

Palm Coast Fire Department



Fire Station Development Methodology 2020-2029

GOAL 1A

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Fire Chief



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EXECUTIVE SUMMARY

The *Fire Station Development Methodology* report was commissioned following adoption of Palm Coast Fire Department's Ten-Year Plan. As a component in the Ten-Year Plan, this report rose to one of the first projects commissioned due to the influence the report has on a process underway through the City of Palm Coast Finance Department – a Development Impact Fee Rate Study.

The report is designed to develop methodologies and processes to determine and monitor the impact of development, population growth, increases in service demand (emergency incident call volume), and to study the demographics to align services with citizens' needs in order to determine the appropriateness of the fire facilities. Studying the fire station appropriateness is part of a continuing effort to ensure the fire department is best poised to deliver superior services to the citizens of the City.

This effort is part of a triad approach to delivering fire services: fire facility location, responder staffing analyses, and equipment and apparatus evaluation. Each of these three co-dependently provide the necessary support to meet the needs of the community, today and in the future.

The *Fire Station Development Methodology* approach incorporates the fire service industry's methodologies for response times and travel distances. The report evaluates the current actual response times and call volume for areas throughout the City. Also considered and discussed are the housing developments and vacant lots, prospects for growth and annexation, and the mechanisms that will cause an increase in call volume for first responders. Finally, the report ends with an analysis and set of recommendations for consideration.

Included in the recommendations are the following growth considerations for the next 10 years:

- Fire Station on Seminole Woods
- Alternative Staffing Plan for Whiteview Parkway
- Alternative Staffing Plan for Belle Terre Boulevard
- Fire Station on Colbert Lane
- Fire Station in Palm Coast Park

- Improved Records Management Program for Statistical Analyses

COMMUNITY OVERVIEW

Palm Coast began as the largest planned unit development in Florida history marketed in the north and mid-west as a great place to live. From its inception as a service area through today it remains a largely residential community. Residents support over 4,500 businesses located in Palm Coast, the majority of which are retail, services, and healthcare. The unemployment rate is low at 3.4 percent (September 2019). Major employers include the Flagler County School System, Publix Grocery Stores, Palm Coast Data, Advent Health Palm Coast, Walmart, and Insurance Services Office Inc.

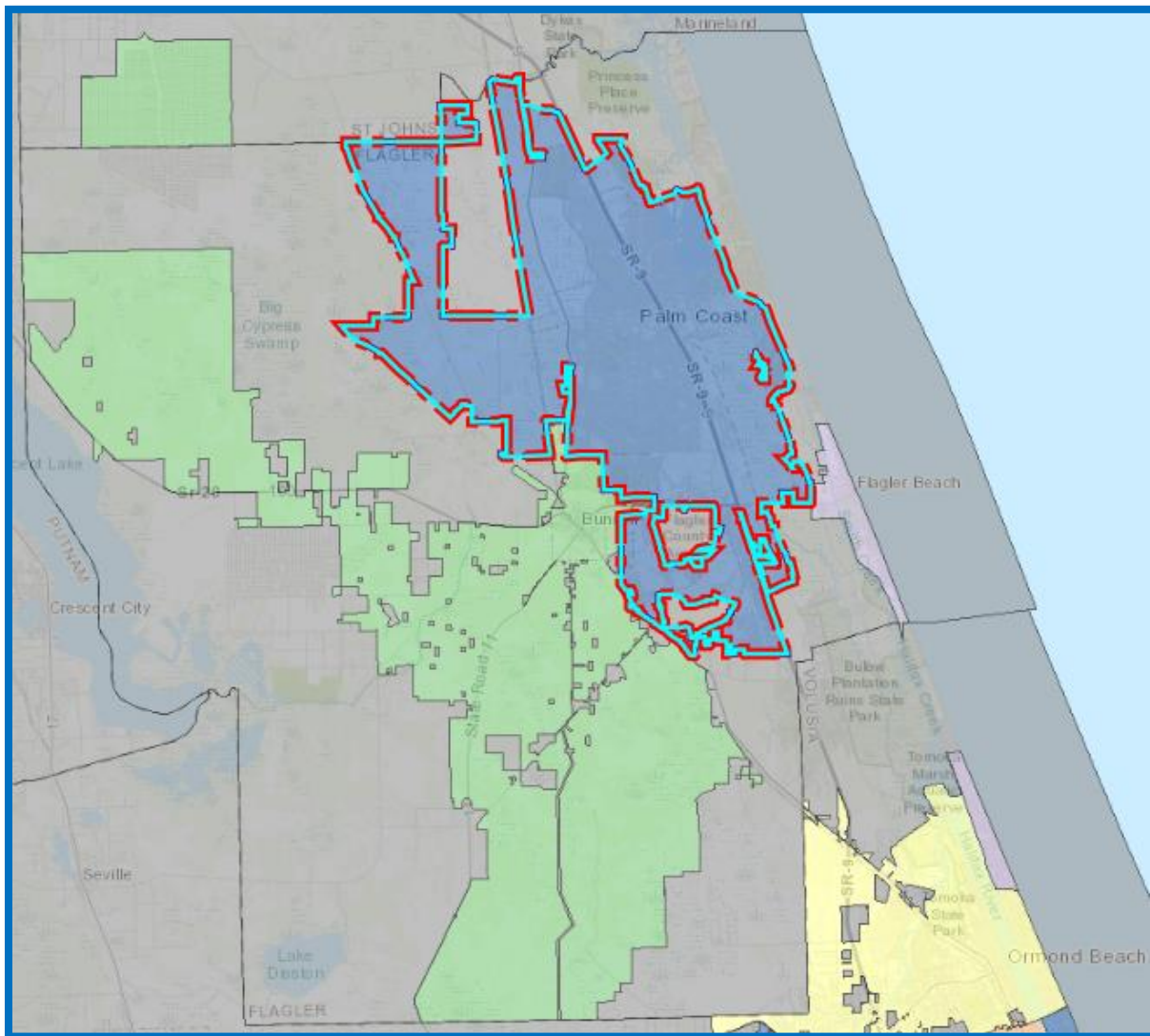


Figure 1: Flagler County: Palm Coast and Neighboring Cities

Community History

Palm Coast's history began with the arrival of the International Telephone and Telegraph (ITT) Corporation in 1969. They purchased large tracts of swamp and pine forest and began to build infrastructure for a residential community. Flagler County established the Palm Coast Service District in 1975 and ITT began marketing largely in the Northeastern United States. The results: people purchased lots in Palm Coast hoping to someday live close to the ocean in the Florida sunshine. The genesis of Palm Coast is that of one of the largest planned urban developments of its kind. The ITT Corporation provided many services and was a leading voice in the community until its exit from the community in 1995.

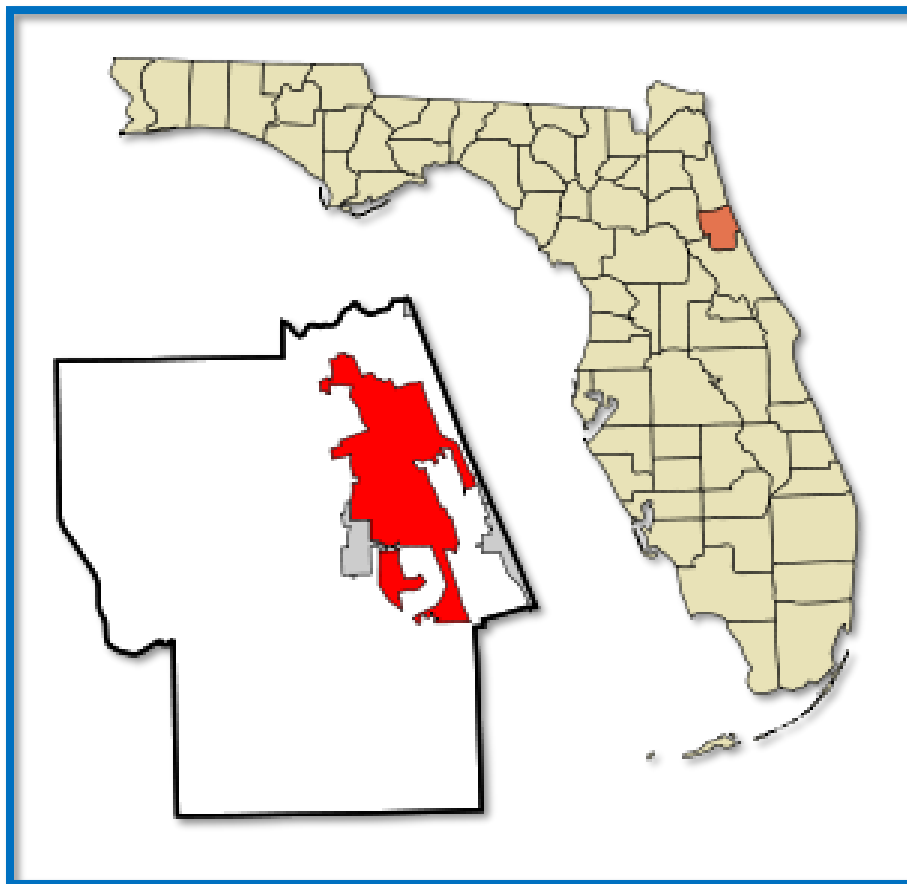


Figure 2: Regional Map of Palm Coast, Florida

Many of the residents moved in to retire in Palm Coast. Golf and tennis were both valued by community founders and played a large role, along with the coastal lifestyle, in attracting both residents and visitors. While the environment created much of the allure of the area it also brought hardships to the new community. Wildfires in 1985 and 1998 damaged or destroyed 594 homes and caused emergency declarations. The 1998 wildfires were the first and only time in state history that an entire county, 45,000 residents, were under a mandatory evacuation order. Hurricanes have also affected residents: four hurricanes in 2004, Hurricane Matthew, Hurricane Irma, and Hurricane Dorian were all significant events in the community's history.

Palm Coast incorporated as a city on December 31, 1999 with a population of 29,360. Over the next ten years the community would grow faster than any metro area in the country according to the 2010 US Census. Residential growth would drive retail and service growth as business and government sought to keep pace. The economic downturn in 2008-2011 would hit Palm Coast particularly hard at the end of the city's first decade. Unemployment levels reached as high as 15.7% and property values dropped from over nine billion in 2008 to five and a half billion in 2013.

As the city climbed out of its economic rut the rate of growth slowed dramatically. However, the city continued to move forward, building four new fire stations and a city hall, expanding and diversifying its recreational options for residents, growing the capacity of its water utility, and updating its existing community center. The local economic recovery witnessed the redevelopment of Island Walk, residential development in the Seminole Woods, Town Center, and Matanzas Woods areas, and hospital and medical service expansion in and around the renamed Advent Palm Coast.

Economic activity associated with building and real estate remained a significant part of the local economy, but technology based business and post-secondary education appear to be growth areas. As the city celebrates its 20th birthday, the fire department looks to provide its best service to those who live, work, or play in Palm Coast.

Community Map and Boundaries

Located in Northeast Florida, Palm Coast is the primary population center of Flagler County. Palm Coast is halfway between St. Augustine and Daytona Beach and about 70 miles from both the Jacksonville and Orlando metropolitan areas. Palm Coast has approximately 541 miles of public roadway, with 55 miles serving as major arterial streets. There are also 1,082 miles of drainage swales that assist in the coastal rains throughout much of the year. There are 62 bridges in Palm Coast, totaling 735 linear feet.

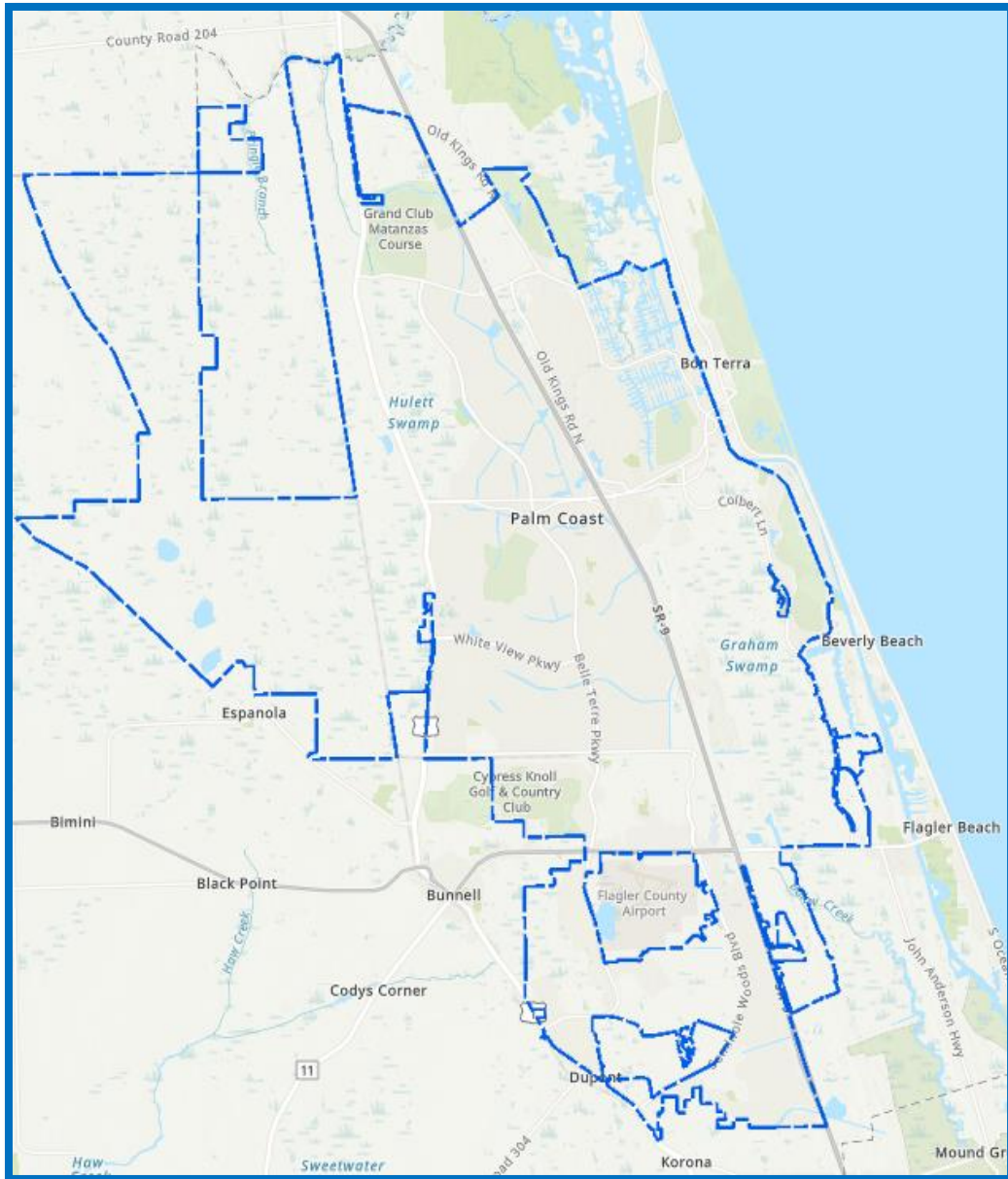


Figure 3: City of Palm Coast Service Area

FIRE DEPARTMENT OVERVIEW

Palm Coast Fire Department (PCFD) provides fire, rescue, paramedic-level first responder emergency medical services, and emergency management services to the citizens and many visitors of Palm Coast. PCFD is a combination career/volunteer emergency response agency that delivers essential services from five (5) strategically placed fire stations, determined through strategic planning and consultation by an independent agency. Each fire station is staffed around the clock, every day of the year.

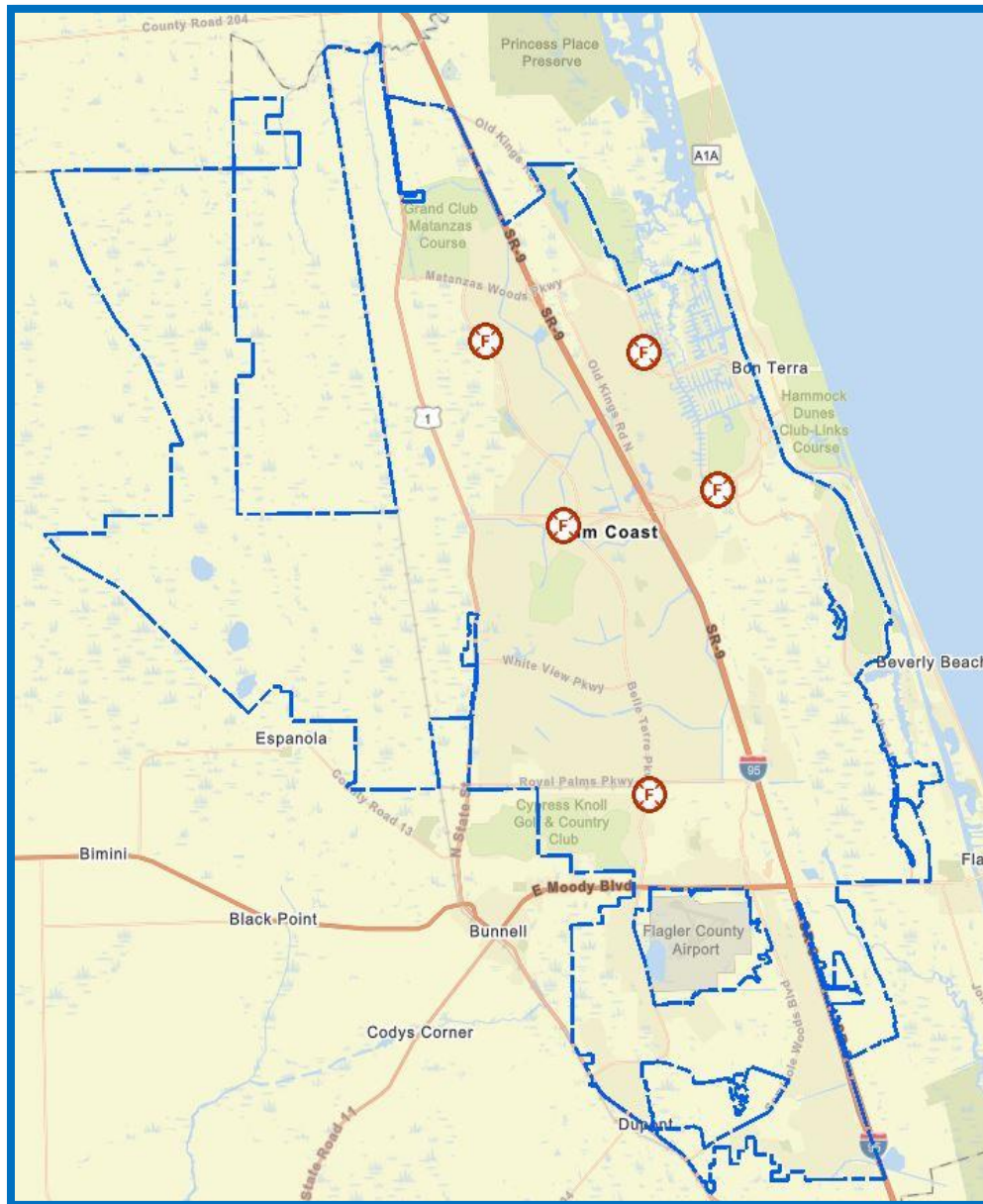


Figure 4: Palm Coast Fire Station Location Map

To provide the best possible emergency medical services, PCFD partners with Flagler Beach Fire Department (FBFD) and Flagler County Fire Rescue (FCFR) to reduce response times, develop county-wide treatment protocols, and assist in delivering state-of-the-art medical care. In three City of Palm Coast fire stations, FCFR staffs an ambulance with two (2) employees, around the clock, each day of the year. In these fire stations, a total of five (5) employees provide emergency services response, either together, or separately, depending on the nature and severity of the emergency call.

The three agencies also share the same Medical Director and train together to enhance new and existing skills. The Medical Director also conducts an all-agency monthly Quality Assurance (QA) meeting to improve on past performances.

In 2018, PCFD responded to 10,105 emergencies, which accounts for over 60% of the total emergency incidents county-wide. The annual emergency call volume, as discussed later, has grown at a similar annualized rate as the population of the City. In addition to population growth, annexation continues to increase the overall size of the city, in terms of area. As depicted in the following figure, the area of the City has grown by 50% since incorporation. A number of projects that would further increase the area of the City are proposed and under consideration.

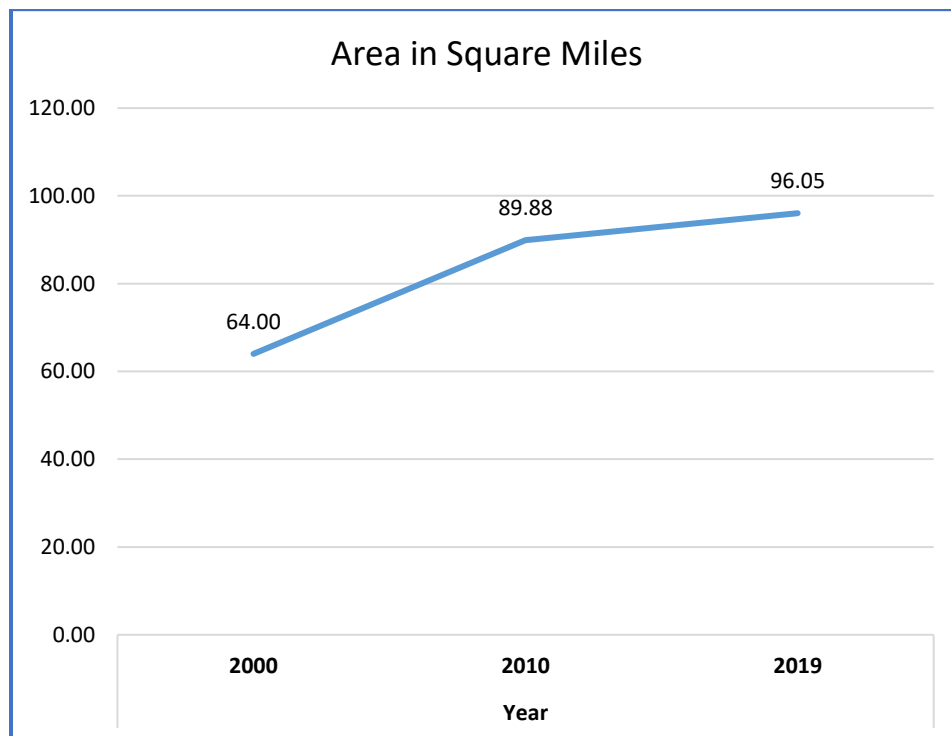


Figure 5: Growth in Area of Palm Coast

The fire department's Fiscal Year 2020 budget is \$9,426,294. The budget is funded from the City's General Fund budget, based on the collection of Ad Valorem taxes. The City also collects Impact Development fees for fire services, used to purchase specialty equipment or construct fire services facilities to expand the services provided by the fire department. Impact Development Fees provide funding for fire department growth at the expense of new development, not existing citizens and businesses. The City carries no debt services for the delivery of fire and emergency medical services and pays cash as purchases are made or facilities are constructed.

Emergency communications is administered and operated by Flagler County Sheriff's Department. Partnering agencies for PCFD utilize the Communications Center and the same radio system and radio frequency channels making simultaneous dispatching and response and operating coordination seamless.

Palm Coast Fire Department coordinates and facilitates the emergency management effort for City of Palm Coast. Through the Comprehensive Emergency Management Plan (CEMP), all city departments function as one team for preparedness, response, and recovery from natural and man-made wide-area disasters. The City's efforts are closely coordinated with Flagler County's local Emergency Operations Center (EOC) and the local Emergency Response Plan (ERP).

Mission and Core Values

Establishing a common mission statement and core values for the department lays the foundation for employees to provide consistent services to the community. The mission guides decisions for service delivery and planning efforts for changing the current delivery model. In an organization where all employees are empowered to improve the services delivered, grounding the beliefs to one mission and set of core values harmonizes the decision-making process for all employees, and standardizes efforts in each area where employees work to make the services better reach the customers. The department's administrators empower employees to oversee, facilitate, change, and create opportunities within the department's functions under these philosophies. Employee ownership produces spectacular results, evidenced by the level of participation by the employees, and the overall buy-in in the department's efforts to constantly improve.

Mission Statement

“Delivering the best service to our community...every time.”

Management Philosophy

“Making people the priority and empower them to deliver the best service to our community...every time.”

The management philosophy is accomplished by:

- Removing obstacles to our employees’ success
- Celebrating Character
- Invest in our employees’ safety and development
- Valuing all employees’ input equally

Values:

The values of our employees are evident in the services they provide:

- Family
- Integrity
- Loyalty

Staffing Information

An organization's most valuable asset are the people who deliver the services. It is important to pay special attention to managing human resources in a manner that achieves maximum productivity while ensuring a high level of job satisfaction for the individual. Consistent management practices combined with a safe working environment, equitable treatment, opportunity for input, and recognition of the workforce's commitment and sacrifice are key components impacting job satisfaction.

The size and structure of an organization's staffing is dependent upon the specific needs of the organization. These needs must directly correlate to the needs of the community and a structure that works for one agency may not necessarily work for another. This section provides an overview of the Palm Coast Fire Department's staffing configuration and management practices.

Fire department staffing can be divided into two different groups. The first group is what the citizens typically recognize: the operations unit, which is generally classified as the emergency response personnel. The second group typically works behind the scenes to provide the support needed by the operation's personnel to deliver effective emergency response and is known as the administrative section.

The fire department career staffing includes the following administrative and operations personnel (budgeted for staffing of 18 per day):

<i>Administration</i>		<i>Operations</i>	
1	Fire Chief	3	Battalion Chiefs (one per shift day)
1	Deputy Fire Chief	3	Captains (one per shift day)
1	Fire Inspector/Captain	15	Lieutenants (5 per shift day)
1	Administrative Manager	15	Driver Engineers (5 per shift day)
1	Staff Assistant	18	Firefighters (6 per shift day)

Figure 6: Palm Coast Fire Department Career Staffing

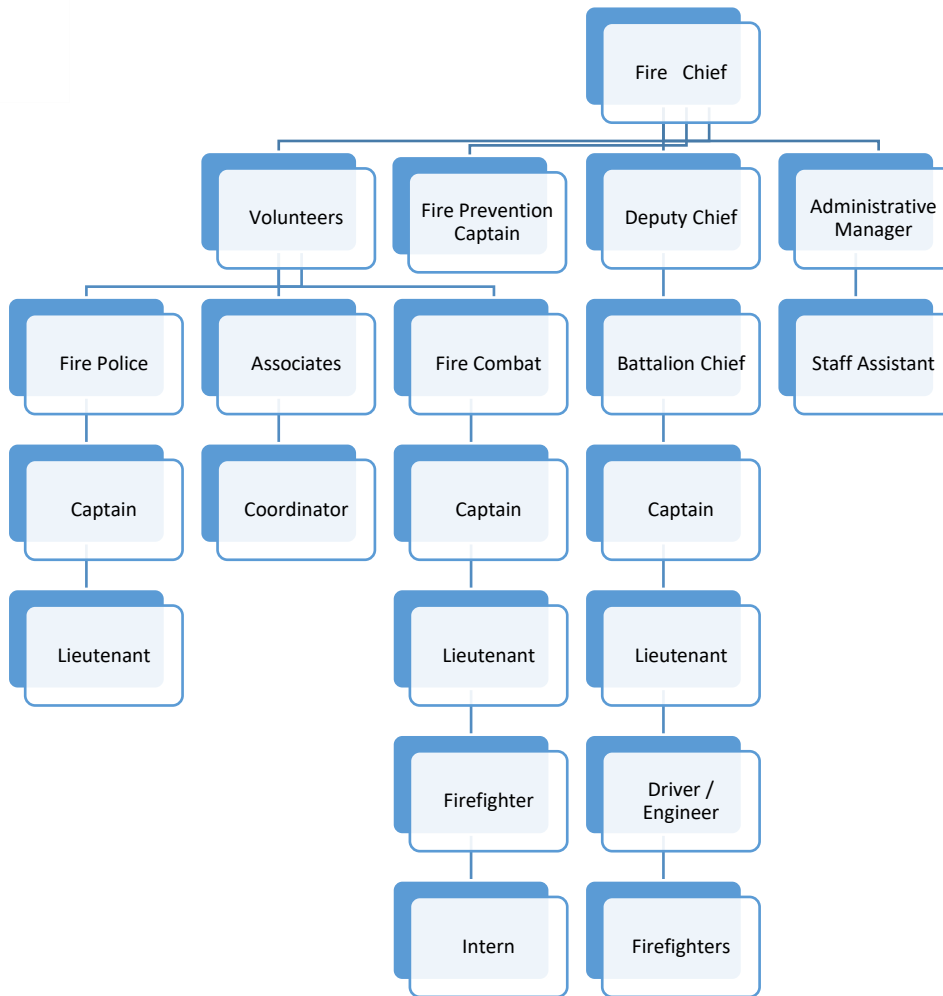


Figure 7: PCFD Organizational Chart, 2019

Operations Staffing

Career firefighters provide around the clock staffing for fire apparatus, operating on a three shift 24/48-hour rotation. During periods of high service demand, special events, or severe weather, the department implements increased on-duty staffing at levels and locations specific to the risk. This strategic staffing ensures that firefighters are available during periods of anticipated high service demand above the daily response scheme. Increasing the staffing level provides capacity for not only the special event or weather phenomena but provides capacity for the anticipated service demand experienced on any given day.

