. A list of available transportation resources was provided by counties within the EPZ and is shown in Table 8-1. It is assumed that there are enough drivers available to operate all resources listed in Table 8-1.

When school evacuation needs are satisfied, subsequent assignments of buses to service the transit-dependent should be sensitive to their mobilization time. Clearly, the buses should be dispatched after people have completed their mobilization activities and are in a position to board the buses when they arrive along the bus transit route.

*Evacuation of Schools*

Activity: Mobilize Drivers (A→B→C)

Mobilization is the elapsed time from the ATE until the time the buses arrive at the school to be evacuated. As discussed in item 4 of Section 2.4, it is estimated that for a rapidly escalating radiological emergency with no observable indication before the fact, drivers would likely require 105 minutes to be contacted, to travel to the depot, be briefed, and to travel to the schools that will be evacuated. Mobilization time is slightly longer – 115 minutes – in rain.

Activity: Board Passengers (C→D)

Based on discussions with the offsite agencies, a loading time of 15 minutes for good weather (20 minutes for rain) for school buses is used.

Activity: Travel to EPZ Boundary (D→E)

The buses servicing the schools are ready to begin their evacuation trips at 120 minutes after the ATE – 105 minutes mobilization time plus 15 minutes loading time – in good weather. The UNITES software discussed in Section 1.3 was used to define generic Area-specific bus routes along the most likely path from the center of each Area to the EPZ boundary, traveling toward the appropriate H.S. These generic routes were used to compute representative ETE for each school in each Area due to the large number of schools within the EPZ. This is done in UNITES by interactively selecting the series of nodes from the center of the Area to the EPZ boundary. Each bus route is given an identification number and is written to the DYNEV II input stream. DYNEV computes the route length and outputs the average speed for each 5-minute interval, for each bus route. The specified bus routes are documented in Table 10-2 (refer to the maps of the link-node analysis network in Appendix K for node locations). Data provided by DYNEV during the appropriate timeframe depending on the mobilization and loading times (i.e., 120 minutes after the ATE for good weather) were used to compute the average speed for each route, as follows:

$$Average\ Speed\ \left(\frac{mi.}{hr}\right)$$
$$= \left[\frac{\sum_{i=1}^{n} length\ of\ link\ i\ (mi)}{\sum_{i=1}^{n}\left\{Delay\ on\ link\ i\ (min.) + \frac{length\ of\ link\ i\ (mi.)}{current\ speed\ on\ link\ i\ \left(\frac{mi.}{hr.}\right)} \times \frac{60\ min.}{1\ hr.}\right\}}\right] \times \frac{60\ min.}{1\ hr.}$$

The average speed computed (using this methodology) for the buses servicing all of the schools within each Area are shown in Table 8-2 and Table 8-3. The travel time to the EPZ boundary was computed for the buses servicing each Area using the computed average speed and the distance to the EPZ boundary along the route in GIS. The travel time from the EPZ boundary to the H.S. was computed assuming an average speed of 15 mph and 10 mph for good weather and rain, respectively, given the widespread congestion in the Shadow Region where most of the H.S. are located. Speeds were reduced in Table 8-2 through Table 8-3 to 45 mph (40 mph for rain – 10% decrease, rounded to the nearest 5 mph) for those calculated bus speeds which exceed 45 mph, as the school bus speed limit for state routes within the EPZ is 45 mph (assumption 8 in Section 2.1).

Table 8-2 (good weather) and Table 8-3 (rain) present the following time estimates (rounded up to the nearest 5 minutes) for schools in the EPZ:

1. The "ETE" or elapsed time from the ATE until the bus exits the EPZ; and
2. The "ETA to H.S." or estimated time of arrival of the bus at the host school.

The evacuation time out of the EPZ can be computed as the sum of times associated with Activities A→B→C, C→D, and D→E (For example: 105 min. + 15 + 260 = 6:20, for Schools in Area 4 in good weather). Here, 260 minutes is the time to travel 8.7 miles at 2.0 mph.

The average single-wave ETE for schools is 5 hours and 35 minutes, which is 2 hours and 50 minutes less than the 90th percentile ETE (8:25) for evacuation of the general population in the entire EPZ (Region R03) under winter, midweek, midday, good weather (Scenario 6) conditions and should not impact protective action decision making.

The ETA to the H.S. is determined by adding the time associated with Activity E→F (discussed below) to this EPZ evacuation time.

Activity: Travel to School Reception Centers (E→F)

The distances from the EPZ boundary to the H.S. are measured using GIS software along the most likely route from the EPZ exit point to the H.S. The H.S. are mapped in Figure 10-3. For a single-wave evacuation, this travel time outside the EPZ does not contribute to the ETE. As discussed above, assumed bus speeds of 15 mph and 10 mph for good weather and rain, respectively, will be applied for this activity for buses servicing the schools.

Activity: Passengers Leave Bus (F→G)

A bus can empty within 5 minutes. The driver takes a 10-minute break.

Activity: Bus Returns to Route for Second Wave Evacuation (G→C→D→E)

As shown in Table 8-1, Miami-Dade Schools has sufficient buses for evacuation of schoolchildren in a single wave if the entire EPZ is evacuated at once (a highly unlikely event). Nonetheless, if any buses are out of service or if there is a shortfall of available bus drivers in an emergency, a two-wave evacuation may be needed for some schools. Due to the large number of schools in the EPZ, second wave ETE were not computed for each school or each Area. Rather, the following representative ETE is provided to estimate the additional time needed for a second wave evacuation of schools in each Area. The travel time from the H.S. back to the EPZ boundary was computed using a speed of 40 mph (good weather) and 35 mph (rain) as buses will be traveling counter to evacuating traffic. The portion of the return trip from the EPZ boundary back to the schools was computed using an average speed of all the school bus routes at the time. Although the buses will be traveling counter to evacuating traffic, the PTN EPZ is extremely congested, and the average speeds are likely lower than the speeds assumed for vehicles traveling outside the EPZ. Times and distances are based on averages for all schools in the EPZ for good weather:

- Buses arrive at the H.S. at 6:15 (see average value in Table 8-2)
- Bus discharges passengers (5 minutes) and driver takes a 10-minute rest: 15 minutes
- Bus returns to facility: 57 minutes (15 minutes – average distance to H.S. (9.5 miles)

at 40 mph + 42 minutes – average distance to EPZ boundary (7.1 miles) at 10.3 mph – average speed of all school bus routes at 6:45)

- Loading Time: 15 minutes
- Bus travels back to the EPZ boundary: 34 minutes (average distance to EPZ boundary (7.1 miles) at average speed (12.8 mph) of all school bus routes at 7:45)
- Bus exits EPZ at time 6:15 + 0:15 + 0:57 + 0:15 + 0:34 = 8:20 (rounded up to the nearest 5 minutes) after the ATE.

Given the average single-wave ETE for schools is 5:35 (see Table 8-2); a second-wave evacuation would require an additional 2 hours and 45 minutes on average. The average second-wave ETE for schools is 5 minutes (8:25 - 8:20 = 0:05) lower than the 90th percentile ETE for the full EPZ during a winter, midweek, midday (Scenario 6) evacuation of the full EPZ (Region R03) and should not impact protective action decision making.

*<u>Evacuation of Transit Dependent People (Residents without access to a vehicle)</u>*

A detailed computation of transit dependent population was done and is discussed in Section 3.6. The total number of transit dependent people per Area was determined using a weighted distribution based on population (Area population divided by EPZ population multiplied by the number of transit dependent people). See Table 3-13 for the distribution used. The number of buses required to evacuate this population was determined using a capacity of 30 people per bus. The annual public information brochure lists bus stops by zip code for Miami-Dade County where Miami-Dade Transit will pick up those people that need a ride in an emergency. Five bus routes were designed in this study to service the major evacuation routes and bus stops in each zip code from the center of the zip code to the EPZ boundary in order to estimate evacuation times for the transit dependent population. The bus routes are shown graphically in Figure 10-2 and are described in Table 10-1. Those buses servicing the transit-dependent evacuees will first travel along these routes, then proceed out of the EPZ toward the reception center.

<u>Activity: Mobilize Drivers (A→B→C)</u>

Mobilization time is the elapsed time from the ATE until the time the buses arrive at their designated route. The buses dispatched from the depots to service the transit-dependent evacuees will be scheduled so that they arrive at their respective routes after the majority of their passengers have completed their mobilization. As shown in Figure 5-4 (Residents with no Commuters), 91% of the evacuees will have completed their mobilization when the buses will begin their routes 150 minutes after the ATE for good weather. Those routes with multiple buses have been designed such that buses are dispatched using 30-minute headways. The use of bus headways ensures that those people who take longer to mobilize will be picked up.

<u>Activity: Board Passengers (C→D)</u>

For multiple stops along a route, estimation of travel time must allow for the delay associated with stopping and starting at each pick-up point. The time, t, required for a bus to decelerate at a rate, “a”, expressed in ft/sec/sec, from a speed, “v”, expressed in ft/sec, to a stop, is $t = v/a$. Assuming the same acceleration rate and final speed following the stop yields a total time, T, to service boarding passengers:

$$T = t + B + t = B + 2t = B + \frac{2v}{a},$$

Where B = Dwell time to service passengers. The total distance, “s” in feet, travelled during the deceleration and acceleration activities is: s = $v^2$/a. If the bus had not stopped to service passengers, but had continued to travel at speed, v, then its travel time over the distance, s, would be: s/v = v/a. Then the total delay (i.e. pickup time, P) to service passengers is:

$$P = T - \frac{v}{a} = B + \frac{v}{a}$$

Assigning reasonable estimates:

- B = 50 seconds: a generous value for a single passenger, carrying personal items, to board per stop
- v = 25 mph = 37 ft/sec
- a = 4 ft/sec/sec, a moderate average rate

Then, P ≈ 1 minute per stop. Allowing 30 minutes pick-up time per bus run implies 30 stops per run, for good weather. It is assumed that bus acceleration and speed will be less in rain; thus, total loading time is 40 minutes per bus for rain.

Activity: Travel to EPZ Boundary (D→E)

The travel distance along the respective pick-up routes within the EPZ is estimated using the UNITES software. Bus travel times within the EPZ are computed using average speeds computed by DYNEV, using the aforementioned methodology that was used for school evacuation.

Table 8-4 and Table 8-5 present the transit-dependent population ETEs for each bus route calculated using the above procedures for good weather and rain, respectively.

For example, the ETE for the first group of buses servicing zip code 33030 is computed as 150 + 103 + 30 = 4:45 for good weather (rounded up to nearest 5 minutes). Here, 103 minutes is the time to travel 14.4 miles at 8.4 mph, the average speed output by the model for this route at 150 minutes.

The average single wave ETE (5:10) for the transit dependent population does not exceed the 90th percentile ETE (8:25) for the general population for a winter, midweek, midday, good weather (Scenario 6) evacuation of the full EPZ (Region R03) and should not impact protective action decision making.

The ETE for a second wave (discussed below) is presented in the event there is a shortfall of available buses or bus drivers.

Activity: Travel to Reception Centers (E→F)

The distance from the EPZ boundary to the reception center is measured using GIS software along the most likely route from the EPZ exit point to the reception center. The general population reception centers are mapped in Figure 10-3. For a one-wave evacuation, this travel time outside the EPZ does not contribute to the ETE. Assumed bus speeds of 15 mph and 10 mph for good weather and rain, respectively, will be applied for this activity for buses servicing the transit-dependent population.

Activity: Passengers Leave Bus (F→G)

A bus can empty within 5 minutes. The driver takes a 10-minute break.

Activity: Bus Returns to Route for Second Wave Evacuation (G→C→D→E)

The buses assigned to return to the EPZ to perform a "second wave" evacuation of transit-dependent evacuees will be those that have already evacuated transit-dependent people who mobilized more quickly. The first wave of transit-dependent people depart the bus, and the bus then returns to the EPZ, travels to the start of its route and proceeds to pick up more transit-dependent evacuees along the route. The travel time back to the EPZ is computed based on the distance from the reception center to the EPZ boundary assuming average speeds of 40 mph and 35 mph for good weather and rain, respectively, as buses will be traveling counter to evacuating traffic.

The second wave ETE for the bus route servicing zip code 33030 is computed as follows for good weather (assuming the first 11 buses dispatched are returning for the second wave):

- Bus arrives at reception center at 5:35 in good weather (4:45 to exit EPZ + 50-minute travel time to reception center – 12.4 miles @ 15 mph).
- Bus discharges passengers (5 minutes) and driver takes a 10-minute rest: 15 minutes.
- Bus returns to EPZ and completes second route: 19-minutes (12.4 miles to return from R.C. to EPZ boundary @ 40 mph) + 52 minutes to travel to the start of the route and to rerun the route a second time (14.4 miles @ 26.5 mph [average speed of all transit bus routes as bus is traveling in the opposite direction] + 14.4 miles @ 43.7 mph [route specific speed output from the model at this time]) = 71 minutes (1:11)
- Bus completes pick-ups along route: 30 minutes.
- Bus exits EPZ at time 5:35 + 0:15 + 1:11 + 0:30 = 7:35 (rounded up to nearest 5 minutes) after the ATE.

The ETE for the completion of the second wave for all transit-dependent bus routes are provided in Table 8-4 and Table 8-5.

The average ETE (8:05, refer to Table 8-4) for a two-wave evacuation of the transit-dependent population is 20 minutes shorter than the ETE (8:25) for the general population at the 90th percentile for an evacuation of the entire EPZ (Region R03) under winter, midweek, midday, good weather conditions (Scenario 6) and should not impact protective action decision making.

The relocation of transit-dependent evacuees from the reception centers to congregate care centers, if the counties decide to do so, is not considered in this study.

*Evacuation of Medical Facilities*

As discussed in Section 2.4, Item 2b, Florida state law requires medical facilities to have a comprehensive emergency management plan (CEMP) which identifies mutual aid agreements, emergency resources, and transportation needs for an emergency which will require a possible evacuation of the residents to a similar facility outside of the area to be evacuated. As such, buses, wheelchair vans and ambulances (provided by or contracted by the medical facilities) will evacuate patients at medical facilities.

Activity: Mobilize Drivers (A→B→C)

As discussed in Section 2.4, it is assumed that the mobilization time for transport vehicles servicing medical facilities averages 90 minutes in good weather and 100 minutes in rain. Specially trained medical support staff (working their regular shift) will be on site to assist in the evacuation of patients. Additional staff (if needed) could be mobilized over this same 90-minute timeframe (good weather).

Activity: Board Passengers (C→D)

Item 5 of Section 2.4 discusses transit vehicle loading times for medical facilities. Loading times are assumed to be 1 minute per ambulatory passenger, 5 minutes per wheelchair bound passenger, and 15 minutes per bedridden passenger for buses, wheelchair buses, and ambulances respectively. Item 3 of Section 2.4 discusses transit vehicle capacities to cap loading times per vehicle type. Concurrent loading on multiple vehicles is also assumed, as stated in item 5 of Section 2.4, such that the maximum loading time for buses is 30 minutes (30 passengers x 1 minute per passenger), for wheelchair buses is 75 minutes (15 passengers x 5 minutes per passenger), and for ambulances is 15 minutes (1 passenger x 15 minutes per passenger).

Activity: Travel to EPZ Boundary (D→E)

The travel distance along the respective evacuation routes within the EPZ is estimated using the UNITES software. Bus travel times within the EPZ are computed using average speeds computed by DYNEV, using the aforementioned methodology that was used for school evacuation.

Table 8-6 and Table 8-7 summarize the ETE for medical facilities within the EPZ for good weather and rain. Average speeds output by the model for Scenario 6 (Scenario 7 for rain) Region 3, capped at 45 mph (40 mph for rain), are used to compute travel time to the EPZ boundary. The travel time to the EPZ boundary is computed by dividing the distance to the EPZ boundary by the average travel speed. The ETE is the sum of the mobilization time, total passenger loading time, and travel time out of the EPZ. Similar to schools, a representative route for each Area from the center of the Area to the EPZ boundary was used and the current census at each medical facility in the Area was used to estimate the loading time. All ETE are rounded up to the nearest 5 minutes.

For example, the calculation of ETE for the medical facilities in Area 4 with 38 ambulatory residents during good weather is:

ETE: 90 + 30 x 1 + 260 = 380 min. or 6:20

It is assumed that the population at medical facilities is directly evacuated to appropriate host medical facilities outside the EPZ. Relocation of this population to permanent facilities and/or passing through the reception center before arriving at the host facility are not considered in this analysis.

The average single wave ETE (5:55) for medical facilities in the EPZ does not exceed the 90th percentile ETE (8:25) for the general population for a winter, midweek, midday, good weather (Scenario 6) evacuation of the full EPZ (Region R03) and should not impact protective action decision making.

<u>Activity: Vehicles Travel to Host Facilities (E→F), Passengers Leave (F→G), Vehicle Returns to Route for Second Wave Evacuation (G→C→D→E)</u>

In the event there is a shortfall of available buses to evacuate the medical facilities within the EPZ, a second-wave ETE is computed for the ambulatory patients as follows for good weather:

- Buses arrive at host medical facility at 6:40 [5:50 average ETE for ambulatory in Table 8-6 + estimated 50-minute travel time (average travel time to reception center from EPZ boundary; calculated from Table 8-4)]
- Bus discharges passengers (30 minutes – average loading time for ambulatory patients) and driver takes a 10-minute rest: 40 minutes.
- Bus returns to facility: 19 minutes to travel back to the EPZ boundary (12.4 miles @ 40 mph from reception center back to EPZ boundary for good weather) + 35 minutes to travel back to the facility (average distance to EPZ – 8.2 miles @ 14.3 mph – average speed of all bus routes serving medical facilities at 7:40) = 54 minutes (0:54).
- Remaining ambulatory patients load on bus (maximum): 30 minutes (average from Table 8-6).
- Bus travels to EPZ boundary: 20 minutes (average distance from medical facilities to EPZ boundary (8.2 miles) at 25.7 mph (average speed of all bus routes serving medical facilities at 8:45)
- Bus exits EPZ at time 6:40 + 0:40 + 0:54 + 0:30 + 0:20 = 9:05 (rounded up to nearest 5 minutes) after the ATE.

Thus, the second wave evacuation requires an additional 3 hours and 10 minutes (9:05 – 5:55 = 3:10). The average ETE for a two-wave evacuation of medical facilities exceeds the ETE for the 90th percentile ETE (8:25) for the general population for a winter, midweek, midday, good weather (Scenario 6) evacuation of the full EPZ (Region R03) by 40 minutes and could impact protective action decision making.

In the event there is a shortfall of wheelchair buses available to evacuate the medical facilities within the EPZ, a second-wave ETE is computed for the wheelchair bound patients as follows for good weather:

- Wheelchair buses arrive at host medical facility at 7:08 [6:18 average ETE for wheelchair buses in Table 8-6 + estimated 50-minute travel time (average travel time to reception center from EPZ boundary, calculated from Table 8-4)]
- Wheelchair bus discharges passengers (67 minutes-average loading time for wheelchair buses) and driver takes a 10-minute rest: 77 minutes (1:17).
- Wheelchair bus returns to EPZ and completes second route: 19 minutes to travel back to the EPZ boundary (12.4 miles @ 40 mph from reception center to EPZ boundary for good weather) + 20 minutes to travel back to the facility (average distance to EPZ – 8.2 miles @ 25.7mph – average speed of all bus routes serving medical facilities at 8:45) = 39 minutes (0:39).
- Remaining wheelchair bound patients loaded on wheelchair bus: 67 minutes (1:07, average from Table 8-6).
- Wheelchair bus travels to EPZ boundary: 13 minutes (average distance from medical

facilities to EPZ boundary (8.2 miles) at 40.4 mph (average speed of all bus routes serving medical facilities at 10:15)

- Wheelchair bus exits EPZ at time 7:08 + 1:17 + 0:39 + 1:07 + 0:13 = 10:25 (rounded up to the nearest 5 minutes) after the ATE.

Thus, the second wave evacuation requires an additional 4 hours and 30 minutes (10:25 – 5:55 = 4:30). The average ETE for a two-wave evacuation of wheelchair bound patients exceeds the 90th percentile ETE (8:25) for the general population by 2 hours for a winter, midweek, midday, good weather (Scenario 6) evacuation of the full EPZ (Region R03) and could impact protective action decision making.

In the event there is a shortfall of ambulances at the medical facilities within the EPZ, a second-wave ETE is computed for the bedridden patients as follows for good weather:

- Ambulances arrive at host medical facility at 6:21 [5:31 average ETE for ambulances in Table 8-6 + estimated 50-minute travel time (average travel time to reception center from EPZ boundary from Table 8-4)]
- Ambulance discharges passengers (15 minutes-average loading time for ambulances) and driver takes a 10-minute rest: 25 minutes.
- Ambulance returns to EPZ and completes second route: 19 minutes to travel back to the EPZ boundary (12.4 miles @ 40 mph from reception center to EPZ boundary for good weather) + 31 minutes to travel back to the facility (average distance to EPZ – 8.2 miles @ 16.2 mph - average speed of all bus routes serving medical facilities at 7:05) = 50 minutes (0:50).
- Remaining bedridden patients loaded on ambulance (maximum): 15 minutes (average from Table 8-6).
- Ambulance travels to EPZ boundary: 24 minutes (average distance from medical facilities to EPZ boundary (8.2 miles) at 20.9 mph (average speed of all bus routes serving medical facilities at 7:55)
- Ambulance exits EPZ at time 6:21 + 0:25 + 0:50 + 0:15 + 0:24 = 8:15 (rounded up to nearest 5 minutes) after the ATE.

Thus, the second wave evacuation requires an additional 2 hours and 20 minutes (8:15 - 5:55 = 2:20). The average ETE for a two-wave evacuation of medical facilities is less than the 90th percentile ETE (8:25) for the general population by 10 minutes for a winter, midweek, midday, good weather (Scenario 6) evacuation of the full EPZ (Region R03) and should not impact protective action decision making.

*Correctional Facilities*

Activity: Mobilize Drivers (A→B→C)

As discussed in Item 2 of Section 2.4, it is assumed that the mobilization time for both the correctional facilities averages 90 minutes in good weather, 100 minutes in rain.

Activity:  Mobilize Drivers (B→C→D)

It is estimated that it takes at most 30 minutes to load the inmates onto a bus during good weather (40 minutes in rain) and that the buses can be loaded in parallel.

Activity:  Mobilize Drivers (C→D)

As detailed in Table 8-8, there are two correctional facilities within the EPZ – the Miami Dade Police Department (temporary holding facility) and the Dade Juvenile Residential Facility. The total inmate population at these two facilities are 45 and 55, respectively. Using GIS software, the shortest route from each facility to the EPZ boundary, travelling away from the plant was estimated. The average speed output by DYNEV for the route was used to calculate the travel time to the EPZ boundary. The ETE for correctional facilities is the sum of mobilization time, total loading time, and travel time.

For example, the calculation of ETE for the Dade Juvenile Facility with 55 inmates during good weather is as follows:

a. Buses are mobilized: 90 minutes
b. Load inmates onto the bus: 30 minutes
c. Travel to EPZ boundary: 330 min or 5:30 (20.5 miles at 3.7 mph)

ETE: 90 + 30 + 330 = 450 min or 7:30

According to State of Florida Radiological Emergency Preparedness Plan, the correctional facilities have their own resources to evacuate. Thus, a second wave ETE is not computed.

## 8.2 ETE for Access and/or Functional Needs Population

The special needs population registered within the EPZ was provided by the offsite agencies. Table 8-9 summarizes the ETE for the registered access and/or functional needs people who would need transportation assistance in the event of an emergency.  The table is categorized by type of vehicle required and then broken down by weather condition.  The table takes into consideration the deployment of multiple vehicles (not filled to capacity) to reduce the number of stops per vehicle.  Due to the limitations on driving for access and/or functional needs persons, it assumed they will be picked up from their homes. Furthermore, it is conservatively assumed that access and/or functional needs households are spaced 3 miles apart.  Vehicles speeds approximate 15 mph between households in good weather (10% slower in rain).  Mobilization times of 150 minutes were used (160 minutes for rain) as this is when 91% of residents without commuters are mobilized.  The last household (HH) is assumed to be 5 miles from the EPZ boundary, and the network-wide average speed, capped at 45 mph (40 mph for rain), after the last pickup is used to compute travel time.

ETE is computed by summing mobilization time, loading time at first household, travel to subsequent households, loading time at subsequent households, and travel time to EPZ boundary.  All ETE are rounded up to the nearest 5 minutes.

For example, assuming no more than one access and/or functional needs person per HH implies that 19 ambulatory households need to be serviced.  While only 1 bus is needed from a capacity perspective, if 5 buses are deployed to service these HH, then each would require at most 4 stops. The following outlines the ETE calculations for a good weather scenario:

1. Assume 5 buses are deployed, each with about 4 stops, to service a total of 19 HH.
2. The ETE is calculated as follows:
    a. Buses arrive at the first pickup location: 150 minutes
    b. Load passenger at first pickup: 1 minute
    c. Travel to subsequent pickup locations: 3 @ 12 minutes (3 miles at 15 mph) = 36 minutes
    d. Load passengers at subsequent pickup locations: 3 @ 1 minute = 3 minutes
    e. Travel to EPZ boundary: 64 minutes (5 miles at 4.7 mph – network wide average speed at 3:10).

ETE: 150 + 1 + 36 + 3 + 64 = 254 minutes or 4:15 (rounded up to the nearest 5 minutes)

The average ETE (4:30) of a one-wave evacuation of the access and/or functional needs population is lower than the general population ETE at the 90th percentile (8:25) for an evacuation of the entire EPZ (Region R03) during Scenario 6 conditions and should not impact protective action decision making.

The following outlines the ETE calculations of a second wave evacuation using buses after the medical facilities been evacuated for good weather (see Table 8-10):

a. Transit buses arrive at designated Reception Center (R.C.): 9:55 (9:05 second wave medical ETE for ambulatory plus 50-minute average travel time to R.C. from Table 8-4)
b. Unload passengers at R.C.: 5 minutes.
c. Driver takes 10-minute rest: 10 minutes.
d. Travel time back to EPZ: 19 minutes (average distance from EPZ boundary to RC is 12.4 miles @ 40 mphTable 8-5)
e. Travel to all households: 4 @ 12 minutes = 48 minutes (0:48)
f. Loading time at all households: 4 stops @ 1 minutes = 4 minutes
g. Travel time to EPZ boundary - 5 miles @ 15.1 mph (network wide average speed at 11:25) = 20 minutes

ETE: 9:55 + 0:05 + 0:10 + 0:19 + 0:48 + 0:04 + 0:20 = 11:45 (rounded up to nearest 5 minutes)

The average ETE (13:05) of a second-wave evacuation of the access and/or functional needs population within the EPZ is significantly longer than the 90th percentile ETE (8:25) for evacuation of the general population in the entire EPZ (Region R03) under winter, midweek, midday, good weather (Scenario 6) conditions and could impact protective action decision-making.

**Table 8-1. Summary of Transportation Resources**

| Transportation Resources | Buses | Wheelchair Buses | Ambulances |
|---|---|---|---|
| **Resources Available** | | | |
| Miami-Dade County Public Schools | 999[1] | | 0 |
| Monroe County | 0 | 0 | 0 |
| Miami-Dade Transit and Public Works | 20[2] | 0 | 0 |
| Miami-Dade Fire and Rescue | 0 | 0 | 71 |
| Medical Facilities | As needed[3] | | |
| **TOTAL:** | **1,019** | | **71** |
| **Resources Needed** | | | |
| **Schools (Table 3-8):** | 799 | 0 | 0 |
| **Medical Facilities (Table 3-6):** | 141 | 108 | 66 |
| **Correctional Facilities (Table 3-11)** | 4 | 0 | 0 |
| **Transit-Dependent Population (Section 3.6):** | 206 | 0 | 0 |
| **Access and/or Functional Needs (Table 3-10):** | 5 | 25 | 71 |
| **TOTAL TRANSPORTATION NEEDS:** | **1,155** | **133** | **137** |

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[1] Miami-Dade County Public Schools has 224 buses in its fleet that have wheelchair lifts; these buses can accommodate 3 wheelchair passengers each for a capacity of 672 wheelchair bound patients.

[2] Miami-Dade Transit and Public Works can provide 20 buses with no interruption to their regular service routes.

[3] Florida State Law requires medical facilities to have an emergency plan including transportation to evacuate residents. See Section 2.4, Item 2b.

**Table 8-2. School Evacuation Time Estimates – Good Weather**

| SCHOOLS IN | Driver Mobilization Time (min) | Loading Time (min) | Dist. To EPZ Bdry (mi) | Average Speed (mph) | Travel Time to EPZ Bdry (min) | ETE (hr:min) | Dist. EPZ Bdry to H.S (mi.) | Travel Time from EPZ Bdry to H.S. (min) | ETA to H.S. (hr:min) |
|---|---|---|---|---|---|---|---|---|---|
| **MIAMI-DADE COUNTY SCHOOLS** | | | | | | | | | |
| AREA 4 | 105 | 15 | 8.7 | 2.0 | 260 | **6:20** | 6.4 | 25 | **6:45** |
| AREA 5 | 105 | 15 | 4.0 | 3.5 | 69 | **3:10** | 9.1 | 36 | **3:50** |
| AREA 6 | 105 | 15 | 3.6 | 2.2 | 99 | **3:40** | 9.4 | 38 | **4:20** |
| AREA 7 | 105 | 15 | 9.4 | 1.6 | 356 | **8:00** | 9.2 | 37 | **8:40** |
| AREA 8 | 105 | 15 | 13.7 | 2.1 | 392 | **8:35** | 12.4 | 50 | **9:25** |
| **MONROE COUNTY SCHOOLS** | | | | | | | | | |
| AREA 10 | 105 | 15 | 3.4 | 2.3 | 87 | **3:30** | 10.5 | 42 | **4:15** |
| **Maximum for EPZ:** | | | | | | **8:35** | **Maximum:** | | **9:25** |
| **Average for EPZ:** | | | | | | **5:35** | **Average:** | | **6:15** |

**Table 8-3. School Evacuation Time Estimates – Rain**

| SCHOOLS IN | Driver Mobilization Time (min) | Loading Time (min) | Dist. To EPZ Bdry (mi) | Average Speed (mph) | Travel Time to EPZ Bdry (min) | ETE (hr:min) | Dist. EPZ Bdry to H.S (mi.) | Travel Time from EPZ Bdry to H.S. (min) | ETA to H.S. (hr:min) |
|---|---|---|---|---|---|---|---|---|---|
| **MIAMI-DADE COUNTY SCHOOLS** | | | | | | | | | |
| AREA 4 | 115 | 20 | 8.7 | 1.9 | 281 | **7:00** | 6.4 | 38 | **7:40** |
| AREA 5 | 115 | 20 | 4.0 | 3.0 | 79 | **3:35** | 9.1 | 54 | **4:30** |
| AREA 6 | 115 | 20 | 3.6 | 1.8 | 120 | **4:15** | 9.4 | 57 | **5:15** |
| AREA 7 | 115 | 20 | 9.4 | 1.5 | 369 | **8:25** | 9.2 | 55 | **9:20** |
| AREA 8 | 115 | 20 | 13.7 | 2.0 | 408 | **9:05** | 12.4 | 74 | **10:20** |
| **MONROE COUNTY SCHOOLS** | | | | | | | | | |
| AREA 10 | 115 | 20 | 3.4 | 1.6 | 129 | **4:25** | 10.5 | 63 | **5:30** |
| | | | | | **Maximum for EPZ:** | **9:05** | | **Maximum:** | **10:20** |
| | | | | | **Average for EPZ:** | **6:10** | | **Average:** | **7:05** |

## Table 8-4. Transit-Dependent Evacuation Time Estimates – Good Weather

| | | One-Wave | | | | | | Two-Wave | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Route Number** | **Bus Number** | **Mobilization (min)** | **Route Length (miles)** | **Speed (mph)** | **Route Travel Time (min)** | **Pickup Time (min)** | **ETE (hr:min)** | **Distance to R. C. (miles)** | **Travel Time to R. C. (min)** | **Unload (min)** | **Driver Rest (min)** | **Route Travel Time (min)** | **Pickup Time (min)** | **ETE (hr:min)** |
| **33030** | 1-11 | 150 | 14.4 | 8.4 | 103 | 30 | **4:45** | 12.4 | 50 | 5 | 10 | 71 | 30 | **7:35** |
| | 12-22 | 180 | 14.4 | 10.1 | 85 | 30 | **4:55** | 12.4 | 50 | 5 | 10 | 71 | 30 | **7:45** |
| | 22-31 | 210 | 14.4 | 12.7 | 68 | 30 | **5:10** | 12.4 | 50 | 5 | 10 | 71 | 30 | **8:00** |
| **33032** | 1-16 | 150 | 8.9 | 5.7 | 94 | 30 | **4:35** | 12.4 | 50 | 5 | 10 | 94 | 30 | **7:45** |
| | 17-32 | 180 | 8.9 | 5.6 | 96 | 30 | **5:10** | 12.4 | 50 | 5 | 10 | 83 | 30 | **8:10** |
| | 33-51 | 210 | 8.9 | 6.0 | 89 | 30 | **5:30** | 12.4 | 50 | 5 | 10 | 67 | 30 | **8:15** |
| | 52-62 | 240 | 8.9 | 6.7 | 80 | 30 | **5:50** | 12.4 | 50 | 5 | 10 | 55 | 30 | **8:20** |
| **33033** | 1-18 | 150 | 9.6 | 4.2 | 137 | 30 | **5:20** | 12.5 | 50 | 5 | 10 | 75 | 30 | **8:10** |
| | 19-36 | 180 | 9.6 | 4.4 | 132 | 30 | **5:45** | 12.5 | 50 | 5 | 10 | 60 | 30 | **8:20** |
| | 37-54 | 210 | 9.6 | 4.8 | 121 | 30 | **6:05** | 12.5 | 50 | 5 | 10 | 78 | 30 | **9:00** |
| | 55-72 | 240 | 9.6 | 5.3 | 109 | 30 | **6:20** | 12.5 | 50 | 5 | 10 | 73 | 30 | **9:10** |
| **33034** | 1-13 | 150 | 18.8 | 12.1 | 93 | 30 | **4:35** | 12.4 | 50 | 5 | 10 | 175 | 30 | **9:05** |
| | 14-26 | 180 | 18.8 | 15.4 | 73 | 30 | **4:45** | 12.4 | 50 | 5 | 10 | 169 | 30 | **9:10** |
| **33157** | 1-9 | 150 | 3.6 | 5.0 | 42 | 30 | **3:45** | 12.4 | 50 | 5 | 10 | 31 | 30 | **5:55** |
| | 10-17 | 180 | 3.6 | 5.5 | 39 | 30 | **4:10** | 12.4 | 50 | 5 | 10 | 31 | 30 | **6:20** |
| | | | | | | **Maximum for EPZ:** | **6:20** | | | | | | **Maximum:** | **9:10** |
| | | | | | | **Average for EPZ:** | **5:10** | | | | | | **Average:** | **8:05** |

## Table 8-5. Transit-Dependent Evacuation Time Estimates – Rain

| Route Number | Bus Number | One-Wave | | | | | | Two-Wave | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Mobilization (min) | Route Length (miles) | Speed (mph) | Route Travel Time (min) | Pickup Time (min) | ETE (hr:min) | Distance to R. C. (miles) | Travel Time to R. C. (min) | Unload (min) | Driver Rest (min) | Route Travel Time (min) | Pickup Time (min) | ETE (hr:min) |
| **33030** | 1-11 | 160 | 14.4 | 7.7 | 112 | 40 | **5:15** | 12.4 | 74 | 5 | 10 | 67 | 40 | **8:35** |
| | 12-22 | 190 | 14.4 | 8.5 | 102 | 40 | **5:35** | 12.4 | 74 | 5 | 10 | 67 | 40 | **8:55** |
| | 22-31 | 220 | 14.4 | 10.2 | 85 | 40 | **5:45** | 12.4 | 74 | 5 | 10 | 67 | 40 | **9:05** |
| **33032** | 1-16 | 160 | 8.9 | 4.1 | 131 | 40 | **5:35** | 12.4 | 74 | 5 | 10 | 51 | 40 | **8:35** |
| | 17-32 | 190 | 8.9 | 4.3 | 126 | 40 | **6:00** | 12.4 | 74 | 5 | 10 | 51 | 40 | **9:00** |
| | 33-51 | 220 | 8.9 | 4.9 | 109 | 40 | **6:10** | 12.4 | 74 | 5 | 10 | 51 | 40 | **9:10** |
| | 52-62 | 250 | 8.9 | 5.8 | 92 | 40 | **6:25** | 12.4 | 74 | 5 | 10 | 51 | 40 | **9:25** |
| **33033** | 1-18 | 160 | 9.6 | 4.2 | 139 | 40 | **5:40** | 12.5 | 75 | 5 | 10 | 54 | 40 | **8:45** |
| | 19-36 | 190 | 9.6 | 4.1 | 140 | 40 | **6:10** | 12.5 | 75 | 5 | 10 | 52 | 40 | **9:15** |
| | 37-54 | 220 | 9.6 | 4.2 | 139 | 40 | **6:40** | 12.5 | 75 | 5 | 10 | 80 | 40 | **10:10** |
| | 55-72 | 250 | 9.6 | 4.4 | 133 | 40 | **7:05** | 12.5 | 75 | 5 | 10 | 66 | 40 | **10:25** |
| **33034** | 1-13 | 160 | 18.8 | 10.2 | 111 | 40 | **5:15** | 12.4 | 74 | 5 | 10 | 83 | 40 | **8:50** |
| | 14-26 | 190 | 18.8 | 12.2 | 92 | 40 | **5:25** | 12.4 | 74 | 5 | 10 | 81 | 40 | **8:55** |
| **33157** | 1-9 | 160 | 3.6 | 3.9 | 55 | 40 | **4:15** | 12.4 | 74 | 5 | 10 | 33 | 40 | **7:00** |
| | 10-17 | 190 | 3.6 | 4.2 | 51 | 40 | **4:45** | 12.4 | 74 | 5 | 10 | 33 | 40 | **7:30** |
| | | | | | | **Maximum for EPZ:** | **7:05** | | | | | | **Maximum:** | **10:25** |
| | | | | | | **Average for EPZ:** | **5:45** | | | | | | **Average:** | **8:55** |

**Table 8-6. Medical Facility Evacuation Time Estimates – Good Weather**

| Medical Facility | Patient | Mobilization (min) | Loading Rate (min per person) | People | Total Loading Time (min) | Dist. To EPZ Bdry (mi) | Travel Time to EPZ Boundary (min) | ETE (hr:min) |
|---|---|---|---|---|---|---|---|---|
| MIAMI-DADE COUNTY | | | | | | | | |
| AREA 4 | Ambulatory | 90 | 1 | 38 | 30 | 8.7 | 260 | **6:20** |
| | Wheelchair bound | 90 | 5 | 7 | 35 | 8.7 | 259 | **6:25** |
| AREA 5 | Ambulatory | 90 | 1 | 516 | 30 | 4.0 | 69 | **3:10** |
| | Wheelchair bound | 90 | 5 | 71 | 75 | 4.0 | 63 | **3:50** |
| | Bedridden | 90 | 15 | 17 | 15 | 4.0 | 73 | **3:00** |
| AREA 6 | Ambulatory | 90 | 1 | 297 | 30 | 5.5 | 62 | **3:05** |
| | Wheelchair bound | 90 | 5 | 44 | 75 | 5.5 | 61 | **3:50** |
| | Bedridden | 90 | 15 | 6 | 15 | 5.5 | 64 | **2:50** |
| AREA 7 | Ambulatory | 90 | 1 | 147 | 30 | 9.4 | 356 | **8:00** |
| | Wheelchair bound | 90 | 5 | 21 | 75 | 9.4 | 335 | **8:20** |
| | Bedridden | 90 | 15 | 5 | 15 | 9.4 | 360 | **7:45** |
| AREA 8 | Ambulatory | 90 | 1 | 1,023 | 30 | 13.7 | 392 | **8:35** |
| | Wheelchair bound | 90 | 5 | 137 | 75 | 13.7 | 377 | **9:05** |
| | Bedridden | 90 | 15 | 40 | 15 | 13.7 | 403 | **8:30** |
| | | | | | | | **Maximum ETE:** | **9:05** |
| | | | | | | | **Average ETE:** | **5:55** |

## Table 8-7. Medical Facility Evacuation Time Estimates – Rain

| Medical Facility | Patient | Mobilization (min) | Loading Rate (min per person) | People | Total Loading Time (min) | Dist. To EPZ Bdry (mi) | Travel Time to EPZ Boundary (min) | ETE (hr:min) |
|---|---|---|---|---|---|---|---|---|
| MIAMI-DADE COUNTY | | | | | | | | |
| AREA 4 | Ambulatory | 100 | 1 | 38 | 30 | 8.7 | 287 | **7:00** |
| | Wheelchair bound | 100 | 5 | 7 | 35 | 8.7 | 281 | **7:00** |
| AREA 5 | Ambulatory | 100 | 1 | 516 | 30 | 4.0 | 81 | **3:35** |
| | Wheelchair bound | 100 | 5 | 71 | 75 | 4.0 | 68 | **4:05** |
| | Bedridden | 100 | 15 | 17 | 15 | 4.0 | 84 | **3:20** |
| AREA 6 | Ambulatory | 100 | 1 | 297 | 30 | 5.5 | 70 | **3:20** |
| | Wheelchair bound | 100 | 5 | 44 | 75 | 5.5 | 67 | **4:05** |
| | Bedridden | 100 | 15 | 6 | 15 | 5.5 | 67 | **3:05** |
| AREA 7 | Ambulatory | 100 | 1 | 147 | 30 | 9.4 | 369 | **8:20** |
| | Wheelchair bound | 100 | 5 | 21 | 75 | 9.4 | 346 | **8:45** |
| | Bedridden | 100 | 15 | 5 | 15 | 9.4 | 374 | **8:10** |
| AREA 8 | Ambulatory | 100 | 1 | 1,023 | 30 | 13.7 | 415 | **9:05** |
| | Wheelchair bound | 100 | 5 | 137 | 75 | 13.7 | 399 | **9:35** |
| | Bedridden | 100 | 15 | 40 | 15 | 13.7 | 424 | **9:00** |
| | | | | | | | **Maximum ETE:** | **9:35** |
| | | | | | | | **Average ETE:** | **6:20** |

### Table 8-8. Evacuation Time Estimates for Correctional Facilities

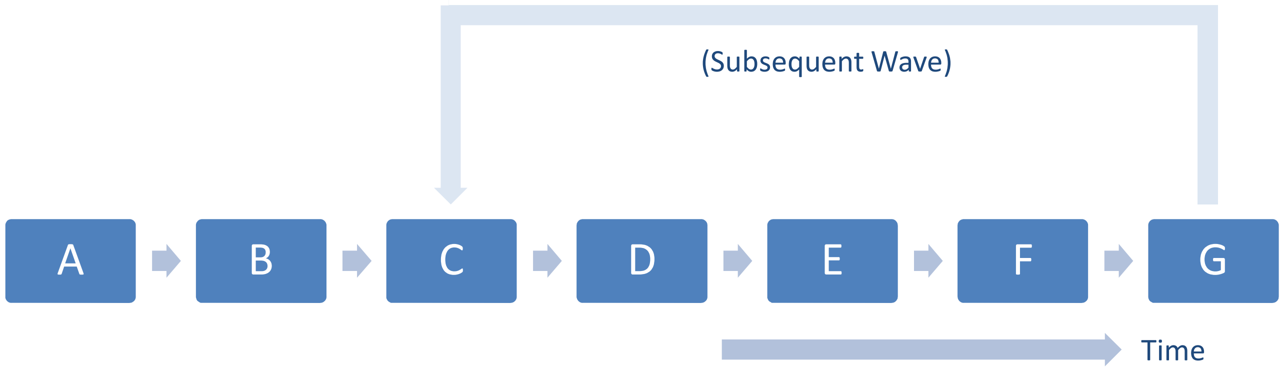
| Vehicle Type | Weather Conditions | Mobilization (min) | Number of Inmates | Number of Vehicles | Total Loading Time (min) | Dist. To EPZ Bdry | Travel Time to EPZ Boundary (min) | ETE (hr:min) |
|---|---|---|---|---|---|---|---|---|
| Miami-Dade Police Department | Good | 90 | 45 | 2 | 30 | 2.8 | 87 | **3:30** |
| | Rain | 100 | | | 40 | 2.8 | 119 | **4:20** |
| Dade Juvenile Residential Facility | Good | 90 | 55 | 2 | 30 | 20.5 | 330 | **7:30** |
| | Rain | 100 | | | 40 | 20.5 | 362 | **8:25** |
| | | | | | | | **Maximum ETE** | **8:25** |
| | | | | | | | **Average ETE** | **6:00** |

### Table 8-9. Evacuation Time Estimates for Access and/or Functional Needs Population

| Vehicle Type | People Requiring Vehicle | Vehicles deployed | Stops | Weather Conditions | Mobiliza-tion Time (min) | Loading Time at 1st Stop (min) | Travel to Subsequent Stops (min) | Total Loading Time at Subsequent Stops (min) | Travel Time to EPZ Boundary (min) | ETE (hr:min) |
|---|---|---|---|---|---|---|---|---|---|---|
| Buses | 19 | 5 | 4 | Good | 150 | 1 | 36 | 3 | 64 | **4:15** |
| | | | | Rain | 160 | | 39 | | 73 | **4:40** |
| Wheelchair Buses | 107 | 25 | 5 | Good | 150 | 5 | 48 | 20 | 61 | **4:45** |
| | | | | Rain | 160 | | 52 | | 67 | **5:05** |
| Ambulances | 142 | 71 | 1 | Good | 150 | 15 | 0 | 0 | 64 | **3:50** |
| | | | | Rain | 160 | | 0 | | 72 | **4:10** |
| | | | | | | | | | **Maximum ETE:** | **5:05** |
| | | | | | | | | | **Average ETE:** | **4:30** |

## Table 8-10. Evacuation Time Estimates for Access and/or Functional Needs Persons – Second Wave

| Vehicle Type | People Requiring Vehicle | Vehicles deployed | Stops | Weather Conditions | One Wave ETE (hr:min) | Unload Passengers(min) | Driver Rest (min) | Travel Time Back to EPZ (min) | Travel to All Stops (min) | Total Loading Time at All Stops (min) | Travel Time to EPZ Boundary (min) | ETE (hr:min) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Buses | 19 | 5 | 4 | Good | 9:55 | 5 | 10 | 19 | 48 | 4 | 20 | **11:45** |
|  |  |  |  | Rain | 11:09 | 5 | 10 | 21 | 52 |  | 25 | **13:10** |
| Wheelchair buses | 107 | 25 | 5 | Good | 11:15 | 67 | 10 | 19 | 60 | 25 | 8 | **14:25** |
|  |  |  |  | Rain | 12:29 | 67 | 10 | 21 | 65 |  | 8 | **15:45** |
| Ambulances | 142 | 71 | 1 | Good | 9:05 | 15 | 10 | 19 | 15 | 15 | 25 | **10:45** |
|  |  |  |  | Rain | 10:39 | 15 | 10 | 21 | 17 |  | 33 | **12:30** |
| **Maximum ETE:** |  |  |  |  |  |  |  |  |  |  |  | **15:45** |
| **Average ETE:** |  |  |  |  |  |  |  |  |  |  |  | **13:05** |



| Event | |
|---|---|
| A | Advisory to Evacuate |
| B | Bus Dispatched from Depot |
| C | Bus Arrives at Facility/Pick-up Route |
| D | Bus Departs for Reception Center/Host School |
| E | Bus Exits Region |
| F | Bus Arrives at Reception Center/Host School |
| G | Bus Available for "Second Wave" Evacuation Service |
| **Activity** | |
| A→B | Driver Mobilization |
| B→C | Travel to Facility or to Pick-up Route |
| C→D | Passengers Board the Bus |
| D→E | Bus Travels Towards Region Boundary |
| E→F | Bus Travels Towards Reception Center/Host School Outside the EPZ |
| F→G | Passengers Leave Bus; Driver Takes a Break |

**Figure 8-1. Chronology of Transit Evacuation Operations**

## 9 TRAFFIC MANAGEMENT STRATEGY

This section discusses the suggested Traffic Management Plan (TMP) that is designed to expedite the movement of evacuating traffic. The resources required to implement this strategy include:

- Personnel with the capabilities of performing the planned control functions of traffic guides (preferably, not necessarily, law enforcement officers).
- Guidance is provided by the Manual on Uniform Traffic Control Devices (MUTCD) published by the Federal Highway Administration (FHWA) of the U.S.D.O.T. All state and most county transportation agencies have access to the MUTCD, which is available on-line: http://mutcd.fhwa.dot.gov which provides access to the official PDF version.
- A written plan that defines all Traffic Control Point (TCP) locations, provides necessary details and is documented in a format that is readily understood by those assigned to perform traffic control.

The functions to be performed in the field are:

1. Facilitate evacuating traffic movements that safely expedite travel out of the EPZ.
2. Discourage traffic movements that move evacuating vehicles in a direction which takes them significantly closer to the power plant, or which interferes with the efficient flow of other evacuees.

The terms "facilitate" and "discourage" are employed rather than "enforce" and "prohibit" to indicate the need for flexibility in performing the traffic control function. There are always legitimate reasons for a driver to prefer a direction other than that indicated.

For example:

- A driver may be traveling home from work or from another location, to join other family members prior to evacuating.
- An evacuating driver may be travelling to pick up a relative, or other evacuees.
- The driver may be an emergency worker en route to perform an important activity.

The implementation of a TMP must also be flexible enough for the application of sound judgment by the traffic guide.

The TMP is the outcome of the following process:

1. The detailed traffic and access control tactics discussed in the Turkey Point Traffic Control Plan, April 2015 (provided by Miami-Dade County) and the Radiological Emergency Preparedness Plan, November 2020 (provided by Monroe County), serve as the basis of the TMP, as per NUREG/CR-7002, Rev. 1.
2. The ETE analysis treated all controlled intersections that are existing TCP locations in the offsite agency plans as being controlled by actuated signals. Appendix K identifies the number of intersections that were modeled as TCPs.
3. Evacuation simulations were run using DYNEV II to predict traffic congestion during evacuation (see Section 7.3 and Figures 7-3 through 7-9). These simulations help to

identify the best routing and critical intersections that experience pronounced congestion during evacuation. Any critical intersections that would benefit from traffic or access control which are not already identified in the existing offsite agency plans are examined. No additional TCPs were identified as part of this study.

4. Prioritization of TCPs:
   a. Application of traffic and access control at some TCPs will have a more pronounced influence on expediting traffic movements than at other TCPs. For example, TCPs controlling traffic originating from areas in close proximity to the power plant could have a more beneficial effect on minimizing potential exposure to radioactivity than those TCPs located far from the power plant. These priorities should be assigned by state/county emergency management representatives and by law enforcement personnel.

Appendix G documents the existing TMP and TCPs, using the process enumerated above. No additional TCPs are recommended as part of this study.

## 9.1 Assumptions

- The ETE calculations documented in Sections 7 and 8 assume that the TMP is implemented during evacuation and the modifications discussed in Appendix G are in place.
- Dynamic Message Signs (DMS) will be strategically positioned outside of the EPZ at logical diversion points to attempt to divert traffic away from the area at risk. The ETE calculations reflect the assumptions that all "external-external" trips are interdicted and diverted after 2 hours have elapsed from the ATE.
- All transit vehicles and other responders entering the EPZ to support the evacuation are assumed to be unhindered by personal manning TCPs.
- Study assumptions 1 through 3 in Section 2.5 discuss TCP operations.

## 9.2 Additional Considerations

The use of Intelligent Transportation Systems (ITS) technologies can reduce the manpower and equipment needs, while still facilitating the evacuation process. DMS can be placed within the EPZ to provide information to travelers regarding traffic conditions, route selection, and reception/care center information. DMS placed outside of the EPZ will warn motorists to avoid using routes that may conflict with the flow of evacuees away from the power plant. Highway Advisory Radio (HAR) can be used to broadcast information to evacuees during egress through their vehicles stereo systems. Automated Travel Information Systems (ATIS) can also be used to provide evacuees with information. Internet websites can provide traffic and evacuation route information before the evacuee begins their trip, while the on-board navigation systems (GPS units) and smartphones can be used to provide information during the evacuation trip.

These are only some examples of how ITS technologies can benefit the evacuation process. Consideration should be given that ITS technologies be used to facilitate the evacuation process, and any additional signage placed should consider evacuation needs.

# 10 EVACUATION ROUTES AND RECEPTION CENTERS

## 10.1 Evacuation Routes

Evacuation routes are comprised of two distinct components:

- Routing from an Area being evacuated to the boundary of the Evacuation Region and thence out of the EPZ.
- Routing of transit-dependent evacuees (schools, medical facilities, correctional facilities, and residents who do not own or have access to a private vehicle) from the EPZ boundary to host schools and/or reception centers.

Evacuees will select routes within the EPZ in such a way as to minimize their exposure to risk. This expectation is met by the DYNEV II model routing traffic away from the location of the plant to the extent practicable. The DTRAD model satisfies this behavior by routing traffic so as to balance traffic demand relative to the available highway capacity to the extent possible. See Appendices B through D for further discussion.

The major evacuation routes for the EPZ are presented in Figure 10-1. These routes will be used by the general population evacuating in private vehicles, and by the transit-dependent population. Transit-dependent evacuees will be routed to reception centers. General population may evacuate to either a reception center or some alternate destination (e.g., lodging facilities, relative's home, campgrounds) outside the EPZ.

The routing of transit-dependent evacuees from the EPZ boundary to reception centers is designed to minimize the amount of travel outside the EPZ from the points where these routes cross the EPZ boundary. The 5 bus routes shown graphically in Figure 10-2 and described in Table 10-1 were designed for this study to service the major evacuation routes through each zip code (public information lists bus pickup points by zip code), in order to compute representative ETE for the transit dependent population within the EPZ. It is assumed that residents will walk to bus stops along these routes and that they can arrive at the stops within the 150-minute bus mobilization time (good weather).

Schools and medical facilities were routed along the most likely path from the Area they located in to the EPZ boundary, traveling toward the appropriate host school.

The specified bus routes for all the transit-dependent population and special facilities are documented in Table 10-2 (refer to the maps of the link-node analysis network in Appendix K for node locations).

## 10.2 Reception Centers

According to the current public information issued to EPZ residents, the Miami-Dade County Emergency Reception Center is located at Tamiami Park and the Monroe County Emergency Reception Center and Shelter is located at the Key Largo School. Figure 10-3 maps the reception centers and host schools for evacuees. Transit-dependent evacuees are assumed to be transported to the nearest reception center for each county. Table 10-3 presents a list of the host schools and reception centers for each school in the EPZ. It is assumed that all school evacuees will be taken to the appropriate host schools or reception center and will be subsequently picked up by parents or guardians.

**Table 10-1. Summary of Transit-Dependent Bus Routes**

| Route | No. of Buses | Route Description | Length (mi.) |
|---|---|---|---|
| Transit Dependent Representative Route – Zip Code 33030 | 30 | Harris Field, Cocowalk, Boardwalk, Aquarius, Laua Saunders Elementary, Police Athletic League Gym, Homestead Trailer Park, and Homestead Senior Center | 14.4 |
| Transit Dependent Representative Route – Zip Code 33032 | 61 | Naranja Elementary, Princetonian Moblie Home Park, and Hud-Pine Island | 8.9 |
| Transit Dependent Representative Route – Zip Code 33033 | 72 | Harris Field, South Dade Camp, Pine Island MHP, and Palm Gardens MHP | 9.6 |
| Transit Dependent Representative Route – Zip Code 33034 | 26 | Florida City Hall, Goldcoaster MHP, Andrew Center, Gateway West MHP, Gateway Estates MHP, Southern Comfort Trailer Park, Florida City Camp Site and RV Park | 18.8 |
| Transit Dependent Representative Route – Zip Code 33157 | 17 | Southland Mall, Cutler Ridge Park, and East Ridge Retirement Village | 3.6 |
| Total: | 206 | | |

**Table 10-2. Bus Route Descriptions**

| Bus Route Number | Bus Route Description | Nodes Traversed from Route Start to EPZ Boundary |
|---|---|---|
| *Special Facility (School, Medical Facility, Correctional Facility) Routes* | | |
| 1 | Area 4 Schools and Medical Facilities | 805, 222, 686, 687, 334, 203, 190, 196, 999, 654, 197, 193, 656, 198, 200, 632, 205, 206, 207, 208, 493, 506, 494, 215, 12, 268, 660, 111, 105, 109 |
| 2 | Area 5 Schools and Medical Facilities | 120, 119, 269, 637, 16, 267, 19, 15, 496, 495, 215, 415, 216, 639, 101, 100 |
| 3 | Area 6 Schools and Miami-Dade Police Department Temporary Holding Facility | 683, 631, 255, 211, 214, 490, 489, 208, 493, 506, 494, 215, 12, 268, 660, 111, 105, 109 |
| 4 | Area 6 Medical Facilities | 685, 221, 36, 32, 885, 31, 29, 25, 24, 18, 219, 11, 9 |
| 5 | Area 7 Schools and Medical Facilities | 347, 183, 337, 184, 806, 187, 202, 189, 192, 655, 197, 193, 656, 198, 200, 632, 205, 206, 207, 208, 493, 506, 494, 215, 12, 268, 660, 111, 105, 109 |
| 6 | Area 8 Schools and Medical Facilities | 674, 139, 158, 66, 67, 673, 155, 167, 166, 172, 839, 170, 174, 176, 178, 840, 179, 337, 184, 806, 187, 202, 189, 192, 655, 197, 193, 656, 198, 200, 632, 205, 206, 207, 208, 493, 506, 494, 215, 12, 268, 660, 111, 105, 109 |
| 7 | Area 10 Schools | 1030, 1022, 1014, 1013, 247, 2, 243 |
| 8 | Dade Juvenile Residential Facility | 237, 239, 236, 235, 234, 233, 232, 228, 227, 231, 230, 226, 225, 229, 224, 73, 604, 72, 70, 69, 218, 158, 66, 67, 673, 155, 167, 166, 172, 839, 170, 174, 176, 178, 840, 179, 337, 184, 806, 187, 202, 189, 192, 655, 197, 193, 656, 198, 200, 632, 205, 206, 207, 208, 493, 506, 494, 215, 12, 268, 660, 111, 105, 109, 122, 661, 123, 483, 124, 485, 450, 663, 452, 747, 775, 777, 781, 453 |
| *Transit Dependent Bus Routes* | | |
| 9 | Zip Code 33032 Route | 222, 686, 687, 334, 203, 190, 189, 409, 410, 712, 411, 657, 420, 332, 201, 633, 635, 412, 413, 414, 415, 416, 417, 418 |
| 10 | Zip Code 33030 Route | 155, 138, 509, 152, 318, 317, 163, 710, 161, 511, 711, 513, 743, 512, 514, 515, 516, 517, 518, 409, 410, 712, 411, 657, 420, 332, 201, 633, 635, 412, 413, 414, 415, 416, 417, 418 |
| 11 | Zip Code 33034 Route | 601, 304, 303, 302, 297, 296, 295, 153, 519, 509, 510, 137, 511, 711, 513, 743, 512, 514, 515, 516, 517, 518, 409, 410, 712, 411, 657, 420, 332, 201, 633, 635, 412, 413, 414, 415, 416, 417, 418 |
| 12 | Zip Code 33033 Route | 183, 347, 350, 364, 48, 49, 51, 52, 883, 47, 46, 44, 41, 40, 39, 34, 33, 884, 32, 885, 31, 29, 25, 24, 18, 219, 11 |
| 13 | Zip Code 33157 Route | 904, 1066, 382, 274, 837, 834, 836, 120, 119, 269, 637, 16, 267, 19, 15, 496, 495, 215, 415, 416, 417, 418 |

**Table 10-3. Host Schools/ Reception Centers**

| School and Colleges | Host School/Reception Center |
|---|---|
| Homestead Middle | Arvida Middle |
| West Homestead Elementary[1] | Claude Elementary |
| Corporate Academy South | Colonial Drive Elementary |
| Goulds Elementary School | |
| Air Base K-8 Center for International Education | Coral Reef Elementary |
| Coconut Palm K-8 Academy | Coral Reef Senior |
| Gulfstream Elementary | |
| Mandarin Lakes K-8 Academy | |
| Medical Academy For Science and Technology | |
| Bel-Aire Elementary | Devon Aire K-8 Center |
| William A. Chapman Elementary | Ethel F. Beckford Elementary |
| Pine Villa Elementary | Frank C. Martin Elementary |
| Homestead Senior High School | Hammocks Middle |
| Arthur & Polly Mays Conservatory of the Arts | Howard D. McMillan Middle School |
| Whispering Pines Elementary | Howard Drive Elementary |
| South Dade Skill Center | Kendale Lakes Elementary |
| Academy at Ocean Reef | Key Largo Elementary |
| Reef Club Kids | |
| Redland Center | Miami Heights Elementary |
| South Dade Center | |
| South Dade Senior High School | Miami Killian Senior |
| South Dade Technical College | |
| Campbell Drive K-8 Center | Palmetto Elementary |
| Florida City Elementary | |
| Cutler Bay Senior High School | Palmetto Middle |
| Migrant Education Program | |
| Center For International Education | Palmetto Senior |
| Avocado Elementary | Pine Lake Elementary |
| Neva King Cooper Educational Center | |
| Caribbean K-8 Center | Pinecrest Elementary |
| Dr. E.L. Whigham Elementary | |
| Laura C. Saunders Elementary | Porter, G.L. Elementary |
| Cutler Bay Middle School | R. Morgan Voc. Tech. |
| Cutler Ridge Elementary | |
| Gateway Environmental K-8 | Richmond Heights Middle |
| Irving & Beatrice Peskoe K-8 Center | |
| Miami MacArthur South Senior High | |
| Leisure City K-8 Center | So. M. Heights Elementary |

| School and Colleges | Host School/Reception Center |
|---|---|
| Redland Elementary[1] | South Miami K-8 Center |
| Redland Middle[1] | |
| AcadeMir Charter School of Math & Science | Tamiami Park |
| Advanced Achievers Academy | |
| Advantage Academy of Math and Science at Summerville | |
| Avant Schools of Excellence | |
| Barrington Academy | |
| Colonial Christian School | |
| Coral Reef Montessori Academy | |
| Cutler Ridge Christian Academy | |
| Discovery Montessori Academy | |
| Ebenezer Christian School | |
| Everglades Preparatory Academy | |
| First United Methodist Christian School | |
| Golden Horizon Academy | |
| Hope Academy | |
| Keys Gate Charter School | |
| Lincoln Marti School | |
| Lincoln-Marti Charter Schools International Campus | |
| Mater Academy Bay | |
| Mavericks High of South Miami Dade County | |
| Miami Community Charter School | |
| Miami Dade College - Homestead Campus | |
| Our Lady of the Holy Rosary | |
| Palm Glades Preparatory High School | |
| Promised Land Academy and Therapy | |
| Redland Christian Academy[1] | |
| Saint John's Episcopal School | |
| Shepherd of God Christian Academy | |
| SIA Tech (Homestead Job Corps Center) | |
| Somerset Academy at Silver Palms - Elementary | |
| Somerset Academy at Silver Palms - High School | |
| Somerset Academy Charter Middle School at Country Palms | |
| Somerset Academy Silver Palms at Princeton | |
| Somerset Academy South Homestead | |
| Somerset Arts Academy | |

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[1] Redland Middle, Redland Christian Academy, Redland Elementary, and West Homestead Elementary are located in the Shadow Region but near the EPZ boundary. The public information indicates that students at these schools will be relocated to designated host facilities in the event of an emergency at the PTN.

| School and Colleges | Host School/Reception Center |
|---|---|
| South Point Academy | Tamiami Park |
| The Charter School at Waterstone | |
| The Thinking Child Academy | |
| Villa Preparatory Academy | |
| Redondo Elementary School | Winston Park Elementary |

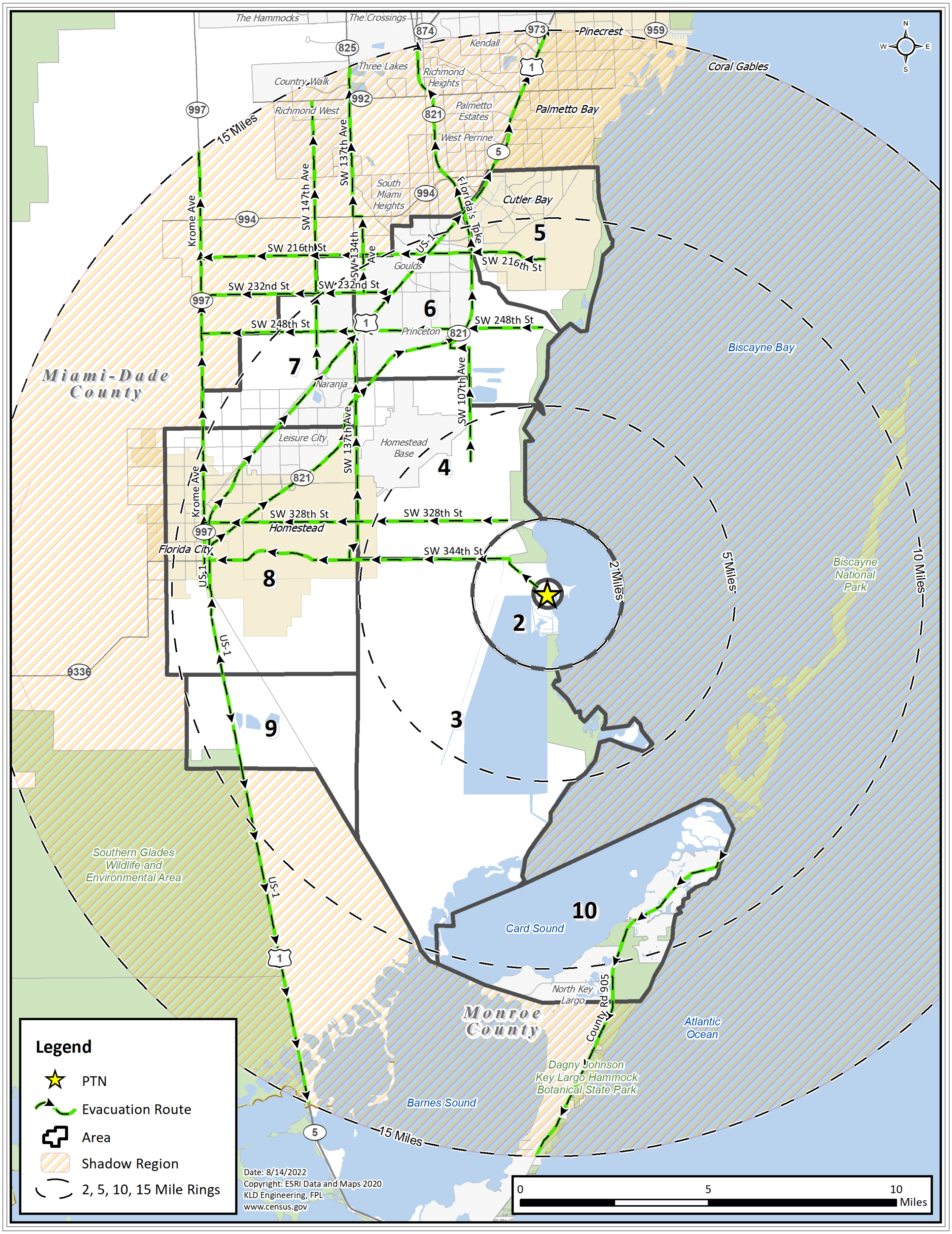
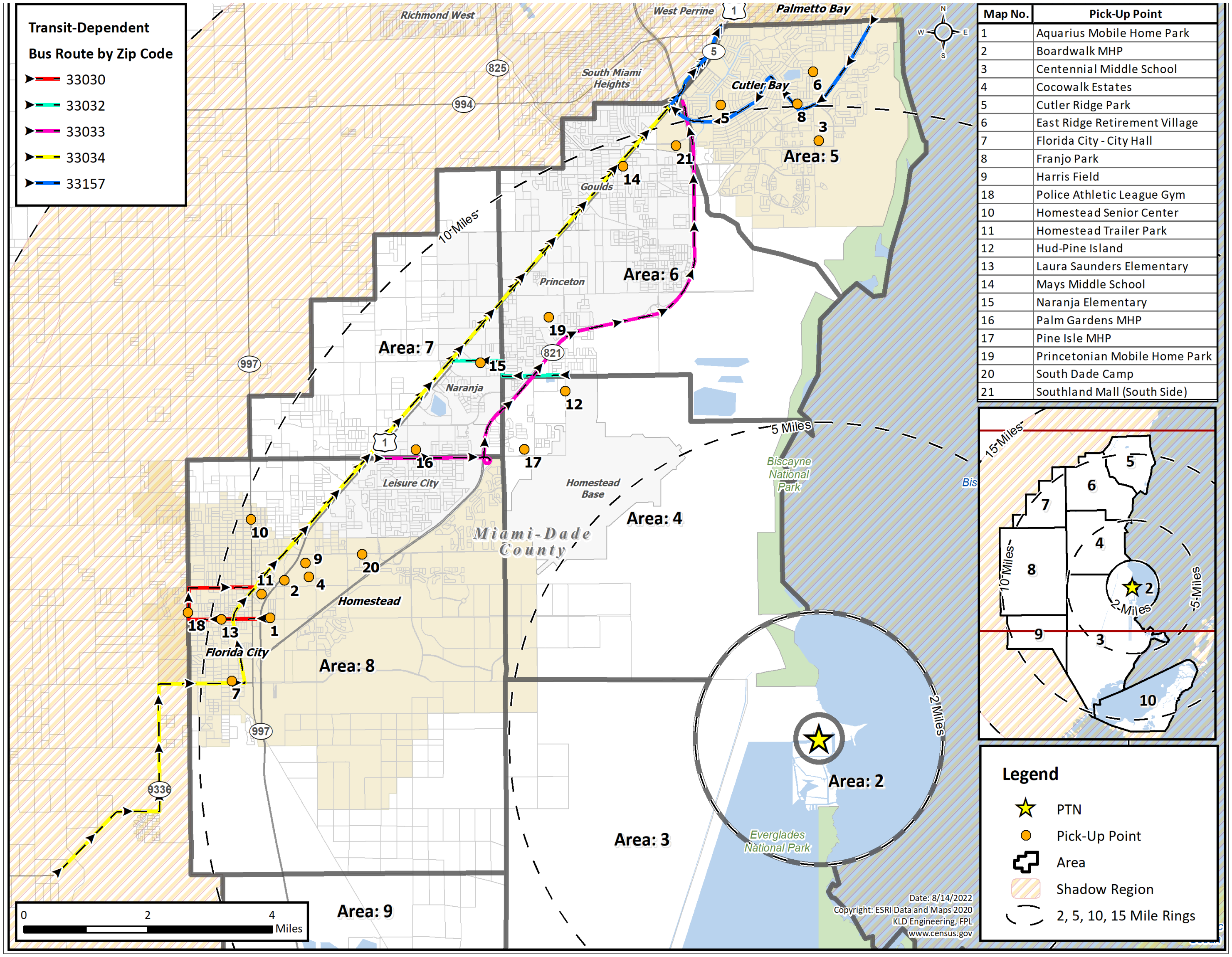
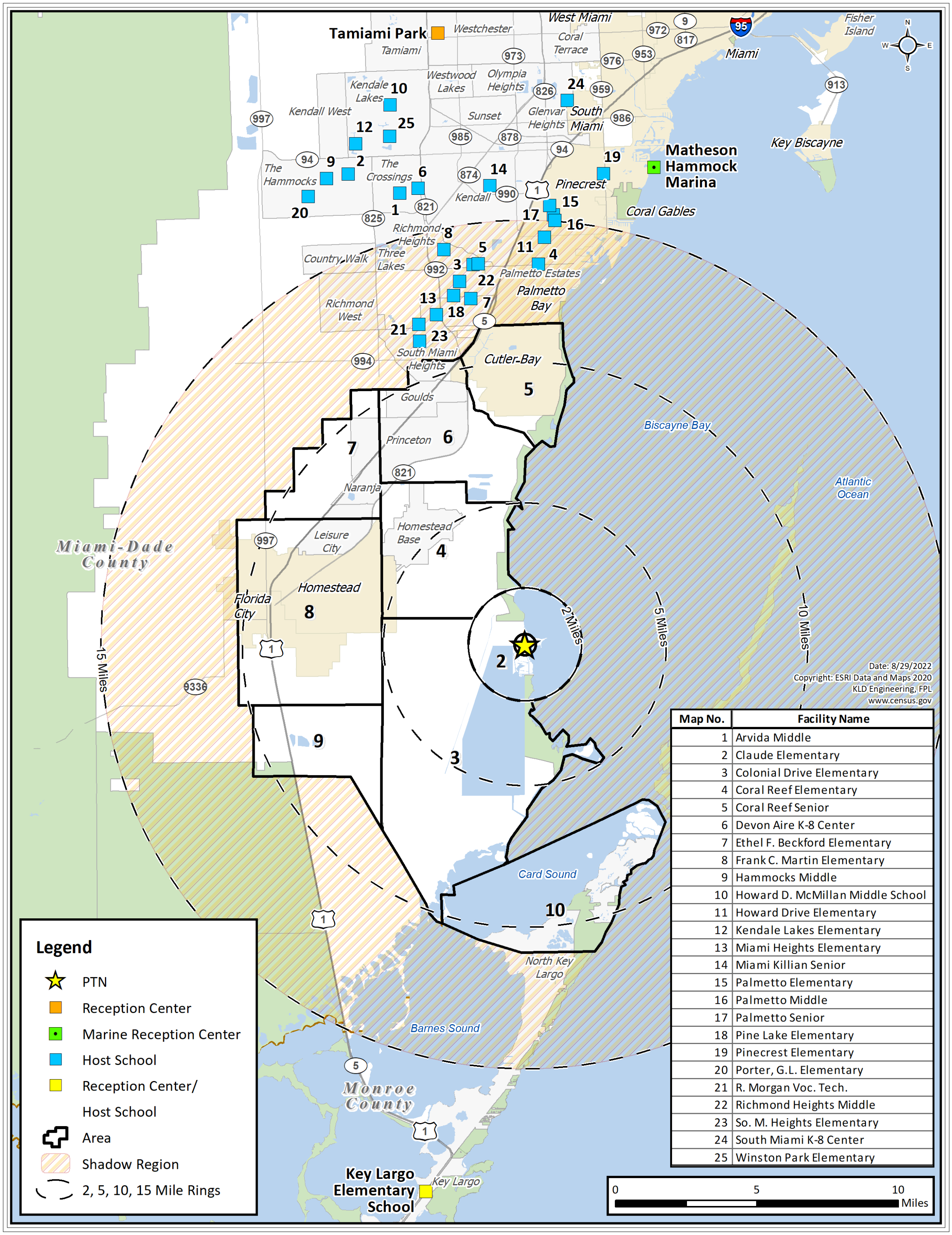


**Figure 10-1. Major Evacuation Routes within the PTN EPZ**



| Map No. | Pick-Up Point |
|---|---|
| 1 | Aquarius Mobile Home Park |
| 2 | Boardwalk MHP |
| 3 | Centennial Middle School |
| 4 | Cocowalk Estates |
| 5 | Cutler Ridge Park |
| 6 | East Ridge Retirement Village |
| 7 | Florida City - City Hall |
| 8 | Franjo Park |
| 9 | Harris Field |
| 18 | Police Athletic League Gym |
| 10 | Homestead Senior Center |
| 11 | Homestead Trailer Park |
| 12 | Hud-Pine Island |
| 13 | Laura Saunders Elementary |
| 14 | Mays Middle School |
| 15 | Naranja Elementary |
| 16 | Palm Gardens MHP |
| 17 | Pine Isle MHP |
| 19 | Princetonian Mobile Home Park |
| 20 | South Dade Camp |
| 21 | Southland Mall (South Side) |

**Figure 10-2. Transit-Dependent Bus Routes**



| Map No. | Facility Name |
|---|---|
| 1 | Arvida Middle |
| 2 | Claude Elementary |
| 3 | Colonial Drive Elementary |
| 4 | Coral Reef Elementary |
| 5 | Coral Reef Senior |
| 6 | Devon Aire K-8 Center |
| 7 | Ethel F. Beckford Elementary |
| 8 | Frank C. Martin Elementary |
| 9 | Hammocks Middle |
| 10 | Howard D. McMillan Middle School |
| 11 | Howard Drive Elementary |
| 12 | Kendale Lakes Elementary |
| 13 | Miami Heights Elementary |
| 14 | Miami Killian Senior |
| 15 | Palmetto Elementary |
| 16 | Palmetto Middle |
| 17 | Palmetto Senior |
| 18 | Pine Lake Elementary |
| 19 | Pinecrest Elementary |
| 20 | Porter, G.L. Elementary |
| 21 | R. Morgan Voc. Tech. |
| 22 | Richmond Heights Middle |
| 23 | So. M. Heights Elementary |
| 24 | South Miami K-8 Center |
| 25 | Winston Park Elementary |

**Figure 10-3. PTN Reception Centers and Host Schools**

# APPENDIX A

## Glossary of Traffic Engineering Terms

# A. GLOSSARY OF TRAFFIC ENGINEERING TERMS

**Table A-1. Glossary of Traffic Engineering Terms**

| Term | Definition |
|---|---|
| Analysis Network | A graphical representation of the geometric topology of a physical roadway system, which is comprised of directional links and nodes. |
| Link | A network link represents a specific, one-directional section of roadway. A link has both physical (length, number of lanes, topology, etc.) and operational (turn movement percentages, service rate, free-flow speed) characteristics. |
| Measures of Effectiveness | Statistics describing traffic operations on a roadway network. |
| Node | A network node generally represents an intersection of network links. A node has control characteristics, i.e., the allocation of service time to each approach link. |
| Origin | A location attached to a network link, within the EPZ or Shadow Region, where trips are generated at a specified rate in vehicles per hour (vph). These trips enter the roadway system to travel to their respective destinations. |
| Prevailing Roadway and Traffic Conditions | Relates to the physical features of the roadway, the nature (e.g., composition) of traffic on the roadway and the ambient conditions (weather, visibility, pavement conditions, etc.). |
| Service Rate | Maximum rate at which vehicles, executing a specific turn maneuver, can be discharged from a section of roadway at the prevailing conditions, expressed in vehicles per second (vps) or vph. |
| Service Volume | Maximum number of vehicles which can pass over a section of roadway in one direction during a specified time period with operating conditions at a specified Level of Service (The Service Volume at the upper bound of Level of Service, E, equals Capacity). Service Volume is usually expressed as vph. |
| Signal Cycle Length | The total elapsed time to display all signal indications, in sequence. The cycle length is expressed in seconds. |
| Signal Interval | A single combination of signal indications. The interval duration is expressed in seconds. A signal phase is comprised of a sequence of signal intervals, usually green, yellow, red. |

| Term | Definition |
|---|---|
| Signal Phase | A set of signal indications (and intervals) which services a particular combination of traffic movements on selected approaches to the intersection. The phase duration is expressed in seconds. |
| Traffic (Trip) Assignment | A process of assigning traffic to paths of travel in such a way as to satisfy all trip objectives (i.e., the desire of each vehicle to travel from a specified origin in the network to a specified destination) and to optimize some stated objective or combination of objectives. In general, the objective is stated in terms of minimizing a generalized "cost". For example, "cost" may be expressed in terms of travel time. |
| Traffic Density | The number of vehicles that occupy one lane of a roadway section of specified length at a point in time, expressed as vehicles per mile (vpm). |
| Traffic (Trip) Distribution | A process for determining the destinations of all traffic generated at the origins. The result often takes the form of a Trip Table, which is a matrix of origin-destination traffic volumes. |
| Traffic Simulation | A computer model designed to replicate the real-world operation of vehicles on a roadway network, so as to provide statistics describing traffic performance. These statistics are called Measures of Effectiveness. |
| Traffic Volume | The number of vehicles that pass over a section of roadway in one direction, expressed in vph. Where applicable, traffic volume may be stratified by turn movement. |
| Travel Mode | Distinguishes between private auto, bus, rail, pedestrian and air travel modes. |
| Trip Table or Origin-Destination Matrix | A rectangular matrix or table, whose entries contain the number of trips generated at each specified origin, during a specified time period, that are attracted to (and travel toward) each of its specified destinations. These values are expressed in vph or in vehicles. |
| Turning Capacity | The capacity associated with that component of the traffic stream which executes a specified turn maneuver from an approach at an intersection. |

# APPENDIX B

## DTRAD: Dynamic Traffic Assignment and Distribution Model

# B. DYNAMIC TRAFFIC ASSIGNMENT AND DISTRIBUTION MODEL

This appendix describes the integrated dynamic trip assignment and distribution model named DTRAD (Dynamic TRaffic Assignment and Distribution) that is expressly designed for use in analyzing evacuation scenarios. DTRAD employs logit-based path-choice principles and is one of the models of the DYNEV II System. The DTRAD module implements path-based *Dynamic Traffic Assignment* (DTA) so that time dependent Origin-Destination (O-D) trips are "assigned" to routes over the network based on prevailing traffic conditions.