Within the operations division are volunteer firefighter interns, who are prospective employees beginning their career in the craft of firefighting. Under the direction and mentoring of a Lieutenant, Interns begin to develop skills associated with patient care and firefighting. The Intern program includes formal training classes, including Firefighter I and II, and Emergency Medical Technician (EMT). When not in training or school, interns ride on fire engines for a minimum of 24 hours each month with their mentor. Interns earn points for education, participation in school and riding with their mentor, which contribute to their standing on the hiring list.

The operations division also includes the Fire Police, who assist PCFD and other state and local emergency services agencies. Primary duties of Fire Police include responding to incidents to protect responders and assist with traffic control and diversion. Fire Police also conduct area evacuations, maintain in /out traffic at Haz-Mat decontamination incidents and establish helicopter landing zones for medical evacuation of critical patients. Other responsibilities include preserving scene integrity for chain of custody for fire investigations, driving apparatus to incidents, public education, and assisting Palm Coast Streets Division with traffic dispersion. Most often, Fire Police assist law enforcement agencies with traffic flow around major incidents and crime scene perimeter control.

Administrative Staffing

Administrative personnel provide support services, liaise with outside agencies, participate in administering local government, manage funds and purchases, oversee contracts, and oversee human resource support. Administrative staff work a traditional 40-hour work week but remain available around the clock.

Fire Administrators include the Fire Chief and Deputy Fire Chief. Responsibilities of chief officers includes planning, organizing, budgeting, directing, coordinating, and reporting. Ultimately, the chief administrative officers are tasked with determining the appropriate size and scope of the fire department's service delivery system, in order to satisfy the City Council's performance expectations.

All fire prevention and code enforcement actions occur under the direction of the Fire Prevention Captain. Once a commercial occupancy is granted a certificate of occupancy, the Florida Fire Code prescribes the life-long maintenance of the building. The Fire Prevention Captain utilizes the Florida Fire Code, in addition to education and annual fire prevention inspections, to create a fire safe and code compliant commercial sector.

Two administrative non-uniformed employees provide fiscal management and administrative coordination for the many functions and services of the department. These administrative staff provide overall fiduciary responsibility and governmental reporting requirements, as well as coordinating, scheduling, tracking, processing, and communicating with other local government agencies.

Palm Coast Volunteer Fire Department Associates assist fire administration by providing support for a myriad of administrative functions. These volunteers support administration through computer/IT support, public relations, photography, maintenance, community education and general administrative functions. The Associates also assist in community special events. These volunteers have served for literally thousands of hours of community support, worthy of the highest accolades. Their service and pride are remarkable, and model all that is great of supporting community efforts.

Apparatus Fleet

Palm Coast Fire Department maintains a reliable front-line fleet of specialized fire apparatus, and sufficient back-up apparatus for continuity of operations. Although the fleet represents numerous manufacturers, the specifications for the design of the apparatus have consistently met the operational needs of the department. The depth and reliability of the fleet also provides flexibility to nearly double the fire department's response capacity during times of disaster, such as wide-area wildland fires and hurricanes.

Palm Coast Fire Department's fire suppression apparatus includes nine (9) fire engines, two (2) aerial trucks, two (2) command vehicles, three (3) wildland/brush trucks, and one (1) rehab unit. In addition, PCFD maintains fleet of cargo trailers to deliver specialty equipment to scenes that rarely occur, such as the specialized confined space rescue equipment.

CRITICAL TASKING AND ASSIGNMENTS

In order to determine the appropriate size of the fire department, City of Palm Coast must consider the ability to assemble an adequate number of personnel on an initial alarm assignment to meet emergency call volume. Tasks that must be performed at a fire can be broken down into three priorities:

Life Safety	Involves search and rescue and evacuation of victims from the building or fire area.
Incident Stabilization	Involves the delivery of sufficient water to control and extinguish the fire, and to create a suitable working environment for firefighters to perform firefighting tasks.
Property Conservation	Involves ventilation, water run-off containment, and salvage and overhaul as needed.

The number and types of tasks needing simultaneous action will dictate the minimum number of personnel required to control and extinguish fires. If staffing is not adequate on the emergency scene, tasks must be prioritized and completed in a productive order instead of simultaneously. The delay causes higher risk to life safety, increased property loss, and greater threat to firefighter safety. Critical tasks include, but are not limited to:

- Command
- Scene Safety
- Search & Rescue
- Fire Attack
- Water Supply
- Operating Fire Pumps
- Ventilation
- Utility Security
- Rapid Intervention Team
- Exposure Protection

The fire service assesses relative risk of properties based on several factors. Properties with high fire risk often require greater numbers of personnel and apparatus to effectively mitigate a fire emergency; properties with lower risk may require fewer people, apparatus, and equipment. Staffing and deployment decisions should be made with consideration of the level of risk involved. The Center for Public Safety Excellence (CPSE) uses the following risk categories:

- **Low Risk** – Areas and properties used for agricultural purposes, open space, low-density residential and other low intensity uses.
- **Moderate Risk** – Areas and properties used for medium density single family residences, small commercial and office uses, low intensity retail sales and equivalently sized business activities.
- **High or Maximum Risk** – Higher density businesses and structures, mixed use areas, high density residential, industrial, warehousing, and large mercantile structures.

Most of Palm Coast contains residential neighborhoods with medium density development. Compounding housing intensity is the threat of building in the wildland-urban interface, where combustible development exists in close proximity to naturally occurring vegetation. The result of developing in formerly thick vegetative areas is the potential for catastrophic losses for out-of-control wildland fires. Palm Coast experienced catastrophic structure loss on more than one occasion due to the wildland-urban interface, including 131 homes in 1985 and over 67 homes in 1998.

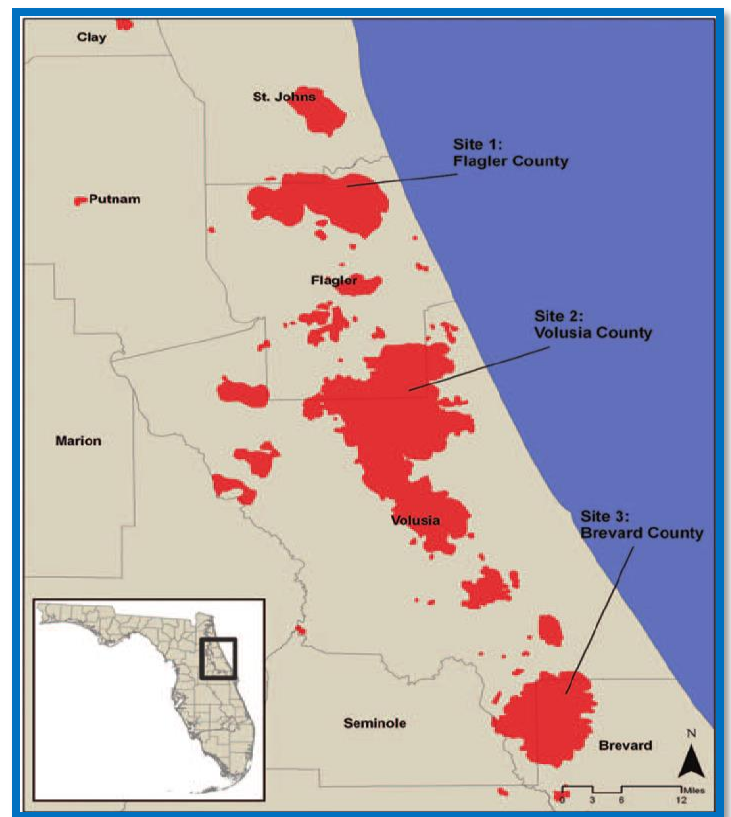


Figure 8: 1998 Wildland Fire Area

Service Delivery and Performance

The most important and probably the most notable factor in delivering emergency services is arriving at the scene of the emergency in the least amount of time possible. Actively occurring emergencies are literally a race against time, as depicted in the following figures and section. Various industry standards define staffing for fire department operations based on fire dynamics of a modern structure fire, essential tasks that must be performed with first arriving apparatus at a fire to save lives and reduce property loss, and upon the need to transport patients to a hospital facility within the "Golden Hour," which is critical for stroke, cardiac, and trauma patients.

The fire propagation curve in Figure 9 depicts the benefit of an early, aggressive, and offensive interior attack on a working fire to reducing loss of life and property damage. When this approach is feasible, the offensive interior attack provides the greatest benefit to the occupants in the fire building, and the thermodynamic insult from fire on the structure. The fire grows to the point of flashover (the very rapid growth of fire due to the heating of combustible contents) generally in less than ten (10) minutes. Early detection of the fire, fast arrival of sufficient numbers of trained firefighters, and an aggressive attack on the fire are the best ways to limit growth to flashover in structures that do not contain fire suppression systems.

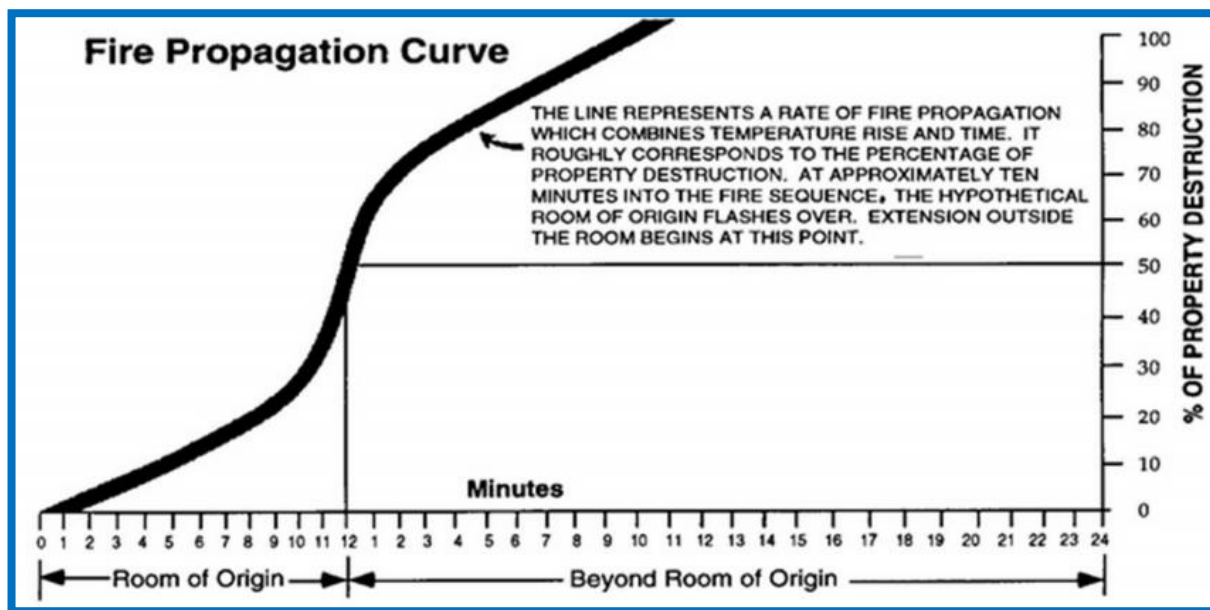


Figure 9: Fire Propagation Curve

According to a report from the Institute of Medicine titled *Strategies to Improve Cardiac Arrest Survival* (Institute of Medicine. 2015. *Strategies to Improve Cardiac Arrest Survival: A Time to Act*. Washington, DC: The National Academies Press), cardiac arrest strikes almost 600,000 people in the United States each year. The vast majority do not survive the sudden cardiac event. Approximately 395,000 cases of cardiac arrest occur outside of a hospital setting, in which less than 6 percent survive. Approximately 200,000 cardiac arrests occur each year in hospitals, and 24 percent of those patients survive. Estimates suggest that cardiac arrest is the third leading cause of death in the U.S. behind cancer and heart disease.

Following a cardiac arrest, each minute without treatment decreases the likelihood of surviving without disability, and survival rates depend greatly on where the cardiac arrest occurs, said the committee that carried out the study and wrote the report. In addition, there are wide variations in survival rates among communities and hospitals across the U.S. The committee recommended a series of strategies and actions to improve survival and quality of life following cardiac arrest, in part:

Educate and train the public on how to recognize cardiac arrest, contact emergency responders, administer CPR, and use AEDs, as well as facilitate state and local education departments to include CPR and AED training as middle- and high-school graduation requirements.

Adopt continuous quality improvement programs for cardiac arrest to promote accountability, encourage training and continued competency, and facilitate performance comparisons within hospitals and EMS and health care systems.

Enhance performance of EMS systems with emphasis on dispatcher-assisted CPR and high-performance CPR.

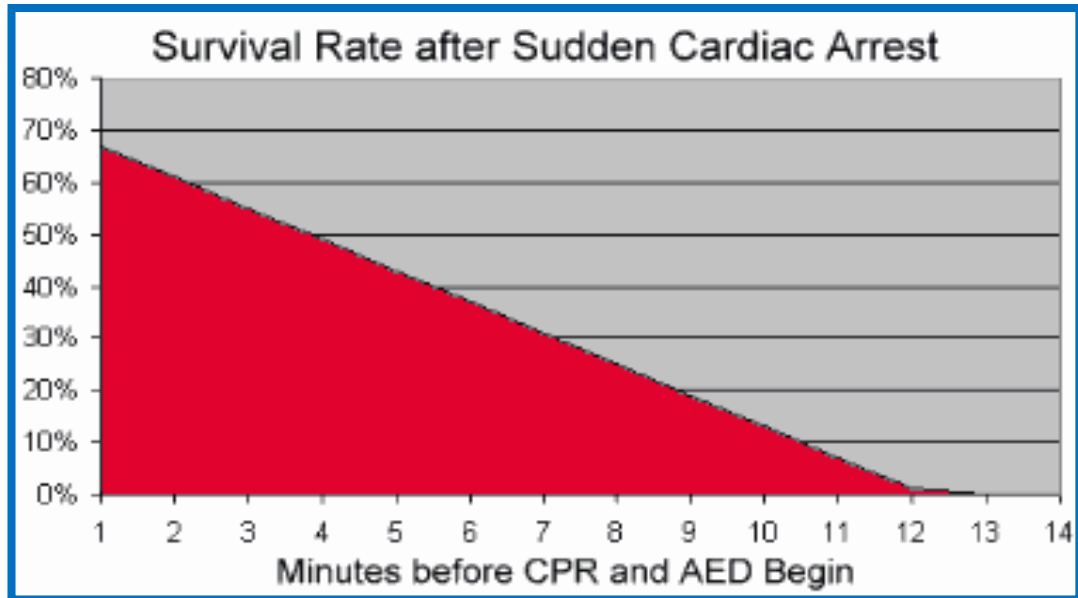


Figure 10: Survival Rate after Sudden Cardiac Arrest

Performance measures for emergency operations are almost entirely inclusive of time. A few examples of measures of time in emergency services include:

- Out the Door
- Arrival at emergency scene
- Arrival at patient's side
- Water on the fire
- Trauma patient's arrival at a trauma center

Before setting and evaluating performance measures, it is imperative to first establish an understanding of how the service is organized, deployed, and managed. These analyses set a baseline for evaluating current performance in order to determine and set expected performance outcomes. The gap between current and expected performance levels can then become the focus of training, technology, equipment, and attitude improvement efforts.

EMERGENCY RESPONSE EXPECTATIONS & METHODOLOGY

This section presents goals and expectations for emergency response for fire engines to structure fires and serious medical emergencies. These emergency call types receive emergency responses with lights and sirens and all actions are expedited in order to deliver services as quickly as possible. It is important to note that this section is not a presentation of actual performance but will serve to compare to actual performance in future sections of the paper.

City Council

Palm Coast City Council establishes performance goals for emergency responses for Palm Coast Fire Department. The response performance goal is defined as: *the first fire apparatus should arrive on the scene of an emergency in the city limits within seven (7) minutes of notification, 85% of the time.* The response expectation is for emergency responses, and not non-emergent calls to assist citizens.

Seven Minutes to the Scene, 85% of the time

The performance goal accounts for peak traffic periods, railroad tracks, and traffic calming devices such as traffic circles, speed humps and tables, four-way stops, and other impediments to rapid emergency response. Note: Florida Statute prohibits emergency responding vehicles from speeding through school zones or passing school buses picking up or dropping off children.

Generally, there are two ways to determine the success of an emergency response system. The first is to use predictive data to “test” the fire station locations. The predictive data demonstrates the geographic information system (GIS) functionality and includes mapping for predicted outcomes. The second is to use historical data from actual emergency responses as an overlay to the predicted success.

Mapping the driving prediction includes only six (6) minutes, allowing for one (1) minute for firefighters to don protective apparel and begin their emergency response. Figure 11 depicts a map of all five (5) PCFD fire station response predictions for six (6) minutes of driving. It is important to note that the map depicts only areas accessible by roads, leaving large areas of undeveloped land to appear to be outside the travel goal or area. When these areas develop, data can be evaluated for travel along the new roads.

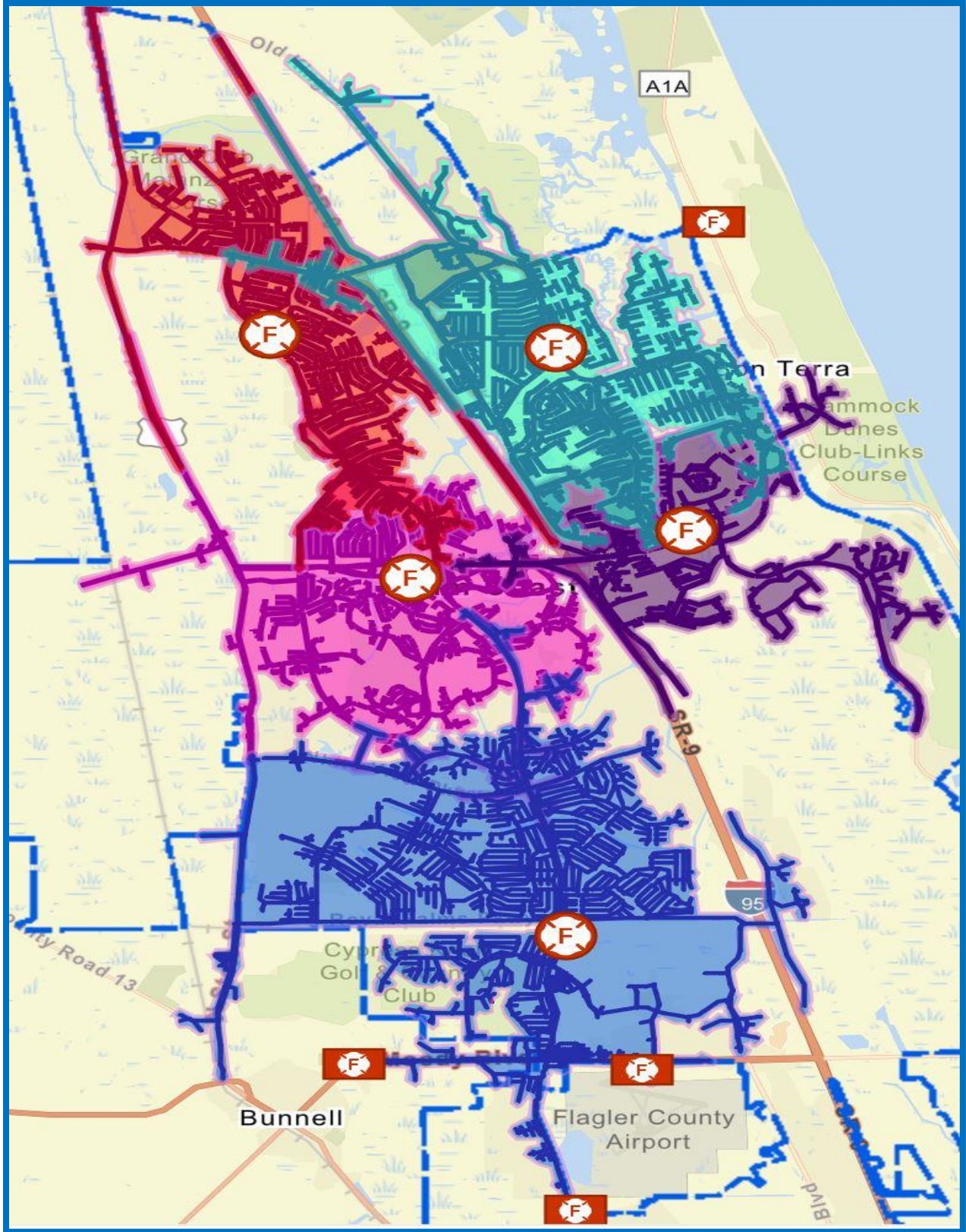


Figure 11: Seven Minute Response Prediction, PCFD Fire Stations

Fire station #21 is located in the heart of the City of Palm Coast. The major corridors of Palm Coast Parkway and Belle Terre Parkway provide momentum for responses through the district. The map below (Figure 12) is a prediction for driving for six minutes from the fire station, which provides one minute for turning out to meet the City Council performance goal.

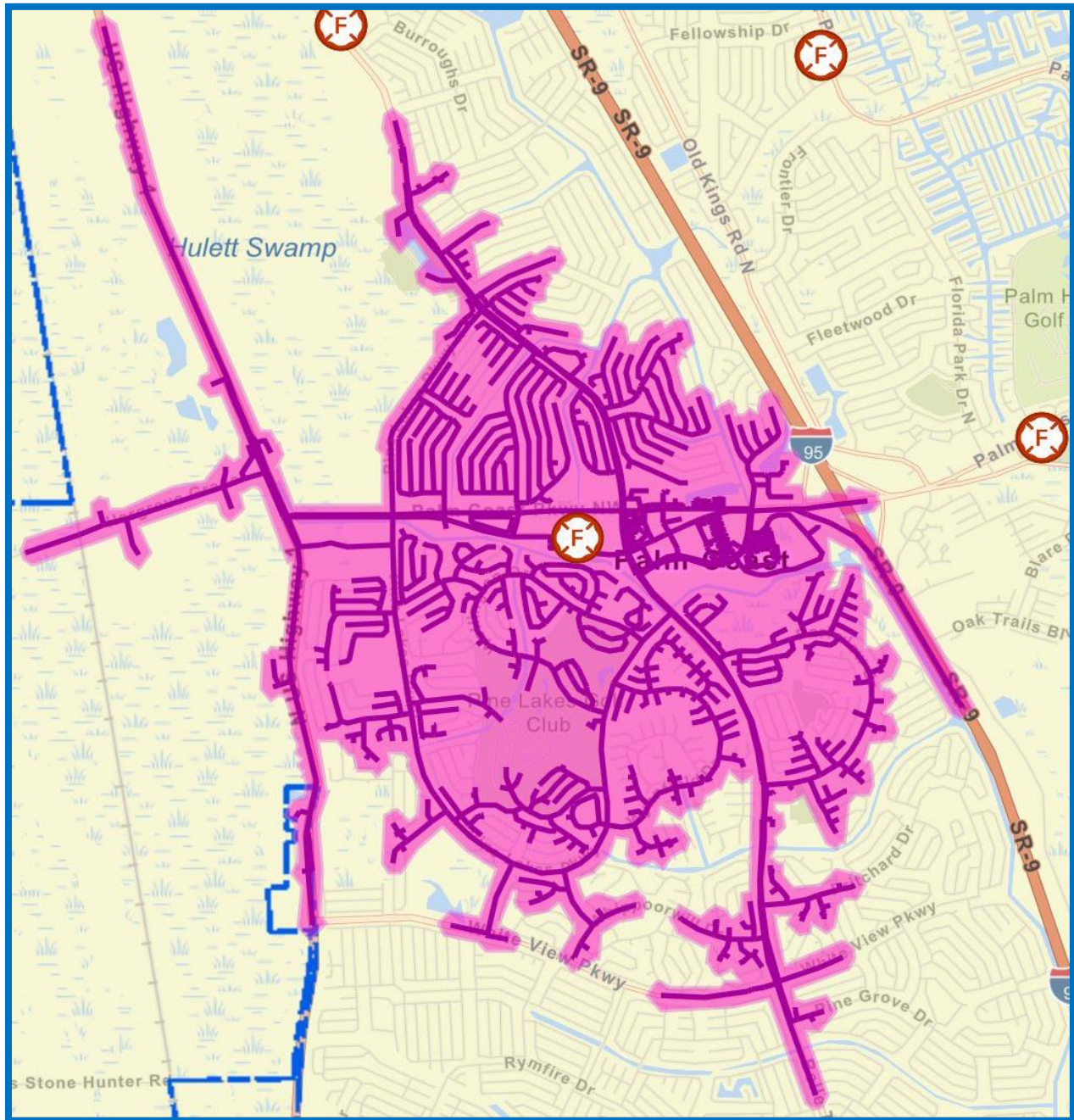


Figure 12: Seven Minute Response Prediction - Fire Station #21

Next, fire station #22 sits in the original location of Palm Coast Volunteer Department, operating since 1973. Palm Coast Parkway is the major corridor for fire station #22 to respond through the district. The map below (Figure 13) is a prediction for driving for six minutes from the fire station, which provides one minute for turning out to meet the City Council performance goal.

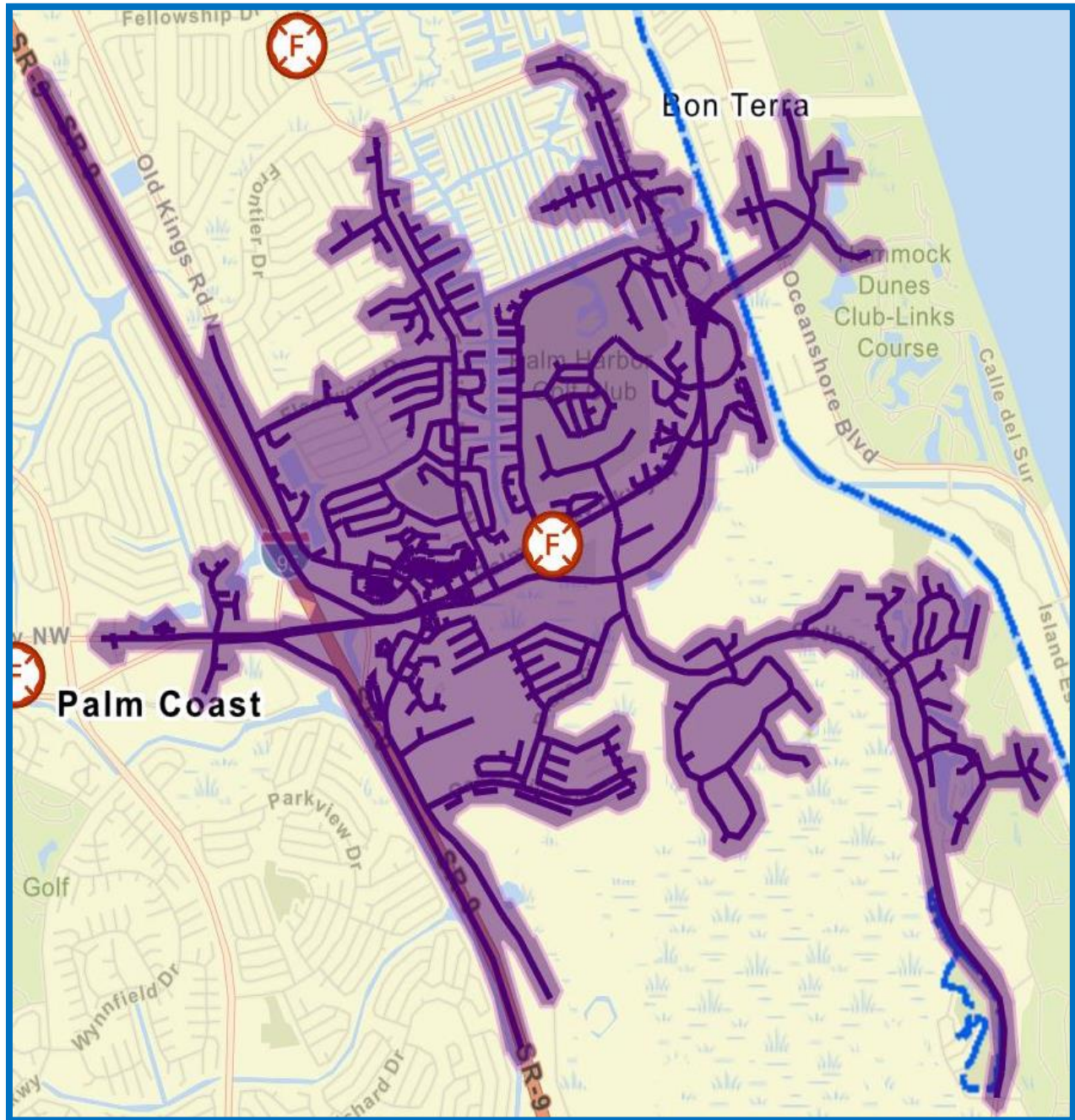


Figure 13: Seven Minute Response Prediction - Fire Station #22

Next, fire station #23 sits in the Northwest section of the City of Palm Coast. Belle Terre Parkway and Matanzas Parkway are the major corridors for fire station #23 to respond through the district. The map below (Figure 14) is a prediction for driving for six minutes from the fire station, which provides one minute for turning out to meet the City Council performance goal.

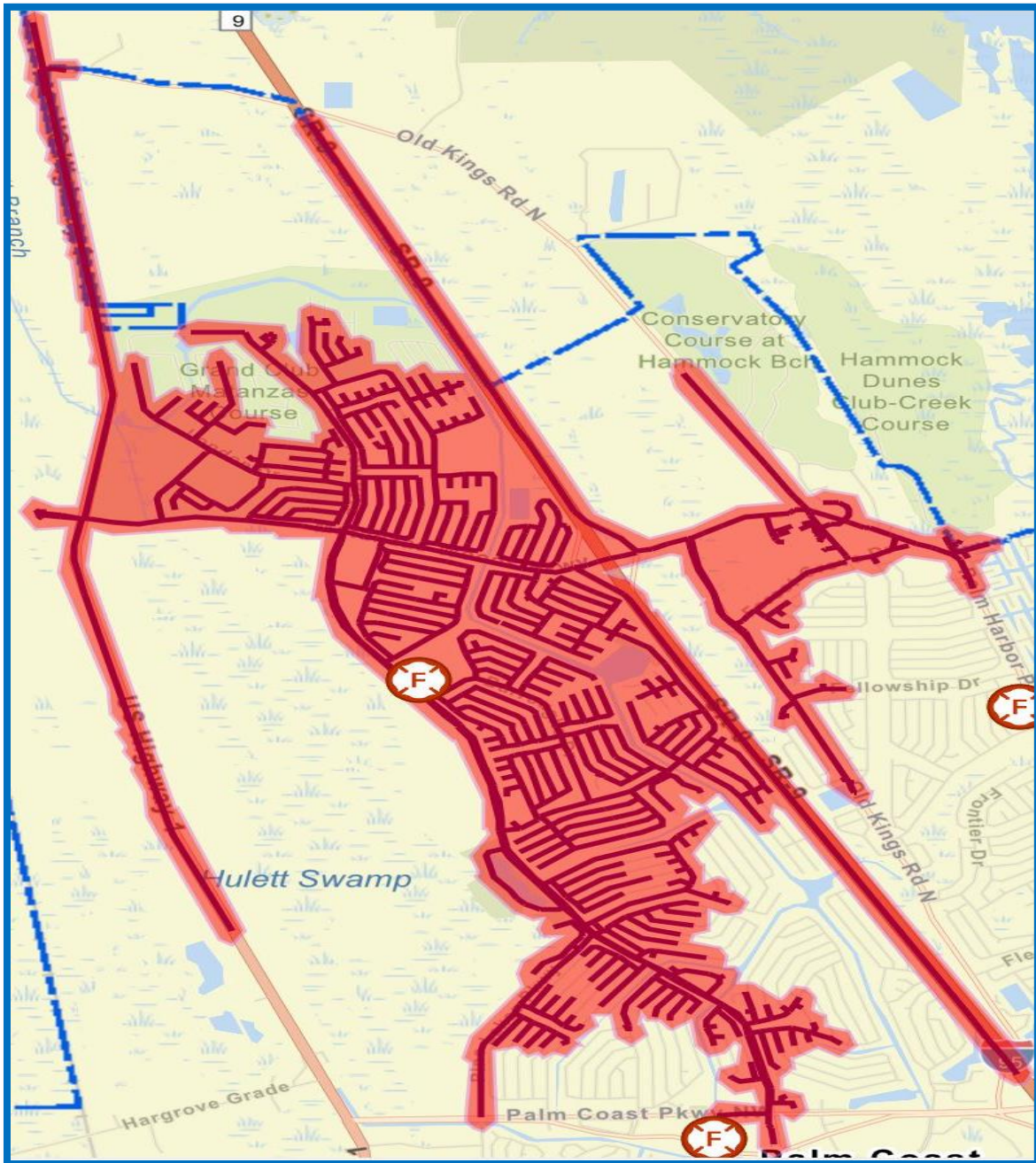


Figure 14: Seven Minute Response Prediction - Fire Station #23

Next, fire station #24 sits in the Northeast section of the City of Palm Coast. Palm Harbor Parkway and Matanzas Parkway are the major corridors for fire station #24 to respond through the district. The map below (Figure 15) is a prediction for driving for six minutes from the fire station, which provides one minute for turning out to meet the City Council performance goal.

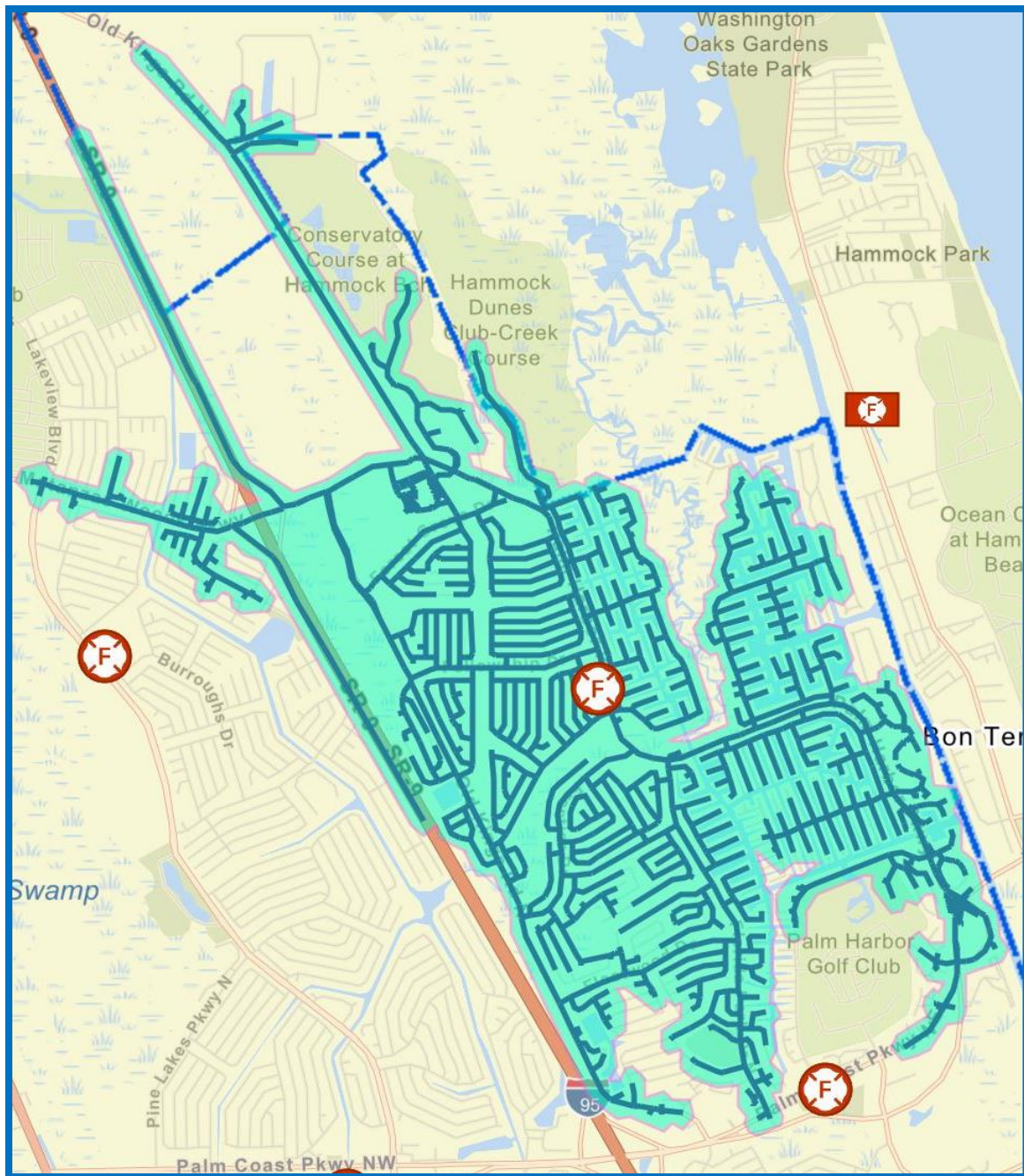


Figure 15: Seven Minute Response Prediction - Fire Station #24

Next, fire station #25 is the South-most fire station in the City of Palm Coast. Belle Terre Parkway and Royal Palms Parkway are the major corridors for fire station #25 to respond through the district. The map below (Figure 16) is a prediction for driving for six minutes from the fire station, which provides one minute for turning out to meet the City Council performance goal.

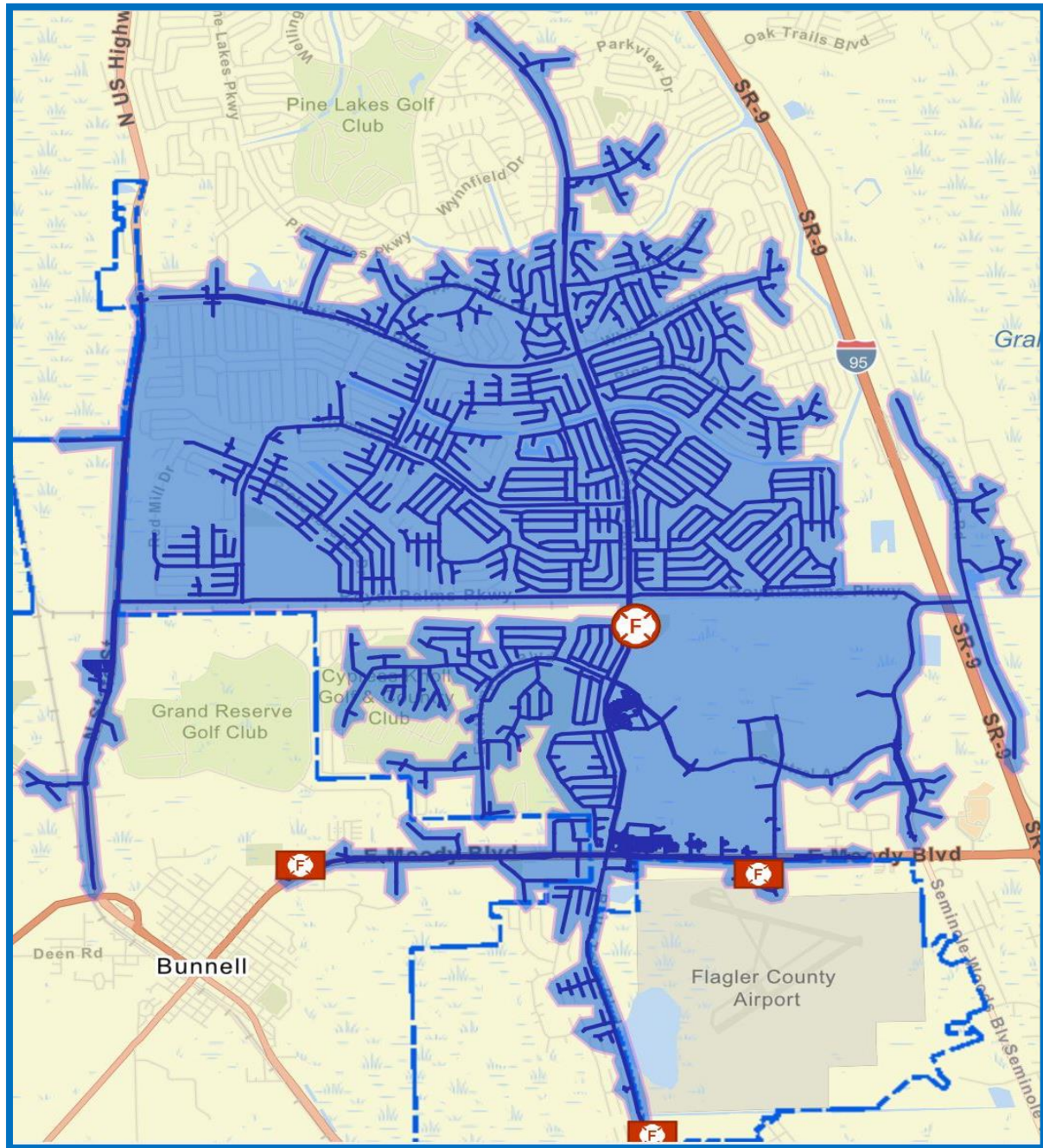


Figure 16: Seven Minute Response Prediction - Fire Station #25

Lastly, Flagler County Fire Rescue fire station #92 is depicted because of the proximity to the South-most sections of Palm Coast, the areas south of State Road 100 (SR 100). Although the fire station responds to areas within the Flagler County service area, through agreement, fire station #92 also responds to areas along and south of SR 100 in the city limits. The map below (Figure 17) is a prediction for driving for six minutes from the fire station, which provides one minute for turning out to meet the City Council performance goal.

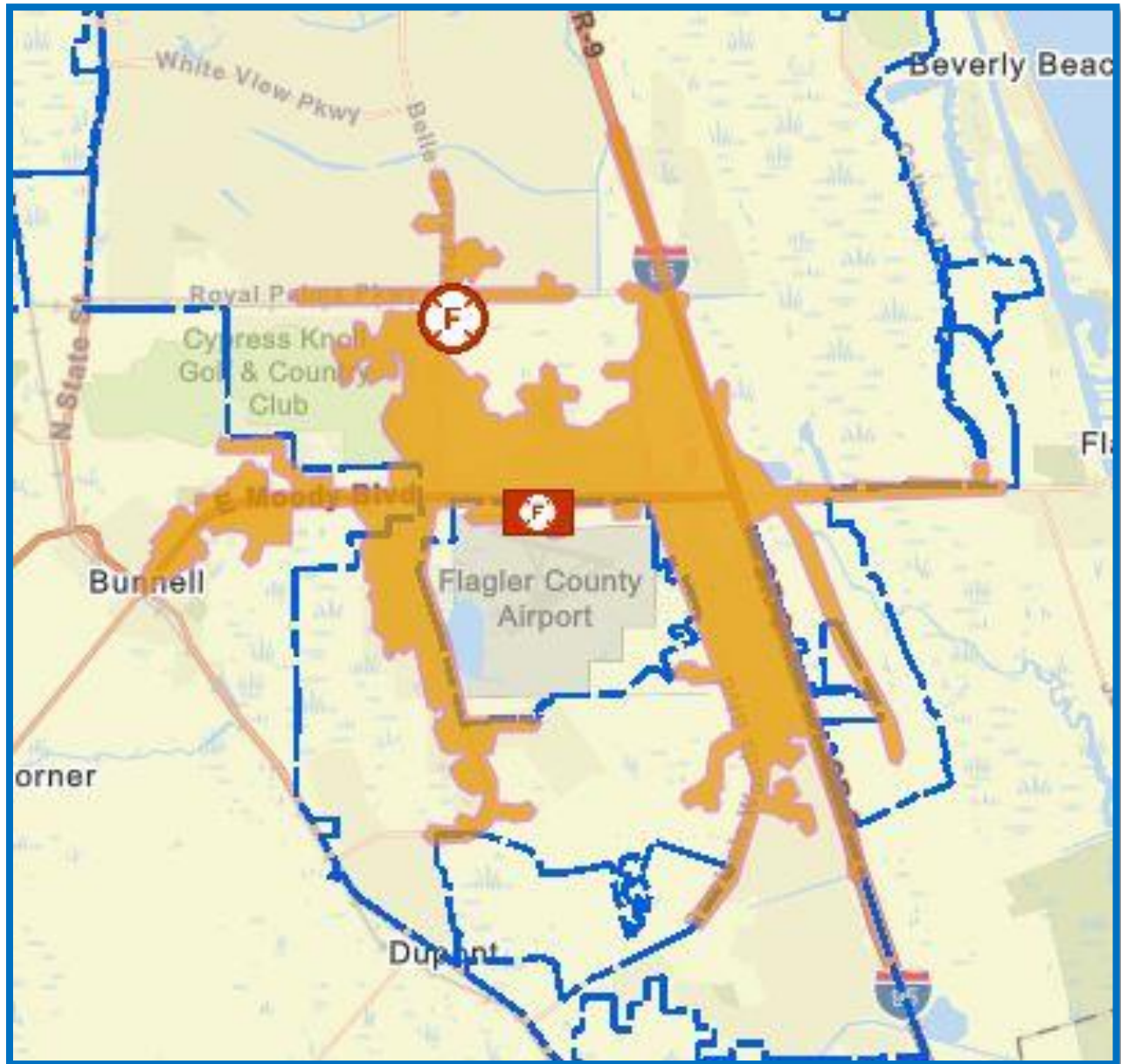


Figure 17: Seven Minute Response Prediction - Fire Station #92

ISO Distribution

The Insurance Services Office (ISO) is a New Jersey-based insurance advisory organization that provides the insurance industry with quantified fire insurance ratings for communities across the United States. The ratings are known as Public Protection Classification (PPC®) ratings, developed to provide recommendations for key areas of improvement for communities. The PPC® rating is based on a scale of one (1) (best protection) to ten (10) (fire protection that fails to meet minimum requirements) and assesses all areas of fire protection in four major categories:

- Emergency dispatch and communications (10 points)
- Water system supply and distribution capabilities (40 points)
- The fire department (50 points)
- Community Risk Reduction (5.5 points)

The PPC® score is developed using the Fire Suppression Rating Schedule (FSRS), which outlines sub-categories and detailed requirements for each evaluation area.

Once the PPC® score is determined for a community, properties must be determined to sit within five driving miles of a fire station, or otherwise are assigned a PPC® score of "10". Buildings and facilities assigned a rating of 10 (because they are further than five-mile driving miles) are considered to not meet the minimum standards for ISO. According to Figure 18, 100% of the properties accessible by a road are located within five-miles of a fire station, whether it is a Palm Coast Fire Department facility, or a partnering agency - Flagler County Fire Rescue or Flagler Beach Fire Department - facility.

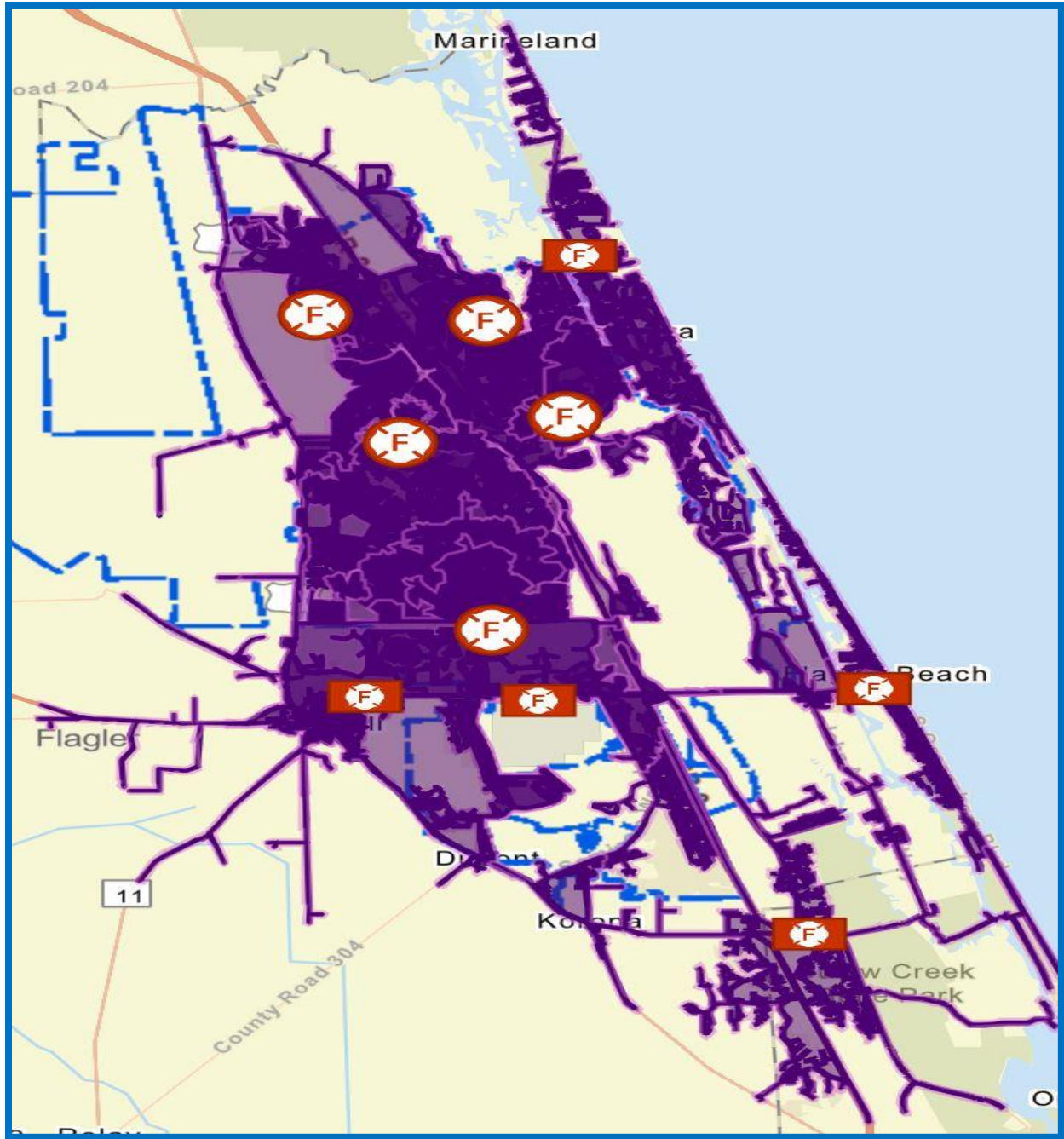


Figure 18: Fire Station Distribution - 5-Mile Travel Distance Engine Company

To reduce property damage from a fire, firefighters need to get to the scene quickly. Therefore, ISO evaluates the deployment of fire stations in each community. For full credit in the Fire Suppression Rating Schedule (FSRS), the fire protection area with residential and commercial properties should have a first-due engine company within 1.5 road miles and a ladder service

company within 2.5 road miles. The following two figures (Figure 19 and Figure 20) depict the area of the City sitting within 1.5 miles of a fire station. In these figures, Palm Coast Fire Department and partnering agencies – Flagler County Fire Rescue and Flagler Beach Fire Department – facilities are shown. Because of the size of the maps, the city is divided into North and South. The first figure (Figure 19) represents the North half of the city, with fire stations 21, 22, 23, 24, and 41 (FCFR).

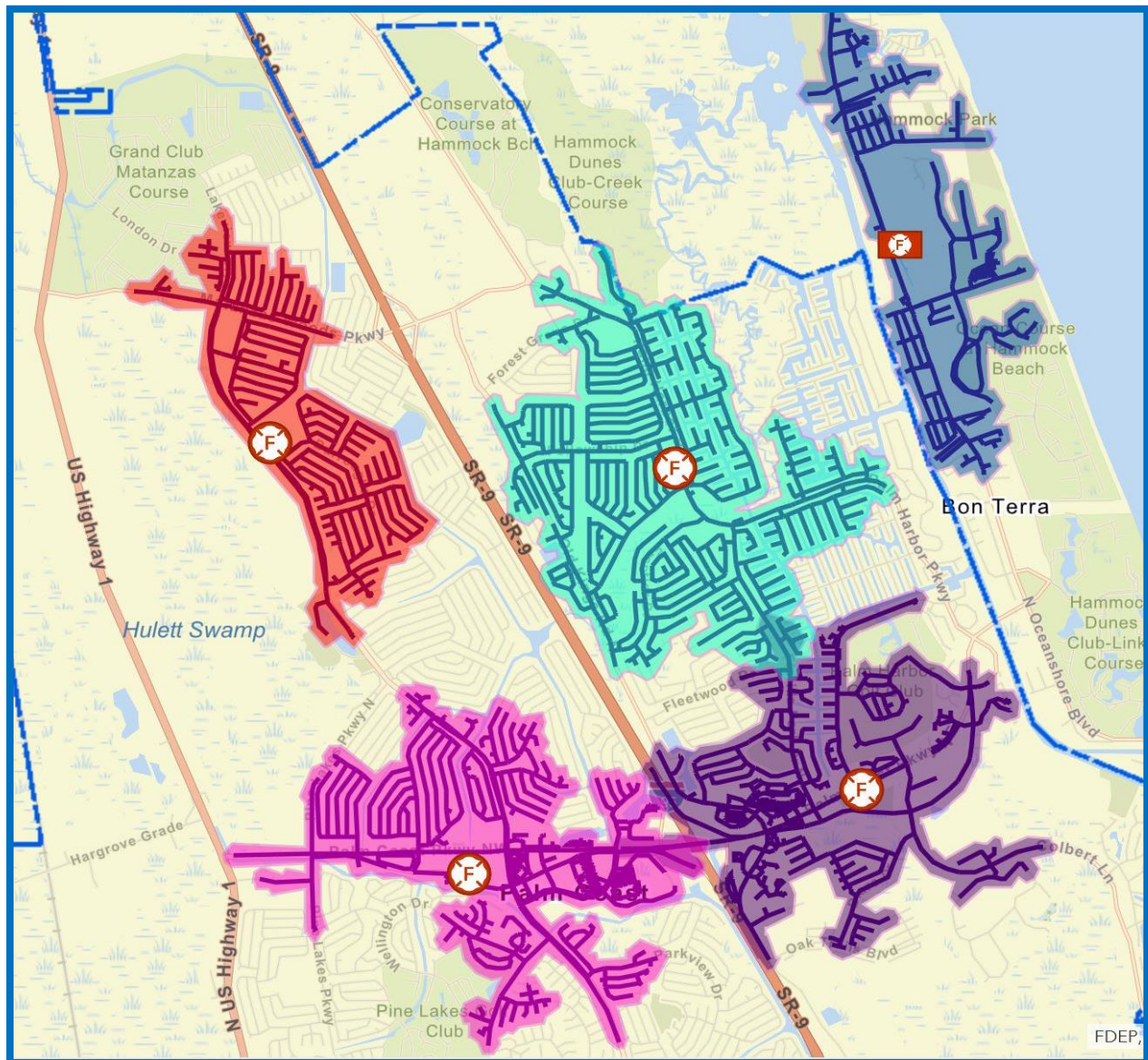


Figure 19: North Fire Station Distribution - 1.5 Road Mile Travel Distance (Engine Company)

The South half of the City of Palm Coast is represented in Figure 20, and includes Palm Coast Fire Department fire station #25, Flagler Beach Fire Rescue fire station #11, and Flagler County Fire Rescue fire stations #16, #41, and #62.

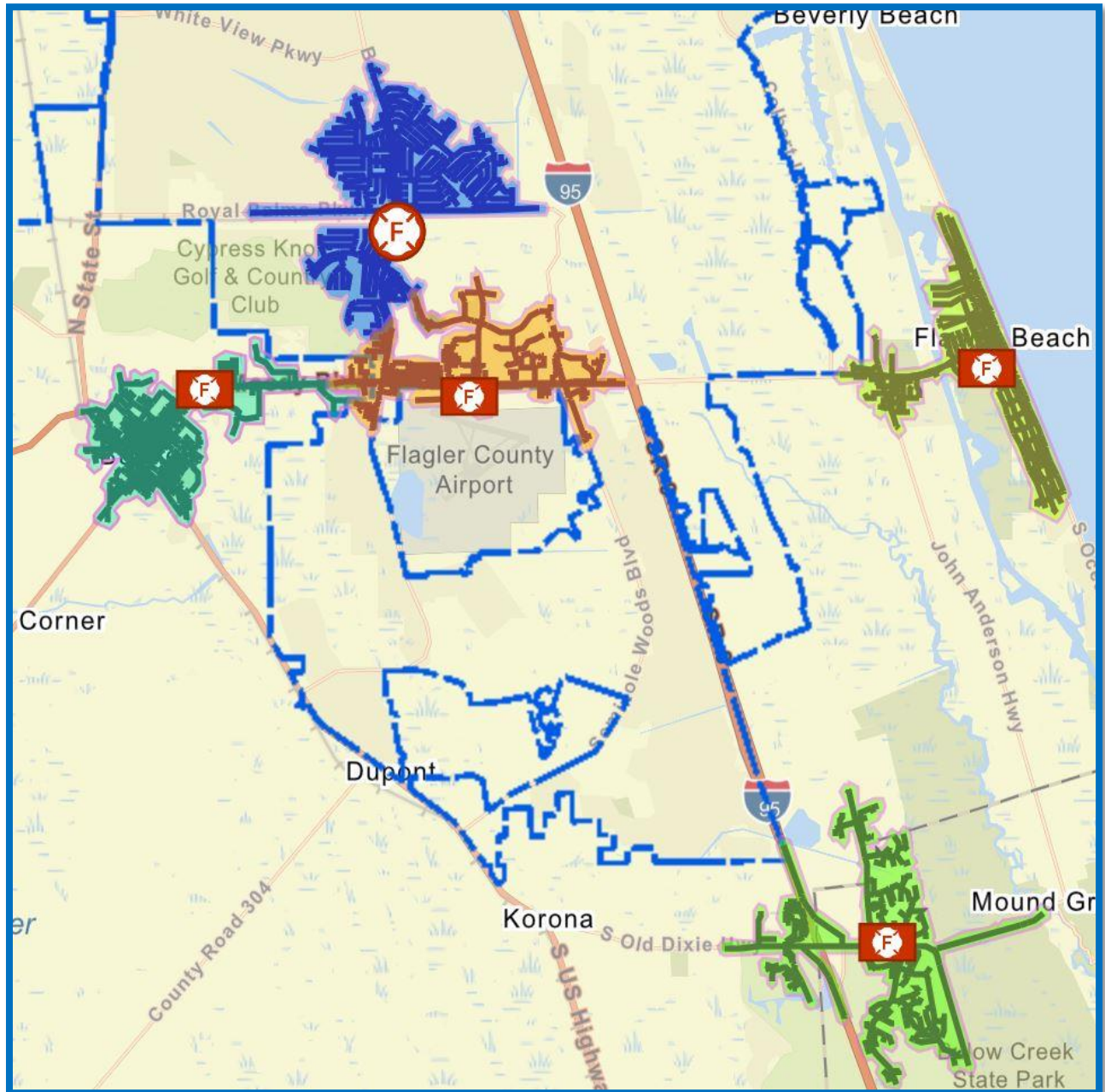


Figure 20: South Fire Station Distribution - 1.5 Road Mile Travel Distance (Engine Company)

NFPA

The National Fire Protection Association (NFPA) is an international nonprofit organization devoted to eliminating death, injury, property and economic loss due to fire, electrical and related hazards. In 2018, the NFPA claims to have 50,000 members and 9,000 volunteers working with the organization through its 250 technical committees that produce standards. The standards are considered best practices in numerous industries, unless the standard is codified as law. Several standards serve as laws for both states and localities.