To apply the DYNEV II System, the analyst must specify the highway network, link capacity information, the time-varying volume of traffic generated at all origin centroids and, optionally, a set of accessible candidate destination nodes on the periphery of the Emergency Planning Zone (EPZ) for selected origins. DTRAD calculates the optimal dynamic trip distribution (i.e., trip destinations) and the optimal dynamic trip assignment (i.e., trip routing) of the traffic generated at each origin node traveling to its set of candidate destination nodes, so as to minimize evacuee travel "cost."

## B.1 Overview of Integrated Distribution and Assignment Model

The underlying premise is that the selection of destinations and routes is intrinsically coupled in an evacuation scenario. That is, people in vehicles seek to travel out of an area of potential risk as rapidly as possible by selecting the "best" routes. The model is designed to identify these "best" routes in a manner that realistically distributes vehicles from origins to destinations and routes them over the highway network, in a consistent and optimal manner, reflecting evacuee behavior.

For each origin, a set of "candidate destination nodes" is selected by the software logic and by the analyst to reflect the desire by evacuees to travel away from the power plant and to access major highways. The specific destination nodes within this set that are selected by travelers and the selection of the connecting paths of travel, are both determined by DTRAD. This determination is made by a logit-based path choice model in DTRAD, so as to minimize the trip "cost", as discussed later.

The traffic loading on the network and the consequent operational traffic environment of the network (density, speed, throughput on each link) vary over time as the evacuation takes place. The DTRAD model, which is interfaced with the DYNEV simulation model, executes a succession of "sessions" wherein it computes the optimal routing and selection of destination nodes for the conditions that exist at that time.

## B.2 Interfacing the DYNEV Simulation Model with DTRAD

The DYNEV II system reflects NRC guidance that evacuees will seek to travel in a general direction away from the location of the hazardous event. An algorithm was developed to support the DTRAD model in dynamically varying the Trip Table (O-D matrix) over time from one DTRAD session to the next. Another algorithm executes a “mapping” from the specified “geometric” network (link-node analysis network) that represents the physical highway system, to a “path” network that represents the vehicle [turn] movements. DTRAD computations are performed on the “path” network: DYNEV simulation model, on the “geometric” network.

### B.2.1 DTRAD Description

DTRAD is the DTA module for the DYNEV II System.

When the road network under study is large, multiple routing options are usually available between trip origins and destinations. The problem of loading traffic demands and propagating them over the network links is called Network Loading and is addressed by DYNEV II using macroscopic traffic simulation modeling. Traffic assignment deals with computing the distribution of the traffic over the road network for given O-D demands and is a model of the route choice of the drivers. Travel demand changes significantly over time, and the road network may have time dependent characteristics, e.g., time-varying signal timing or reduced road capacity because of lane closure, or traffic congestion. To consider these time dependencies, DTA procedures are required.

The DTRAD DTA module represents the dynamic route choice behavior of drivers, using the specification of dynamic origin-destination matrices as flow input. Drivers choose their routes through the network based on the travel cost they experience (as determined by the simulation model). This allows traffic to be distributed over the network according to the time-dependent conditions. The modeling principles of DTRAD include:

- It is assumed that drivers not only select the best route (i.e., lowest cost path) but some also select less attractive routes. The algorithm implemented by DTRAD archives several “efficient” routes for each O-D pair from which the drivers choose.

- The choice of one route out of a set of possible routes is an outcome of “discrete choice modeling”. Given a set of routes and their generalized costs, the percentages of drivers that choose each route is computed. The most prevalent model for discrete choice modeling is the logit model. DTRAD uses a variant of Path-Size-Logit model (PSL). PSL overcomes the drawback of the traditional multinomial logit model by incorporating an additional deterministic path size correction term to address path overlapping in the random utility expression.

- DTRAD executes the traffic assignment (TA) algorithm on an abstract network representation called "the path network" which is built from the actual physical link-node analysis network. This execution continues until a stable situation is reached: the volumes and travel times on the edges of the path network do not change significantly from one iteration to the next. The criteria for this convergence are defined by the user.
- Travel "cost" plays a crucial role in route choice. In DTRAD, path cost is a linear summation of the generalized cost of each link that comprises the path. The generalized cost for a link, a, is expressed as

  $$c_a = \alpha t_a + \beta l_a + \gamma s_{a,}$$

  where $c_a$ is the generalized cost for link $a$ and $\alpha, \beta$, and $\gamma$ are cost coefficients for link travel time, distance, and supplemental cost, respectively. Distance and supplemental costs are defined as invariant properties of the network model, while travel time is a dynamic property dictated by prevailing traffic conditions. The DYNEV simulation model computes travel times on all edges in the network and DTRAD uses that information to constantly update the costs of paths. The route choice decision model in the next simulation iteration uses these updated values to adjust the route choice behavior. This way, traffic demands are dynamically re-assigned based on time dependent conditions. The interaction between the DTRAD TA and DYNEV II simulation models is depicted in Figure B-1. Each round of interaction is called a Traffic Assignment Session (TA session). A TA session is composed of multiple iterations, marked as loop B in the figure.
- The supplemental cost is based on the "survival distribution" (a variation of the exponential distribution). The Inverse Survival Function is a "cost" term in DTRAD to represent the potential risk of travel toward the plant:

  $s_a = - \beta \ln (p), 0 \leq p \leq l ; \beta > 0$

  $p = \frac{d_n}{d_0}$

  $d_n$ = Distance of node, n, from the plant
  $d_0$ =Distance from the plant where there is zero risk
  β = Scaling factor

  The value of $d_o$ = 11.4 miles, the outer distance of the EPZ. Note that the supplemental cost, $s_{a,}$ of link, a, is (high, low), if its downstream node, n, is (near, far from) the power plant.

### B.2.2 Network Equilibrium

In 1952, John Wardrop wrote:

> *Under equilibrium conditions traffic arranges itself in congested networks in such a way that no individual trip-maker can reduce his path costs by switching routes.*

The above statement describes the “User Equilibrium” definition, also called the “Selfish Driver Equilibrium”. It is a hypothesis that represents a [hopeful] condition that evolves over time as drivers search out alternative routes to identify those routes that minimize their respective “costs”. It has been found that this “equilibrium” objective to minimize costs is largely realized by most drivers who routinely take the same trip over the same network at the same time (i.e., commuters). Effectively, such drivers “learn” which routes are best for them over time. Thus, the traffic environment “settles down” to a near-equilibrium state.

Clearly, since an emergency evacuation is a sudden, unique event, it does not constitute a long-term learning experience which can achieve an equilibrium state. Consequently, DTRAD was not designed as an equilibrium solution, but to represent drivers in a new and unfamiliar situation, who respond in a flexible manner to real-time information (either broadcast or observed) in such a way as to minimize their respective costs of travel.

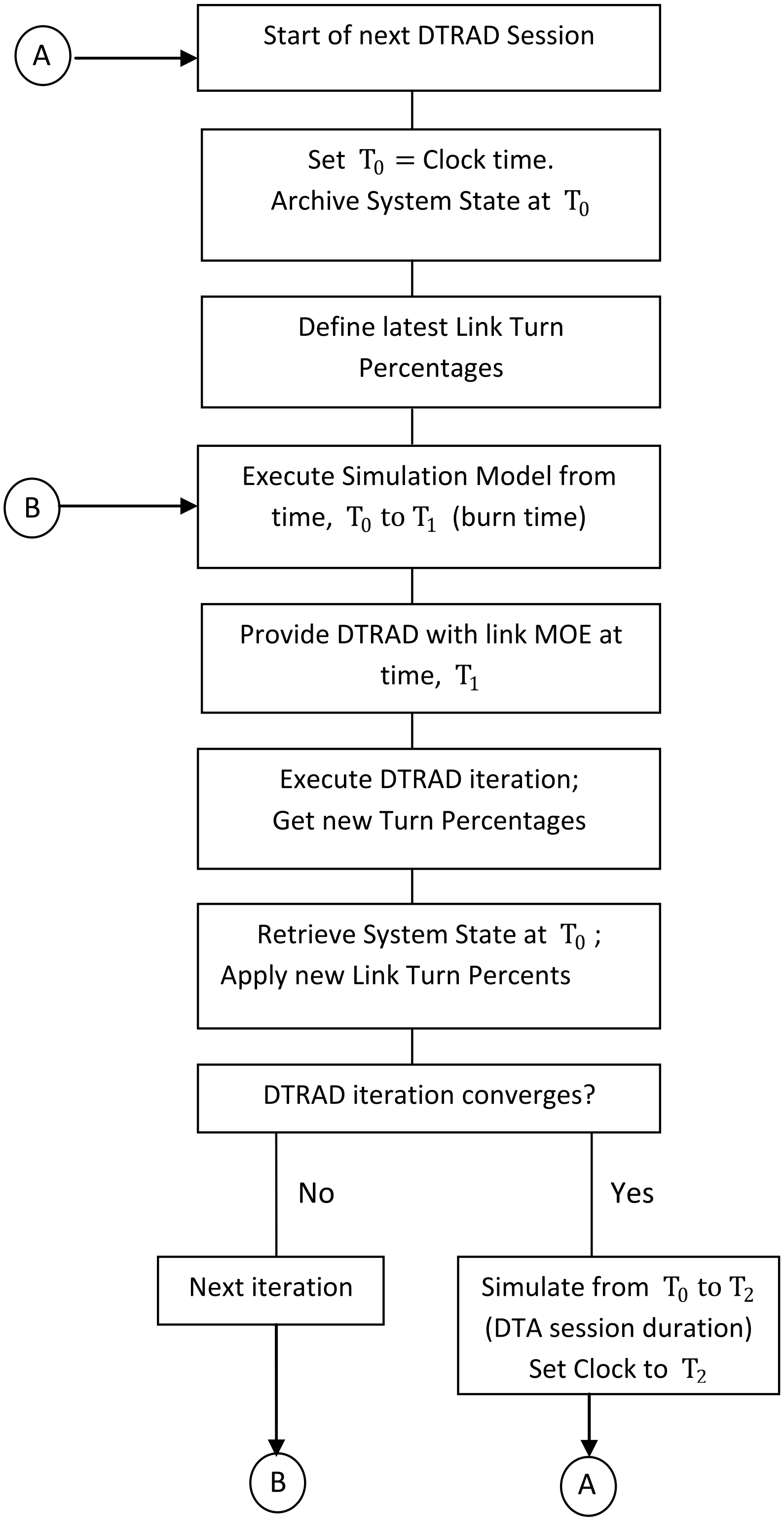


**Figure B-1. Flow Diagram of Simulation-DTRAD Interface**

# APPENDIX C

## DYNEV Traffic Simulation Model

# C. DYNEV TRAFFIC SIMULATION MODEL

This appendix describes the DYNEV traffic simulation model. The DYNEV traffic simulation model is a *macroscopic* model that describes the operations of traffic flow in terms of aggregate variables: vehicles, flow rate, mean speed, volume, density, queue length, *on each link*, for each turn movement, during each Time Interval (simulation time step). The model generates trips from "sources" and from Entry Links and introduces them onto the analysis network at rates specified by the analyst based on the mobilization time distributions. The model simulates the movements of all vehicles on all network links over time until the network is empty. At intervals, the model outputs Measures of Effectiveness (MOE) such as those listed in Table C-1.

Model Features Include:

- Explicit consideration is taken of the variation in density over the time step; an iterative procedure is employed to calculate an average density over the simulation time step for the purpose of computing a mean speed for moving vehicles.
- Multiple turn movements can be serviced on one link; a separate algorithm is used to estimate the number of (fractional) lanes assigned to the vehicles performing each turn movement, based, in part, on the turn percentages provided by the Dynamic TRaffic Assignment and Distribution (DTRAD) model.
- At any point in time, traffic flow on a link is subdivided into two classifications: queued and moving vehicles. The number of vehicles in each classification is computed. Vehicle spillback, stratified by turn movement for each network link, is explicitly considered and quantified. The propagation of stopping waves from link to link is computed within each time step of the simulation. There is no "vertical stacking" of queues on a link.
- Any link can accommodate "source flow" from zones via side streets and parking facilities that are not explicitly represented. This flow represents the evacuating trips that are generated at the source.
- The relation between the number of vehicles occupying the link and its storage capacity is monitored every time step for every link and for every turn movement. If the available storage capacity on a link is exceeded by the demand for service, then the simulator applies a "metering" rate to the entering traffic from both the upstream feeders and source node to ensure that the available storage capacity is not exceeded.
- A "path network" that represents the specified traffic movements from each network link is constructed by the model; this path network is utilized by the DTRAD model.
- A two-way interface with DTRAD: (1) provides link travel times; (2) receives data that translates into link turn percentages.
- Provides MOE to animation software, Evacuation Animator (EVAN).
- Calculates Evacuation Time Estimates (ETE) statistics.

All traffic simulation models are data-intensive. Table C-2 outlines the necessary input data elements.

To provide an efficient framework for defining these specifications, the physical highway environment is represented as a network. The unidirectional links of the network represent roadway sections: rural, multi-lane, urban streets or freeways. The nodes of the network generally represent intersections or points along a section where a geometric property changes (e.g., a lane drop, change in grade or free flow speed).

Figure C-1 is an example of a small network representation. The freeway is defined by the sequence of links, (20,21), (21,22), and (22,23). Links (8001, 19) and (3, 8011) are Entry and Exit links, respectively. An arterial extends from node 3 to node 19 and is partially subsumed within a grid network. Note that links (21,22) and (17,19) are grade-separated.

## C.1 Methodology

### C.1.1 The Fundamental Diagram

It is necessary to define the fundamental diagram describing flow-density and speed-density relationships. Rather than "settling for" a triangular representation, a more realistic representation that includes a "capacity drop", (I-R)$Q_{max,}$ at the critical density when flow conditions enter the forced flow regime, is developed and calibrated for each link. This representation, shown in Figure C-2, asserts a constant free speed up to a density, $k_f$, and then a linear reduction in speed in the range, $k_f \leq k \leq k_c = 45$ vpm, the density at capacity. In the flow-density plane, a quadratic relationship is prescribed in the range, $k_c < k \leq k_s = 95$ vpm which roughly represents the "stop-and-go" condition of severe congestion. The value of flow rate, $Q_s$, corresponding to $k_s$, is approximated at $0.7\, RQ_{max}$. A linear relationship between $k_s$ and $k_j$ completes the diagram shown in Figure C-2. Table C-3 is a glossary of terms.

The fundamental diagram is applied to moving traffic on every link. The specified calibration values for each link are: (1) Free speed, $v_f$ ; (2) Capacity, $Q_{max}$ ; (3) Critical density, $k_c = 45$ vpm ; (4) Capacity Drop Factor, R = 0.9 ; (5) Jam density, $k_j$. Then, $v_c = \frac{Q_{max}}{k_c}$ , $k_f = k_c - \frac{(V_f - V_c)\, k_c^2}{Q_{max}}$. Setting $\bar{k} = k - k_c$, then $Q = RQ_{max} - \frac{RQ_{max}}{8333}\, \bar{k}^2$ for $0 \leq \bar{k} \leq \bar{k}_s = 50$. It can be shown that $Q = \left(0.98 - 0.0056\, \bar{k}\right) RQ_{max}$ for $\bar{k}_s \leq \bar{k} \leq \bar{k}_j$, where $\bar{k}_s = 50$ and $\bar{k}_j = 175$.

### C.1.2 The Simulation Model

The simulation model solves a sequence of "unit problems". Each unit problem computes the movement of traffic on a link, for each specified turn movement, over a specified time interval (TI) which serves as the simulation time step for all links. Figure C-3 is a representation of the unit problem in the time-distance plane. Table C-3 is a glossary of terms that are referenced in the following description of the unit problem procedure.

The formulation and the associated logic presented below are designed to solve the unit problem for each sweep over the network (discussed below), for each turn movement serviced on each link that comprises the evacuation network, and for each TI over the duration of the evacuation.

```
Given = $Q_b, M_b, L, TI, E_0, LN, {}^{G}/_{C}, h, L_v, R_0, L_c, E, M$
Compute = $O, Q_e, M_e$
Define  $O = O_Q + O_M + O_E$ ;  $E = E_1 + E_2$

1. For the first sweep, s = 1, of this TI, get initial estimates of mean density, $k_0$, the R – factor,
   $R_0$ and entering traffic, $E_0$, using the values computed for the final sweep of the prior TI.
   For each subsequent sweep, $s > 1$, calculate $E = \sum_i P_i \; O_i + S$ where $P_i, O_i$ are the
   relevant turn percentages from feeder link, i, and its total outflow (possibly metered) over
   this TI; S is the total source flow (possibly metered) during the current TI.
   Set iteration counter, n = 0, $k = k_0$, and $E = E_0$.

2. Calculate $v(k)$ such that $k \leq 130$ using the analytical representations of the
   fundamental diagram.
   Calculate $Cap = \frac{Q_{max}(TI)}{3600} \left({}^{G}/_{C}\right) LN$, in vehicles, this value may be reduced
   due to metering
   Set $R = 1.0$ if ${}^{G}/_{C} < 1$ or if $k \leq k_c$ ; Set $R = 0.9$ only if ${}^{G}/_{C} = 1$ and $k > k_c$
   Calculate queue length,    $L_b = Q_b \frac{L_v}{LN}$

3. Calculate $t_1 = TI - \frac{L}{V}$.   If $t_1 \prec 0$, set $t_1 = E_1 = O_E = 0$ ; Else, $E_1 = E \frac{t_1}{TI}$.

4. Then $E_2 = E - E_1$ ; $t_2 = TI - t_1$

5. If $Q_b \geq Cap$, then
       $O_Q = Cap, O_M = O_E = 0$
       If $t_1 > 0$, then
           $Q'_e = Q_b + M_b + E_1 - Cap$
       Else
           $Q'_e = Q_b - Cap$
       End if
       Calculate $Q_e$ and $M_e$ using Algorithm A (below)

6. Else $(Q_b \prec Cap)$
       $O_Q = Q_b$,    $RCap = Cap - O_Q$

7.     If $M_b \leq RCap$, then

8.             If $t_1 > 0$,    $O_M = M_b, O_E = \min\left(RCap - M_b, \frac{t_1 \, Cap}{TI}\right) \geq 0$
                   $Q'_e = E_1 - O_E$
                   If $Q'_e > 0$, then
                       Calculate $Q_e, M_e$ with Algorithm A
```

```
            Else
                $Q_e = 0\,,\ M_e = E_2$
            End if
        Else $(t_1 = 0)$
                $O_M = \left(\frac{v(TI) - L_b}{L - L_b}\right) M_b$ and $O_E = 0$
                $M_e = M_b - O_M + E\,;\ Q_e = 0$
        End if

9.  Else $(M_b > RCap)$
        $O_E = 0$
        If $t_1 > 0$, then
            $O_M = RCap\,,\ Q_e' = M_b - O_M + E_1$
            Calculate $Q_e$ and $M_e$ using Algorithm A

10.     Else $(t_1 = 0)$
            $M_d = \left[\left(\frac{v(TI) - L_b}{L - L_b}\right) M_b\right]$
            If $M_d > RCap\,,\ then$
                $O_M = RCap$
                $Q_e' = M_d - O_M$
                Apply Algorithm A to calculate $Q_e$ and $M_e$
            Else
                $O_M = M_d$
                $M_e = M_b - O_M + E$ and $Q_e = 0$
            End if
        End if
    End if
  End if

11. Calculate a new estimate of average density, $\bar{k}_n = \frac{1}{4}[k_b + 2\,k_m + k_e]$,
    where $k_b$ = density at the beginning of the TI
        $k_e$ = density at the end of the TI
        $k_m$ = density at the mid-point of the TI
        All values of density apply only to the moving vehicles.

  If $|\bar{k}_n - \bar{k}_{n-1}| > \in$ and $n < N$
    where $N = \max$ number of iterations, and $\epsilon$ is a convergence criterion, then

12. set $n = n + 1$, and return to step 2 to perform iteration, n, using $k = \bar{k}_n$.
  End if
```

**Computation of unit problem is now complete.** Check for excessive inflow causing spillback.

13. If $Q_e + M_e > \frac{(L-W)\,LN}{L_v}$ , then

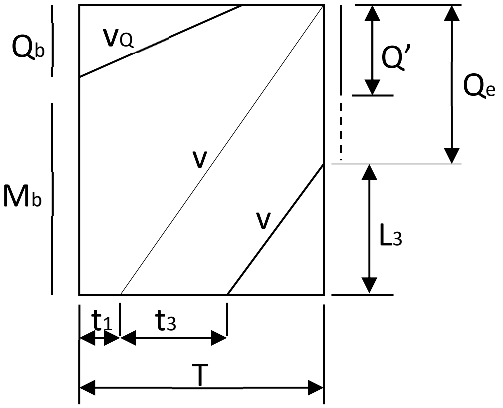
The number of excess vehicles that cause spillback is: $SB = Q_e + M_e - \frac{(L-W)\cdot LN}{L_v}$ , where W is the width of the upstream intersection. To prevent spillback, meter the outflow from the feeder approaches and from the source flow, S, during this TI by the amount, SB. That is, set

$$M = 1 - \frac{SB}{(E+S)} \geq 0 \text{ , where M is the metering factor (over all movements).}$$

This metering factor is assigned appropriately to all feeder links and to the source flow, to be applied during the next network sweep, discussed later.

*Algorithm A*

This analysis addresses the flow environment over a TI during which moving vehicles can join a standing or discharging queue. For the case shown, $Q_b \leq Cap$, with $t_1 > 0$ and a queue of length, $Q'_e$, formed by that portion of $M_b$ and $E$ that reaches the stop-bar within the TI, but could not discharge due to inadequate capacity. That is, $Q_b + M_b + E_1 > Cap$. This queue length, $Q'_e = Q_b + M_b + E_1 - Cap$ can be extended to $Q_e$ by traffic entering the approach during the current TI, traveling at speed, v, and reaching the rear of the queue within the TI. A portion of the entering vehicles, $E_3 = E\,\frac{t_3}{TI}$, will likely join the queue. This analysis calculates $t_3$ , $Q_e$ and $M_e$ for the input values of L, TI, v, E, t, $L_v$, LN, $Q'_e$ .



When $t_1 > 0$ and $Q_b \leq Cap$:

Define: $L'_e = Q'_e \frac{L_v}{LN}$ . From the sketch, $L_3 = v(TI - t_1 - t_3) = L - (Q'_e + E_3)\frac{L_v}{LN}$ .

Substituting $E_3 = \frac{t_3}{TI}\,E$ yields: $-vt_3 + \frac{t_3}{TI}\,E\,\frac{L_v}{LN} = L - v(TI - t_1) - L'_e$ . Recognizing that the first two terms on the right hand side cancel, solve for $t_3$ to obtain:

$$t_3 = \frac{L'_e}{\left[v - \frac{E}{TI}\frac{L_v}{LN}\right]} \qquad \text{such that} \quad 0 \leq t_3 \leq TI - t_1$$

If the denominator, $\left[v - \frac{E}{TI}\frac{L_v}{LN}\right] \leq 0$, set $t_3 = TI - t_1$ .

Then, $Q_e = Q'_e + E\,\frac{t_3}{TI}$ , $M_e = E\left(1 - \frac{t_1 + t_3}{TI}\right)$

The complete Algorithm A considers all flow scenarios; space limitation precludes its inclusion, here.

### C.1.3 Lane Assignment

The “unit problem” is solved for each turn movement on each link. Therefore it is necessary to calculate a value, $\mathrm{LN_x}$, of allocated lanes for each movement, x. If in fact all lanes are specified by, say, arrows painted on the pavement, either as full lanes or as lanes within a turn bay, then the problem is fully defined. If however there remain un-channelized lanes on a link, then an analysis is undertaken to subdivide the number of these physical lanes into turn movement specific virtual lanes, $LN_x$.

## C.2 Implementation

### C.2.1 Computational Procedure

The computational procedure for this model is shown in the form of a flow diagram as Figure C-4. As discussed earlier, the simulation model processes traffic flow for each link independently over TI that the analyst specifies; it is usually 60 seconds or longer. The first step is to execute an algorithm to define the sequence in which the network links are processed so that as many links as possible are processed after their feeder links are processed, within the same network sweep. Since a general network will have many closed loops, it is not possible to guarantee that every link processed will have all of its feeder links processed earlier.

The processing then continues as a succession of time steps of duration, TI, until the simulation is completed. Within each time step, the processing performs a series of “sweeps” over all network links; this is necessary to ensure that the traffic flow is synchronous over the entire network. Specifically, the sweep ensures continuity of flow among all the network links; in the context of this model, this means that the values of E, M, and S are all defined for each link such that they represent the synchronous movement of traffic from each link to all of its outbound links. These sweeps also serve to compute the metering rates that control spillback.

Within each sweep, processing solves the “unit problem” for each turn movement on each link. With the turn movement percentages for each link provided by the DTRAD model, an algorithm allocates the number of lanes to each movement serviced on each link. The timing at a signal, if any, applied at the downstream end of the link, is expressed as a G/C ratio, the signal timing needed to define this ratio is an input requirement for the model. The model also has the capability of representing, with macroscopic fidelity, the actions of actuated signals responding to the time-varying competing demands on the approaches to the intersection.

The solution of the unit problem yields the values of the number of vehicles, O, that discharge from the link over the time interval and the number of vehicles that remain on the link at the end of the time interval as stratified by queued and moving vehicles: $\mathrm{Q_e}$ and $\mathrm{M_e}$. The procedure considers each movement separately (multi-piping). After all network links are processed for a given network sweep, the updated consistent values of entering flows, E; metering rates, M; and source flows, S are defined so as to satisfy the “no spillback” condition. The procedure then performs the unit problem solutions for all network links during the following sweep.

Experience has shown that the system converges (i.e., the values of E, M and S "settle down" for all network links) in just two sweeps if the network is entirely under-saturated or in four sweeps in the presence of extensive congestion with link spillback. (The initial sweep over each link uses the final values of E and M, of the prior TI). At the completion of the final sweep for a TI, the procedure computes and stores all MOEs for each link and turn movement for output purposes. It then prepares for the following time interval by defining the values of $\mathrm{Q_b}$ and $\mathrm{M_b}$ for the start of the next TI as being those values of $\mathrm{Q_e}$ and $\mathrm{M_e}$ at the end of the prior TI. In this manner, the simulation model processes the traffic flow over time until the end of the run. Note that there is no space-discretization other than the specification of network links.

### C.2.2 Interfacing with Dynamic Traffic Assignment (DTRAD)

The **DYNEV II** system reflects NRC guidance that evacuees will seek to travel in a general direction away from the location of the hazardous event. Thus, an algorithm was developed to identify an appropriate set of destination nodes for each origin based on its location and on the expected direction of travel. This algorithm also supports the DTRAD model in dynamically varying the Trip Table (O-D matrix) over time from one DTRAD session to the next.

Figure B-1 depicts the interaction of the simulation model with the DTRAD model in the **DYNEV II** system. As indicated, **DYNEV II** performs a succession of DTRAD "sessions"; each such session computes the turn link percentages for each link that remain constant for the session duration, $[\mathrm{T_0}, \mathrm{T_2}]$, specified by the analyst. The end product is the assignment of traffic volumes from each origin to paths connecting it with its destinations in such a way as to minimize the network-wide cost function. The output of the DTRAD model is a set of updated link turn percentages which represent this assignment of traffic.

As indicated in Figure B-1, the simulation model supports the DTRAD session by providing it with operational link MOE that are needed by the path choice model and included in the DTRAD cost function. These MOE represent the operational state of the network at a time, $\mathrm{T_1} \leq \mathrm{T_2}$, which lies within the session duration, $[\mathrm{T_0}, \mathrm{T_2}]$. This "burn time", $\mathrm{T_1} - \mathrm{T_0}$, is selected by the analyst. For each DTRAD iteration, the simulation model computes the change in network operations over this burn time using the latest set of link turn percentages computed by the DTRAD model. Upon convergence of the DTRAD iterative procedure, the simulation model accepts the latest turn percentages provided by the Dynamic Traffic Assignment (DTA) model, returns to the origin time, $\mathrm{T_0}$, and executes until it arrives at the end of the DTRAD session duration at time, $\mathrm{T_2}$. At this time the next DTA session is launched and the whole process repeats until the end of the **DYNEV II** run.

Additional details are presented in Appendix B.

**Table C-1. Selected Measures of Effectiveness Output by DYNEV II**

| Measure | Units | Applies To |
|---|---|---|
| Vehicles Discharged | Vehicles | Link, Network, Exit Link |
| Speed | Miles/Hours (mph) | Link, Network |
| Density | Vehicles/Mile/Lane | Link |
| Level of Service | LOS | Link |
| Content | Vehicles | Network |
| Travel Time | Vehicle-hours | Network |
| Evacuated Vehicles | Vehicles | Network, Exit Link |
| Trip Travel Time | Vehicle-minutes/trip | Network |
| Capacity Utilization | Percent | Exit Link |
| Attraction | Percent of total evacuating vehicles | Exit Link |
| Max Queue | Vehicles | Node, Approach |
| Time of Max Queue | Hours:minutes | Node, Approach |
| Route Statistics | Length (mi); Mean Speed (mph); Travel Time (min) | Route |
| Mean Travel Time | Minutes | Evacuation Trips; Network |

**Table C-2. Input Requirements for the DYNEV II Model**

HIGHWAY NETWORK

- Links defined by upstream and downstream node numbers
- Link lengths
- Number of lanes (up to 9) and channelization
- Turn bays (1 to 3 lanes)
- Destination (exit) nodes
- Network topology defined in terms of downstream nodes for each receiving link
- Node Coordinates (X,Y)
- Nuclear Power Plant Coordinates (X,Y)

GENERATED TRAFFIC VOLUMES

- On all entry links and source nodes (origins), by Time Period

TRAFFIC CONTROL SPECIFICATIONS

- Traffic signals: link-specific, turn movement specific
- Signal control treated as fixed time or actuated
- Location of traffic control points (these are represented as actuated signals)
- Stop and Yield signs
- Right-turn-on-red (RTOR)
- Route diversion specifications
- Turn restrictions
- Lane control (e.g., lane closure, movement-specific)

DRIVER'S AND OPERATIONAL CHARACTERISTICS

- Driver's (vehicle-specific) response mechanisms: free-flow speed, discharge headway
- Bus route designation.

DYNAMIC TRAFFIC ASSIGNMENT

- Candidate destination nodes for each origin (optional)
- Duration of DTA sessions
- Duration of simulation "burn time"
- Desired number of destination nodes per origin

INCIDENTS

- Identify and Schedule of closed lanes
- Identify and Schedule of closed links

**Table C-3. Glossary**

| | |
|---|---|
| Cap | The maximum number of vehicles, of a particular movement, that can discharge from a link within a time interval. |
| E | The number of vehicles, of a particular movement, that enter the link over the time interval. The portion, $E_{TI}$, can reach the stop-bar within the TI. |
| G/C | The green time: cycle time ratio that services the vehicles of a particular turn movement on a link. |
| h | The mean queue discharge headway, seconds. |
| k | Density in vehicles per lane per mile. |
| $\bar{k}$ | The average density of <u>moving</u> vehicles of a particular movement over a TI, on a link. |
| L | The length of the link in feet. |
| $L_b$ , $L_e$ | The queue length in feet of a particular movement, at the [beginning, end] of a time interval. |
| LN | The number of lanes, expressed as a floating point number, allocated to service a particular movement on a link. |
| $L_v$ | The mean effective length of a queued vehicle including the vehicle spacing, feet. |
| M | Metering factor (Multiplier): 1. |
| $M_b$ , $M_e$ | The number of moving vehicles on the link, of a particular movement, that are moving at the [beginning, end] of the time interval. These vehicles are assumed to be of equal spacing, over the length of link upstream of the queue. |
| O | The total number of vehicles of a particular movement that are discharged from a link over a time interval. |
| $O_Q$ , $O_M$ , $O_E$ | The components of the vehicles of a particular movement that are discharged from a link within a time interval: vehicles that were Queued at the beginning of the TI; vehicles that were Moving within the link at the beginning of the TI; vehicles that Entered the link during the TI. |
| $P_x$ | The percentage, expressed as a fraction, of the total flow on the link that executes a particular turn movement, x. |

| | |
|---|---|
| $Q_b$ , $Q_e$ | The number of queued vehicles on the link, of a particular turn movement, at the [beginning, end] of the time interval. |
| $Q_{max}$ | The maximum flow rate that can be serviced by a link for a particular movement in the absence of a control device. It is specified by the analyst as an estimate of link capacity, based upon a field survey, with reference to the Highway Capacity Manual (HCM) 2016. |
| R | The factor that is applied to the capacity of a link to represent the "capacity drop" when the flow condition moves into the forced flow regime. The lower capacity at that point is equal to $RQ_{max}$ . |
| RCap | The remaining capacity available to service vehicles of a particular movement after that queue has been completely serviced, within a time interval, expressed as vehicles. |
| $S_x$ | Service rate for movement x, vehicles per hour (vph). |
| $t_1$ | Vehicles of a particular turn movement that enter a link over the first $t_1$ seconds of a time interval, can reach the stop-bar (in the absence of a queue down-stream) within the same time interval. |
| TI | The time interval, in seconds, which is used as the simulation time step. |
| v | The mean speed of travel, in feet per second (fps) or miles per hour (mph), of moving vehicles on the link. |
| $v_Q$ | The mean speed of the last vehicle in a queue that discharges from the link within the TI. This speed differs from the mean speed of moving vehicles, v. |
| W | The width of the intersection in feet. This is the difference between the link length which extends from stop-bar to stop-bar and the block length. |

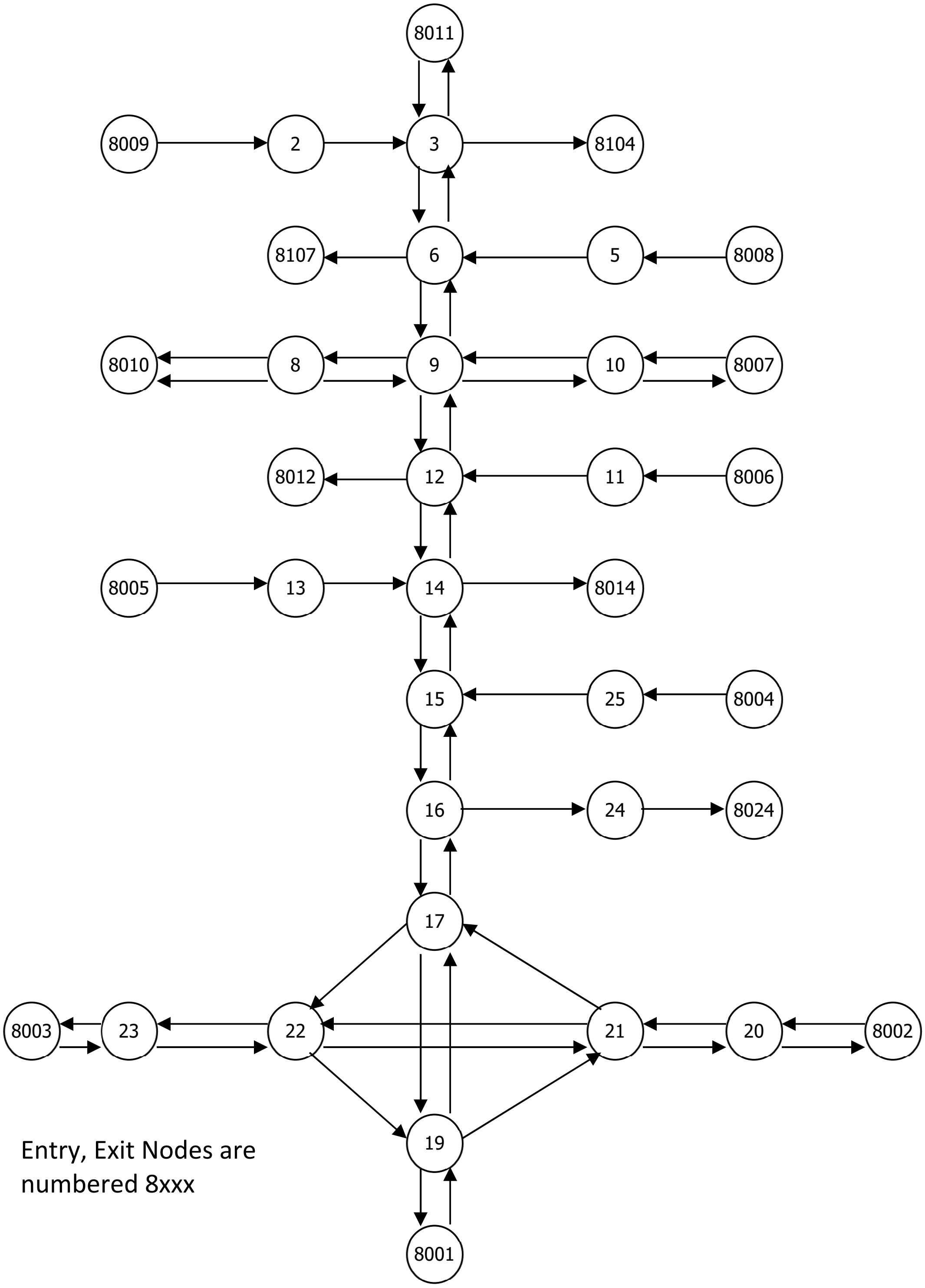


**Figure C-1. Representative Analysis Network**

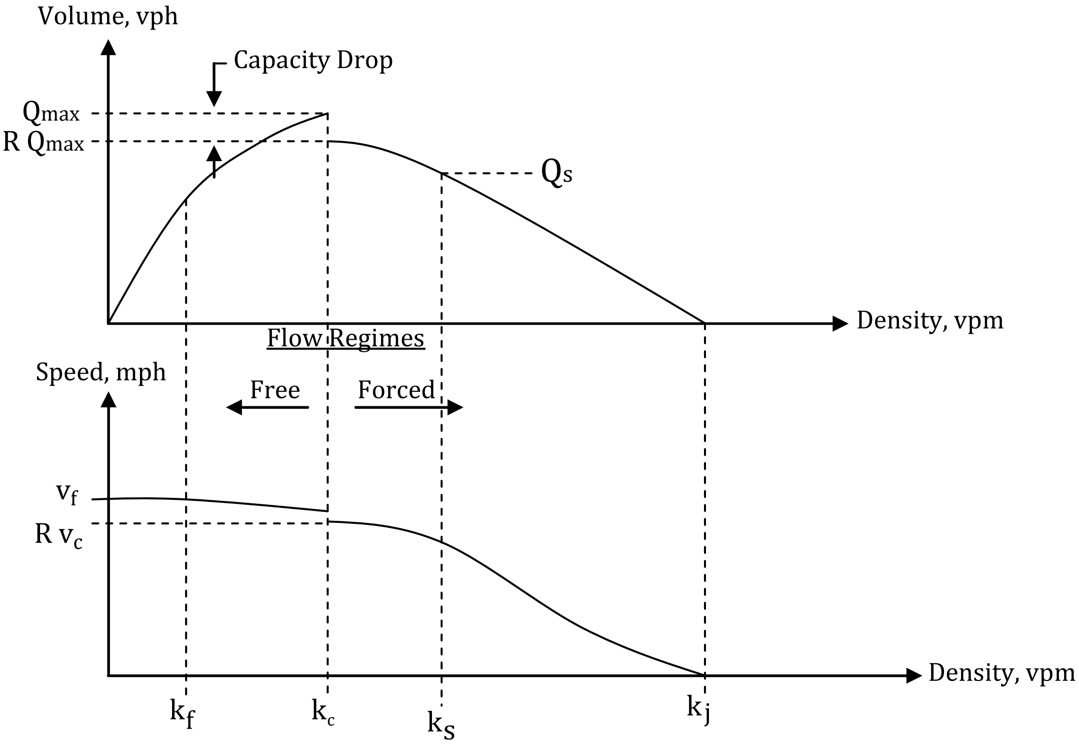


Figure C-2. Fundamental Diagrams

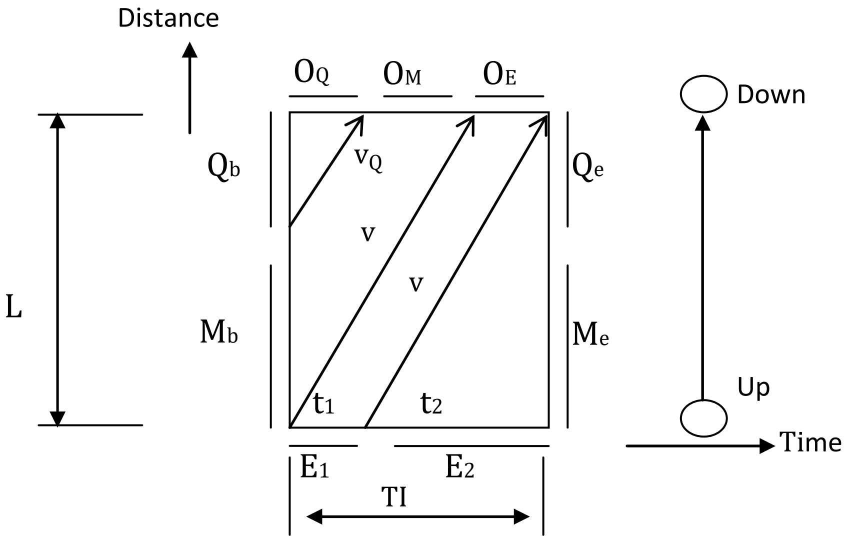


Figure C-3. A UNIT Problem Configuration with $t_1 > 0$

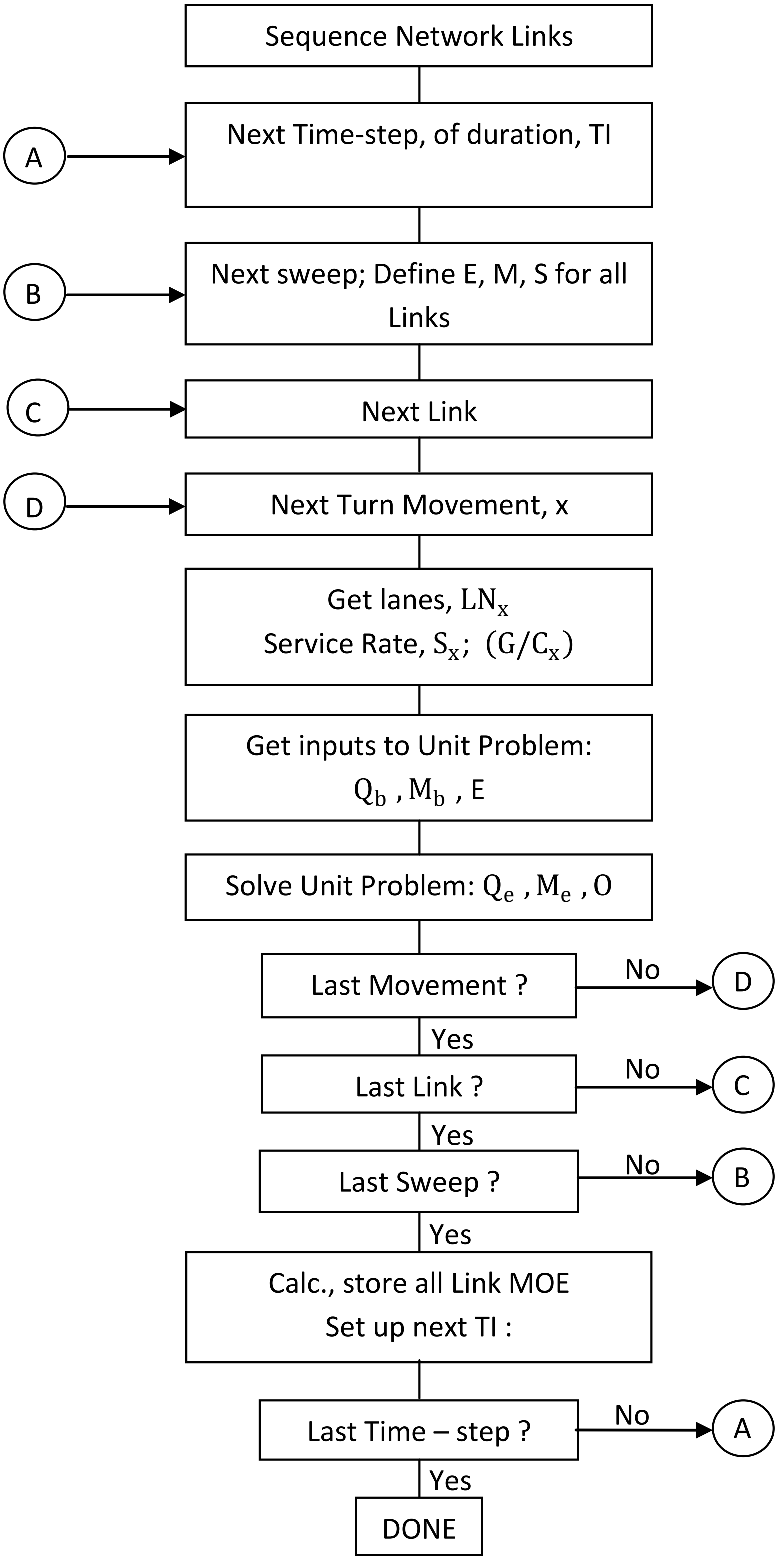


**Figure C-4. Flow of Simulation Processing (See Glossary: Table C-3)**

# APPENDIX D

## Detailed Description of Study Procedure

# D. DETAILED DESCRIPTION OF STUDY PROCEDURE

This appendix describes the activities that were performed to compute ETE. The individual steps of this effort are represented as a flow diagram in Figure D-1. Each numbered step in the description that follows corresponds to the numbered element in the flow diagram.

Step 1

The first activity was to obtain EPZ boundary information and create a GIS base map. The base map extends beyond the Shadow Region which extends approximately 15 miles (radially) from the power plant location. The base map incorporates the local roadway topology, a suitable topographic background and the EPZ boundary.

Step 2

2020 Census block population was obtained in GIS format. This information was used to determine the permanent resident population within the EPZ and Shadow Region and to define the spatial distribution and demographic characteristics of the population within the study area. Employee data were estimated using the US Census Longitudinal Employer-Household Dynamics from the OnTheMap Census analysis tool[1] and the plant employee data was provided by FPL. Transient data were obtained from county emergency management agencies. Parking lot capacity for some transient attractions was estimated using aerial imagery. Information concerning schools, medical and other types of special facilities within the EPZ was obtained from county sources, supplemented with phone calls and internet searches. In addition, transportation resources available during the emergency were also provided by the counties.

Step 3

A kickoff meeting was conducted with major stakeholders (county and state emergency managers and FPL). The purpose of the kickoff meeting was to present an overview of the work effort, identify key agency personnel, and indicate the data requirements for the study. Specific requests for information were presented to county emergency managers. Unique features of the study area were discussed to identify the local concerns that should be addressed by the ETE study.

Step 4

Next, a physical survey of the roadway system in the study area was conducted to determine the geometric properties of the highway sections, the channelization of lanes on each section of roadway, whether there are any turn restrictions or special treatment of traffic at intersections, the type and functioning of traffic control devices, gathering signal timings for pre-timed traffic signals (if any exist within the study area), and to make the necessary observations needed to estimate realistic values of roadway capacity. Roadway characteristics were also verified using aerial imagery.

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[1] http://onthemap.ces.census.gov/

Step 5

A demographic survey of households within the EPZ was conducted to identify household dynamics, trip generation characteristics, and evacuation-related demographic information of the EPZ population for this study. This information was used to determine important study factors including the average number of evacuating vehicles used by each household, and the time required to perform pre-evacuation mobilization activities.

Step 6

A computerized representation of the physical roadway system, called a link-node analysis network, was developed using the most recent UNITES software (see Section 1.3) developed by KLD. Once the geometry of the network was completed, the network was calibrated using the information gathered during the road survey (Step 4) and information obtained from aerial imagery. Estimates of highway capacity for each link and other link-specific characteristics were introduced to the network description. Traffic signal timings were input accordingly. The link-node analysis network was imported into a GIS map. The 2020 permanent resident population estimates (Step 2) were overlaid in the map, and origin centroids where trips would be generated during the evacuation process were assigned to appropriate links.

Step 7

The EPZ is subdivided into 10 Areas. Based on wind direction and speed, Regions (groupings of Areas) that may be advised to evacuate, were developed.

The need for evacuation can occur over a range of time-of-day, day-of-week, seasonal and weather-related conditions. Scenarios were developed to capture the variation in evacuation demand, highway capacity and mobilization time, for different time of day, day of the week, time of year, and weather conditions.

Step 8

The input stream for the DYNEV II model, which integrates the dynamic traffic assignment and distribution model, DTRAD, with the evacuation simulation model, was created for a prototype evacuation case – the evacuation of the entire EPZ for a representative scenario.

Step 9

After creating this input stream, the DYNEV II System was executed on the prototype evacuation case to compute evacuating traffic routing patterns consistent with the appropriate NRC guidelines. DYNEV II contains an extensive suite of data diagnostics which check the completeness and consistency of the input data specified. The analyst reviews all warning and error messages produced by the model and then corrects the database to create an input stream that properly executes to completion.

The model assigns destinations to all origin centroids consistent with a (general) radial evacuation of the EPZ and Shadow Region. The analyst may optionally supplement and/or replace these model-assigned destinations, based on professional judgment, after studying the topology of the analysis highway network. The model produces link and network-wide measures of effectiveness as well as ETE.

Step 10

The results generated by the prototype evacuation case are critically examined. The examination includes observing the animated graphics (using the EVAN software – see Section 1.3) and reviewing the statistics output by the model. This is a labor-intensive activity, requiring the direct participation of skilled engineers who possess the necessary practical experience to interpret the results and to determine the causes of any problems reflected in the results.

Essentially, the approach is to identify those bottlenecks in the network that represent locations where congested conditions are pronounced and to identify the cause of this congestion. This cause can take many forms, either as excess demand due to high rates of trip generation, improper routing, a shortfall of capacity, or as a quantitative flaw in the way the physical system was represented in the input stream. This examination leads to one of two conclusions:

- The results are satisfactory; or
- The input stream must be modified accordingly.

This decision requires, of course, the application of the user's judgment and experience based upon the results obtained in previous applications of the model and a comparison of the results of the latest prototype evacuation case iteration with the previous ones. If the results are satisfactory in the opinion of the user, then the process continues with Step 13. Otherwise, proceed to Step 11.

Step 11

There are many "treatments" available to the user in resolving apparent problems. These treatments range from decisions to reroute the traffic by assigning additional evacuation destinations for one or more sources, imposing turn restrictions where they can produce significant improvements in capacity, changing the control treatment at critical intersections so as to provide improved service for one or more movements, adding routes (which are paved and traversable) that were not previously modelled but may assist in an evacuation and increase the available roadway network capacity, or in prescribing specific treatments for channelizing the flow so as to expedite the movement of traffic along major roadway systems. Such "treatments" take the form of modifications to the original prototype evacuation case input stream. All treatments are designed to improve the representation of evacuation behavior.

Step 12

As noted above, the changes to the input stream must be implemented to reflect the modifications undertaken in Step 11. At the completion of this activity, the process returns to Step 9 where the DYNEV II System is again executed.

Step 13

Evacuation of transit-dependent evacuees and special facilities are included in the evacuation analysis. Fixed routing for transit buses, school buses, ambulatory buses, wheelchair buses, and ambulances are introduced into the final prototype evacuation case data set. DYNEV II generates route-specific speeds over time for use in the estimation of evacuation times for the transit dependent and special facility population groups.

Step 14

The prototype evacuation case is used as the basis for generating all region and scenario-specific evacuation cases to be simulated. This process is automated through the UNITES user interface. For each specific case, the population to be evacuated, the trip generation distributions, the highway capacity and speeds, and other factors are adjusted to produce a customized case-specific data set.

Step 15

All evacuation cases are executed using the DYNEV II System to compute ETE. Once results are available, quality control procedures are used to assure the results are consistent, dynamic routing is reasonable, and traffic congestion/bottlenecks are addressed properly.

Step 16

Once vehicular evacuation results are accepted, average travel speeds for transit and special facility routes are used to compute ETE for transit-dependent permanent residents, schools, hospitals, and other special facilities.

Step 17

The simulation results are analyzed, tabulated and graphed. The results are then documented, as required by NUREG/CR-7002, Rev. 1.

Step 18

Following the completion of documentation activities, the ETE criteria checklist (see Appendix N) is completed. An appropriate report reference is provided for each criterion provided in the checklist.

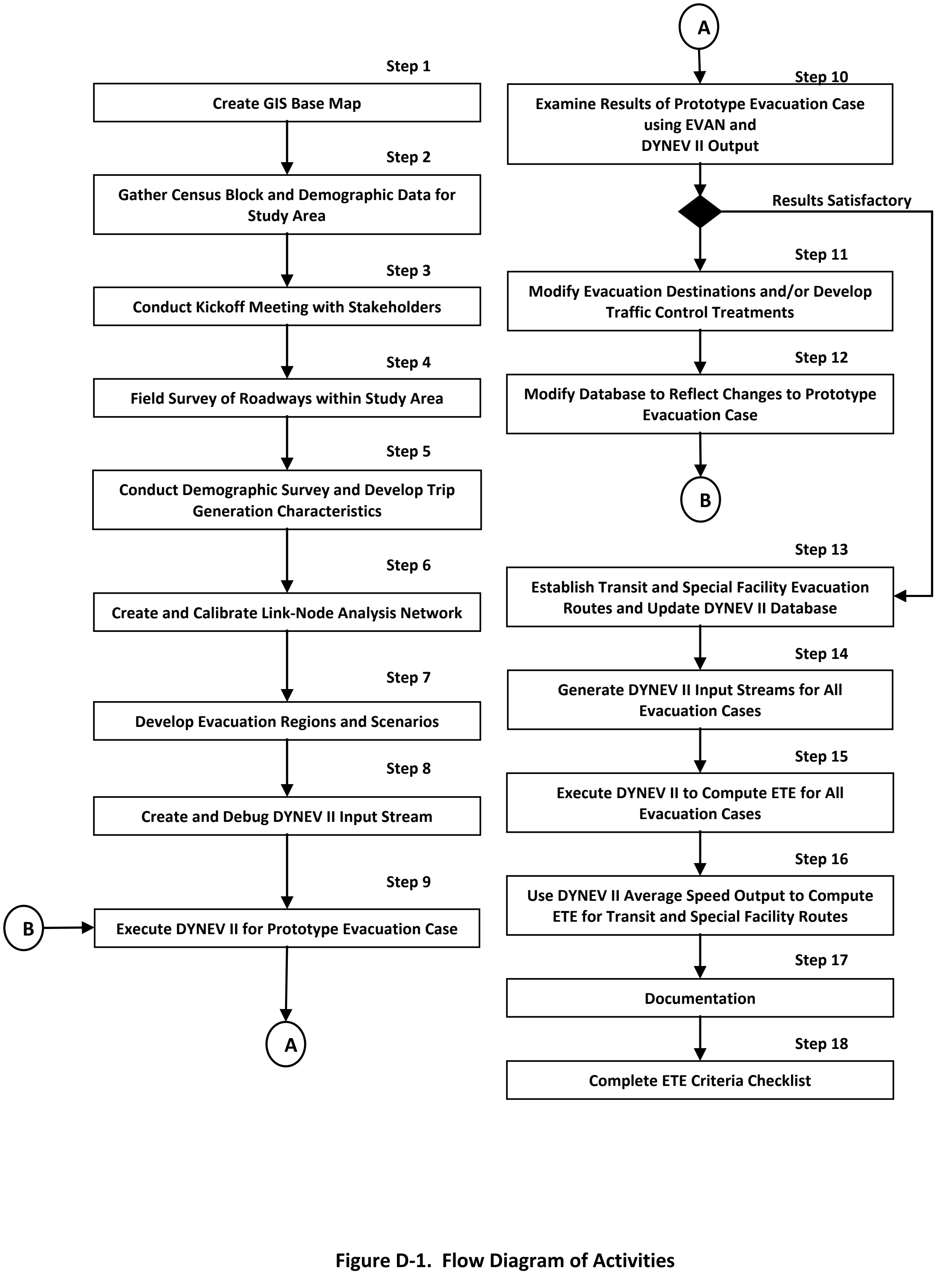

**Figure D-1. Flow Diagram of Activities**

# APPENDIX E

Facility Data

# E. FACILITY DATA

The following tables list population information, as of July 2022, for special facilities that are located within the PTN EPZ. Special facilities are defined as schools, medical facilities and correctional facilities. Transient population data is included in the tables for transient attractions (golf courses, marinas, parks, day camp, other recreational facilities) and lodging facilities. Employment data is included in the table for major employers. Each table is grouped by county. The location of the facility is defined by its straight-line distance (miles) and direction (magnetic bearing) from the center point of the plant. Maps of each school, medical facility, correctional facility, transient attraction (golf course, marina, park, day camp, other recreational facility), lodging facility, and areas of major employment are also provided.

### Table E-1. Schools within the Study Area

| Area | Distance (miles) | Dire-ction | School Name | Street Address | Municipality | Enroll-ment |
|---|---|---|---|---|---|---|
| | | | **MIAMI-DADE COUNTY** | | | |
| 4 | 5.6 | WNW | South Dade Center[1] | 13600 SW 312th St | Homestead | N/A |
| 4 | 6.2 | NW | Migrant Education Program | 28205 SW 125th Ave | Homestead | 16 |
| 4 | 6.3 | NW | Mandarin Lakes K-8 Academy | 12225 SW 280th St | Homestead | 1,508 |
| 4 | 6.4 | NW | AcadeMir Charter School of Math & Science | 13330 SW 288th St | Homestead | 150 |
| 4 | 6.5 | NW | Villa Preparatory Academy | 13350 SW 288th St | Homestead | 164 |
| 4 | 7.0 | NW | Air Base K-8 Center for International Education | 12829 SW 272nd St | Homestead | 1,268 |
| 5 | 8.7 | N | Mater Academy Bay | 22025 SW 87th Ave | Cutler Bay | 864 |
| 5 | 9.0 | N | Dr. E.L. Whigham Elementary | 21545 SW 87th Ave | Miami | 898 |
| 5 | 9.5 | N | Cutler Bay Senior High School | 8601 SW 212th St | Miami | 1,530 |
| 5 | 9.6 | N | Gulfstream Elementary | 20900 SW 97th Ave | Miami | 897 |
| 5 | 10.0 | N | Cutler Ridge Christian Academy | 10301 Caribbean Blvd | Miami | 238 |
| 5 | 10.1 | N | Cutler Ridge Elementary | 20210 Coral Sea Rd | Miami | 982 |
| 5 | 10.2 | N | Golden Horizon Academy | 8601 SW 199th St | Cutler Bay | 60 |
| 5 | 10.6 | N | Cutler Bay Middle School | 19400 Gulfstream Rd | Miami | 1,659 |
| 5 | 10.6 | N | Bel-Aire Elementary | 10205 SW 194th St | Miami | 616 |
| 5 | 10.8 | N | Whispering Pines Elementary | 18929 SW 89th Rd | Miami | 724 |
| 5 | 11.3 | N | Our Lady of the Holy Rosary | 18455 Franjo Rd | Miami | 460 |
| 6 | 8.0 | NNW | Advantage Academy of Math and Science at Summerville | 11575 SW 243Rd St | Homestead | 552 |
| 6 | 8.3 | NNW | Goulds Elementary School | 23555 SW 112th Ave | Miami | 824 |
| 6 | 8.3 | NNW | Coconut Palm K-8 Academy | 24400 SW 124th Ave | Homestead | 1,499 |
| 6 | 8.4 | NW | Somerset Academy Silver Palms at Princeton | 13390 SW 248th St | Homestead | 511 |
| 6 | 8.6 | NNW | Somerset Academy at Silver Palms - Elementary | 23255 SW 115th Ave | Homestead | 1,766 |
| 6 | 8.6 | NNW | Somerset Academy at Silver Palms - High School | 23255 SW 115th Ave | Homestead | 236 |
| 6 | 8.8 | NNW | Palm Glades Preparatory High School | 22655 SW 112th Ave | Miami | 389 |
| 6 | 9.4 | NNW | Coral Reef Montessori Academy | 10853 SW 216th St | Miami | 511 |
| 6 | 9.5 | NNW | Pine Villa Elementary | 21799 SW 117th Ct | Miami | 834 |
| 6 | 9.6 | NNW | Arthur & Polly Mays Conservatory of the Arts | 11700 SW 216th St | Miami | 955 |
| 6 | 10.6 | NNW | Caribbean K-8 Center | 11990 SW 200th St | Miami | 896 |

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[1] The enrollment data for South Dade Center and Redland Center are unavailable. These two schools are adult learning centers where students are likely to evacuate in private vehicles. Thus, no transportation resources were estimated for these schools. Refer to Section 3 for additional information.

| Area | Distance (miles) | Dire-ction | School Name | Street Address | Municipality | Enroll-ment |
|---|---|---|---|---|---|---|
| 7 | 7.7 | NW | William A. Chapman Elementary | 27190 SW 140th Ave | Homestead | 620 |
| 7 | 7.8 | NW | SIA Tech (Homestead Job Corps Center) | 12350 SW 285th St | Homestead | 357 |
| 7 | 8.1 | NW | Corporate Academy South | 13990 SW 264th St | Homestead | 63 |
| 7 | 8.1 | NW | Miami MacArthur South Senior High | 13990 SW 264th St | Homestead | 714 |
| 7 | 8.2 | NW | South Dade Skill Center | 28300 SW 152nd Ave | Homestead | 282 |
| 7 | 8.3 | NW | South Point Academy | 27835 S Dixie Hwy | Homestead | 48 |
| 7 | 8.5 | NW | Promised Land Academy and Therapy | 27500 Old Dixie Hwy | Homestead | 81 |
| 7 | 9.3 | WNW | South Dade Senior High School | 28401 SW 167th Ave | Homestead | 3,302 |
| 8 | 6.5 | WNW | The Charter School at Waterstone | 855 Waterstone Way | Homestead | 1,117 |
| 8 | 6.6 | WNW | Keys Gate Charter School | 2000 SE 28th Ave | Homestead | 1,143 |
| 8 | 7.1 | NW | Discovery Montessori Academy | 14112 SW 288th St | Homestead | 81 |
| 8 | 7.2 | NW | Irving & Beatrice Peskoe K-8 Center | 29035 SW 144th Ave | Homestead | 866 |
| 8 | 7.7 | WNW | Gateway Environmental K-8 | 955 SE 18th Ave | Homestead | 1,690 |
| 8 | 7.7 | WNW | Everglades Preparatory Academy | 2251 E Mowry Dr | Homestead | 461 |
| 8 | 7.8 | WNW | Center For International Education | 900 NE 23rd Ave | Homestead | 1,010 |
| 8 | 7.8 | NW | Leisure City K-8 Center | 14950 SW 288th St | Homestead | 1,213 |
| 8 | 7.9 | WNW | Campbell Drive K-8 Center | 15790 SW 307th St | Leisure City | 1,220 |
| 8 | 8.0 | WNW | Lincoln Marti School | 28800 SW 152nd Ave | Homestead | 270 |
| 8 | 8.1 | W | Homestead Senior High School | 2351 SE 12th Ave | Homestead | 2,894 |
| 8 | 8.5 | WNW | Redland Center[1] | 33033, 29355 S Dixie Hwy | Homestead | N/A |
| 8 | 8.8 | WNW | Mavericks High of South Miami Dade County | 698 N Homestead Blvd | Homestead | 338 |
| 8 | 9.0 | WNW | Hope Academy | 1100 Old Dixie Hwy | Homestead | 383 |
| 8 | 9.2 | WNW | Lincoln-Marti Charter Schools International Campus | 103 E Lucy St | Florida City | 197 |
| 8 | 9.3 | WNW | Somerset Academy South Homestead | 300 SE 1st Dr | Homestead | 536 |
| 8 | 9.4 | WNW | Miami Dade College - Homestead Campus | 500 College Terr | Homestead | 4,651 |
| 8 | 9.4 | WNW | Avocado Elementary | 16969 SW 294th St | Homestead | 869 |
| 8 | 9.4 | WNW | Colonial Christian School | 17105 SW 296th St | Homestead | 183 |
| 8 | 9.5 | WNW | South Dade Technical College | 109 NE 8th St | Homestead | 100 |
| 8 | 9.5 | WNW | Saint John's Episcopal School | 145 NE 10th St | Homestead | 138 |
| 8 | 9.6 | W | Ebenezer Christian School | 530 SW 1st St | Florida City | 53 |
| 8 | 9.7 | WNW | First United Methodist Christian School | 622 N Krome Ave | Homestead | 233 |
| 8 | 9.7 | WNW | The Thinking Child Academy | 155 NW 4th St | Homestead | 85 |
| 8 | 9.7 | WNW | Neva King Cooper Educational Center | 151 NW 5th St | Homestead | 107 |

| Area | Distance (miles) | Dire-ction | School Name | Street Address | Municipality | Enroll-ment |
|---|---|---|---|---|---|---|
| 8 | 9.7 | W | Laura C. Saunders Elementary | 505 SW 8th St | Homestead | 819 |
| 8 | 9.8 | W | Florida City Elementary | 364 NW 6th Ave | Florida City | 848 |
| 8 | 9.8 | WNW | Barrington Academy | 344 SW 4th Ave | Florida City | 300 |
| 8 | 9.8 | WNW | Somerset Arts Academy | 1700 N Krome Ave | Homestead | 243 |
| 8 | 9.8 | WNW | Homestead Middle | 650 NW 2nd Ave | Homestead | 834 |
| 8 | 9.8 | W | Advanced Achievers Academy | 713 W Palm Dr | Florida City | 113 |
| 8 | 9.8 | WNW | Somerset Academy Charter Middle School at Country Palms | 47 NW 16th St | Homestead | 405 |
| 8 | 9.9 | WNW | Medical Academy For Science and Technology | 1220 NW 1st St | Homestead | 1,108 |
| 8 | 9.9 | W | Avant Schools of Excellence | 777 W Palm Dr | Florida City | 79 |
| 8 | 10.0 | W | Shepherd of God Christian Academy | 824 W Palm Dr | Florida City | 43 |
| 8 | 10.2 | W | Miami Community Charter School | 101 S Redland Rd | Florida City | 1,022 |
| 8 | 10.6 | WNW | Redondo Elementary School | 18480 SW 304th St | Homestead | 749 |
| S.R. | 10.3 | NW | Redland Middle[2] | 16001 SW 248th St | Homestead | 497 |
| S.R. | 10.4 | WNW | Redland Christian Academy[2] | 17700 SW 280th St | Homestead | 250 |
| S.R. | 10.5 | NW | Redland Elementary[2] | 24501 SW 162nd Ave | Homestead | 747 |
| S.R. | 10.6 | W | West Homestead Elementary[2] | 1550 SW 6th St | Homestead | 778 |
| | | | | | *Miami-Dade County Subtotal:* | *55,147* |
| | | | **MONROE COUNTY** | | | |
| 10 | 8.8 | SSE | Reef Club Kids[3] | 35 Ocean Reef Dr #120 | Key Largo | N/A |
| 10 | 9.7 | SSE | Academy at Ocean Reef | 395 S Harbor Dr | Key Largo | 80 |
| | | | | | *Monroe County Subtotal:* | *80* |
| | | | | | **STUDY AREA TOTAL:** | **55,227** |

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[2] Redland Middle, Redland Christian Academy, Redland Elementary and West Homestead Elementary are located in the Shadow Region (S.R.) but near the EPZ boundary. According to the FPL "Important information for Turkey Point neighbors" brochure, students in these schools will be relocated to designated host facilities in the event of an emergency at the PTN. Refer to Section 10 for additional information.

[3] Reef Club Kids is a private school located within the Ocean Reef Club (ORC). The enrollment data is unavailable. It is assumed that parents will pick up children at private schools (see Section 2). Thus, no transportation resources were estimated for this school. Refer to Section 3 for additional information.