One of the standards germane to discussions involving fire station facility placement is NFPA 1710: Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments. NFPA 1710 specifies requirements for effective and efficient organization and deployment of fire suppression, emergency medical, and special operations to the public by career fire departments to protect citizens and the occupational safety and health of fire department employees.

It is important to understand the standard does not prescribe minimum staffing requirements for each fire apparatus or minimum numbers of fire stations per population. NFPA 1710 establishes performance measures to consider and/or adopt locally, or for use in civil litigation for comparative purposes. NFPA 1710 establishes performance expectations for the 90th percentile, meaning that service delivery capabilities are not averaged, but instead baseline performance is defined as that which occurs 90 percent of the time or better.

NFPA 1710 recommends a maximum travel time of four (4) minutes for the initial responding unit 90 percent of the time for career fire departments and all remaining resources arrive on scene from the initial point of dispatch within eight (8) minutes 90 percent of the time. The following figures (Figure 21 and 22) depict the expected travel distance from each fire station according to the performance measures set by NFPA 1710. In Figure 22, the light pink depicts areas where only one apparatus arrive within 8-minutes. Where purple is depicted, one unit arrives within 4-minutes, and at least one arrives within 8-minutes. The darker shades of pink means that more units arrive within the 8-minute goal.

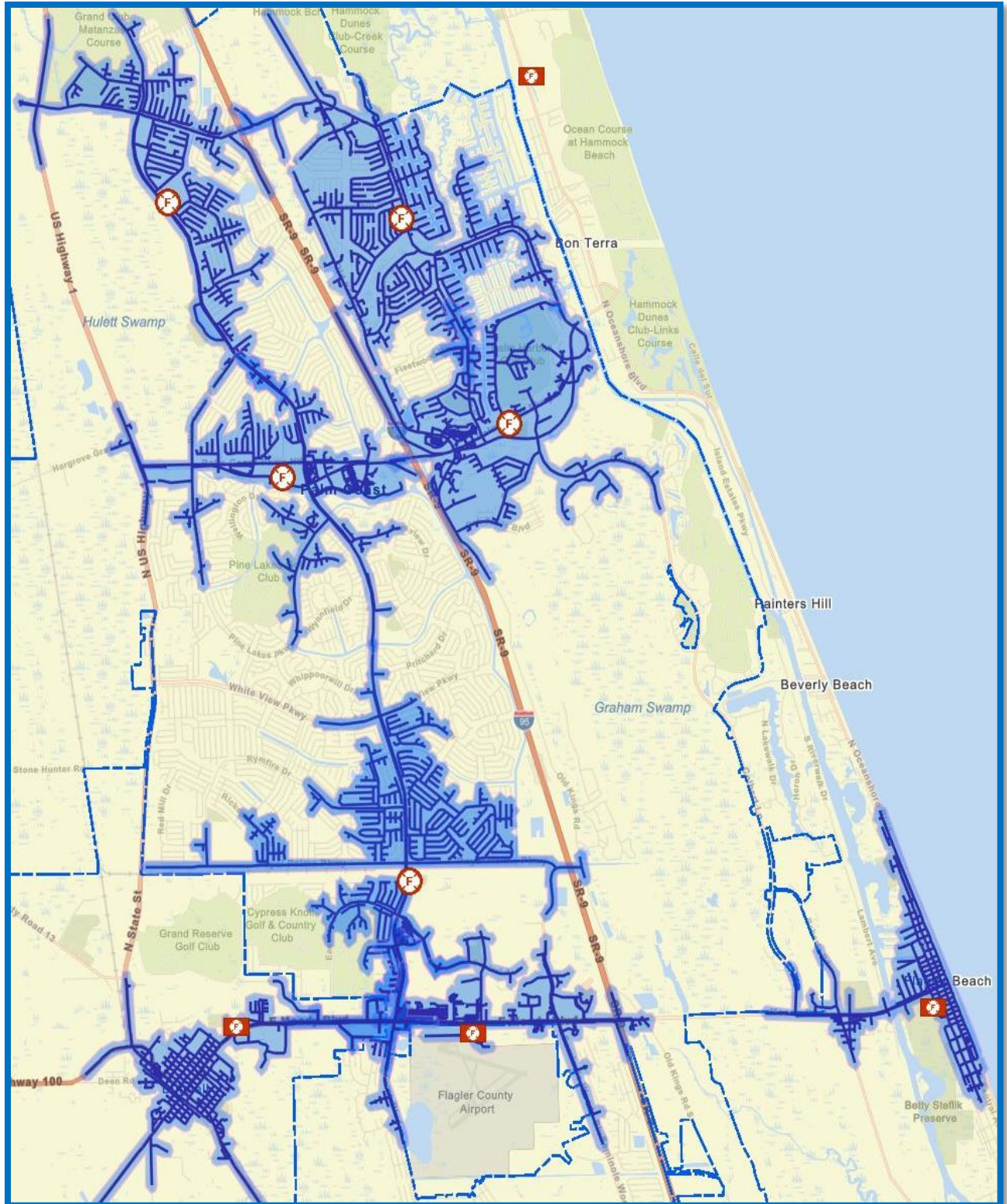


Figure 21: NFPA 1710: 4-Minute Travel Time for Engine Company

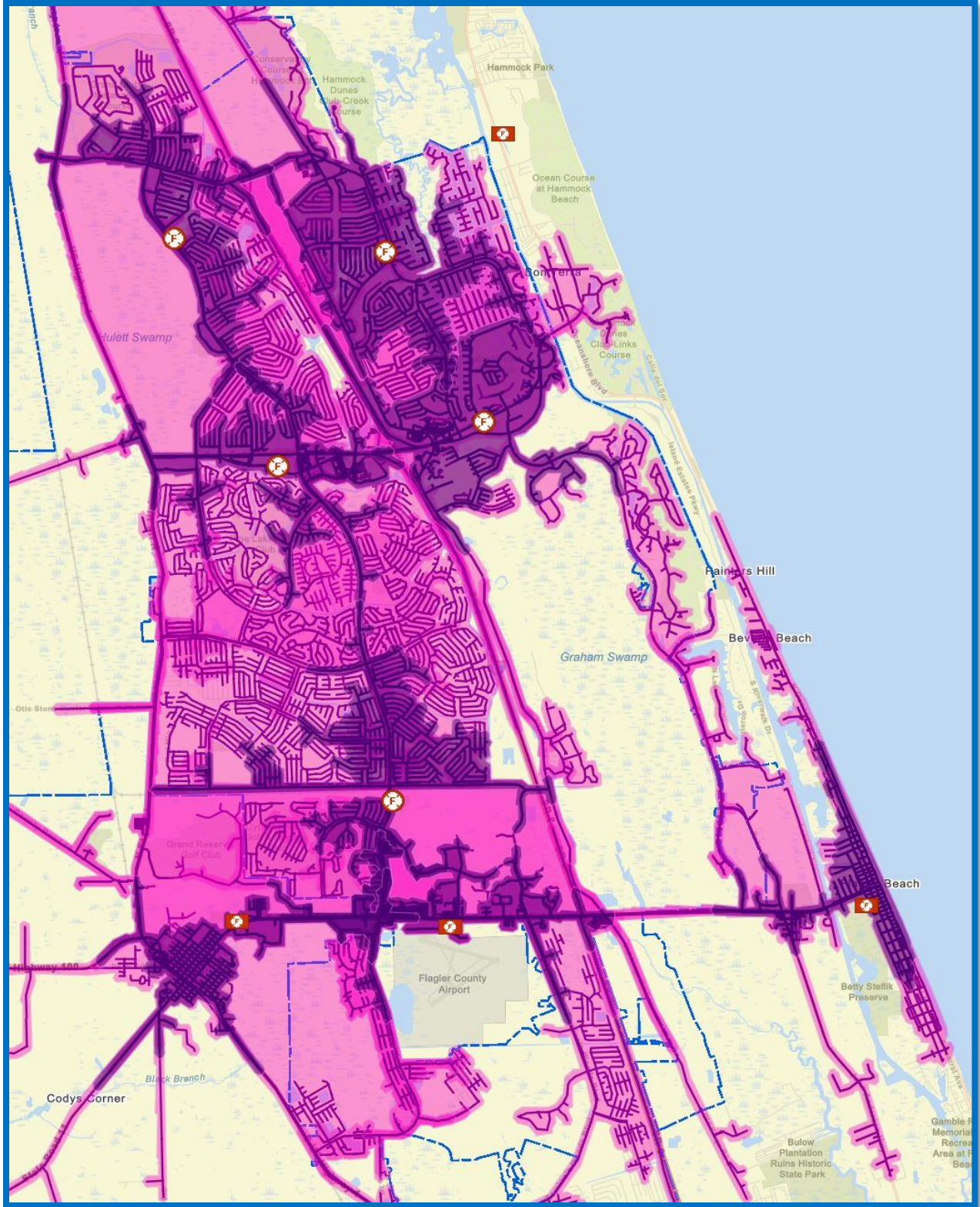


Figure 22: NFPA 1710: 8-Minute Travel Time for Engine Company

Population Served

Many factors contribute to the nature and frequency of service demand experienced in communities across the country. Often, researchers use total population to provide gross estimations of expected service demand. Other factors can have significant impacts on service demand within a community such as population demographics, economic characteristics, composition of occupancies, levels of education, and cultural norms. The following series of sections and figures provide an examination of socio-economic characteristics for the City of Palm Coast.

GENERAL POPULATION

The 1980 decennial census of Palm Coast was 2,837 and the 2010 census population was 75,180 citizens. In 2018, the population estimate was 84,575. The population of Palm Coast has grown at an average rate of 5.6 % per year since the 2010 census. Over a longer period, Palm Coast grew in population from 1980 to 2018 by 4,000%.

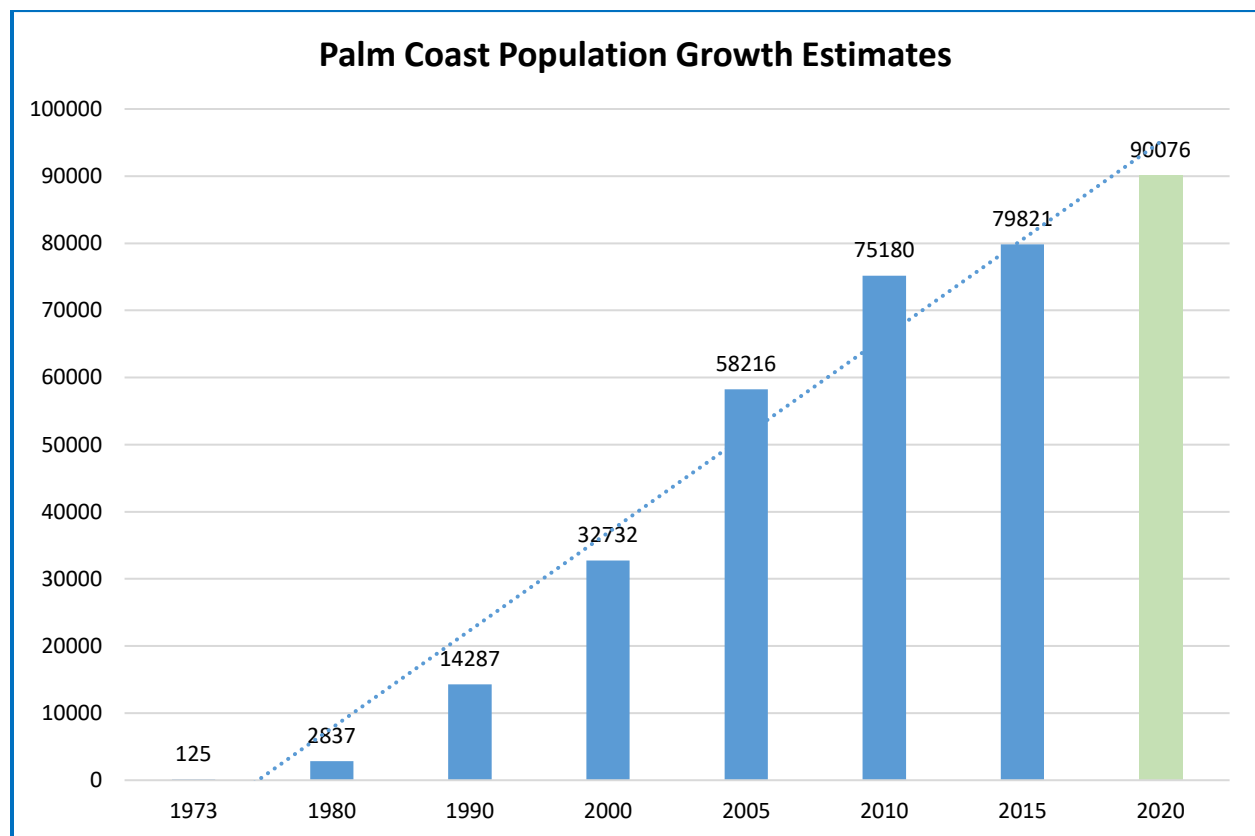


Figure 23: City of Palm Coast Population Trend Line

Although axiomatic, fire stations are located to protect lives and property. Administrators must balance population growth with funding opportunity, such as impact fees, when planning additional fire facilities. Adding fire facilities too soon to areas where population growth was predicted but not realized is often fodder for criticism for poor decision-making and inadequate fiduciary responsibility. Likewise, placing facilities after service gaps and increased emergency call volume are already occurring leads to speculation that additional facilities are long overdue.

The preferred approach to evaluating the need to add fire facilities involves close coordination between fire administrators and Community Development Department personnel. The Community Development Department provides clear insight into future development and growth information, necessary to prudently plan for service delivery expansion. Also, State of Florida Office of Economic and Demographic Research population data can be beneficial to decision-makers to evaluate population trends, which leads to predictions for expectations for emergency call volume. Traditionally, population increases equate to increases in emergency call volume. The following figure provides population density by U.S. Census blocks, which are the smallest division used by the census. This data is from the 2010 census.

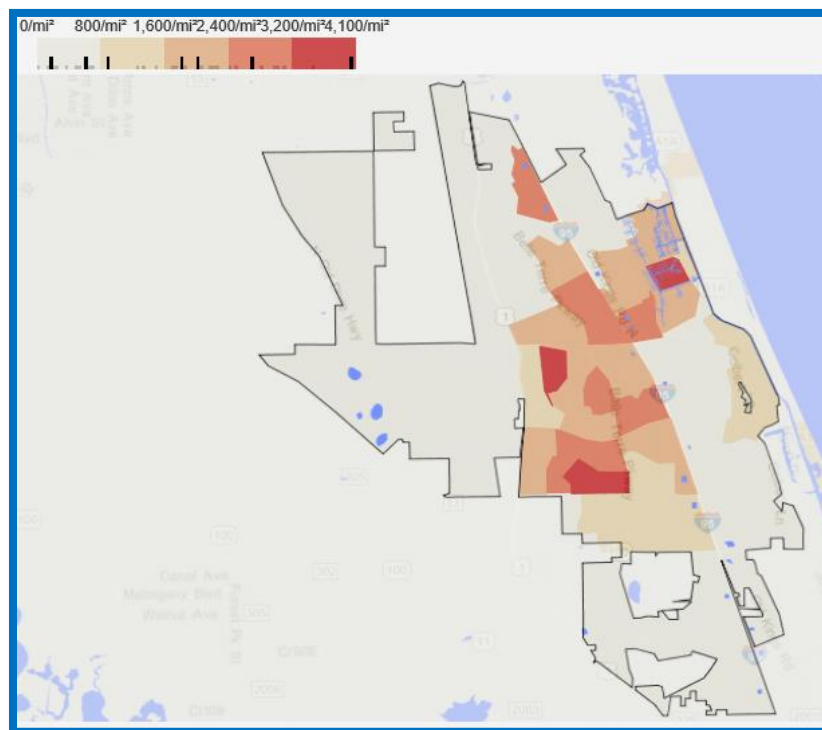


Figure 24: Population Density by 2010 Census Block

Alarm Assignments

Palm Coast Fire Department utilizes automatic vehicle location (AVL) technology to locate and assign the closest apparatus to calls for service. Emergency calls are received by the Flagler County Sheriff's Office Emergency Communications Center who employ computer aided dispatching (CAD) to assign the most appropriate unit for each response. The appropriate type of unit, number of each type, and which agency responds are all factors considered by the emergency run cards built into the CAD system. Twelve levels of response are utilized to respond to 21 types of emergencies ranging from a bomb threat to a train incident. Unit types include rescue (medical transport), engine (fire suppression), aerial (fire suppression), tender (water supply), brush (attack or woods truck for wildland fire), command, and fire police. Figure 25 shows the response matrix utilized by the Palm Coast Fire Department.














<i>Emergency Types</i>	<i>Number of Apparatus Assigned Initially</i>				
Structure Fire					
Aircraft, Bomb Threat, Vehicle Fire, Haz-Mat Incident, Smoke in Structure, Train Incident					
Fire Alarm					
Crash w/ injuries, Medical Incidents					
Elevator Incident, Dumpster Fire, General Assist, Power Lines Down,					

Figure 25: Apparatus Assignments to Various Alarm Types



(Ambulance)



(Fire Engine)



(Aerial Truck)

CURRENT EMERGENCY RESPONSE PERFORMANCE

Service delivery is the foundation of any emergency service organization. Administrators must understand how the deployment model works, in order to quantify and enhance the efficiency and effectiveness of the delivery model. This section analyzes multiple facets of the current delivery of fire services in Palm Coast, including:

Service demand	<i>Annual Response Demand and Service Demand to Population Ratio</i>
Workload and Reliability	<i>Fire Station Response Workload Analysis</i>
Resource distribution	<i>Closest Unit Arrival Time Analysis</i>
Response trends	<i>Temporal Analysis</i>

By understanding current performance and system effectiveness, administrators can establish goals and objectives for future performance improvements.

Annual Response Demand

Service demand is one consideration in determining appropriate staffing and fire station locations. Often, analyzing annual response data produces predictable trends useful in determining staffing needs and plans for expansion. Many ambulance services use historical incident data to predict future locations for staging ambulances and staffing plans. Fire stations most often provide around the clock coverage from a fixed facility for up to 50 years, making location selection of utmost importance.

Over a five-year period (2014-2018), there was a 14.4% increase in total call volume (Figure 26) and the estimated population in Palm Coast grew at a rate of 9.5% (Figure 27). Within this time period, operational improvements allowed closer units to be assigned to areas of the city, such as FCFR fire station #92 covering areas south of State Road 100, effectively decreasing the response area.

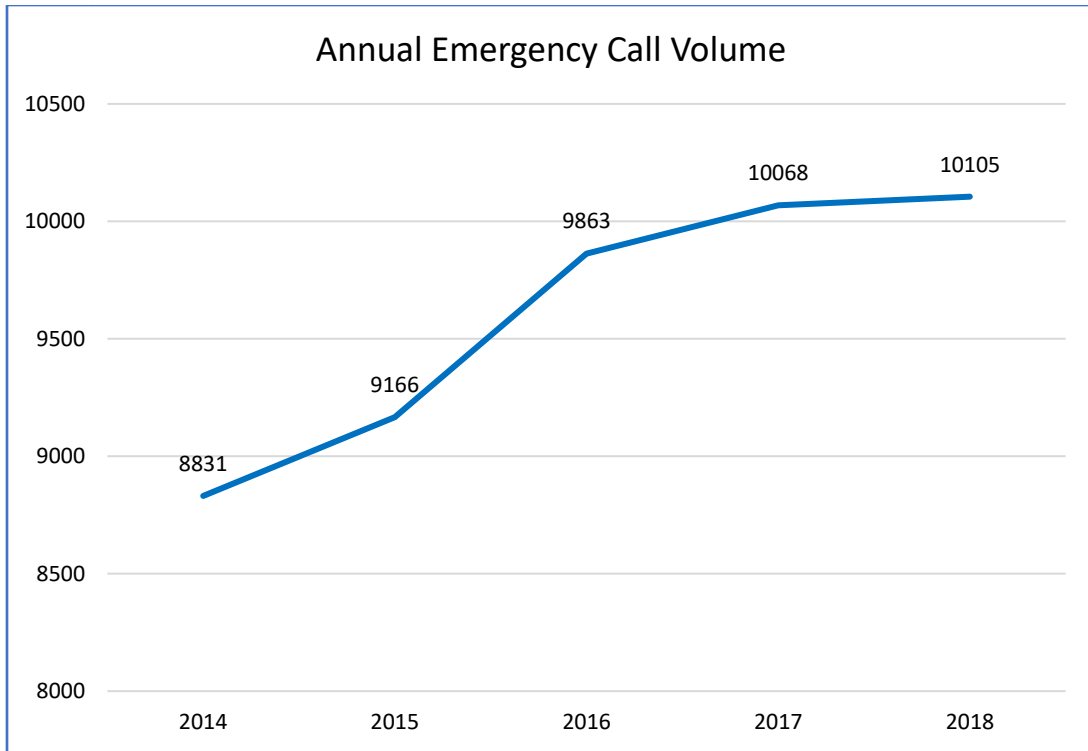


Figure 26: Overall Service Demand (2014-2018)

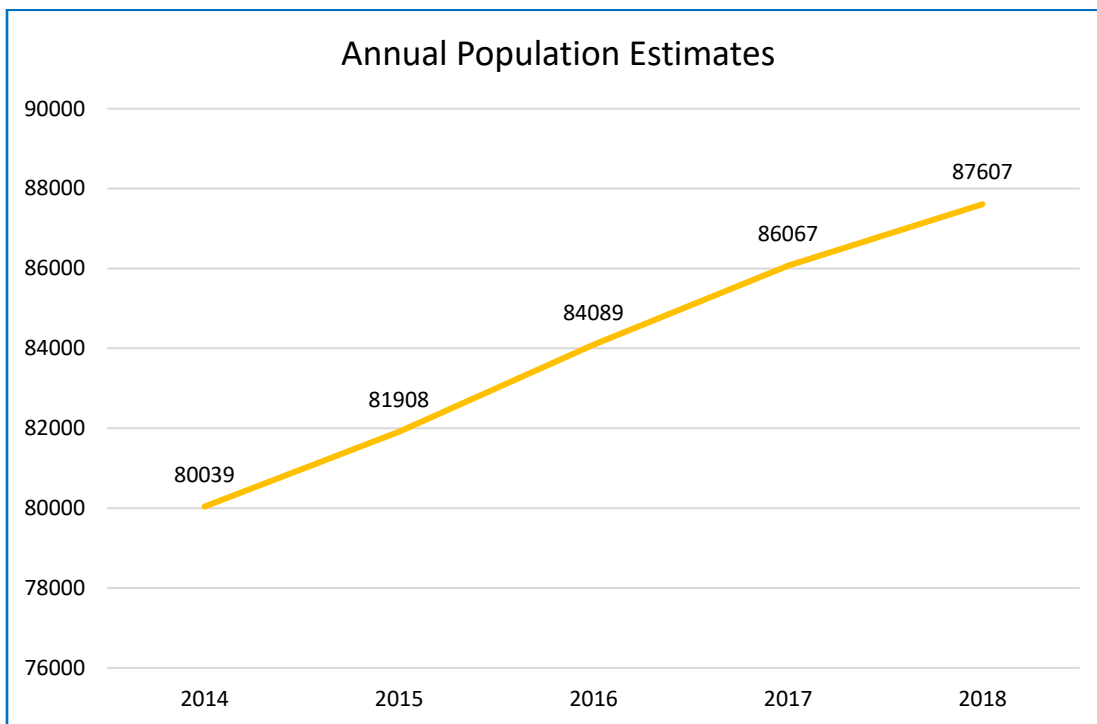


Figure 27: Annual Population Estimates (2014-2018)

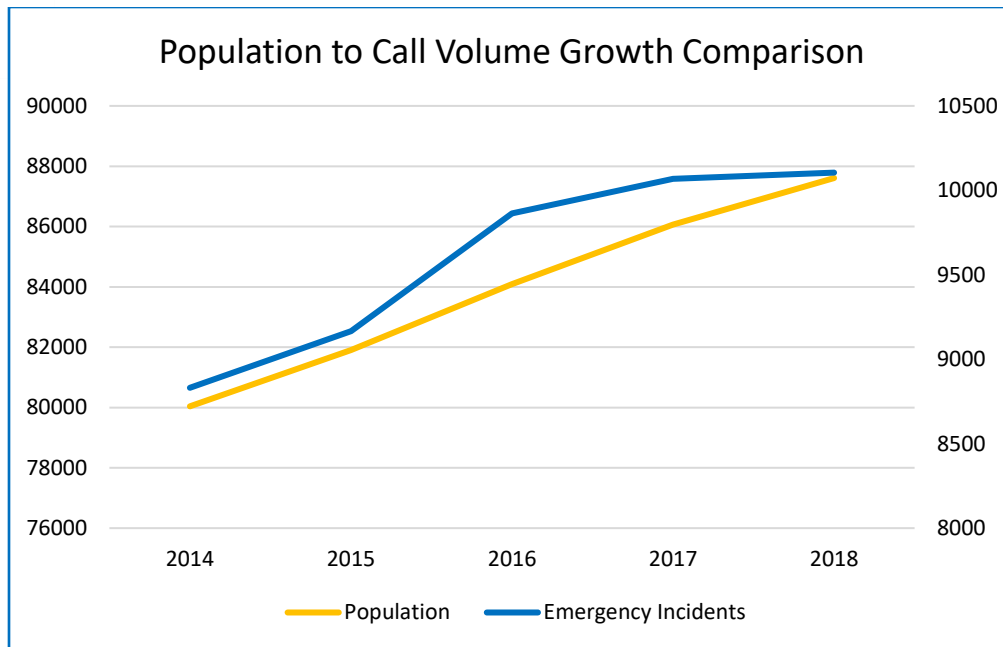


Figure 28: Service Demand to Population Comparison (2014-2018)

In 2017, a downward trend in the number of emergency incidents occurred when PCFD and FCFR entered into agreement to provide emergency response in a closest unit response system. A significant area of the south end of Palm Coast is now the primary response area of a FCFR fire station. This system works by utilizing Automatic Vehicle Location (AVL) data, which works in conjunction with Computer Aided Dispatch (CAD) software to identify the closest appropriate response vehicle.

Fire Station Response Workload Analysis

Areas under increased development, whether expansion or in-fill, cause the need for consideration of how the development will impact current response system performance. In order to determine the impact, regular and recurring analyses show shifts in the number of times a fire station is utilized. Other analyses can also prove helpful, such as concurrent incident analysis and fire station response workload.

One of the ways to monitor the impact is to monitor the response workload for each fire station. In Figure 29, each fire station's annual average number of incidents, with a comparison to the overall percentage is presented.

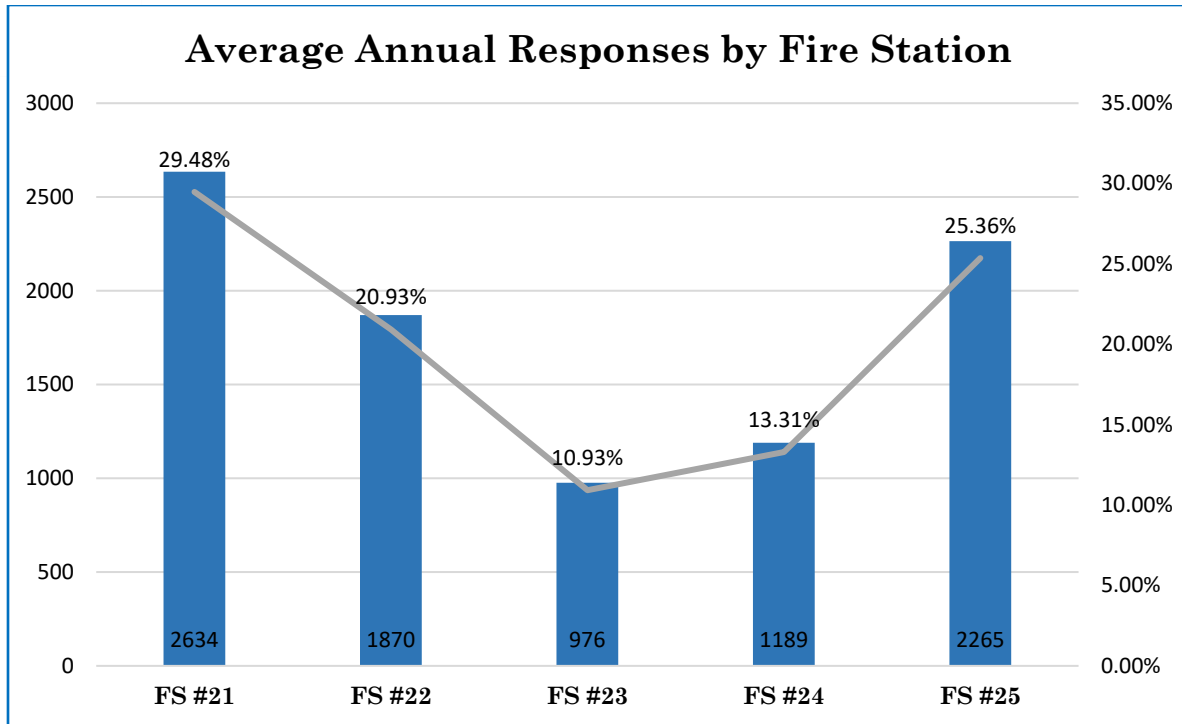


Figure 29: Average Annual Responses by Fire Station (2014-2018)

Fire Stations #21 and #25 perform fifty-five percent (55%) of the overall emergency responses, leaving three fire stations (#22, #23, and #24) to perform forty-five percent (45%) of the overall calls handled by Palm Coast Fire Department. For comparison, the density of population in these areas are also relatively high as compared to the rest of the City. As discussed in a later section, areas of the City considered to contain Developments of Regional Impact (DRI) will experience significant growth due to the intensity of the proposed development. Several of the DRI's are in fire station #23 and #24's immediate response zones, which will have significant impact on their response totals as the developments progress.

Closest Unit Arrival Time Analysis

The next analysis includes facility and apparatus locations as an overview of the current deployment strategy. For fire service organizations, system redundancy is critical as staffing needs for moderate risk incidents, such as a 2,000-square foot residential structure fire and greater, will require at least 13 to 15 firefighters on scene to effectively and safely mitigate the incident.

Without overlapping coverage by stations and units available for response, it is not possible to assemble enough firefighters to achieve positive outcomes for moderate risk events, without posing increased risk to the firefighters operating on scene. In the following figure, an overview of Palm Coast's service area is presented with the city boundaries and fire stations displayed.

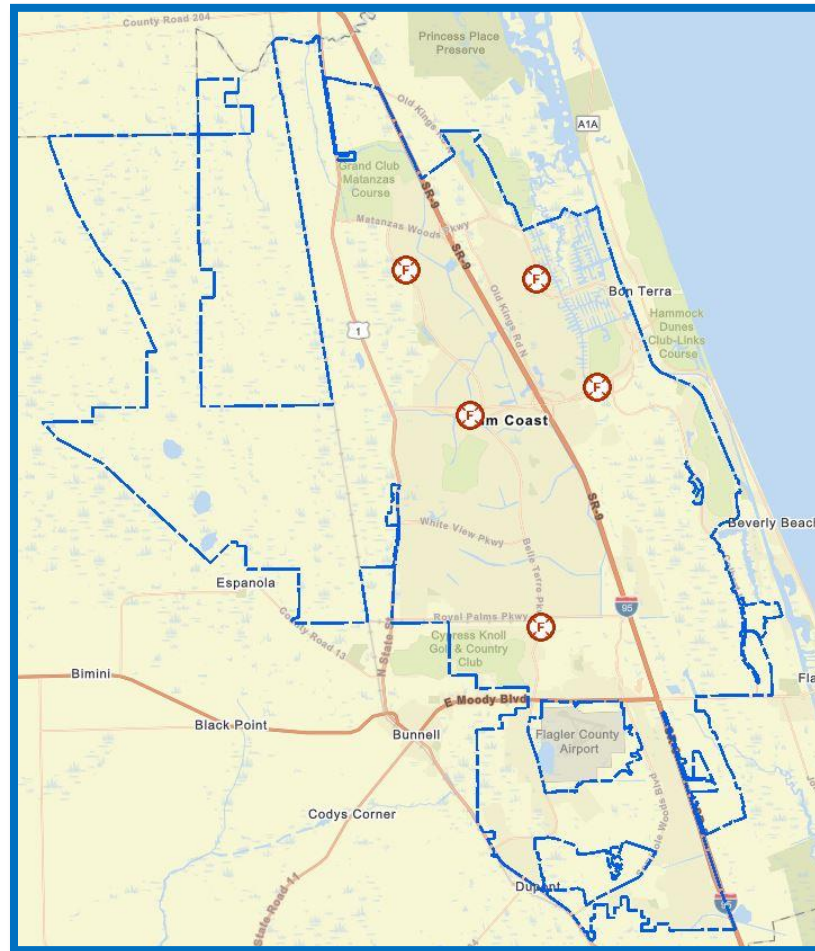


Figure 30: Palm Coast Fire Station Locations

Calls for Service and Response Times

In the following section, the actual emergency incidents for PCFD are depicted on a map by frequency. In Figure 31, the calls for service are for 2019 from the City's five fire stations. Immediately following the frequency depiction, Figure 32 demonstrates the response times, which is calculated from the moment the call is announced by the 9-1-1 Communications Center (tones at the fire station) until the first unit arrives on scene of the reported emergency.

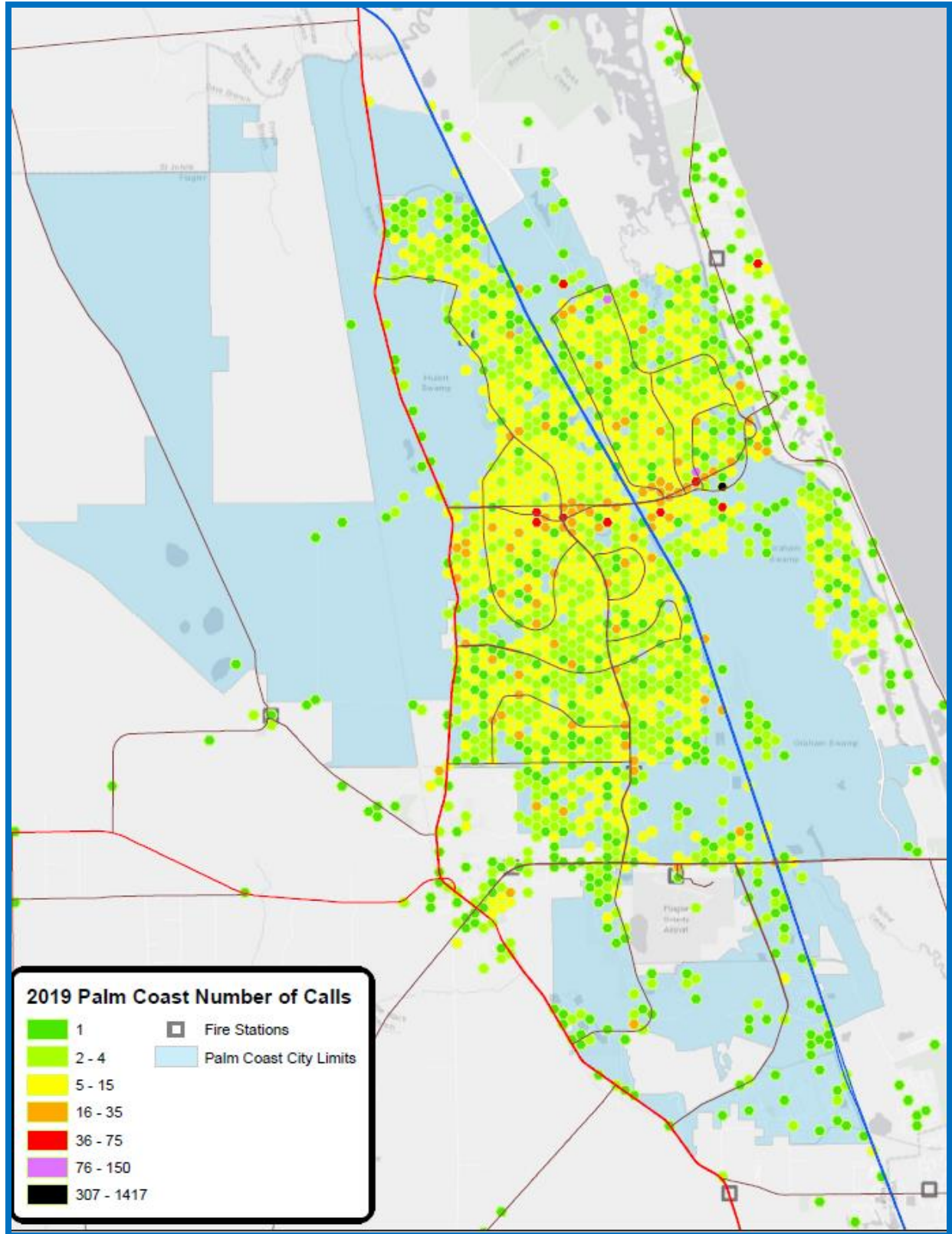


Figure 31: Frequency of Emergency Calls for Service 2019 by Geographical Area

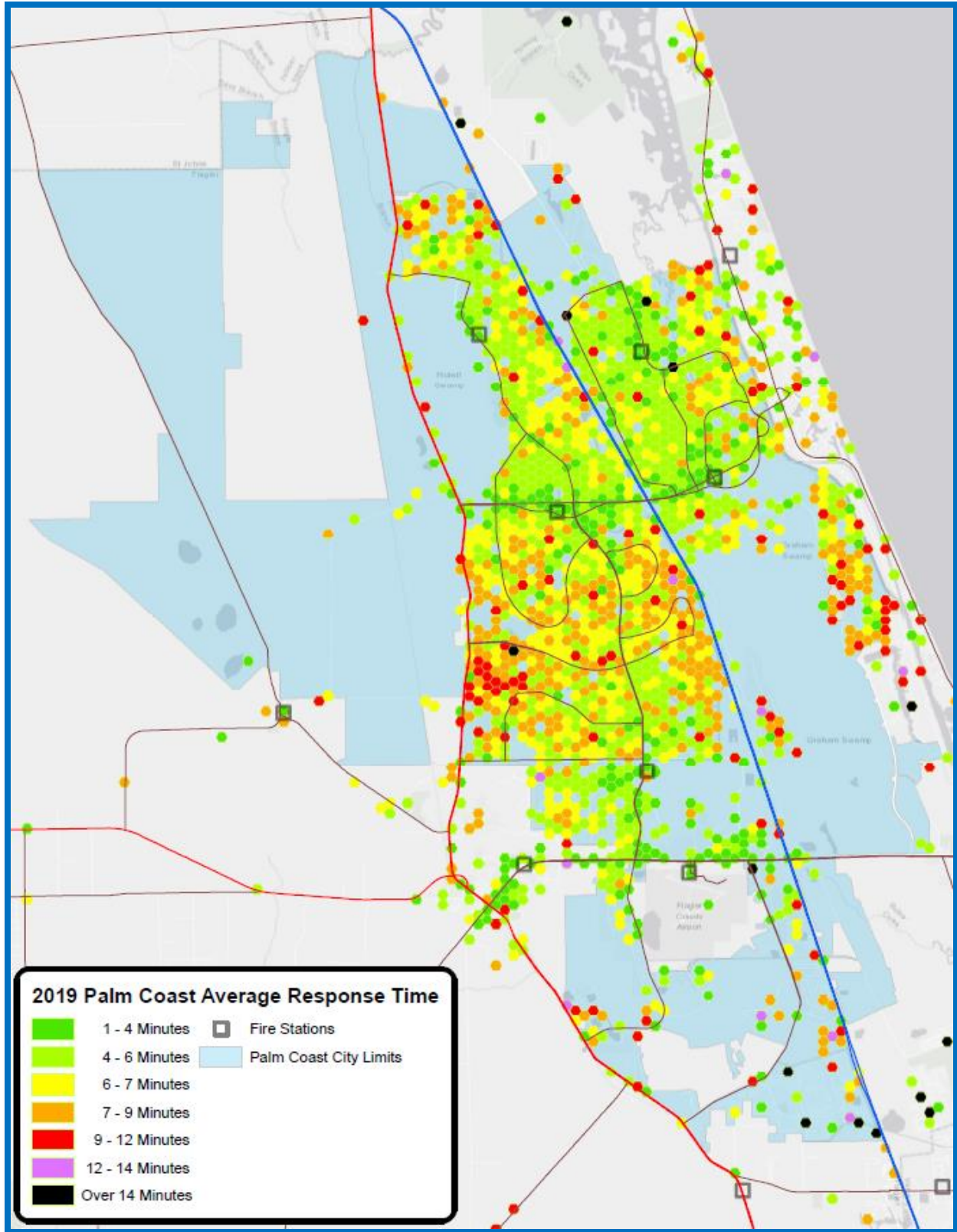


Figure 32: Average Response Times for Calls for Service 2019 by Geographical Area

Next, Figure 33 depicts the frequency of emergency incidents in 2019 in the area of City of Palm Coast South of State Road 100. Immediately following, Figure 34 demonstrates the response times for Flagler County Fire Rescue, which is calculated from the moment the call is announced by the 9-1-1 Communications Center (tones at the fire station) until the first unit arrives on scene of the reported emergency.

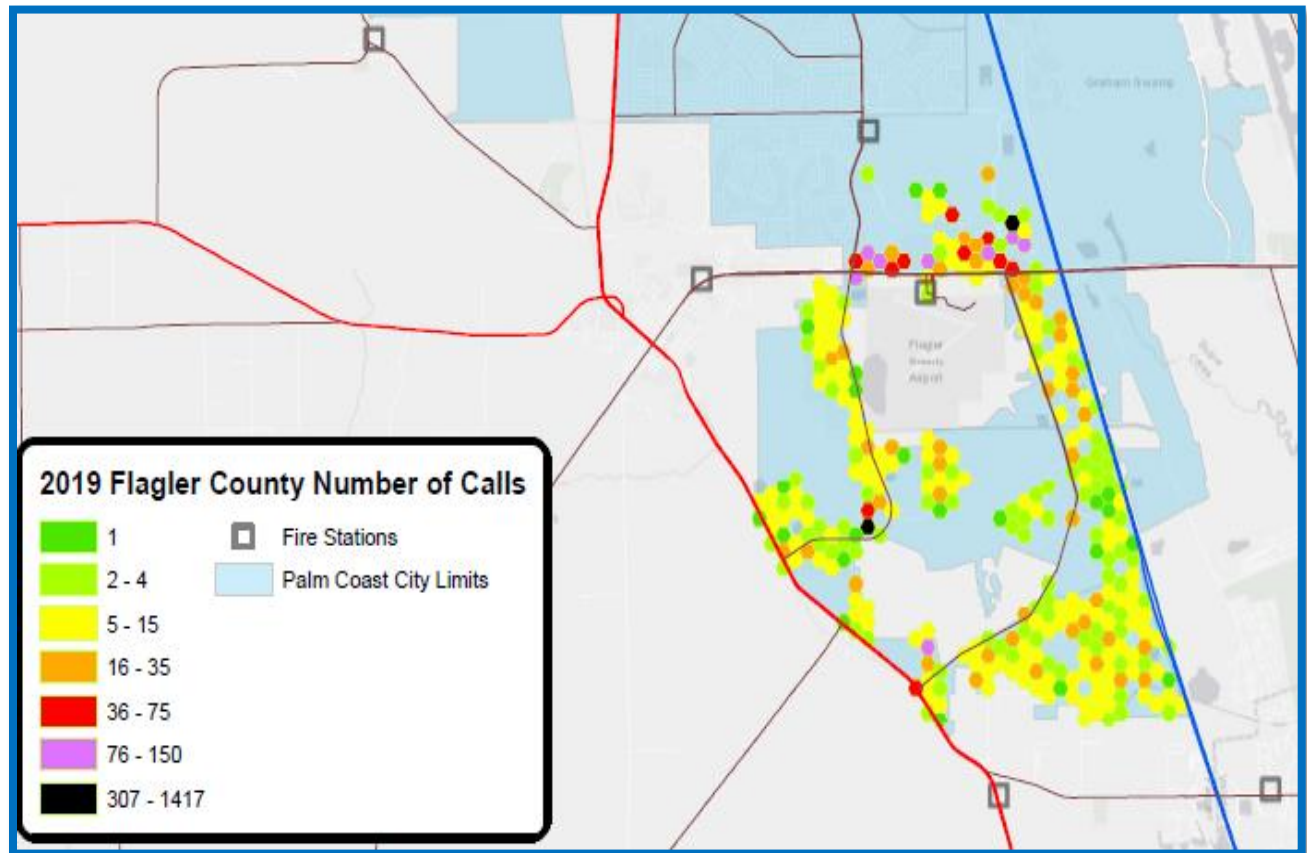


Figure 33: Frequency of Emergency Calls for Service 2019 by Geographical Area

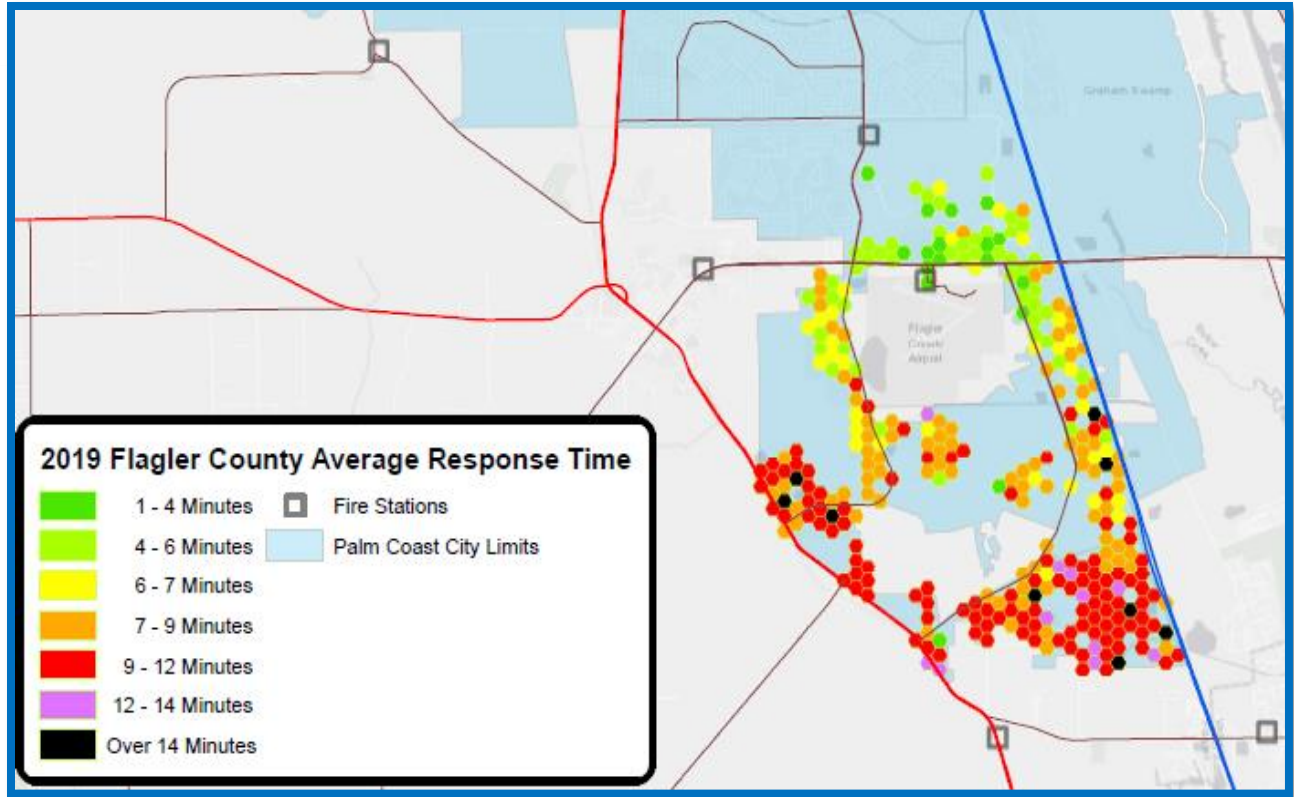


Figure 34: Average Response Times for Calls for Service 2019 by Geographical Area

Temporal Analysis

In addition to evaluating the types and frequency of emergency incidents that produce the service demand, the timing of these events is critical to understanding when service demand will most likely be at its greatest. Knowing when to predict high demand periods enables administrators to alter staffing plans to ensure staffing levels are sufficient, and aids in scheduling additional duties such as training, fire safety inspections, and vehicle maintenance.

Service Demand – Month of the Year

In Figure 35, the temporal analysis begins with an examination of service demand by month of the year. The service demand is slightly unique in the fact that the call volume is higher in December and January, as opposed to the summer months. Often, coastal communities see increases in tourism in the summer months, adding to service demand. But, the six-month period of late fall and winter months

(October-March) only account for 51% of the annual calls. The demands level out for the late spring and summer months (April-September), where the variation from month to month is the least of the year.

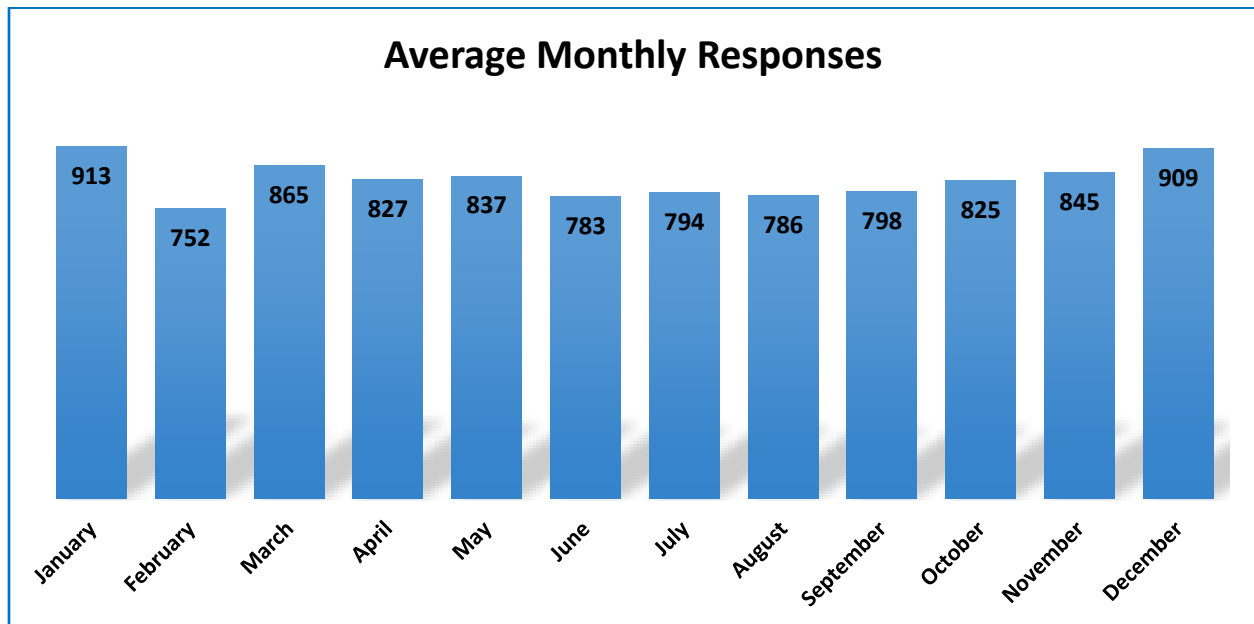


Figure 35: Service Demand by Month (2016-2018)

The busiest two months are December and January, and together they account for 18.3% of the annual calls, whereas the average would be 16.6% for two months of the year. The slowest month of the year actually includes four consecutive months, June to September, but these months are within 5% of the monthly average for the year.

According to University of Florida research, the population of Florida fluctuates by nearly 20% for “snow birds” escaping cold weather in the winter and escaping the heat of the Florida summer. Recognizing much of Florida experiences dynamism in seasonal population, the summer and winter population changes in Palm Coast appear to be within 5% variation. To determine the impact on the population fluctuation, Figure 36 depicts the average number of calls for service each day, per month.

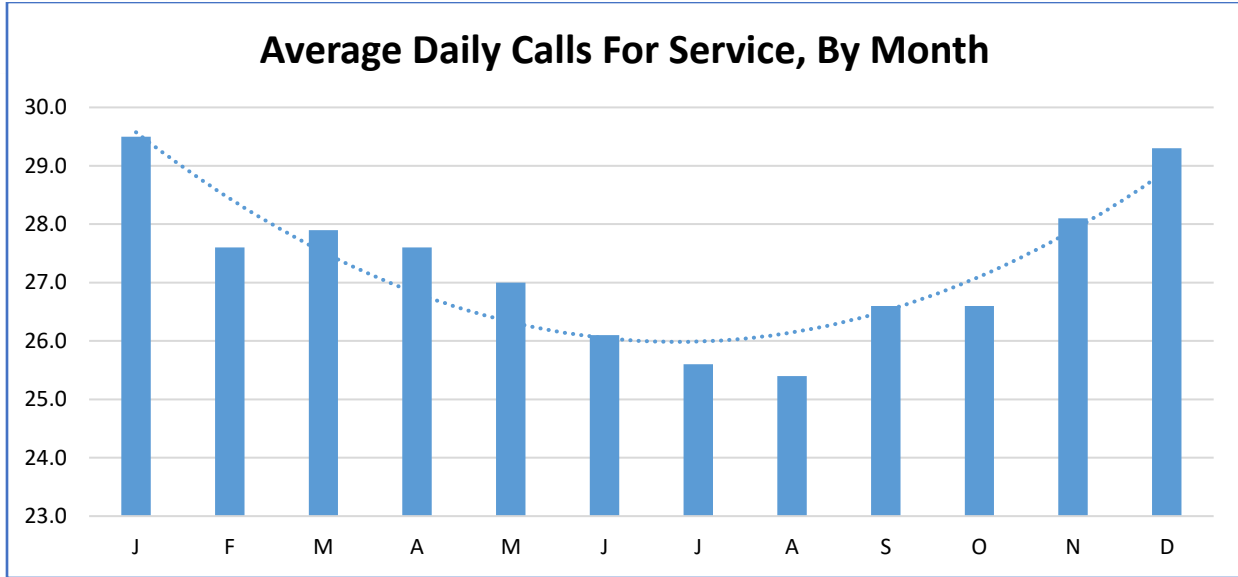


Figure 36: Average Daily Calls for Service, By Month

Service Demand - Day of the Week

Next in Figure 37, the temporal analysis continues with an examination of service demand by day of the week. In some areas, such as coastal communities and areas with large employment centers, populations fluctuate by the day of the week. When these significant fluctuations occur, often the emergency incident call volume fluctuates similarly.

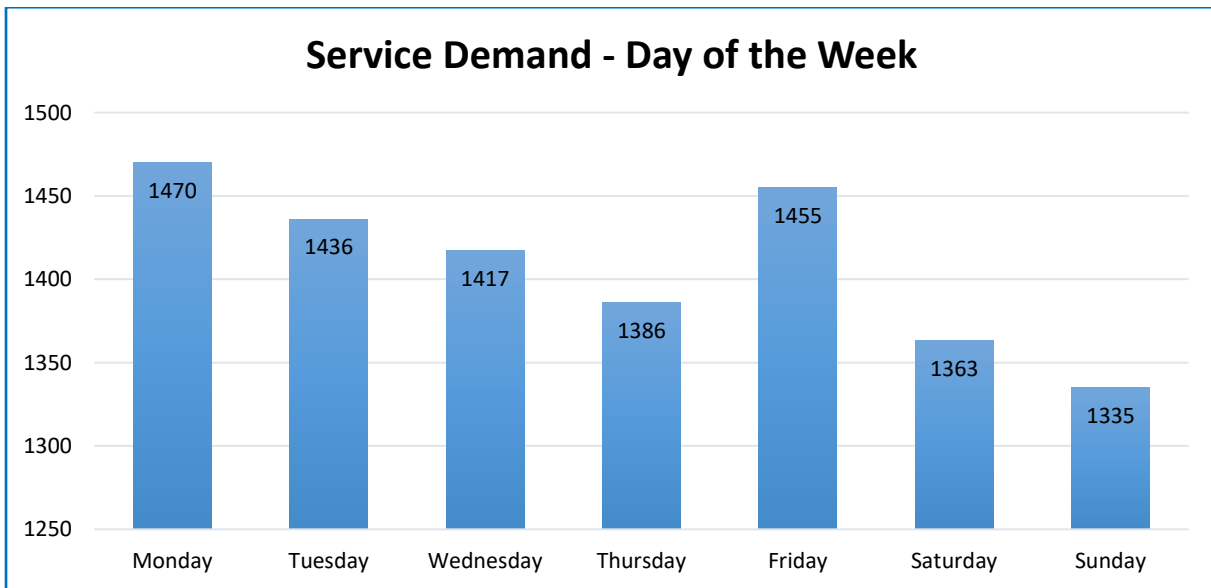


Figure 37: Service Demand by Day of Week (2016-2018)

In evaluating the annual emergency calls for service by their corresponding day of the week (averaged for three consecutive years) it is interesting to see the gap between the busiest day (Monday) and the slowest day (Sunday). The difference in the two days is approximately 3 calls per day, annualized. This is common, as most communities see an increase in incident volume during the workweek due to an increase in transient population, either due to retail or education opportunities, healthcare options, or simply the commercial workforce.