## Table E-2. Medical Facilities within the EPZ

| Area | Distance (miles) | Direction | Facility Name | Street Address | Municipality | Capacity | Current Census | Ambulatory Patients | Wheelchair Patients | Bedridden Patients |
|---|---|---|---|---|---|---|---|---|---|---|
| MIAMI-DADE COUNTY | | | | | | | | | | |
| 4 | 6.6 | NW | Open Arms ALF, Inc | 13453 SW 289 Terr | Homestead | 7 | 7 | 6 | 1 | 0 |
| 4 | 6.9 | NW | Merline's Place | 28412 SW 135th Ave | Homestead | 6 | 6 | 5 | 1 | 0 |
| 4 | 6.9 | NW | A Senior Living Dream | 13442 SW 284 St | Homestead | 6 | 6 | 5 | 1 | 0 |
| 4 | 6.9 | NW | M J Quality Care | 13231 SW 278th Terr | Homestead | 8 | 8 | 7 | 1 | 0 |
| 4 | 7.0 | NW | Mother Golden Years III | 13621 SW 281st Terr | Miami | 6 | 6 | 5 | 1 | 0 |
| 4 | 7.2 | NW | Health Paradise ALF1 | 27780 SW 135th Ave Rd | Homestead | 6 | 6 | 5 | 1 | 0 |
| 4 | 7.5 | NW | Diaz Home Care ALF | 13481 SW 268th Terr | Homestead | 6 | 6 | 5 | 1 | 0 |
| 5 | 8.9 | N | Blue Point Home Care | 21910 SW 97th Ct | Miami | 6 | 6 | 5 | 1 | 0 |
| 5 | 9.0 | N | Paradise Home ALF, CORP. | 8950 SW 215th Terr | Cutler Bay | 7 | 7 | 6 | 1 | 0 |
| 5 | 9.0 | N | M & Y ALF, INC. | 21940 Old Cutler Rd | Cutler Bay | 8 | 8 | 7 | 1 | 0 |
| 5 | 9.2 | N | Old Cutler Retirement Home | 21640 Old Cutler Rd | Miami | 8 | 8 | 7 | 1 | 0 |
| 5 | 9.4 | N | Living Well ALF Corporation | 21280 Old Cutler Rd | Cutler Bay | 6 | 6 | 5 | 1 | 0 |
| 5 | 9.4 | N | Paradise Villa ALF, Inc. | 21164 SW 92nd Pl | Cutler Bay | 8 | 8 | 7 | 1 | 0 |
| 5 | 9.5 | NNW | Cutler Bay Village | 10425 SW 212th St | Miami | 47 | 47 | 40 | 5 | 2 |
| 5 | 9.6 | N | Harmony Family Home | 9245 SW 208th Terr | Miami | 7 | 7 | 6 | 1 | 0 |
| 5 | 9.6 | N | Guardian Angel ALF | 10265 Nicaragua Dr | Cutler Bay | 8 | 8 | 7 | 1 | 0 |
| 5 | 9.6 | N | Encompass Health Rehabilitation Hospital of Miami | 20601 Old Cutler Rd | Miami | 60 | 57 | 49 | 6 | 2 |
| 5 | 9.7 | N | Laugh to Live ALF Inc. | 8635 SW 207th Terr | Cutler Bay | 6 | 6 | 5 | 1 | 0 |
| 5 | 9.7 | N | Rodeck One Inc | 9700 Montego Bay Dr | Miami | 8 | 8 | 7 | 1 | 0 |
| 5 | 9.7 | N | Marlin Retirement ALF | 20610 Marlin Rd | Miami | 8 | 8 | 7 | 1 | 0 |
| 5 | 9.8 | N | Kenneth Home Inc | 10051 Haitian Dr | Miami | 8 | 8 | 7 | 1 | 0 |
| 5 | 10.0 | N | Caribbean ALF | 9860 Caribbean Blvd | Miami | 6 | 6 | 5 | 1 | 0 |
| 5 | 10.0 | NNW | Wellness Advantage Home Care, Inc. | 10601 Caribbean Blvd | Miami | 6 | 6 | 5 | 1 | 0 |
| 5 | 10.2 | N | Isabella's Paradise ALF LLC | 10005 SW 200th St | Cutler Bay | 7 | 7 | 6 | 1 | 0 |
| 5 | 10.5 | N | Jackson Memorial Perdue Medical Center | 19590 Old Cutler Rd | Cutler Bay | 163 | 163 | 139 | 18 | 6 |
| 5 | 10.5 | N | Precious Moments ALF, INC | 9480 Dana Rd | Cutler Bay | 7 | 7 | 6 | 1 | 0 |
| 5 | 10.6 | N | East Ridge Retirement Village | 19301 SW 87th Ave | Miami | 195 | 195 | 166 | 22 | 7 |
| 5 | 10.8 | N | Jean Carlos ALF, Inc. | 9760 Memorial Rd | Cutler Bay | 6 | 6 | 5 | 1 | 0 |
| 5 | 10.9 | N | Bella Luna Retirement Home | 18700 SW 93rd Ct | Miami | 9 | 9 | 8 | 1 | 0 |

| Area | Distance (miles) | Dire- ction | Facility Name | Street Address | Municipality | Capa- city | Current Census | Ambul- atory Patients | Wheel- chair Patients | Bed- ridden Patients |
|---|---|---|---|---|---|---|---|---|---|---|
| 5 | 10.9 | N | Bel Air ALF | 8830 Caribbean Blvd | Miami | 7 | 7 | 6 | 1 | 0 |
| 5 | 11.1 | N | Cutler Bay Assisted Living Corp | 8640 SW 185th St | Cutler Bay | 6 | 6 | 5 | 1 | 0 |
| 6 | 6.8 | NNW | Diaz Home Care ALF II Inc. | 12211 SW 268th St | Homestead | 6 | 6 | 5 | 1 | 0 |
| 6 | 7.0 | NW | Vicky's ALF | 12438 SW 266th Ln | Homestead | 7 | 7 | 6 | 1 | 0 |
| 6 | 7.2 | NW | Duran Home Care Corp | 26775 SW 129th Ave | Homestead | 7 | 7 | 6 | 1 | 0 |
| 6 | 7.4 | NNW | Meadow Wood Homes LLC | 25799 SW 122nd Pl | Homestead | 7 | 7 | 6 | 1 | 0 |
| 6 | 7.5 | NNW | RC Dreams Home Care Inc | 12432 SW 259th St | Homestead | 10 | 10 | 9 | 1 | 0 |
| 6 | 7.6 | NNW | God Is First ALF, Inc | 11316 SW 246th Terr | Miami | 6 | 6 | 5 | 1 | 0 |
| 6 | 7.7 | NW | Del Real Home Care, Inc. | 13071 SW 260th Terr | Homestead | 7 | 7 | 6 | 1 | 0 |
| 6 | 7.7 | NNW | Living Well ALF, Co. | 24151 SW 107th Ave | Homestead | 6 | 6 | 5 | 1 | 0 |
| 6 | 7.8 | NNW | Blanca Azuzena Homecare | 12414 SW 252nd Terr | Homestead | 8 | 8 | 7 | 1 | 0 |
| 6 | 8.0 | NNW | United Lives Leisure Facilities, Inc. | 24167 SW 114 Ct | Homestead | 8 | 8 | 7 | 1 | 0 |
| 6 | 8.1 | NW | Beyond Our Dreams ALF, Corp. | 13434 SW 257th Terr | Homestead | 6 | 6 | 5 | 1 | 0 |
| 6 | 8.3 | NW | Sunny Hills of Homestead ALF | 25268 SW 134th Ave | Homestead | 120 | 120 | 102 | 12 | 6 |
| 6 | 8.5 | NNW | St. Mary Adult Care II[4] | 11271 SW 229th Terr | Miami | 7 | 7 | 6 | 1 | 0 |
| 6 | 8.6 | NNW | ACC Sunshine ALF | 10899 SW 229th St | Miami | 8 | 8 | 7 | 1 | 0 |
| 6 | 8.7 | NNW | Silver Palm ALF, Corp. | 11271 SW 229th Terr | Miami | 6 | 6 | 5 | 1 | 0 |
| 6 | 8.9 | NNW | Sylvia's Senior Home | 23025 SW 120th Ave | Miami | 10 | 10 | 9 | 1 | 0 |
| 6 | 9.0 | NNW | Osmani M ALF LLC | 26423 SW 122nd Pl | Miami | 7 | 7 | 6 | 1 | 0 |
| 6 | 9.0 | NNW | Rick and Dauvy ALF Inc. | 23120 SW 124th Ave | Miami | 6 | 6 | 5 | 1 | 0 |
| 6 | 9.2 | NNW | Biscayne Villa Assisted Living | 22181 SW 117th Ave | Miami | 6 | 6 | 5 | 1 | 0 |
| 6 | 9.3 | NNW | Santos ALF Corp | 10935 SW 218th Terr | Miami | 8 | 8 | 7 | 1 | 0 |
| 6 | 9.3 | NNW | Ive Home II ALF | 22636 SW 125th Ave | Cutler Ridge | 8 | 8 | 7 | 1 | 0 |
| 6 | 9.5 | NNW | Ifa Lola ALF | 12230 SW 220th St | Cutler Ridge | 6 | 6 | 5 | 1 | 0 |
| 6 | 9.7 | NNW | Blessing Time ALF, Inc. | 11461 SW 214 St | Miami | 6 | 6 | 5 | 1 | 0 |
| 6 | 9.7 | NNW | ABC Adult Day Care Center, LLC[4] | 11150 SW 211 St | Cutler Bay | Outpatient only | | | | |
| 6 | 9.9 | NNW | Vereda Nueva, INC | 12412 SW 215th Ln | Miami | 7 | 7 | 6 | 1 | 0 |
| 6 | 10.0 | NNW | Margreg Facilities, Corp. | 12412 SW 213th Terr | Miami | 8 | 8 | 7 | 1 | 0 |
| 6 | 10.0 | NNW | SarriaMachin Corp | 13206 SW 218th Terr | Miami | 6 | 6 | 5 | 1 | 0 |
| 6 | 10.1 | NNW | B&B Home Care, Inc. | 20625 SW 114th Pl | Miami | 7 | 7 | 6 | 1 | 0 |

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[4] It is assumed that patients at adult care providers are outpatients only. Thus, no transportation resources were estimated for these facilities. Refer to Section 3 for additional information.

| Area | Distance (miles) | Dire-ction | Facility Name | Street Address | Municipality | Capa-city | Current Census | Ambul-atory Patients | Wheel-chair Patients | Bed-ridden Patients |
|---|---|---|---|---|---|---|---|---|---|---|
| 6 | 10.2 | NNW | Rafaela's Home ALF II | 20560 SW 113th Rd | Miami | 8 | 8 | 7 | 1 | 0 |
| 6 | 10.2 | NNW | My Sweet Home | 11312 SW 203rd Terr | Miami | 8 | 8 | 7 | 1 | 0 |
| 6 | 10.3 | NNW | Belen Sweet Home ALF | 11825 SW 206th St | Miami | 7 | 7 | 6 | 1 | 0 |
| 6 | 10.3 | NNW | Suany's Home | 20411 SW 116th Rd | Miami | 6 | 6 | 5 | 1 | 0 |
| 6 | 10.4 | NNW | Ive Home | 20020 SW 113th Pl | Miami | 8 | 8 | 7 | 1 | 0 |
| 6 | 10.4 | NNW | Jimenez Senior Care | 20581 SW 124th Ct | Miami | 6 | 6 | 5 | 1 | 0 |
| 7 | 7.3 | NW | Advance ALF | 14335 SW 288 St | Homestead | 6 | 6 | 5 | 1 | 0 |
| 7 | 7.5 | NW | San Rafael Home Health Inc. | 13373 SW 283rd St | Homestead | 7 | 7 | 6 | 1 | 0 |
| 7 | 7.5 | NW | Maria Home Care Corp. | 14615 SW 288th St | Miami | 7 | 7 | 6 | 1 | 0 |
| 7 | 8.1 | NW | Family Welfare, LLC | 26901 SW 143rd Ct | Homestead | 7 | 7 | 6 | 1 | 0 |
| 7 | 8.3 | NW | Mis Abuelitos Felices Adult Day Care INC[4] | 15260 SW 280th St | Homestead | 45 | 45 | 38 | 5 | 2 |
| 7 | 8.3 | NW | Naranja Group Home | 19190 SW 272nd St | Homestead | 12 | 12 | 10 | 1 | 1 |
| 7 | 8.5 | NW | Superior ALF II | 14750 SW 284 St | Homestead | 6 | 6 | 5 | 1 | 0 |
| 7 | 8.5 | WNW | Los Abuelos Felices LLC | 28718 S Dixie Hwy | Homestead | 62 | 62 | 53 | 7 | 2 |
| 7 | 8.5 | NW | Por Una Vida Mejor | 27352 SW 154th Ave | Homestead | 8 | 8 | 7 | 1 | 0 |
| 7 | 8.6 | NW | Serenity Adult Home Care Services[4] | 15401 SW 277th St | Homestead | 6 | 6 | 5 | 1 | 0 |
| 7 | 10.0 | WNW | Loving Heart Corp | 28265 SW 173 Ct | Homestead | 7 | 7 | 6 | 1 | 0 |
| 8 | 6.3 | WNW | Casa de Campo ALF, LLC | 4173 NE 20th St | Homestead | 6 | 6 | 5 | 1 | 0 |
| 8 | 6.6 | WNW | El Viejo Sol ALF Corp | 4163 NE 16th St | Homestead | 6 | 6 | 5 | 1 | 0 |
| 8 | 6.8 | WNW | Homestead Hospital | 975 Baptist Way | Homestead | 147 | 140 | 119 | 16 | 5 |
| 8 | 6.9 | WNW | The Palace At Homestead | 3100 NE 8th St | Homestead | 208 | 208 | 178 | 23 | 7 |
| 8 | 7.0 | WNW | New Horizon Assisted Living | 30110 SW 145th Ct | Homestead | 7 | 7 | 6 | 1 | 0 |
| 8 | 7.0 | WNW | Mi Renacer ALF | 1305 SE 7th St | Homestead | 8 | 8 | 7 | 1 | 0 |
| 8 | 7.1 | NW | Mother Golden Years II | 29332 SW 143rd Ct | Homestead | 6 | 6 | 5 | 1 | 0 |
| 8 | 7.2 | WNW | Superior ALF Inc | 14610 SW 296th St | Homestead | 6 | 6 | 5 | 1 | 0 |
| 8 | 7.3 | WNW | Heaven Assisted Living Facility | 30136 SW 148th Pl | Homestead | 7 | 7 | 6 | 1 | 0 |
| 8 | 7.4 | WNW | Warm Embrace Retirement Home | 30500 SW 152nd Ave | Homestead | 6 | 6 | 5 | 1 | 0 |
| 8 | 7.5 | WNW | Pina & Fuerte Adult Care[4] | 14935 SW 297th St | Homestead | 7 | 7 | 6 | 1 | 0 |
| 8 | 7.5 | WNW | Angele's Assisted Living Facility | 29921 SW 151st Ave | Homestead | 7 | 7 | 6 | 1 | 0 |
| 8 | 7.6 | WNW | Brookwood Gardens Convalescent Center | 1990 S Canal Dr | Homestead | 120 | 120 | 102 | 12 | 6 |
| 8 | 7.6 | NW | Happy Life ALF Inc | 14785 Coolidge Lane | Homestead | 7 | 7 | 6 | 1 | 0 |
| 8 | 7.7 | WNW | Emanuel Adult ALF Inc. [4] | 14950 Leisure Dr | Homestead | 7 | 7 | 6 | 1 | 0 |

| Area | Distance (miles) | Dire- ction | Facility Name | Street Address | Municipality | Capa- city | Current Census | Ambul- atory Patients | Wheel- chair Patients | Bed- ridden Patients |
|---|---|---|---|---|---|---|---|---|---|---|
| 8 | 8.0 | WNW | Alita and John Haran ALF | 1532 Flamingo Ct | Homestead | 6 | 6 | 5 | 1 | 0 |
| 8 | 8.0 | WNW | MD ALF | 15735 SW 303rd Terr | Miami | 6 | 6 | 5 | 1 | 0 |
| 8 | 8.1 | WNW | Orulmila Care ALF | 15700 SW 296th St | Homestead | 6 | 6 | 5 | 1 | 0 |
| 8 | 8.2 | WNW | Casa Bonita ALF, LLC` | 931 NE 17th Terr | Homestead | 6 | 6 | 5 | 1 | 0 |
| 8 | 9.2 | WNW | Sweet Mansion ALF Inc | 16925 SW 300th St | Homestead | 7 | 7 | 6 | 1 | 0 |
| 8 | 9.3 | WNW | Las Mercedes Adult Day Care VI, Inc. [4] | 230 NE 8th St | Homestead | Outpatient only | | | | |
| 8 | 9.4 | WNW | Sara Home Care | 29100 SW 172nd Ave | Homestead | 16 | 16 | 14 | 2 | 0 |
| 8 | 9.5 | WNW | Sol Radiante Inc. | 221 NE 15th St | Homestead | 6 | 6 | 5 | 1 | 0 |
| 8 | 9.7 | WNW | New Era Comm Health Center LLC | 1351 N Krome Ave | Homestead | 210 | 210 | 179 | 23 | 8 |
| 8 | 9.7 | WNW | Krome Apartments - Sunrise Community Inc. | 1102 N Krome Ave | Homestead | 12 | 12 | 10 | 1 | 1 |
| 8 | 9.7 | WNW | Swankridge Holistic Research & Care Center | 122 NW 7th St | Homestead | 12 | 12 | 10 | 1 | 1 |
| 8 | 9.9 | WNW | Homestead Manor | 1330 NW 1st Ave | Homestead | 88 | 88 | 75 | 10 | 3 |
| 8 | 9.9 | WNW | Long Life ALF, LLC | 245 NW 5th Ave | Homestead | 8 | 8 | 7 | 1 | 0 |
| 8 | 9.9 | WNW | Swankridge Care Center | 120 NW 17th St | Homestead | 12 | 12 | 10 | 1 | 1 |
| 8 | 10.0 | W | Aprea Home Health Inc | 840 SW 5th St | Florida City | 8 | 8 | 7 | 1 | 0 |
| 8 | 10.0 | WNW | Homestead Adult Day Care Center[4] | 653 SW 4th St | Homestead | Outpatient only | | | | |
| 8 | 10.1 | W | South Florida Evaluation and Treatment Center | 18680 SW 376th St | Homestead | 249 | 237 | 203 | 26 | 8 |
| 8 | 10.2 | WNW | High Tower ALF LLC | 432 NW 15th St | Homestead | 6 | 6 | 5 | 1 | 0 |
| 8 | 10.2 | WNW | Loreto Homes, INC | 770 NW 9th Ct | Homestead | 6 | 6 | 5 | 1 | 0 |
| | | | | | *Miami-Dade County Subtotal:* | *2,391* | *2,369* | *2,021* | *280* | *68* |
| **MONROE COUNTY** | | | | | | | | | | |
| 10 | 8.5 | SSE | The Medical Center At Ocean Reef | 50 Barracuda Ln | Key Largo | Outpatient only | | | | |
| | | | | | *Monroe County Subtotal:* | - | - | - | - | - |
| | | | | | **EPZ TOTAL:** | **2,391** | **2,369** | **2,021** | **280** | **68** |

## Table E-3. Major Employers[5] within the EPZ

| Area | Distance (miles) | Dire-ction | Facility Name | Street Address | Municipality | Employees (Max Shift) | % Employees Commuting into the EPZ | Employees Commuting into the EPZ | Employee Vehicles Commuting into the EPZ |
|---|---|---|---|---|---|---|---|---|---|
| **MIAMI-DADE COUNTY** | | | | | | | | | |
| Various locations throughout the EPZ[6] | | | | | | 12,770 | 59.6%[7] | 7,611 | 6,856 |
| *Miami-Dade County Subtotal:* | | | | | | *12,770* | - | *7,611* | *6,856* |
| **MONROE COUNTY** | | | | | | | | | |
| Various locations throughout the Ocean Reef Club | | | | | | 2,621 | 56.9% | 1,491 | 1,343 |
| *Monroe County Subtotal[8]:* | | | | | | *2,621* | - | *1,491* | *1,343* |
| **EPZ TOTAL:** | | | | | | **15,391** | **-** | **9,102** | **8,199** |

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[5] The major employer locations identified by the Census Bureau are shown in Figure E-7. The locations are represented by circles which increase in size proportional to the number of employees commuting into the EPZ in each census block.

[6] The employment data for the PTN in Area 1 was provided by FPL. According to FPL, the maximum employment in a single shift is 800. It is conservatively assumed that all the employees are not EPZ residents to accurately depict the evacuation of the PTN site and the 2-Mile Region. Thus, the percent of employees living outside of the EPZ was not applied to the PTN employee number.

[7] The Census LEHD data (see Section 3.4) indicates 56.9% of employees in the EPZ commute in from outside the EPZ. The 800 plant employees were subtracted from the max shift employees and the employees commuting into the EPZ resulting in 59.6% commuting into other major employers in the EPZ. (7,611 – 800) ÷ (12,770 – 800) x 100% = 56.9%

[8] According to the ORC Association, the ORC has an average 2,621 employees on a daily basis within Monroe County. This number was used as the maximum shift employment for the ORC.

### Table E-4. Recreational Areas within the Study Area

| Area | Distance (miles) | Dire-ction | Facility Name | Street Address | Municipality | Facility Type | Transients | Vehicles |
|---|---|---|---|---|---|---|---|---|
| **MIAMI-DADE COUNTY** | | | | | | | | |
| 4 | 2.0 | N | Homestead Bayfront Marina | 9698 SW 328th St | Homestead | Marina | 2,000 | 500 |
| 4 | 2.0 | N | Biscayne National Park (Convoy Point) | 9700 SW 328th St | Homestead | Park | 400 | 70 |
| 6 | 7.1 | N | Black Point Marina | 24775 SW 87th Ave | Miami | Marina | 2,613 | 871 |
| 6 | 7.1 | N | Black Point Park | 24775 SW 87th Ave | Cutler Bay | Park | 4,000 | 1,333 |
| 6 | 9.7 | NNW | South Miami-Dade Cultural Arts Center | 10950 SW 211st St | Cutler Bay | Other, Not Listed | 1,250 | 313 |
| 6 | 10.1 | NNW | Southland Mall | 20505 S Dixie Hwy | Miami | Other, Not Listed | 1,913 | 638 |
| 7 | 8.4 | WNW | Coral Castle Museum | 28655 S Dixie Hwy | Homestead | Other, Not Listed | 50 | 20 |
| 8 | 6.5 | W | Homestead Sports Complex | 1601 SE 28th Ave | Homestead | Park | 364 | 129 |
| 8 | 8.8 | WNW | Harris Field | 1034 NE 8th St | Homestead | Park | 591 | 197 |
| 8 | 8.9 | W | Prime Outlets of Florida City | 250 E Palm Dr | Florida City | Other, Not Listed | 1,858 | 615 |
| S.R. | 10.4 | NW | Camp Owaissa Bauer[9] | 17001 SW 264 St | Miami | Day Camp | 150 | 6[10] |
| S.R. | 12.0 | NNW | Larry & Penny Thompson Memorial Park[8] | 12451 SW 184th St | Miami | Park | 1,360 | 920 |
| | | | | | | *Miami-Dade County Subtotal:* | *16,549* | *5,612* |
| **MONROE COUNTY** | | | | | | | | |
| 10 | 8.0 | SSE | Card Sound Golf Club | 100 Country Club Rd | Key Largo | Golf Course | Included in the table below[11] | |
| 10 | 8.8 | SSE | Key Largo Anglers Club | 50 Clubhouse Rd | Key Largo | Other, Not Listed | | |
| 10 | 8.9 | SSE | Ocean Reef Club Marina | 35 Ocean Reef Dr | Key Largo | Marina | | |
| 10 | 9.1 | SSE | Ocean Reef Yacht Club | 24 Dockside Ln | Key Largo | Marina | | |
| | | | | | | *Monroe County Subtotal:* | - | - |
| | | | | | | **STUDY AREA TOTAL:** | **16,549** | **5,612** |

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[9] As per Miami-Dade County Office of Emergency Management, Camp Owaissa Bauer and Larry & Penny Thompson Memorial Park are located in the S.R. but will be evacuated in the event of an emergency at the PTN due to their close proximity to the EPZ boundary.

[10] Camp Owaissa Bauer will provide three buses, which hold 50 campers each, for evacuation. A bus is equivalent to two passenger vehicles due to its larger size and more sluggish operating characteristics. As such, six vehicles were modeled in the ETE simulations.

[11] These facilities are located in the ORC. As discussed in Section 3.3.1, visitors to these facilities have been included with the ORC transient population provided in Table E-5.

## Table E-5. Lodging Facilities within the EPZ

| Area | Distance (miles) | Dire-ction | Facility Name | Street Address | Municipality | Transients | Vehicles |
|---|---|---|---|---|---|---|---|
| MIAMI-DADE COUNTY, FL | | | | | | | |
| 6 | 9.3 | NNW | Kent Motel | 22345 S Dixie Hwy | Miami | 48 | 12 |
| 6 | 10.1 | NNW | Motel 6 (Best Western Floridian Hotel) | 10775 Caribbean Blvd | Miami | 600 | 150 |
| 6 | 10.2 | NNW | La Quinta Inn | 10821 Caribbean Blvd | Cutler Bay | 412 | 103 |
| 7 | 8.4 | NW | American Best Inn | 26480 S Dixie Hwy | Homestead | 71 | 25 |
| 7 | 8.4 | WNW | Deluxe Inn Motel | 28475 S Dixie Hwy | Homestead | 44 | 15 |
| 8 | 7.1 | WNW | TownePlace Suites by Marriott | 935 NE 30th Terr | Homestead | 274 | 97 |
| 8 | 7.1 | WNW | Courtyard by Marriott | 2905 N E 9th St | Homestead | 282 | 100 |
| 8 | 7.2 | WNW | Hampton Inn & Suites | 2855 N E 9th St | Homestead | 355 | 126 |
| 8 | 7.2 | WNW | BEST STUDIO INN | 2750 NE 8th St | Homestead | 341 | 121 |
| 8 | 7.3 | WNW | Uptown Suites Extended Stay | 1071 Northeast 28th Terr | Homestead | 358 | 127 |
| 8 | 8.9 | WNW | A-1 Budget Motel | 30600 S Dixie Hwy | Homestead | 49 | 17 |
| 8 | 8.9 | WNW | The Inn of Homestead | 1020 N Homestead Blvd | Homestead | 123 | 43 |
| 8 | 8.9 | WNW | Floridian Hotel of Homestead | 990 N Homestead Blvd | Homestead | 345 | 119 |
| 8 | 9.0 | W | Travelodge - Florida City | 409 SE 1st Ave | Florida City | 264 | 88 |
| 8 | 9.0 | W | Quality Inn (Comfort Inn Florida City Hotel) | 333 SE First Ave | Florida City | 496 | 124 |
| 8 | 9.0 | W | Ramada Inn Florida City (Hampton Inn) | 124 E Palm Dr | Florida City | 354 | 85 |
| 8 | 9.0 | W | Holiday Inn Express | 35200 S Dixie Hwy | Florida City | 200 | 100 |
| 8 | 9.1 | W | Fairway Inn | 100 SE 1st Ave | Florida City | 394 | 136 |
| 8 | 9.1 | W | Baymont by Wyndham | 553 NE 1st Ave | Florida City | 104 | 36 |
| 8 | 9.1 | W | Home2 Suites by Hilton | 77 NE 3rd St | Florida City | 271 | 96 |
| 8 | 9.1 | WNW | Garden Inn Homestead | 51 S Homestead Blvd | Homestead | 187 | 94 |
| 8 | 9.1 | W | Best Western Gateway to the Keys | 411 S Krome Ave | Florida City | 281 | 97 |
| 8 | 9.2 | W | Knights Inn Florida City Hotel (Sea Glades Hotel) | 1223 NE 1st Ave | Florida City | 70 | 35 |
| 8 | 9.2 | W | Country Lodge | 651 N Krome Ave | Florida City | 89 | 31 |
| 8 | 9.3 | W | Budget Host (Roadway Inn) | 815 N Krome Ave | Florida City | 90 | 45 |
| 8 | 9.3 | W | Holiday Motel | 1405 N Krome Ave | Florida City | 62 | 22 |
| 8 | 9.3 | W | Coral Roc Motel | 1100 N Krome Ave | Florida City | 30 | 10 |
| 8 | 9.3 | W | Super 8 by Wyndham | 1202 N Krome Ave | Florida City | 62 | 22 |
| 8 | 9.3 | WNW | Everglades Motel | 605 S Krome Ave | Homestead | 25 | 8 |
| 8 | 9.4 | WNW | Hotel Redland | 5 S Flagler Ave | Homestead | 41 | 22 |
| 8 | 9.4 | WNW | Park Motel | 600 S Krome Ave | Homestead | 52 | 18 |

| Area | Distance (miles) | Dire-ction | Facility Name | Street Address | Municipality | Transients | Vehicles |
|---|---|---|---|---|---|---|---|
| 8 | 9.4 | WNW | Anhinga Motel | 250 S Krome Ave | Homestead | 99 | 34 |
| 8 | 9.6 | WNW | NEXX Motel | 841 N Krome Ave | Homestead | 103 | 34 |
| 8 | 9.6 | WNW | Budget Host Inn | 815 N Krome Ave | Florida City | 127 | 45 |
| 8 | 9.6 | WNW | Tradewinds Motel | 846 N Krome Ave | Homestead | 21 | 11 |
| 8 | 9.7 | WNW | Bel Air Motel | 1202 N Krome Ave | Homestead | 104 | 26 |
| | | | | | *Miami- Dade County Subtotal:* | *6,828* | *2,274* |
| **MONROE COUNTY, FL** | | | | | | | |
| | | | Various locations throughout Ocean Reef Club[12] | | | 4,436 | 2,543 |
| | | | | | *Monroe County Subtotal:* | *4,436* | *2,543* |
| | | | | | **EPZ TOTAL:** | **11,264** | **4,817** |

## Table E-6. Correctional Facilities within the EPZ

| Area | Distance (miles) | Dire-ction | Facility Name | Street Address | Municipality | Cap-acity | Current Census |
|---|---|---|---|---|---|---|---|
| **MIAMI-DADE COUNTY, FL** | | | | | | | |
| 6 | 9.7 | NNW | Miami-Dade Police Department | 10800 SW 211 St | Cutler Bay | 45 | 45[13] |
| 9 | 10.2 | WSW | Dade Juvenile Residential Facility | 18500 SW 424th St | Florida City | 55 | 55 |
| | | | | | *Miami- Dade County Subtotal:* | *100* | *100* |
| | | | | | **EPZ TOTAL:** | **100** | **100** |

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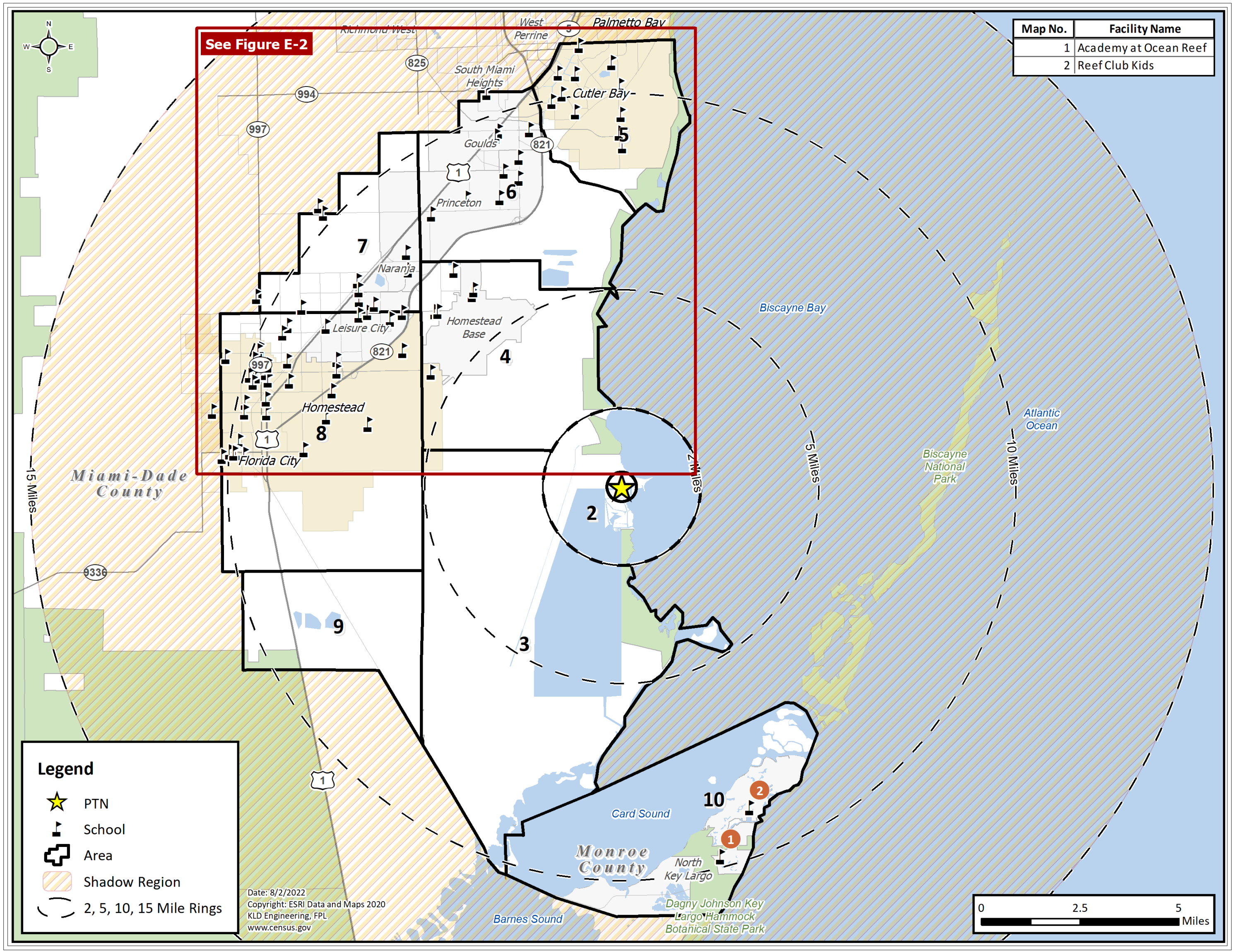
[12] Refer to Section 3 for detailed discussion of the data and methodology used to estimate transient population and vehicles at the ORC.

[13] The current census for the Miami-Dade Police Department temporary holding facility is unavailable. The current census was assumed to be equal to the capacity. Refer to Section 3.10 for additional information.



| Map No. | Facility Name |
|---|---|
| 1 | Academy at Ocean Reef |
| 2 | Reef Club Kids |

Date: 8/2/2022
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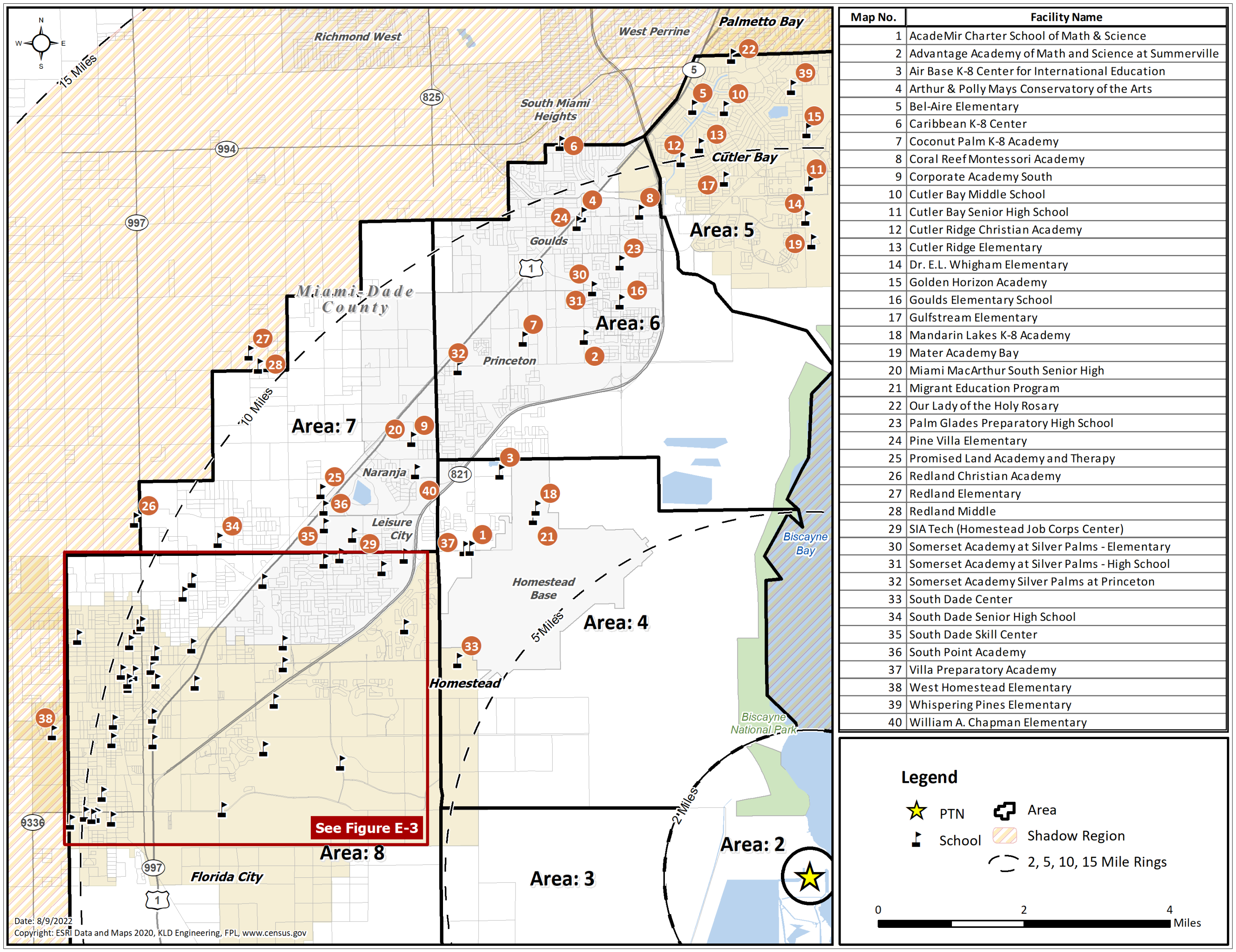
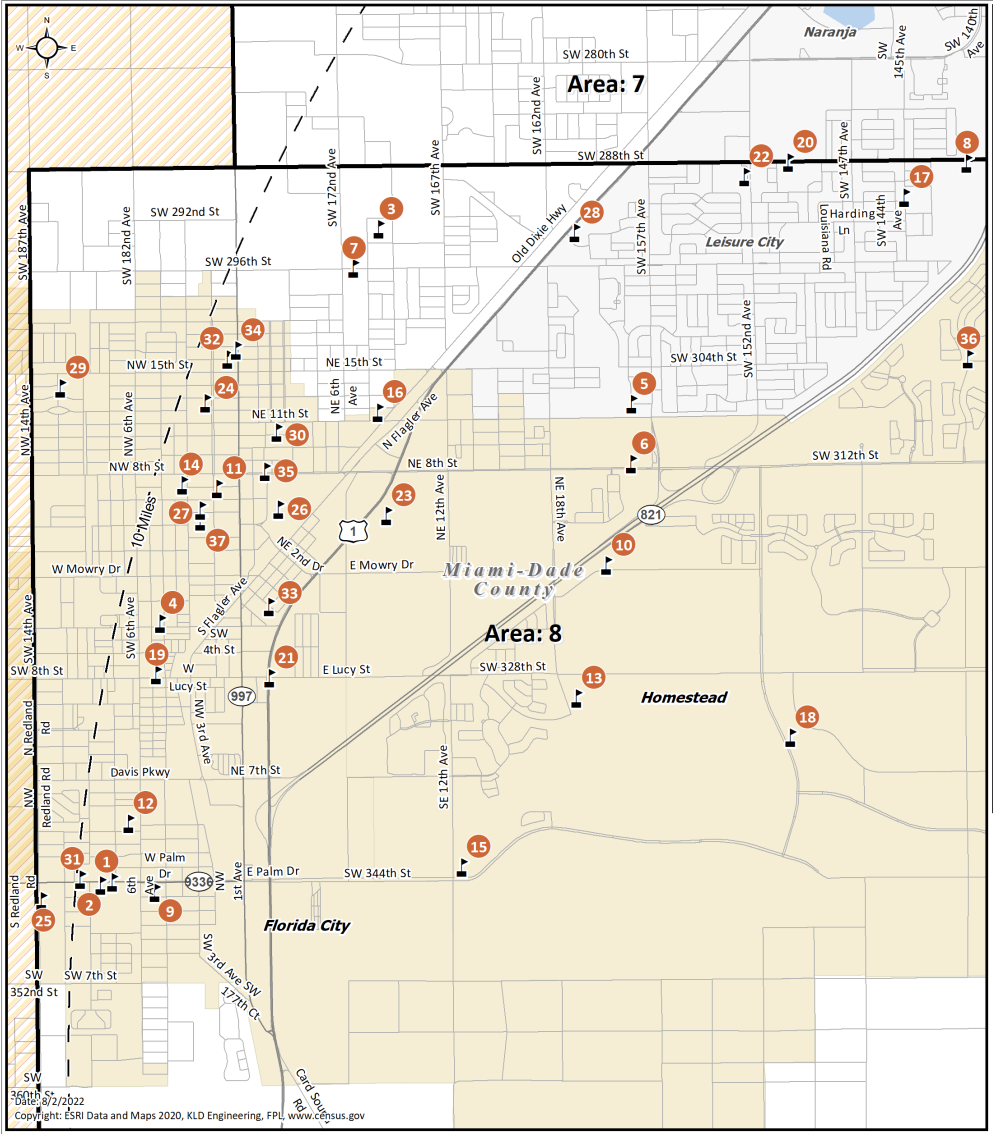
KLD Engineering, FPL
www.census.gov

Figure E-1. Overview of Schools within the PTN Study Area



| Map No. | Facility Name |
|---|---|
| 1 | AcadeMir Charter School of Math & Science |
| 2 | Advantage Academy of Math and Science at Summerville |
| 3 | Air Base K-8 Center for International Education |
| 4 | Arthur & Polly Mays Conservatory of the Arts |
| 5 | Bel-Aire Elementary |
| 6 | Caribbean K-8 Center |
| 7 | Coconut Palm K-8 Academy |
| 8 | Coral Reef Montessori Academy |
| 9 | Corporate Academy South |
| 10 | Cutler Bay Middle School |
| 11 | Cutler Bay Senior High School |
| 12 | Cutler Ridge Christian Academy |
| 13 | Cutler Ridge Elementary |
| 14 | Dr. E.L. Whigham Elementary |
| 15 | Golden Horizon Academy |
| 16 | Goulds Elementary School |
| 17 | Gulfstream Elementary |
| 18 | Mandarin Lakes K-8 Academy |
| 19 | Mater Academy Bay |
| 20 | Miami MacArthur South Senior High |
| 21 | Migrant Education Program |
| 22 | Our Lady of the Holy Rosary |
| 23 | Palm Glades Preparatory High School |
| 24 | Pine Villa Elementary |
| 25 | Promised Land Academy and Therapy |
| 26 | Redland Christian Academy |
| 27 | Redland Elementary |
| 28 | Redland Middle |
| 29 | SIA Tech (Homestead Job Corps Center) |
| 30 | Somerset Academy at Silver Palms - Elementary |
| 31 | Somerset Academy at Silver Palms - High School |
| 32 | Somerset Academy Silver Palms at Princeton |
| 33 | South Dade Center |
| 34 | South Dade Senior High School |
| 35 | South Dade Skill Center |
| 36 | South Point Academy |
| 37 | Villa Preparatory Academy |
| 38 | West Homestead Elementary |
| 39 | Whispering Pines Elementary |
| 40 | William A. Chapman Elementary |

Figure E-2. Schools within the PTN Study Area – Areas 4, 5, 6, 7 and Shadow Region



| Map No. | Facility Name |
|---|---|
| 1 | Advanced Achievers Academy |
| 2 | Avant Schools of Excellence |
| 3 | Avocado Elementary |
| 4 | Barrington Academy |
| 5 | Campbell Drive K-8 Center |
| 6 | Center For International Education |
| 7 | Colonial Christian School |
| 8 | Discovery Montessori Academy |
| 9 | Ebenezer Christian School |
| 10 | Everglades Preparatory Academy |
| 11 | First United Methodist Christian School |
| 12 | Florida City Elementary |
| 13 | Gateway Environmental K-8 |
| 14 | Homestead Middle |
| 15 | Homestead Senior High School |
| 16 | Hope Academy |
| 17 | Irving & Beatrice Peskoe K-8 Center |
| 18 | Keys Gate Charter School |
| 19 | Laura C. Saunders Elementary |
| 20 | Leisure City K-8 Center |
| 21 | Lincoln-Marti Charter Schools International Campus |
| 22 | Lincoln Marti School |
| 23 | Mavericks High of South Miami Dade County |
| 24 | Medical Academy For Science and Technology |
| 25 | Miami Community Charter School |
| 26 | Miami Dade College - Homestead Campus |
| 27 | Neva King Cooper Educational Center |
| 28 | Redland Center |
| 29 | Redondo Elementary School |
| 30 | Saint John's Episcopal School |
| 31 | Shepherd of God Christian Academy |
| 32 | Somerset Academy Charter Middle School at Country Palms |
| 33 | Somerset Academy South Homestead |
| 34 | Somerset Arts Academy |
| 35 | South Dade Technical College |
| 36 | The Charter School at Waterstone |
| 37 | The Thinking Child Academy |

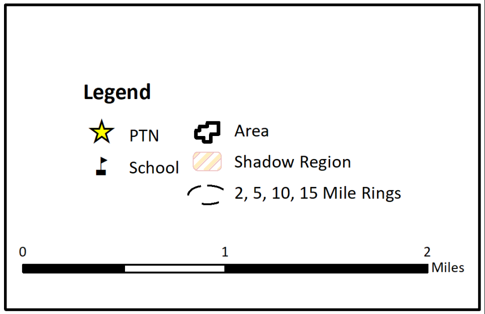
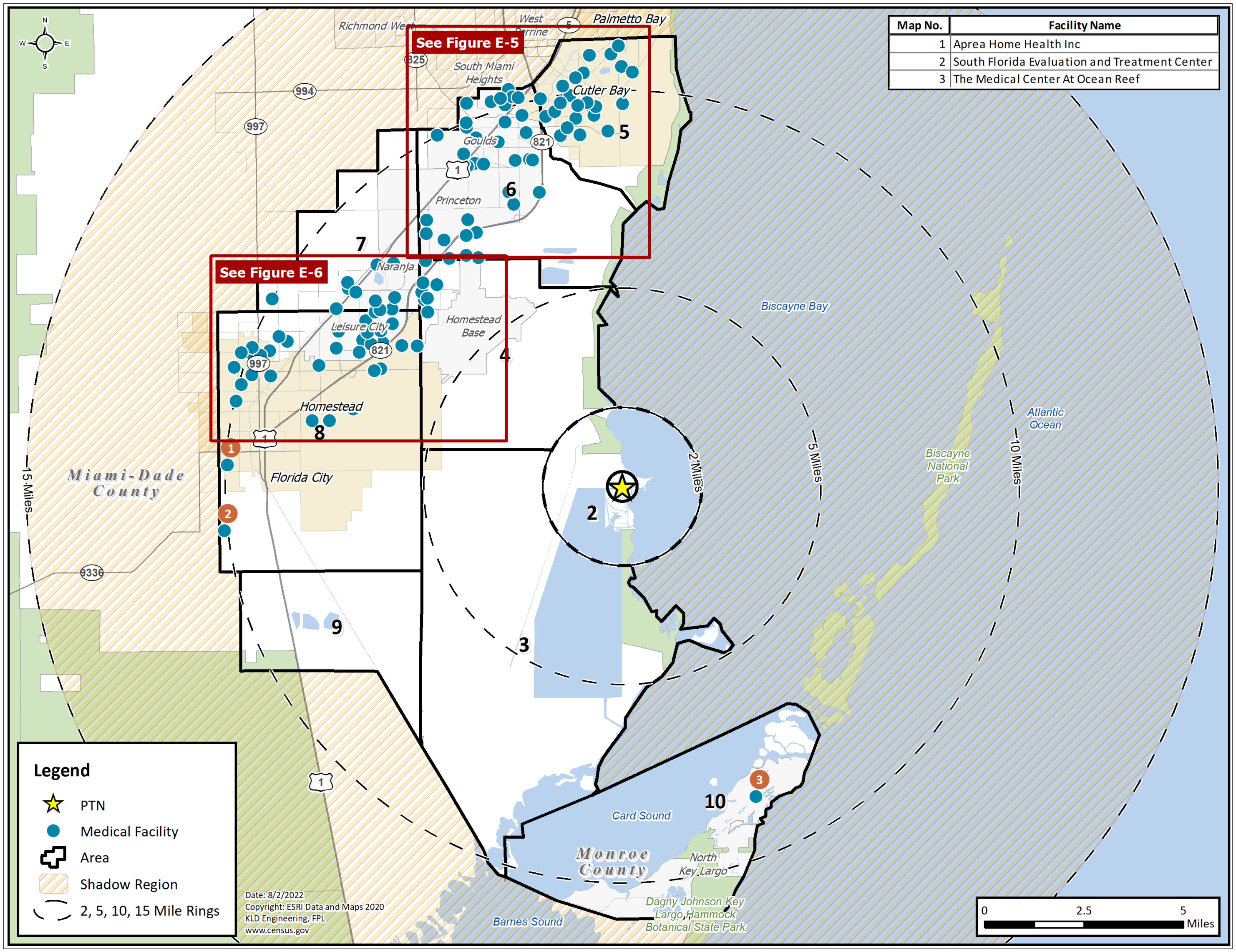


Figure E-3. Schools within the PTN Study Area – Area 8



| Map No. | Facility Name |
|---|---|
| 1 | Aprea Home Health Inc |
| 2 | South Florida Evaluation and Treatment Center |
| 3 | The Medical Center At Ocean Reef |

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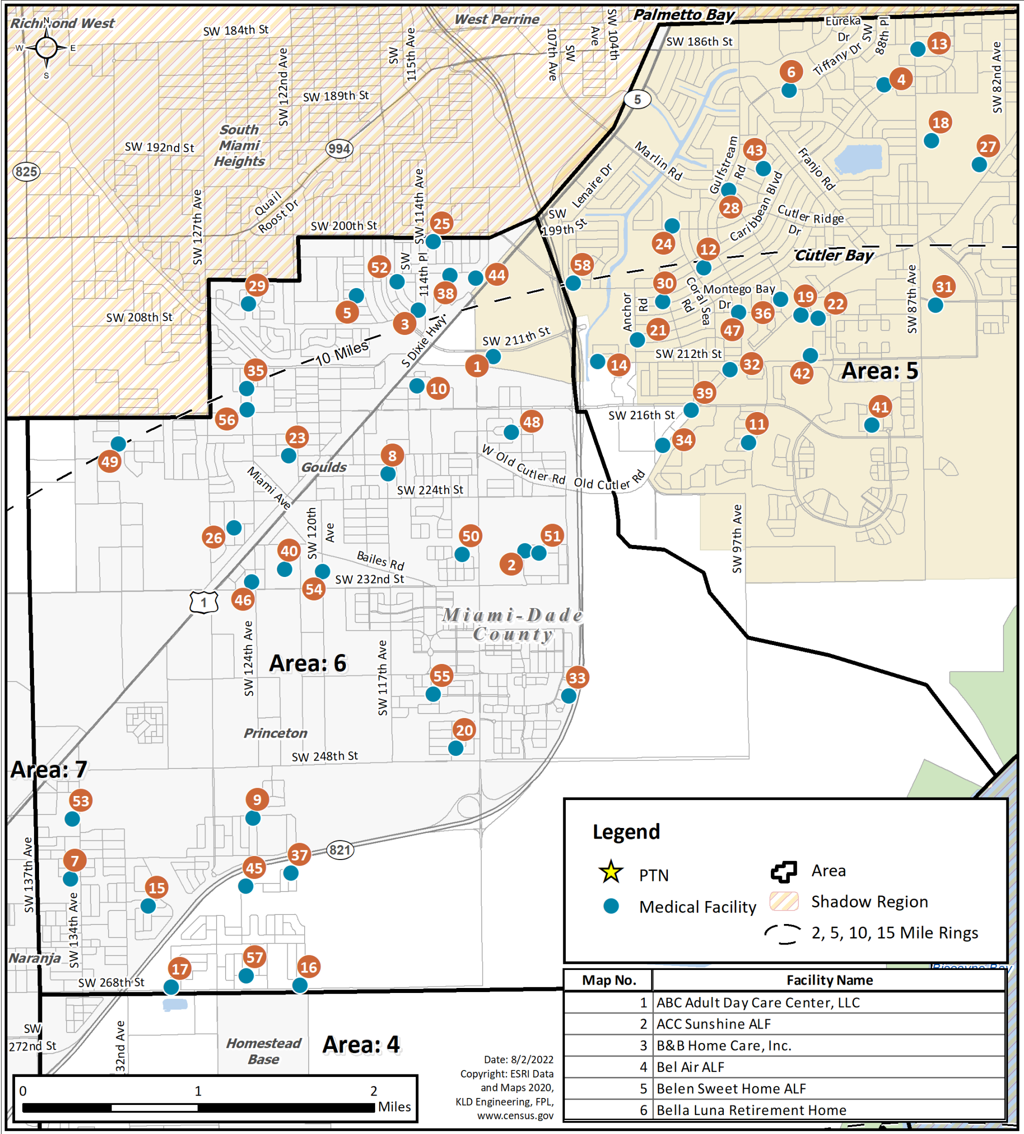
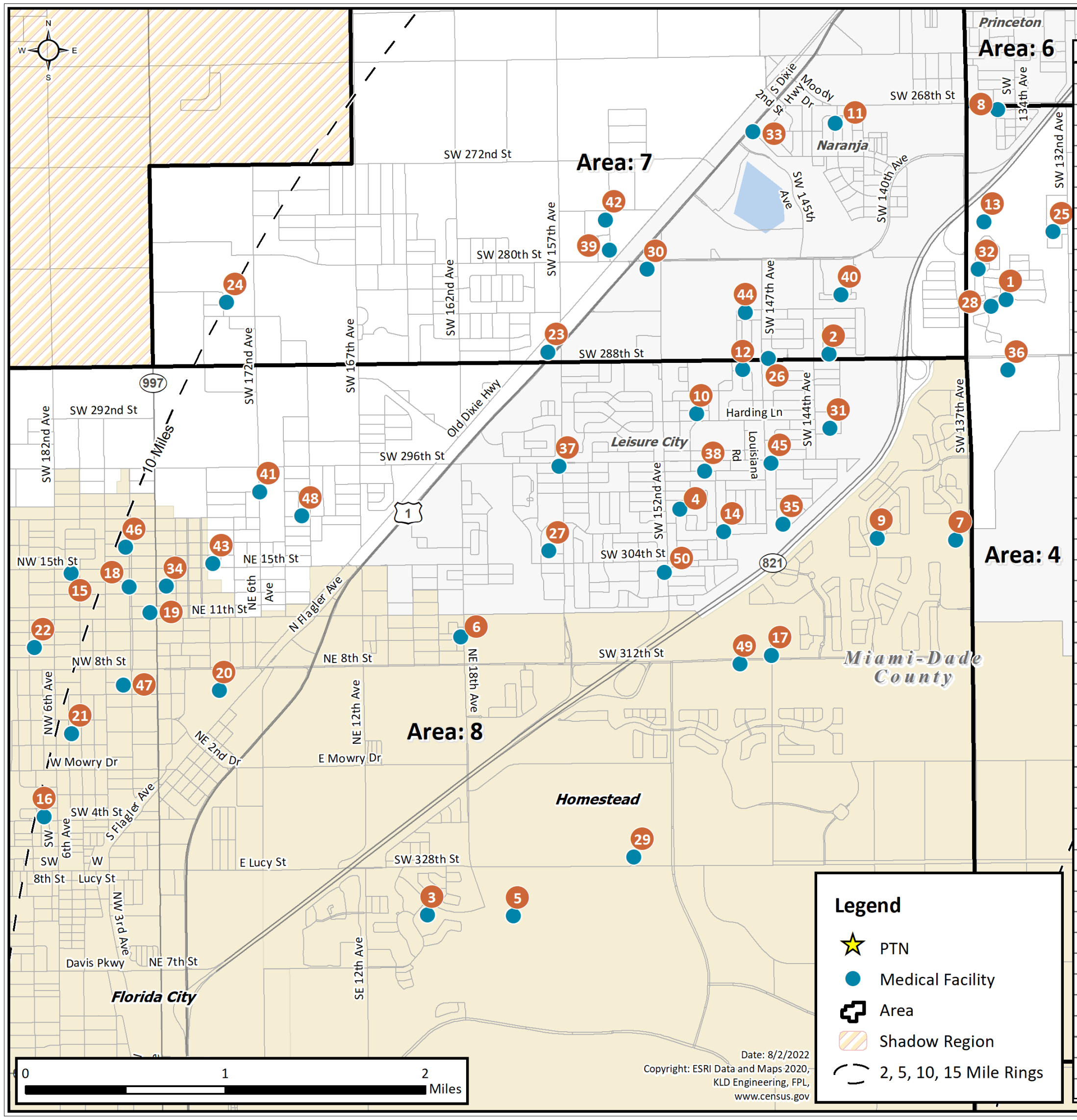
Figure E-4. Overview of Medical Facilities within the PTN EPZ



| Map No. | Facility Name |
|---|---|
| 1 | ABC Adult Day Care Center, LLC |
| 2 | ACC Sunshine ALF |
| 3 | B&B Home Care, Inc. |
| 4 | Bel Air ALF |
| 5 | Belen Sweet Home ALF |
| 6 | Bella Luna Retirement Home |
| 7 | Beyond Our Dreams ALF, Corp. |
| 8 | Biscayne Villa Assisted Living |
| 9 | Blanca Azuzena Homecare |
| 10 | Blessing Time ALF, Inc. |
| 11 | Blue Point Home Care |
| 12 | Caribbean ALF |
| 13 | Cutler Bay Assisted Living Corp |
| 14 | Cutler Bay Village |
| 15 | Del Real Home Care, Inc. |
| 16 | Diaz Home Care ALF II Inc. |
| 17 | Duran Home Care Corp |
| 18 | East Ridge Retirement Village |
| 19 | Encompass Health Rehabilitation Hospital of Miami |
| 20 | God Is First ALF, Inc |
| 21 | Guardian Angel ALF |
| 22 | Harmony Family Home |
| 23 | Ifa Lola ALF |
| 24 | Isabella"s Paradise ALF LLC |
| 25 | Ive Home |
| 26 | Ive Home II ALF |
| 27 | Jackson Memorial Perdue Medical Center |
| 28 | Jean Carlos ALF, Inc. |
| 29 | Jimenez Senior Care |
| 30 | Kenneth Home Inc |
| 31 | Laugh to Live ALF Inc. |
| 32 | Living Well ALF Corporation |
| 33 | Living Well ALF, Co. |
| 34 | M & Y ALF, INC. |
| 35 | Margreg Facilities, Corp. |
| 36 | Marlin Retirement ALF |
| 37 | Meadow Wood Homes LLC |
| 38 | My Sweet Home |
| 39 | Old Cutler Retirement Home |
| 40 | Osmani M ALF LLC |
| 41 | Paradise Home ALF, CORP. |
| 42 | Paradise Villa ALF, Inc. |
| 43 | Precious Moments ALF, INC |
| 44 | Rafaela's Home ALF II |
| 45 | RC Dreams Home Care Inc |
| 46 | Rick and Dauvy ALF Inc. |
| 47 | Rodeck One Inc |
| 48 | Santos ALF Corp |
| 49 | Sarria Machin Corp |
| 50 | Silver Palm ALF, Corp. |
| 51 | St. Mary Adult Care II |
| 52 | Suany's Home |
| 53 | Sunny Hills of Homestead ALF |
| 54 | Sylvia's Senior Home |
| 55 | United Lives Leisure Facilities, Inc. |
| 56 | Vereda Nueva, INC |
| 57 | Vicky's ALF |
| 58 | Wellness Advantage Home Care, Inc. |

Figure E-5. Medical Facilities within the PTN EPZ – Areas 5 and 6



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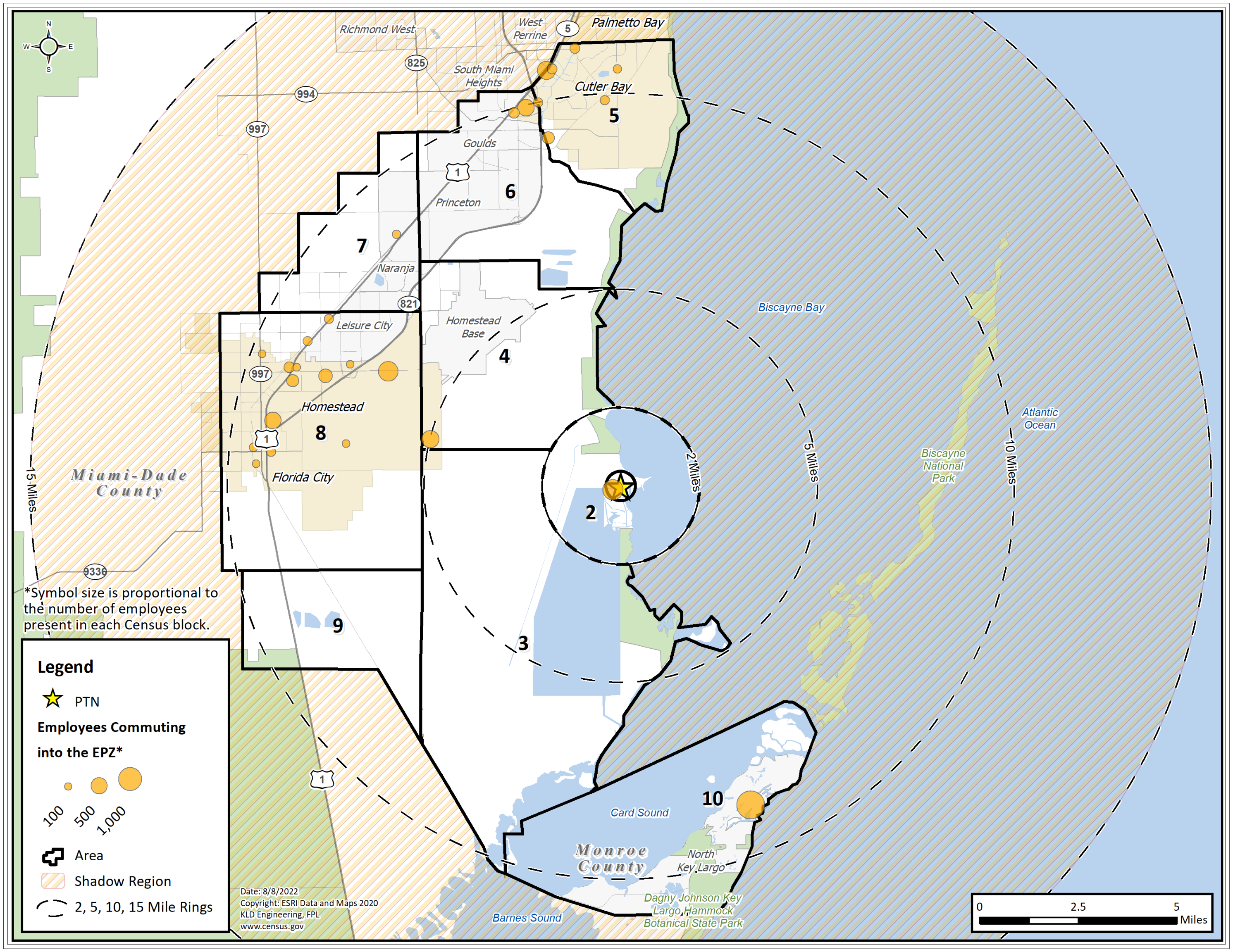
| Map No. | Facility Name |
|---|---|
| 1 | A Senior Living Dream |
| 2 | Advance ALF |
| 3 | Alita and John Haran ALF |
| 4 | Angele's Assisted Living Facility |
| 5 | Brookwood Gardens Convalescent Center |
| 6 | Casa Bonita ALF, LLC` |
| 7 | Casa de Campo ALF, LLC |
| 8 | Diaz Home Care ALF |
| 9 | El Viejo Sol ALF Corp |
| 10 | Emanuel Adult ALF Inc. |
| 11 | Family Welfare, LLC |
| 12 | Happy Life ALF Inc |
| 13 | Health Paradise ALF1 |
| 14 | Heaven Assisted Living Facility |
| 15 | High Tower ALF LLC |
| 16 | Homestead Adult Day Care Center |
| 17 | Homestead Hospital |
| 18 | Homestead Manor |
| 19 | Krome Apartments - Sunrise Community Inc. |
| 20 | Las Mercedes Adult Day Care VI, Inc. |
| 21 | Long Life ALF,LLC |
| 22 | Loreto Homes, INC |
| 23 | Los Abuelos Felices LLC |
| 24 | Loving Heart Corp |
| 25 | M J Quality Care |
| 26 | Maria Home Care Corp. |
| 27 | MD ALF |
| 28 | Merline's Place |
| 29 | Mi Renacer ALF |
| 30 | Mis Abuelitos Felices Adult Day Care INC |
| 31 | Mother Golden Years II |
| 32 | Mother Golden Years III |
| 33 | Naranja Group Home |
| 34 | New Era Comm Health Center llc |
| 35 | New Horizon Assisted Living |
| 36 | Open Arms ALF, Inc |
| 37 | Orulmila Care ALF |
| 38 | Pina & Fuerte Adult Care |
| 39 | Por Una Vida Mejor |
| 40 | San Rafael Home Health Inc. |
| 41 | Sara Home Care |
| 42 | Serenity Adult Home Care Services |
| 43 | Sol Radiante Inc. |
| 44 | Superior ALF II |
| 45 | Superior ALF Inc |
| 46 | Swankridge Care Center |
| 47 | Swankridge Holistic Research & Care Center |
| 48 | Sweet Mansion ALF Inc |
| 49 | The Palace At Homestead |
| 50 | Warm Embrace Retirement Home |

Figure E-6. Medical Facilities within the PTN EPZ – Areas 4, 7 and 8



*Symbol size is proportional to the number of employees present in each Census block.

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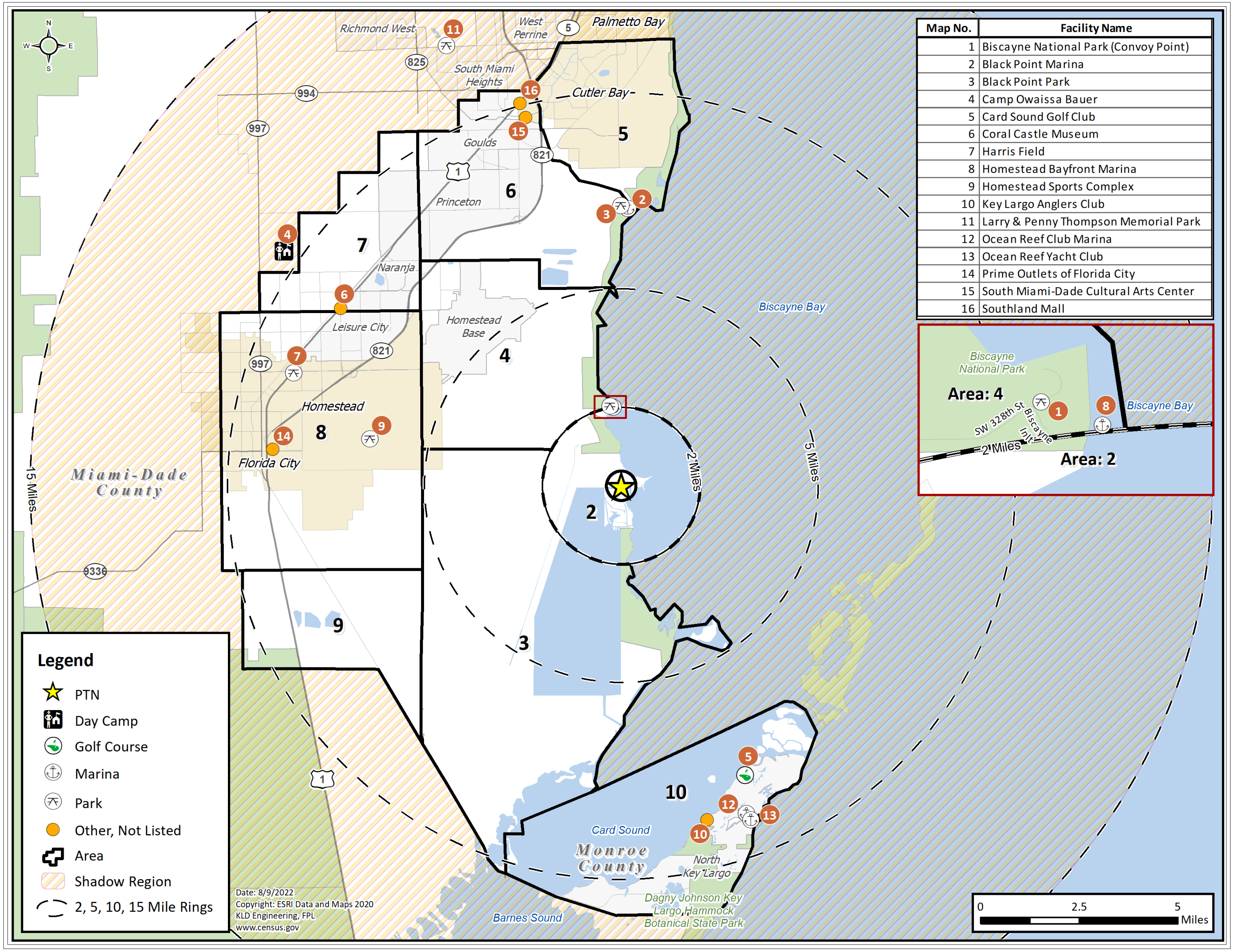
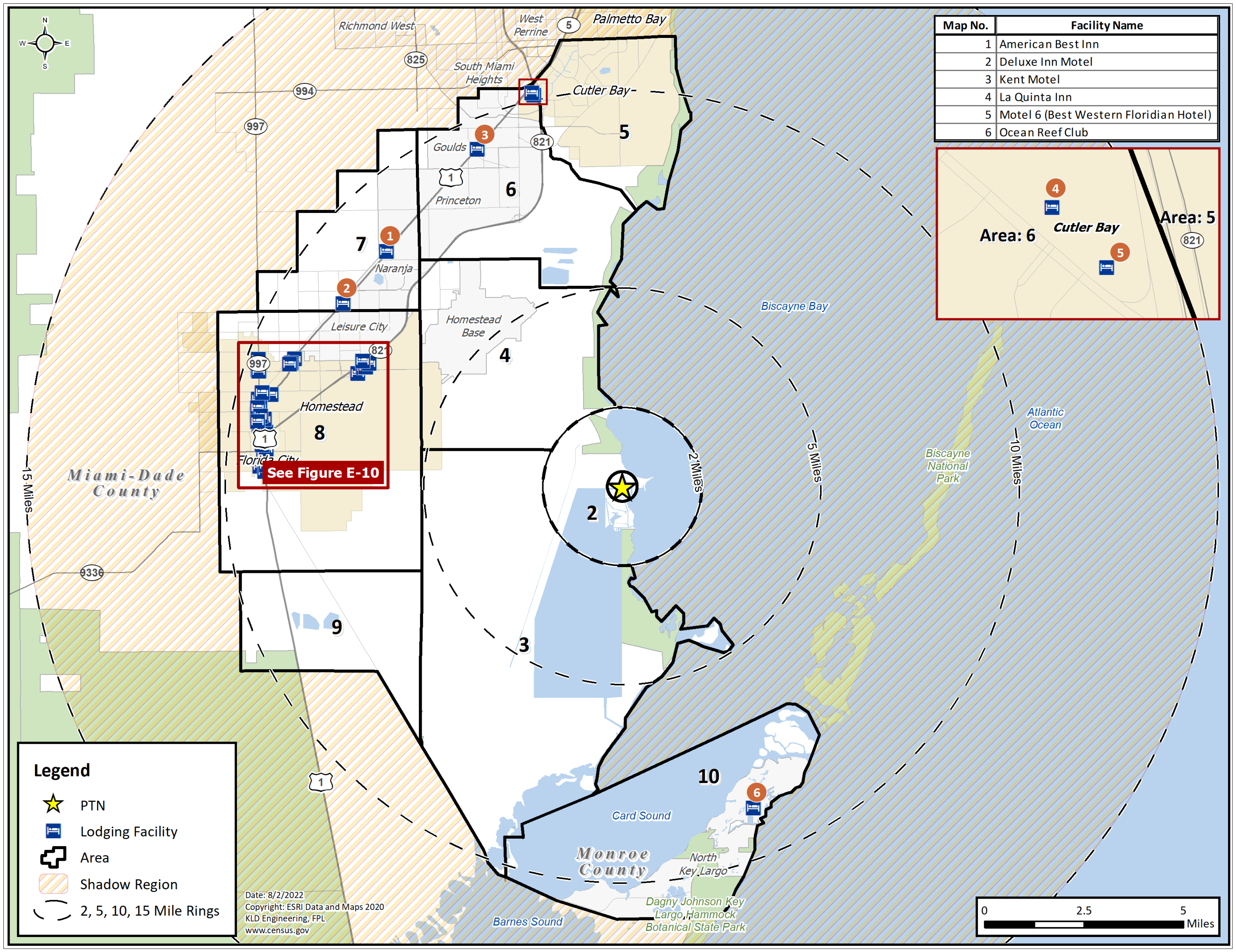
Figure E-7. Major Employers within the PTN EPZ



| Map No. | Facility Name |
|---|---|
| 1 | Biscayne National Park (Convoy Point) |
| 2 | Black Point Marina |
| 3 | Black Point Park |
| 4 | Camp Owaissa Bauer |
| 5 | Card Sound Golf Club |
| 6 | Coral Castle Museum |
| 7 | Harris Field |
| 8 | Homestead Bayfront Marina |
| 9 | Homestead Sports Complex |
| 10 | Key Largo Anglers Club |
| 11 | Larry & Penny Thompson Memorial Park |
| 12 | Ocean Reef Club Marina |
| 13 | Ocean Reef Yacht Club |
| 14 | Prime Outlets of Florida City |
| 15 | South Miami-Dade Cultural Arts Center |
| 16 | Southland Mall |

Figure E-8. Recreational Areas within the PTN Study Area



| Map No. | Facility Name |
|---|---|
| 1 | American Best Inn |
| 2 | Deluxe Inn Motel |
| 3 | Kent Motel |
| 4 | La Quinta Inn |
| 5 | Motel 6 (Best Western Floridian Hotel) |
| 6 | Ocean Reef Club |

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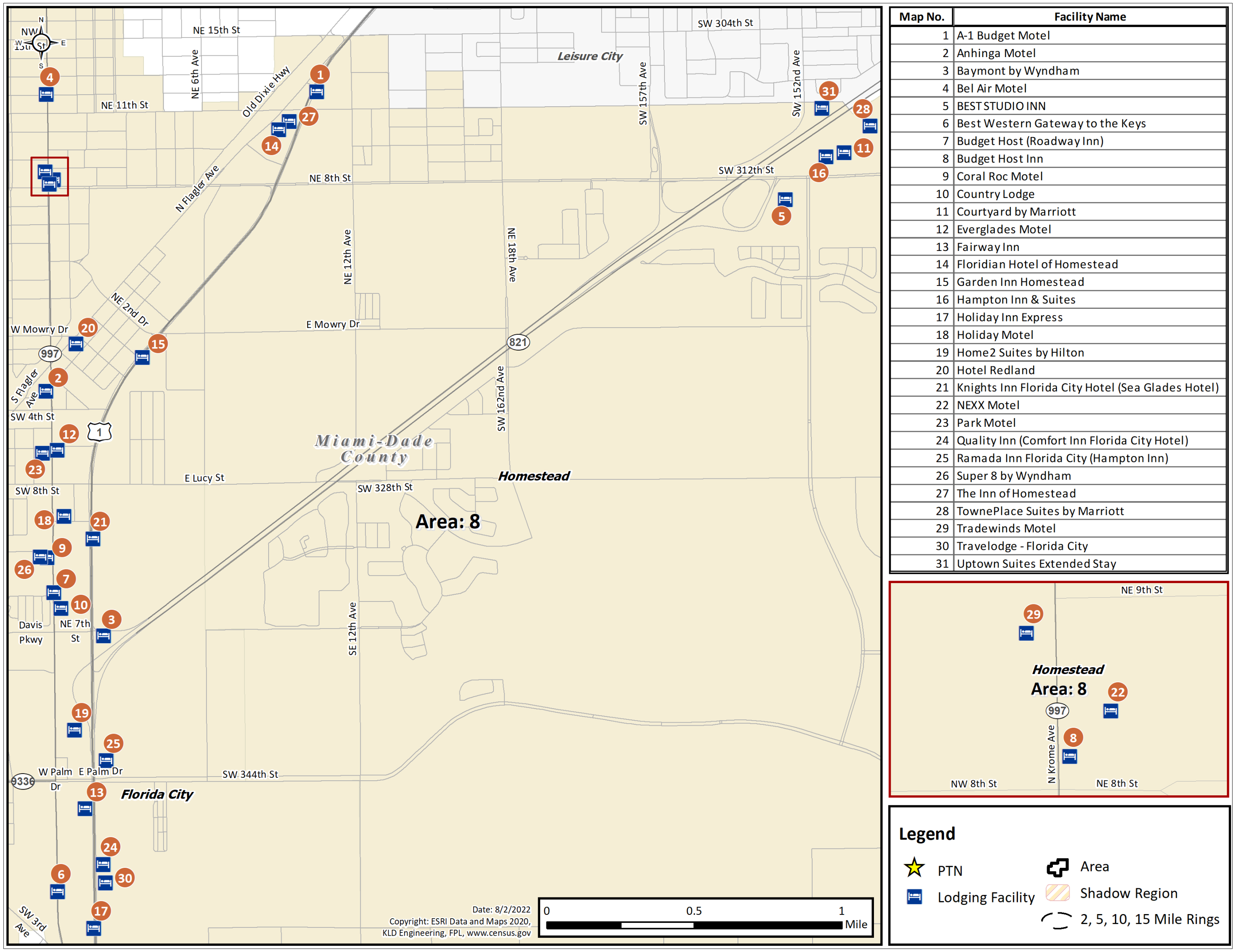
Figure E-9. Overview of Lodging Facilities within the PTN EPZ



| Map No. | Facility Name |
|---|---|
| 1 | A-1 Budget Motel |
| 2 | Anhinga Motel |
| 3 | Baymont by Wyndham |
| 4 | Bel Air Motel |
| 5 | BEST STUDIO INN |
| 6 | Best Western Gateway to the Keys |
| 7 | Budget Host (Roadway Inn) |
| 8 | Budget Host Inn |
| 9 | Coral Roc Motel |
| 10 | Country Lodge |
| 11 | Courtyard by Marriott |
| 12 | Everglades Motel |
| 13 | Fairway Inn |
| 14 | Floridian Hotel of Homestead |
| 15 | Garden Inn Homestead |
| 16 | Hampton Inn & Suites |
| 17 | Holiday Inn Express |
| 18 | Holiday Motel |
| 19 | Home2 Suites by Hilton |
| 20 | Hotel Redland |
| 21 | Knights Inn Florida City Hotel (Sea Glades Hotel) |
| 22 | NEXX Motel |
| 23 | Park Motel |
| 24 | Quality Inn (Comfort Inn Florida City Hotel) |
| 25 | Ramada Inn Florida City (Hampton Inn) |
| 26 | Super 8 by Wyndham |
| 27 | The Inn of Homestead |
| 28 | TownePlace Suites by Marriott |
| 29 | Tradewinds Motel |
| 30 | Travelodge - Florida City |
| 31 | Uptown Suites Extended Stay |

Figure E-10. Lodging Facilities within the PTN EPZ – Area 8

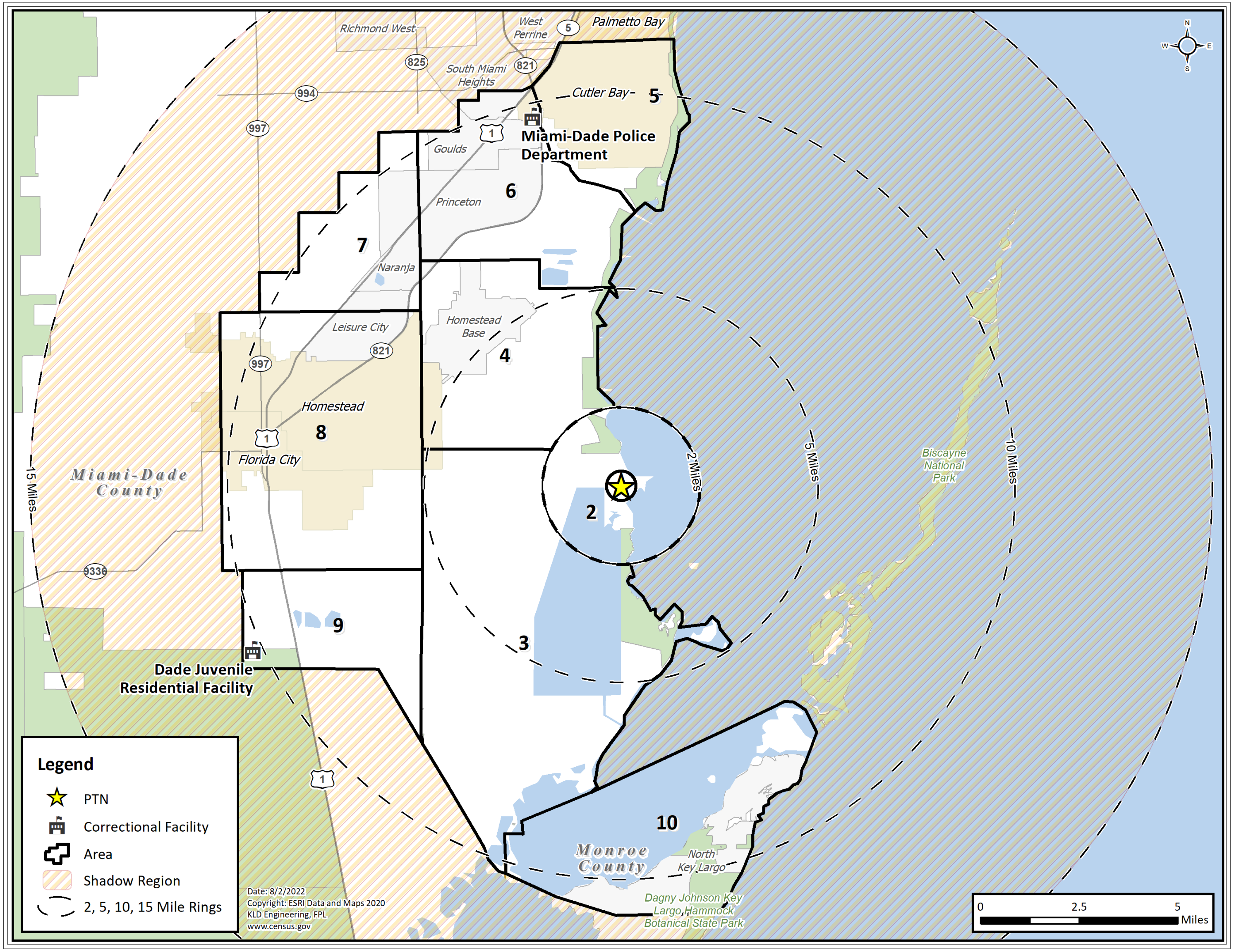


Figure E-11. Correctional Facilities within the PTN EPZ

# APPENDIX F

Demographic Survey

# F. DEMOGRAPHIC SURVEY

## F.1 Introduction

The development of ETE for the PTN EPZ requires the identification of travel patterns, car ownership, and household size of the population within the EPZ. Demographic information can be obtained from Census data. The use of this data, however, has several limitations when applied to emergency planning. First, the Census data do not encompass the range of information needed to identify the time required for preliminary activities (mobilization) that must be undertaken prior to evacuating the area. Secondly, Census data do not contain attitudinal responses needed from the population of the EPZ and consequently may not accurately represent the anticipated behavioral characteristics of the evacuating populace.

These concerns are addressed by conducting a demographic survey of a representative sample of the EPZ population. The survey is designed to elicit information from the public concerning family demographics and estimates of response times to well defined events. The design of the survey includes a limited number of questions of the form "What would you do if …?" and other questions regarding activities with which the respondent is familiar ("How long does it take you to …?").

## F.2 Survey Instrument and Sampling Plan

Attachment A presents the final survey instrument used for the demographic survey in this study. A draft of the instrument was submitted to stakeholders for comment. Comments were received and the survey instrument was modified accordingly, prior to conducting the survey. The survey was available in English and in Spanish.

Following the completion of the instrument, a sampling plan was developed. Since the demographic survey discussed herein was originally performed in July 2021 (prior to the release of the 2020 Census data), the 2010 Census data was used to develop the sampling plan.

A sample size of 471 **completed** survey forms yields results with a sampling error of ±4.5% at the 95% confidence level. The sample must be drawn from the EPZ population. Consequently, a list of zip codes in the EPZ was developed using GIS software. This list is shown in Table F-1. An estimate of the population and number of households in each zip code was determined by overlaying 2010 Census data and the EPZ boundary, again using GIS software. The proportional number of desired completed survey interviews for each zip code was identified, as shown in Table F-1. Note that the average household size computed in Table F-1 was an estimate for sampling purposes and was not used in the ETE study.

The demographic survey was originally advertised in late July 2021. A total of 132 completed surveys was obtained, corresponding to a sampling error of ±8.5% at the 95% confidence level for the number of households in the EPZ according to the 2010 Census. The number of samples obtained was significantly less than the desired sampling plan. After discussions with FPL, the decision was made to readvertise the survey in April 2022. A total of 382 additional completed surveys was received. This increased the total number of **completed** surveys received to 514 and reduced the sampling error to ±4.3%. The number of samples obtained within each zip code is also shown in Table F-1.

## F.3 Survey Results

The results of the survey fall into two categories. First, the household demographics of the area can be identified. Demographic information includes such factors as household size, automobile ownership, and automobile availability. The distributions of the time to perform certain pre-evacuation activities are the second category of survey results. These data are processed to develop the trip generation distributions used in the evacuation modeling effort, as discussed in Section 5.

A review of the survey instrument reveals that several questions have a "I would rather not answer" entry for a response. It is accepted practice in conducting surveys of this type to accept the answers of a respondent who offers a "I would rather not answer" response or who refuses to answer a few questions. To address the issue of occasional "I would rather not answer" responses from a large sample, the practice is to assume that the distribution of these responses is the same as the underlying distribution of the positive responses. In effect, the "I would rather not answer" responses are ignored, and the distributions are based upon the positive data that is acquired.

### F.3.1 Household Demographic Results

Household Size

Figure F-1 presents the distribution of household size within the EPZ, based on the responses to the demographic survey. The average household contains 2.82[1] people. The estimated average household size from the 2020 Census data is 2.95 people, which is in good agreement with the results of the demographic survey. The percent difference between the 2020 Census data and the survey data is 4.4%, which is consistent with the sampling error of ±4.3% discussed in Section F.2.

The average household size (2.10 people) in Monroe County was also computed using the survey samples obtained from zip codes in Monroe County. Figure F-2 presents the distribution of household size within Monroe County.