Service Demand - Hour of the Day

The final temporal analysis of service demand examines service demand by hour of day, averaged for the entire week. Data from these analyses are designed to identify trends, abnormalities, and baseline support for evidence derived.

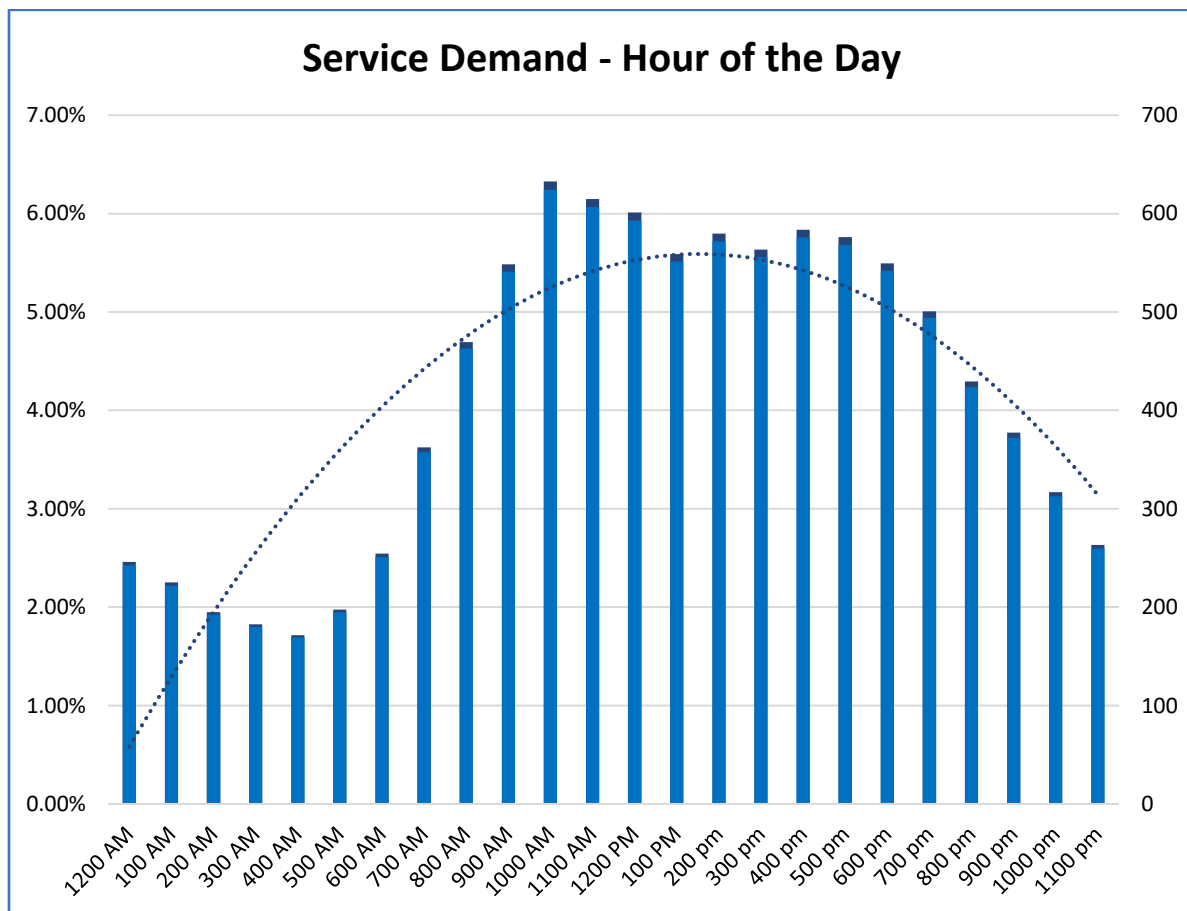


Figure 38: Service Demand by Hour of Day (2016-2018)

The analysis of service demand by hour of day is related to the activities within the community where demand for service is higher during regular working hours and declines during the nighttime and overnight hours.

As presented by the data in Figure 39, nearly fifty percent (50%) of the incidents occur between the eight-hour period of 10:00 AM and 5:00 PM. The busiest single hour (10:00 AM) and the busiest eight hours of the overall day are within this period. These consecutive hours of the day account for over one-half of the emergency incident responses of the entire 24-hour day.

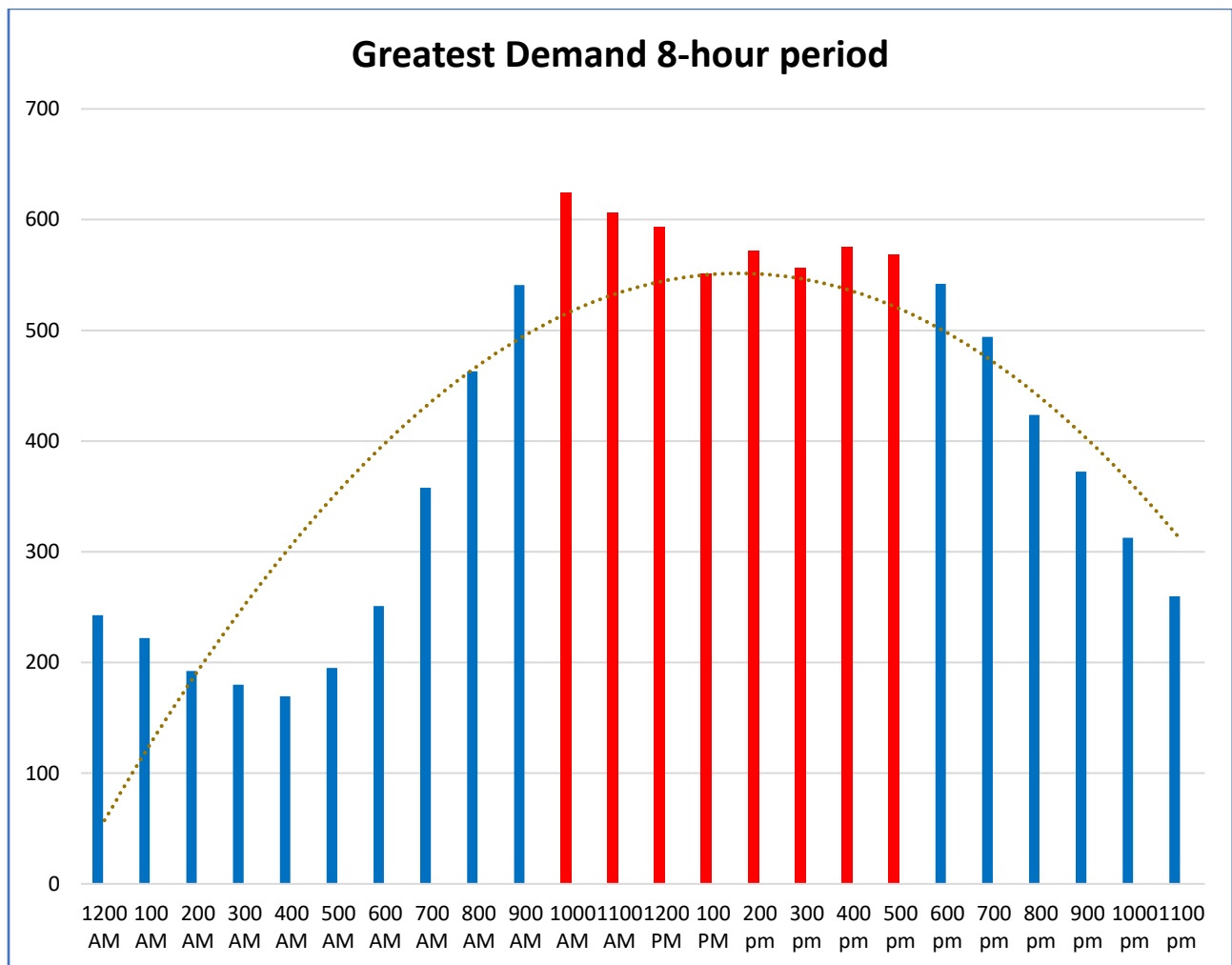


Figure 39: Greatest Service Demand by Hour of Day, 8-Hour Period

Finally, in Figure 40, the busiest service demand 12-hour period is the continuous hours of 8:00 AM to 8:00 PM where 72.08% of the overall emergency calls occur.

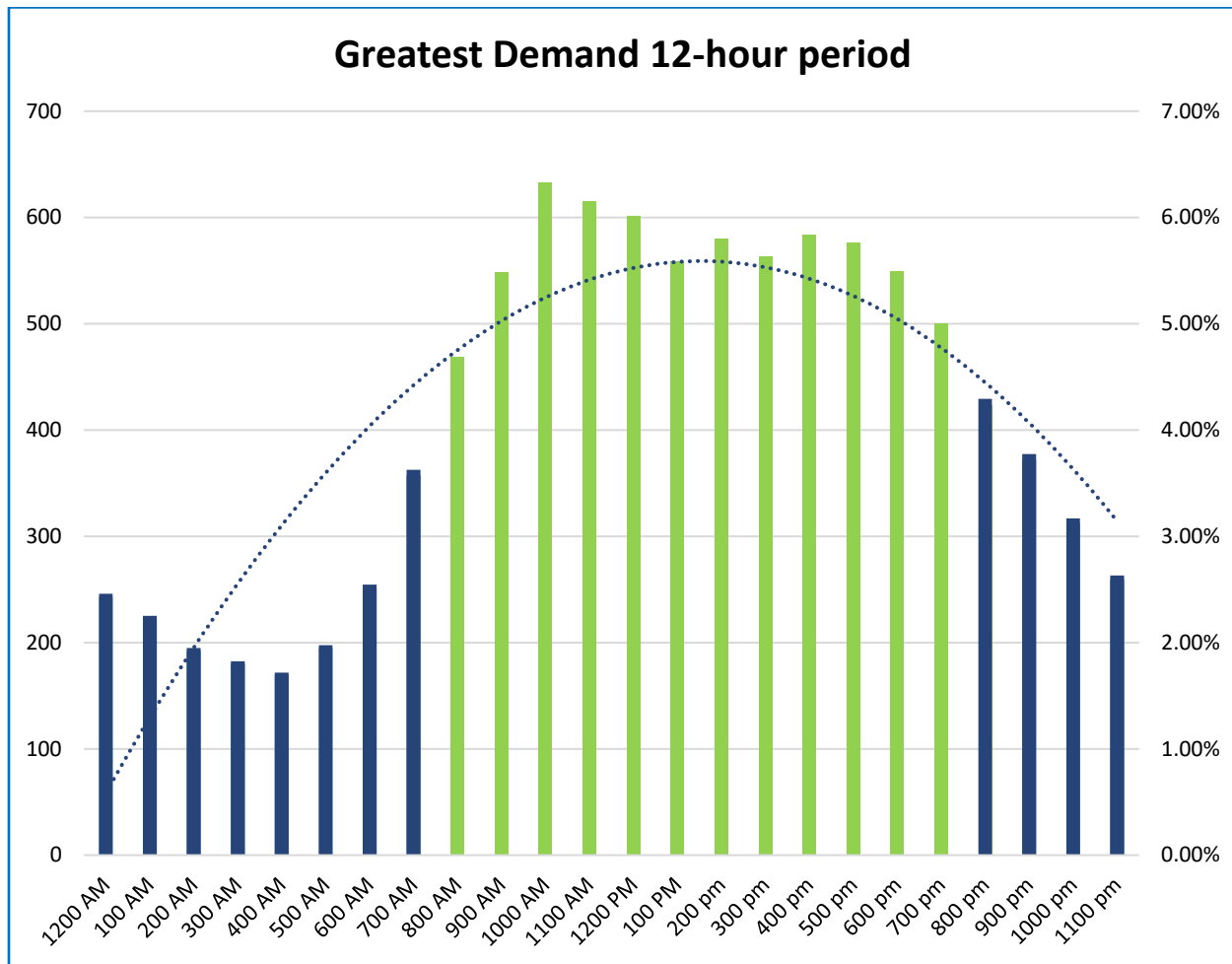


Figure 40: Greatest Service Demand by Hour of Day, 12-Hour Period

It is important to also note that while service demand is lower in the early morning hours, repeatedly fire statistics gathered by the United States Fire Administration show that residential fire fatalities occur most frequently late at night or in the early morning hours.

Service Demand to Population Ratio

In addition to population growth, the total number of emergency incidents increased since the department and City formed in December, 1999. Another analysis can be derived by determining the ratio of emergency calls of the overall population to see if the call volume is changing in proportion to the population growth, or if the population is using the services at a greater rate.

As depicted in Figure 41, the percentage of calls to population in 2000 was approximately 7%. The ratio continued to climb or fall gradually over 4 to 5 year periods, but the long-term trend shows overall growth in the percentage of emergency incidents to the City of Palm Coast population. By 2018, the percentage of calls to the overall population grew to 12%. Therefore, the population of Palm Coast grew (risk being managed), the total number of emergency incidents grew (demand for services), and the ratio of emergency incidents to population increased (consumption rate).

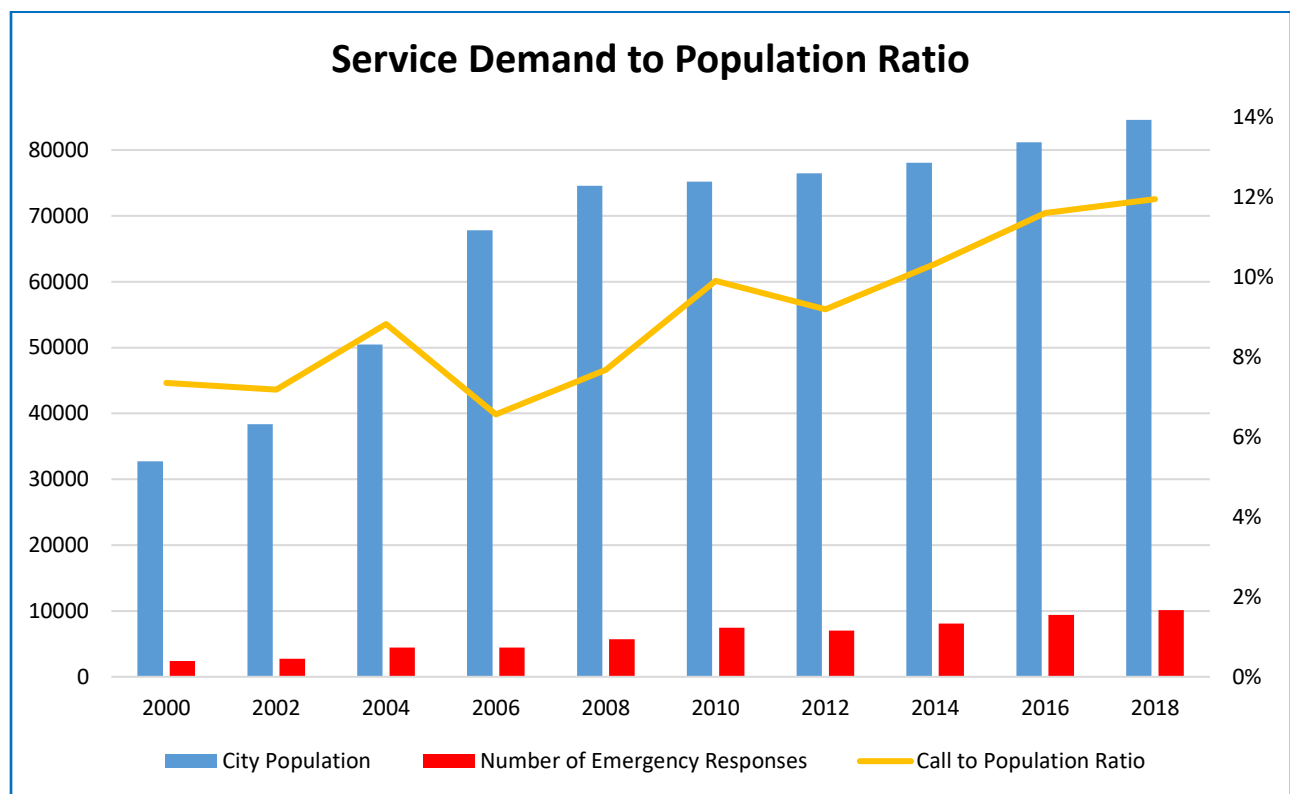


Figure 41: Service Demand to Population Ratio (2000-2016)

FUTURE SYSTEM DEMAND PROJECTIONS

The most important – and usually the most visible – element of operations for an emergency services organization is the ability to deliver service in a timely fashion. Before fire administrators can establish goals for efficiency and effectiveness of the organization, it is imperative to first establish an understanding of how the service is currently organized, deployed, and managed.

The analysis of service delivery and performance allows an organization to evaluate multiple facets of their system. This section evaluates the current and future service delivery elements as a coordinated approach to recommend improvements for what is predicted to occur.

Population Growth Projections

Palm Coast Fire Department has provided fire and emergency medical services to the citizens of Palm Coast since 1973. Over the years, the department experienced exponential growth in the number of citizens served, the area of coverage, number of fire stations, number of firefighters, and the complexity of emergency responses. Following careful and creative planning improved infrastructure, notwithstanding a great climate and proximity to the Atlantic Ocean, Palm Coast quickly grew to the 33rd largest city in the state of Florida.

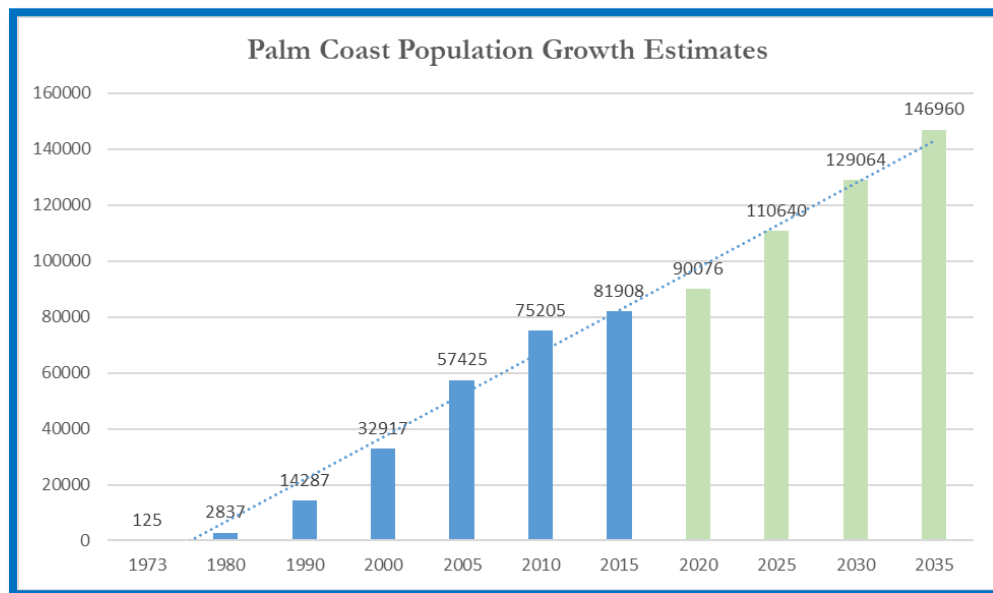


Figure 42: Population Growth Estimates

Service Demand Projections

City of Palm Coast Community Development Department prepares an annual report to summarize growth and development trends occurring in the City. These projections are designed to coordinate future growth with infrastructure needs and services. Community Development and fire department administrators work in concert to discuss growth and service needs, including the impact of proposed development on the existing service delivery system.

Building Permits

Residential construction permits in one of the indicators fire administrators use to predict growth in the number of service calls. As demonstrated earlier, growth in population and growth in the percentage of calls of the overall population have both caused the annual number of emergency incidents to increase. The number of annual residential building permits from 2013–2018 is depicted in Figure 43 and Figure 44.

	2013	2014	2015	2016	2017	2018
Single Family	263	339	355	538	630	715
Duplex	2	12	0	12	64	166
Multi-family	116	61	24	0	0	0
total	381	412	379	550	694	881

Figure 43: Residential Building Permits (2013-2018)

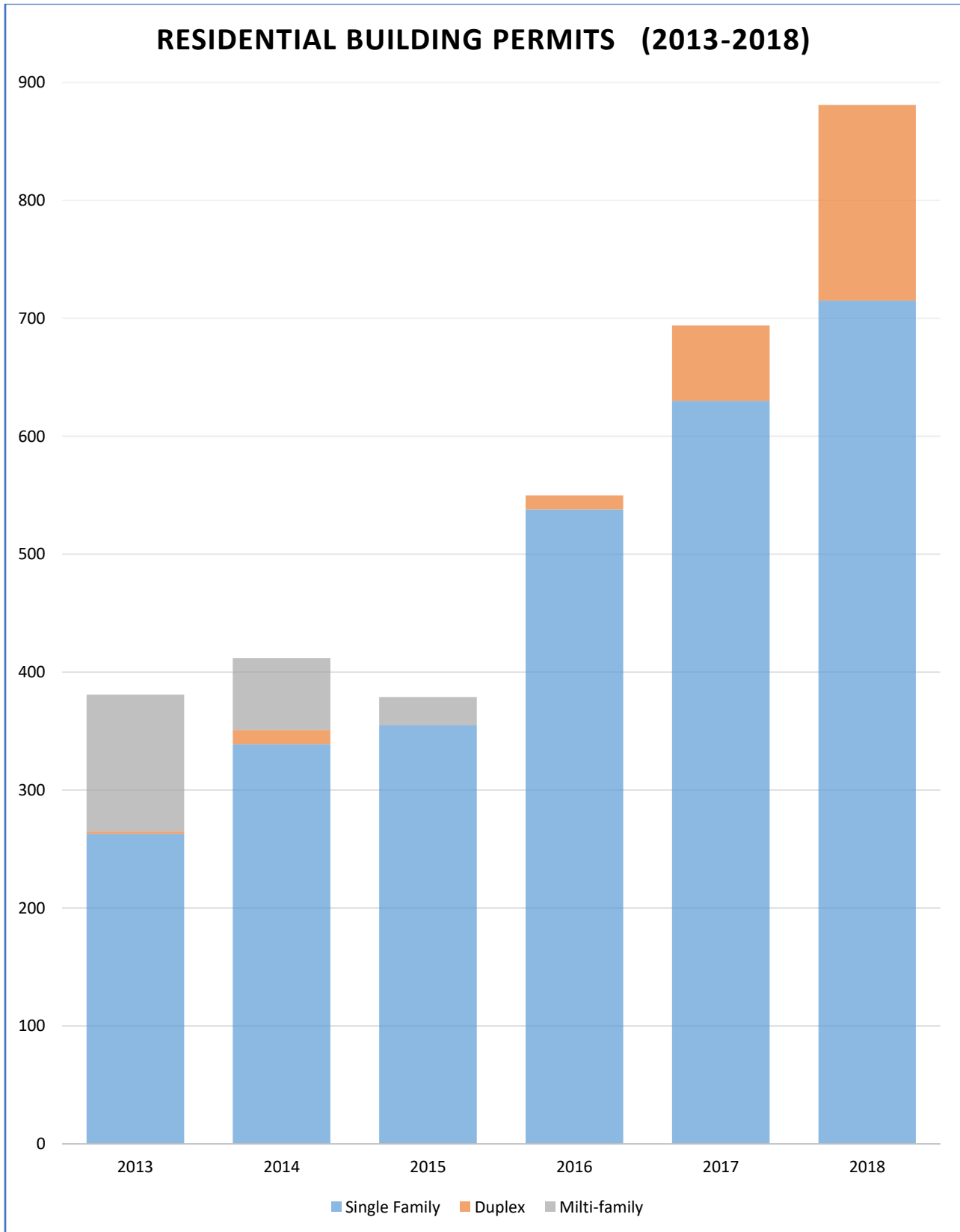


Figure 44: Residential Building Permits Issues (2013-2017)

The following map (Figure 45) identifies the concentration of building permits by location in Palm Coast for the year 2018.

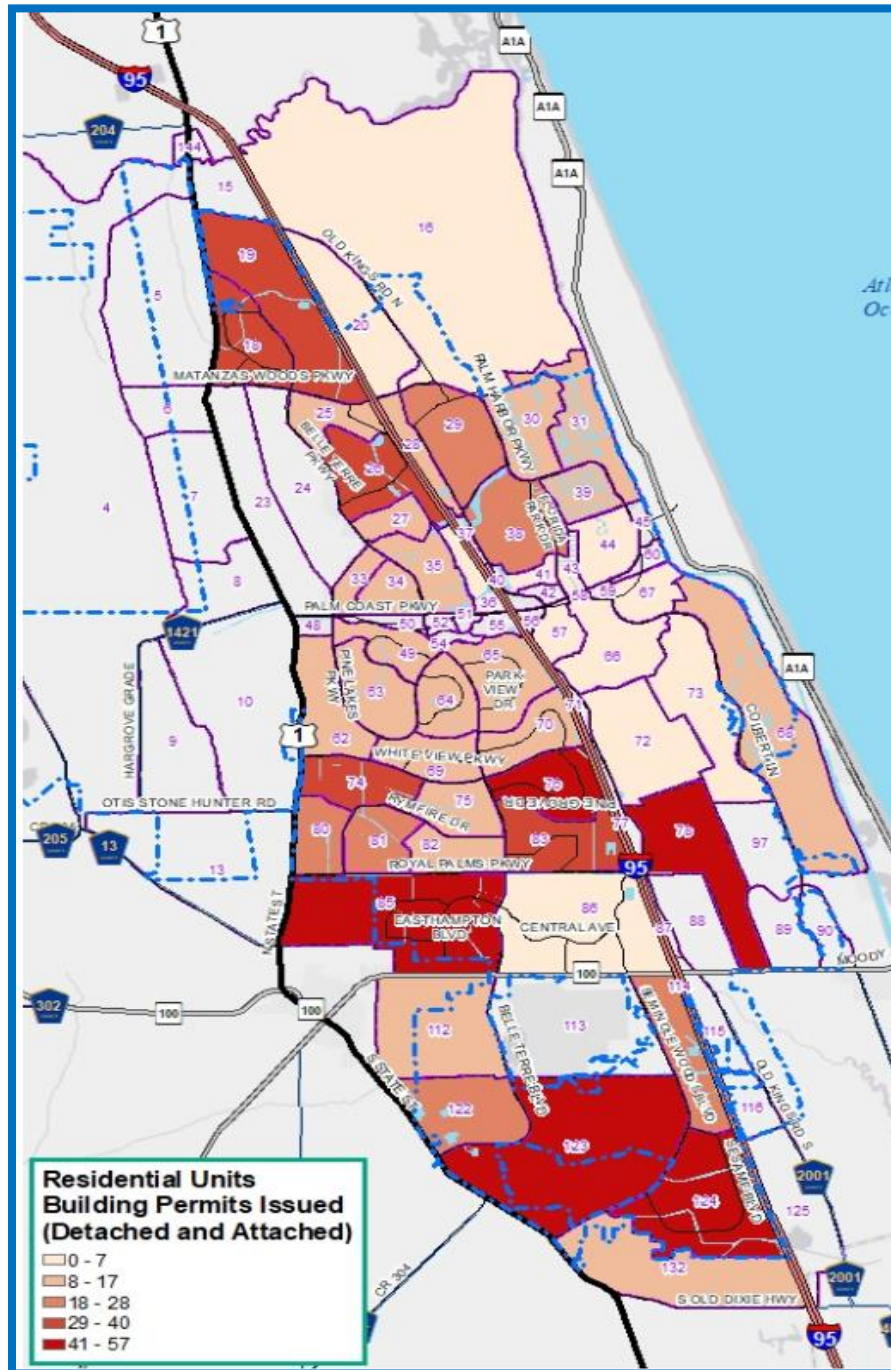


Figure 45: Residential Building Permits Map (2018)

Developments of Regional Impact

Six (6) major developments, or Developments of Regional Impact (DRI), are approved within the City and will contribute to the overall growth of the City over a long-term (up to 25 years). Figure 46 depicts the six (6) DRI areas in Palm Coast.