Seasonal Residents

There were 48 households (9.3% of the households surveyed) with seasonal residents within the EPZ. Of these households that contain seasonal residents, 27.3% of the homes have one seasonal resident, 59.1% have two seasonal residents, and 13.6% have three or more seasonal residents, as shown in Figure F-3. As shown in Figure F-4, 11% reside within the EPZ in the Summer, 25% in the Fall, 39% in the Winter and 25% in the Spring.

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[1] Average household size is based up on the survey sample obtained from both Miami-Dade and Monroe County.

### Vehicle Availability

The average number of vehicles available per household in the EPZ is 1.93. It should be noted that 5.1% of households have no access to a vehicle. The distribution of vehicle availability is presented in Figure F-5. Figure F-6 and Figure F-7 present the vehicle availability by household size.

### Ridesharing

A majority (67.2%) of the households surveyed responded that they could share a ride with a neighbor, relative, or friend if a car was not available to them when advised to evacuate in the event of an emergency, as shown in Figure F-8.

### Commuters

Figure F-9 presents the distribution of the number of commuters in each household. Commuters are defined as household members who travel to work or school on a daily basis. The data shows an average of 1.16 commuters in each household in the EPZ, and 59% of households have at least one commuter.

### Commuter Travel Modes

Figure F-10 presents the mode of travel that commuters use on a daily basis. The vast majority (80.1%) of commuters use their private automobiles to travel to work or school alone. The data shows an average of 1.11 commuters per vehicle, assuming 2 people per vehicle – on average – for carpools.

### Impact of COVID-19 on Commuters

Figure F-11 presents the distribution of the number of commuters in each household that were temporarily impacted by the COVID-19 pandemic. 26.5% of households indicated someone in their household had a work or school commute that was impacted by the COVID-19 pandemic. Since the vast majority of commuters (73.5%) were not impacted, the results of the survey, as they relate to commuters, were adapted without adjustment.

### Functional or Transportation Needs

Figure F-12 presents the distribution of the number of individuals with an access and/or functional transportation need. The survey results indicate that 14.4% of households have an individual with an access and/or functional transportation need. Of those with an access and/or functional need, 39.5% require a bus, 16.2% require a medical bus/van, 18.9% require a wheelchair accessible vehicle, 7.6% require an ambulance and 17.8% indicated that they would require other accommodations.

### F.3.2 Evacuation Response

Several questions were asked to gauge the population's response to an emergency. These are now discussed:

***"How many vehicles would your household use during an evacuation for an emergency with no prior warning?"*** The response is shown in Figure F-13. On average, evacuating households would use 1.41 vehicles in the EPZ. Seven households (1.4%) within the EPZ stated they would not use a vehicle to evacuate.

As discussed earlier, the responses from households within Monroe County was reviewed separately, in addition to the entire EPZ. Considering only the responses received in Monroe County, households would use 1.24 vehicles to evacuate as shown in Figure F-14. Of those households in Monroe County, there are 4% of households that would not use a vehicle during an evacuation.

***"Would your family await the return of other family members prior to evacuating the area?"*** Of the survey participants who responded, 54.3% said they would await the return of other family members before evacuating and 45.7% indicated that they would not await the return of other family members, as shown in Figure F-15.

***"Emergency officials advise you to shelter-in-place in an emergency because you are not in the area of risk. Would you?"*** This question is designed to elicit information regarding compliance with instructions to shelter-in-place. As shown in Figure F-16, the results indicate that 83.5% of households who are advised to shelter-in-place would do so; the remaining 16.5% would choose to evacuate the area.

Note the baseline ETE study assumes 20% of households will not comply with the shelter advisory, as per Section 2.5.2 of NUREG/CR-7002, Rev. 1. Thus, the data obtained above is lower than the federal guidance recommendation. A sensitivity study was conducted to estimate the impact of shadow evacuation non-compliance to a shelter advisory on ETE – see Appendix M.

***"Emergency officials advise you to shelter-in-place now in an emergency and possibly evacuate later while people in other areas are advised to evacuate now. Would you?"*** This question is designed to elicit information specifically related to the possibility of a staged evacuation. That is, asking a population to shelter-in-place now and then to evacuate after a specified period of time. As shown in Figure F-17, the survey responses indicate that 75.7% of households would follow instructions and delay the start of evacuation until advised, while the other 24.3% would choose to begin evacuating immediately.

***"Emergency officials advise you to evacuate due to an emergency. Where would you evacuate to?"*** This question is designed to elicit information regarding the destination of evacuees in case of an evacuation. In total, 38.0% of households indicated that they would evacuate to a friend or relatives' home, 4.5% to a reception center, 20.2% to a hotel, motel, or campground, 9.4% to a second or seasonal home, and 26.1% indicated "other location/don't know" to this question, as shown in Figure F-18. It should be noted that 1.8% of households indicated they would not evacuate, according to the survey.

***"If you had a pet and/or animal, what would you do with your pet and/or animal if you had to evacuate?"*** Based on responses to the survey, 61.7% of households have a family pet, as shown in Figure F-19. Of the households with pets, 20.8% indicated that they would take their pets with them to a shelter, 77.5% indicated that they would take their pets somewhere else and only 1.7% would leave their pet at home, as shown in Figure F-20. Of the households that would evacuate with their pets, 96% indicated that they have sufficient room in their vehicle to evacuate with their pet(s)/animal(s).

***"What type of pet(s) and/or animal(s) do you have?"*** Based on responses from the survey, 95.9% are household pets (dog, cat, bird, reptile, or fish), 3.2% are farm animals (horse, chicken, goat, pig, etc.), and 0.9% are other small pets/animals.

### F.3.3 Time Distribution Results

The survey asked several questions about the amount of time it takes to perform certain pre-evacuation activities. These activities involve actions taken by residents during the course of their day-to-day lives. Thus, the answers fall within the realm of the responder's experience.

The mobilization distributions provided below are the result of having applied the analysis described in Section 5.4.1 to the component activities of the mobilization.

***"How long does it take the commuter to complete preparation for leaving work/school?"*** Figure F-21 presents the cumulative distribution. In all cases, the activity is completed by 105 minutes (1 hour and 45 minutes). Approximately 92% can leave within 1 hour.

***"How long would it take the commuter to travel home?"*** Figure F-22 presents the time to travel home from work/school. About 94% of commuters can arrive home within 1 hour of leaving work/school; all within 105 minutes (1 hour and 45 minutes).

***"How long would it take the family to pack clothing, secure the house, and load the car?"*** Figure F-23 presents the time required to prepare for leaving on an evacuation trip. In many ways this activity mimics a family's preparation for a short holiday or weekend away from home. Hence, the responses represent the experience of the responder in performing similar activities.

The distribution shown in Figure F-23 has a long "tail." About 89% of households can be ready to leave home within 2 hours; the remaining households require up to an additional 90 minutes.

### F.3.4 Emergency Communications

***"At your place of residence, how reliable is your cell phone signal?"*** This question is designed to elicit information regarding the ability to be notified in case of an evacuation.

Approximately 81% of households indicated that they have very reliable signal to receive texts and phone calls, 6% indicated that their signal is reliable for text messages only, and about 11% indicated that they do not always receive cell communications at their residence, as shown in Figure F-24.

***"Emergency management officials in your state may send text messages, similar to AMBER Alerts, with emergency directions for the public during a radiological emergency at the Turkey Point Nuclear Power Plant. How likely would you be to take action on these directions, if you received the message?"*** This question is designed to elicit information regarding the likelihood of an individual to take action based on emergency management officials' guidelines.

81% of households indicated that they are highly likely to take action on these directions, 15.6% indicated likely, 3% indicated neither likely nor unlikely, 0.2% indicated unlikely and 0.2% indicated highly unlikely for them to take action on emergency management officials' directions, as shown in Figure F-25.

***"Which of the following emergency communication methods do you think is most likely to alert you at your residence?"*** This question is designed to elicit information regarding the most efficient way to alert residents within the EPZ.

65.3% of households indicated that a text message from emergency officials would be most likely to alert them at their residence, 26% indicated that a siren sounding near their home would likely alert them, while the balance of households would be alerted using other methods as shown in Figure F-26.

Table F-1. PTN Demographic Survey Sampling Plan

| Zip Code | EPZ Population Zip Code (2010) | EPZ Households within Zip Code (2010) | Desired Samples | Samples Obtained |
|---|---|---|---|---|
| 33030 | 26468 | 7880 | 58 | 47 |
| 33031 | 1691 | 577 | 4 | 20 |
| 33032 | 34081 | 9710 | 73 | 0 |
| 33033 | 49027 | 14098 | 105 | 91 |
| 33034 | 13220 | 3991 | 30 | 28 |
| 33035 | 13497 | 4609 | 35 | 31 |
| 33037 | 1103 | 487 | 4 | 78 |
| 33039 | 122 | 32 | 1 | 0 |
| 33157 | 14200 | 4664 | 35 | 104 |
| 33170 | 10091 | 2821 | 21 | 11 |
| 33177 | 7551 | 2011 | 15 | 37 |
| 33189 | 23683 | 8086 | 61 | 43 |
| 33190 | 11593 | 3868 | 29 | 24 |
| **Total EPZ** | **206,327** | **62,834** | **471** | **514** |
| **Average HH Size:** | | **3.28** | | |

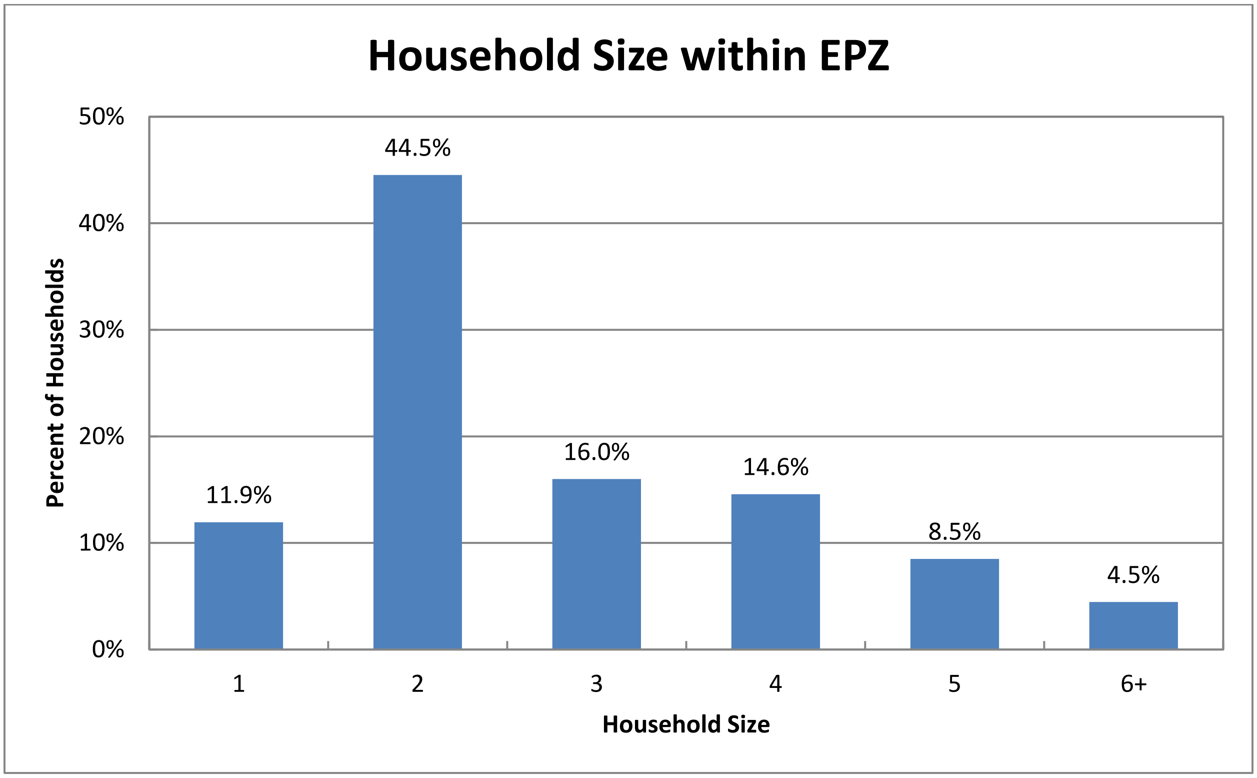

Figure F-1. Household Size in the EPZ

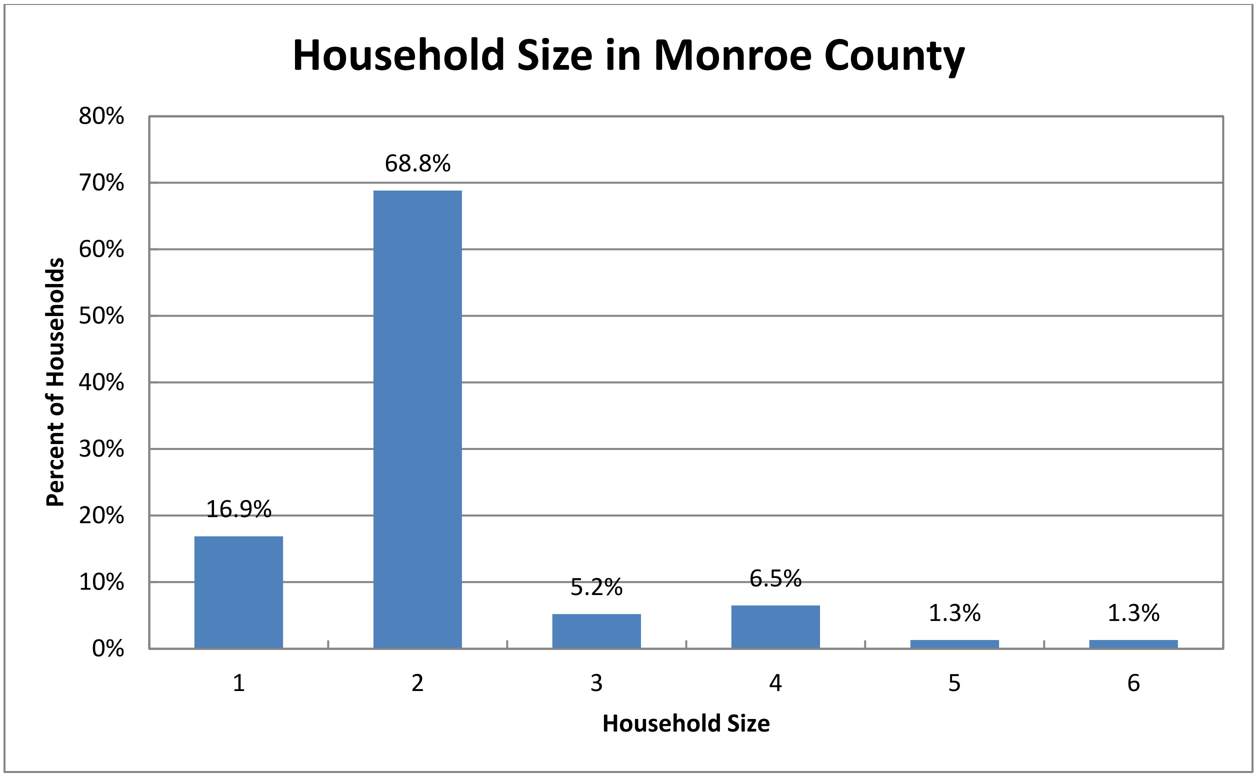

Figure F-2 Household Size in Monroe County

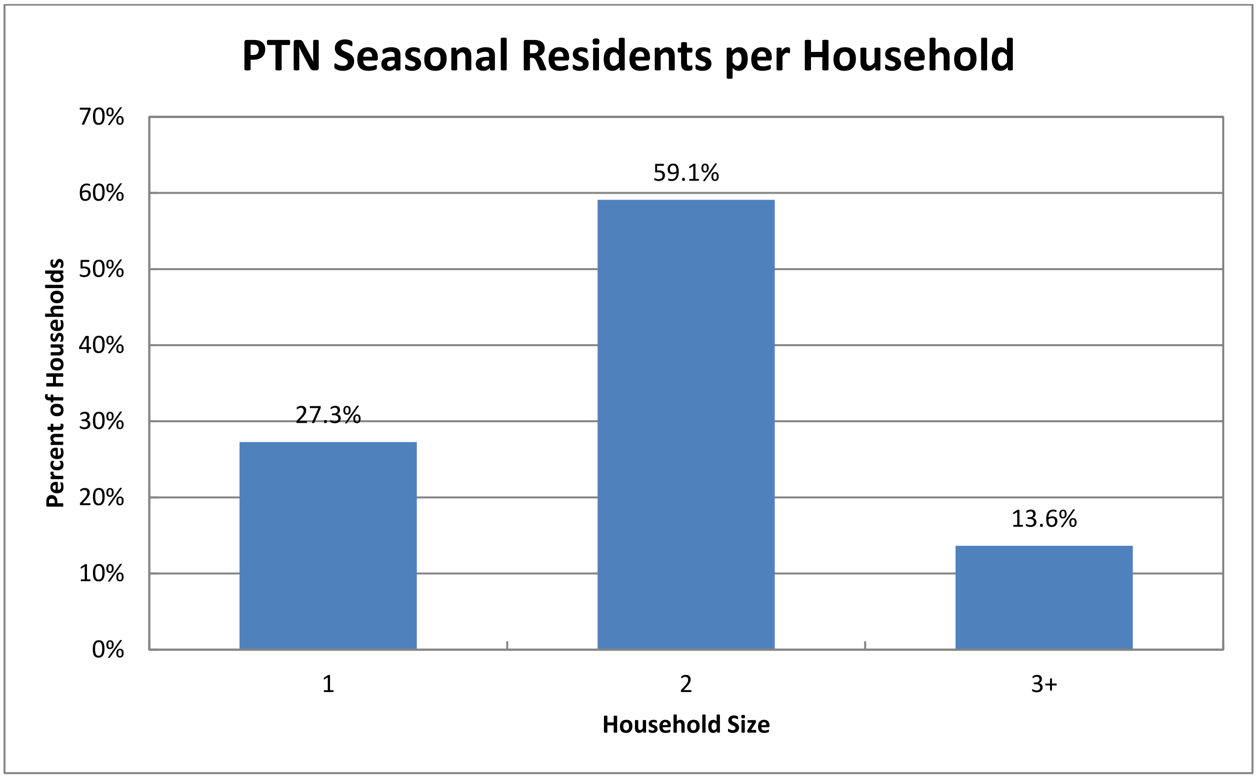

Figure F-3 Seasonal Residents per Household

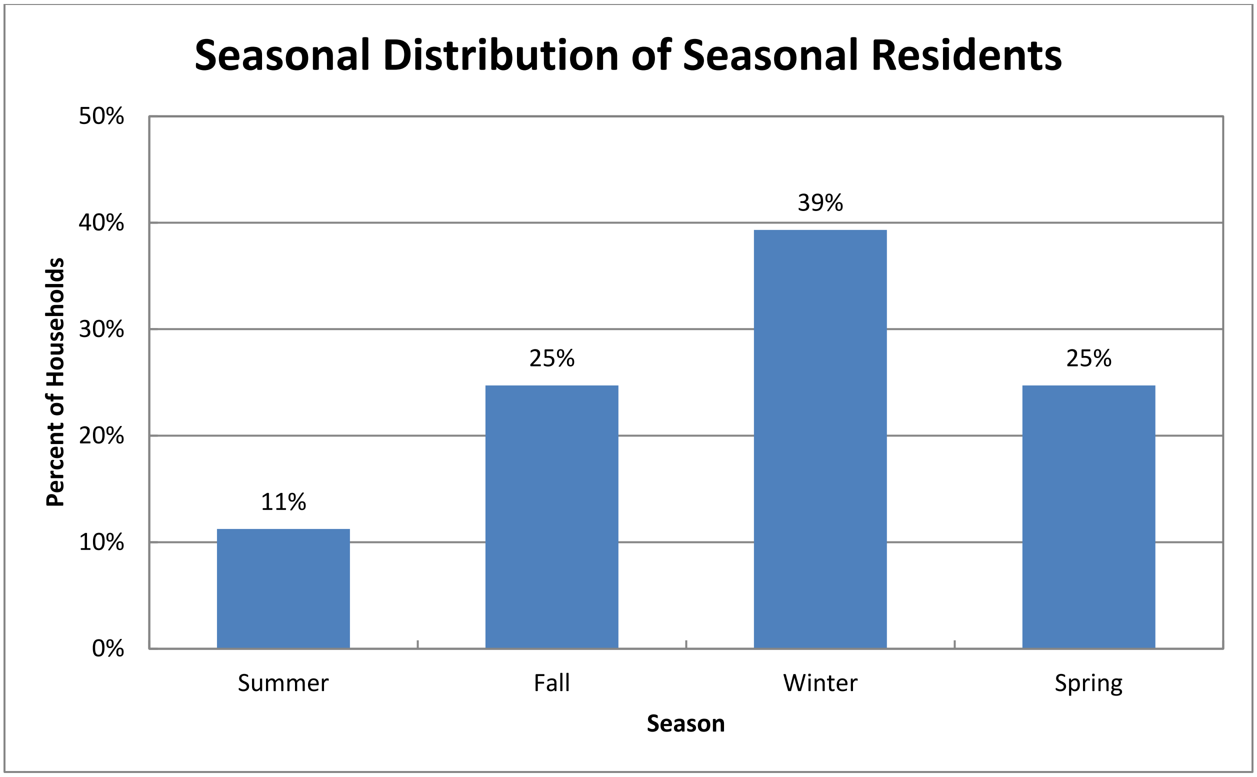

Figure F-4. Seasonal Distribution of the Seasonal Residents in the EPZ

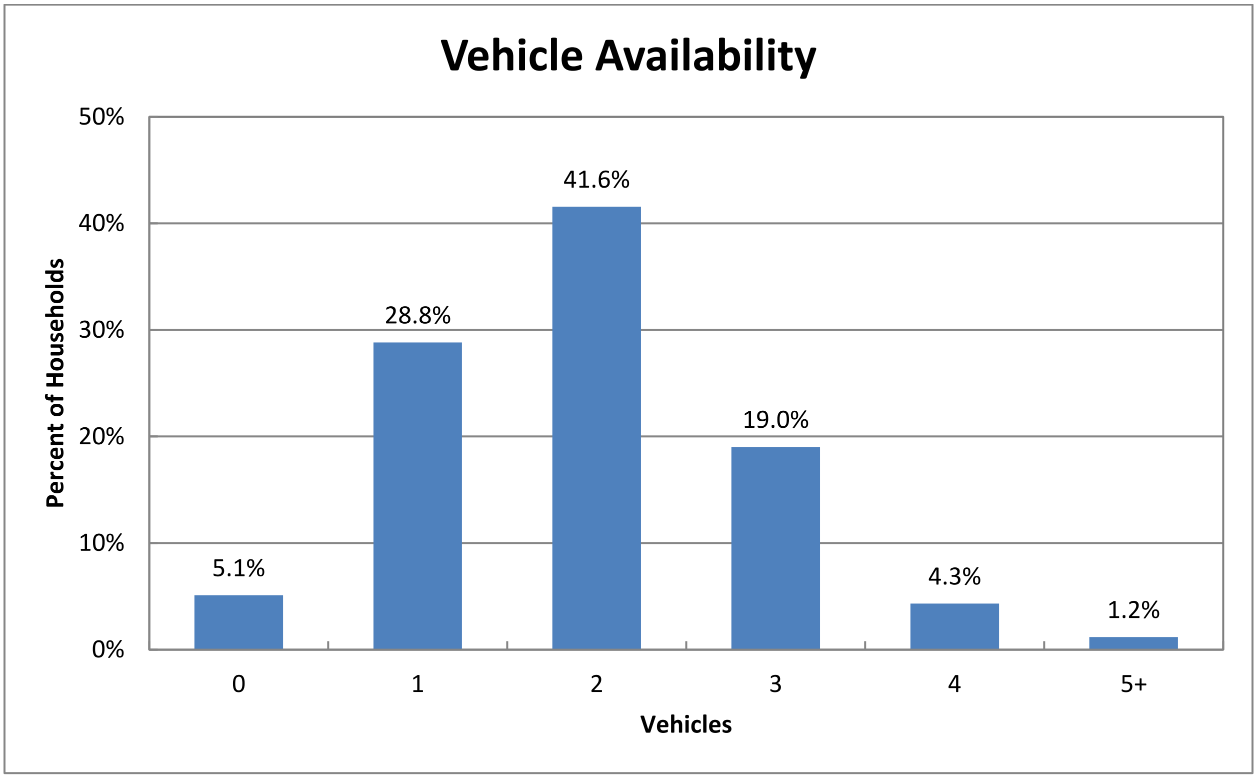

Figure F-5. Vehicle Availability

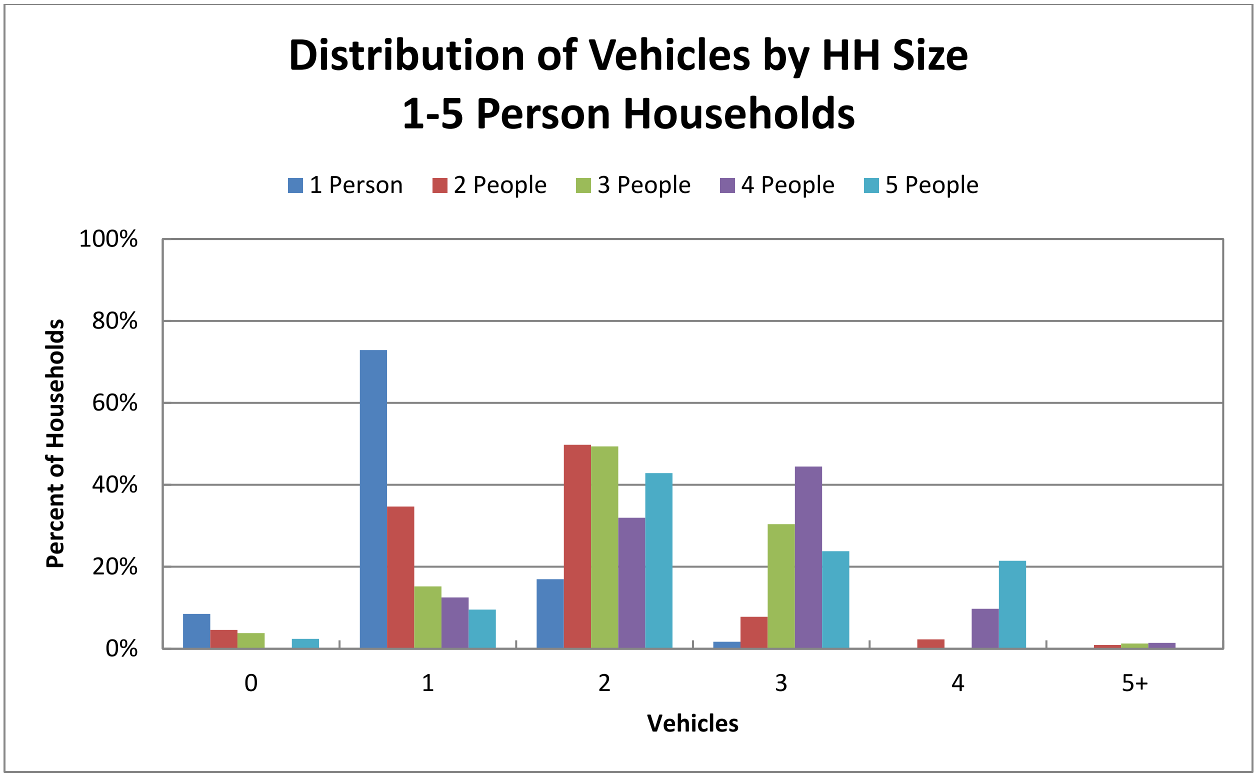

Figure F-6. Vehicle Availability – 1 to 5 Person Households

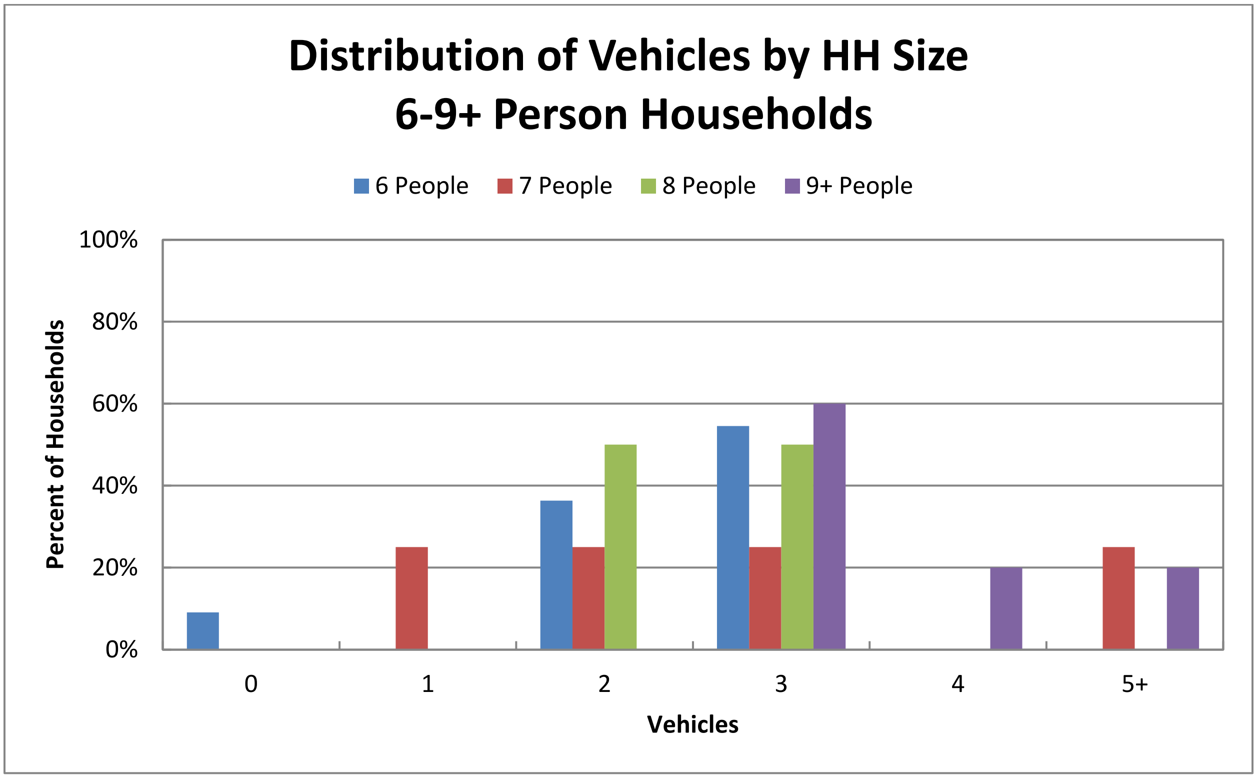

Figure F-7. Vehicle Availability – 6 to 9+ Person Households

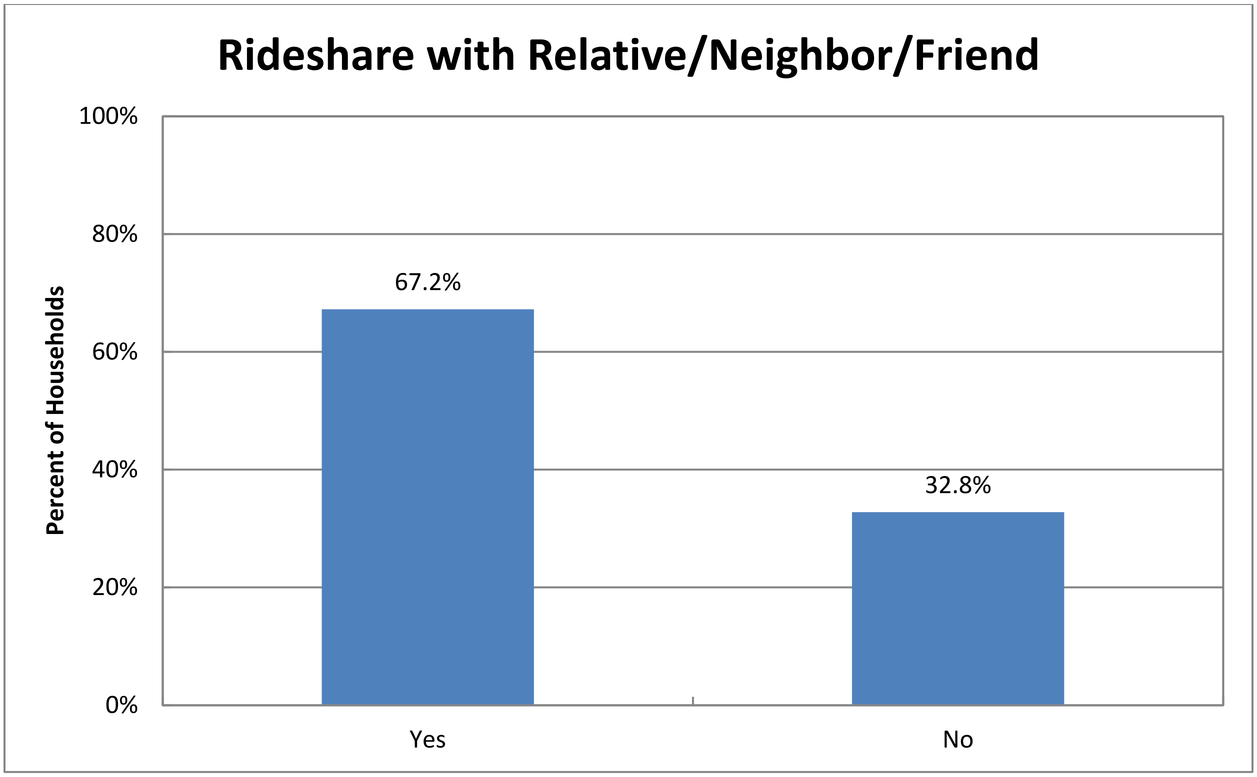

Figure F-8. Household Ridesharing Preference

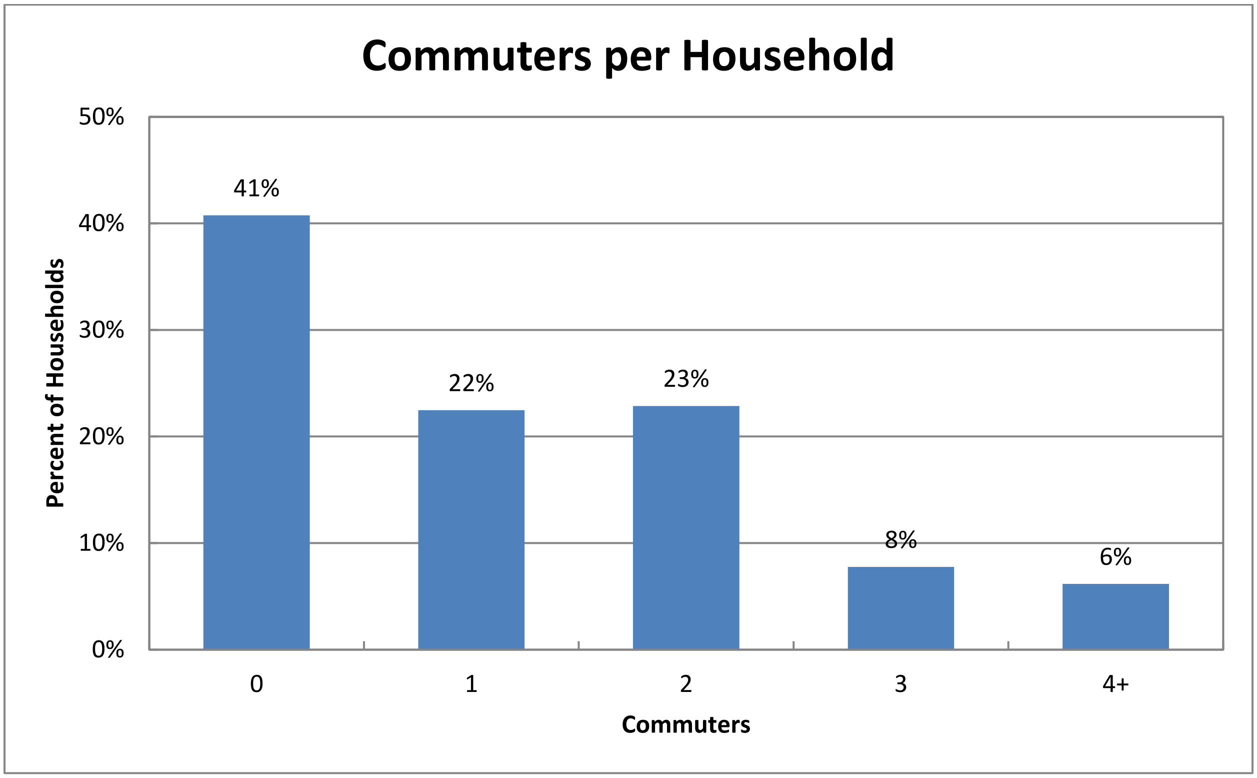

Figure F-9. Commuters per Households in the EPZ

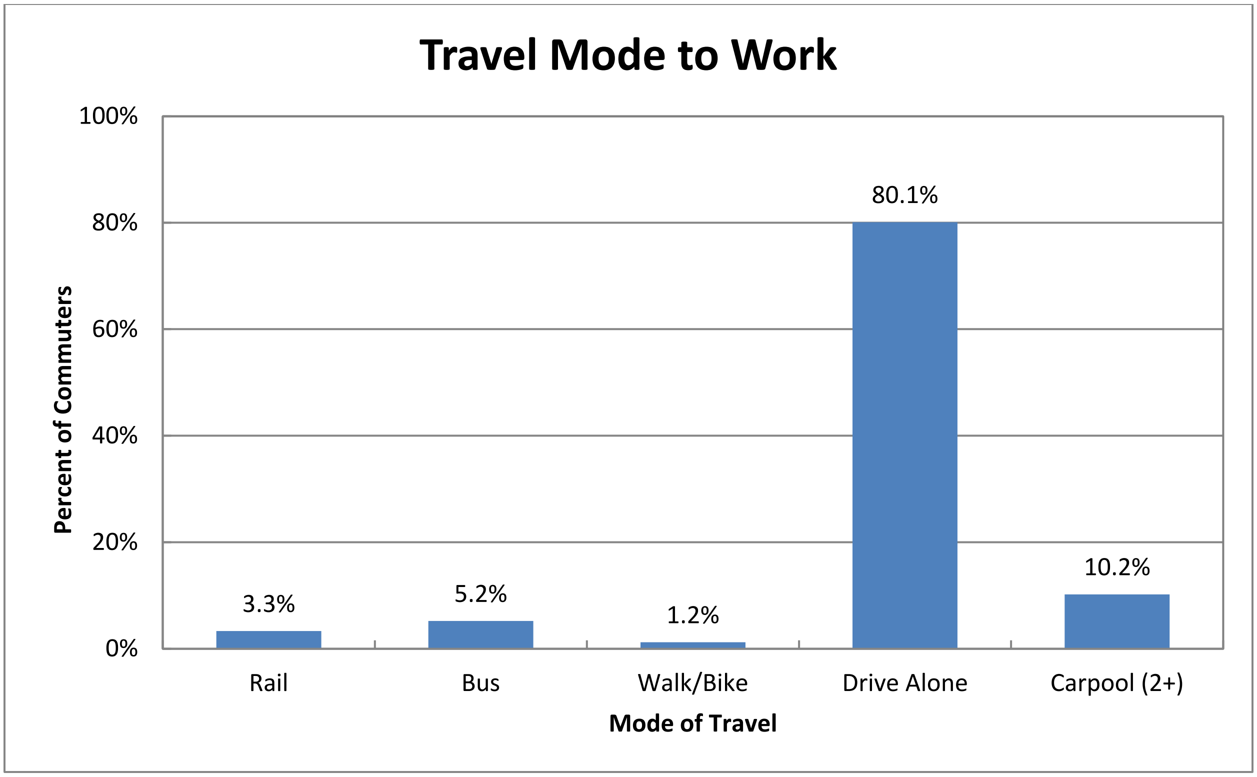

Figure F-10. Modes of Travel in the EPZ

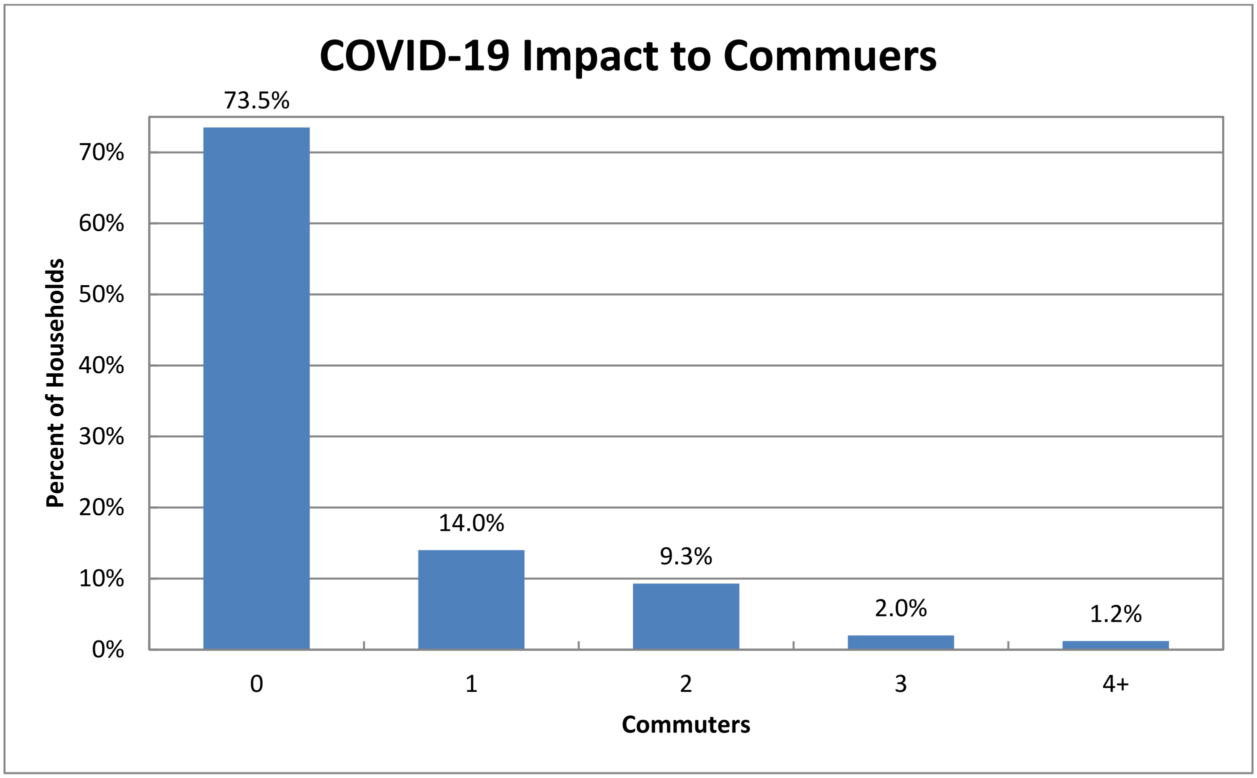

Figure F-11. Commuters Impacted by COVID-19

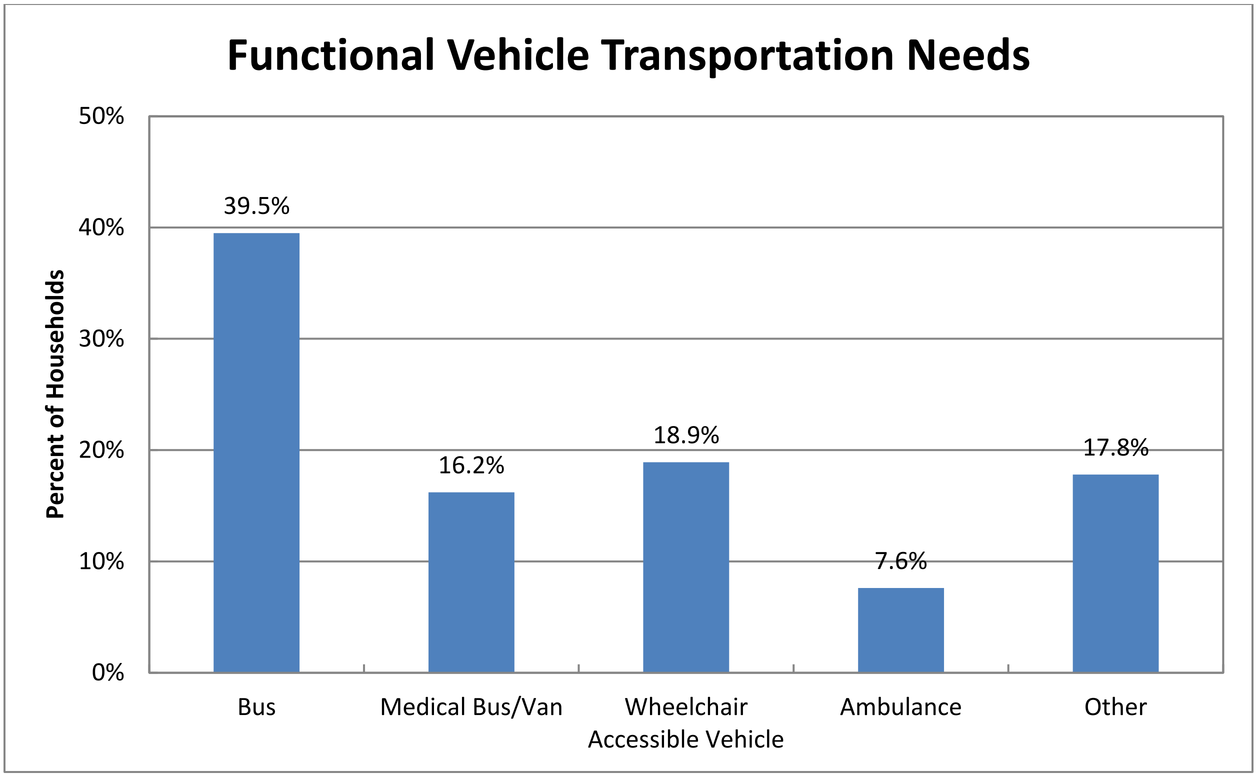

**Figure F-12. Households with Access and/or Functional Transportation Needs**

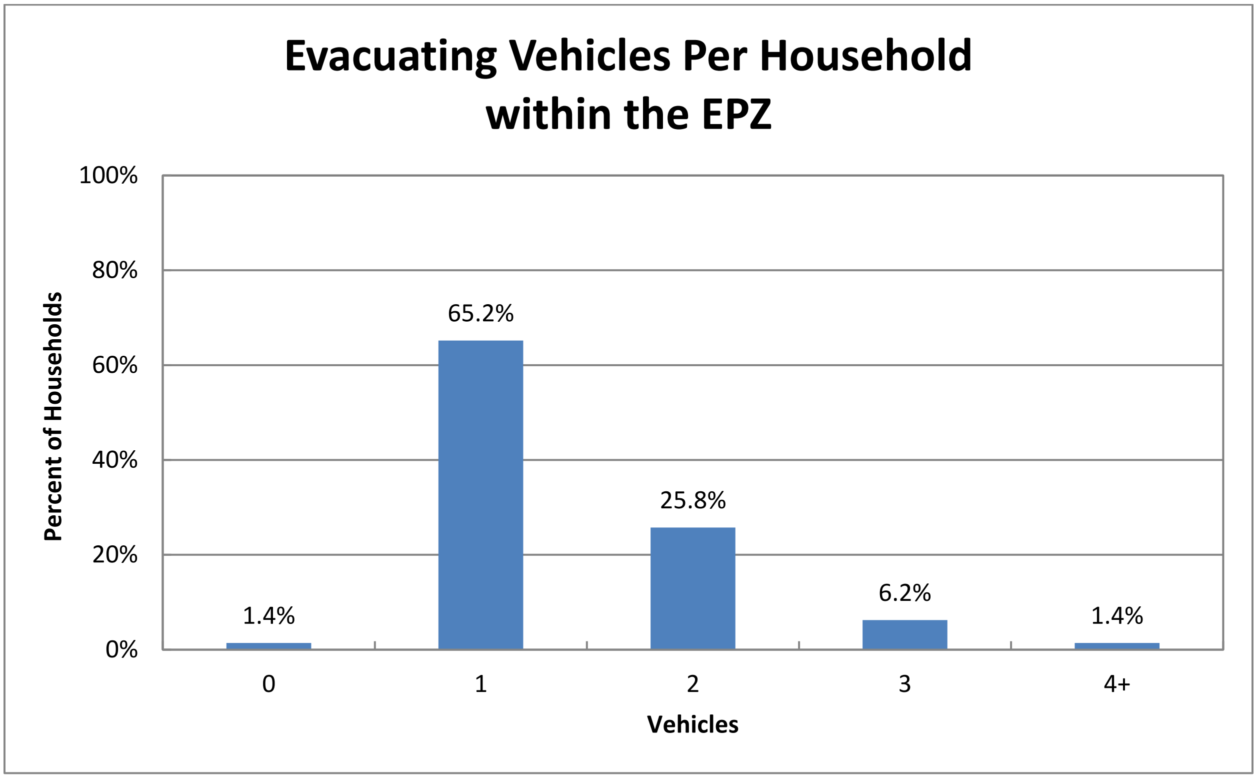

**Figure F-13. Number of Vehicles Used for Evacuation in the EPZ**

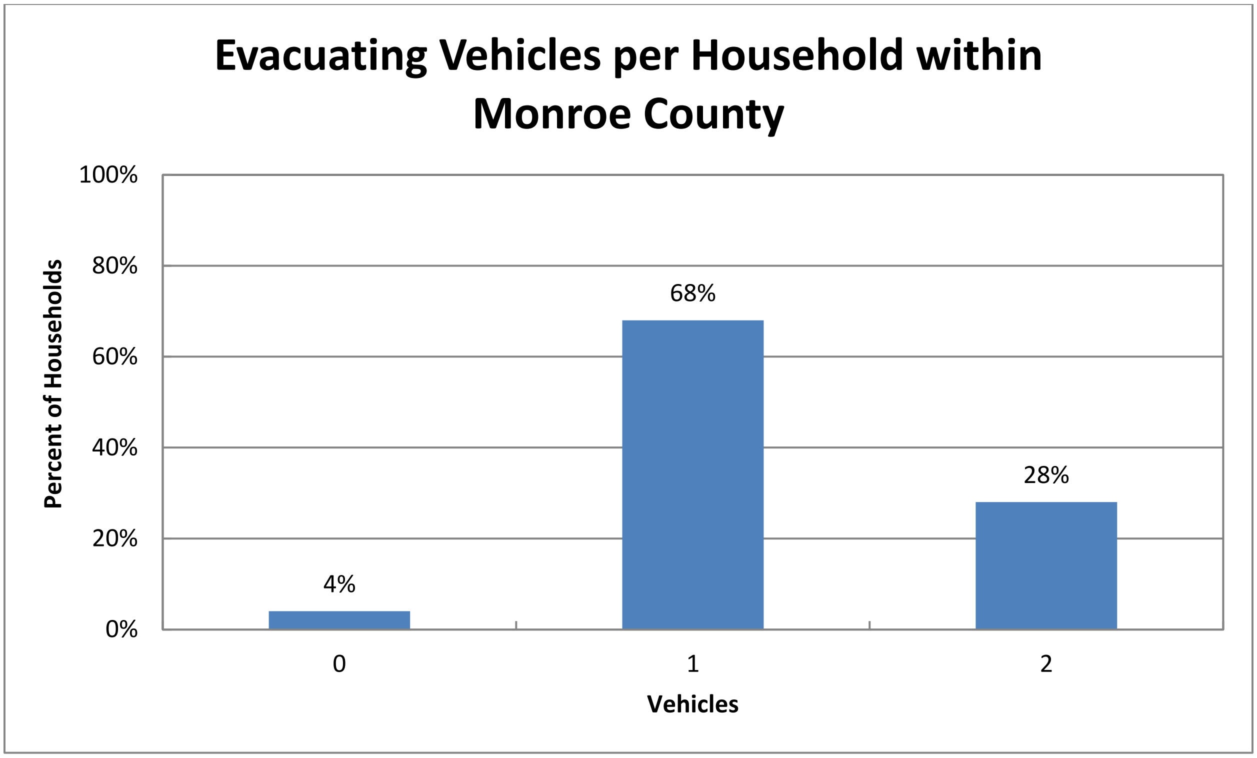

Figure F-14. Number of Vehicles Used for Evacuation in Monroe County

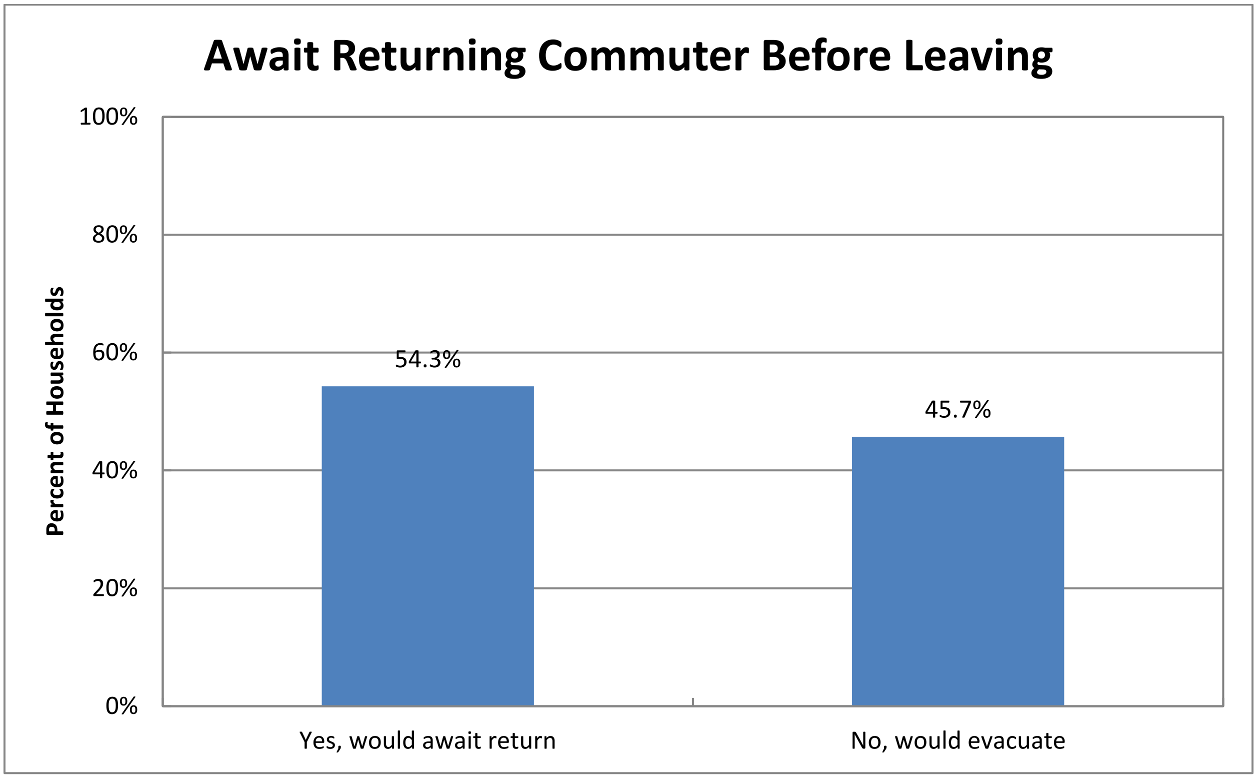

Figure F-15. Percent of Households that Await Returning Commuter Before Evacuating

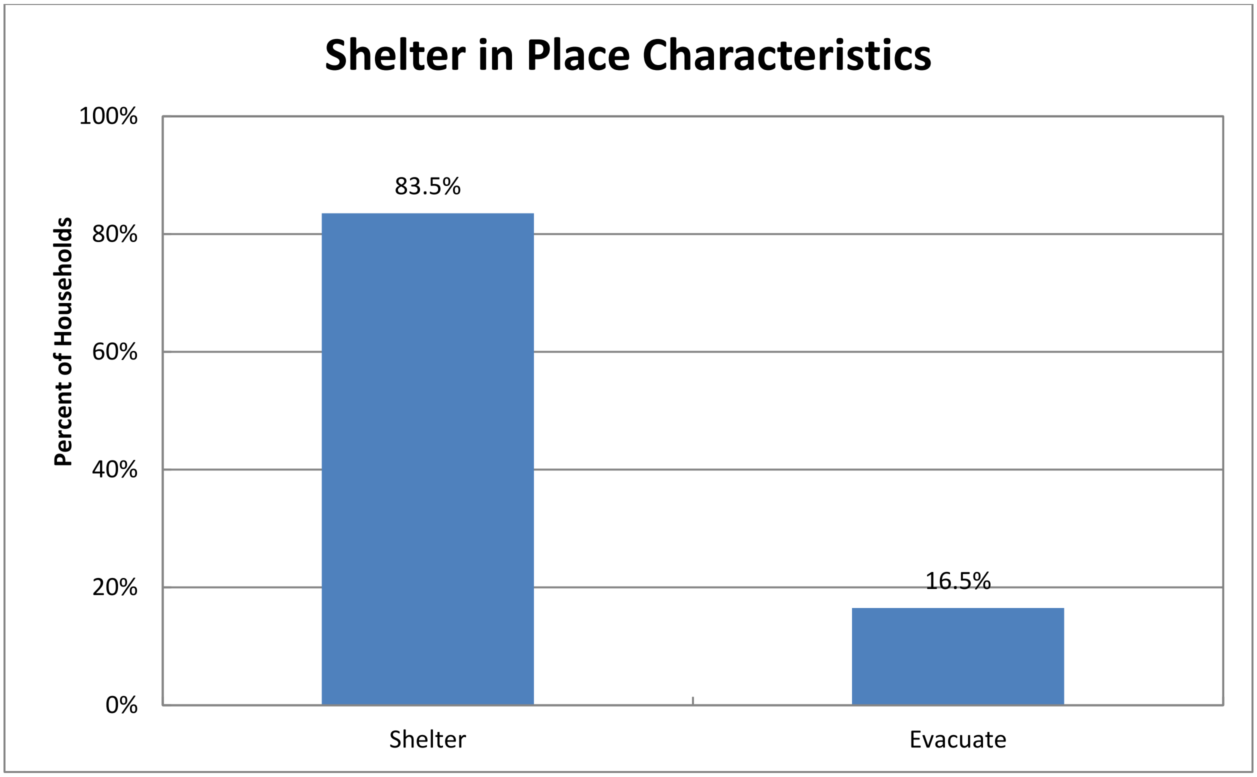

Figure F-16. Shelter in Place Characteristics

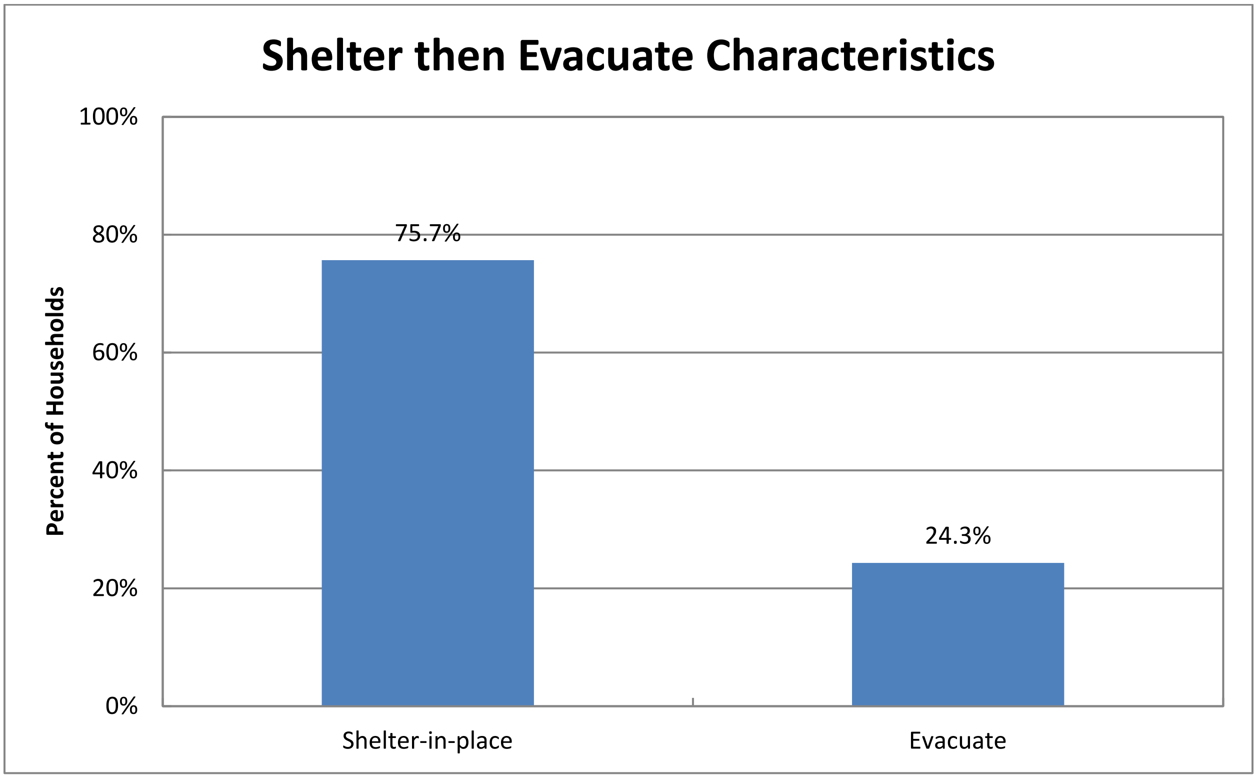

Figure F-17. Shelter in Place Characteristics – Staged Evacuation

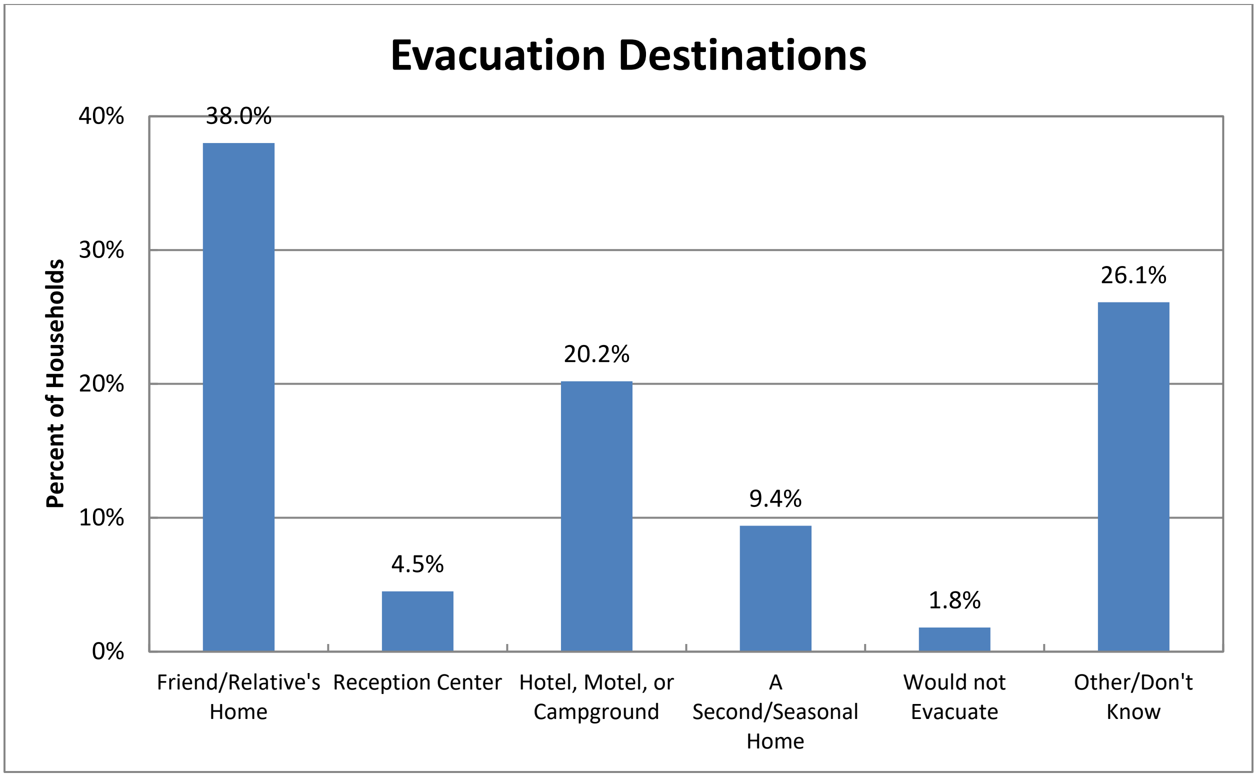

Figure F-18. Destinations for Evacuees

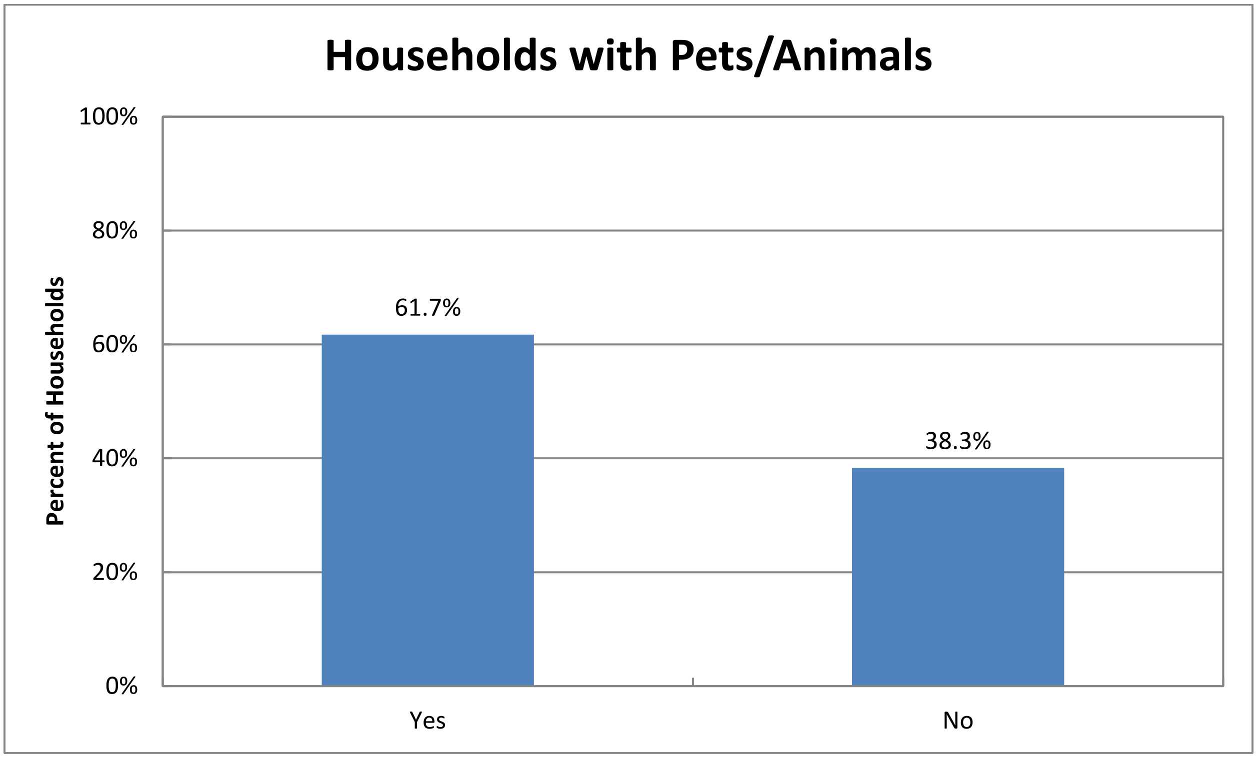

Figure F-19. Households with Pets/Animals

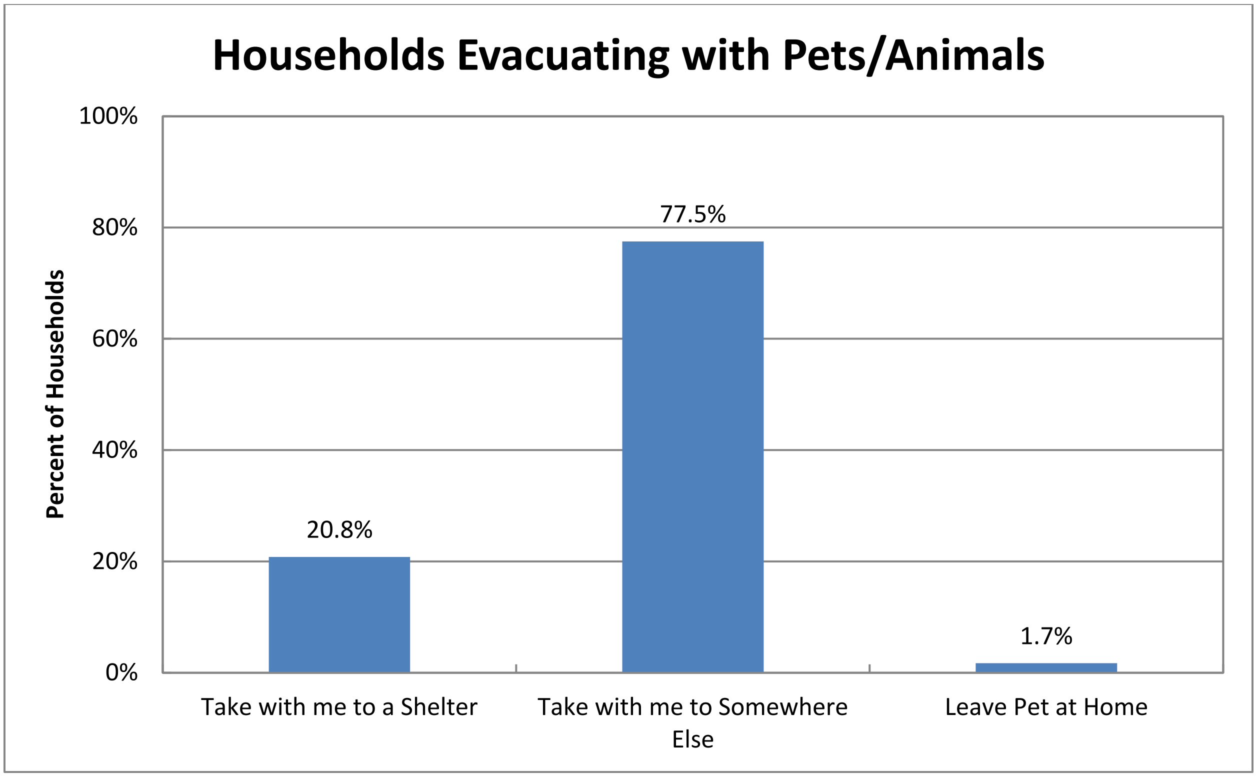

Figure F-20. Households Evacuating with Pets/Animals

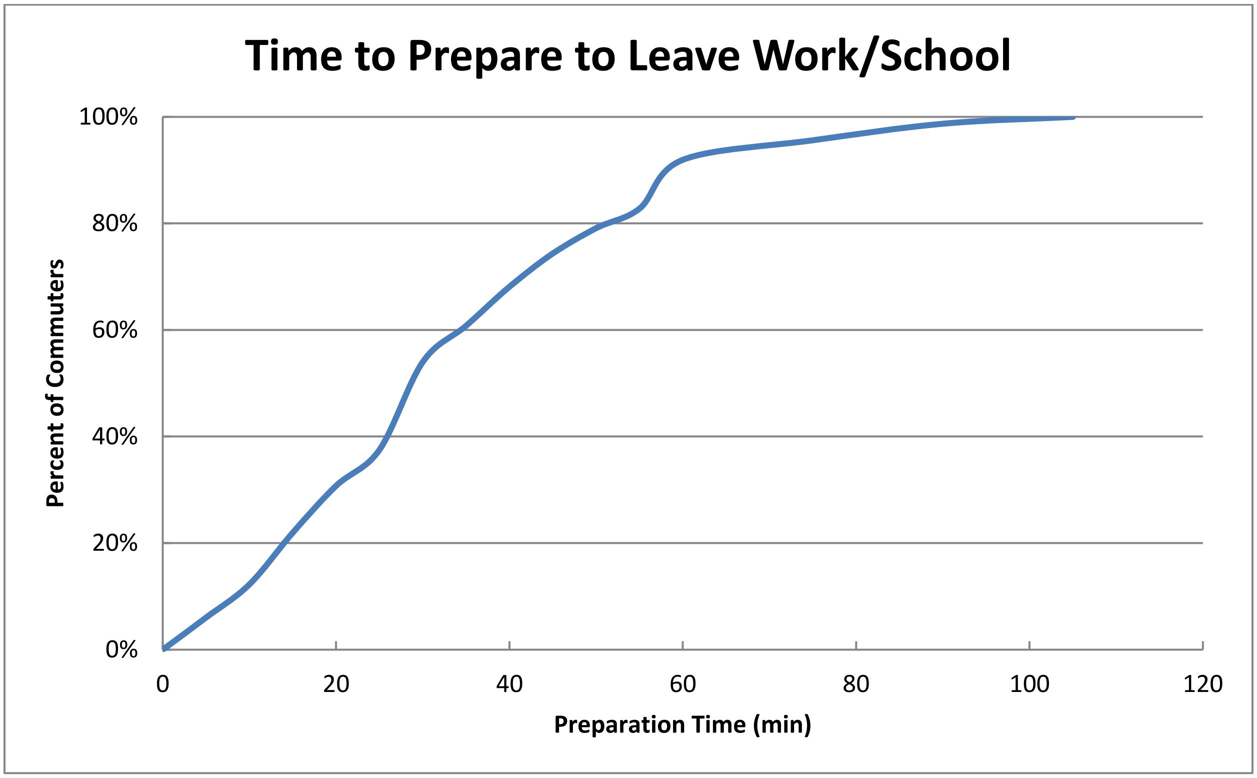

Figure F-21. Time Required to Prepare to Leave Work/School

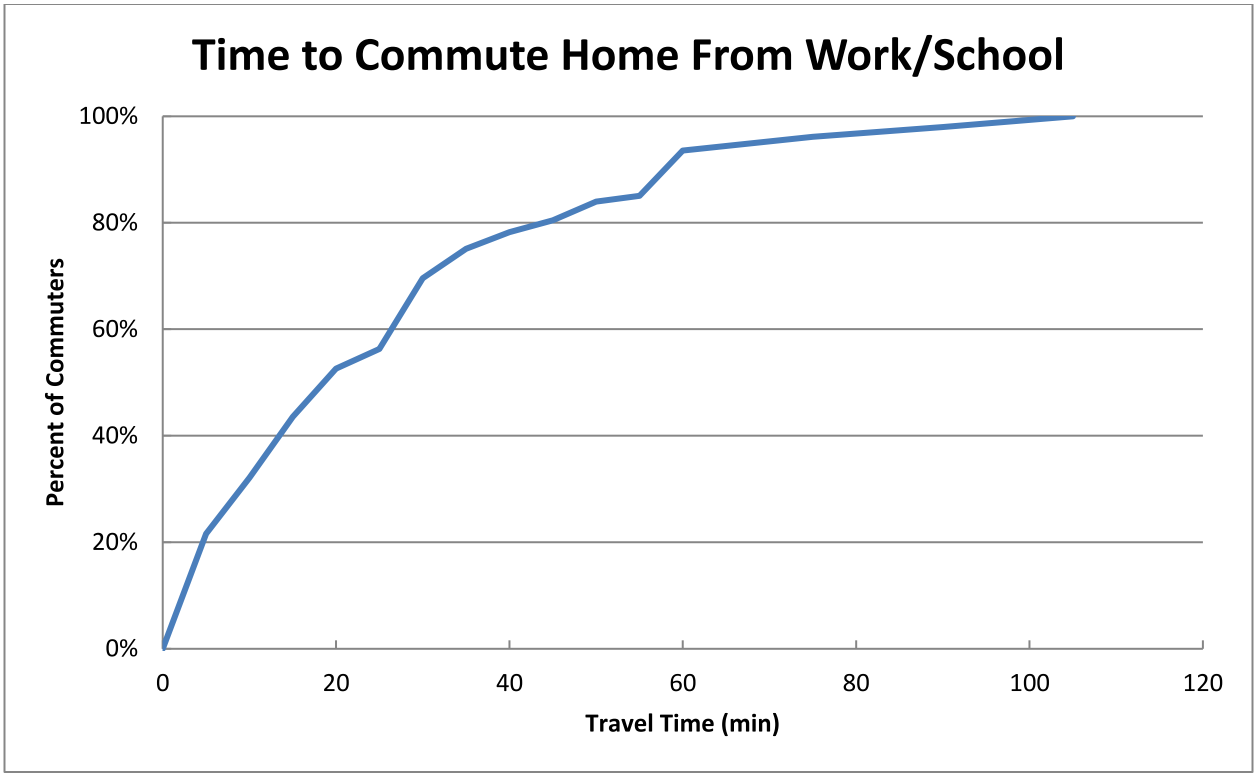

Figure F-22. Time to Travel Home from Work/School

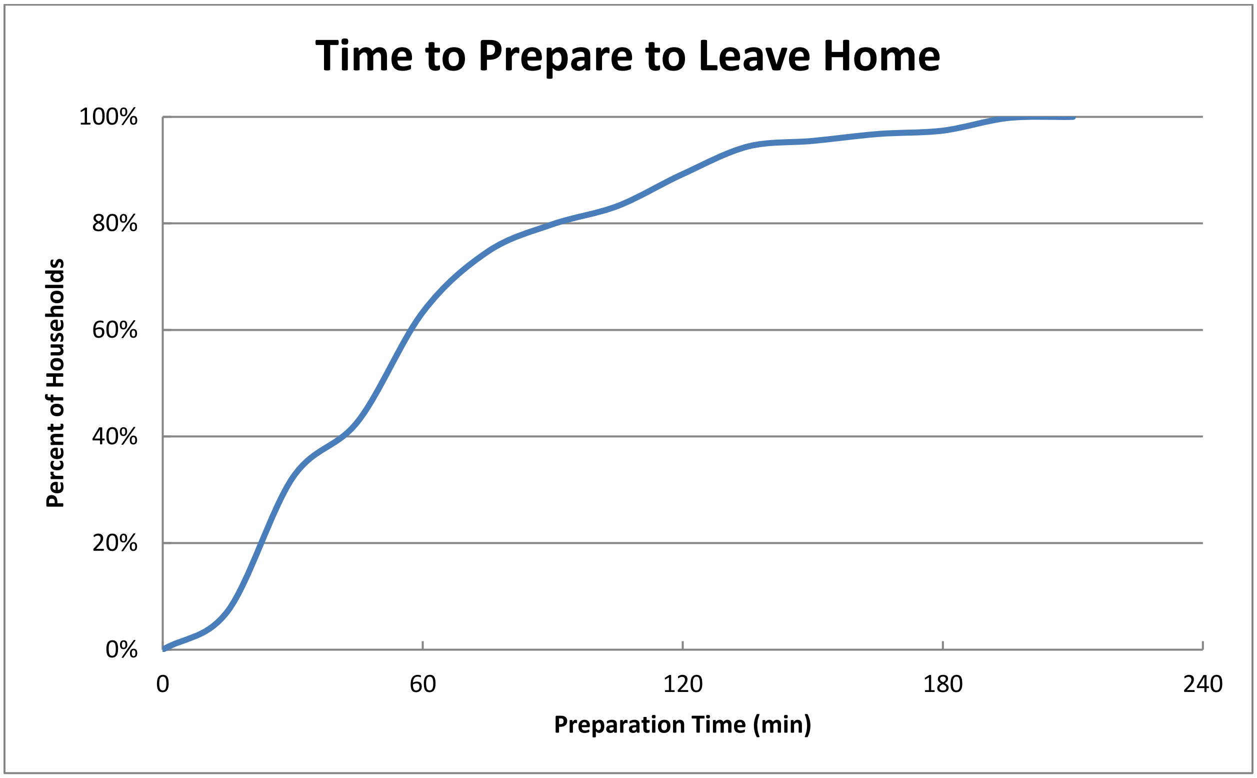

Figure F-23. Time to Prepare Home for Evacuation

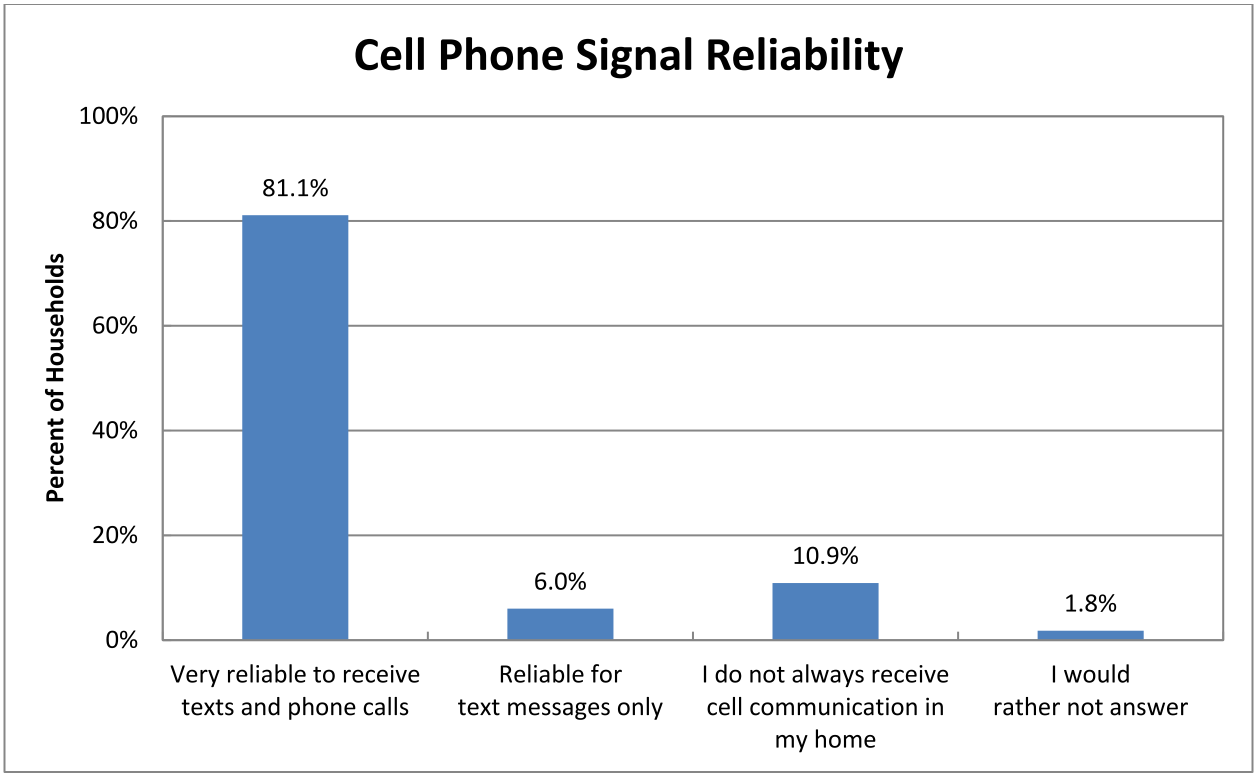

Figure F-24. Cell Phone Signal Reliability

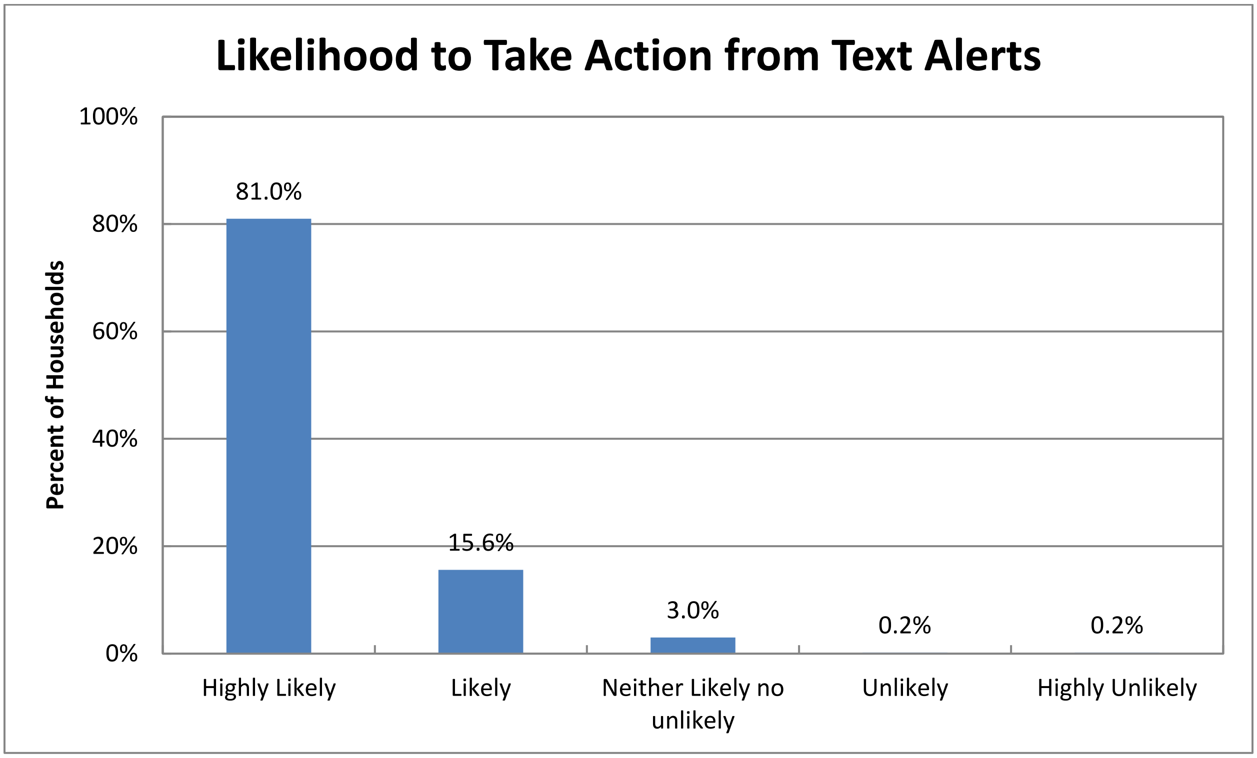

Figure F-25. Resident's Likelihood to Take Action from Text Alerts

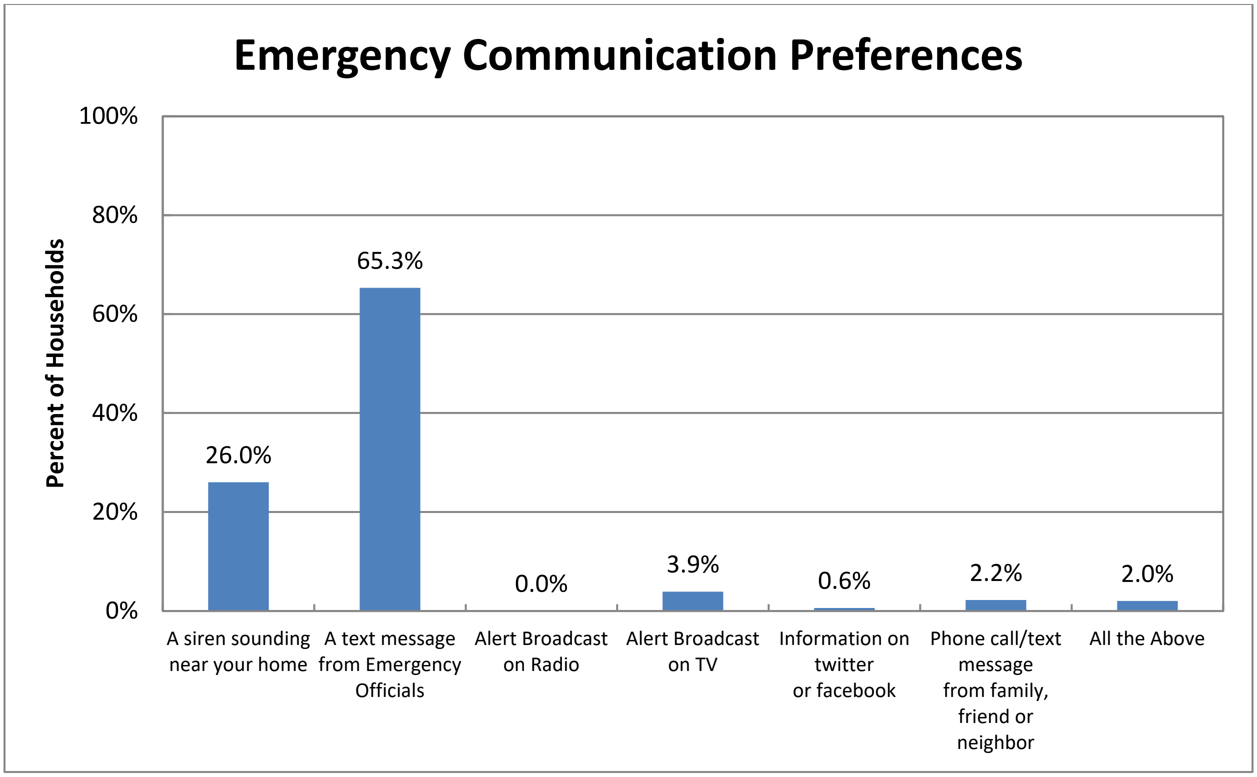

**Figure F-26. Emergency Communication**

# ATTACHMENT A

# Demographic Survey Instrument

# Emergency Response Survey

* Required

## Purpose

The purpose of this survey is to identify local behavior during emergency situations with no prior warning, such as a wildfire, chemical spill or radiological event. The information gathered in this survey will be shared with Miami-Dade County and Monroe County emergency planning personnel to enhance emergency response plans in your area. Your responses will greatly contribute to local emergency preparedness. **Please only complete one survey per household**. **Please have the head of the household (18 years or older) complete the survey**. Do not provide your name or any personal information. This survey will take less than ten minutes to complete.