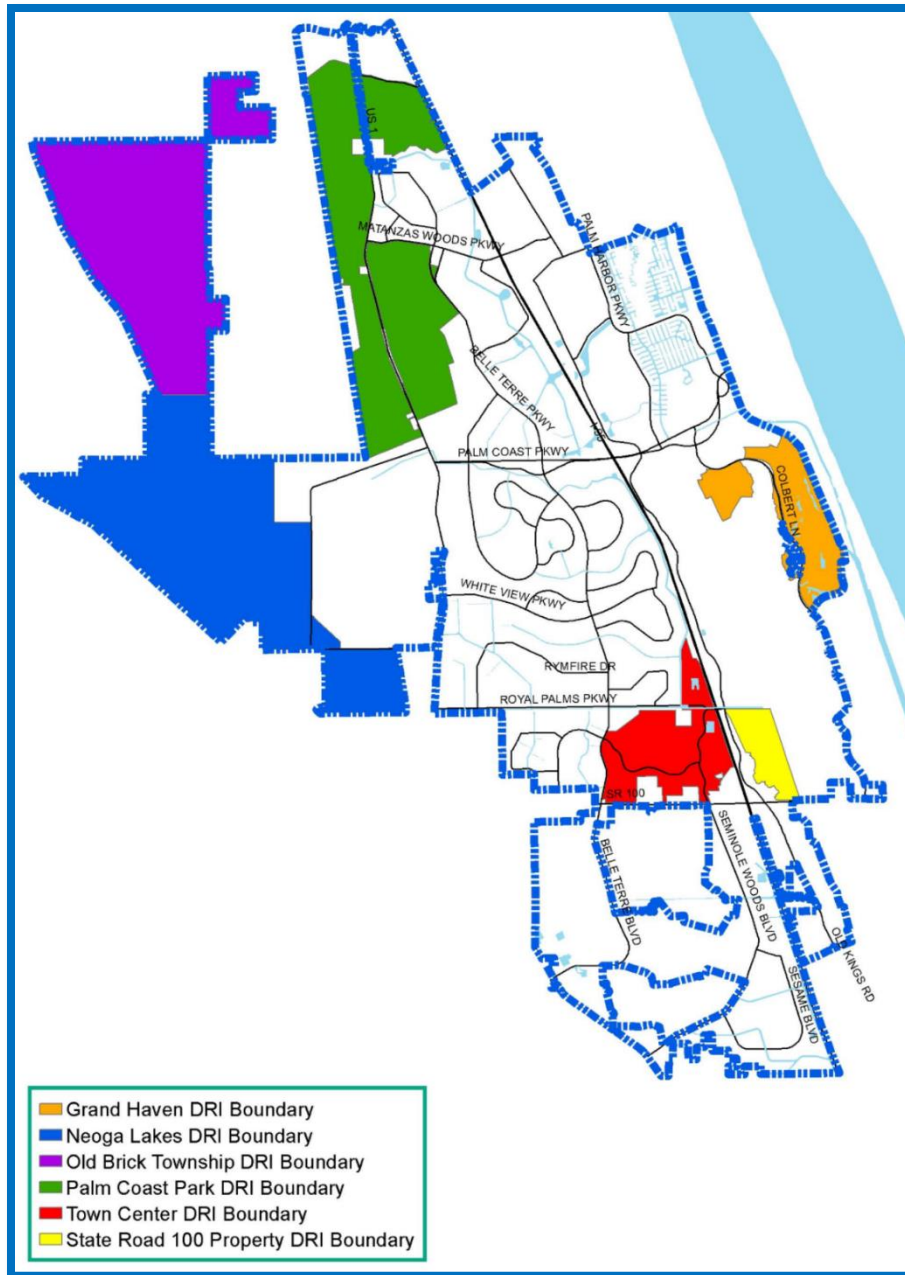


Figure 46: Major Development Location Map (2018)

Six (6) DRI areas are outlined in the Community Development Department Annual Report. One of the DRI areas – Grand Haven DRI - is substantially complete, and therefore not depicted in the following table (Figure 47).

	Max. # of Dwellings	Sq. Ft. of Office	Sq. Ft. of Commercial	Sq. Ft. of Industrial	Sq. Ft. of Institutional	Projected Buildout
Palm Coast Park DRI	4,960	800,000	1.31 million	80,000	100,000	2034
State Road 100 Property DRI	2,411	30,000	50,000			2015
Town Center DRI	2,500		4.8 million			2020
Neoga Lakes DRI	7,000	45,000	2.49 million			2030
Old Brick Township DRI	5,000	50,000	100,000	1,000,000		2031

Figure 47: Major Developments in Palm Coast

Existing Vacant Residential Lots

The City of Palm Coast maintains a database of existing vacant lots for planning purposes. As of the end of 2018, the inventory of vacant residential lots was 16,545. The number of existing vacant lots represents future potential growth in the City for an extended period, up to twenty (20) years.

In Figure 48, the Existing Vacant Residential Lots, depicted according to the corresponding traffic analysis zone (TAZ) is presented. Following, in Figure 49, is a map of the TAZ and a color code scheme for the available residential lots, as of the end of 2018.

TAZ	Total Lots	Vacant Lots	Percentage Vacant	TAZ	Total Lots	Vacant Lots	Percentage Vacant
16	354	302	85.31%	65	1694	518	30.58%
18	1039	429	41.29%	66	577	57	9.88%
19	1407	614	43.64%	67	33	3	9.09%
20	22	21	95.45%	68	2320	90	3.88%
25	859	304	35.39%	69	1291	444	34.39%
26	2029	663	32.68%	70	1543	583	37.78%
27	774	199	25.71%	72	78	75	96.15%
28	236	122	51.69%	73	183	20	10.93%
29	1875	690	36.80%	74	1708	606	35.48%
30	1032	214	20.74%	75	1441	520	36.09%
31	1449	277	19.12%	76	2016	830	41.17%
33	601	155	25.79%	78	503	211	41.95%
34	786	179	22.77%	80	888	344	38.74%
35	1309	241	18.41%	81	1117	417	37.33%
36	467	162	34.69%	82	1242	454	36.55%
38	2309	439	19.01%	83	1752	788	44.98%
39	959	129	13.45%	85	2511	579	23.06%
41	362	6	1.66%	86	9	0	0.00%
43	321	21	6.54%	112	730	282	38.63%
44	967	11	1.14%	114	1301	779	59.88%
49	977	153	15.66%	122	736	303	41.17%
57	424	4	0.94%	123	1202	602	50.08%
62	1172	254	21.67%	124	3156	1890	59.89%
63	1493	198	13.26%	132	486	157	32.30%
64	1177	206	17.50%	Total	52,917	16,545	31.27%

Figure 48: Existing Vacant Residential Lots, by TAZ (2018)

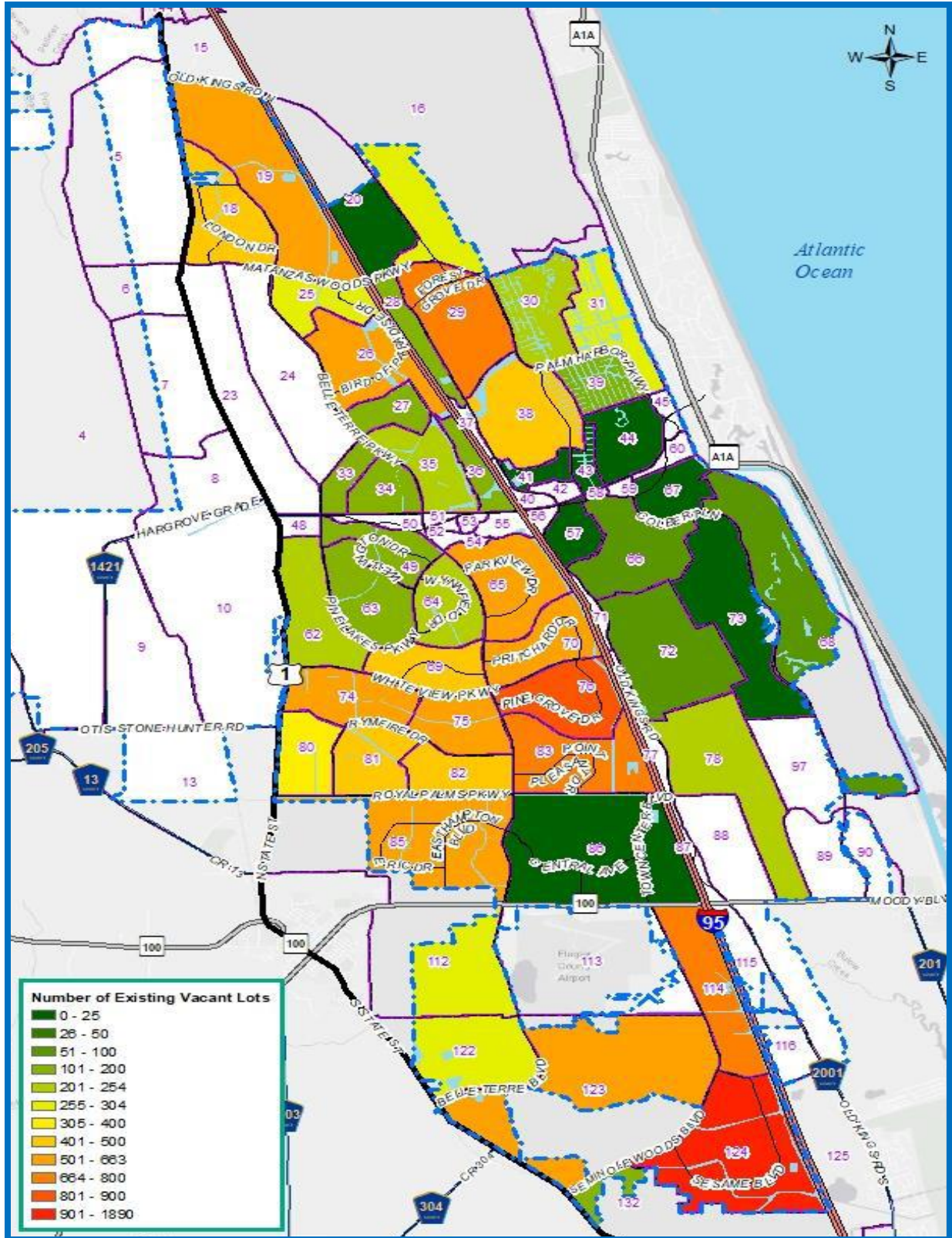


Figure 49: Existing Vacant Residential Lots Map (2018)

Community Risk Analysis

The risks to people and property within a community are unique, at least compared to other communities. Although similarities may exist, government and service organizations should tailor their service delivery to meet the risks inherent in the community they protect. Risks inherent to Palm Coast are discussed and evaluated in order to succinctly identify potential impacts and to assist in planning improved service delivery effectiveness. The following section identifies community risks as a foundation for a community risk analysis.

Demographics (people at risk)

Risk assessment involves evaluating hazards in terms of the likelihood that a problem may occur and the damage it might cause. Risk assessment includes information about the people who are impacted by, or a part of, the problem being measured. Risk for people is influenced, and often magnified by other issues, including age, socioeconomic issues, language barriers, health or preparation, and so forth.

Developing a community demographic profile with accurate statistical data of its population provides insight into extenuating circumstances affecting the community. Causal factors and at-risk populations must be evaluated with consideration of the following:

- Identification of risk factors in specific populations
 - Children (age 5 & under)
 - Older adults (age 65 & older)
 - People with disabilities
 - People living in poverty
 - Populations that speak little or no English
- Social factors and cultural influences
- Economic factors
- Environmental elements

Palm Coast has a significant population that are both under 18 and over 65, two key age groups for the risks managed by fire services. The estimated number of citizens under 18 is 15,820, or 19.2% of the total population. The number of citizens 65 or over is 22,266, or 27.0% of the overall population. On the risk factor of age alone, 46.2% of the population are considered most at risk.

The race breakdown in Palm Coast is 82.2% White, 13.2% Black/African American, and 11.3% Hispanic or Latino. The population that speaks a primary language other than English is 16.5%. The two major language groups are Spanish at 7.6% and Indo-European at 6.8%.

Other risk factors include economic condition. The proximity of the city between the large metropolitan areas of Jacksonville and Orlando advanced to a rapid shift in demographics. Population growth transformed a rural community into an area filled with new housing subdivisions. Over 92% of the population have a high school degree or higher. The poverty rate is 13.4% as compared to 12.9% in the United States. The median household income \$51,208 and the mean income is \$61,044. The State of Florida median household income of \$50,883 annually. Typically, those who struggle economically rely more heavily on emergency services than those who afford preventative healthcare and professional household repairs.

There are 35,645 housing units in Palm Coast, with an estimated mean home value of \$181,400 as compared to \$225,300 in the United States. Over 97% of the homes are heated with electricity, and over 75.4% are occupied by the owner of the property. Most homes, estimated at 45.2%, are occupied by 2 people. Lastly, the occupancy rate of the housing market is estimated at 83.4%, with a vacancy rate of 16.6%. Just over 50% of the homes were built after the year 2000, a time when widespread smoke detector rules became part of the design specifications.

Coastal Flood Risk

Along the coast, storm surge is often the greatest threat to life and property from a hurricane. In the past, large death tolls have resulted from the rise of the ocean associated with many of the major hurricanes that have made landfall. Hurricane Katrina (2005) is a prime example of the damage and devastation that can be caused by surge. At least 1,500 persons lost their lives during Katrina and many of those deaths occurred directly, or indirectly, as a result of storm surge.

Most people in the City of Palm Coast do not need to evacuate during a hurricane. Citizens who live in coastal evacuation areas, require electricity for medical purposes, or live in mobile homes are asked to evacuate ahead of a storm event before emergency responses become too dangerous for emergency responders. Evacuation orders will be issued for storm surge areas by the coastal flood evacuation zones depicted in Figure 50.

In addition to coastal flooding, after a hurricane or tropical storm, especially one that generates lots of rain, it may be necessary to evacuate areas around streams, creeks, freshwater canals and drainage retention areas. Citizens are encouraged to be prepared to changing conditions during storms.

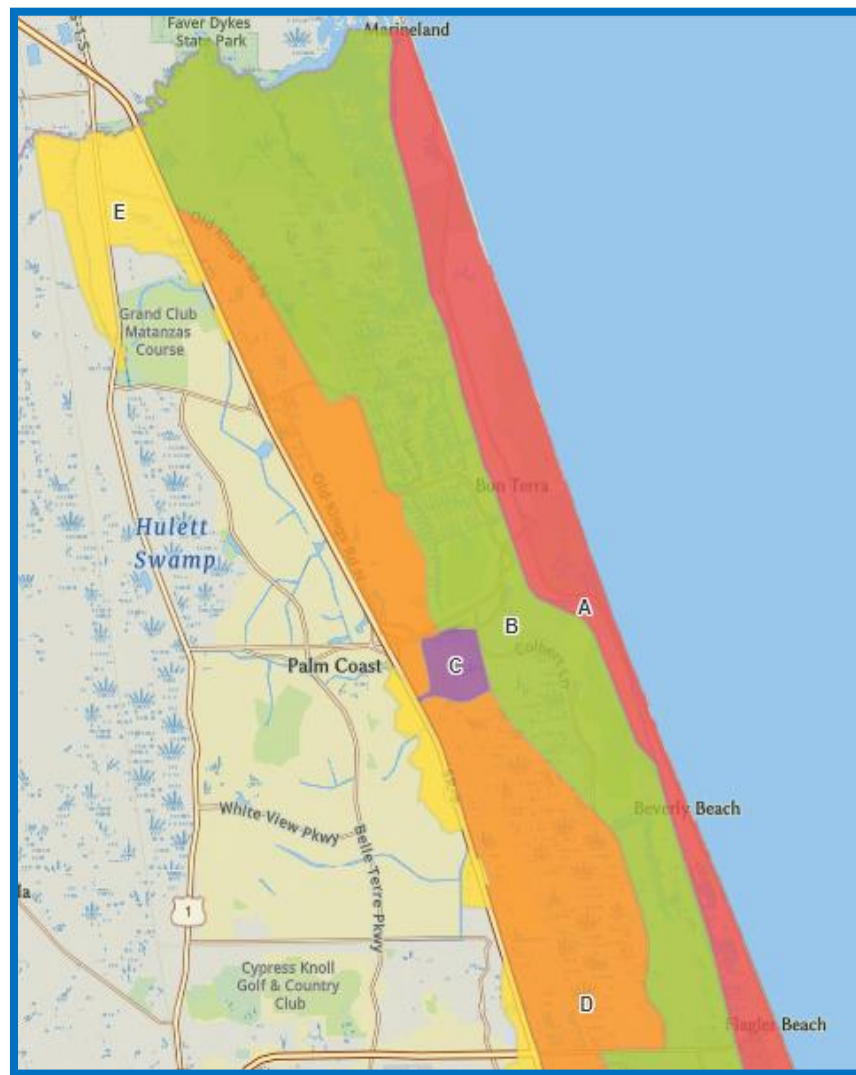


Figure 50: Palm Coast Coastal Flood Evacuation Zones

FIRE STATION LOCATION ANALYSIS

The *Fire Station Development Methodology* report was created for two predominant purposes: to evaluate the current conditions and to establish a methodology for future analyses for fire facility expansion. Prior to spending invaluable public funds, careful consideration should be taken to evaluate the prospect by considering current effectiveness and impending demand.

There is no one best measure to predict the appropriate time to add facilities, especially when considering the perennial costs associated with around-the-clock fire protection. This report was designed in a progression of:

- *Expectations*: present various methodologies that drive fire service performance
- *Data Analysis*: evaluate response data to identify gaps between expected and actual
- *Forecast*: evaluate expected growth, increased demand, or future challenges
- *Conclude*: develop significant findings

In completing the review of the fire station location analysis, information from these sections incorporated into geographic information system (GIS) maps provides the clearest picture of current successes in the response methodologies, as well as gaps in performance expectations. When these analyses are coupled with future growth predictions, platted developments, and areas subject to annexation, the result provides the most succinct information possible for planning for future service delivery models and locations.

In the future, these data can be updated in order to determine response time goals, and likewise can be compared to growth in service area, in-fill development, and any development that significantly impact the response availability and arrival efficiency for the fire department.

Current Response Goals and Performance

For comparison, the predicted effectiveness of several industry models and the actual response times for emergencies were applied to the City of Palm Coast maps. The methodologies used in the fire service for predicting response coverage from occupied fire station are:

- Palm Coast City Council: 7-minute response time, 85% of the time
- ISO: 1.5-mile fire engine response
- NFPA: 4-minute initial arrival, and 8-minute back-up response
- Population served: rate of growth in population compared to service calls

The results from actual emergency responses were depicted as a heat map, first showing the frequency of calls, and finally the times for responding to the incidents in the area. From these analyses, two areas of concern on the map of the City were determined that deserve additional discussion and evaluation: Whiteview Parkway and south of State Road 100.

Whiteview Parkway

Whiteview Parkway runs from US 1 to the west and east through the City of Palm Coast to Prichard Drive. The road sits within the city limits for its entirety and lies between fire stations #21 and #25 as nearly a boundary to the traditional fire station response district. As noted in Figures 51 and 52, both ends of Whiteview Parkway are at the outer edge (boundary) of the City Council performance goal of 7 minutes response time, 85% of the time.

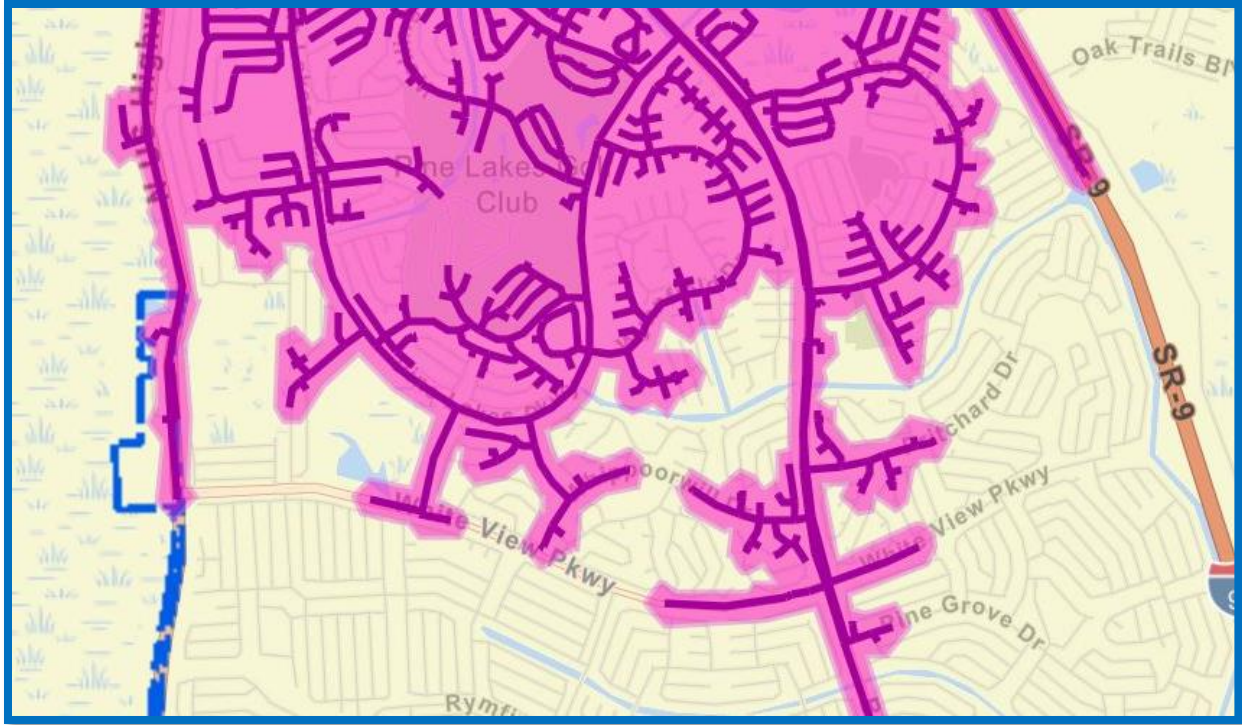


Figure 51: City Council Performance Goal, from Fire Station #21

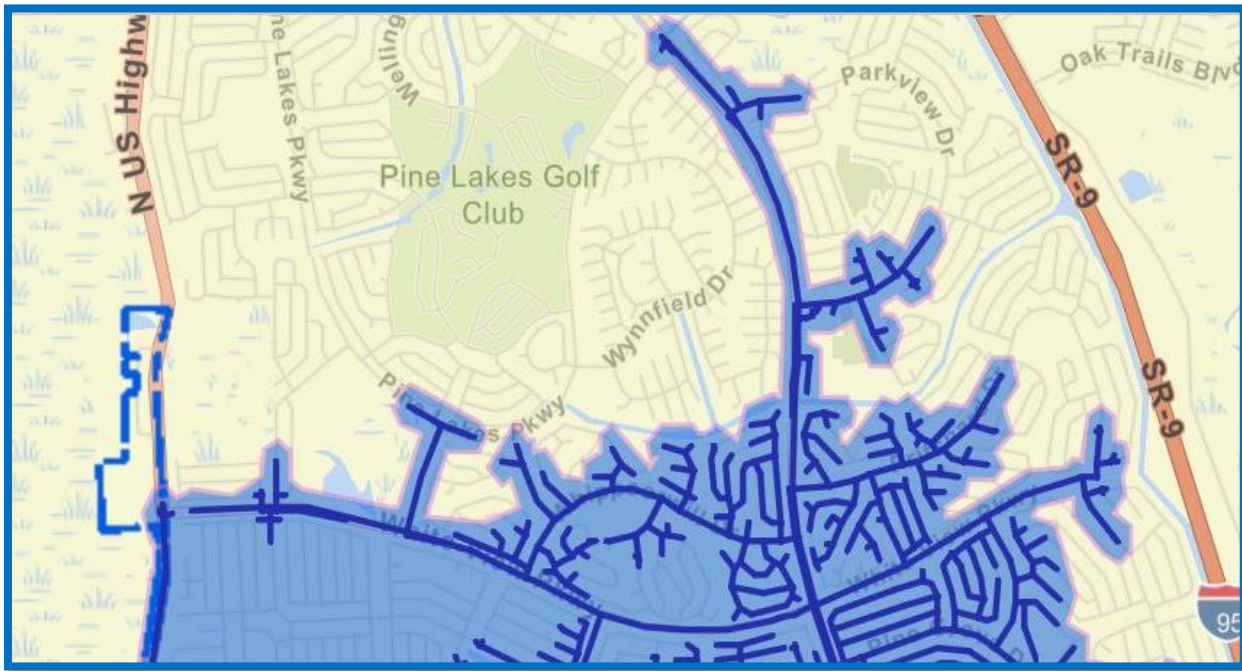


Figure 52: City Council Performance Goal, from Fire Station #25

Also, when applying the National Fire Protection Association (NFPA) Standard 1710 performance goals, Whiteview Parkway sits largely between the coverage of both fire station #21 and #25, as depicted in Figures 53 and 54.

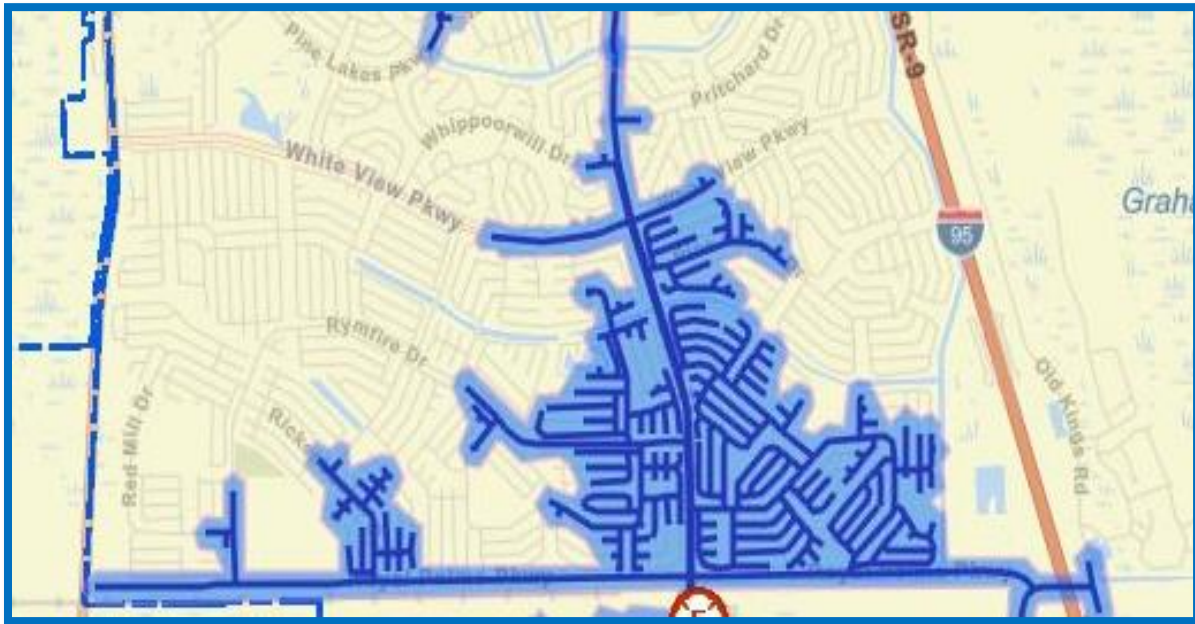


Figure 53: NFPA 4-Minute Initial Response, Fire Station #25



Figure 54: NFPA 8-Minute Response, Fire Stations #21 and #25

In addition to evaluating response time prediction models, such as Palm Coast City Council 7-minute Response NFPA 1710, the actual response time data for the Whiteview Parkway corridor reveals that the responses along the eastern and western segments are outside the City Council performance measure of 7 minutes, 85% of the time, as depicted in Figure 55.



Figure 55: Whiteview Parkway Corridor Response Times

The first step to emergency preparedness is defining and analyzing hazards. Response times, population growth, percentage of the population utilizing services, population demographics, and other related analyses provide insight into the risks that are managed by the service delivery model. The risk grows as the area develops, the service area expands through annexation, and as the demographics change to include more or less people at risk.

According to data from the City of Palm Coast Community Development Department, presented in Figure 56, the area along Whiteview Parkway will continue to grow, evidenced by the remaining developable lot inventory in the area's traffic assessment zones (TAZ):

TAZ	Remaining Lots
62	254
63	198 (one-half)
69	444
74	606
80	344
81	417
Total	2,164

Figure 56: Residential Developable Lots along Whiteview Parkway Corridor

Lastly, in reviewing the inventory of developments of regional impact (DRI) in the City of Palm Coast, there are no DRI projects along the Whiteview Parkway corridor. Development in and along the Whiteview Parkway corridor will occur as infill on the remaining lot inventory. Growth in the region adjacent to Whiteview Parkway will occur to the west along the US 1 corridor through new development proposals and future annexation growth.

South of State Road 100

Flagler County Fire Rescue (FCFR) responds as the first arriving fire apparatus to the area of the city limits south of State Road 100 (SR 100). Although the working relationship is outstanding, geographic travel distance and the obligation to protect areas not in the city limits produces results worthy of further discussion and evaluation.

In Figure 57, the City Council performance goal of 7-minute response time (6-minutes of driving), 85% of the time is presented for PCFD fire station #25, and FCFR fire station #92. These two fire stations are geographically closest to the city limits south of SR 100. As depicted in Figure 57, a large area of city limits is outside the predictions for the City Council performance goal of a 7-minute response time.