1. 1. What is your gender?

*Mark only one oval.*

○ Male
○ Female
○ I would rather not answer
○ Other: ____________________

2. 2. What is your home zip code? *

____________________

## Mode of Evacuation

3. 3A. In an emergency with no prior warning, how would you evacuate?

*Mark only one oval.*

○ Privately owned vehicle
○ Helicopter *Skip to question 7*
○ Airplane *Skip to question 7*
○ Boat *Skip to question 7*
○ Bicycle *Skip to question 7*
○ Public transportation *Skip to question 7*
○ Walk *Skip to question 7*
○ I would rather not answer *Skip to question 7*

## Mode of Evacuation

4. 3B. In total, how many vehicles are usually available to your household?

*Mark only one oval.*

○ One
○ Two
○ Three
○ Four
○ Five
○ Six
○ Seven
○ Eight
○ Nine or more
○ Zero (None)
○ I would rather not answer

5. 3C. In an emergency, if your vehicle(s) are not available, could you get a ride out of the area with a neighbor or friend?

*Mark only one oval.*

○ Yes
○ No
○ I would rather not answer

Mode of Evacuation

6. 4. How many vehicles would your household use during an evacuation for an emergency with no prior warning?

*Mark only one oval.*

○ One
○ Two
○ Three
○ Four
○ Five
○ Six
○ Seven
○ Eight
○ Nine or more
○ Zero (None)
○ I would evacuate by bicycle
○ I would evacuate by bus
○ I would rather not answer

Household Information

7. 5A. How many people usually live in your household?

*Mark only one oval.*

○ One
○ Two
○ Three
○ Four
○ Five
○ Six
○ Seven
○ Eight
○ Nine
○ Ten
○ Eleven
○ Twelve
○ Thirteen
○ Fourteen
○ Fifteen
○ Sixteen
○ Seventeen
○ Eighteen
○ Nineteen or more
○ I would rather not answer

8. 5B. Of the people who live in your household, are any seasonal residents?

A seasonal resident is someone who does not reside in the household for most of the year.

*Mark only one oval.*

○ Yes
○ No *Skip to question 11*
○ I would rather not answer *Skip to question 11*

*Skip to question 11*

## Seasonal Population

9. 5C. How many people only reside in your household for part of the year?

*Mark only one oval.*

○ One
○ Two
○ Three
○ Four
○ Five
○ Six
○ Seven
○ Eight
○ Nine
○ Ten
○ Eleven
○ Twelve
○ Thriteen
○ Fourteen
○ Fifteen
○ Sixteen
○ Seventeen
○ Eighteen
○ Nineteen or more
○ I would rather not answer

10. 5D. When do these residents live in your home? Choose all that apply.

*Check all that apply.*

☐ Summer
☐ Fall
☐ Winter
☐ Spring
☐ I would rather not answer

COVID-19

11. 6. How many adults in your household had to change their work or school commute due to the COVID-19 pandemic?

*Mark only one oval.*

○ None
○ One
○ Two
○ Three
○ Four or more
○ I would rather not answer

Commuters

12. 7. Before COVID-19, how many adults in your household would normally commute for work or school on a daily basis? *

*Mark only one oval.*

- ○ Zero *Skip to question 57*
- ○ One *Skip to question 13*
- ○ Two *Skip to question 14*
- ○ Three *Skip to question 15*
- ○ Four or more *Skip to question 16*
- ○ I would rather not answer *Skip to question 57*

Mode of Travel

13. 8. Thinking about each commuter, how does each person usually travel to work or school? *

*Mark only one oval per row.*

| | Rail | Bus | Walk/ Bicycle | Drive Alone | Carpool- 2 or more people | Boat | Helicopter/ Airplane | I woul rather not answe |
|---|---|---|---|---|---|---|---|---|
| **Commuter 1** | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

*Skip to question 17*

Mode of Travel

14. 8. Thinking about each commuter, how does each person usually travel to work or school?

*Mark only one oval per row.*

| | Rail | Bus | Walk/ Bicycle | Drive Alone | Carpool- 2 or more people | Boat | Helicopter/ Airplane | I woul rather not answe |
|---|---|---|---|---|---|---|---|---|
| **Commuter 1** | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| **Commuter 2** | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

*Skip to question 19*

Mode of Travel

15. 8. Thinking about each commuter, how does each person usually travel to work or school?

*Mark only one oval per row.*

| | Rail | Bus | Walk/ Bicycle | Drive Alone | Carpool- 2 or more people | Boat | Helicopter/ Airplane | I woul rather not answe |
|---|---|---|---|---|---|---|---|---|
| **Commuter 1** | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| **Commuter 2** | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| **Commuter 3** | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

*Skip to question 23*

Mode of Travel

16. 8. Thinking about each commuter, how does each person usually travel to work or school?

*Mark only one oval per row.*

| | Rail | Bus | Walk/ Bicycle | Drive Alone | Carpool- 2 or more people | Boat | Helicopter/ Airplane | I woul rather not answe |
|---|---|---|---|---|---|---|---|---|
| **Commuter 1** | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| **Commuter 2** | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| **Commuter 3** | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| **Commuter 4** | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

*Skip to question 29*

## Preparation to leave Work/School

17. 9-1. During an emergency event with no prior warning, about how much time would it take Commuter #1 to stop working, grab essentials, and walk to their vehicle to start their trip home?

*Mark only one oval.*

- ○ 5 minutes or less
- ○ 6-10 minutes
- ○ 11-15 minutes
- ○ 16-20 minutes
- ○ 21-25 minutes
- ○ 26-30 minutes
- ○ 31-35 minutes
- ○ 36-40 minutes
- ○ 41-45 minutes
- ○ 46-50 minutes
- ○ 51-55 minutes
- ○ 56 minutes - 1 hour
- ○ Over 1 hour, but less than 1 hour 15 minutes
- ○ Between 1 hour 16 minutes and 1 hour 30 minutes
- ○ Between 1 hour 31 minutes and 1 hour 45 minutes
- ○ Between 1 hour 46 minutes and 2 hours
- ○ Over 2 hours
- ○ I would rather not answer

18. If over 2 hours for Question 9-1, specify time here

Leave blank if your answer for Question 9-1 is under 2 hours.

_______________________________

*Skip to question 37*

Preparation to leave Work/School

19. 9-1. During an emergency event with no prior warning, about how much time would it take Commuter #1 to stop working, grab essentials, and walk to their vehicle to start their trip home?

*Mark only one oval.*

○ 5 minutes or less
○ 6-10 minutes
○ 11-15 minutes
○ 16-20 minutes
○ 21-25 minutes
○ 26-30 minutes
○ 31-35 minutes
○ 36-40 minutes
○ 41-45 minutes
○ 46-50 minutes
○ 51-55 minutes
○ 56 minutes - 1 hour
○ Over 1 hour, but less than 1 hour 15 minutes
○ Between 1 hour 16 minutes and 1 hour 30 minutes
○ Between 1 hour 31 minutes and 1 hour 45 minutes
○ Between 1 hour 46 minutes and 2 hours
○ Over 2 hours
○ I would rather not answer

20. If over 2 hours for Question 9-1, specify time here

Leave blank if your answer for Question 9-1 is under 2 hours.

_______________________________

21. 9-2. During an emergency event with no prior warning, about how much time would it take Commuter #2 to stop working, grab essentials, and walk to their vehicle to start their trip home?

*Mark only one oval.*

- ○ 5 minutes or less
- ○ 6-10 minutes
- ○ 11-15 minutes
- ○ 16-20 minutes
- ○ 21-25 minutes
- ○ 26-30 minutes
- ○ 31-35 minutes
- ○ 36-40 minutes
- ○ 41-45 minutes
- ○ 46-50 minutes
- ○ 51-55 minutes
- ○ 56 minutes - 1 hour
- ○ Over 1 hour, but less than 1 hour 15 minutes
- ○ Between 1 hour 16 minutes and 1 hour 30 minutes
- ○ Between 1 hour 31 minutes and 1 hour 45 minutes
- ○ Between 1 hour 46 minutes and 2 hours
- ○ Over 2 hours
- ○ I would rather not answer

22. If over 2 hours for Question 9-2, specify time here

Leave blank if your answer for Question 9-2 is under 2 hours.

______________________________

*Skip to question 39*

Preparation to leave Work/School

23. 9-1. During an emergency event with no prior warning, about how much time would it take Commuter #1 to stop working, grab essentials, and walk to their vehicle to start their trip home?

*Mark only one oval.*

- ○ 5 minutes or less
- ○ 6-10 minutes
- ○ 11-15 minutes
- ○ 16-20 minutes
- ○ 21-25 minutes
- ○ 26-30 minutes
- ○ 31-35 minutes
- ○ 36-40 minutes
- ○ 41-45 minutes
- ○ 46-50 minutes
- ○ 51-55 minutes
- ○ 56 minutes - 1 hour
- ○ Over 1 hour, but less than 1 hour 15 minutes
- ○ Between 1 hour 16 minutes and 1 hour 30 minutes
- ○ Between 1 hour 31 minutes and 1 hour 45 minutes
- ○ Between 1 hour 46 minutes and 2 hours
- ○ Over 2 hours
- ○ I would rather not answer

24. If over 2 hours for Question 9-1, specify time here

Leave blank if your answer for Question 9-1 is under 2 hours.

_______________________________

25. 9-2. During an emergency event with no prior warning, about how much time would it take Commuter #2 to stop working, grab essentials, and walk to their vehicle to start their trip home?

*Mark only one oval.*

○ 5 minutes or less
○ 6-10 minutes
○ 11-15 minutes
○ 16-20 minutes
○ 21-25 minutes
○ 26-30 minutes
○ 31-35 minutes
○ 36-40 minutes
○ 41-45 minutes
○ 46-50 minutes
○ 51-55 minutes
○ 56 minutes - 1 hour
○ Over 1 hour, but less than 1 hour 15 minutes
○ Between 1 hour 16 minutes and 1 hour 30 minutes
○ Between 1 hour 31 minutes and 1 hour 45 minutes
○ Between 1 hour 46 minutes and 2 hours
○ Over 2 hours
○ I would rather not answer

26. If over 2 hours for Question 9-2, specify time here

Leave blank if your answer for Question 9-2 is under 2 hours.

______________________________

27. 9-3. During an emergency event with no prior warning, about how much time would it take Commuter #3 to stop working, grab essentials, and walk to their vehicle to start their trip home?

*Mark only one oval.*

- ○ 5 minutes or less
- ○ 6-10 minutes
- ○ 11-15 minutes
- ○ 16-20 minutes
- ○ 21-25 minutes
- ○ 26-30 minutes
- ○ 31-35 minutes
- ○ 36-40 minutes
- ○ 41-45 minutes
- ○ 46-50 minutes
- ○ 51-55 minutes
- ○ 56 minutes - 1 hour
- ○ Over 1 hour, but less than 1 hour 15 minutes
- ○ Between 1 hour 16 minutes and 1 hour 30 minutes
- ○ Between 1 Hour 31 minutes and 1 hour 45 minutes
- ○ Between 1 hour 46 minutes and 2 hours
- ○ Over 2 hours
- ○ I would rather not answer

28. If over 2 hours for Question 9-3, specify time here

Leave blank if your answer for Question 9-3 is under 2 hours.

______________________________

*Skip to question 43*

Preparation to leave Work/School

29. 9-1. During an emergency event with no prior warning, about how much time would it take Commuter #1 to stop working, grab essentials, and walk to their vehicle to start their trip home?

*Mark only one oval.*

- ○ 5 minutes or less
- ○ 6-10 minutes
- ○ 11-15 minutes
- ○ 16-20 minutes
- ○ 21-25 minutes
- ○ 26-30 minutes
- ○ 31-35 minutes
- ○ 36-40 minutes
- ○ 41-45 minutes
- ○ 46-50 minutes
- ○ 51-55 minutes
- ○ 56 minutes - 1 hour
- ○ Over 1 hour, but less than 1 hour 15 minutes
- ○ Between 1 hour 16 minutes and 1 hour 30 minutes
- ○ Between 1 hour 31 minutes and 1 hour 45 minutes
- ○ Between 1 hour 46 minutes and 2 hours
- ○ Over 2 Hours
- ○ I would rather not answer

30. If over 2 hours for Question 9-1, specify time here

Leave blank if your answer for Question 9-1 is under 2 hours.

________________________________

31. 9-2. During an emergency event with no prior warning, about how much time would it take Commuter #2 to stop working, grab essentials, and walk to their vehicle to start their trip home?

*Mark only one oval.*

- ○ 5 minutes or less
- ○ 6-10 minutes
- ○ 11-15 minutes
- ○ 16-20 minutes
- ○ 21-25 minutes
- ○ 26-30 minutes
- ○ 31-35 minutes
- ○ 36-40 minutes
- ○ 41-45 minutes
- ○ 46-50 minutes
- ○ 51-55 minutes
- ○ 56 minutes - 1 hour
- ○ Over 1 hour, but less than 1 hour 15 minutes
- ○ Between 1 hour 16 minutes and 1 hour 30 minutes
- ○ Between 1 hour 31 minutes and 1 hour 45 minutes
- ○ Between 1 hour 46 minutes and 2 hours
- ○ Over 2 hours
- ○ I would rather not answer

32. If over 2 hours for Question 9-2, specify time here

Leave blank if your answer for Question 9-2 is under 2 hours.

_______________________________

33. 9-3. During an emergency event with no prior warning, about how much time would it take Commuter #3 to stop working, grab essentials, and walk to their vehicle to start their trip home?

*Mark only one oval.*

- ○ 5 minutes or less
- ○ 6-10 minutes
- ○ 11-15 minutes
- ○ 16-20 minutes
- ○ 21-25 minutes
- ○ 26-30 minutes
- ○ 31-35 minutes
- ○ 36-40 minutes
- ○ 41-45 minutes
- ○ 46-50 minutes
- ○ 51-55 minutes
- ○ 56 minutes - 1 hour
- ○ Over 1 hour, but less than 1 hour 15 minutes
- ○ Between 1 hour 16 minutes and 1 hour 30 minutes
- ○ Between 1 hour 31 minutes and 1 hour 45 minutes
- ○ Between 1 hour 46 minutes and 2 hours
- ○ Over 2 hours
- ○ I would rather not answer

34. If over 2 hours for Question 9-3, specify time here

Leave blank if your answer for Question 9-3 is under 2 hours.

_______________________________

35. 9-4. During an emergency event with no prior warning, about how much time would it take Commuter #4 to stop working, grab essentials, and walk to their vehicle to start their trip home?

*Mark only one oval.*

○ 5 minutes or less
○ 6-10 minutes
○ 11-15 minutes
○ 16-20 minutes
○ 21-25 minutes
○ 26-30 minutes
○ 31-35 minutes
○ 36-40 minutes
○ 41-45 minutes
○ 46-50 minutes
○ 51-55 minutes
○ 56 minutes - 1 hour
○ Over 1 hour, but less than 1 hour 15 minutes
○ Between 1 hour 16 minutes and 1 hour 30 minutes
○ Between 1 hour 31 minutes and 1 hour 45 minutes
○ Between 1 hour 46 minutes and 2 hours
○ Over 2 hours
○ I would rather not answer

36. If over 2 hours for Question 9-4, specify time here

Leave blank if your answer for Question 9-4 is under 2 hours.

*Skip to question 49*

## Travel Home From Work/School

37. 10-1. On average, how much time would it take Commuter #1 to travel home from work or school?

*Mark only one oval.*

- ○ 5 minutes or less
- ○ 6-10 minutes
- ○ 11-15 minutes
- ○ 16-20 minutes
- ○ 21-25 minutes
- ○ 26-30 minutes
- ○ 31-35 minutes
- ○ 36-40 minutes
- ○ 41-45 minutes
- ○ 46-50 minutes
- ○ 51-55 minutes
- ○ 56 minutes - 1 hour
- ○ Over 1 hour, but less than 1 hour 15 minutes
- ○ Between 1 hour 16 minutes and 1 hour 30 minutes
- ○ Between 1 hour 31 minutes and 1 hour 45 minutes
- ○ Between 1 hour 46 minutes and 2 hours
- ○ Over 2 hours
- ○ I would rather not answer

38. If over 2 hours for Question 10-1, specify time here

Leave blank if your answer for Question 10-1 is under 2 hours.

_______________________

*Skip to question 57*

Travel Home From Work/School

39. 10-1. On average, how much time would it take Commuter #1 to travel home from work or school?

*Mark only one oval.*

- ○ 5 minutes or less
- ○ 6-10 minutes
- ○ 11-15 minutes
- ○ 16-20 minutes
- ○ 21-25 minutes
- ○ 26-30 minutes
- ○ 31-35 minutes
- ○ 36-40 minutes
- ○ 41-45 minutes
- ○ 46-50 minutes
- ○ 51-55 minutes
- ○ 56 minutes - 1 hour
- ○ Over 1 hour, but less than 1 hour 15 minutes
- ○ Between 1 hour 16 minutes and 1 hour 30 minutes
- ○ Between 1 hour 31 minutes and 1 hour 45 minutes
- ○ Between 1 hour 46 minutes and 2 hours
- ○ Over 2 hours
- ○ I would rather not answer

40. If over 2 hours for Question 10-1, specify time here

Leave blank if your answer for Question 10-1 is under 2 hours.

________________________________________

41. 10-2. On average, how much time would it take Commuter #2 to travel home from work or school?

*Mark only one oval.*

- ○ 5 minutes or less
- ○ 6-10 minutes
- ○ 11-15 minutes
- ○ 16-20 minutes
- ○ 21-25 minutes
- ○ 26-30 minutes
- ○ 31-35 minutes
- ○ 36-40 minutes
- ○ 41-45 minutes
- ○ 46-50 minutes
- ○ 51-55 minutes
- ○ 56 minutes - 1 hour
- ○ Over 1 hour, but less than 1 hour 15 minutes
- ○ Between 1 hour 16 minutes and 1 hour 30 minutes
- ○ Between 1 hour 31 minutes and 1 hour 45 minutes
- ○ Between 1 hour 46 minutes and 2 hours
- ○ Over 2 hours
- ○ I would rather not answer

42. If over 2 hours for Question 10-2, specify time here

Leave blank if your answer for Question 10-2 is under 2 hours.

_______________________________

*Skip to question 57*

## Travel Home From Work/School

43. 10-1. On average, how much time would it take Commuter #1 to travel home from work or school?

*Mark only one oval.*

- ○ 5 minutes or Less
- ○ 6-10 minutes
- ○ 11-15 minutes
- ○ 16-20 minutes
- ○ 21-25 minutes
- ○ 26-30 minutes
- ○ 31-35 minutes
- ○ 36-40 minutes
- ○ 41-45 minutes
- ○ 46-50 minutes
- ○ 51-55 minutes
- ○ 56 minutes - 1 hour
- ○ Over 1 hour, but less 1 hour 15 minutes
- ○ Between 1 hour 16 minutes and 1 hour 30 minutes
- ○ Between 1 Hour 31 minutes and 1 hour 45 minutes
- ○ Between 1 hour 46 minutes and 2 hours
- ○ Over 2 hours
- ○ I would rather not answer

44. If over 2 hours for Question 10-1 specify time here

Leave blank if your answer for Question 10-1 is under 2 hours.

_______________________________

45. 10-2. On average, how much time would it take Commuter #2 to travel home from work or school?

*Mark only one oval.*

○ 5 minutes or less
○ 6-10 minutes
○ 11-15 minutes
○ 16-20 minutes
○ 21-25 minutes
○ 26-30 minutes
○ 31-35 minutes
○ 36-40 minutes
○ 41-45 minutes
○ 46-50 minutes
○ 51-55 minutes
○ 56 minutes - 1 hour
○ Over 1 hour, but less than 1 hour 15 minutes
○ Between 1 hour 16 minutes and 1 hour 30 minutes
○ Between 1 hour 31 minutes and 1 hour 45 minutes
○ Between 1 hour 46 minutes and 2 hours
○ Over 2 hours
○ I would rather not answer

46. If over 2 hours for Question 10-2, specify time here

Leave blank if your answer for Question 10-2 is under 2 hours.

_______________________________

47. 10-3. On average, how much time would it take Commuter #3 to travel home from work or school?

*Mark only one oval.*

○ 5 minutes or less
○ 6-10 minutes
○ 11-15 minutes
○ 16-20 minutes
○ 21-25 minutes
○ 26-30 minutes
○ 31-35 minutes
○ 36-40 minutes
○ 41-45 minutes
○ 46-50 minutes
○ 51-55 minutes
○ 56 minutes - 1 hour
○ Over 1 hour, but less than 1 hour 15 minutes
○ Between 1 hour 16 minutes and 1 hour 30 minutes
○ Between 1 hour 31 minutes and 1 hour 45 minutes
○ Between 1 hour 46 minutes and 2 hours
○ Over 2 hours
○ I would rather not answer

48. If over 2 hours for Question 10-3, specify time here

Leave blank if your answer for Question 10-3 is under 2 hours.

*Skip to question 57*

Travel Home From Work/School

49. 10-1. On average, how much time would it take Commuter #1 to travel home from work or school?

*Mark only one oval.*

- ○ 5 minutes or less
- ○ 6-10 minutes
- ○ 11-15 minutes
- ○ 16-20 minutes
- ○ 21-25 minutes
- ○ 26-30 minutes
- ○ 31-35 minutes
- ○ 36-40 minutes
- ○ 41-45 minutes
- ○ 46-50 minutes
- ○ 51-55 minutes
- ○ 56 minutes - 1 hour
- ○ Over 1 hour, but less than 1 hour 15 minutes
- ○ Between 1 hour 16 minutes and 1 hour 30 minutes
- ○ Between 1 hour 31 minutes and 1 hour 45 minutes
- ○ Between 1 hour 46 minutes and 2 hours
- ○ Over 2 hours
- ○ I would rather not answer

50. If over 2 hours for Question 10-1, specify time here

Leave blank if your answer for Question 10-1 is under 2 hours.

51. 10-2. On average, how much time would it take Commuter #2 to travel home from work or school?

*Mark only one oval.*

- ○ 5 minutes or less
- ○ 6-10 minutes
- ○ 11-15 minutes
- ○ 16-20 minutes
- ○ 21-25 minutes
- ○ 26-30 minutes
- ○ 31-35 minutes
- ○ 36-40 minutes
- ○ 41-45 minutes
- ○ 46-50 minutes
- ○ 51-55 minutes
- ○ 56 minutes - 1 Hour
- ○ Over 1 hour, but less than 1 hour 15 minutes
- ○ Between 1 hour 16 minutes and 1 Hour 30 minutes
- ○ Between 1 hour 31 minutes and 1 hour 45 minutes
- ○ Between 1 hour 46 minutes and 2 hours
- ○ Over 2 hours
- ○ I would rather not answer

52. If over 2 hours for Question 10-2, specify time here

Leave blank if your answer for Question 10-2 is under 2 hours.

________________________________________

53. 10-3. On average, how much time would it take Commuter #3 to travel home from work or school?

*Mark only one oval.*

○ 5 minutes or less
○ 6-10 minutes
○ 11-15 minutes
○ 16-20 minutes
○ 21-25 minutes
○ 26-30 minutes
○ 31-35 minutes
○ 36-40 minutes
○ 41-45 minutes
○ 46-50 minutes
○ 51-55 minutes
○ 56 minutes - 1 hour
○ Over 1 hour, but less than 1 hour 15 minutes
○ Between 1 hour 16 minutes and 1 hour 30 minutes
○ Between 1 hour 31 minutes and 1 hour 45 minutes
○ Between 1 hour 46 minutes and 2 hours
○ Over 2 hours
○ I would rather not answer

54. If over 2 hours for Question 10-3, specify time here

Leave blank if your answer for Question 10-3 is under 2 hours.

_______________________

55. 10-4. On average, how much time would it take Commuter #4 to travel home from work or school?

*Mark only one oval.*

○ 5 minutes or less
○ 6-10 minutes
○ 11-15 minutes
○ 16-20 minutes
○ 21-25 minutes
○ 26-30 minutes
○ 31-35 minutes
○ 36-40 minutes
○ 41-45 minutes
○ 46-50 minutes
○ 51-55 minutes
○ 56 minutes - 1 hour
○ Over 1 hour, but less than 1 hour 15 minutes
○ Between 1 hour 16 minutes and 1 hour 30 minutes
○ Between 1 hour 31 minutes and 1 hour 45 minutes
○ Between 1 hour 46 minutes and 2 hours
○ Over 2 hours
○ I would rather not answer

56. If over 2 hours for Question 10-4, specify time here

Leave blank if your answer for Question 10-4 is under 2 hours.

_______________________

*Skip to question 57*

Additional Questions

57. 11. If you were advised by local authorities to evacuate, how much time would it take your household to pack essentials, secure your home, load the car and start evacuating the area?

*Mark only one oval.*

- ○ Less than 15 minutes
- ○ 15-30 minutes
- ○ 31-45 minutes
- ○ 46 minutes - 1 hour
- ○ 1 hour to 1 hour 15 minutes
- ○ 1 hour 16 minutes to 1 hour 30 minutes
- ○ 1 hour 31 minutes to 1 hour 45 minutes
- ○ 1 hour 46 minutes to 2 hours
- ○ 2 hours to 2 hours 15 minutes
- ○ 2 hours 16 minutes to 2 hours 30 minutes
- ○ 2 hours 31 minutes to 2 hours 45 minutes
- ○ 2 hours 46 minutes to 3 hours
- ○ 3 hours to 3 hours 15 minutes
- ○ 3 hours 16 minutes to 3 hours 30 minutes
- ○ 3 hours 31 minutes to 3 hours 45 minutes
- ○ 3 hours 46 minutes to 4 hours
- ○ 4 hours to 4 hours 15 minutes
- ○ 4 hours 16 minutes to 4 hours 30 minutes
- ○ 4 hours 31 minutes to 4 hours 45 minutes
- ○ 4 hours 46 minutes to 5 hours
- ○ 5 hours to 5 hours 30 minutes
- ○ 5 hours 31 minutes to 6 hours
- ○ Over 6 hours
- ○ Will not evacuate
- ○ I would rather not answer

58. If over 6 hours for Question 11, specify time here

Leave blank if your answer for Question 11 is under 6 hours.

________________________________

59. 12. How many people in your household would require any of the following functional or transportation assistance during an evacuation:

*Mark only one oval per row.*

| | 0 | 1 | 2 | 3 | 4 | More than 4 |
|---|---|---|---|---|---|---|
| **Bus** | ○ | ○ | ○ | ○ | ○ | ○ |
| **Medical Bus/Van** | ○ | ○ | ○ | ○ | ○ | ○ |
| **Wheelchair Accessible Vehicle** | ○ | ○ | ○ | ○ | ○ | ○ |
| **Ambulance** | ○ | ○ | ○ | ○ | ○ | ○ |
| **Other** | ○ | ○ | ○ | ○ | ○ | ○ |

60. Specify "Other" transportation need below

________________________________

61. 13. If members of your household are in different locations when an evacuation is recommended, what would you do?

*Mark only one oval.*

○ I would wait for all members of my household and evacuate together.
○ I would evacuate independently and meet other members of my household later.
○ I would rather not answer

62. 14A. If emergency officials advise you to shelter-in-place during an emergency because you are not in the affected area, would you:

*Mark only one oval.*

○ Shelter-in-place
○ Evacuate
○ I would rather not answer

63. 14B. During an emergency, if emergency officials advise you to shelter-in-place while people in other areas are advised to evacuate, would you:

*Mark only one oval.*

○ Shelter-in-place
○ Evacuate
○ I would rather not answer

64. 14C. During an emergency, if officials advise you to evacuate, where would you go?

*Mark only one oval.*

○ A relative’s or friend's home
○ A reception center
○ A hotel, motel or campground
○ A second/seasonal home
○ I would not evacuate
○ I do not know
○ I would rather not answer
○ Other: ______________________

## Pet Questions

65. 15A. Do you have any pets or animals?

*Mark only one oval.*

- ○ Yes
- ○ No *Skip to question 69*
- ○ I would rather not answer *Skip to question 69*

*Skip to question 69*

Pet Questions

66. 15B. What type of pets or animals do you have? Check all that apply.

*Check all that apply.*

- ☐ Dog
- ☐ Cat
- ☐ Bird
- ☐ Reptile
- ☐ Horse
- ☐ Fish
- ☐ Chicken
- ☐ Goat
- ☐ Pig
- ☐ Other: ____________________

Pet Questions

67. 15C. What would you do with your pets or animals if you had to evacuate?

*Mark only one oval.*

- ○ Take them with me to a shelter
- ○ Take them with me to somewhere else
- ○ Leave them at home *Skip to question 69*
- ○ I would rather not answer *Skip to question 69*

## Pet Questions

68. 15D. Do you have enough room in your vehicle(s) to evacuate with your pets or animals?

*Mark only one oval.*

○ Yes
○ No
○ I would rather not answer
○ Other: ______________________

## Emergency Communications

69. 16A. In your home, how reliable is your cellphone signal?

*Mark only one oval.*

○ Very reliable to receive texts and phone calls
○ Reliable for text messages only
○ I do not always receive cell communication in my home
○ I do not have cell service in my home
○ I would rather not answer

70. 16B. If you receive a text message similar to an AMBER Alert from emergency officials with directions for you to respond to an active radiological emergency at Turkey Point Nuclear Power Plant, how likely is it you would follow these directions?

*Mark only one oval.*

○ Highly likely
○ Likely
○ Nether likely or unlikely
○ Unlikely
○ Highly unlikely
○ I would rather not answer
○ Other: ____________________

71. 16C. Which of the following is the best way to notify you of an emergency while you're home?

*Mark only one oval.*

○ A siren sounding near your home
○ A text message from emergency officials
○ Alert broadcast on radio
○ Alert broadcast on TV
○ Information on twitter or facebook
○ Phone call/text message from family, friend or neighbor
○ I would rather not answer
○ Other: ____________________

# APPENDIX G

## Traffic Management Plan

# G. TRAFFIC MANAGEMENT PLAN

NUREG/CR-7002, Rev. 1 indicates that the existing Traffic Control Points (TCPs) identified by the offsite agencies should be used in the evacuation simulation modeling. The traffic control plans for the EPZ were provided by Miami-Dade County and Monroe County. These plans were reviewed, and the TCPs were modeled accordingly.

## G.1 Traffic Control Points

As discussed in Section 9, TCPs at intersections (which are controlled) are modeled as actuated signals. If an intersection has a pre-timed signal, stop, or yield control, and the intersection is identified as a traffic control point, the control type was changed to an actuated signal in the DYNEV II system, in accordance with Section 3.3 of NUREG/CR-7002, Rev. 1. TCPs at existing actuated traffic signalized intersections were essentially left alone except where modifications to green time allocation were deemed necessary. An exception to this is the all-way stop sign at the intersection of CR-905 and CR-905A (Card Sound Rd) in Monroe County. Based on discussions with county emergency planning personnel, this intersection would be manned by a police officer who would allow the continuous flow of traffic on CR-905 (there will be little to no traffic flowing southbound on CR-905A) to facilitate the evacuation of the ORC. As such, the intersection was modeled as a TCP and uncontrolled. In addition, upon the activation of access control, the intersection of US-1 and CR-905 would also be manned by a police officer to allow continuous flow of traffic on CR-905 southbound onto US 1 southbound according to Monroe County emergency planning personnel. This intersection was also modeled as a TCP.

As shown in Figures 7-3 through 7-9 there is significant traffic congestion in competing directions (east-west and north-south) at intersections in the northwest quadrant of the EPZ where nearly all of the EPZ population resides. Assigning police officers to perform traffic control at these intersections will have no benefit due to the heavy congestion along all approaches. TCPs in this area would be ineffective. TCPs on the Florida Turnpike ramps would have the most benefit for evacuation. These TCPs would facilitate traffic movement onto the turnpike and discourage traffic from exiting the turnpike.

Figure G-1 maps the TCP locations identified in the county emergency plans. These TCPs are concentrated along the Florida Turnpike at access ramps in Miami-Dade County and on CR-905 in Monroe County. This is the most effective allocation of manpower and equipment as these are the primary evacuation routes in each county. The TCPs would be manned during evacuation by traffic guides who would direct evacuees in the proper direction and also facilitate the flow of traffic through intersections. Those TCPs along the Florida Turnpike outside of the EPZ and those TCPs on other roads along the boundary of the EPZ essentially serve as ACPs limiting the flow of traffic into the EPZ once the decision is made to do so.

Note that there are additional TCPs in Miami-Dade County along the EPZ boundary and the boundary of those areas comprising the 5-Mile Region. These TCPs are designed to limit the number of vehicles entering areas at risk from outside the EPZ.

Dynamic and variable message signs will be strategically positioned outside of the EPZ at logical diversion points to attempt to divert traffic away from the area at risk and to discourage through travelers from using major through routes which traverse the EPZ.

As discussed in Section 3.11, external traffic will utilize the Don Shula Expressway, the Florida Turnpike and US-1 to pass through the EPZ. The external trips (7,274 during daytime conditions and 2,910 during evening conditions) cease at 120 minutes after the ATE in the simulation as ACPs are implemented to divert traffic from these routes.

This study did not identify any additional intersections that should be designated as TCPs due to heavy congestion in the competing directions at most intersections in the EPZ. The existing county traffic management plans are adequate.

Table K-1 provides the number of nodes with each control type. If the existing control was changed due to the point being a TCP, the control type is indicated as a TCP in Table K-1. The existing TCPs within the study area are mapped as blue dots in Figure G-1.

## G.2 Analysis of Key TCP Locations

As discussed in Section 5.2 of NUREG/CR-7002, Rev. 1, manual traffic control (MTC) at intersections could benefit from the ETE analysis. The TCP locations contained within the traffic management plans were analyzed to determine key locations where MTC would be most useful and can be readily implemented. In addition, modifications to the exiting TMP were analyzed to see if the ETE could be improved.

As previously mentioned, signalized intersections that were actuated based on field data collection were essentially left as actuated traffic signals in the model, with modifications to green time allocation as needed. Other controlled intersections (pre-timed signals, stop signs and yield signs) were changed to actuated traffic signals to represent the MTC that would be implemented according to the traffic management plans.

Table G-1 shows a list of the intersections that were identified as TCPs in the TMP that were not previously actuated signals, including the type of control that currently exists at each location. To determine the impact of MTC at these locations, a winter, midweek, midday, good weather (Scenario 6) evacuation of the 2- Mile region (Region 01), 5-Mile Region (Region 02) and the entire EPZ (Region R03) was simulated wherein these intersections were left as is (without MTC). The results were compared to the results presented in Section 7. There was no difference in the 90th and the 100th percentile ETE for Region R01 and Region R02, but the 90th and the 100th percentile ETE for the entire EPZ (Region 03) increased by 5 minutes (minimal impact), when MTC was not present at these intersections. The remaining TCPs were left as actuated signals in the model and, therefore, had no impact on ETE. Heavy traffic flows exist in both the competing directions as vehicles evacuate the area. When heavy traffic persists in competing directions, MTC provides little to no benefit since both approaches need equal amounts of green time. As a result, the TCPs do very little to help the ETE.

While TCPs are not necessary to evacuate the EPZ expediently, staffing these locations does still provide value during an evacuation such as guiding those evacuees who are not familiar with the area and serving as fixed point surveillance if there is an incident on one of the major evacuation routes.

**Table G-1. List of Manual Traffic Control Locations at Intersections without Actuated Signals**

| TCP | Node # | Previous Control |
|---|---|---|
| SW 216 St & 134 Ave | 259 | Stop Controlled |
| SW 232 St & 147 Ave | 276 | Stop Controlled |
| SW 232 St & 157 Ave | 277 | Stop Controlled |
| SW 248 St & 157 Ave | 282 | Stop Controlled |
| SW 248 St & 167 Ave | 142 | Stop Controlled |
| SW 264 St & 167 Ave | 143 | Stop Controlled |
| SW 272 St & 167 Ave | 285 | Stop Controlled |
| SW 280 St & 177 Ave | 625 | Stop Controlled |
| SW 344 St & 137 Ave | 527, 529 | Stop Controlled |
| SW 7 St & 187 Ave | 298 | Stop Controlled |

**Table G-2. ETE with no MTC**

| Region | Scenario 6 | | | | | |
|---|---|---|---|---|---|---|
| | 90th Percentile ETE | | | 100th Percentile ETE | | |
| | Base | No MTC | Difference | Base | No MTC | Difference |
| R01 (2-Mile Region) | 1:35 | 1:35 | 0:00 | 2:20 | 2:20 | 0:00 |
| R02 (5-Mile Region) | 2:50 | 2:50 | 0:00 | 5:20 | 5:20 | 0:00 |
| R03 (Full EPZ) | 8:25 | 8:30 | 0:05 | 10:50 | 10:55 | 0:05 |

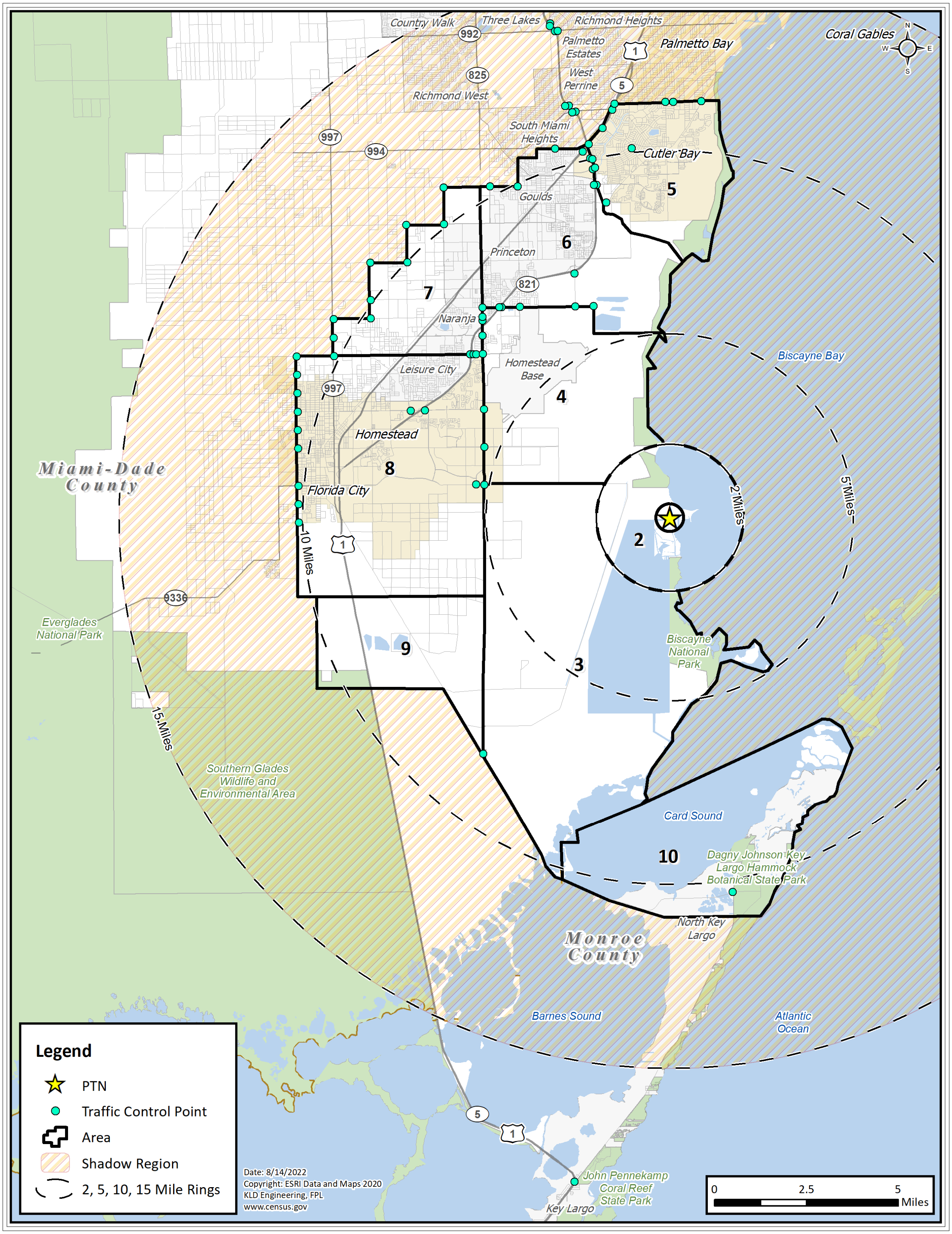

**Figure G-1. Traffic Control Points within the PTN EPZ**

# APPENDIX H

## Evacuation Regions

## H. EVACUATION REGIONS

This appendix presents the evacuation percentages for each evacuation region (Table H-1) and maps of all evacuation regions (Figure H-1 through Figure H-17). The percentages presented in Table H-1 are based on the methodology discussed in assumption 7 of Section 2.2 and shown in Figure 2-1.

Note the baseline ETE study assumes 20% of households will not comply with the shelter advisory, as per Section 2.5.2 of NUREG/CR-7002, Rev. 1.

Note that Area 1 is not labeled in Figure H-1 through Figure H-17. Area 1 is the PTN site and is indicated as a star in these figures.

## Table H-1. Percent of Area Population Evacuating for Each Region

| **Radial Regions** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **Area** | | | | | | | | | | |
| **Region** | **Description** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **EAS Message** |
| **R01** | 2-Mile Region | **100%** | **100%** | **20%** | **20%** | **20%** | **20%** | **20%** | **20%** | **20%** | **20%** | E14/E18/E19/E21/E22/E23 |
| **R02** | 5-Mile Region | **100%** | **100%** | **100%** | **100%** | **20%** | **20%** | **20%** | **20%** | **20%** | **20%** | E16 |
| **R03** | Full EPZ | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | N/A |
| **Evacuate 2-Mile Region and Downwind to 5-Mile Region** | | | | | | | | | | | | |
| | | **Area** | | | | | | | | | | |
| **Region** | **Wind Direction From:** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **EAS Message** |
| **R04** | SSE, S, SSW | **100%** | **100%** | **20%** | **100%** | **20%** | **20%** | **20%** | **20%** | **20%** | **20%** | E17 |
| **N/A** | SW, WSW, W, WNW, NW | **Refer to Region 01** | | | | | | | | | | E14/E18/E19/E21/E22/E23 |
| **R05** | NNW, N, NNE, NE, ENE | **100%** | **100%** | **100%** | **20%** | **20%** | **20%** | **20%** | **20%** | **20%** | **20%** | E15/E20/E25/E26 |
| **N/A** | E, ESE, SE | **Refer to Region 02** | | | | | | | | | | E16 |
| **Evacuate 2-Mile Region and Downwind to EPZ Boundary** | | | | | | | | | | | | |
| | | **Area** | | | | | | | | | | |
| **Region** | **Wind Direction From:** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **EAS Message** |
| **R06** | S, SSW | **100%** | **100%** | **20%** | **100%** | **100%** | **100%** | **20%** | **20%** | **20%** | **20%** | E24 |
| **N/A** | SW, WSW, W, WNW | **Refer to Region 01** | | | | | | | | | | E14/E18/E19/E21/E22/E23 |
| **R07** | NW | **100%** | **100%** | **20%** | **20%** | **20%** | **20%** | **20%** | **20%** | **20%** | **100%** | E14/E18/E19/E21/E22/E23 plus Monroe County |
| **R08** | NNW, N, NNE | **100%** | **100%** | **100%** | **20%** | **20%** | **20%** | **20%** | **20%** | **20%** | **100%** | E15/E20/E25/E26 plus Monroe County |
| **R09** | NE | **100%** | **100%** | **100%** | **20%** | **20%** | **20%** | **20%** | **20%** | **100%** | **20%** | E08 |
| **R10** | ENE | **100%** | **100%** | **100%** | **20%** | **20%** | **20%** | **20%** | **100%** | **100%** | **20%** | E09 |
| **R11** | E | **100%** | **100%** | **100%** | **100%** | **20%** | **20%** | **20%** | **100%** | **100%** | **20%** | E10 |
| **R12** | ESE | **100%** | **100%** | **100%** | **100%** | **20%** | **20%** | **100%** | **100%** | **20%** | **20%** | E11 |
| **R13** | SE | **100%** | **100%** | **100%** | **100%** | **20%** | **100%** | **100%** | **100%** | **20%** | **20%** | E12 |
| **R14** | SSE | **100%** | **100%** | **20%** | **100%** | **100%** | **100%** | **100%** | **20%** | **20%** | **20%** | E13 |
| **Staged Evacuation - 2-Mile Region Evacuates, then Evacuate Downwind to 5-Mile Region** | | | | | | | | | | | | |
| | | **Area** | | | | | | | | | | |
| **Region** | **Wind Direction From:** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **EAS Message** |
| **R15** | 5-Mile Region, E, ESE, SE | **100%** | **100%** | **100%** | **100%** | **20%** | **20%** | **20%** | **20%** | **20%** | **20%** | E16, staged |
| **R16** | SSE, S, SSW | **100%** | **100%** | **20%** | **100%** | **20%** | **20%** | **20%** | **20%** | **20%** | **20%** | E17, staged |
| **N/A** | SW, WSW, W, WNW, NW | **Refer to Region 01** | | | | | | | | | | E14/E18/E19/E21/E22/E23 |
| **R17** | NNW, N, NNE, NE, ENE | **100%** | **100%** | **100%** | **20%** | **20%** | **20%** | **20%** | **20%** | **20%** | **20%** | E15/E20/E25/E26, staged |
| 🟥 Area(s) Evacuate | | | | | | ⬜ Area(s) Shelter-in-Place | | | | | 🟦 Shelter-in-Place until 90% ETE for R01, then Evacuate | |

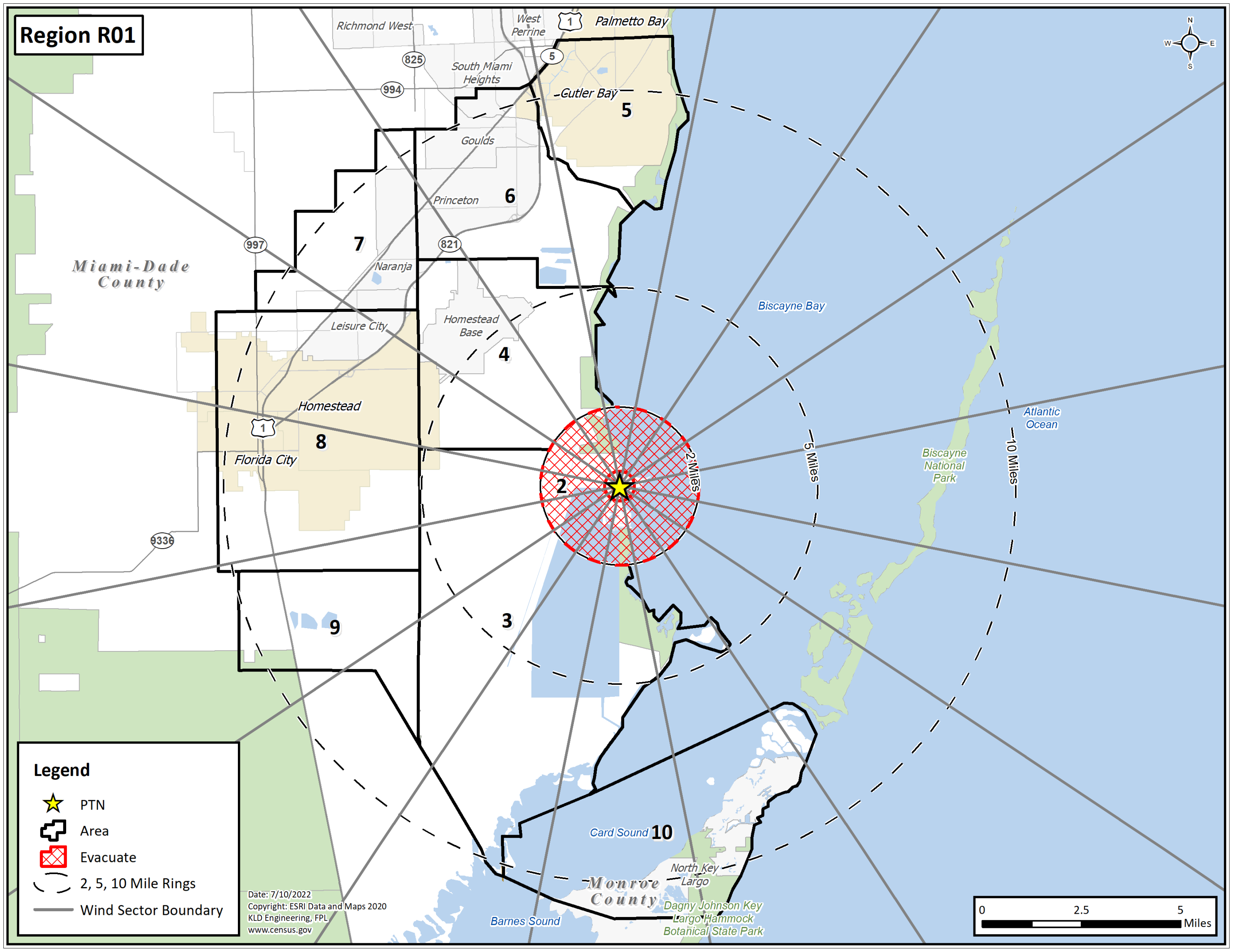

Figure H-1. Region R01

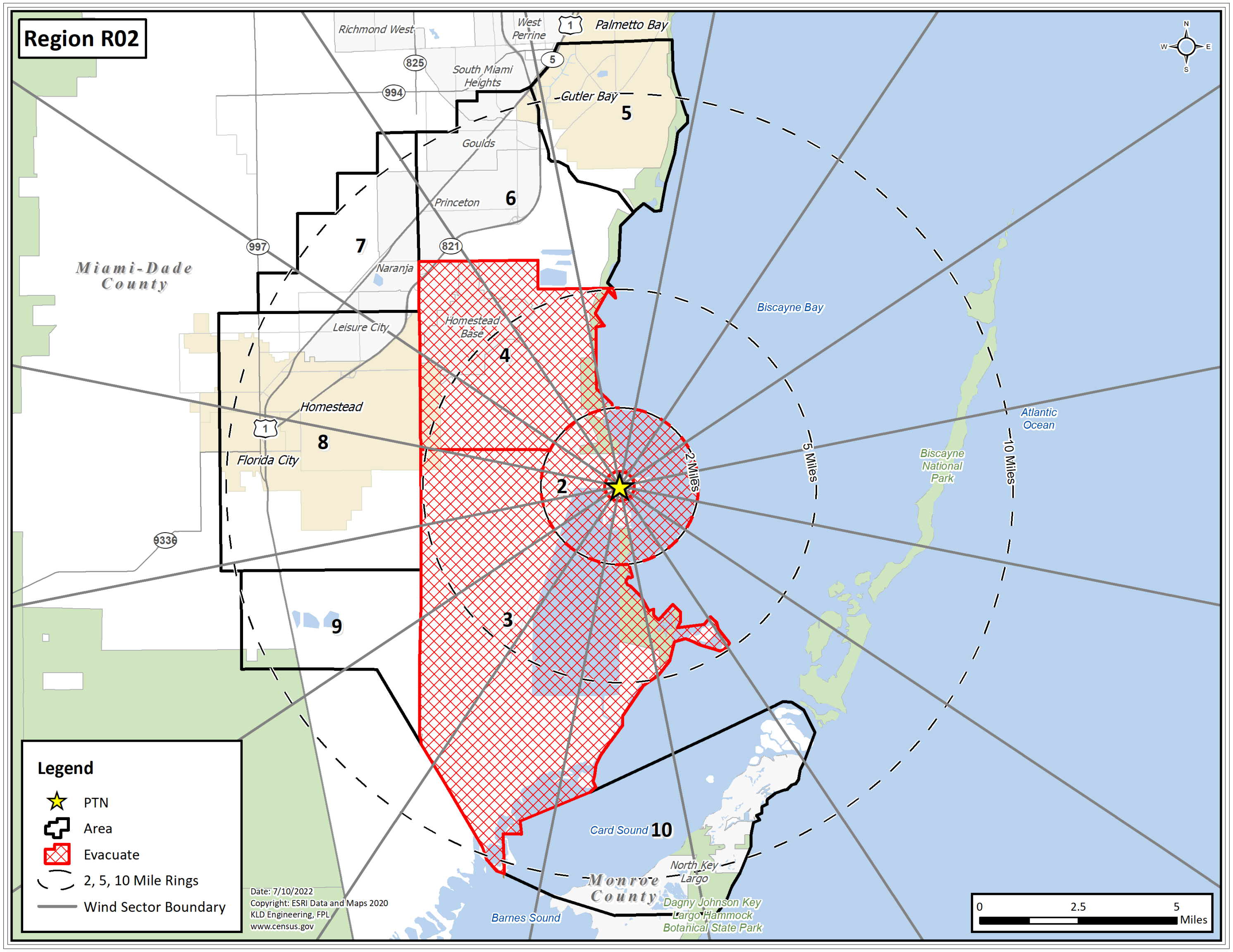

Figure H-2. Region R02

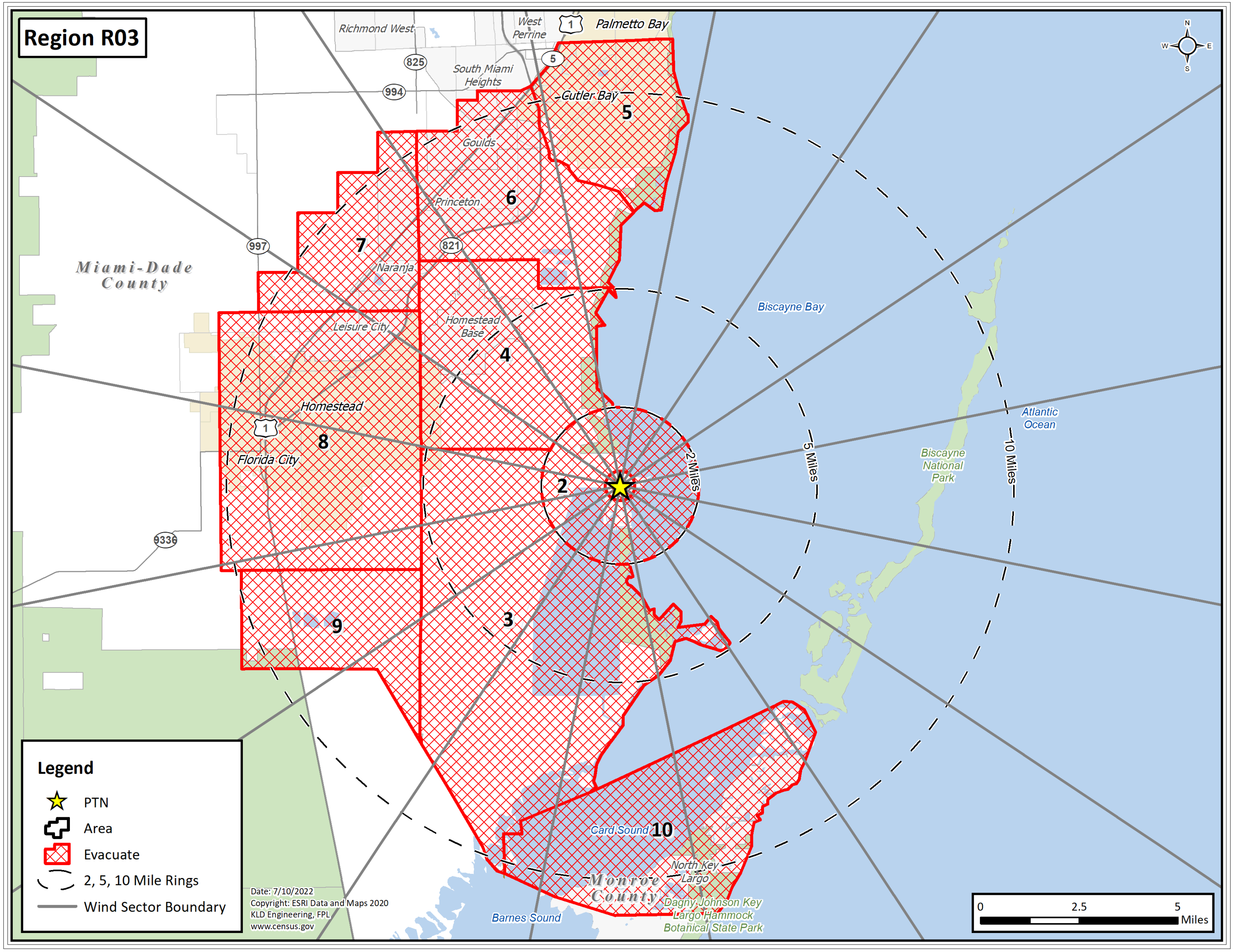

Figure H-3. Region R03

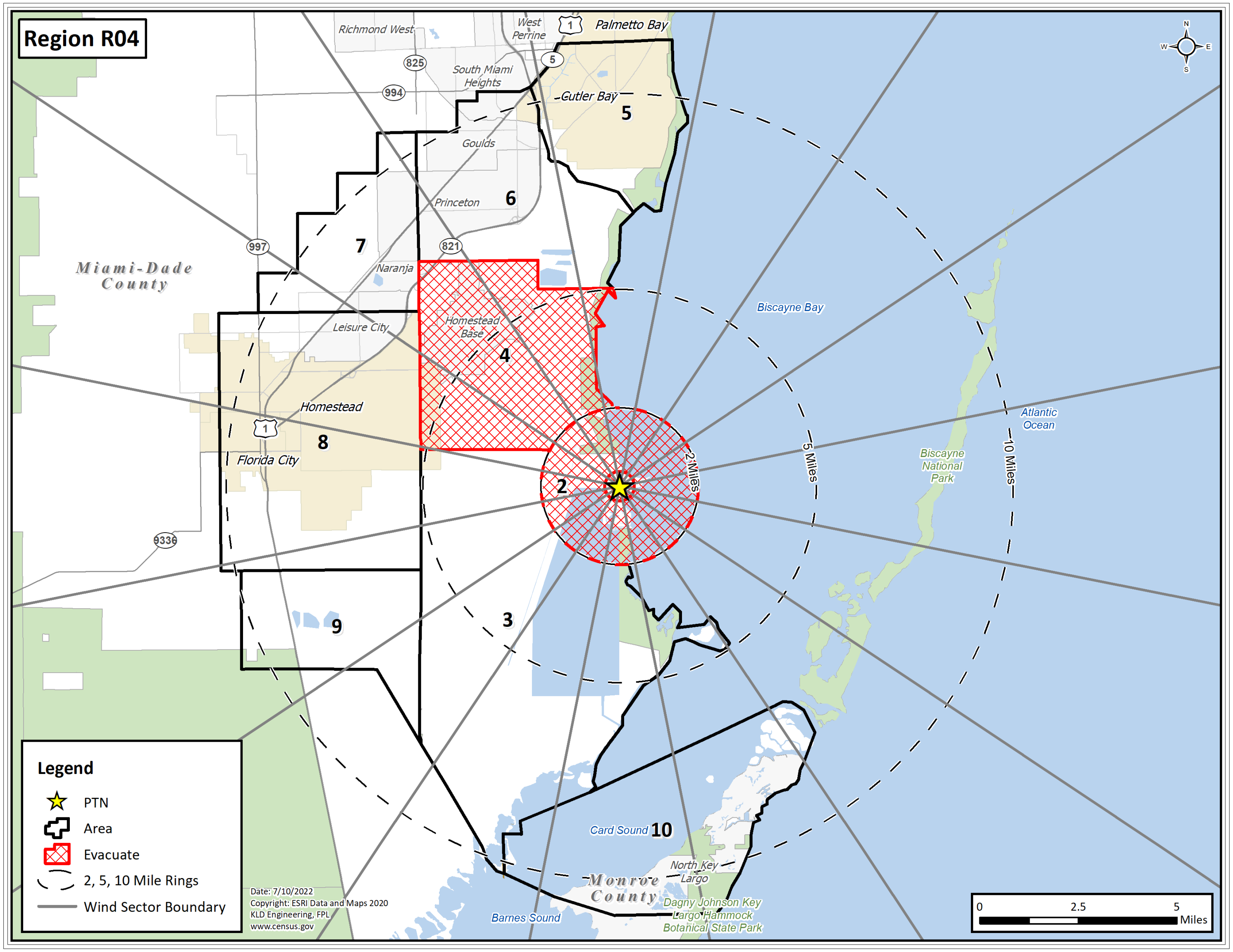

Figure H-4. Region R04

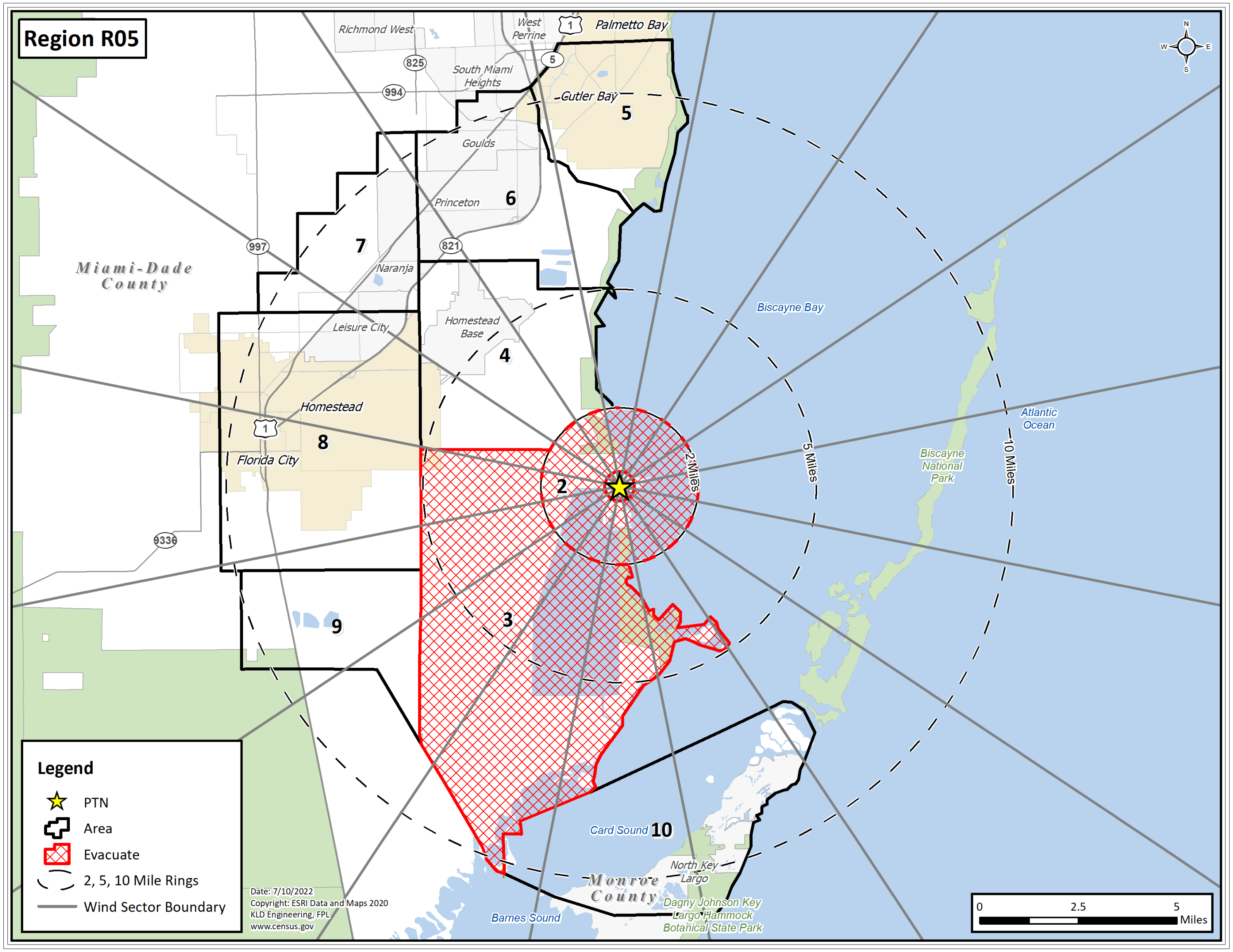

**Figure H-5. Region R05**

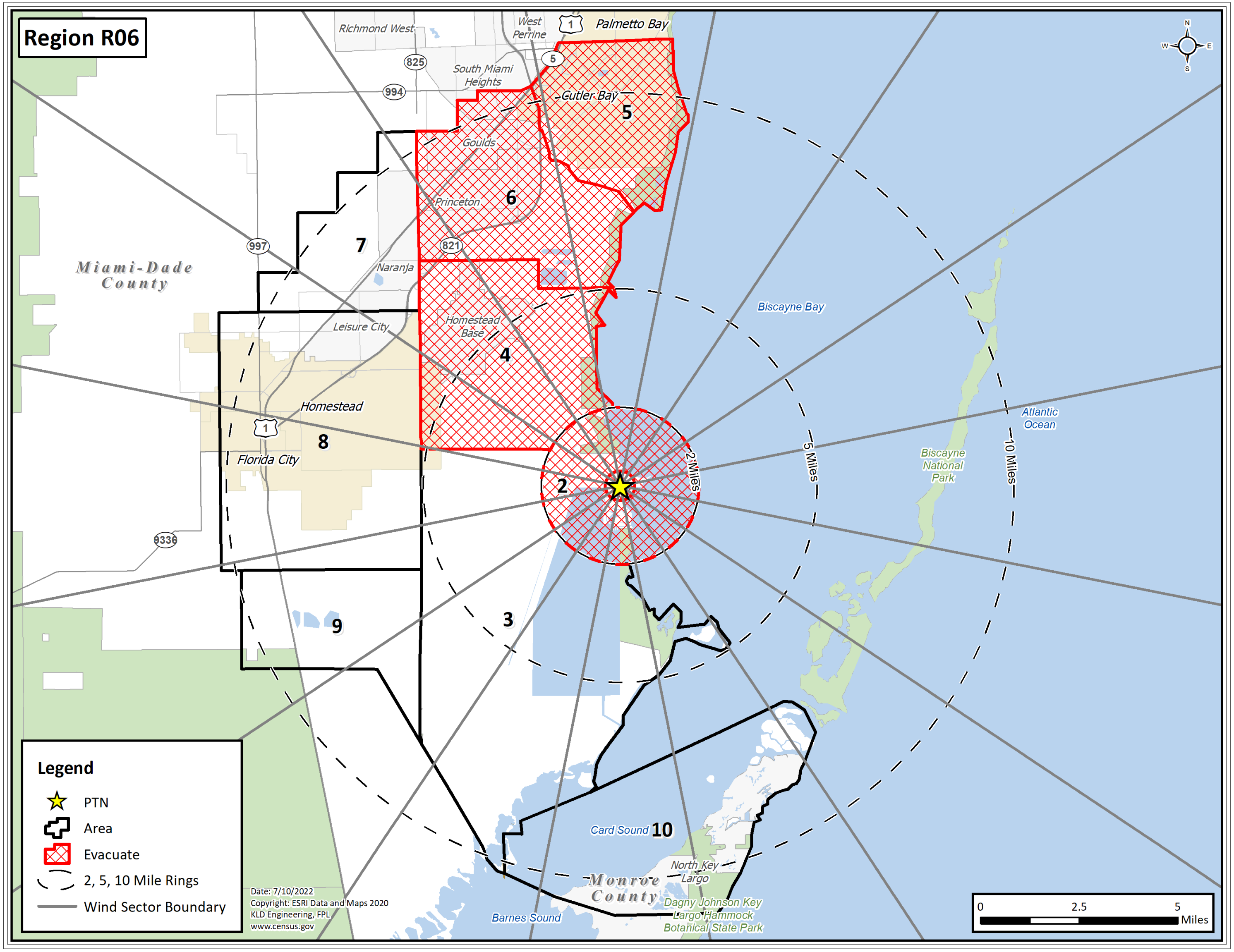

Figure H-6. Region R06

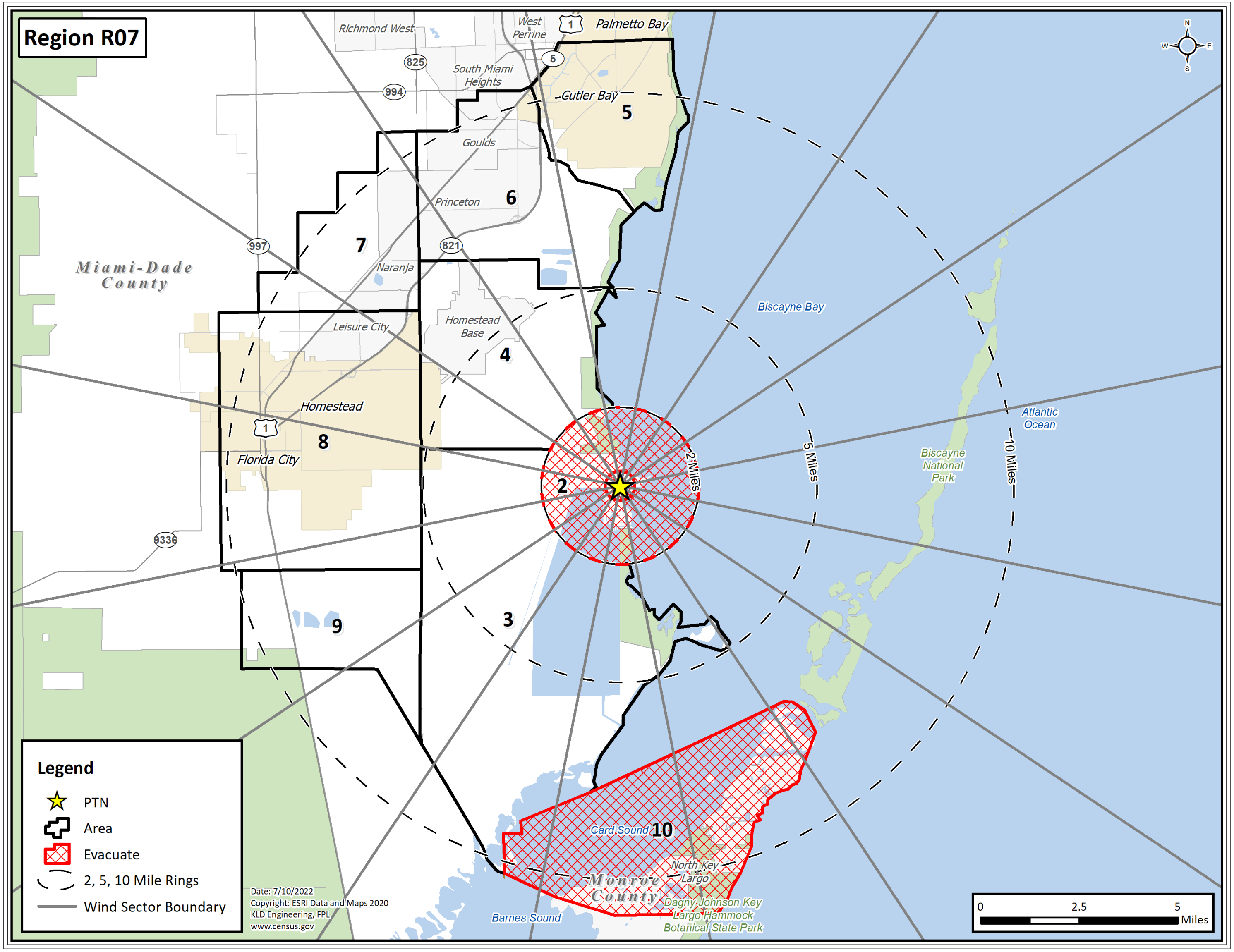

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Figure H-7. Region R07

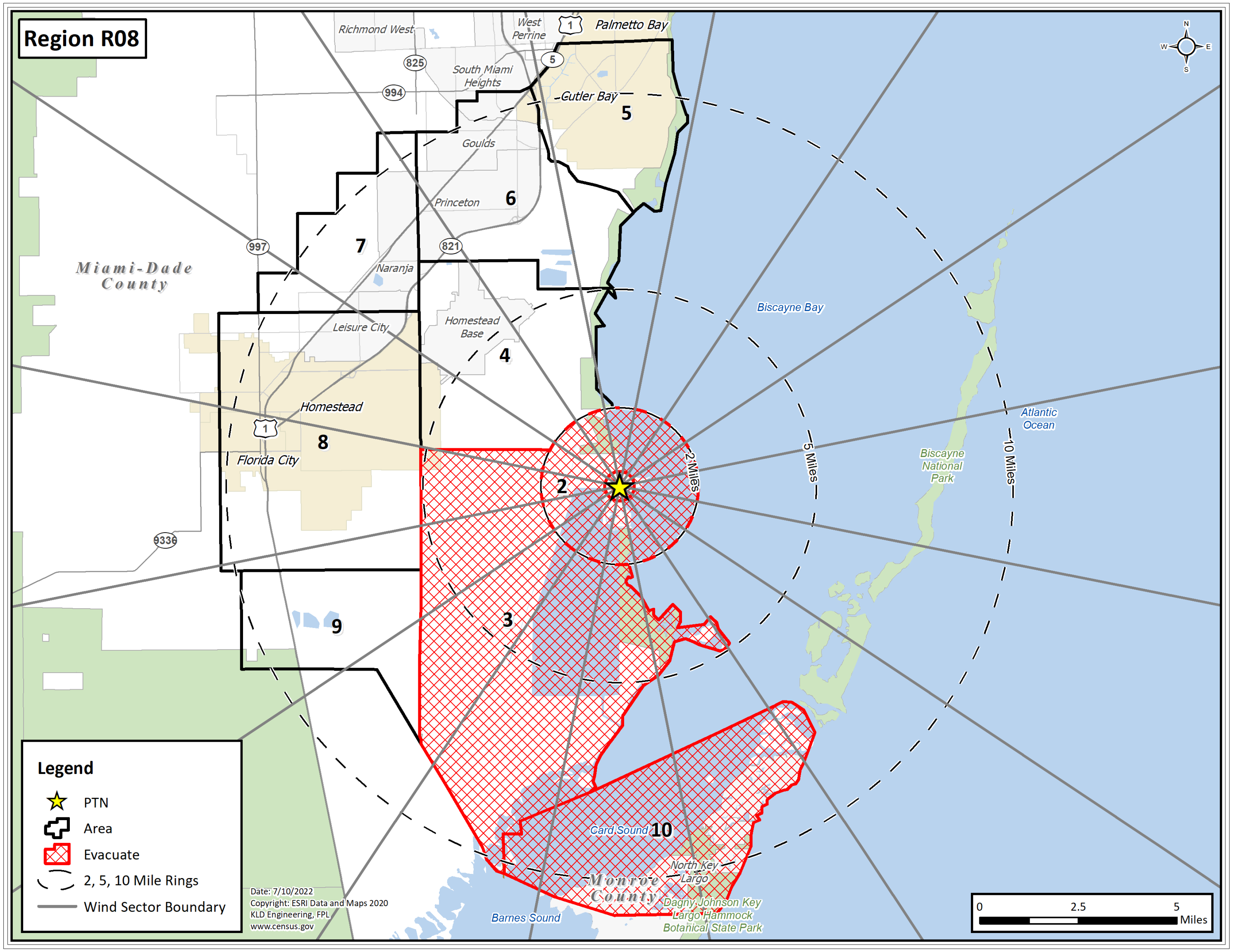

Figure H-8. Region R08

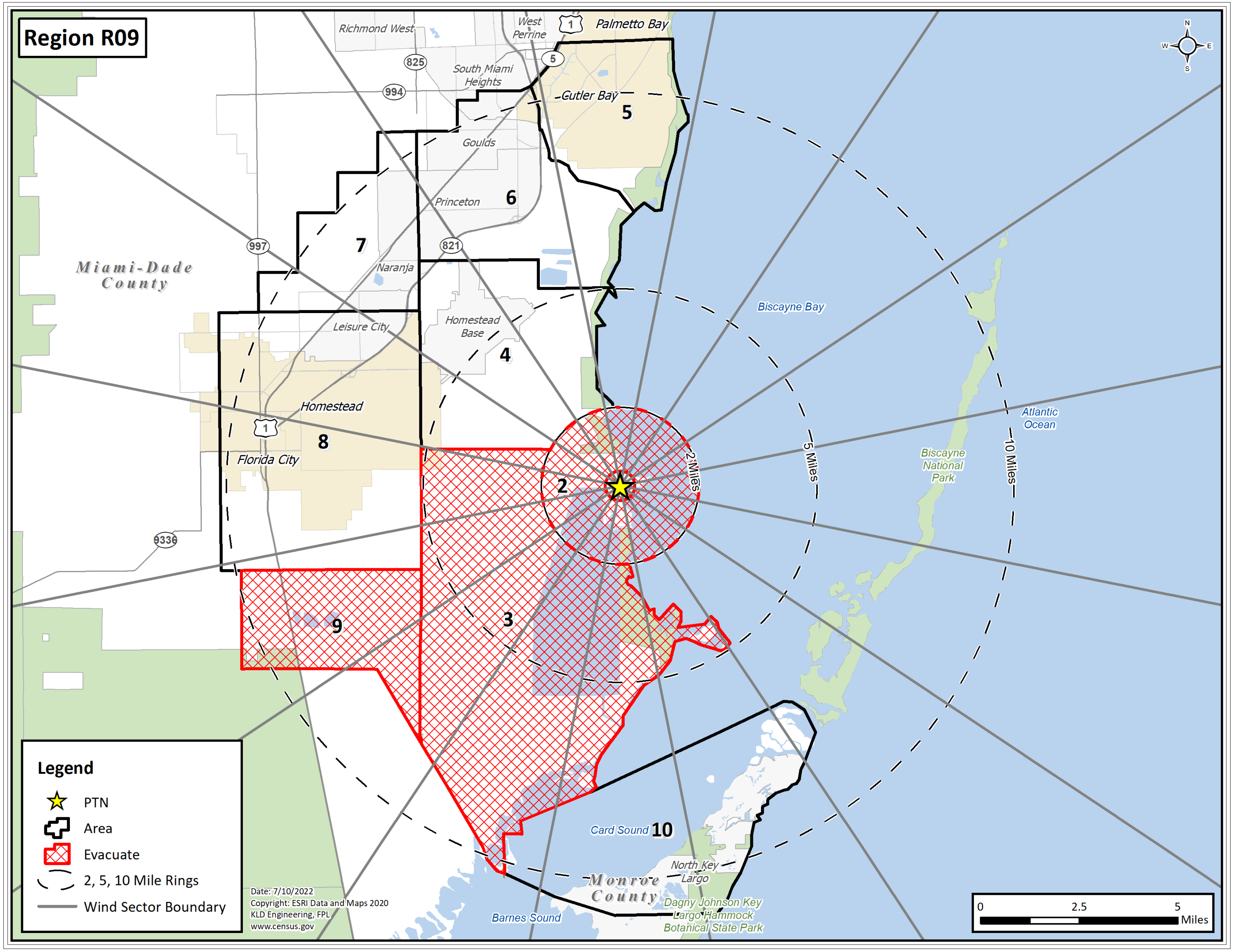

Figure H-9. Region R09

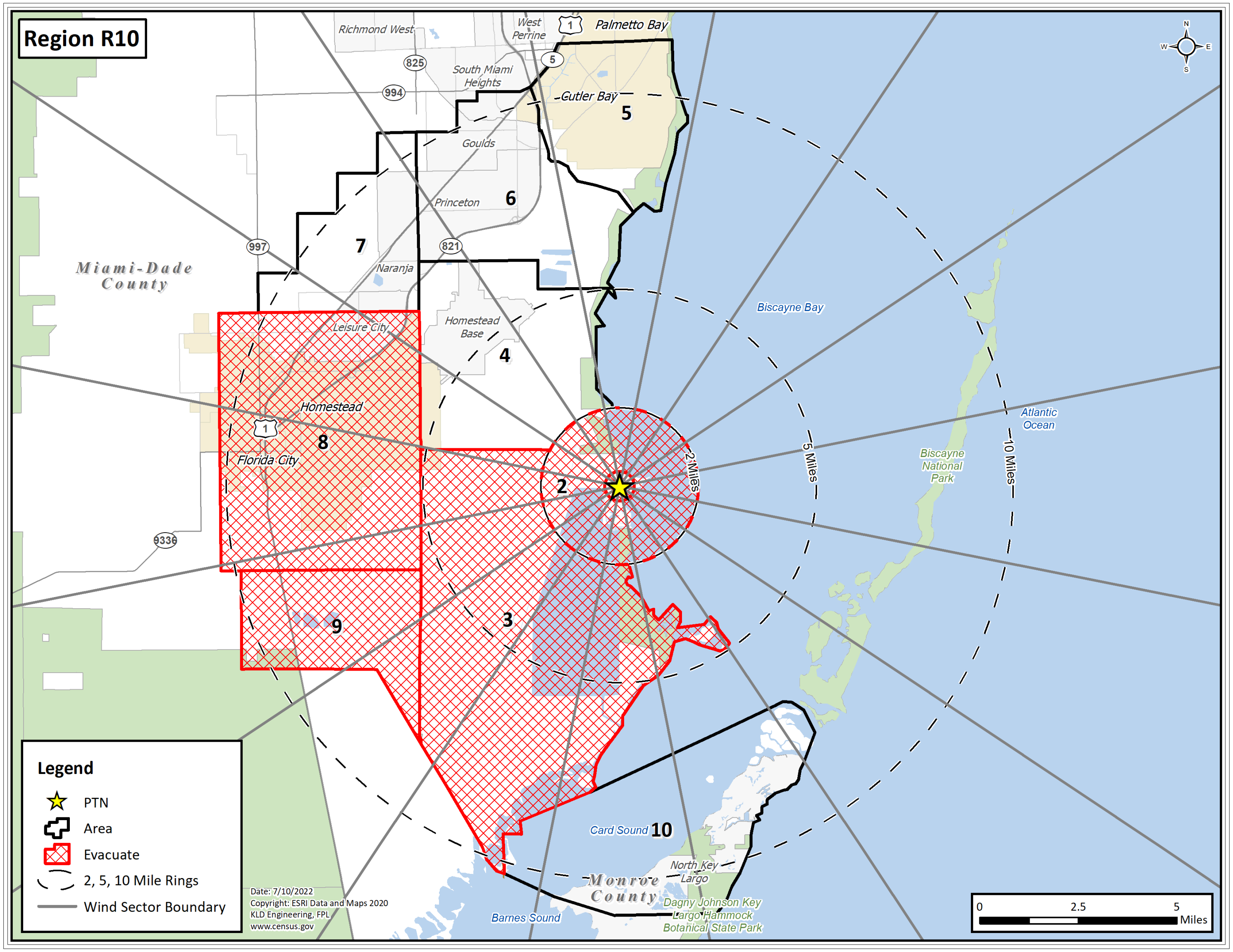

Figure H-10. Region R10

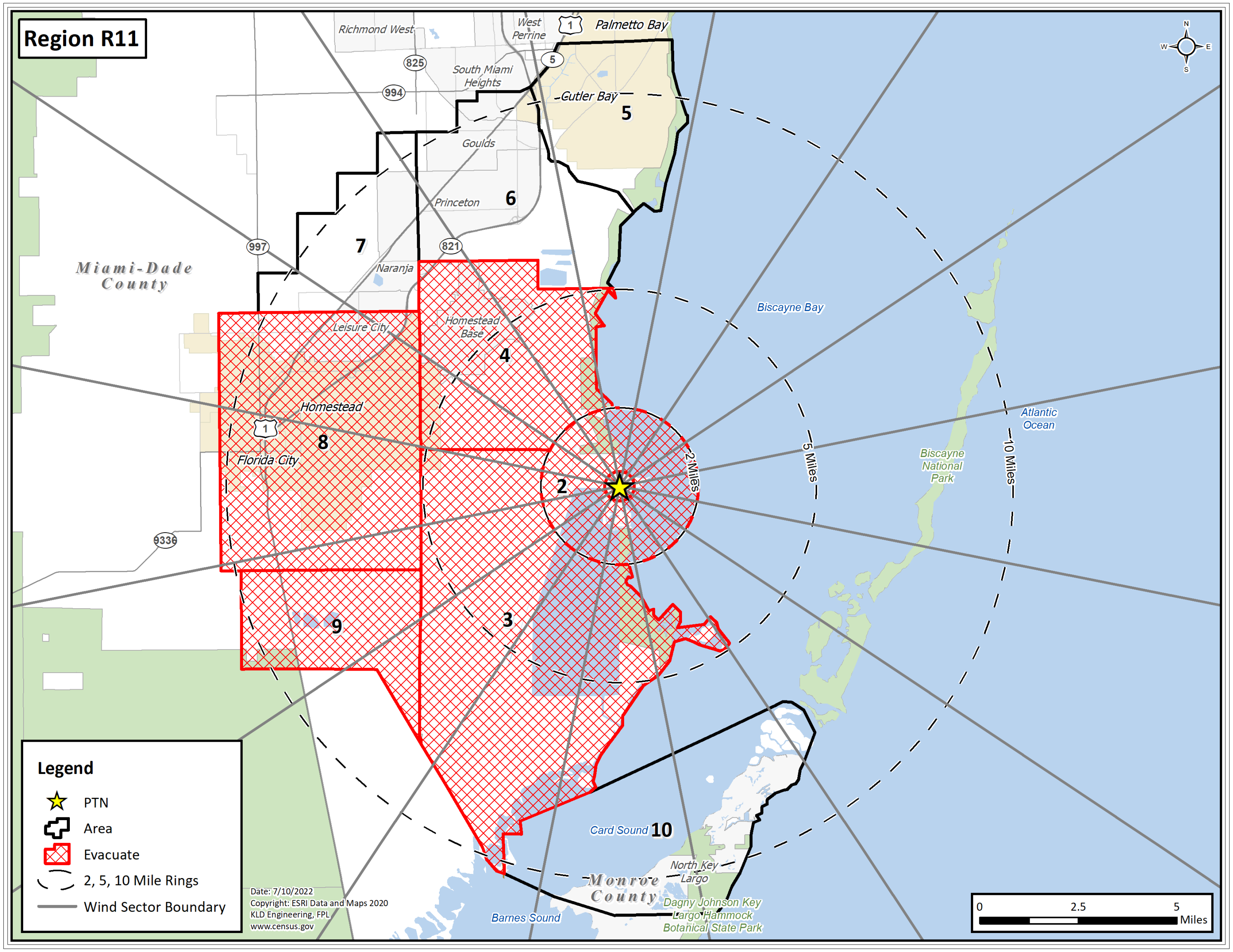

Figure H-11. Region R11

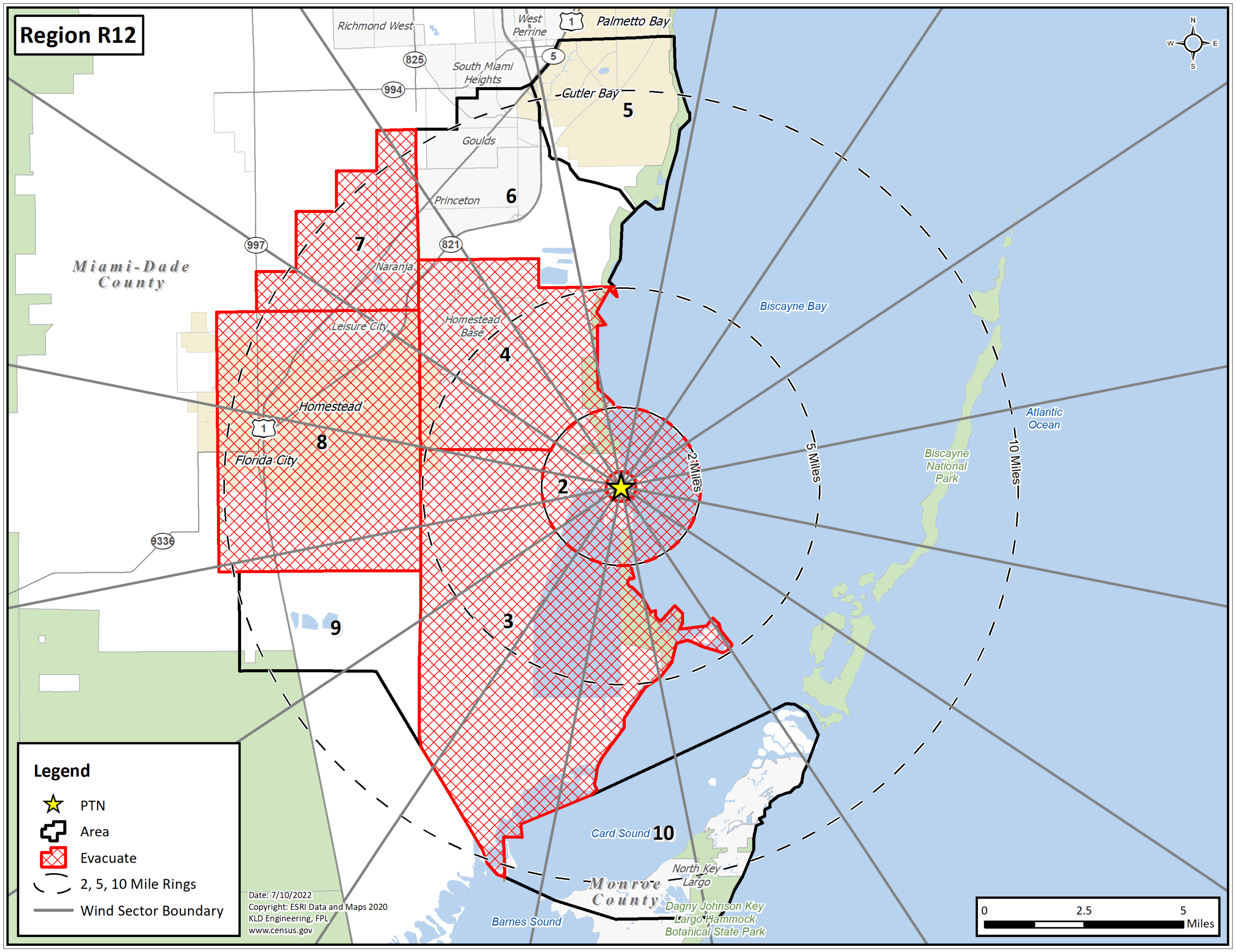

Figure H-12. Region R12

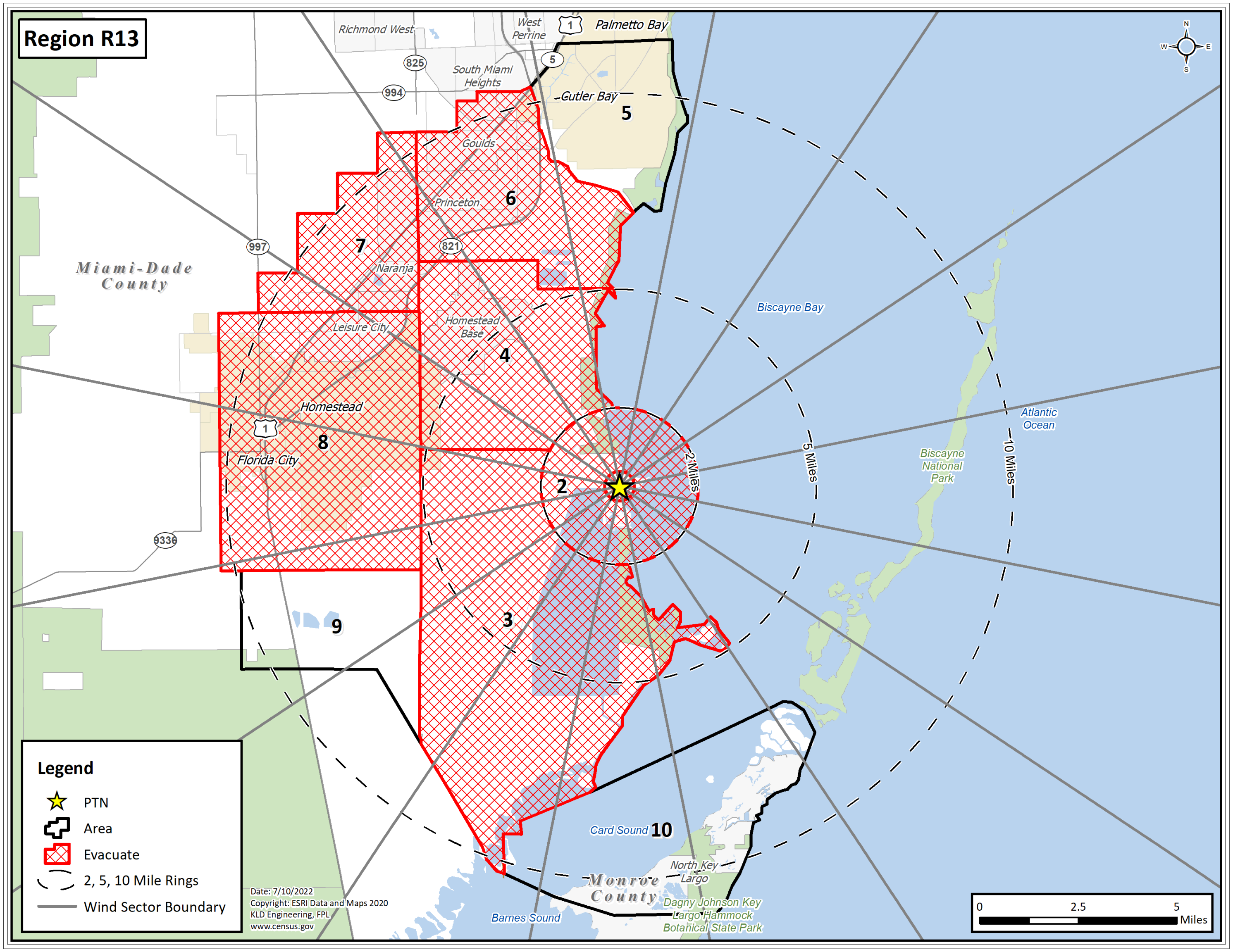

Figure H-13. Region R13

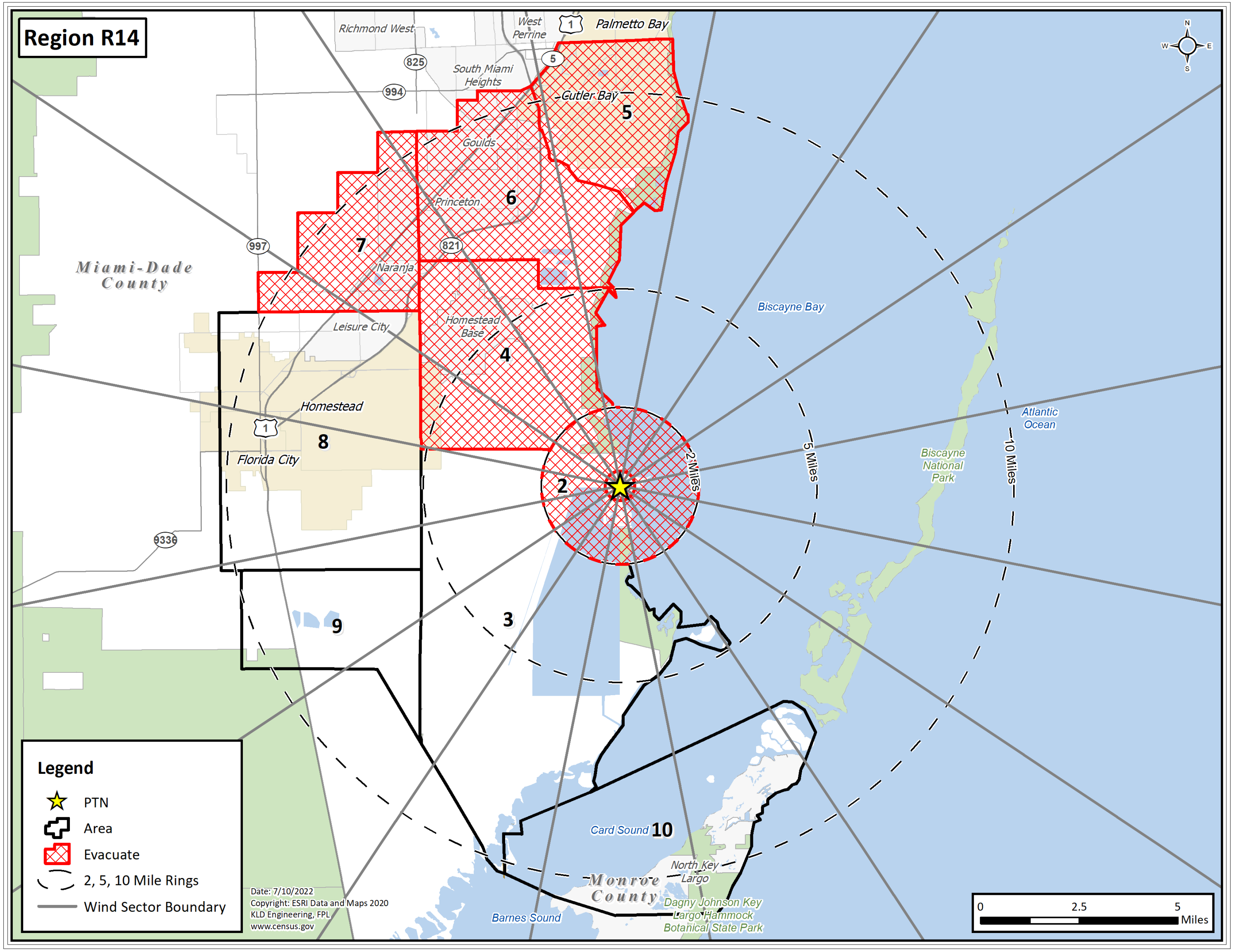

Figure H-14. Region R14

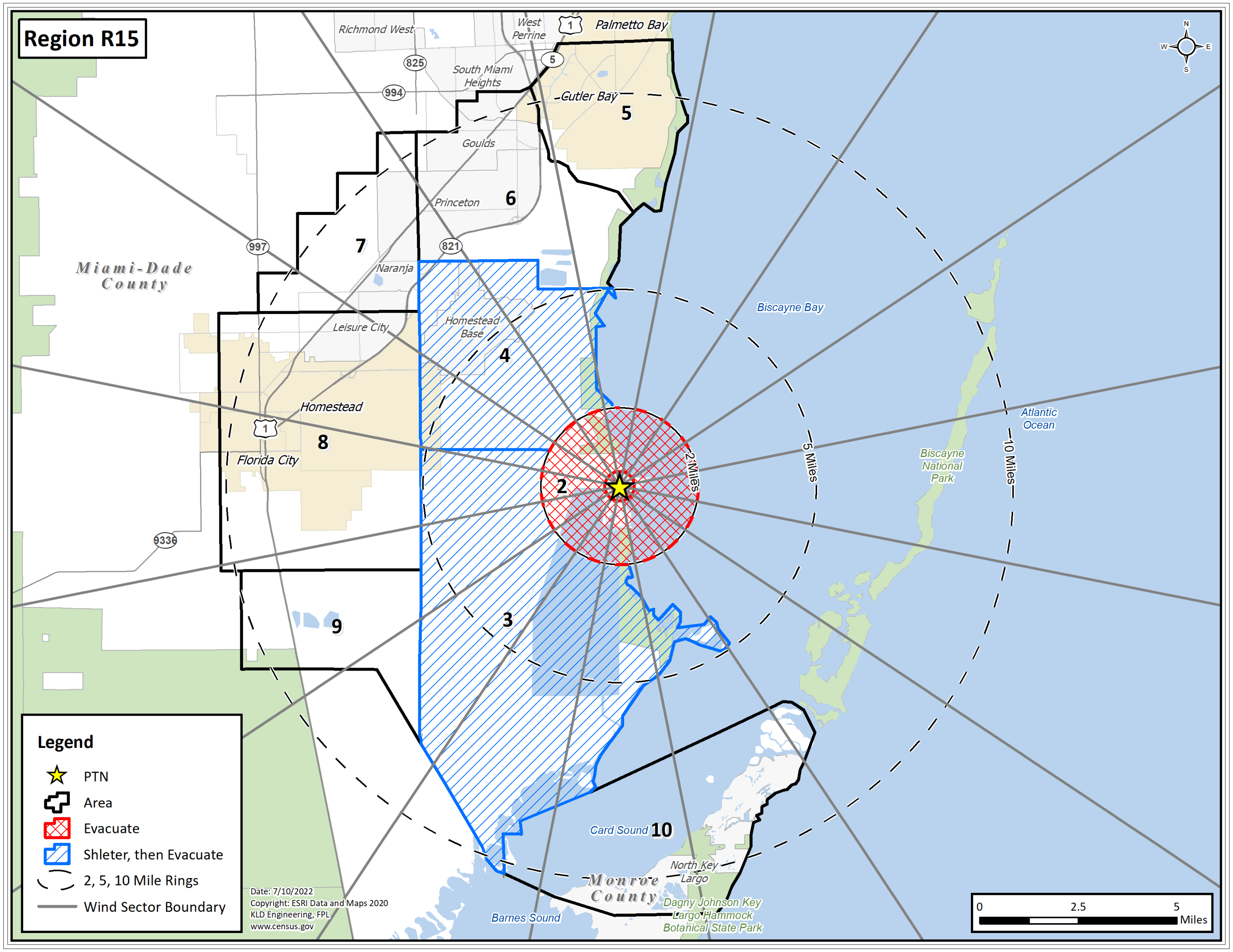

Figure H-15. Region R15

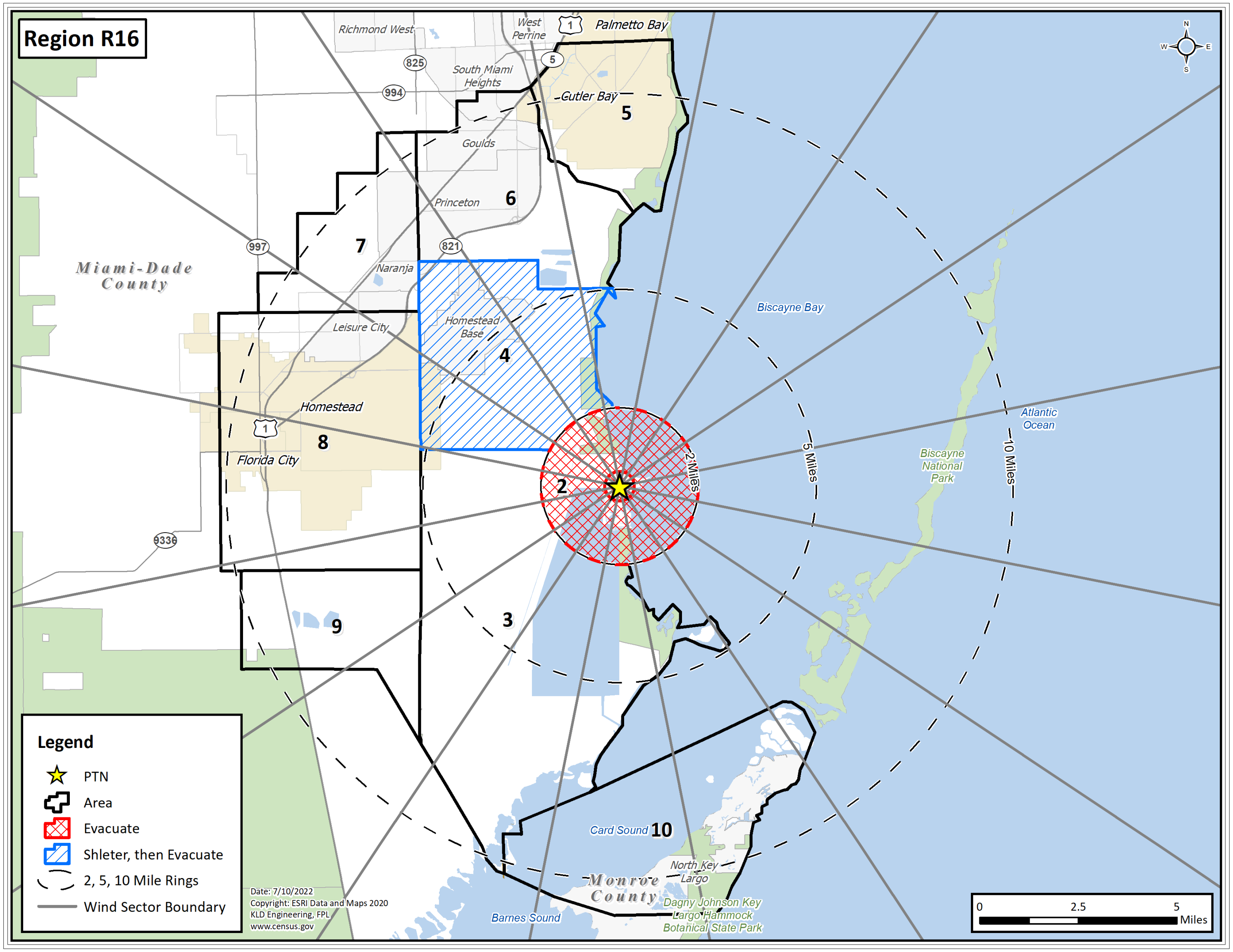

Figure H-16. Region R16

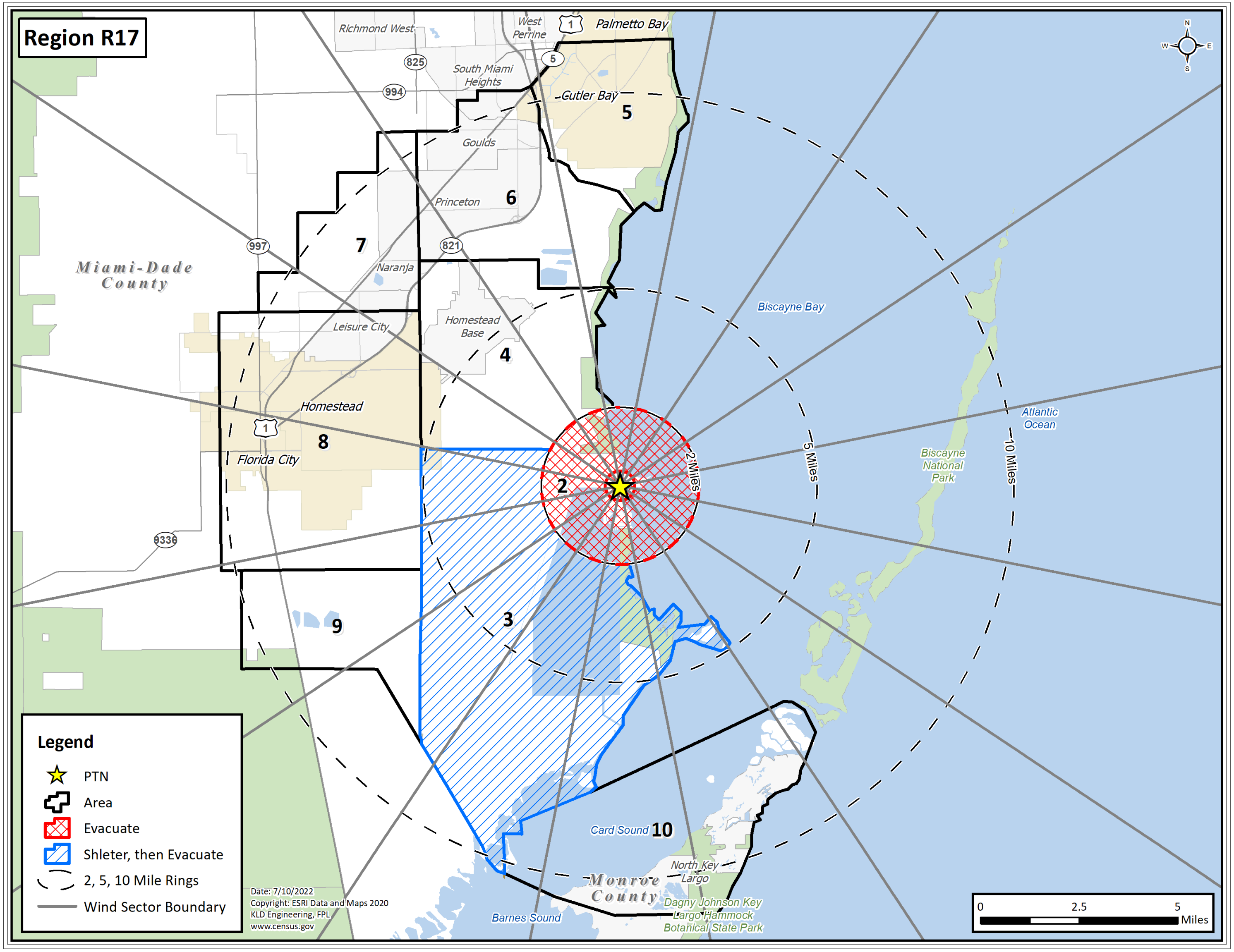

Figure H-17. Region R17

# APPENDIX J

## Representative Inputs to and Outputs from the DYNEV II System

# J. REPRESENTATIVE INPUTS TO AND OUTPUTS FROM THE DYNEV II SYSTEM

This appendix presents data input to and output from the DYNEV II System.

Table J-1 provides source (vehicle loading) and destination information for several roadway segments (links) in the analysis network. There are 591 source links (origins) in the model. The source links are shown as centroid points in Figure J-1. On average, evacuees travel a straight-line distance of 4.88 miles to exit the study area.

Table J-2 provides network-wide statistics (average travel time, average delay time[1], average speed and number of vehicles exiting) for an evacuation of the entire EPZ (Region R03) for each scenario. Rain scenarios (Scenarios 2, 4, 7 and 9) exhibit slower average speeds, longer average travel times, and longer average delays compared to good weather scenarios. When comparing Scenario 11 (special event) and Scenario 8, the additional vehicles evacuating for the special event lower the average speed and increase the average travel time and average delay.

Table J-3 provides statistics (average speed and travel time) for the major evacuation routes – U.S. Highway 1 northbound, U.S. Highway 1 southbound, Florida Turnpike northbound, Florida Turnpike southbound, Krome Ave northbound and CR-905 southbound – for an evacuation of the entire EPZ (Region R03) under Scenario 1 conditions. As discussed in Sections 7.3 and shown in Figures 7-3 through 7-9, there is significant congestion on the aforementioned routes throughout the evacuation; therefore, the travel times and speeds, shown in Table J-3, are significantly lower than the free-flow speeds. The average speeds approach free-flow speeds in the 11th hour when most of the congestion has dissipated, except for Krome Ave northbound which is the last route to clear of congestion.

Table J-4 provides the number of vehicles discharged and the cumulative percent of total vehicles discharged for each link exiting the analysis network, for an evacuation of the entire EPZ (Region R03) under Scenario 1 conditions. Refer to the figures in Appendix K for a map showing the geographic location of each link. As expected, the Florida Turnpike northbound, the Don Shula Expressway northbound, US-1 northbound, and Krome Ave northbound are the most heavily utilized evacuation routes servicing approximately 75% of evacuees.

Figure J-2 through Figure J-12 plot the trip generation time versus the ETE for each of the 12 Scenarios considered. The distance between the trip generation curve and ETE curve is the travel time. Plots of trip generation versus ETE are indicative of the level of traffic congestion during evacuation. For low population density sites, the curves are close together indicating short travel times and minimal traffic congestion. For higher population density sites, the curves are farther apart indicating longer travel times and the presence of traffic congestion.

As seen in Figure J-2 through Figure J-12, the curves are significantly spatially separated as a result of the traffic congestion within in the EPZ discussed in detail in Section 7.3. Those evacuees who depart at about 2:30 after the ATE for Scenario 1 would take approximately 4 hours and 30 minutes to travel to the EPZ boundary.

---

[1] Computed as the difference of the average travel time and the average ideal travel time under free flow conditions.

**Table J-1. Sample Simulation Model Input**

| Link Number | Up Node | Down Node | Vehicles Entering Network on this Link | Directional Preference | Destination Nodes | Destination Capacity |
|---|---|---|---|---|---|---|
| 896 | 378 | 874 | 336 | N | 8124 | 4,275 |
| | | | | | 8076 | 2,850 |
| | | | | | 8458 | 2,850 |
| 1869 | 1068 | 334 | 520 | NW | 8474 | 11,250 |
| | | | | | 8010 | 6,750 |
| | | | | | 8124 | 4,275 |
| 712 | 281 | 276 | 32 | NW | 8124 | 4,275 |
| | | | | | 8076 | 2,850 |
| | | | | | 8458 | 2,850 |
| 434 | 168 | 154 | 41 | W | 8474 | 11,250 |
| | | | | | 8010 | 6,750 |
| | | | | | 8076 | 2,850 |
| 1222 | 611 | 694 | 297 | W | 8474 | 11,250 |
| | | | | | 8010 | 6,750 |
| | | | | | 8114 | 1,275 |
| 226 | 96 | 98 | 252 | N | 8124 | 4,275 |
| | | | | | 8076 | 2,850 |
| | | | | | 8458 | 2,850 |
| 999 | 429 | 728 | 84 | NW | 8124 | 4,275 |
| | | | | | 8788 | 1,275 |
| | | | | | 8458 | 2,850 |
| 1376 | 704 | 705 | 1 | W | 8076 | 2,850 |
| | | | | | 8788 | 1,275 |
| | | | | | 8458 | 2,850 |
| 1555 | 810 | 444 | 83 | N | 8458 | 2,850 |
| | | | | | 8010 | 6,750 |
| | | | | | 8474 | 11,250 |

**Table J-2. Selected Model Outputs for the Evacuation of the Entire EPZ (Region R03)**

| Scenario | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Network-Wide Average Travel Time (Min/Veh-Mi) | 8.6 | 9.7 | 8.7 | 10.0 | 8.6 | 8.7 |
| Network-Wide Average Delay Time (Min/Veh-Mi) | 7.3 | 8.4 | 7.4 | 8.7 | 7.3 | 7.4 |
| Network-Wide Average Speed (mph) | 7.0 | 6.2 | 6.9 | 6.0 | 7.0 | 6.9 |
| Total Vehicles Exiting Network | 180,956 | 180,915 | 177,181 | 176,151 | 168,422 | 188,444 |
| **Scenario** | **7** | **8** | **9** | **10** | **11** | **12** |
| Network-Wide Average Travel Time (Min/Veh-Mi) | 10.0 | 9.1 | 10.1 | 8.8 | 9.5 | 9.7 |
| Network-Wide Average Delay Time (Min/Veh-Mi) | 8.6 | 7.8 | 8.8 | 7.5 | 8.2 | 8.4 |
| Network-Wide Average Speed (mph) | 6.0 | 6.6 | 6.0 | 6.8 | 6.3 | 6.2 |
| Total Vehicles Exiting Network | 186,041 | 177,484 | 178,325 | 168,888 | 213,670 | 180,401 |

## Table J-3. Average Speed (mph) and Travel Time (min) for Major Evacuation Routes (Region R03, Scenario 1)

| | | Elapsed Time (hours) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | |
| Route | Length (miles) | Speed (mph) | Travel Time (min) | Speed | Travel Time | Speed | Travel Time | Speed | Travel Time | Speed | Travel Time | Speed | Travel Time |
| U.S. Highway 1 Northbound | 39.2 | 8.8 | 268.0 | 3.8 | 618.0 | 3.9 | 595.4 | 4.0 | 594.1 | 4.6 | 510.8 | 7.5 | 311.7 |
| U.S. Highway 1 Southbound | 39.1 | 37.9 | 62.0 | 35.0 | 67.0 | 41.6 | 56.4 | 53.4 | 43.9 | 52.1 | 45.0 | 53.4 | 43.9 |
| Florida Turnpike Northbound | 40.3 | 25.0 | 96.6 | 17.0 | 142.5 | 14.5 | 167.0 | 16.3 | 148.2 | 26.5 | 91.3 | 36.2 | 66.8 |
| Florida Turnpike Southbound | 41.1 | 30.6 | 80.6 | 28.3 | 87.2 | 33.4 | 73.9 | 36.1 | 68.3 | 45.6 | 54.0 | 45.6 | 54.1 |
| Krome Ave Northbound | 12.9 | 13.0 | 59.5 | 2.8 | 276.3 | 2.3 | 333.9 | 2.5 | 310.7 | 2.1 | 372.4 | 2.3 | 342.7 |
| CR-905 Southbound | 10.0 | 4.6 | 131.5 | 1.2 | 505.4 | 1.4 | 440.5 | 11.8 | 50.9 | 40.9 | 14.7 | 53.2 | 11.3 |

| | | 7 | | 8 | | 9 | | 10 | | 11 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Route | Length (miles) | Speed | Travel Time | Speed | Travel Time | Speed | Travel Time | Speed | Travel Time | Speed | Travel Time |
| U.S. Highway 1 Northbound | 39.2 | 6.1 | 383.3 | 9.6 | 243.8 | 26.6 | 88.5 | 39.8 | 59.0 | 53.1 | 44.2 |
| U.S. Highway 1 Southbound | 39.1 | 53.4 | 43.9 | 53.4 | 43.9 | 53.4 | 43.9 | 53.4 | 43.9 | 53.4 | 43.9 |
| Florida Turnpike Northbound | 40.3 | 34.7 | 69.7 | 46.8 | 51.6 | 53.8 | 44.9 | 54.9 | 44.0 | 58.7 | 41.2 |
| Florida Turnpike Southbound | 41.1 | 50.5 | 48.8 | 49.2 | 50.2 | 49.6 | 49.7 | 58.8 | 42.0 | 58.8 | 41.9 |
| Krome Ave Northbound | 12.9 | 2.8 | 272.3 | 2.6 | 301.4 | 3.1 | 246.9 | 4.7 | 165.3 | 19.3 | 40.1 |
| CR-905 Southbound | 10.0 | 53.2 | 11.3 | 53.2 | 11.3 | 53.2 | 11.3 | 53.2 | 11.3 | 53.2 | 11.3 |

## Table J-4. Simulation Model Outputs at Network Exit Links for Region R03, Scenario 1

| Network Exit Link | Up Node | Down Node | Roadway | Elapsed Time (hours) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| | | | | Cumulative Vehicles Discharged by the Indicated Time | | | | | | | | | | | |
| | | | | Cumulative Percent of Vehicles Discharged by the Indicated Time Interval | | | | | | | | | | | |
| 176 | 76 | 424 | Krome Ave (FL-997) Northbound | 1,077 | 2,900 | 4,781 | 6,665 | 8,516 | 10,301 | 12,042 | 13,744 | 15,458 | 17,125 | 18,846 | 19,832 |
| | | | | 11% | 8% | 8% | 8% | 8% | 8% | 8% | 9% | 9% | 10% | 11% | 11% |
| 634 | 239 | 237 | US 1 Southbound | 1,583 | 3,305 | 4,984 | 6,456 | 7,954 | 7,957 | 7,957 | 7,957 | 7,957 | 7,957 | 7,957 | 7,957 |
| | | | | 15% | 10% | 8% | 8% | 7% | 6% | 6% | 5% | 5% | 5% | 4% | 4% |
| 1052 | 453 | 870 | US 1 Northbound | 1,702 | 5,367 | 9,048 | 12,731 | 16,450 | 18,957 | 20,192 | 20,939 | 21,318 | 21,780 | 21,851 | 21,851 |
| | | | | 17% | 15% | 15% | 15% | 15% | 15% | 14% | 13% | 13% | 12% | 12% | 12% |
| 1080 | 467 | 871 | Miami-Dade Busway Northbound | 0 | 0 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | | | | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| 1569 | 820 | 822 | SW 117th Ave Northbound | 119 | 1,526 | 3,827 | 6,343 | 8,604 | 9,197 | 9,327 | 9,522 | 9,649 | 9,724 | 9,726 | 9,727 |
| | | | | 1% | 4% | 6% | 7% | 8% | 7% | 7% | 6% | 6% | 6% | 5% | 5.5% |
| 1637 | 866 | 869 | FL-973 Northbound | 177 | 1,243 | 2,389 | 3,538 | 4,687 | 5,416 | 5,487 | 5,521 | 5,531 | 5,543 | 5,545 | 5,545 |
| | | | | 2% | 4% | 4% | 4% | 4% | 4% | 4% | 4% | 3% | 3% | 3% | 3% |
| 1669 | 891 | 476 | Don Shula Expressway Northbound | 2,436 | 6,412 | 11,027 | 15,056 | 19,081 | 22,598 | 25,206 | 27,580 | 31,454 | 34,412 | 35,143 | 35,241 |
| | | | | 24% | 18% | 18% | 18% | 17% | 18% | 18% | 18% | 19% | 20% | 20% | 19.5% |
| 1772 | 982 | 983 | SW 137th Ave Northbound | 855 | 3,862 | 6,965 | 9,593 | 11,631 | 13,809 | 15,500 | 17,339 | 18,974 | 20,288 | 21,083 | 21,457 |
| | | | | 8% | 11% | 12% | 11% | 11% | 11% | 11% | 11% | 11% | 12% | 12% | 12% |
| 1804 | 1011 | 1009 | Old Cutler Rd Northbound | 4 | 21 | 372 | 393 | 395 | 395 | 395 | 395 | 395 | 395 | 395 | 395 |
| | | | | 0% | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| 1846 | 1052 | 474 | Florida Turnpike Northbound | 2,301 | 10,134 | 16,923 | 25,255 | 32,660 | 40,103 | 46,934 | 53,532 | 56,475 | 58,425 | 58,860 | 58,948 |
| | | | | 22% | 29% | 28% | 29% | 30% | 31% | 33% | 34% | 34% | 33% | 33% | 33% |

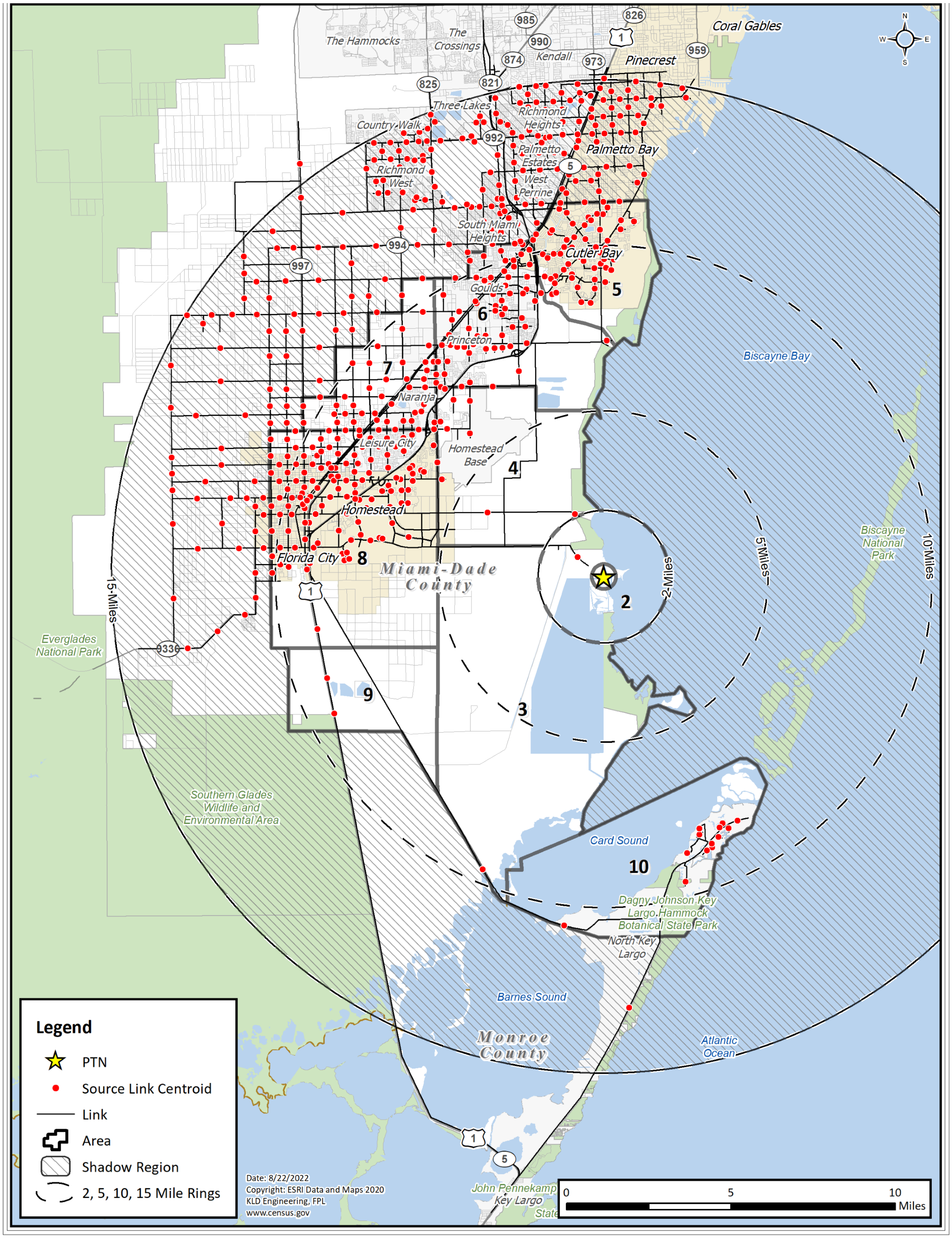

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**Figure J-1. Network Sources/Origins**

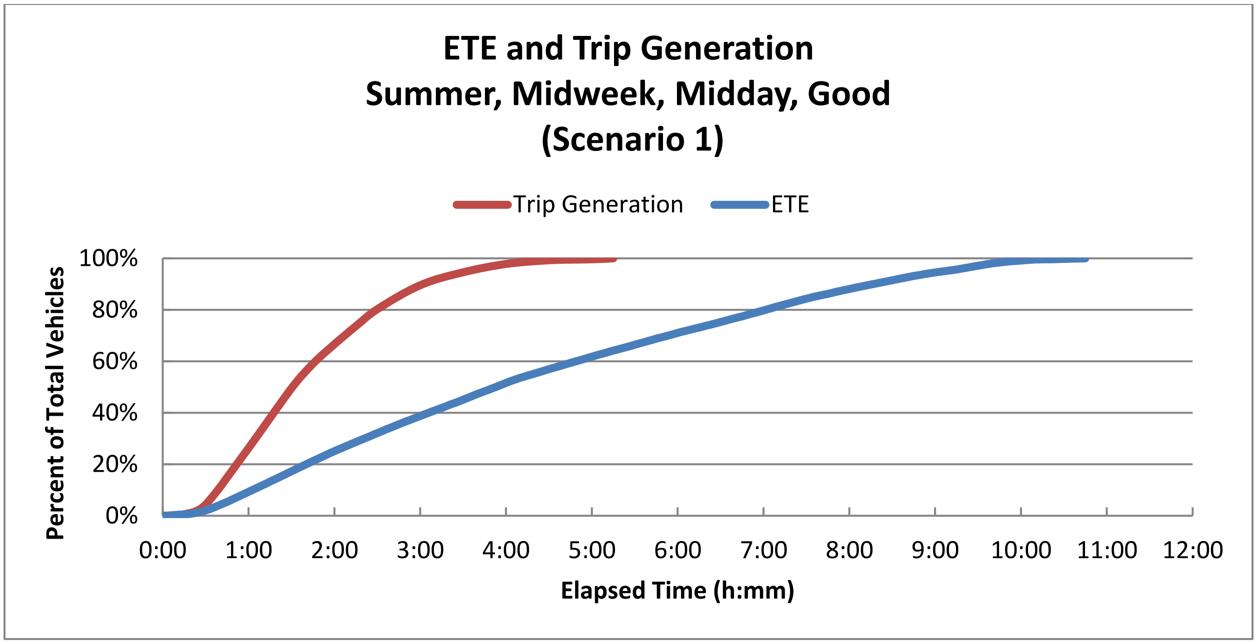

Figure J-2. ETE and Trip Generation: Summer, Midweek, Midday, Good Weather (Scenario 1)

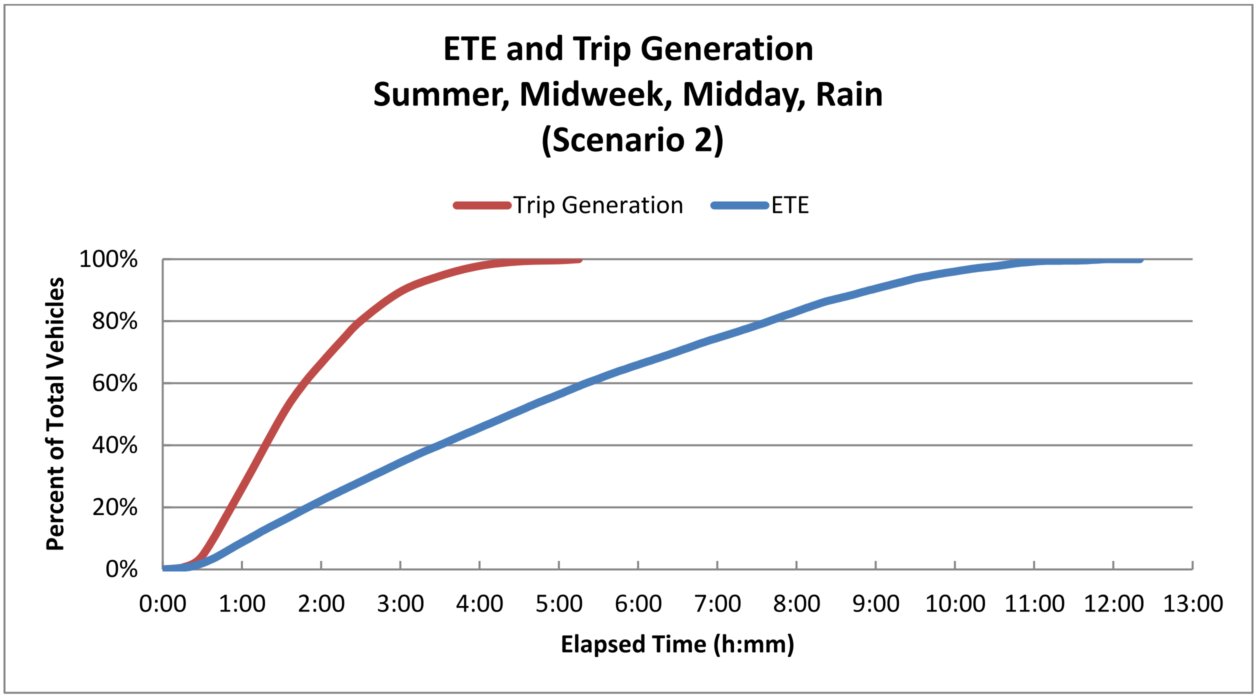

Figure J-3. ETE and Trip Generation: Summer, Midweek, Midday, Rain (Scenario 2)

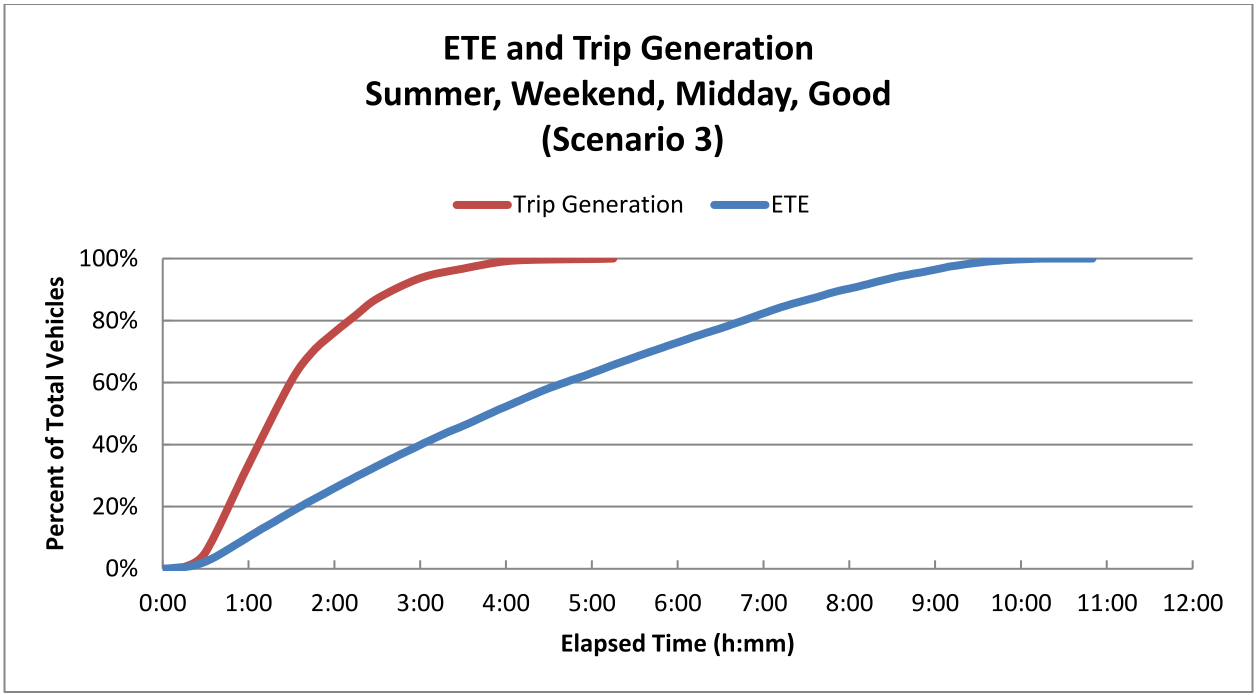

Figure J-4. ETE and Trip Generation: Summer, Weekend, Midday, Good Weather (Scenario 3)

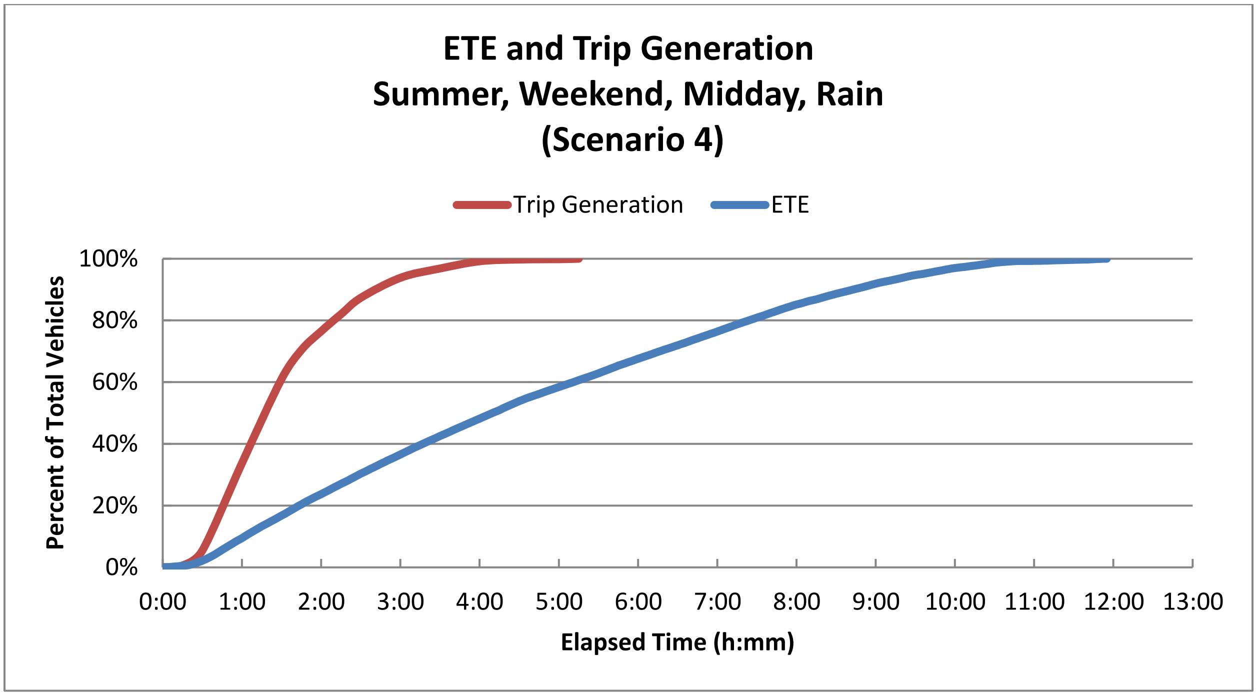

Figure J-5. ETE and Trip Generation: Summer, Weekend, Midday, Rain (Scenario 4)

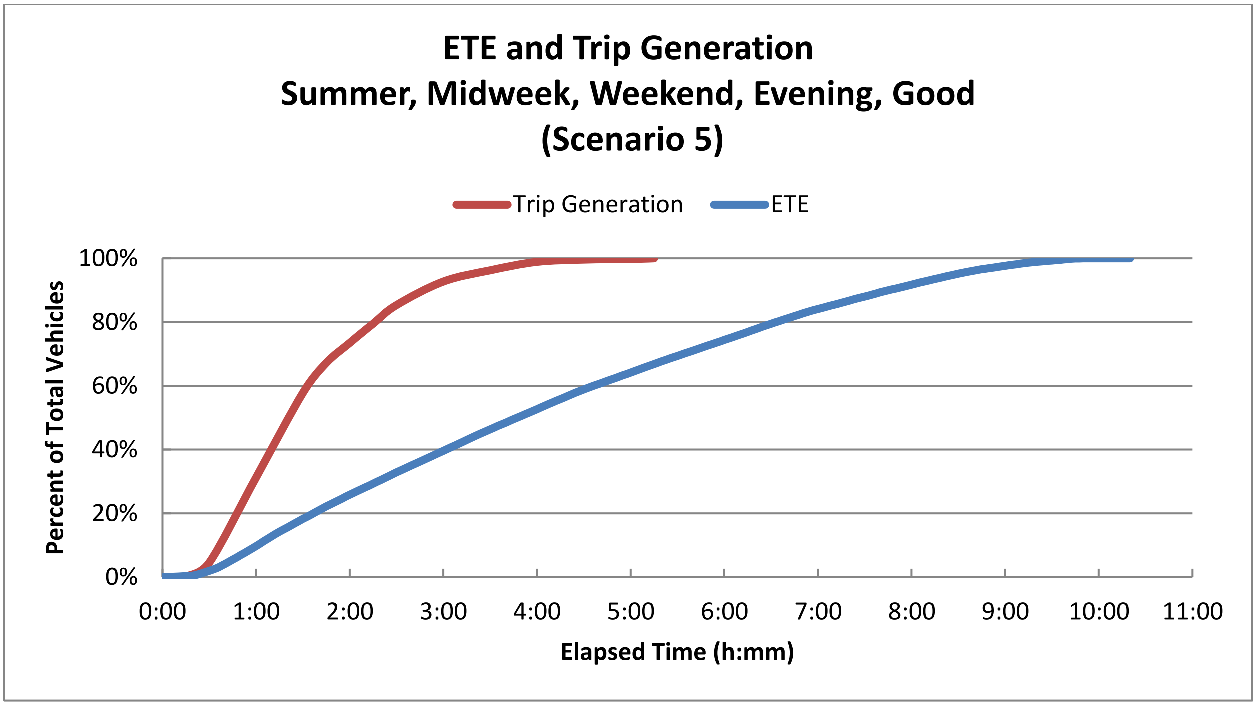

Figure J-6. ETE and Trip Generation: Summer, Midweek, Weekend, Evening, Good Weather (Scenario 5)

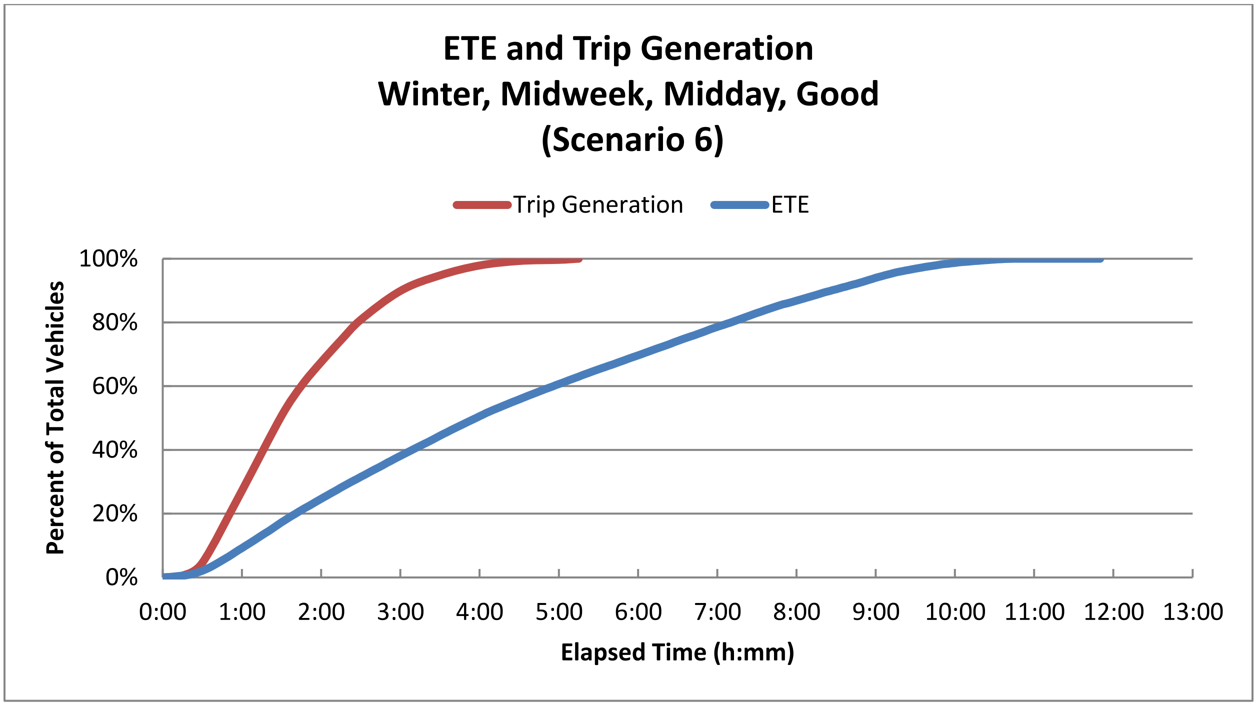

Figure J-7. ETE and Trip Generation: Winter, Midweek, Midday, Good Weather (Scenario 6)

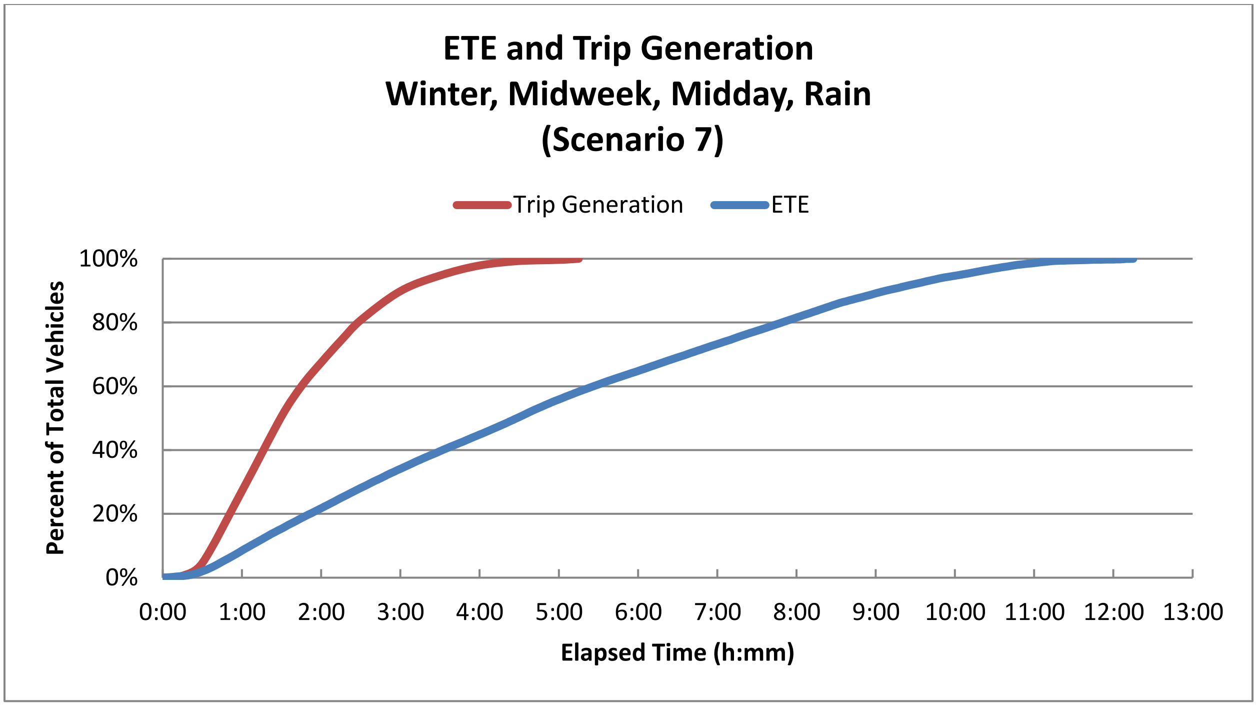

**Figure J-8. ETE and Trip Generation: Winter, Midweek, Midday, Rain (Scenario 7)**

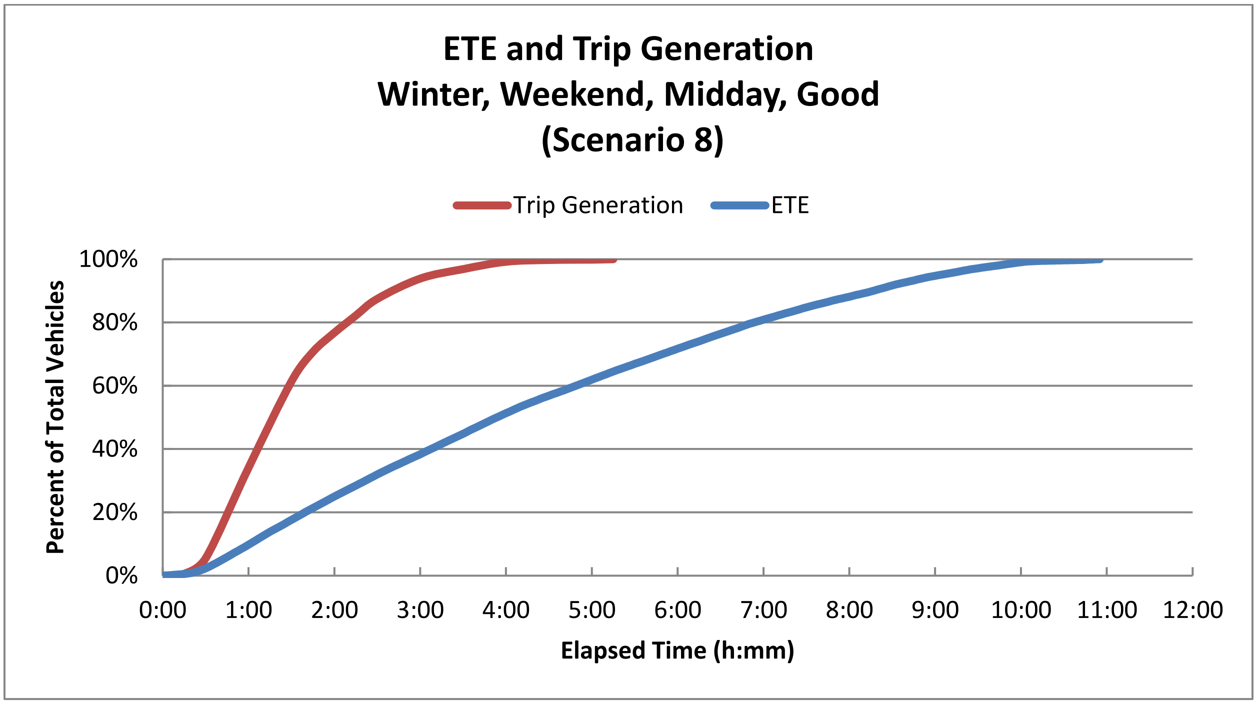

**Figure J-9. ETE and Trip Generation: Winter, Weekend, Midday, Good Weather (Scenario 8)**

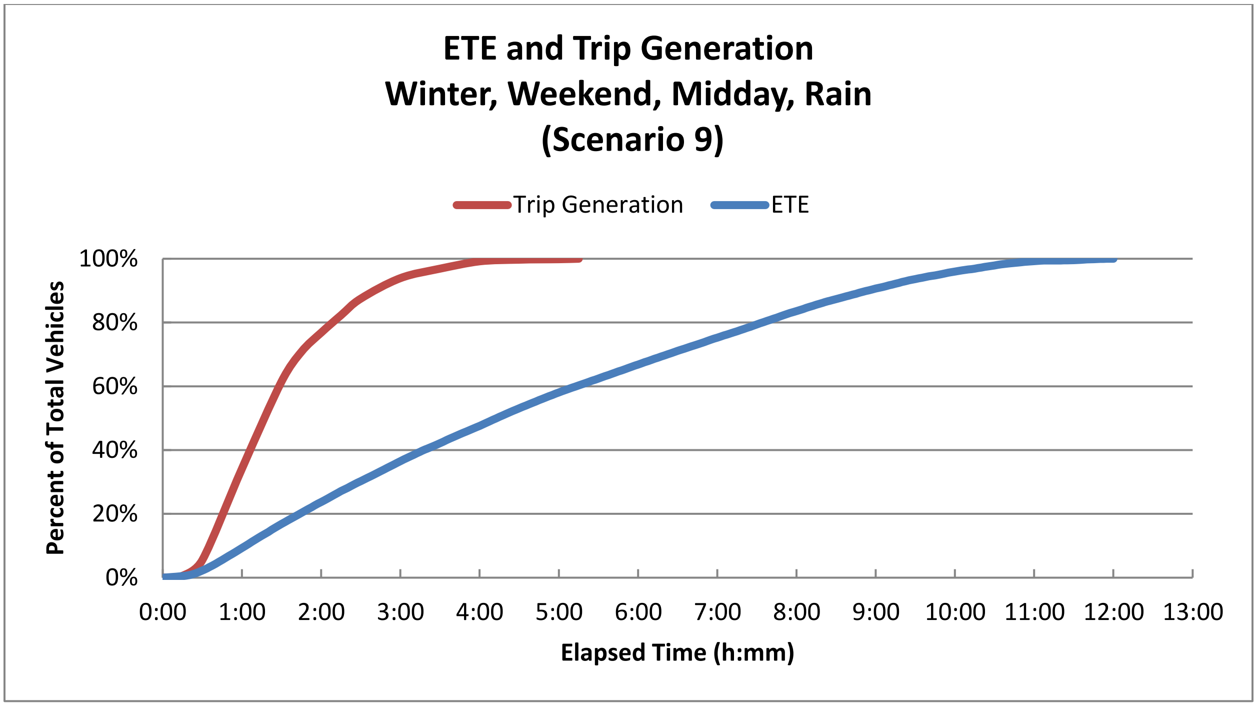

**Figure J-10. ETE and Trip Generation: Winter, Weekend, Midday, Rain (Scenario 9)**

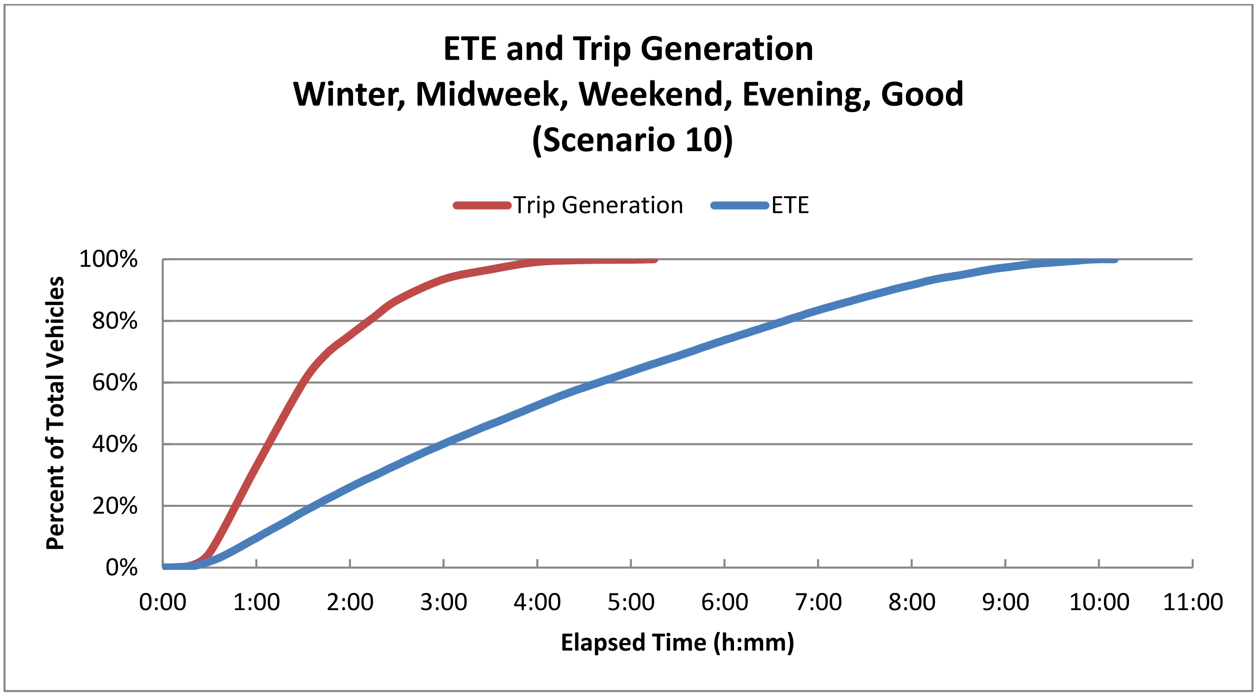

**Figure J-11. ETE and Trip Generation: Winter, Midweek, Weekend, Evening, Good Weather (Scenario 10)**

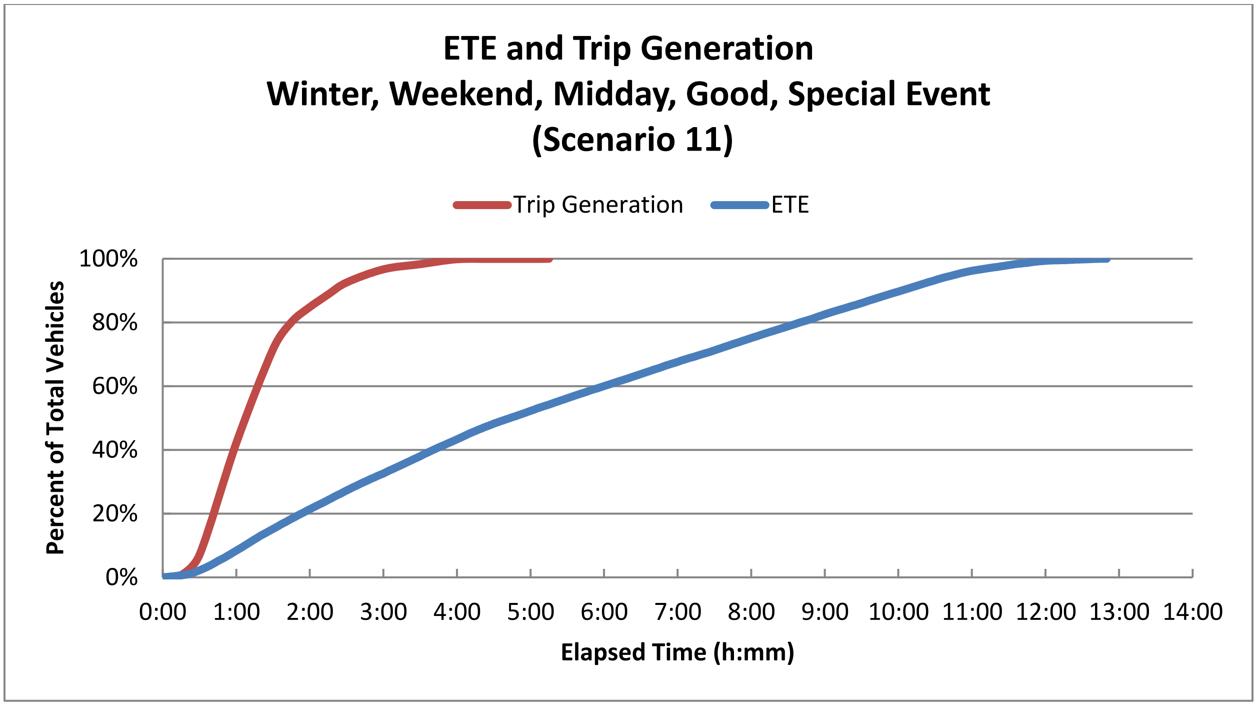

**Figure J-12. ETE and Trip Generation: Winter, Weekend, Midday, Special Event (Scenario 11)**

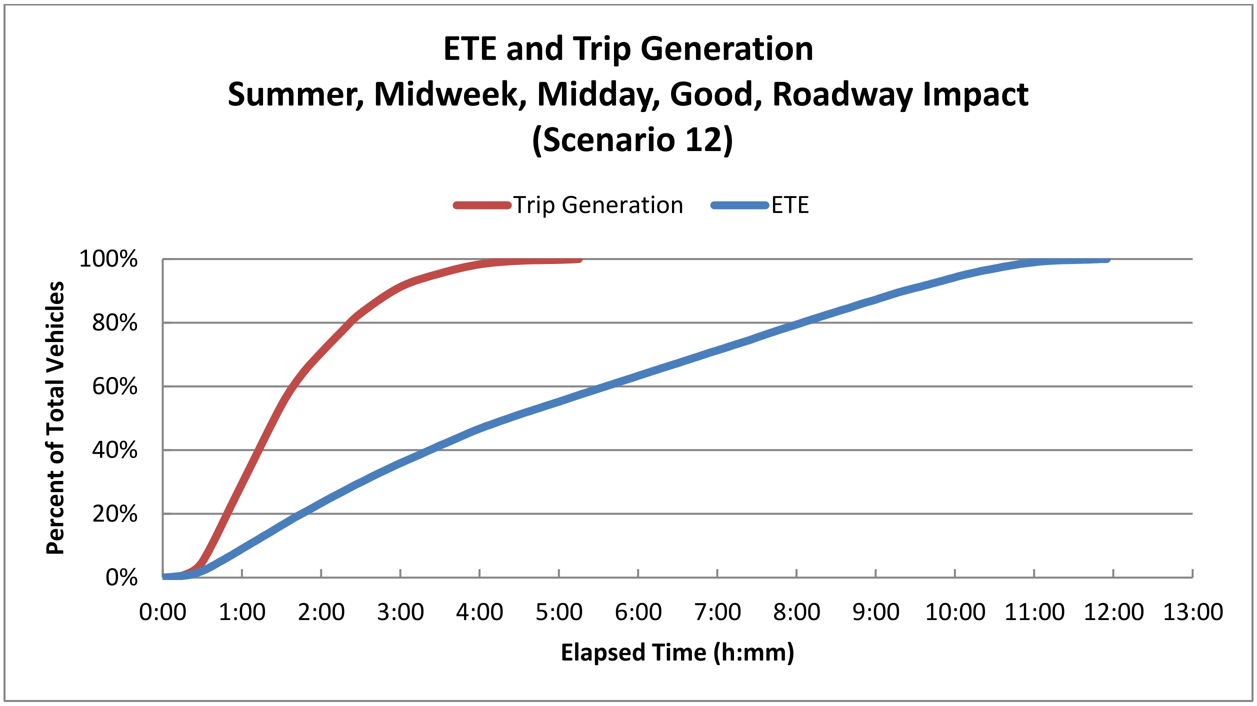

**Figure J-13. ETE and Trip Generation: Summer, Midweek, Midday, Roadway Impact, Good Weather (Scenario 12)**

# APPENDIX K

## Evacuation Roadway Network

# K. EVACUATION ROADWAY NETWORK

As discussed in Section 1.3, a link-node analysis network was constructed to model the roadway network within the study area. Figure K-1 provides an overview of the link-node analysis network. The figure has been divided up into 28 more detailed figures (Figure K-2 through Figure K-29) which show each of the links and nodes in the network.

The analysis network was calibrated using the observations made during the field surveys conducted in February 2021.

Table K-1 summarizes the number of nodes by the type of control (stop sign, yield sign, pre-timed signal, actuated signal, traffic control point [TCP], uncontrolled).

**Table K-1. Summary of Nodes by the Type of Control**

| Control Type | Number of Nodes |
|---|---|
| Uncontrolled | 478 |
| Pretimed | 1 |
| Actuated | 258 |
| Stop | 192 |
| TCP | 69 |
| Yield | 26 |
| **Total:** | **1,024** |

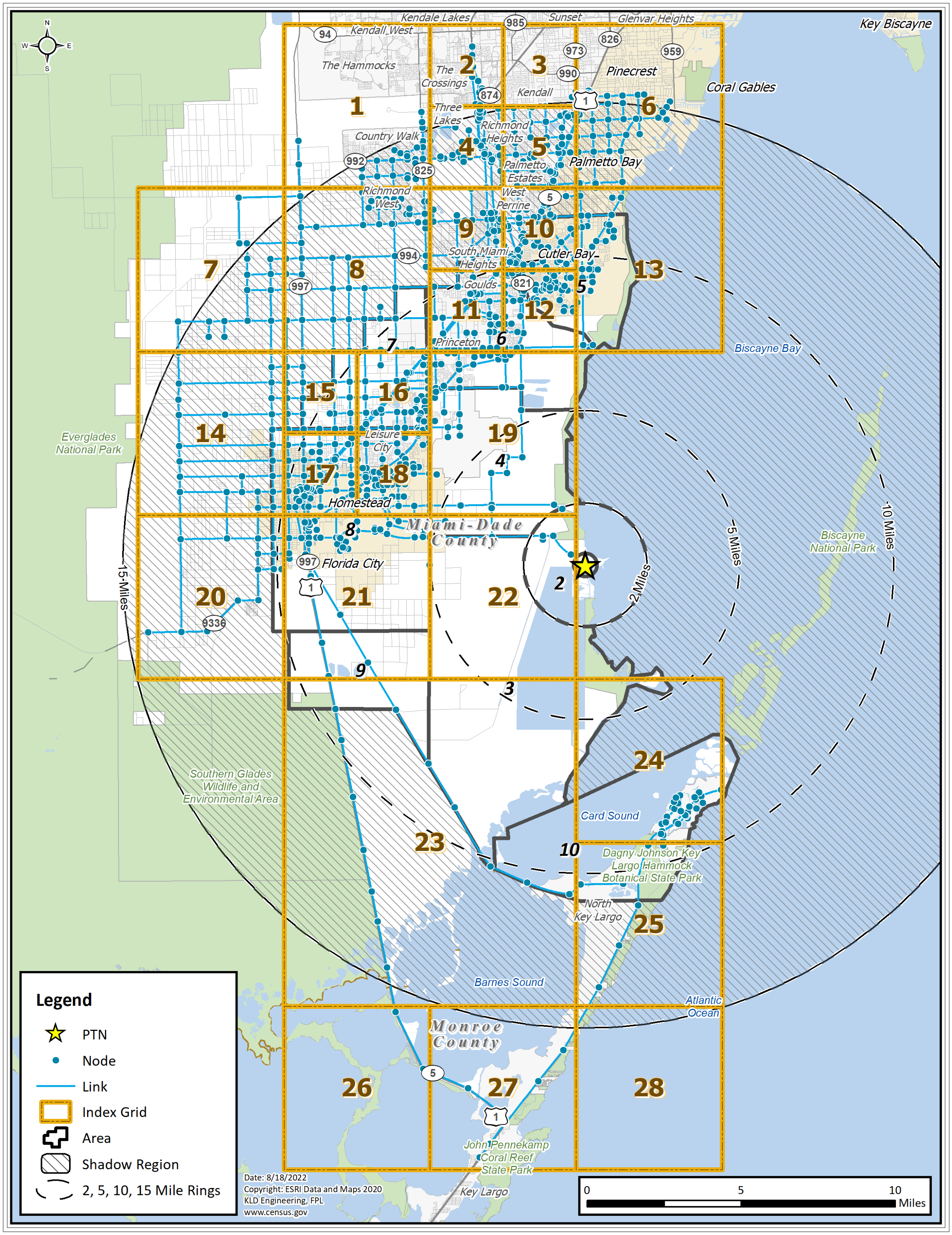

Figure K-1. PTN Link-Node Analysis Network

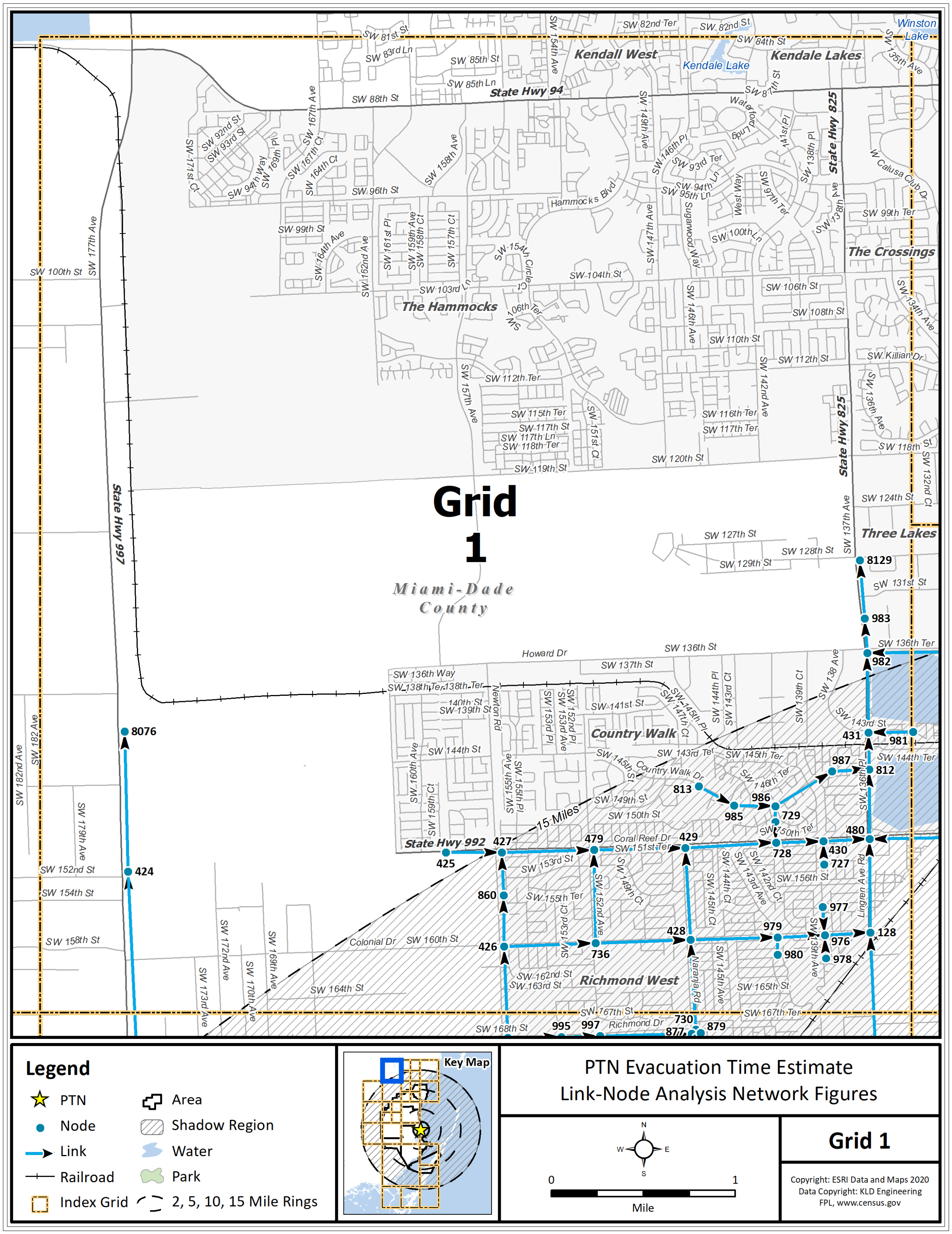

Figure K-2. Link-Node Analysis Network – Grid 1

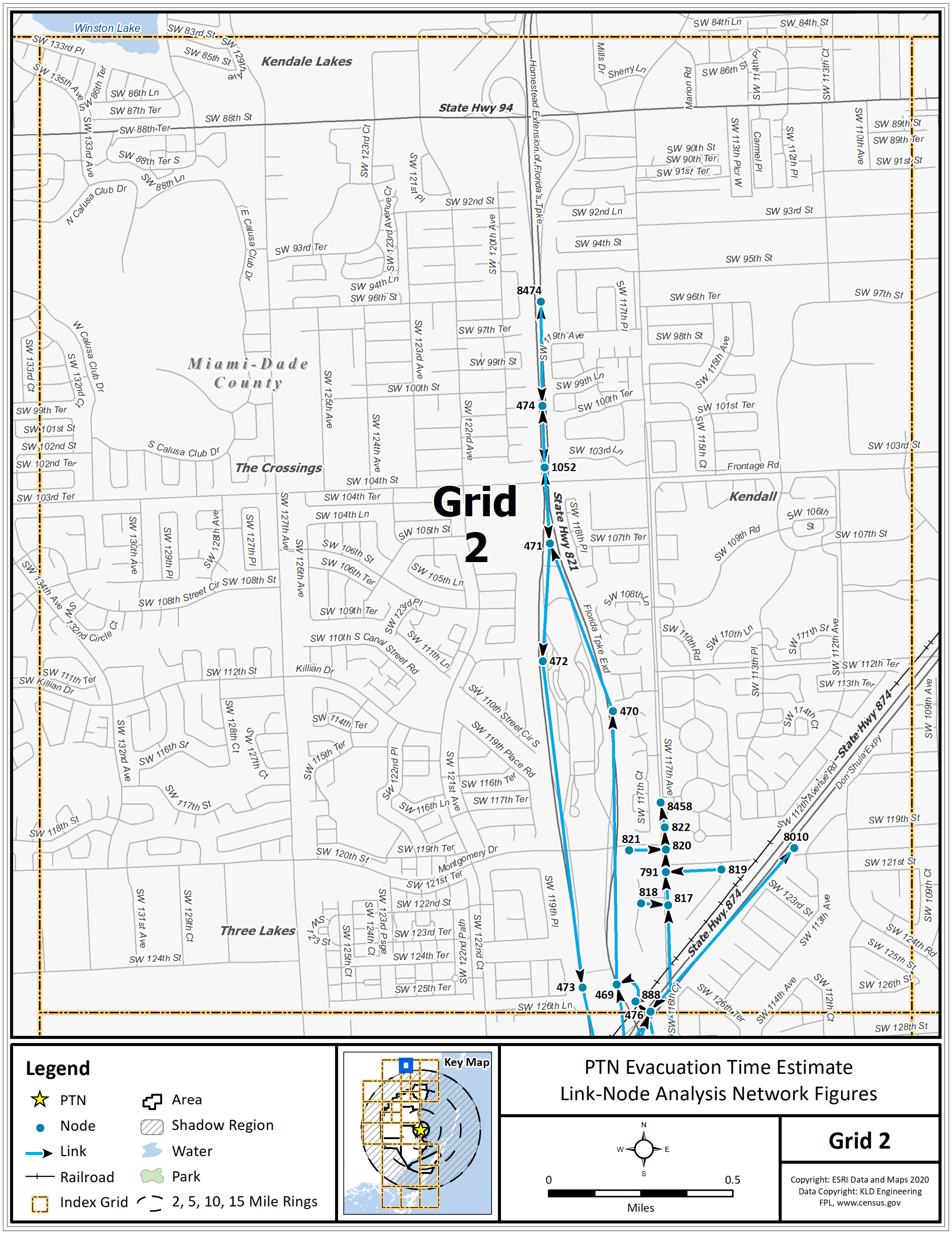

Figure K-3. Link-Node Analysis Network - Grid 2

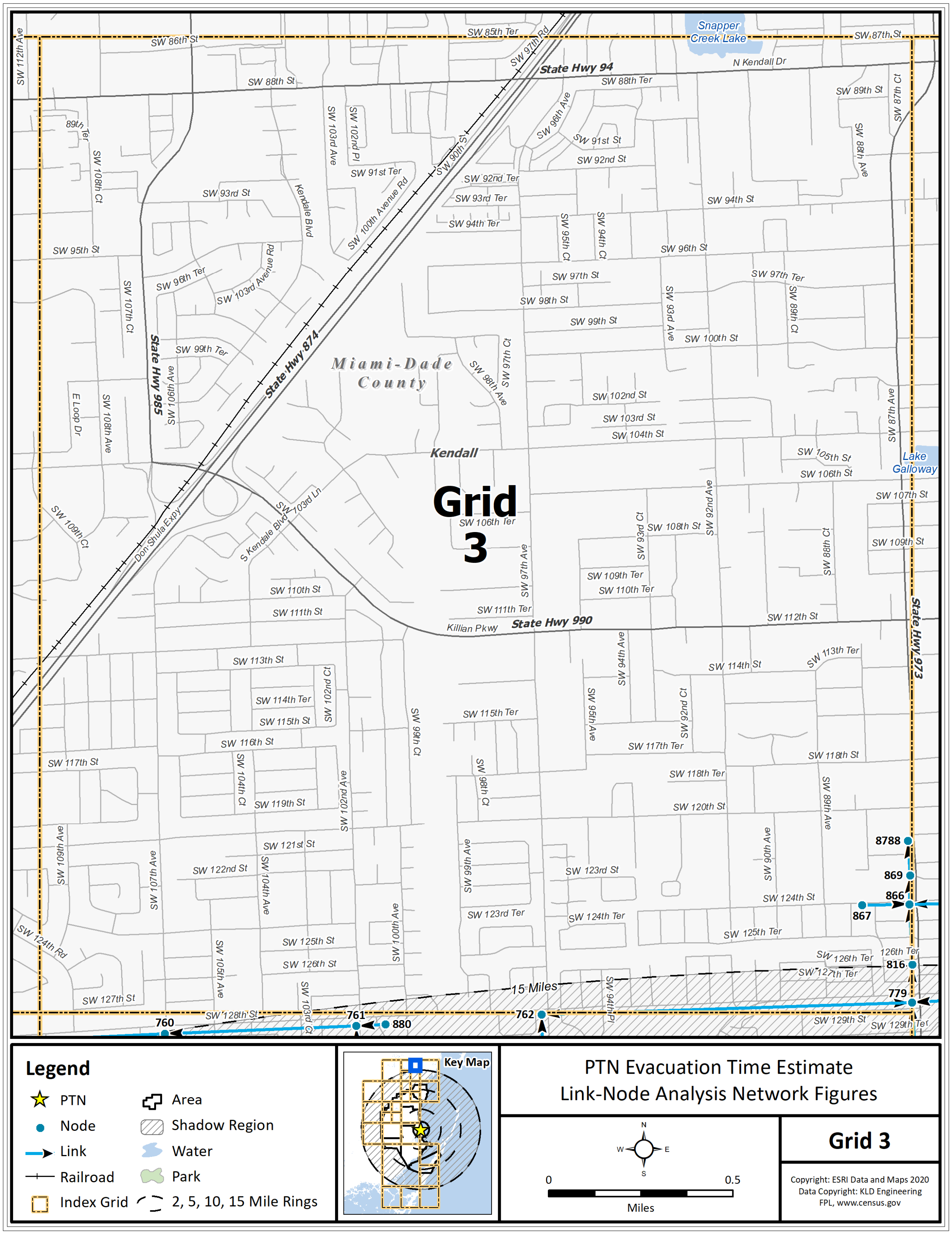

Figure K-4. Link-Node Analysis Network - Grid 3

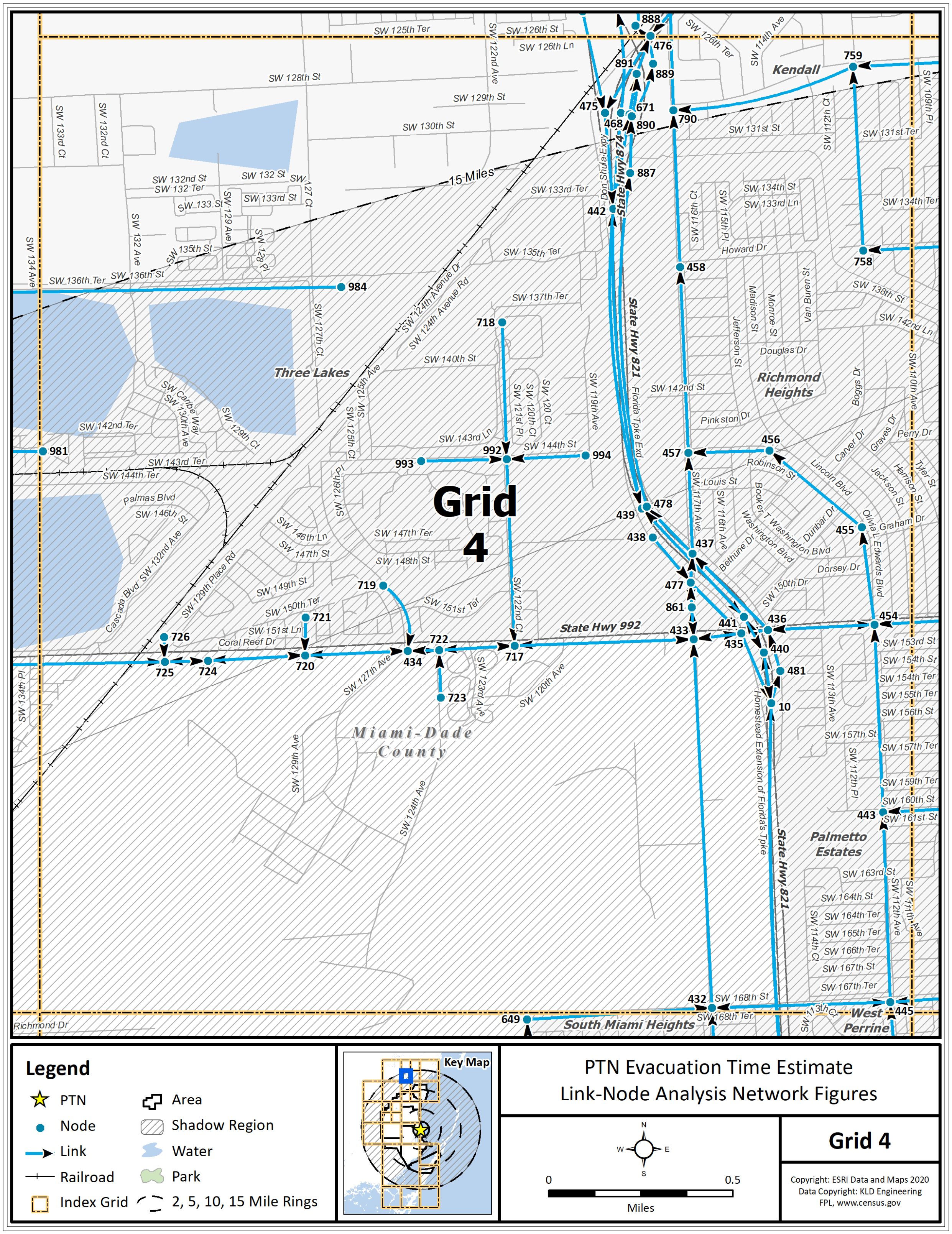

Figure K-5. Link-Node Analysis Network - Grid 4

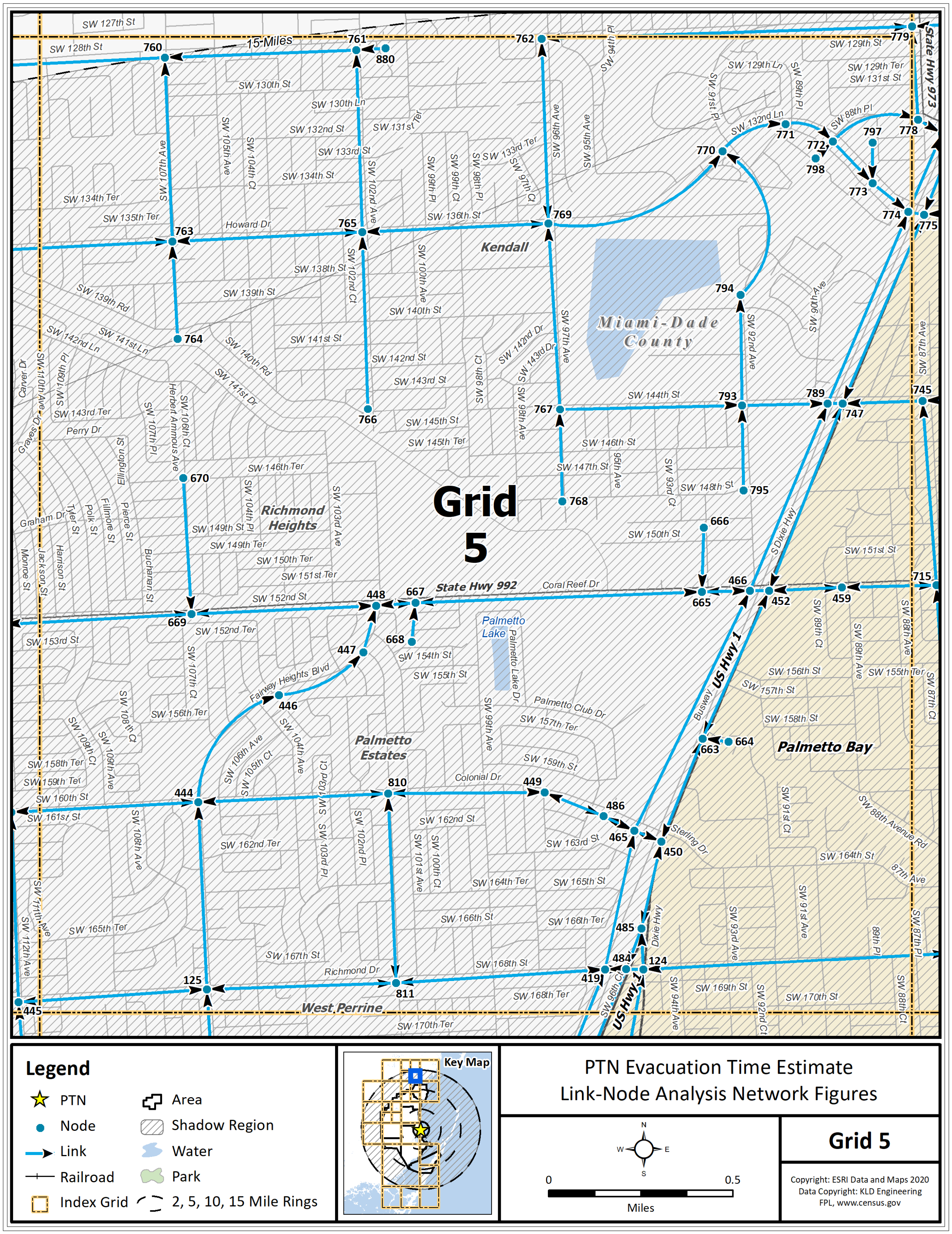

Figure K-6. Link-Node Analysis Network - Grid 5

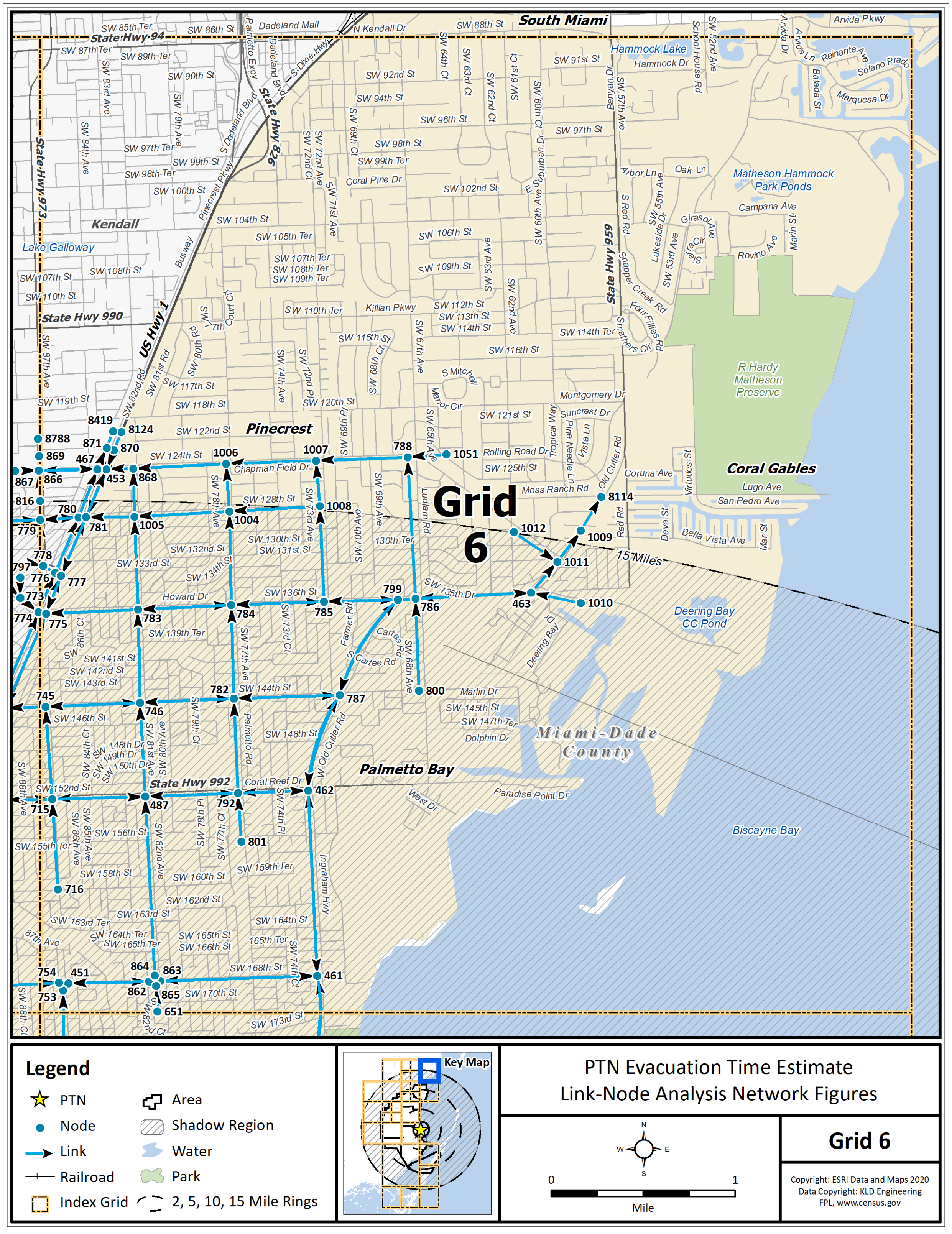

Figure K-7. Link-Node Analysis Network - Grid 6

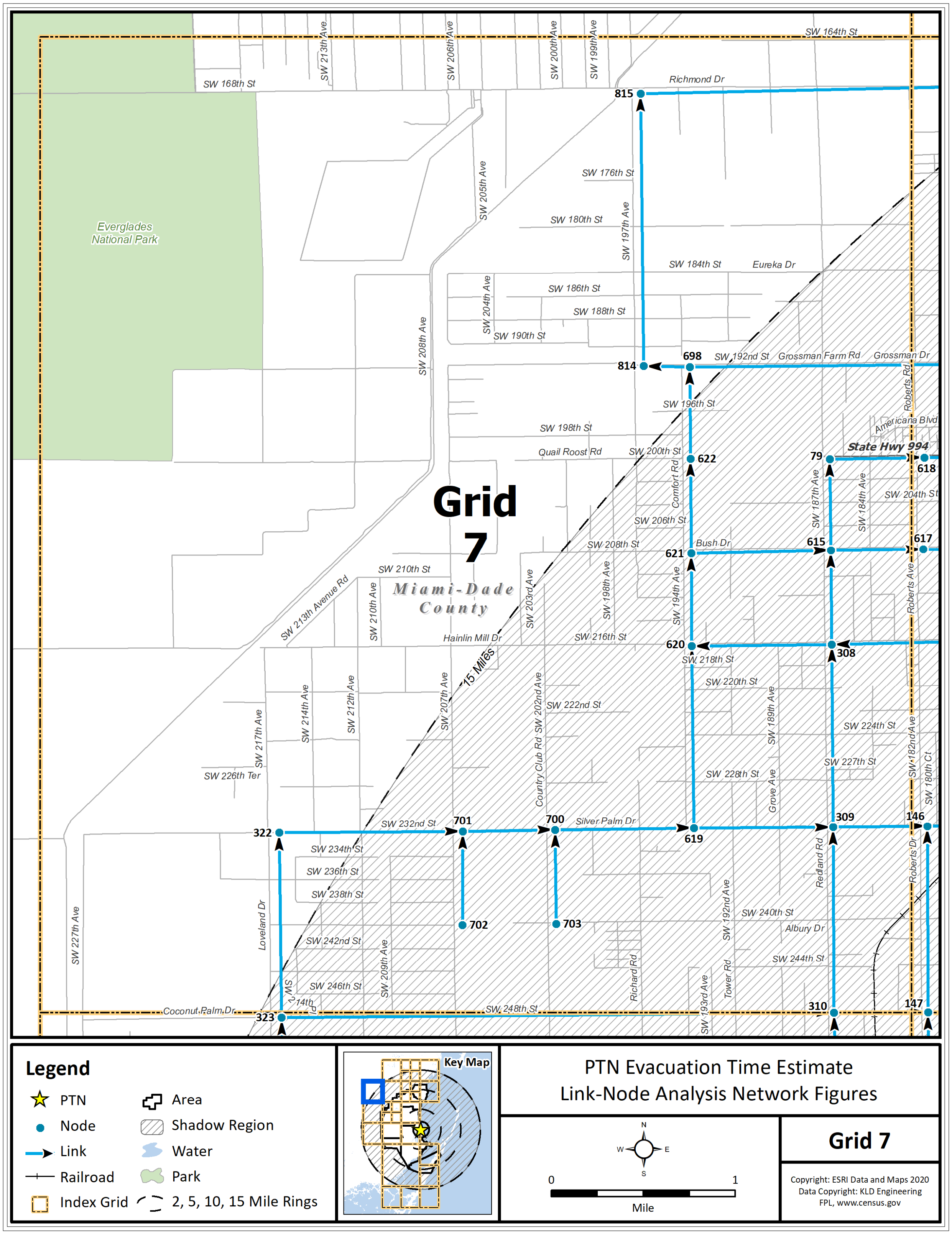

Figure K-8. Link-Node Analysis Network - Grid 7

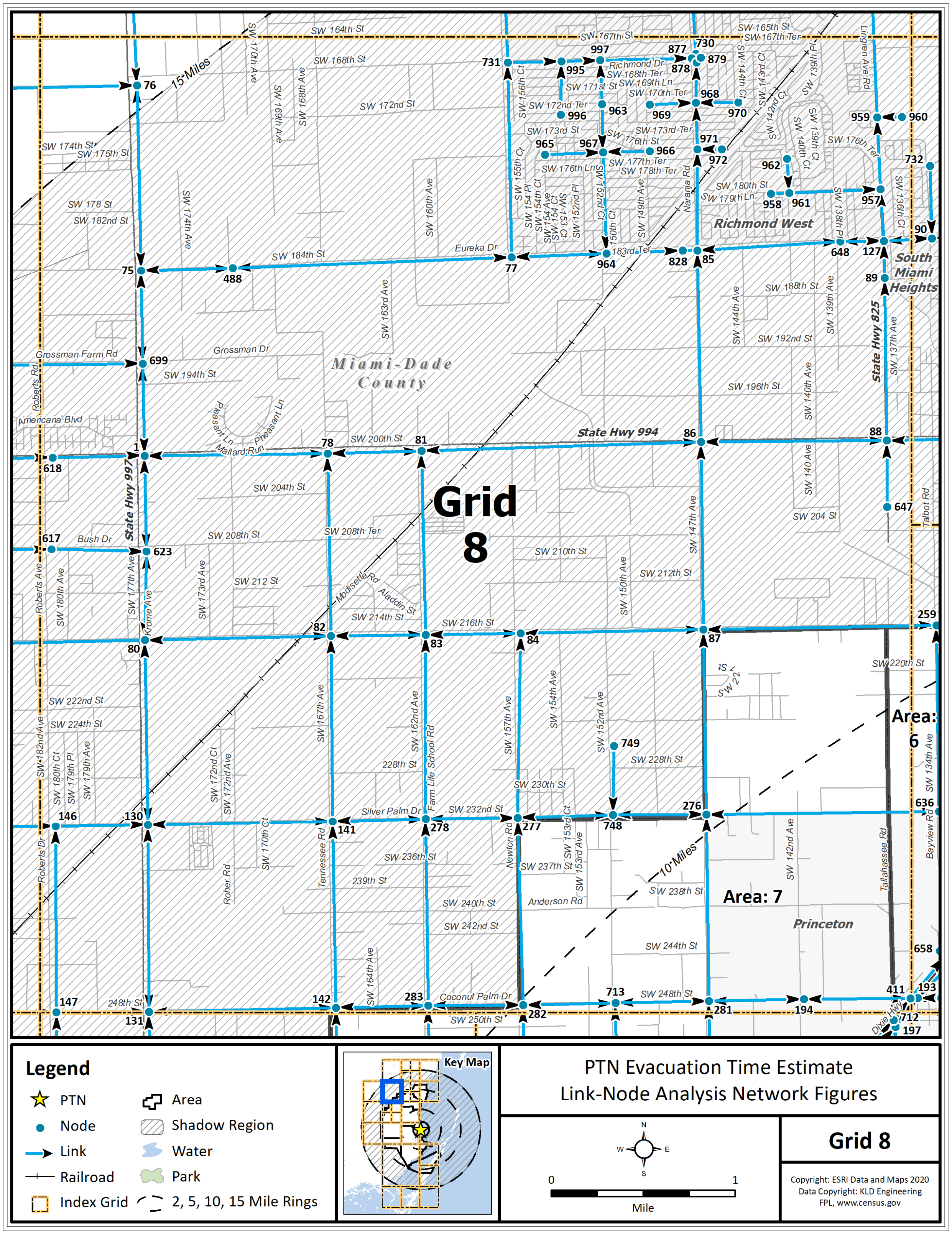

Figure K-9. Link-Node Analysis Network - Grid 8

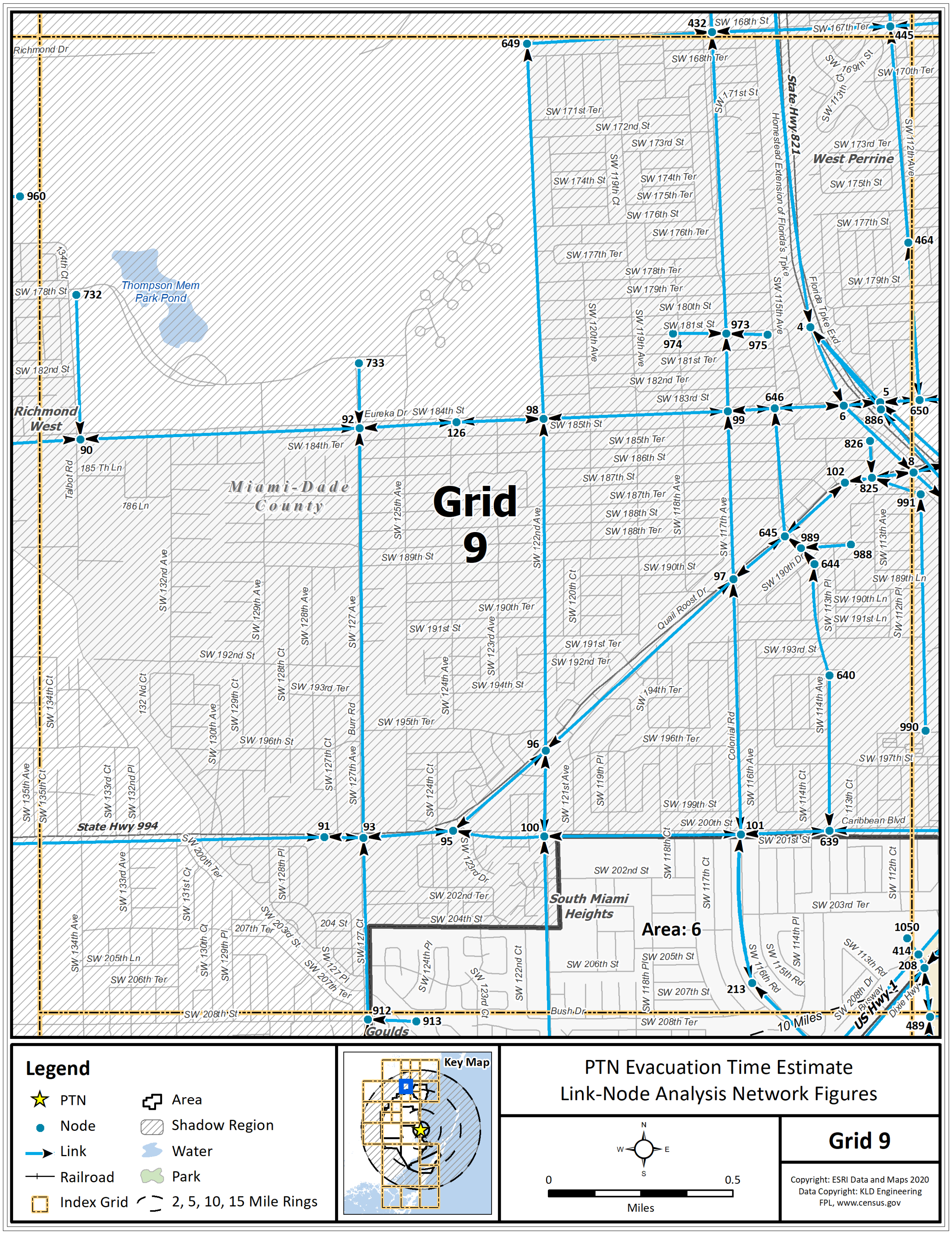

Figure K-10. Link-Node Analysis Network - Grid 9

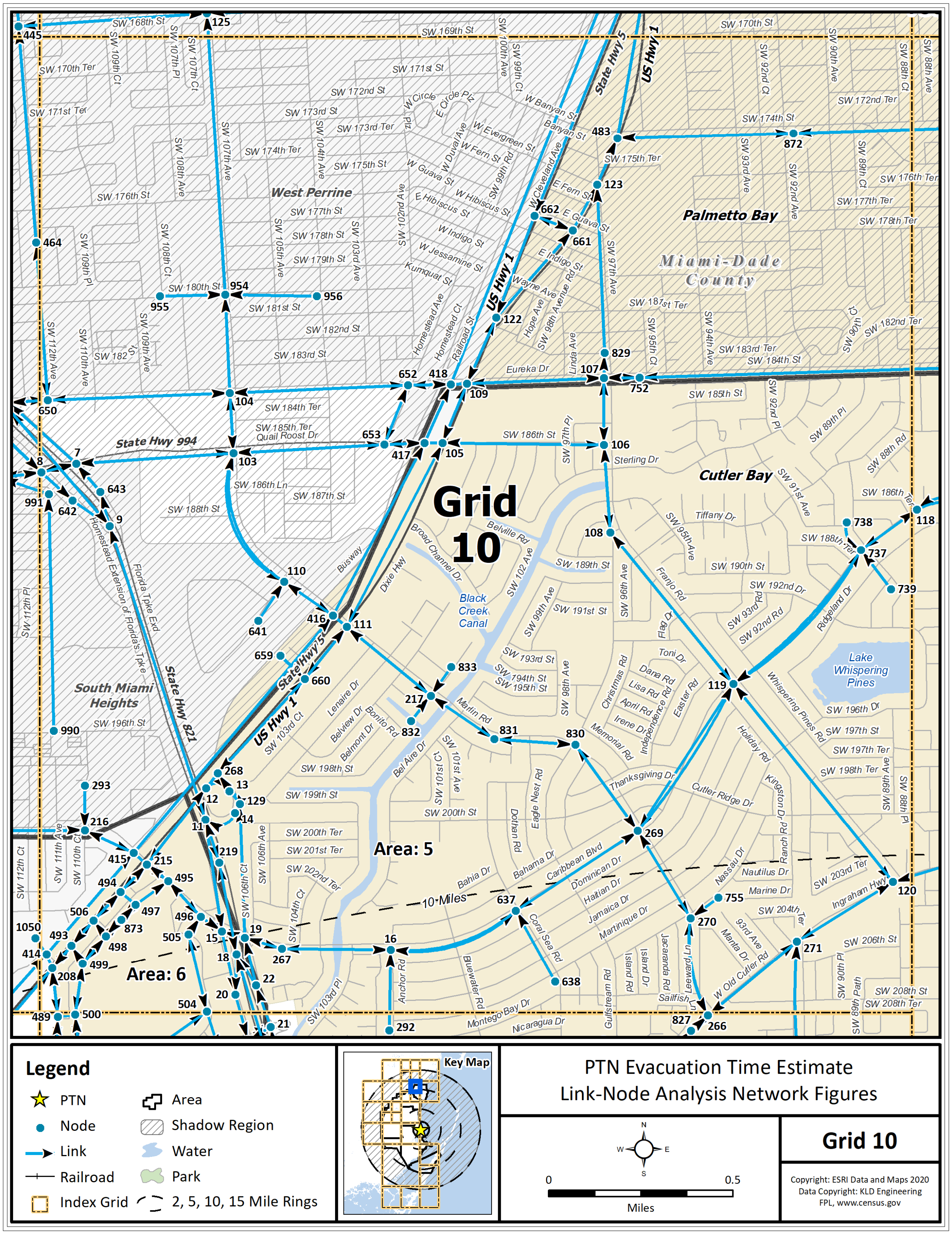

Figure K-11. Link-Node Analysis Network - Grid 10

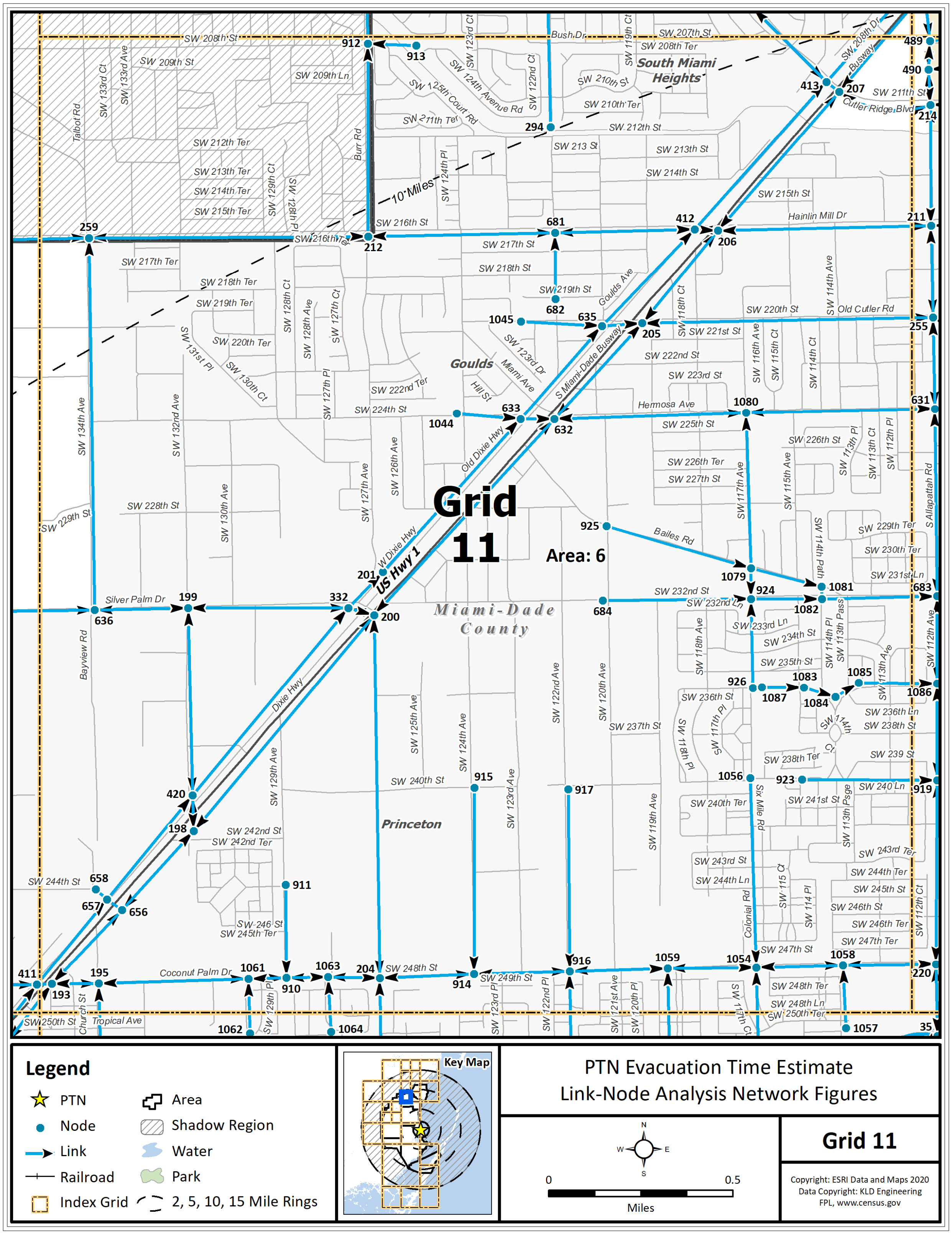

**Figure K-12. Link-Node Analysis Network - Grid 11**

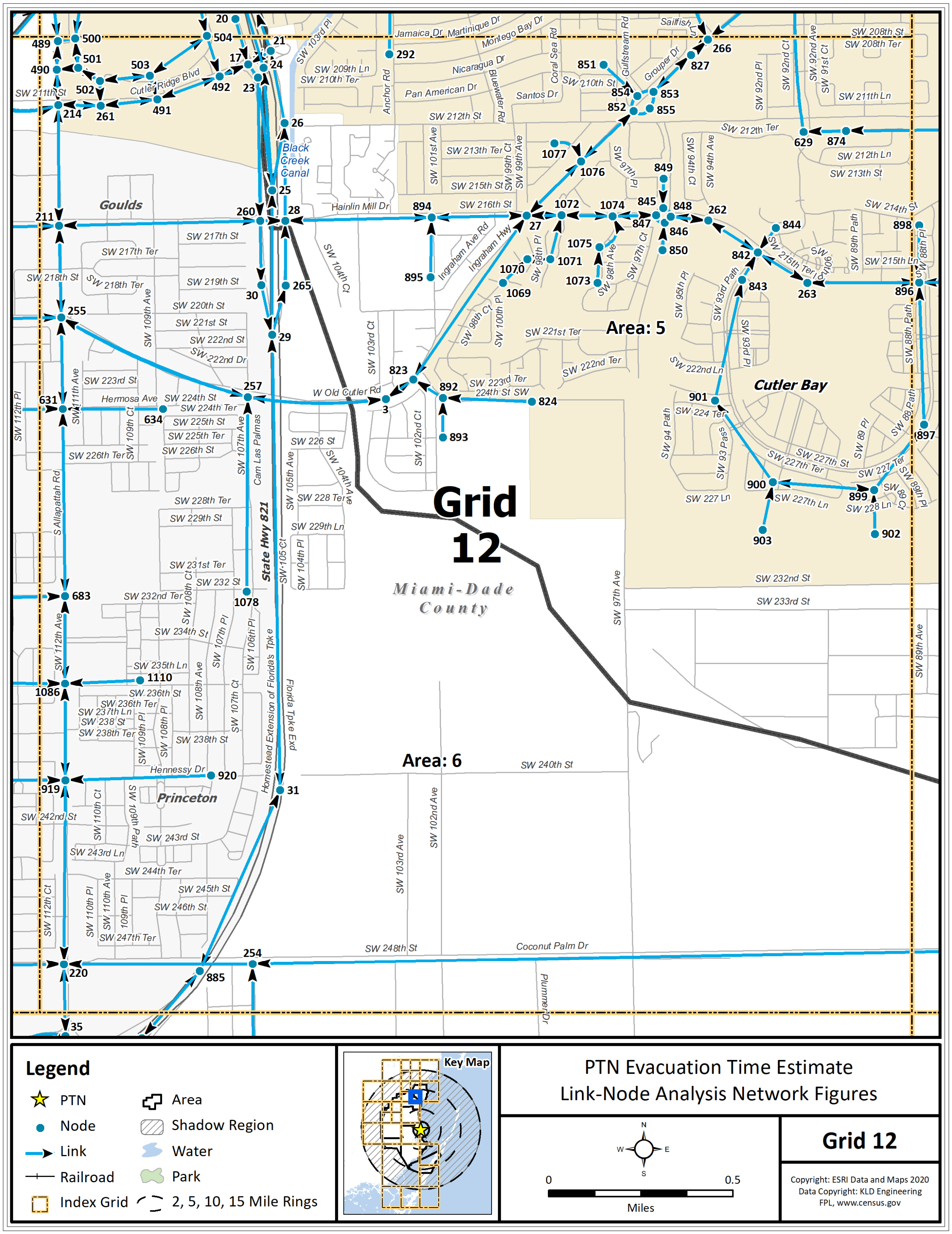

**Figure K-13. Link-Node Analysis Network - Grid 12**

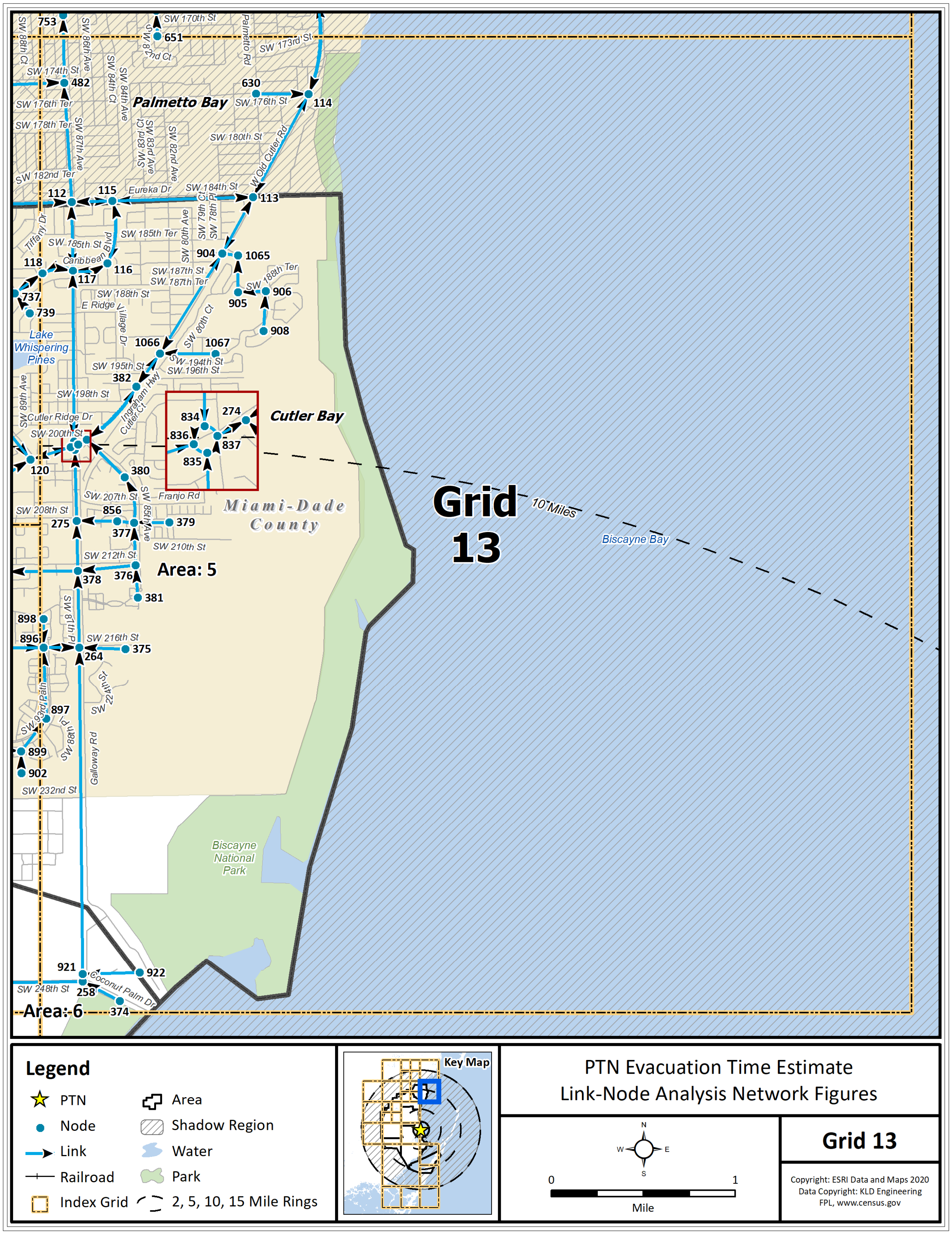

**Figure K-14. Link-Node Analysis Network - Grid 13**

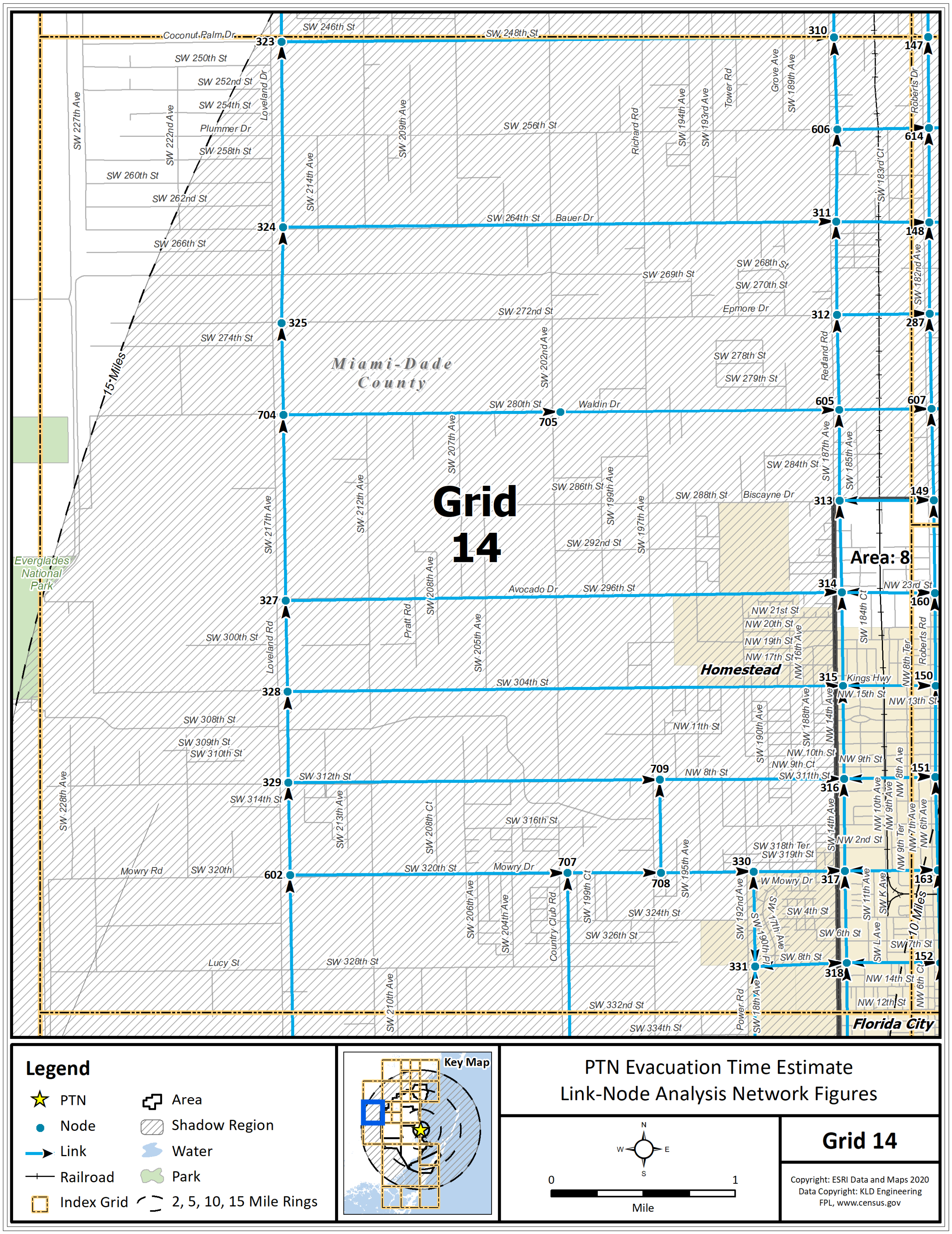

Figure K-15. Link-Node Analysis Network - Grid 14

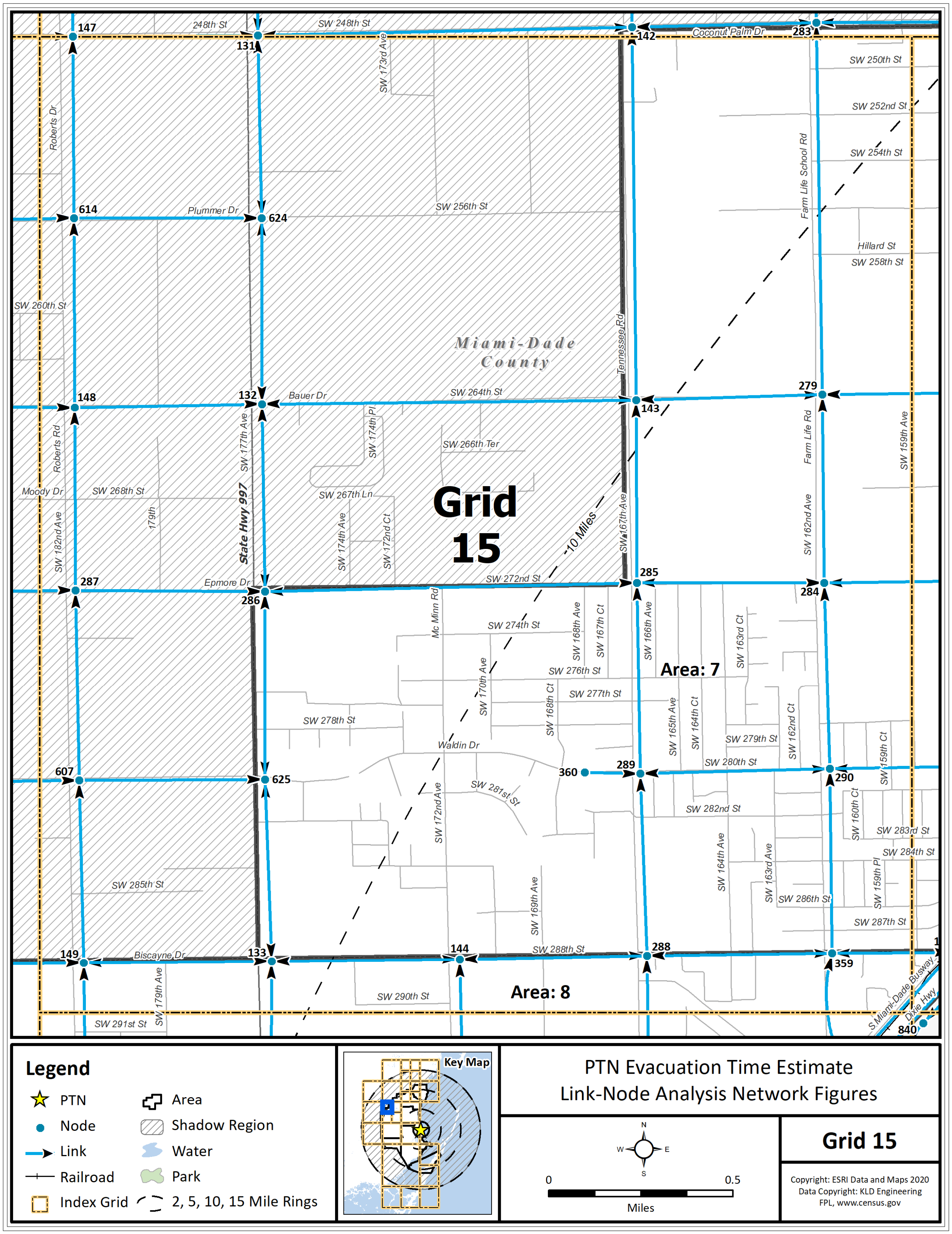

Figure K-16. Link-Node Analysis Network - Grid 15

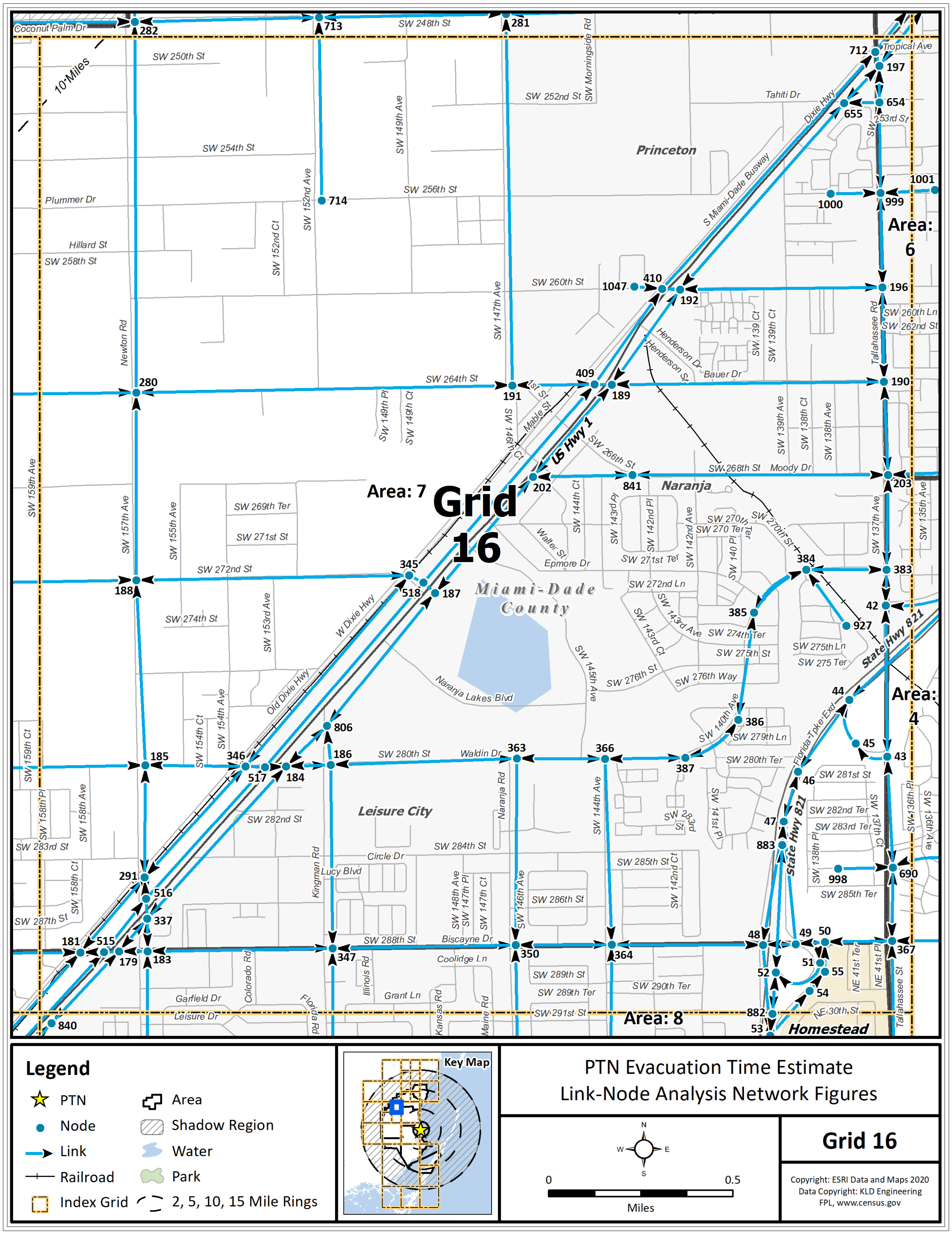

**Figure K-17. Link-Node Analysis Network - Grid 16**

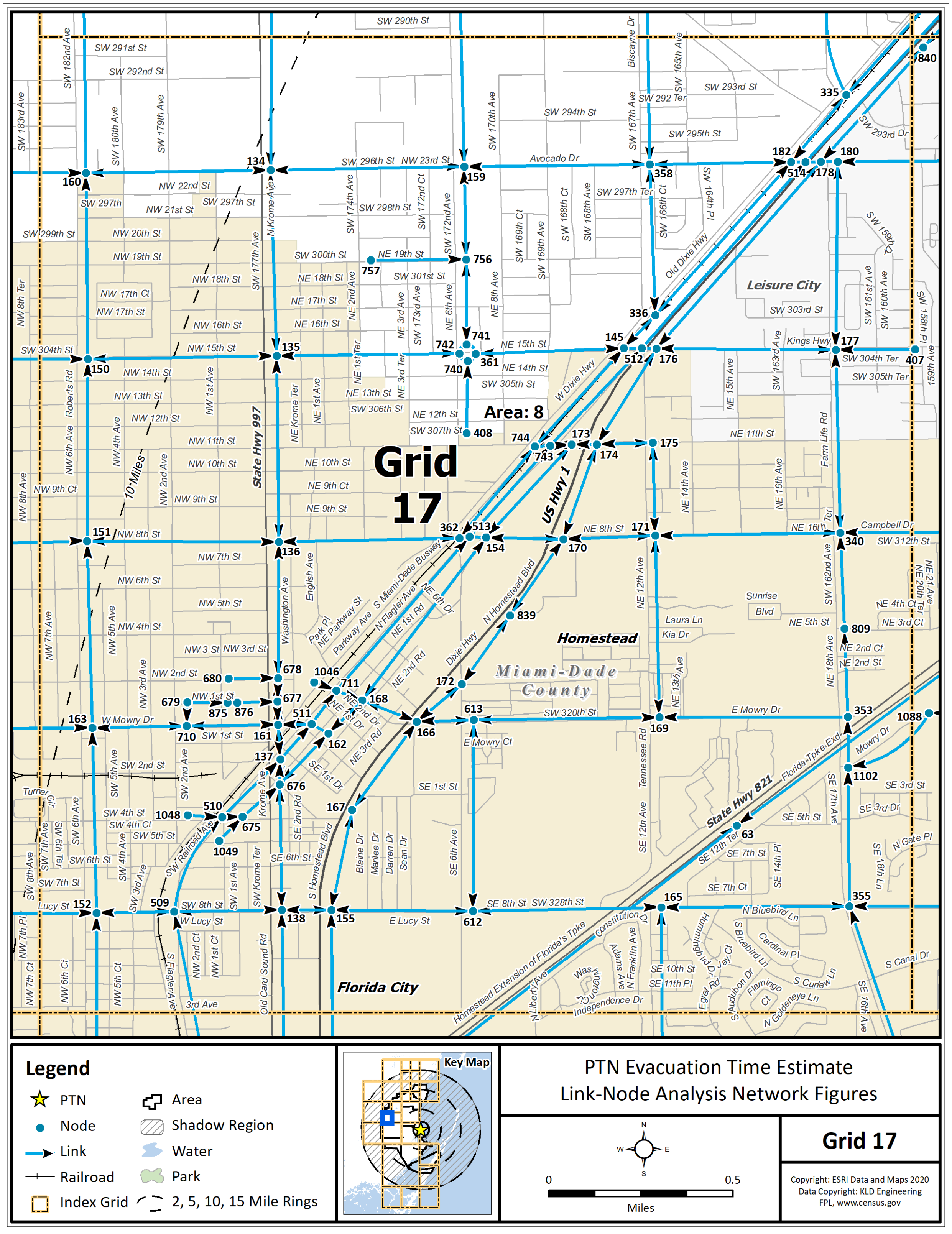

Figure K-18. Link-Node Analysis Network - Grid 17

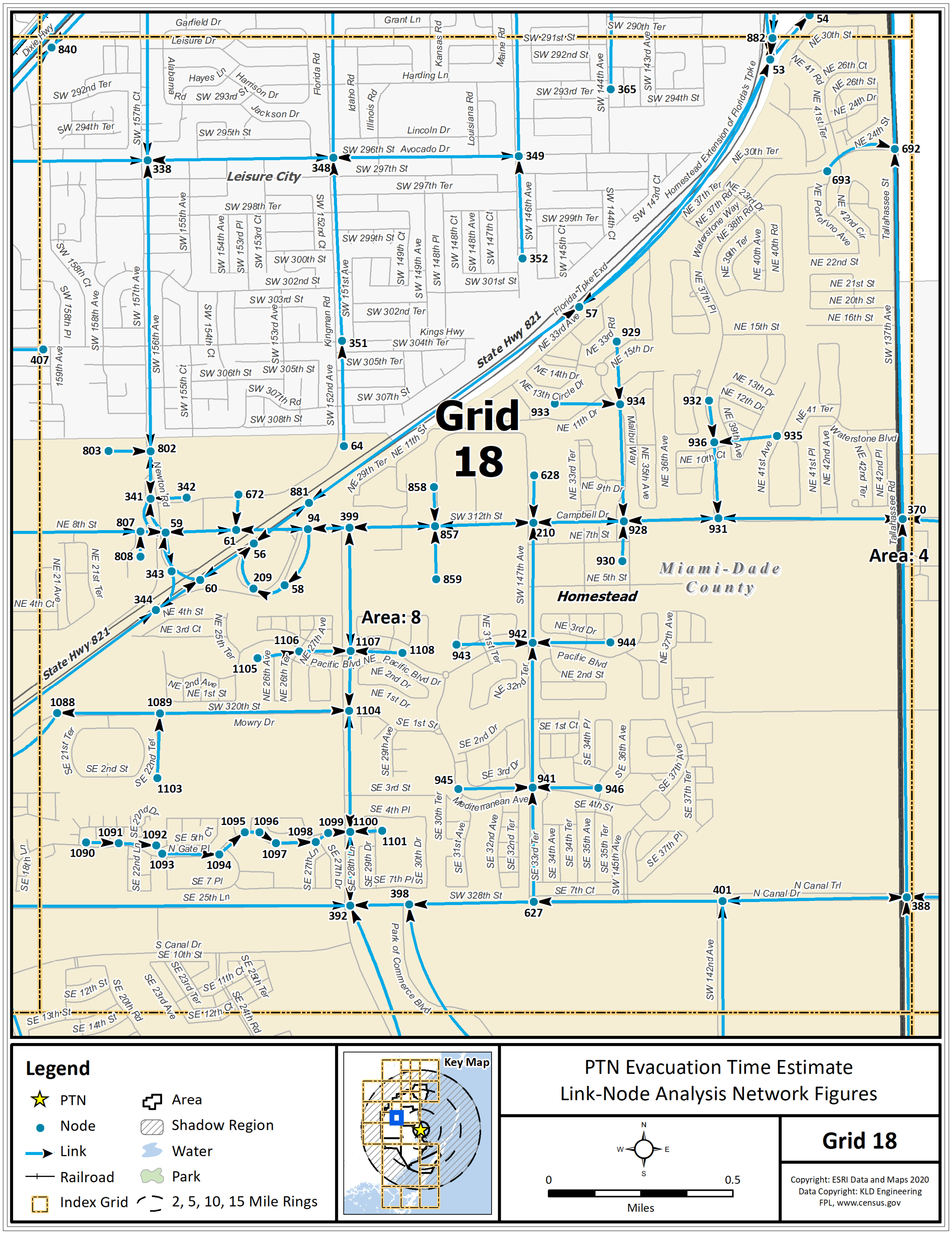

Figure K-19. Link-Node Analysis Network - Grid 18

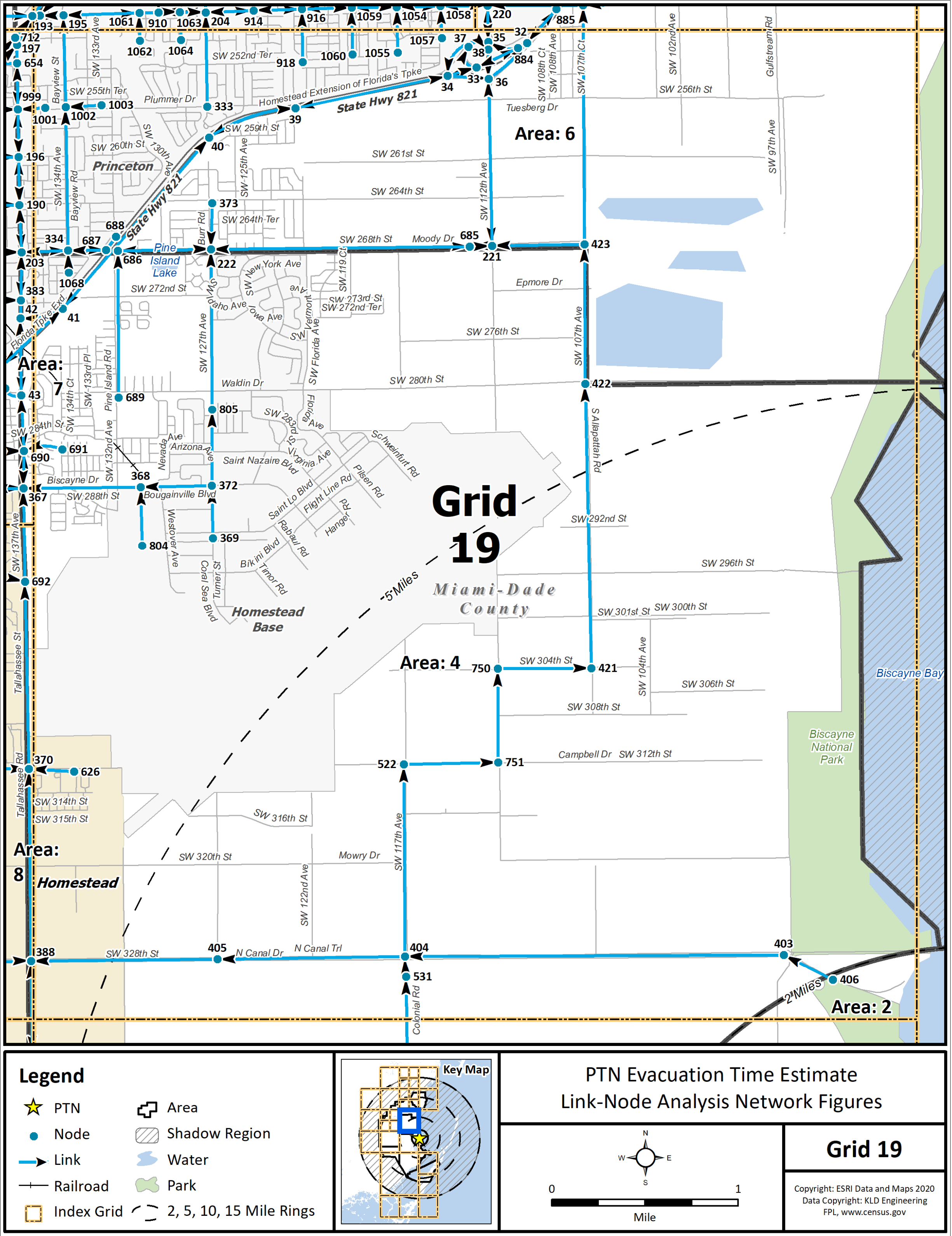

Figure K-20. Link-Node Analysis Network - Grid 19

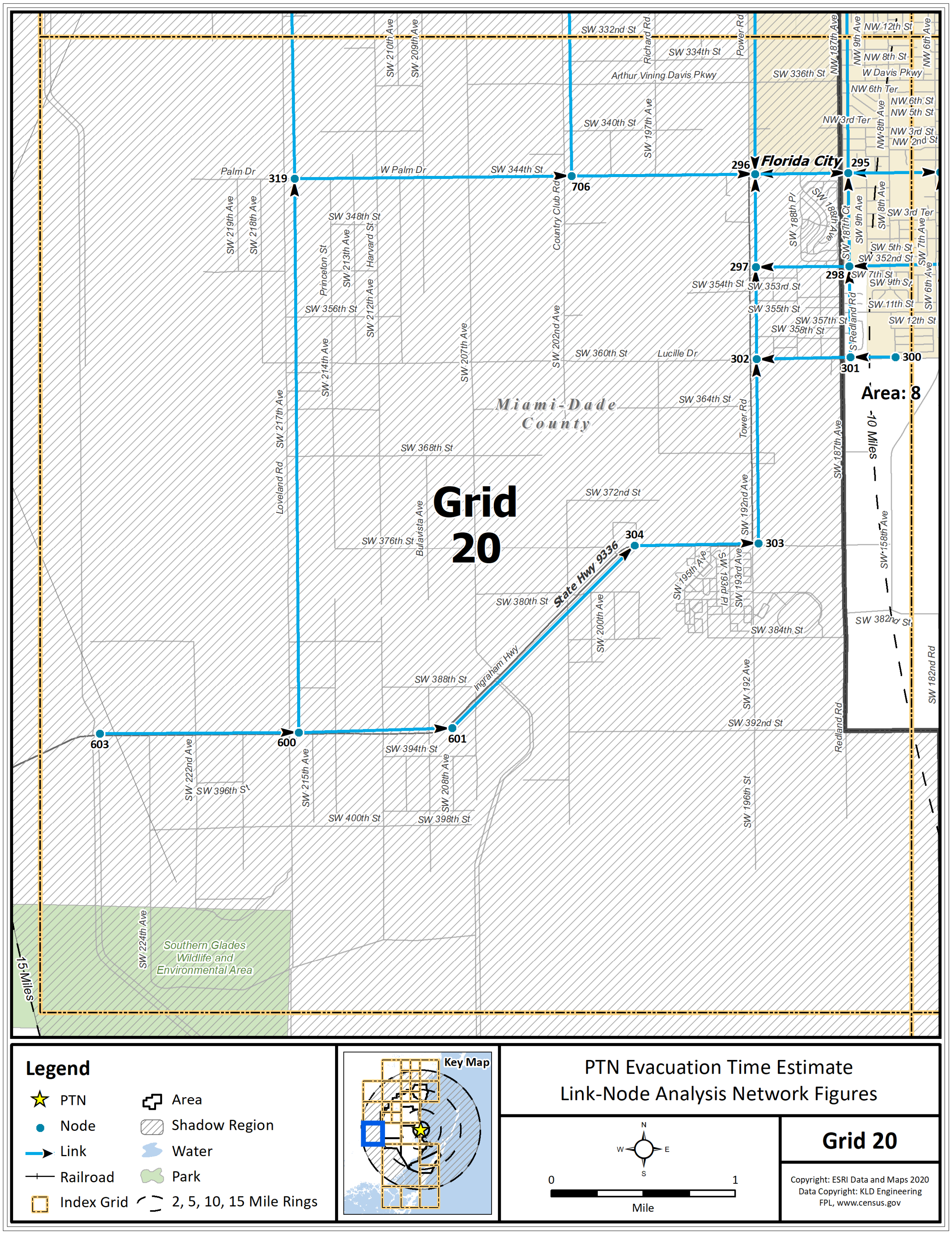

Figure K-21. Link-Node Analysis Network - Grid 20

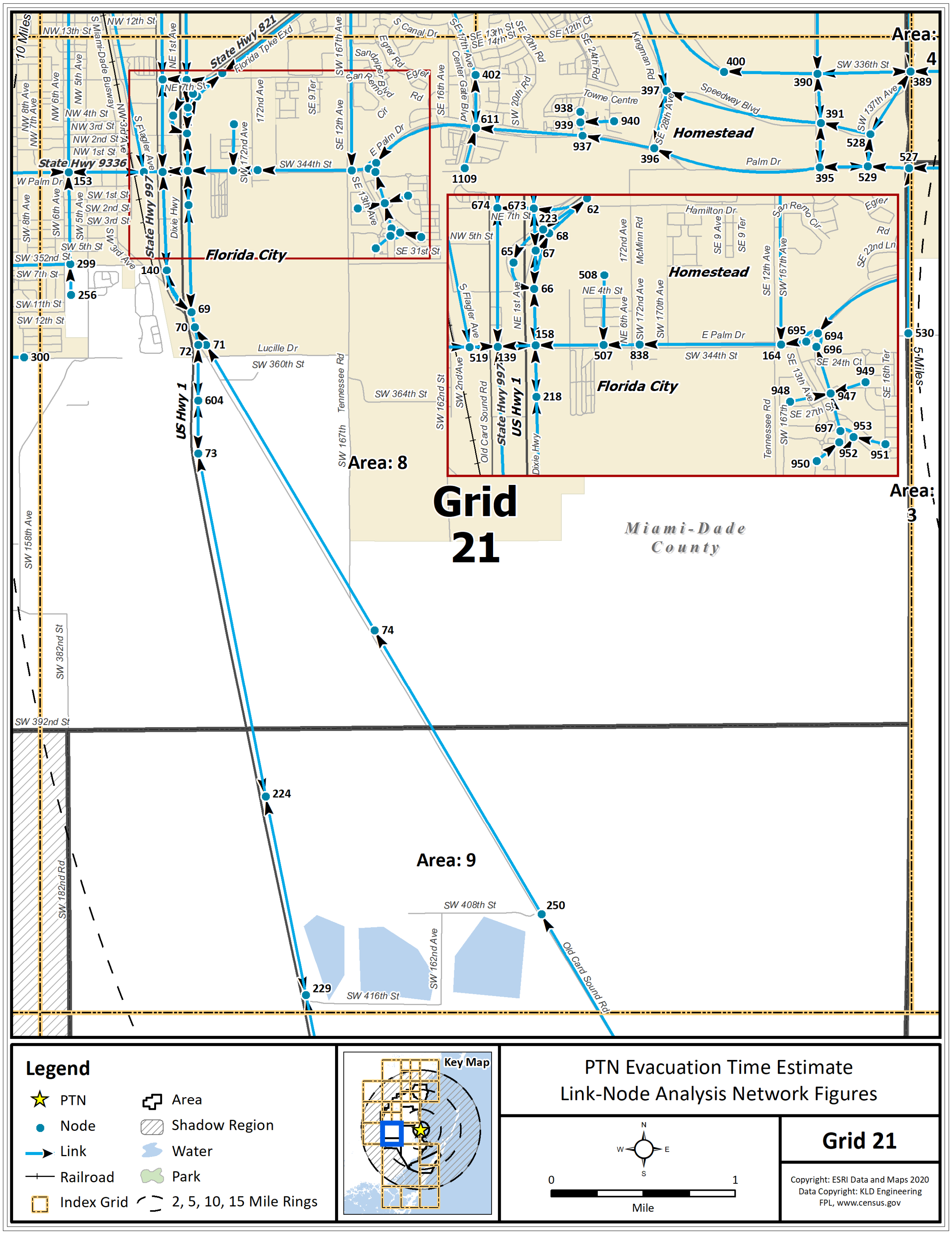

**Figure K-22. Link-Node Analysis Network - Grid 21**

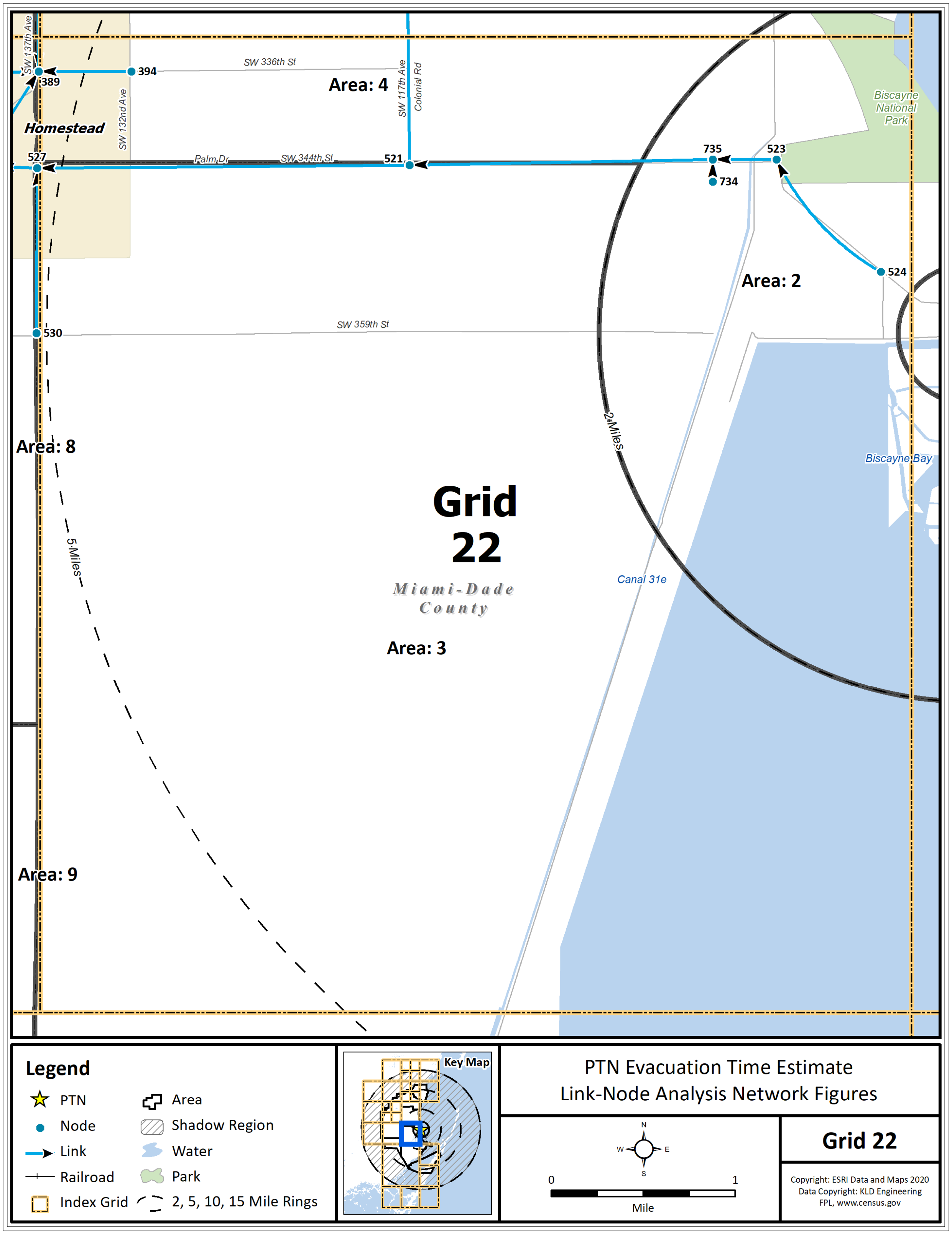

Figure K-23. Link-Node Analysis Network - Grid 22

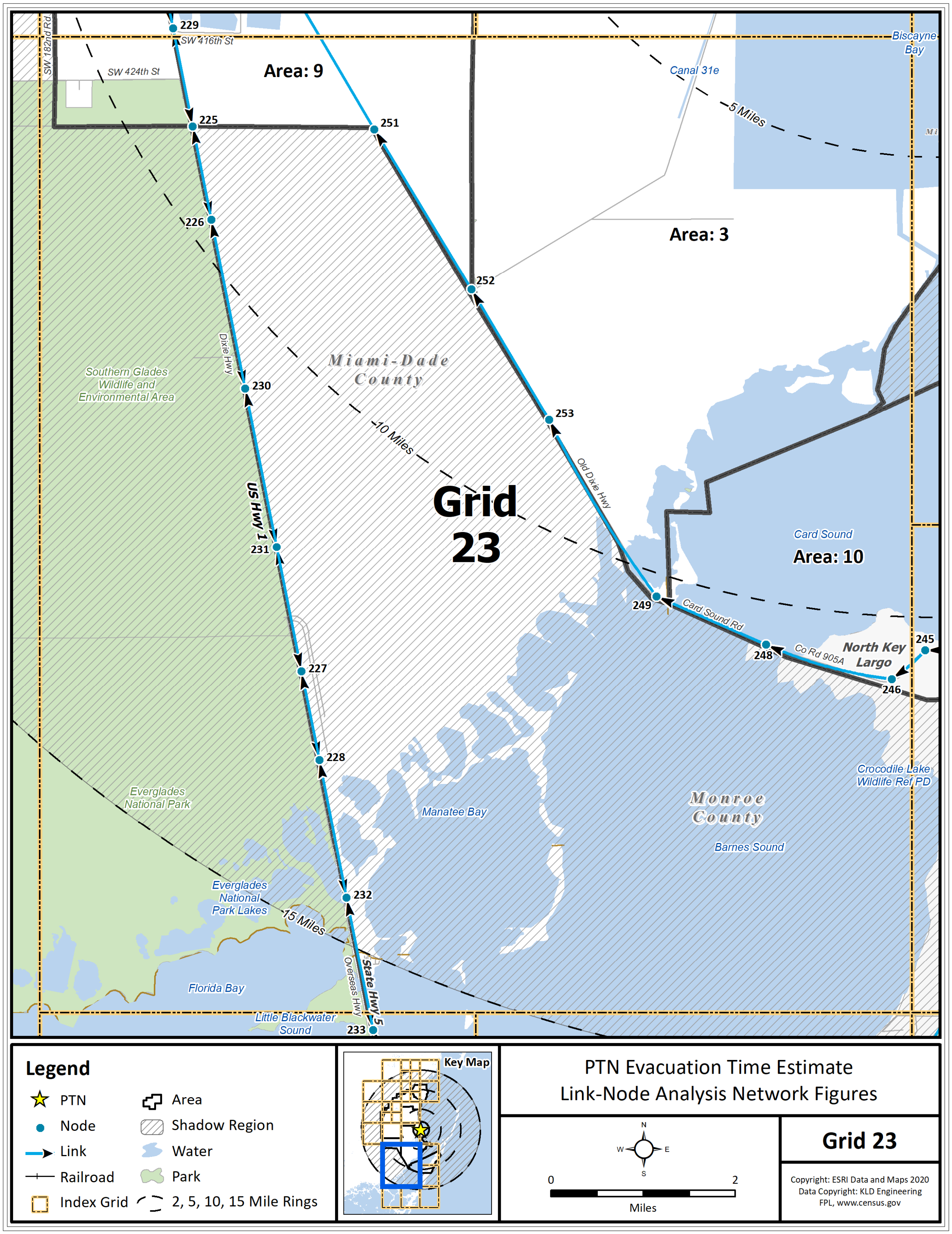

**Figure K-24. Link-Node Analysis Network - Grid 23**

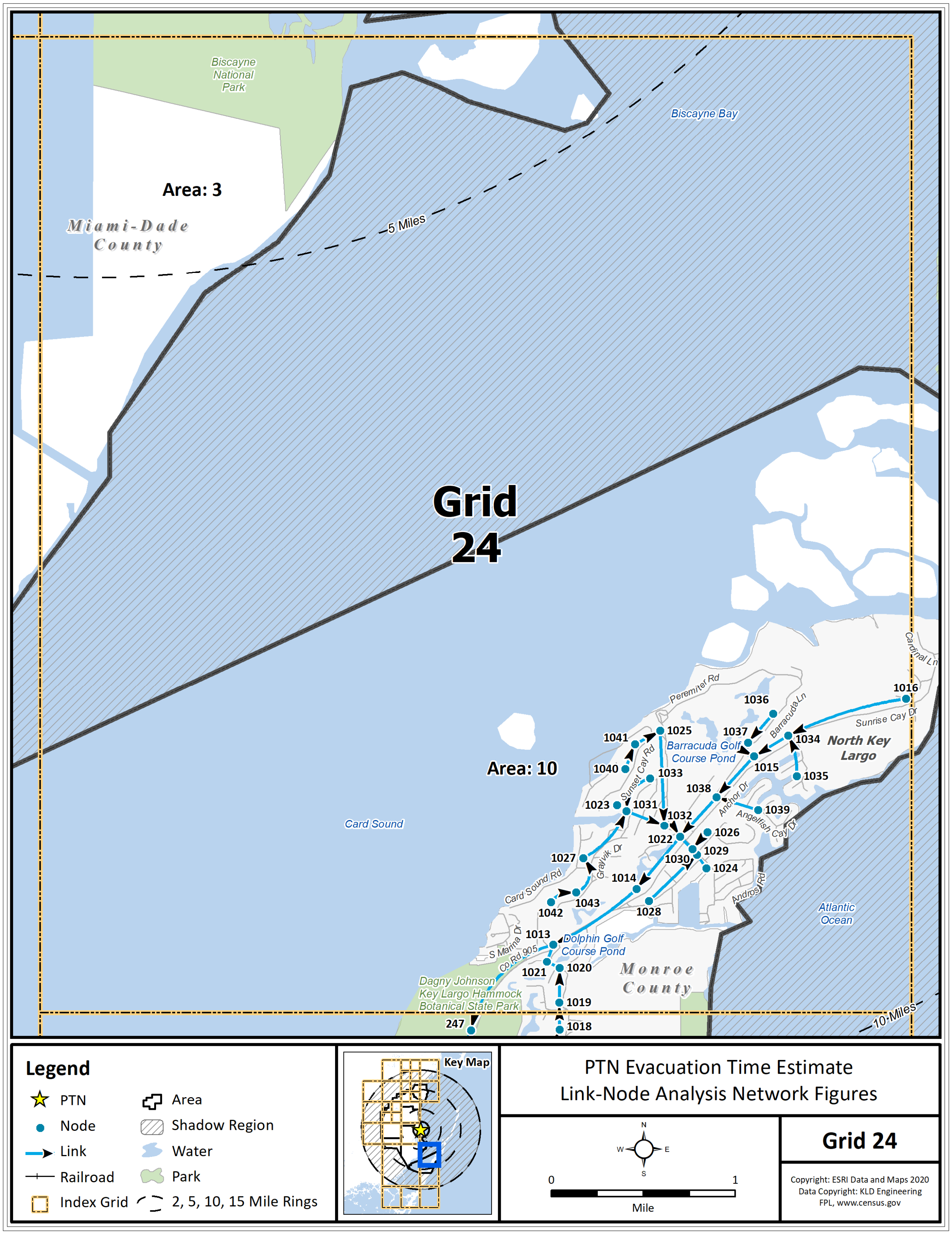

Figure K-25. Link-Node Analysis Network - Grid 24

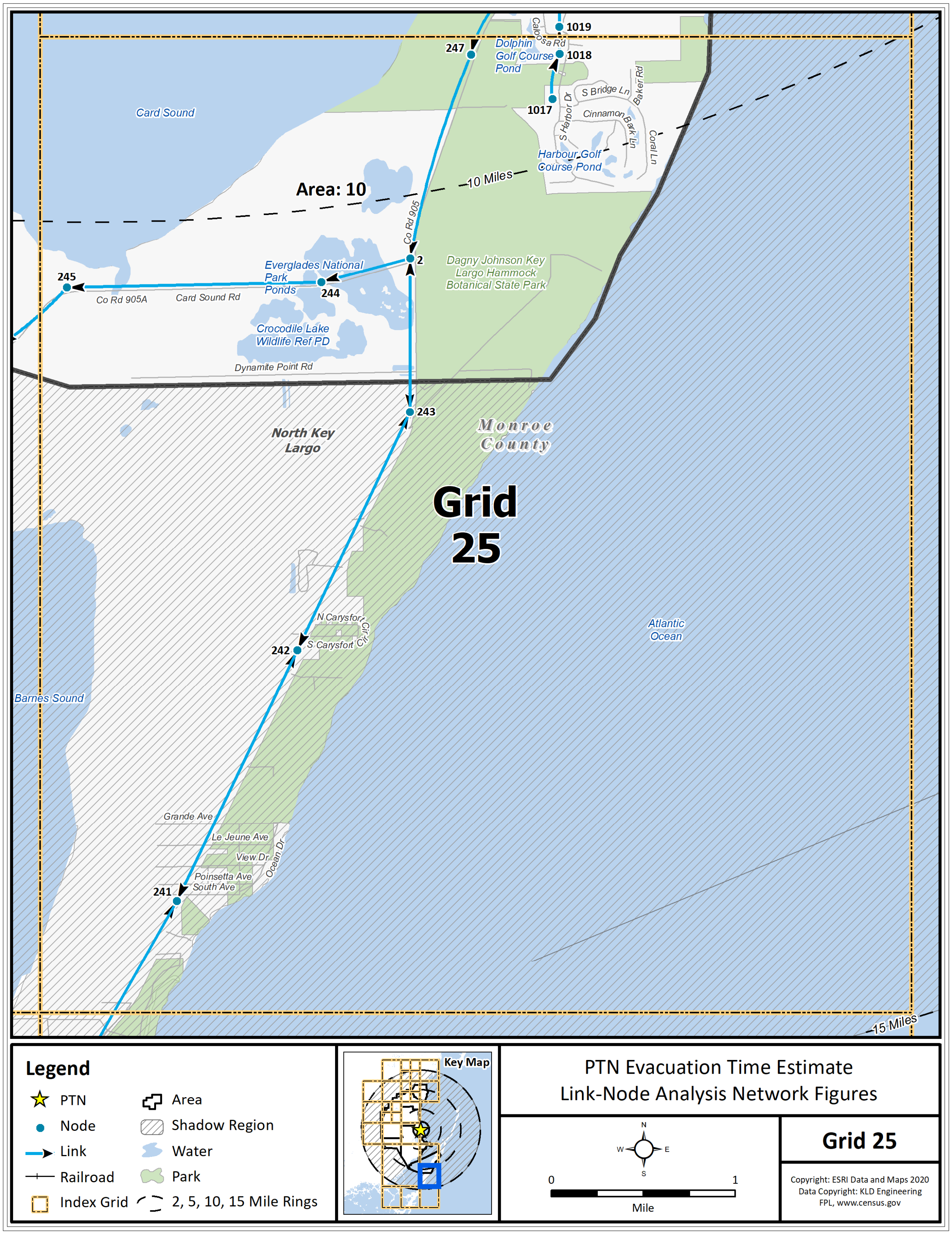

**Figure K-26. Link-Node Analysis Network - Grid 25**

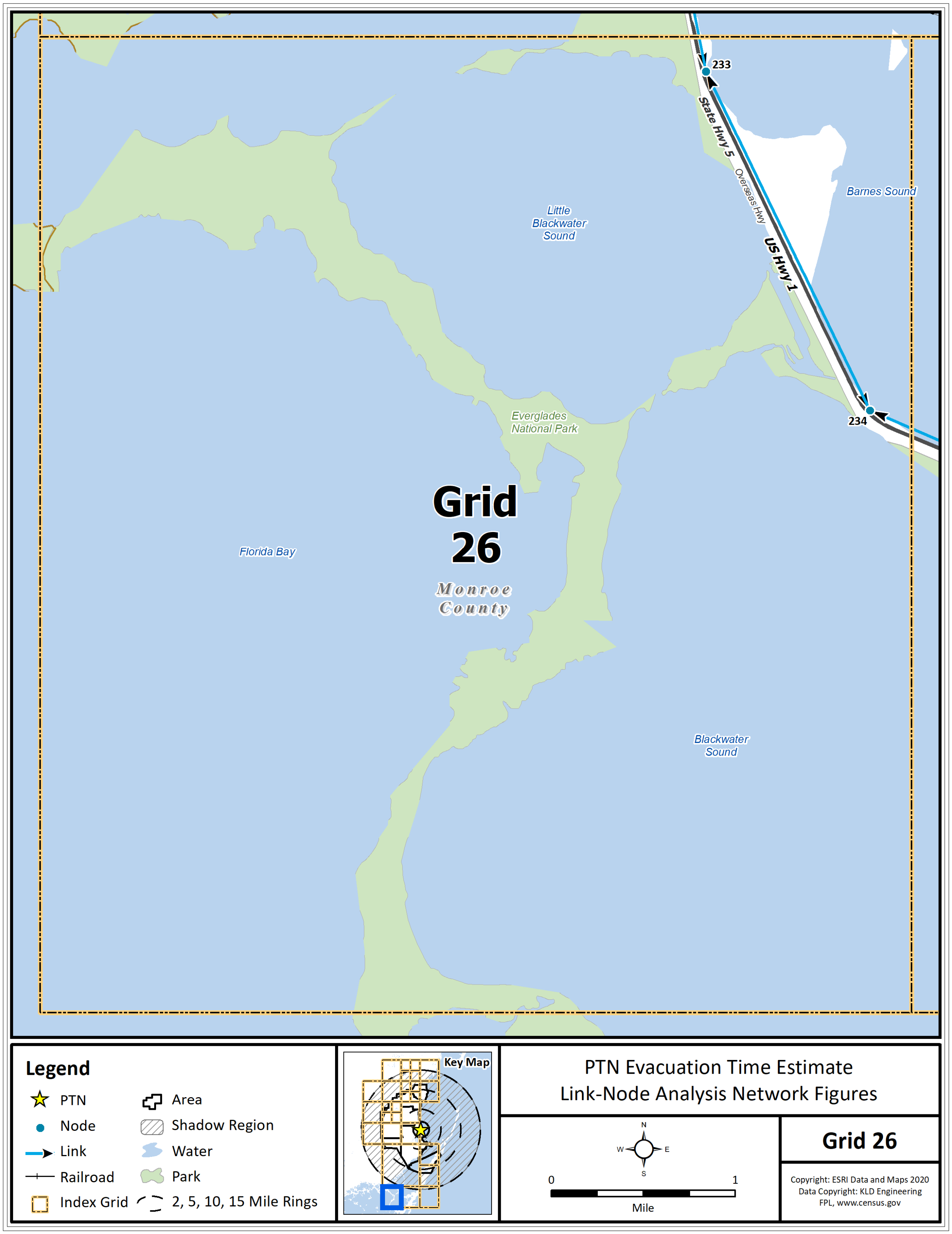

**Figure K-27. Link-Node Analysis Network - Grid 26**

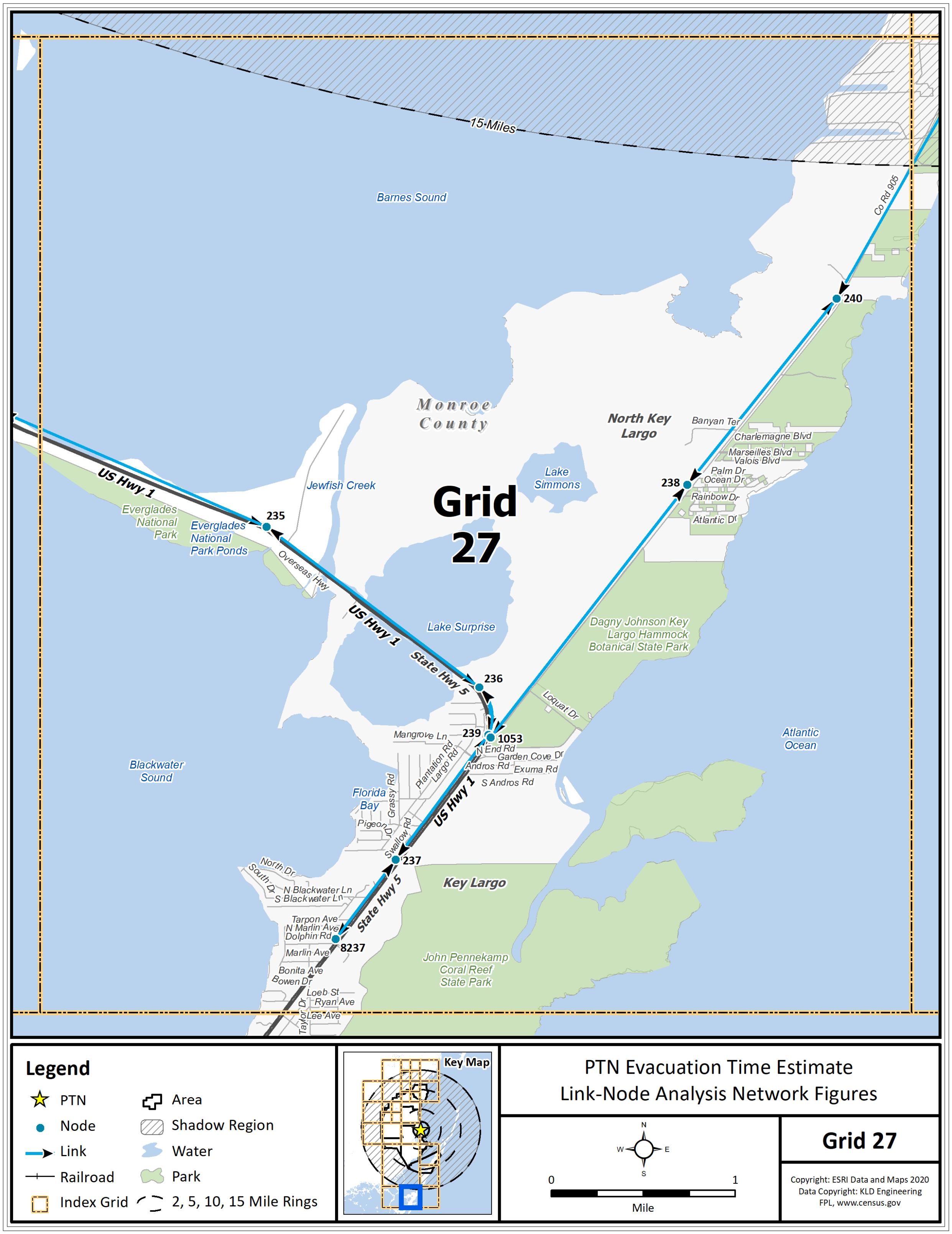

**Figure K-28. Link-Node Analysis Network - Grid 27**

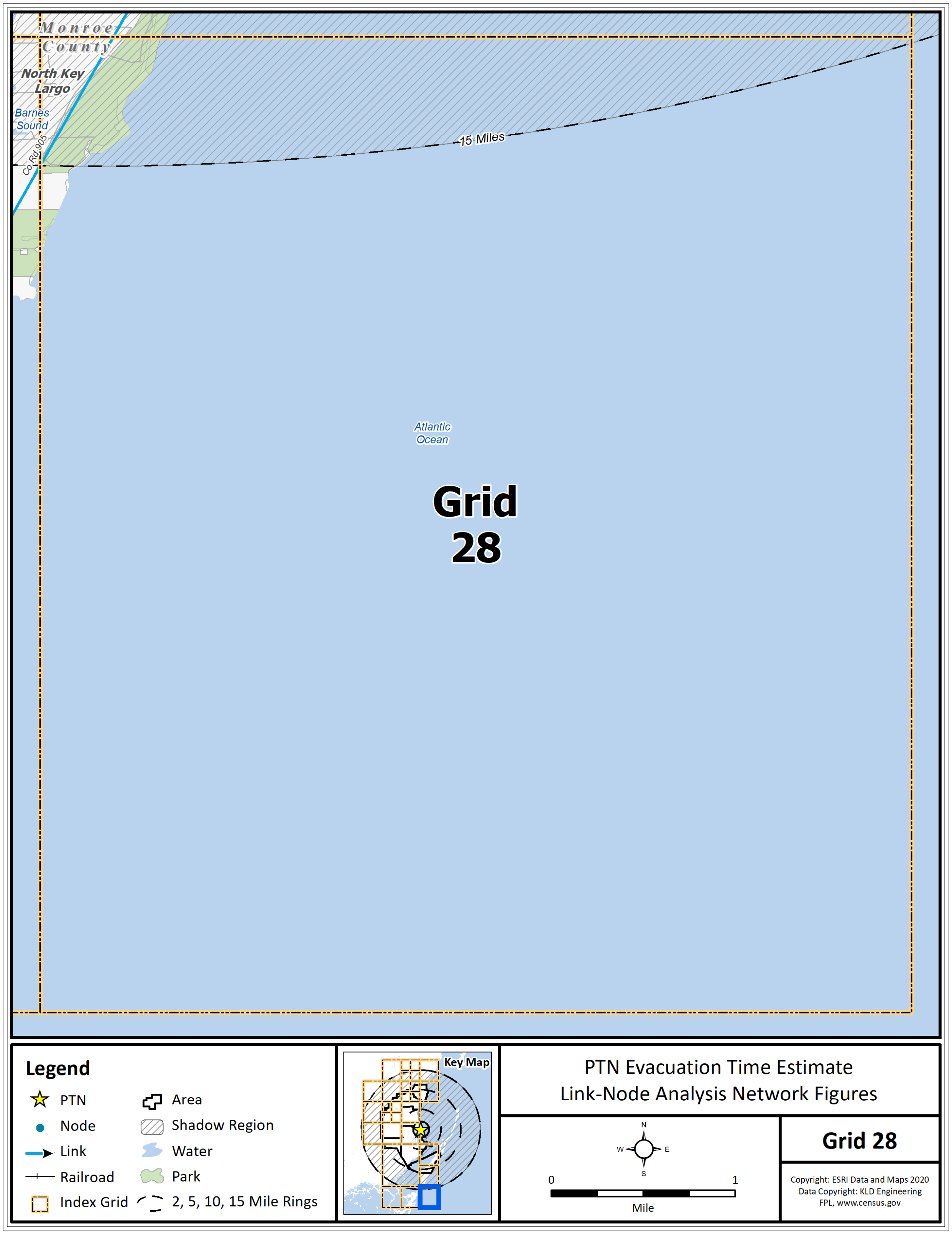

Figure K-29. Link-Node Analysis Network - Grid 28

# APPENDIX L

Area Boundaries

## L. AREA BOUNDARIES

Area 1 County: Miami-Dade

Turkey Point Units 3 & 4.

Area 2 County: Miami-Dade

Defined as the area within the following boundary: An annular ring with a radius of 2 miles centered at the Turkey Point Units 3 & 4.

Area 3 County: Miami-Dade

Defined as the area within the following boundary: Palm Drive (SW 344th Street) west from the border of area 2 to SW 137th Avenue. 137th Avenue south to Card Sound Road. Card Sound Road south to Card Sound. North on the coast to the border of Area 2.

Area 4 County: Miami-Dade

Defined as the area within the following boundary: SW 280th Street west from the coast to SW 107th Avenue. SW 107th Avenue north to SW 268th Street (Hainlin Mill Drive). SW 268th Street west to SW 137th Avenue. SW 137th Avenue south to Palm Drive (SW 344th Street). SW 344th Street east to the Area 2 boundary. Follows Area 2 boundary to the shore and follows the shore north to SW 280th Street.

Area 5 County: Miami-Dade

Defined as the area within the following boundary: Eureka Drive (SW 184th Street) west from the coast to S Dixie Highway (U.S. Highway 1). U.S. Highway 1 south to the Florida Turnpike. Florida Turnpike south to Black Creek Canal. Follows Black Creek Canal south to the shore. Follows the shoreline north to Eureka Drive.

Area 6 County: Miami-Dade

Defined as the area within the following boundary: West on Caribbean Boulevard (SW 200th Street) from the intersection with U.S. Highway 1 and the Florida Turnpike to SW 122nd Avenue. South on SW 122nd Avenue to SW 204th Street. West on SW 204th Street to SW 127th Avenue. South on SW 127th Avenue to Hainlin Mill Drive (SW 216th Street). West on SW 216th Street to SW 137th Avenue. South on SW 137th Avenue to Moody Drive (SW 268th Street). East on Moody Drive to SW 107th Avenue. South on SW 107th Avenue to SW 280th Street. East on SW 280th Street to the shore. Follows the shoreline north to Black Creek Canal. Follows Black Creek Canal north to the Florida Turnpike. Florida Turnpike north to the intersection with U.S. Highway 1 just north of Caribbean Boulevard.

Area 7 County: Miami-Dade

Defined as the area within the following boundary: Hainlin Mill Drive (SW 216th Street) west from the intersection with SW 137th Avenue to Naranja Road (SW 147th Avenue). Naranja Road south to Silver Palm Drive (SW 232nd Street). Silver Palm Drive west to Newton Road (SW 157th Avenue). Newton Road south to Coconut Palm Drive (SW 248th Street). Coconut Palm Drive west to Tennessee Road (SW 167th Avenue). Tennessee Road south to Epmore Drive (SW 272nd Street). Epmore Drive west to Krome Avenue (SW 177th Street). Krome Avenue south to Biscayne Drive (SW 288th Street). Biscayne Drive east to SW 137th Avenue. SW 137th Avenue north to intersection with Hainlin Mill Drive.

Area 8 County: Miami-Dade

Defined as the area within the following boundary: Biscayne Drive (SW 288th Street) west from the intersection with SW 137th Avenue to Redland Road (SW 187th Avenue). Redland Road south to SW 392nd Street. SW 392nd Street east to SW 137th Avenue. SW 137th Avenue north to intersection with Biscayne Drive.

Area 9 County: Miami-Dade

Defined as the area within the following boundary: SW 392nd Street west from the intersection with SW 137th Avenue to SW 182nd Avenue. SW 182nd Avenue south to Dade County Work Camp Road. Work Camp Road east to Card Sound Road (road physically ends at U.S. Highway 1). Card Sound Road south to SW 137th Avenue. SW 137th Avenue north to intersection with SW 392nd Street.

Area 10 County: Monroe

Ocean Reef Community and Card Sound Road residents and visitors.

# APPENDIX M

## Evacuation Sensitivity Studies

# M. EVACUATION SENSITIVITY STUDIES

This appendix presents the results of a series of sensitivity analyses. These analyses are designed to identify the sensitivity of the ETE to changes in some base evacuation conditions.

## M.1 Effect of Changes in Trip Generation Times

A sensitivity study was performed to determine whether changes in the estimated trip generation time have an effect on the ETE for the entire EPZ. Specifically, if the tail of the mobilization distribution were truncated (i.e., if those who responded most slowly to the ATE could be persuaded to respond much more rapidly), or if the tail were elongated (i.e., spreading out the departure of evacuees to limit the demand during peak times), how would the ETE be affected? The case considered was Scenario 6, Region 3; a winter, midweek, midday, good weather evacuation of the entire EPZ. Table M-1 presents the results of this study.

If evacuees mobilize one hour quicker, the 90th percentile ETE decreases by 5 minutes (minimal impact) and the 100th percentile ETE is unchanged, whereas if evacuees mobilize two hours quicker, the 90th percentile ETE increases by 5 minutes (minimal impact) and the 100th percentile ETE increases by 55 minutes (significant impact). If the evacuees take one hour longer to mobilize, the 90th percentile ETE decreases by 5 minutes and the 100th percentile ETE increases by 25 minutes (not a significant change per federal guidance). See Table M-1.

As discussed in Section 7.3, congestion exists within the EPZ for about 10 hours and 25 minutes after the ATE. As such, the ETE for the 90th percentile is not significantly affected by the trip generation time, but by the time needed to clear the congestion within the EPZ. The 100th percentile ETE are also dictated by traffic congestion. In fact, when evacuees mobilize more quickly, they overwhelm the capacity of the roadway system by having more vehicles get on the road sooner, thereby increasing congestion and actually causing the 90th and 100th percentile ETE to increase.

## M.2 Effect of Changes in the Number of People in the Shadow Region Who Relocate

A sensitivity study was conducted to determine the effect on ETE of changes in the percentage of people who decide to relocate from the Shadow Region. The case considered was Scenario 6, Region 3; a winter, midweek, midday, good weather evacuation for the entire EPZ. The movement of people in the Shadow Region has the potential to impede vehicles evacuating from an Evacuation Region within the EPZ. Refer to Sections 3.2 and 7.1 for additional information on population within the Shadow Region.

Table M-2 presents the ETE for each of the cases considered. The results show that decreasing the shadow evacuation from 20% to 0% decreases the 90th percentile ETE by 5 minutes, while the 100th percentile ETE remains the same. Quadrupling the shadow percentage from 20% to 80% increases the ETE by 50 minutes and 1 hour 5 minutes for the 90th and 100th percentiles, respectively – both significant changes. A full evacuation of the Shadow Region increases the 90th and 100th percentile ETE by 1 hour and 25 minutes and 3 hours and 10 minutes, respectively. The Shadow Region for the PTN is densely populated to the north of the plan, specifically in population centers of South Miami Heights and Palmetto Bay. As shown in Figure 7-3 through Figure 7-9, there is significant traffic congestion within the Shadow Region to the north of the plant. Therefore, any additional shadow residents that decide to voluntarily evacuate will increase this congestion, delaying the egress of EPZ evacuees, and prolonging ETE.

Note, the demographic survey results presented in Appendix F indicate that 16.5% of households would elect to evacuate if advised to shelter, which is less than the 20% non-compliance suggested in NUREG/CR-7002, Rev. 1. A sensitivity study was run with this shadow evacuation percentage as well; there was no impact on ETE.

## M.3 Effect of Changes in Permanent Resident Population

A sensitivity study was conducted to determine the effect on ETE due to changes in the permanent resident population within the study area (EPZ plus Shadow Region). As population in the study area changes over time, the time required to evacuate the public may increase, decrease, or remain the same. Since the ETE is related to the demand to capacity ratio present within the study area, changes in population will cause the demand side of the equation to change and could impact ETE.

As per the NRC's response to the Emergency Planning Frequently Asked Question (EPFAQ) 2013-001, the ETE population sensitivity study must be conducted to determine what percentage increase in permanent resident population causes an increase in the 90th percentile ETE of 25% or 30 minutes, whichever is less. The sensitivity study must use the scenario with the <u>longest 90th percentile ETE</u> (excluding the roadway impact scenario and the special event scenario if it is a one day per year special event).

The sensitivity study was conducted using the following planning assumptions:

1. The percent change in population within the study area was increased by up to 5%. Changes in population were applied to permanent residents only (as per federal guidance), in both the EPZ and the Shadow Region.
2. The transportation infrastructure (as presented in Appendix K) remained fixed; the presence of future proposed roadway changes and/or highway capacity improvements were not considered.
3. The study was performed for the 2-Mile Region (R01), the 5-Mile Region (R02) and the entire EPZ (R03).
4. The scenario (excluding roadway impact and special event) which yielded the <u>longest 90th percentile ETE</u> values was selected as the case to be considered in this sensitivity study (Scenario 7 – Winter, Midweek, Midday with Rain).

Table M-3 presents the results of the sensitivity study. Section IV of Appendix E to 10 CFR Part 50 requires licensees to provide an updated ETE analysis to the NRC between decennial censuses when a population increase within the EPZ causes the <u>longest 90th percentile ETE</u> values (for the 2-Mile Region, 5-Mile Region or entire EPZ) to increase by 25% or 30 minutes, whichever is less. All base ETE values for the 5-Mile Region (R02) and for the entire (EPZ) are greater than 2 hours; 25% of these base ETE is always equal or greater than 30 minutes.

Therefore, 30 minutes is the lesser and is the criterion for updating ETE for the 5-Mile Region and the entire EPZ. The base ETE for the 2-Mile Region is less than 2 hours (1:35); thus 25% of the ETE (24 minutes) is less than 30 minutes and 25% (24 minutes) is the criterion for Region R01.

Those percent population changes which result in the longest 90th percentile ETE change greater than or equal to 30 minutes (for Region R02 and R03) or 24 minutes (for Region R01) are highlighted in red in Table M-3 – a 5% or greater increase in the full EPZ permanent resident population (includes 20% of the Shadow permanent resident population). Florida Power and Light will have to estimate the full EPZ population on an annual basis. If the EPZ population increases by 5% or more relative to the 2020 Census, an updated ETE analysis will be needed.

## M.4 Enhancements in Evacuation Time

This appendix documents sensitivity studies on critical variables that could potentially impact ETE. Possible improvements to ETE are further discussed below:

- Reducing or elongating mobilization time does not have a beneficial impact on ETE. Nonetheless, public education to encourage evacuees to have a bag packed in advance and to have a plan for evacuation is encouraged.
- Increasing the percent shadow evacuation (especially over 80%) has a significant impact on ETE (Section M.2). As such, public outreach could be considered to inform those people within the EPZ (and potentially beyond the EPZ) that if they are not advised to evacuate, they should not.
- Population growth results in more evacuating vehicles which could significantly increase ETE (Section M.3). Public outreach to inform people within the EPZ to evacuate as a family in a single vehicle would reduce the number of evacuating vehicles and could reduce ETE or offset the impact of population growth.

**Table M-1. Evacuation Time Estimates for Trip Generation Sensitivity Study**

| Trip Generation Period | Evacuation Time Estimate for Entire EPZ | |
|---|---|---|
| | 90th Percentile | 100th Percentile |
| 3 hours, 15 minutes | 8:30 | 11:45 |
| 4 hours, 15 minutes | 8:20 | 10:50 |
| 5 hours, 15 minutes (Base) | 8:25 | 10:50 |
| 6 hours, 15 minutes | 8:20 | 11:15 |

**Table M-2. Evacuation Time Estimates for Shadow Sensitivity Study**

| Percent Shadow Evacuation | Evacuating Shadow Vehicles | Evacuation Time Estimate for Entire EPZ | |
|---|---|---|---|
| | | 90th Percentile | 100th Percentile |
| 0 | 0 | 8:20 | 10:50 |
| 16.5 | 15,253 | 8:25 | 10:50 |
| 20 (Base) | 18,488 | 8:25 | 10:50 |
| 40 | 36,976 | 8:35 | 11:35 |
| 60 | 55,464 | 8:55 | 11:55 |
| 80 | 73,952 | 9:15 | 11:55 |
| 100 | 92,440 | 9:50 | 14:00 |

**Table M-3. ETE Variation with Population Increase**

| EPZ and 20% Shadow Permanent Resident Population | Base | Population Change | | |
|---|---|---|---|---|
| | | 3% | 4% | 5% |
| | 303,852 | 312,968 | 316,006 | 319,045 |
| ETE for 90th Percentile | | | | |
| Region | Base | Population Change | | |
| | | 3% | 4% | 5% |
| 2-MILE | 1:35 | 1:35 | 1:35 | 1:35 |
| 5-MILE | 2:50 | 3:45 | 3:05 | 3:00 |
| FULL EPZ | 9:10 | 9:25 | 9:35 | 9:45 |
| ETE for 100th Percentile | | | | |
| Region | Base | Population Change | | |
| | | 3% | 4% | 5% |
| 2-MILE | 2:20 | 2:20 | 2:20 | 2:20 |
| 5-MILE | 5:20 | 6:00 | 5:20 | 5:20 |
| FULL EPZ | 12:15 | 12:50 | 12:40 | 12:55 |

# APPENDIX N

ETE Criteria Checklist

# N. ETE CRITERIA CHECKLIST

**Table N-1. ETE Review Criteria Checklist**

| NRC Review Criteria | Addressed in ETE Analysis (Yes/No/NA) | Comments |
|---|---|---|
| **1.0 Introduction** | | |
| a. The emergency planning zone (EPZ) and surrounding area is described. | Yes | Section 1.2 |
| b. A map is included that identifies primary features of the site including major roadways, significant topographical features, boundaries of counties, and population centers within the EPZ. | Yes | Figures 1-1, 3-1, 6-1 |
| c. A comparison of the current and previous ETE is provided including information similar to that identified in Table 1-1, “ETE Comparison.” | Yes | Section 1.4, Table 1-3 |
| **1.1 Approach** | | |
| a. The general approach is described in the report as outlined in Section 1.1, “Approach.” | Yes | Section 1.1, Section 1.3, Appendix D |
| **1.2 Assumptions** | | |
| a. Assumptions consistent with Table 1-2, “General Assumptions,” of NUREG/CR-7002 are provided and include the basis to support use. | Yes | Section 2 |

| NRC Review Criteria | Addressed in ETE Analysis (Yes/No/NA) | Comments |
|---|---|---|
| **1.3 Scenario Development** | | |
| a. The scenarios in Table 1-3, "Evacuation Scenarios," are developed for the ETE analysis. A reason is provided for use of other scenarios or for not evaluating specific scenarios. | Yes | Table 2-1, Section 6, Table 6-2 |
| **1.4 Evacuation Planning Areas** | | |
| a. A map of the EPZ with emergency response planning areas (ERPAs) is included. | Yes | Figure 3-1, Figure 6-1 |
| **1.4.1 Keyhole Evacuation** | | |
| a. A table similar to Table 1-4 "Evacuation Areas for a Keyhole Evacuation", is provided identifying the ERPAs considered for each ETE calculation by downwind direction. | Yes | Table 6-1, Table 7-5, Table H-1 |
| **1.4.2 Staged Evacuation** | | |
| a. The approach used in development of a staged evacuation is discussed. | Yes | Section 7.2, Section 5.4.2 |
| b. A table similar to Table 1-5, "Evacuation Areas for a Staged Evacuation," is provided for staged evacuations identifying the ERPAs considered for each ETE calculation by downwind direction. | Yes | Table 6-1, Table 7-5, Table H-1 |
| **2.0 Demand Estimation** | | |
| a. Demand estimation is developed for the four population groups (permanent residents of the EPZ, transients, special facilities, and schools). | Yes | Section 3 |

| NRC Review Criteria | Addressed in ETE Analysis (Yes/No/NA) | Comments |
|---|---|---|
| **2.1 Permanent Residents and Transient Population** | | |
| a. The U.S. Census is the source of the population values, or another credible source is provided. | Yes | Section 3.1 |
| b. The availability date of the census data is provided. | Yes | Section 3.1 |
| c. Population values are adjusted as necessary for growth to reflect population estimates to the year of the ETE. | N/A | N/A - 2020 Census used as the base year of the analysis |
| d. A sector diagram, similar to Figure 2-1, "Population by Sector," is included showing the population distribution for permanent residents. | Yes | Figure 3-2 |
| **2.1.1 Permanent Residents with Vehicles** | | |
| a. The persons per vehicle value is between 1 and 3 or justification is provided for other values. | Yes | Section 3.1, Appendix F |
| **2.1.2 Transient Population** | | |
| a. A list of facilities that attract transient populations is included, and peak and average attendance for these facilities is listed. The source of information used to develop attendance values is provided. | Yes | Section 3.3, Table E-4, Table E-5 |
| b. Major employers are listed. | Yes | Section 3.4, Table E-3 |

| NRC Review Criteria | Addressed in ETE Analysis (Yes/No/NA) | Comments |
|---|---|---|
| c. The average population during the season is used, itemized and totaled for each scenario. | Yes | Table 3-4, Table 3-5, and Appendix E itemize the peak transient population and employee estimates. These estimates are multiplied by the scenario specific percentages provided in Table 6-3 to estimate average transient population and employee by scenario – see Table 6-4. |
| d. The percentage of permanent residents assumed to be at facilities is estimated. | Yes | Section 3.3 and Section 3.4 |
| e. The number of people per vehicle is provided. Numbers may vary by scenario, and if so, reasons for the variation are discussed. | Yes | Section 3.3 and Section 3.4 |
| f. A sector diagram is included, similar to Figure 2-1, “Population by Sector”, is included showing the population distribution for the transient population. | Yes | Figure 3-6 (transients) and Figure 3-8 (employees) |
| **2.2 Transit Dependent Permanent Residents** | | |
| a. The methodology (e.g., surveys, registration programs) used to determine the number of transit dependent residents is discussed. | Yes | Section 3.6 |
| b. The State and local evacuation plans for transit dependent residents are used in the analysis. | Yes | Section 8.1 |

| NRC Review Criteria | Addressed in ETE Analysis (Yes/No/NA) | Comments |
|---|---|---|
| c. The methodology used to determine the number of people with disabilities and those with access and functional needs who may need assistance and do not reside in special facilities is provided. Data from local/county registration programs are used in the estimate. | Yes | Section 3.9 |
| d. Capacities are provided for all types of transportation resources. Bus seating capacity of 50 percent is used or justification is provided for higher values. | Yes | Item 3 of Section 2.4 |
| e. An estimate of the transit dependent population is provided. | Yes | Section 3.6, Table 3-7, Table 3-10, Table 3-13 |
| f. A summary table showing the total number of buses, ambulances, or other transport assumed available to support evacuation is provided. The quantification of resources is detailed enough to ensure that double counting has not occurred. | Yes | Table 3-12, Table 8-1 |
| **2.3 Special Facility Residents** | | |
| a. Special facilities, including the type of facility, location, and average population, are listed. Special facility staff is included in the total special facility population. | Yes | Table E-2 lists all medical facilities by facility name, location, and average population. Staff estimates were not provided. Table E-6 lists all correctional facility by name, location and capacity. |
| b. The method of obtaining special facility data is discussed. | Yes | Section 3.5, Section 3.10 |

| NRC Review Criteria | Addressed in ETE Analysis (Yes/No/NA) | Comments |
|---|---|---|
| c. An estimate of the number and capacity of vehicles assumed available to support the evacuation of the facility is provided. | Yes | Table 3-6, Section 3.10 |
| d. The logistics for mobilizing specially trained staff (e.g., medical support or security support for prisons, jails, and other correctional facilities) are discussed when appropriate. | Yes | Section 8.1 – under “Evacuation of Medical Facilities”<br>Section 8.1 – under “Evacuation of Correctional Facilities” |
| **2.4 Schools** | | |
| a. A list of schools including name, location, student population, and transportation resources required to support the evacuation, is provided. The source of this information should be identified. | Yes | Table 3-8, Table E-1, Section 3.7, Section 3.7.1 |
| b. Transportation resources for elementary and middle schools are based on 100 percent of the school capacity. | Yes | Section 3.7 |
| c. The estimate of high school students who will use personal vehicle to evacuate is provided and a basis for the values used is given. | Yes | Section 3.7 |
| d. The need for return trips is identified. | Yes | Section 8.1- return trips are needed. |
| **2.5 Other Demand Estimate Considerations** | | |
| **2.5.1 Special Events** | | |
| a. A complete list of special events is provided including information on the population, estimated duration, and season of the event. | Yes | Section 3.8 |

| NRC Review Criteria | Addressed in ETE Analysis (Yes/No/NA) | Comments |
|---|---|---|
| b. The special event that encompasses the peak transient population is analyzed in the ETE. | Yes | Section 3.8 |
| c. The percentage of permanent residents attending the event is estimated. | Yes | Section 3.8 |
| **2.5.2 Shadow Evacuation** | | |
| a. A shadow evacuation of 20 percent is included consistent with the approach outlined in Section 2.5.2, “Shadow Evacuation”. | Yes | Item 7 of Section 2.2, Figure 2-1 and Figure 7-1, Section 3.2 |
| b. Population estimates for the shadow evacuation in the shadow region beyond the EPZ are provided by sector. | Yes | Section 3.2, Table 3-3, Figure 3-4 |
| c. The loading of the shadow evacuation onto the roadway network is consistent with the trip generation time generated for the permanent resident population. | Yes | Section 5 – Table 5-8 (footnote) |
| **2.5.3 Background and Pass Through Traffic** | | |
| a. The volume of background traffic and pass-through traffic is based on the average daytime traffic. Values may be reduced for nighttime scenarios. | Yes | Section 3.11 and Section 3.12 |
| b. The method of reducing background and pass-through traffic is described. | Yes | Section 2.2 – Item 10, 11 and 12<br>Section 2.5<br>Section 3.11 and Section 3.12<br>Table 6-3 – External Through Traffic footnote |

| NRC Review Criteria | Addressed in ETE Analysis (Yes/No/NA) | Comments |
|---|---|---|
| c. Pass-through traffic is assumed to have stopped entering the EPZ about two (2) hours after the initial notification. | Yes | Based on discussion with offsite agencies, pass through traffic will be stopped within 2 hours after the ATE.<br>Section 2.5, Section 3.11 |
| **2.6 Summary of Demand Estimation** | | |
| a. A summary table is provided that identifies the total populations and total vehicles used in the analysis for permanent residents, transients, transit dependent residents, special facilities, schools, shadow population, and pass-through demand in each scenario. | Yes | Table 3-13, Table 3-14, and Table 6-4 |
| **3.0 Roadway Capacity** | | |
| a. The method(s) used to assess roadway capacity is discussed. | Yes | Section 4 |
| **3.1 Roadway Characteristics** | | |
| a. The process for gathering roadway characteristic data is described including the types of information gathered and how it is used in the analysis. | Yes | Section 1.3, Appendix D |
| b. Legible maps are provided that identify nodes and links of the modeled roadway network similar to Figure A-1, “Roadway Network Identifying Nodes and Links,” and Figure A-2, “Grid Map Showing Detailed Nodes and Links.” | Yes | Appendix K |

| NRC Review Criteria | Addressed in ETE Analysis (Yes/No/NA) | Comments |
|---|---|---|
| **3.2 Model Approach** | | |
| a. The approach used to calculate the roadway capacity for the transportation network is described in detail, and the description identifies factors that are expressly used in the modeling. | Yes | Section 4 |
| b. Route assignment follows expected evacuation routes and traffic volumes. | Yes | Appendix B and Appendix C |
| c. A basis is provided for static route choices if used to assign evacuation routes. | N/A | Static route choices are not used to assign evacuation routes. Dynamic traffic assignment is used. |
| d. Dynamic traffic assignment models are described including calibration of the route assignment. | Yes | Appendix B and Appendix C |
| **3.3 Intersection Control** | | |
| a. A list that includes the total numbers of intersections modeled that are unsignalized, signalized, or manned by response personnel is provided. | Yes | Table K-1 |
| b. The use of signal cycle timing, including adjustments for manned traffic control, is discussed. | Yes | Section 4, Appendix G |
| **3.4 Adverse Weather** | | |
| a. The adverse weather conditions are identified. | Yes | Item 2 and 3 of Section 2.6 |

| NRC Review Criteria | Addressed in ETE Analysis (Yes/No/NA) | Comments |
|---|---|---|
| b. The speed and capacity reduction factors identified in Table 3-1, "Weather Capacity Factors," are used or a basis is provided for other values, as applicable to the model. | Yes | Table 2-2 |
| c. The calibration and adjustment of driver behavior models for adverse weather conditions are described, if applicable. | N/A | Driver behavior is not adjusted for adverse weather conditions. |
| d. The effect of adverse weather on mobilization is considered and assumptions for snow removal on streets and driveways are identified, when applicable. | Yes | Item 4 of Section 2.6, Table 2-2 |
| **4.0 Development of Evacuation Times** | | |
| **4.1 Traffic Simulation Models** | | |
| a. General information about the traffic simulation model used in the analysis is provided. | Yes | Section 1.3, Table 1-3, Appendix B, Appendix C |
| b. If a traffic simulation model is not used to perform the ETE calculation, sufficient detail is provided to validate the analytical approach used. | N/A | Not applicable since a traffic simulation model was used. |
| **4.2 Traffic Simulation Model Input** | | |
| a. Traffic simulation model assumptions and a representative set of model inputs are provided. | Yes | Section 2, Appendix J |
| b. The number of origin nodes and method for distributing vehicles among the origin nodes are described. | Yes | Appendix J, Appendix C |
| c. A glossary of terms is provided for the key performance measures and parameters used in the analysis. | Yes | Appendix A, Table C-1, and Table C-3 |

| NRC Review Criteria | Addressed in ETE Analysis (Yes/No/NA) | Comments |
|---|---|---|
| **4.3 Trip Generation Time** | | |
| a. The process used to develop trip generation times is identified. | Yes | Section 5 |
| b. When surveys are used, the scope of the survey, area of the survey, number of participants, and statistical relevance are provided. | Yes | Appendix F |
| c. Data used to develop trip generation times are summarized. | Yes | Appendix F, Section 5 |
| d. The trip generation time for each population group is developed from site-specific information. | Yes | Section 5 |
| e. The methods used to reduce uncertainty when developing trip generation times are discussed, if applicable. | Yes | Appendix F |
| **4.3.1 Permanent Residents and Transient Population** | | |
| a. Permanent residents are assumed to evacuate from their homes but are not assumed to be at home at all times. Trip generation time includes the assumption that a percentage of residents will need to return home before evacuating. | Yes | Section 5 discusses trip generation for households with and without returning commuters.<br>Table 6-3 presents the percentage of households with returning commuters and the percentage of households either without returning commuters or with no commuters.<br>Appendix F presents the percent households who will await the return of commuters.<br>Assumption 3 of Section 2.3 |

| NRC Review Criteria | Addressed in ETE Analysis (Yes/No/NA) | Comments |
|---|---|---|
| b. The trip generation time accounts for the time and method to notify transients at various locations. | Yes | Section 5 |
| c. The trip generation time accounts for transients potentially returning to hotels before evacuating. | Yes | Section 5, Figure 5-1 |
| d. The effect of public transportation resources used during special events where a large number of transients are expected is considered. | Yes | Section 3.8<br>Public Transportation is not provided for the special event and was therefore not considered. |
| **4.3.2 Transit Dependent Permanent Residents** | | |
| a. If available, existing and approved plans and bus routes are used in the ETE analysis. | N/A | Established bus routes do not exist. Basic bus routes were developed for the ETE analysis.<br>Section 8.1 under "Evacuation of Transit Dependent People (Residents without access to a vehicle)" |
| b. The means of evacuating ambulatory and non-ambulatory residents are discussed. | Yes | Section 8.1 under "Evacuation of Transit Dependent People (Residents without access to a vehicle)"<br>Section 8.2 |
| c. Logistical details, such as the time to obtain buses, brief drivers and initiate the bus route are used in the analysis. | Yes | Section 8.1, Figure 8-1 |
| d. The estimated time for transit dependent residents to prepare and then travel to a bus pickup point, including the expected means of travel to the pickup point, is described. | Yes | Section 8.1 under "Evacuation of Transit Dependent People (Residents without access to a vehicle)" |

| NRC Review Criteria | Addressed in ETE Analysis (Yes/No/NA) | Comments |
|---|---|---|
| e. The number of bus stops and time needed to load passengers are discussed. | Yes | Section 8.1, Table 8-4, Table 8-5 |
| f. A map of bus routes is included. | Yes | Figure 10-2 |
| g. The trip generation time for non-ambulatory persons including the time to mobilize ambulances or special vehicles, time to drive to the home of residents, time to load, and time to drive out of the EPZ, is provided. | Yes | Section 8.2 |
| h. Information is provided to support analysis of return trips, if necessary. | Yes | Sections 8.1 and 8.2 |
| **4.3.3 Special Facilities** | | |
| a. Information on evacuation logistics and mobilization times is provided. | Yes | Section 2.4, Section 8.1, Table 8-6 and Table 8-7 (medical facility) and Table 8-8 (correctional facility) |
| b. The logistics of evacuating wheelchair and bed bound residents are discussed. | Yes | Section 8.1, Table 8-9 and Table 8-10 |
| c. Time for loading of residents is provided. | Yes | Section 2.4, Section 8.1, Table 8-6 and Table 8-7 |
| d. Information is provided that indicates whether the evacuation can be completed in a single trip or if additional trips are needed. | Yes | Section 8.1 |
| e. Discussion is provided on whether special facility residents are expected to pass through the reception center before being evacuated to their final destination. | Yes | Section 8.1 |

| NRC Review Criteria | Addressed in ETE Analysis (Yes/No/NA) | Comments |
|---|---|---|
| f. Supporting information is provided to quantify the time elements for each trip, including destinations if return trips are needed. | Yes | Section 8.1 |
| **4.3.4 Schools** | | |
| a. Information on evacuation logistics and mobilization times is provided. | Yes | Section 2.4, Section 8.1, Table 8-2, Table 8-3 |
| b. Time for loading of students is provided. | Yes | Section 2.4, Section 8.1, Table 8-2, Table 8-3 |
| c. Information is provided that indicates whether the evacuation can be completed in a single trip or if additional trips are needed. | Yes | Section 8.1 |
| d. If used, reception centers should be identified. A discussion is provided on whether students are expected to pass through the reception center before being evacuated to their final destination. | Yes | Section 8.1, Table 10-3 |
| e. Supporting information is provided to quantify the time elements for each trip, including destinations if return trips are needed. | Yes | Section 8.1, Table 8-2, Table 8-3 |

|  |  |  |
|---|---|---|
| **4.4 Stochastic Model Runns** |  |  |
| a. The number of simulation runs needed to produce average results is discussed. | N/A | DYNEV does not rely on simulation averages or random seeds for statistical confidence. For DYNEV/DTRAD, it is a mesoscopic simulation and uses dynamic traffic assignment model to obtain the "average" (stable) network work flow distribution. This is different from microscopic simulation, which is monte-carlo random sampling by nature relying on different seeds to establish statistical confidence. Refer to Appendix B for more details. |
| b. If one run of a single random seed is used to produce each ETE result, the report includes a sensitivity study on the 90 percent and 100 percent ETE using 10 different random seeds for evacuation of the full EPZ under Summer, Midweek, Daytime, Normal Weather conditions. | N/A |  |
| **4.5 Model Boundaries** |  |  |
| a. The method used to establish the simulation model boundaries is discussed. | Yes | Section 4.5 |
| b. Significant capacity reductions or population centers that may influence the ETE and that are located beyond the evacuation area or shadow region are identified and included in the model, if needed. | Yes | Section 4.5 |
| **4.6 Traffic Simulation Model Output** |  |  |
| a. A discussion of whether the traffic simulation model used must be in equilibration prior to calculating the ETE is provided. | Yes | Appendix B |

| | | |
|---|---|---|
| b. The minimum following model outputs for evacuation of the entire EPZ are provided to support review:<br>1. Evacuee average travel distance and time.<br>2. Evacuee average delay time.<br>3. Number of vehicles arriving at each destination node.<br>4. Total number and percentage of evacuee vehicles not exiting the EPZ.<br>5. A plot that provides both the mobilization curve and evacuation curve identifying the cumulative percentage of evacuees who have mobilized and exited the EPZ.<br>6. Average speed for each major evacuation route that exits the EPZ. | Yes | 1. Appendix J, Table J-2<br>2. Table J-2<br>3. Table J-4<br>4. None and 0%. 100 percent ETE is based on the time the last vehicle exits the evacuation zone<br>5. Figures J-2 through J-13 (one plot for each scenario considered)<br>6. Table J-3 |
| c. Color coded roadway maps are provided for various times (e.g., at 2, 4, 6 hrs.) during a full EPZ evacuation scenario, identifying areas where congestion exists. | Yes | Figure 7-3 through Figure 7-9 |
| **4.7 Evacuation Time Estimates for the General Public** | | |
| a. The ETE includes the time to evacuate 90 percent and 100 percent of the total permanent resident and transient population. | Yes | Table 7-1 and Table 7-2 |
| b. Termination criteria for the 100 percent ETE are discussed, if not based on the time the last vehicle exits the evacuation zone. | N/A | 100 percent ETE is based on the time the last vehicle exits the evacuation zone. |
| c. The ETE for 100 percent of the general public includes all members of the general public. Any reductions or truncated data is explained. | Yes | Section 5.4.1 – truncating survey data to eliminate statistical outliers<br>Table 7-2 – 100th percentile ETE for general population |

| | | |
|---|---|---|
| d. Tables are provided for the 90 and 100 percent ETEs similar to Table 4-3, “ETEs for a Staged Evacuation,” and Table 4-4, “ETEs for a Keyhole Evacuation.” | Yes | Table 7-3 and Table 7-4 |
| e. ETEs are provided for the 100 percent evacuation of special facilities, transit dependent, and school populations. | Yes | Section 8 |
| **5.0 Other Considerations** | | |
| **5.1 Development of Traffic Control Plans** | | |
| a. Information that responsible authorities have approved the traffic control plan used in the analysis are discussed. | Yes | Section 9, Appendix G |
| b. Adjustments or additions to the traffic control plan that affect the ETE is provided. | Yes | Section 9, Appendix G |
| **5.2 Enhancements in Evacuation Time** | | |
| a. The results of assessments for enhancing evacuations are provided. | Yes | Appendix M |
| **5.3 State and Local Review** | | |
| a. A list of agencies contacted is provided and the extent of interaction with these agencies is discussed. | Yes | Table 1-1 |
| b. Information is provided on any unresolved issues that may affect the ETE. | No | Will discuss with the state and local authorities during the final meeting and address the issues in the final report. |
| **5.4 Reviews and Updates** | | |
| a. The criteria for when an updated ETE analysis is required to be performed and submitted to the NRC is discussed. | Yes | Appendix M, Section M.3 |
| **5.4.1 Extreme Conditions** | | |

| | | |
|---|---|---|
| a. The updated ETE analysis reflects the impact of EPZ conditions not adequately reflected in the scenario variations. | N/A | This ETE is being updated as a result of the availability of US Census Bureau decennial census data. |
| **5.5 Reception Centers and Congregate Care Center** | | |
| a. A map of congregate care centers and reception centers is provided. | Yes | Figure 10-3 |