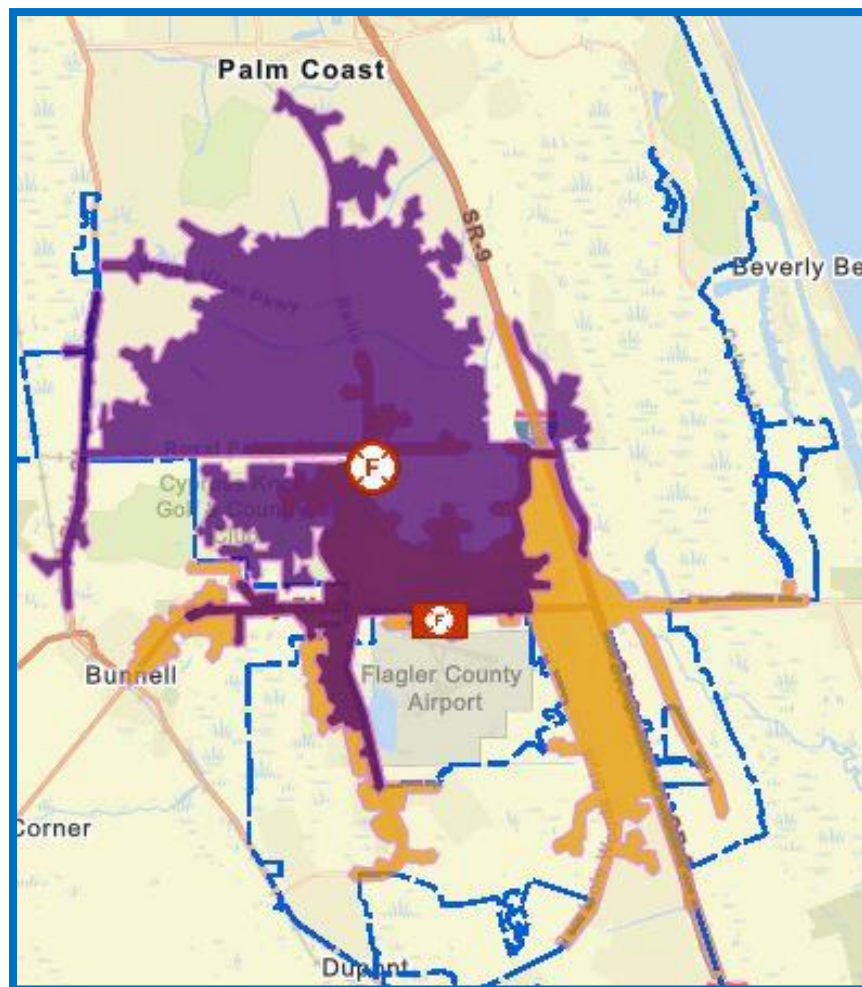


Figure 57: City Council Performance Goals from Fire Station #25 and #92

Also, when applying the National Fire Protection Association (NFPA) Standard 1710 performance goals, the city limits south of SR 100 is a greater distance than the industry performance standard, as depicted in Figures 58 and 59.

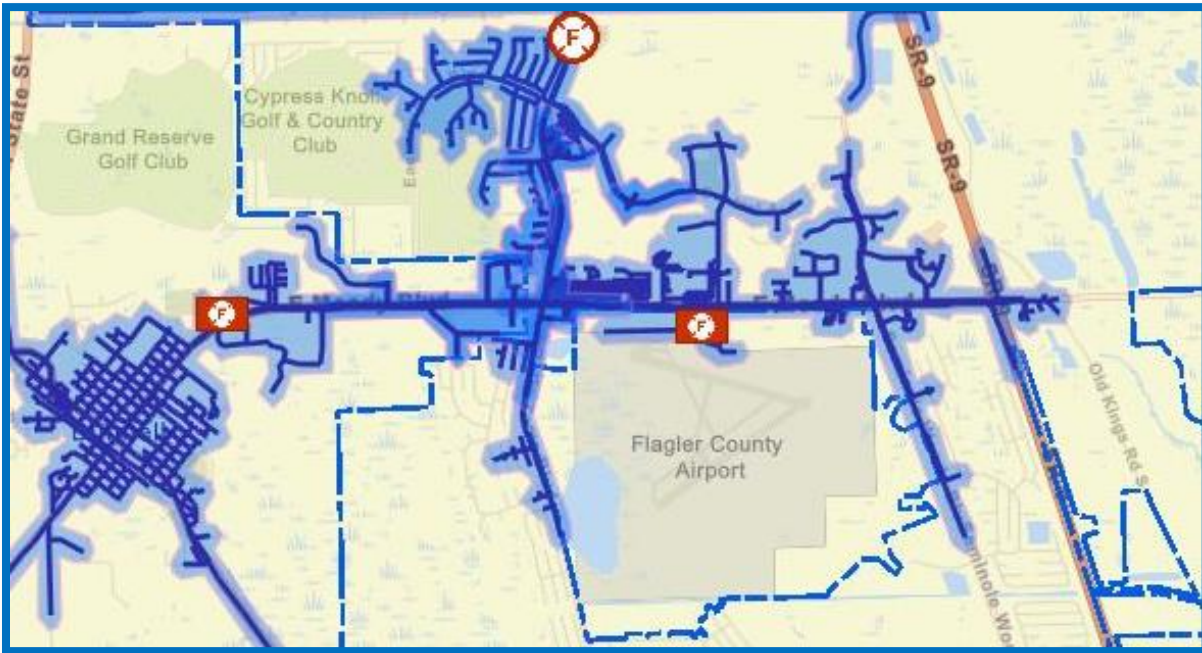


Figure 58: NFPA 4-Minute Initial Response, FCFR Station #92

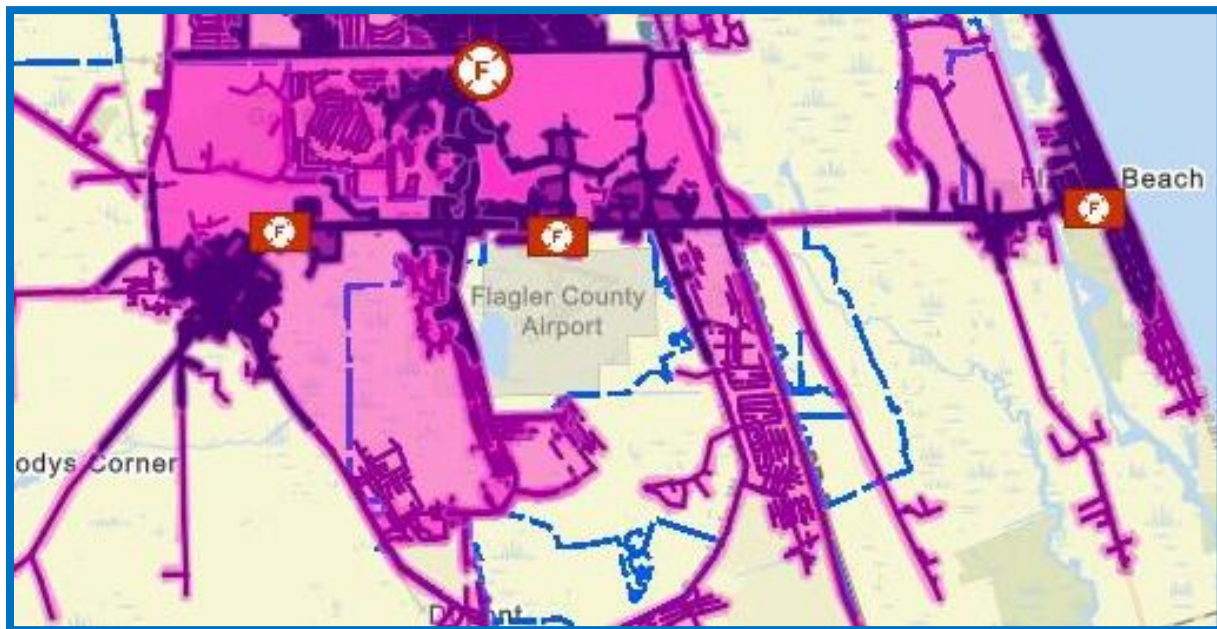


Figure 59: NFPA 8-Minute Initial Response, Fire Stations #25 and #92

In addition to evaluating response time prediction models, such as Palm Coast City Council 7-minute Response and NFPA 1710, the actual response time data for the city limits south of SR 100 reveals that the responses south on Belle Terre Parkway and Seminole Parkway are outside the City Council performance measure of 7 minutes, 85% of the time, as depicted in Figure 60.

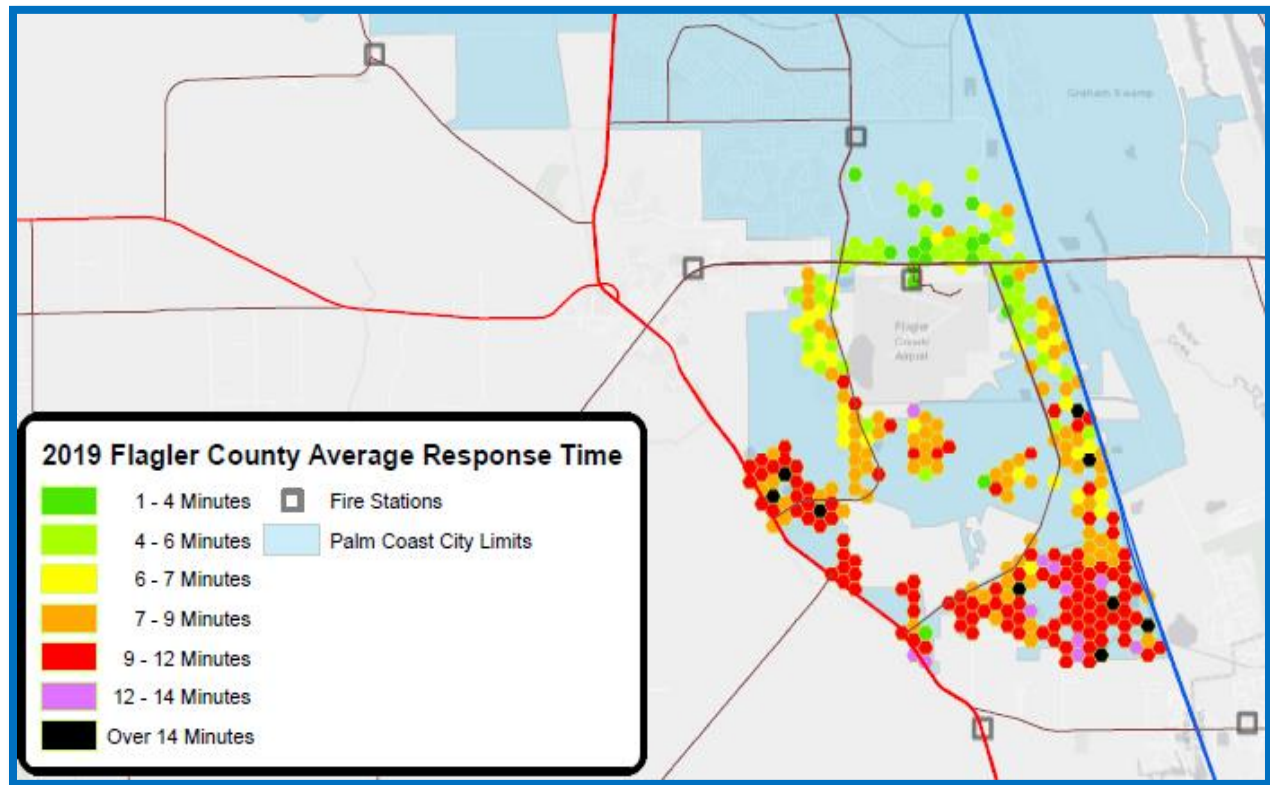


Figure 60: South of SR 100 Response Times

In order to understand the full magnitude of the impact of the geographical distance to the south end of the city limits, it is important to examine the service demand (frequency). Both Flagler County Fire Rescue (FCFR) and Palm Coast Fire Department (PCFD) reference response zones when completing incident reports following each emergency response. A review of the response zone data for the city limits south of SR 100 provided the information for Figure 61, which is a total of the number of emergency incidents in the areas accessible Seminole Woods (to the east) and in Figure 62, areas accessible from Belle Terre (to the west).

<i>Seminole Woods</i>	2016	2017	2018
92J	578	693	554
31A	44	39	32
31C	128	158	162
31M	69	55	59
31G	8	9	10
Total	827	954	817
<i>3-year average</i>	866		

Figure 61: South Seminole Woods Service Demand Totals

<i>Belle Terre Blvd.</i>	2016	2017	2018
25J	74	86	93
25K	54	57	72
31B	225	162	185
31L	8	14	13
62T	15	15	19
Total	376	334	382
<i>3-year average</i>	364		

Figure 62: South Belle Terre Service Demand Totals

Next, it is important to determine if the risk will remain constant, or if there are plans to expand through growth or in-fill development. According to data from City of Palm Coast Community Development Department, presented in Figure 61, the area south of SR 100 will continue to grow, evidenced by the remaining developable lot inventory in the area's traffic assessment zones (TAZ). In fact, the vacant residential lots in this area account for 4,013 of the total inventory of 16,545, or 24.3% of the total in the City of Palm Coast.

TAZ	Remaining Lots
114	779
123	602
124	1,890
112	282
122	303
132	157
Total	4,013

Figure 63: Residential Developable Lots South of SR 100

Lastly, in reviewing the inventory of developments of regional impact (DRI) in the City of Palm Coast, there are no DRI projects south of SR 100. Development in the city limits south of SR 100 will occur as infill on the remaining lot inventory. Growth in the region adjacent to Belle Terre Parkway will occur through new development proposals and future annexation growth.

RECOMMENDATIONS

System Recommendations

Projections show that Palm Coast's third decade will not end the changing dynamic that has marked the young city's early history. City officials and fire department administration are committed to doing their best to protect all those who live, work, and play in the city. This research provides a multi-faceted look at who lives in Palm Coast, where the demand for emergency service occurs, the standards germane to providing emergency services, and the impact of growth (projected and actual) on the service delivery system in Palm Coast.

Palm Coast City Council established a goal of arrival at the scene within seven minutes of notification 85% of the time. Palm Coast Fire Department takes a special look at any call that takes longer than 10 minutes from notification to ensure there is no failure of personnel or system design. The Insurance Services Office (ISO) sets a national standard based on travel distances. The three metrics are 5 miles from a fire station, 1.5 miles from an engine company and 2.5 miles from a ladder company. The National Fire Protection Agency's (NFPA) *Standard 1710 for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments* establishes a four minute travel time for the first arriving unit and an eight minute travel time for all other arriving units ninety percent of the time. Finally, people are more at risk where they sleep than where they shop or dine so Palm Coast Fire Department places priority on protecting bedrooms. Population is increasing, call volume is increasing at a rate greater than the population, and building permits are increasing at a rapid rate. These recommendations show the prudent next steps for Palm Coast Fire Department for future emergency services delivery.

Seminole Woods

The area of Seminole Woods has grown in the ten years since the last fire station location analysis. Currently protected by Flagler County Fire Rescue, residents of this area generated over 900 calls for service in each of the previous four years. While the men and women of that organization are considered great partners by the PCFD for the purpose of this report the authors will consider it best practice when residents are protected primarily by Palm Coast personnel. Responders are not meeting the city council goal of arrival within 7 minutes 85% of the time. Station 92 is located more than 7 minutes projected drive time from much of the Seminole Woods area. Much of the Seminole Woods much of this lies outside the prediction modeling's 7 minute response, so for many of the residents there is virtually no chance they will receive the service the city strives for. In 2019 four of the five districts in this area averaged greater than 7 minute responses. Additionally, some of the worst responses in the city occur in this area with 66 calls receiving response greater than 10 minutes. All of Seminole Woods is within the ISO 5 mile standard from existing fire stations but most of the area is greater than 1.5 miles from an engine company. Under the current model this area is virtually excluded from meeting NFPA 1710's four-minute first arriving compliment, however additional personnel would make the full alarm arrival at eight minutes a possibility for the northern most parts of the area that experience the greatest call volume.

The recommendation is that city council move forward with building and staffing a new fire station on Seminole Woods Boulevard to meet the demand for service in this area in a way consistent with city council expectations and national response standards.

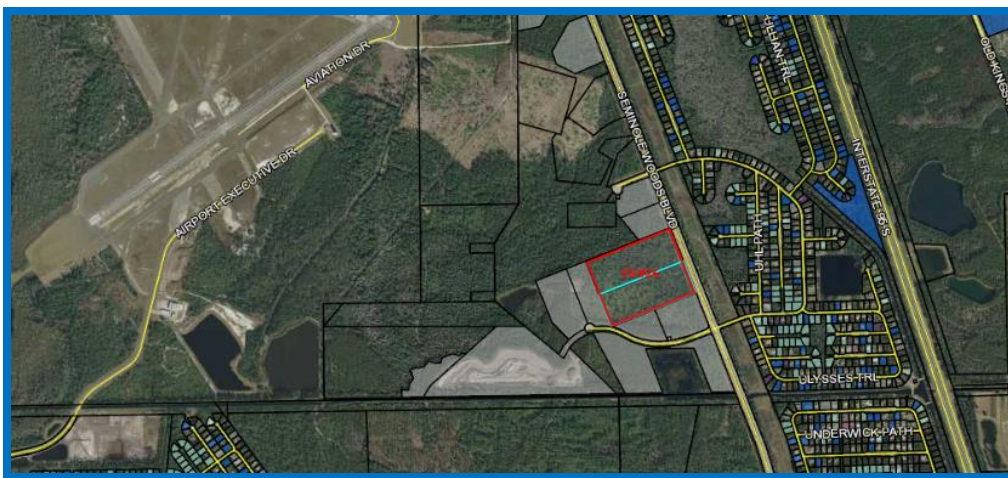


Figure 64: Fire Station #26 in Seminole Woods

The projection for the City Council response time goal is depicted in Figure 65. The entirety of Seminole Woods is within the six-minute drive time prediction. The current call volume is close to the volume of the other Palm Coast fire station, so the impact on the overall system demand would be immediate.

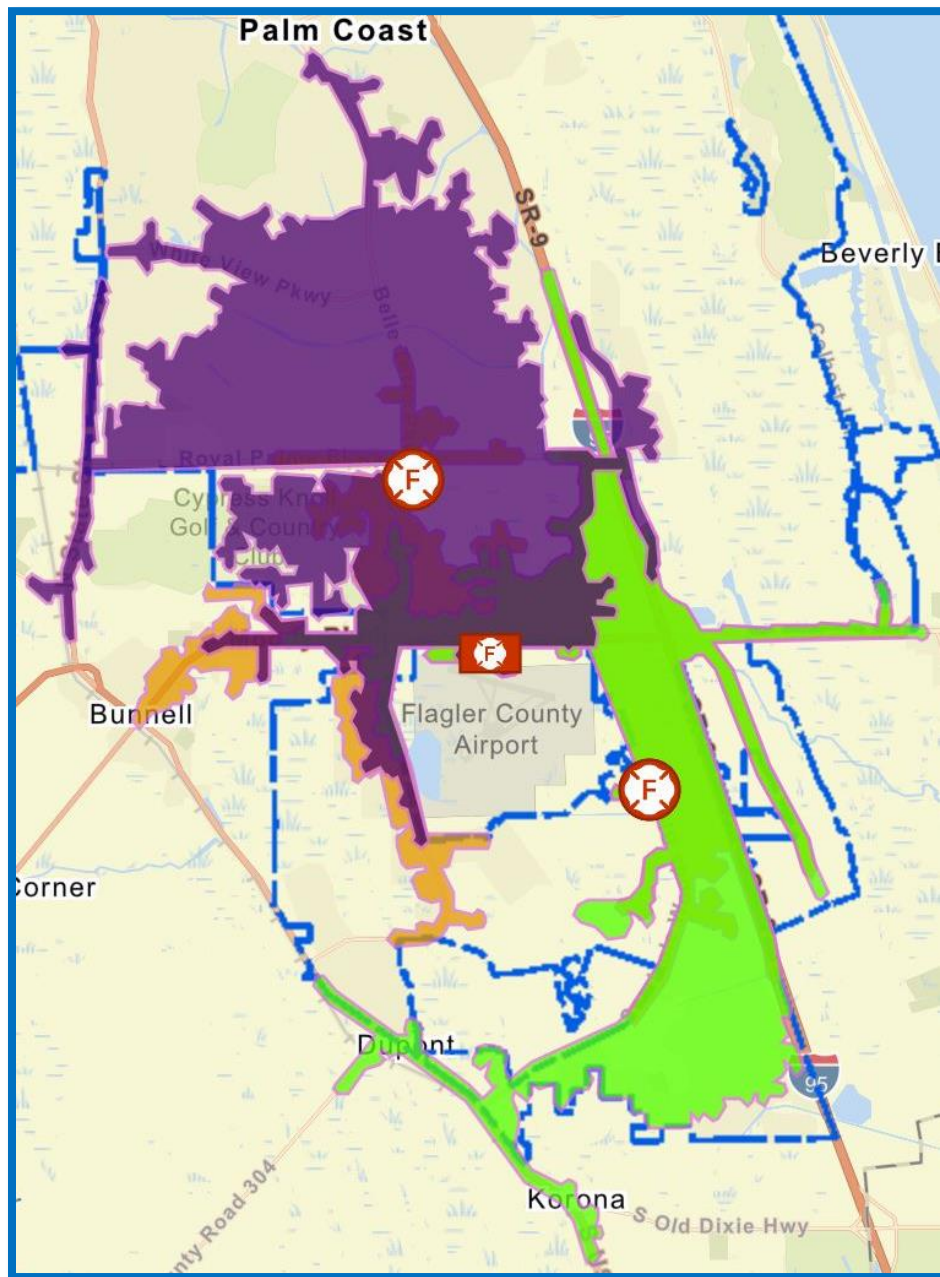


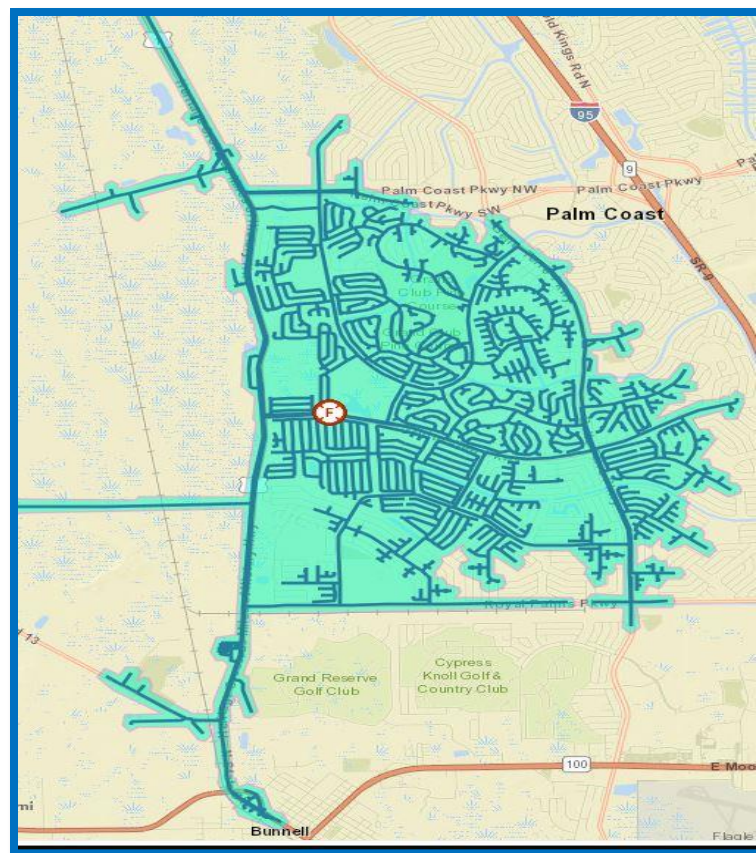
Figure 65: City Council Performance Goal Fire Station #26

Whiteview Parkway / Woodbury Drive

The area of western Whiteview Parkway near the intersection with Woodbury Drive presents a gap in the current protection model. This area is served by both Palm Coast Fire Stations 21 and 25. A challenge to analyzing the data for this area is the design of the response district zones. When a zone has a large longitudinal spread such as district 25 B that stretches from Belle Terre Parkway to US Highway 1 it is difficult to isolate gaps in the response. Three of the eight districts in this vicinity averaged greater than 7 minute arrival in 2019. There were 69 calls for service when the response took longer than ten minutes. This area is within the ISO 5 mile standard from existing fire stations but most of the area is greater than 1.5 miles from an engine company. Under the current model this area is virtually excluded from meeting NFPA 1710's four-minute first arriving compliment, however additional personnel would make the full alarm arrival at eight minutes possible.

The recommendation is for staff to continue to monitor this area and consider alternative deployment strategies to meet the demand for service in this area in a way consistent with city council expectations and national response standards.

**Figure 66: City Council Performance Goal,
Whiteview Fire Station**

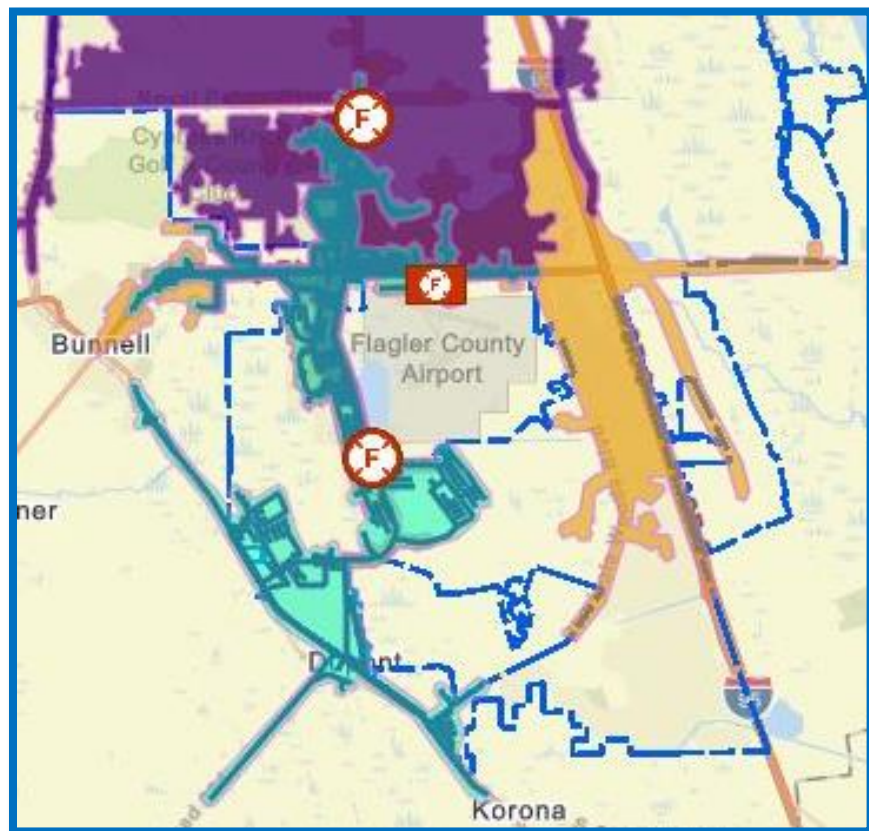


Belle Terre Boulevard

The area of Belle Terre Boulevard (South of State Road 100) is also of concern under the current protection model. This area is served first by Flagler County Fire Rescue Station 92 and backed up by Palm Coast Fire Stations 25. Again when considering this area the authors will consider best practice to be primary protection by the Palm Coast Fire Department best practice. Four of the five districts in this vicinity averaged greater than 7 minute arrival in 2019. There were 27 calls for service when the response took longer than ten minutes. This area is within the ISO 5 mile standard from existing fire stations but most of the area is greater than 1.5 miles from an engine company. Under the current model this area is virtually excluded from meeting NFPA 1710's four minute first arriving compliment, however additional personnel would make the full alarm arrival at eight minutes possible.

The recommendation is for staff to continue to monitor this area and consider alternative deployment strategies to meet the demand for service in this area in a way consistent with city council expectations and national response standards. Additionally, a change occurred with the addition of automatic vehicle location technology and reassessing the application of this tech in the system may provide a marginal benefit to this community.

Figure 67: City Council Performance Goal, Belle Terre (South)



Colbert Lane and State Road 100

The area of south Colbert Lane and State Road 100 is also of concern under the protection models. This area is served by PCFD station #25 and Flagler Beach station #11. While the men and women of that organization are considered great partners by the PCFD for the purpose of this report the authors will consider it best practice when residents are protected primarily by Palm Coast personnel. A challenge to analyzing the data for this area is the design of the response district zones. As this area grows redrawing the response districts would make isolating response outcomes easier. Of the four districts in the city limits in this area two of the four districts in this vicinity averaged greater than 7 minute arrival in 2019. There were 27 calls for service when the response took longer than ten minutes. This area is within the ISO 5-mile standard from existing fire stations but most of the area is greater than 1.5 miles from an engine company. Under the current model this area is outside NFPA 1710's four-minute first arriving goal, however additional personnel would make the full alarm arrival at eight minutes possible.

The recommendation is to monitor this area for call volume and growth. As population and call volume increase, alternative deployment strategies to meet the demand for service in this area in a way consistent with city council expectations and national response standards should be developed.

Palm Coast Park

Anticipated growth in the Palm Coast Park area on US 1 north of Matanzas Woods Parkway will be handled by Station #23 until the generation of calls in the area dictates growth in service. The area is not currently developed, therefore there is no service demand to evaluate. It is reasonable to predict that many of the calls that occur in this district will take longer than ten minutes for responders to arrive. As the roadways are mapped out the 5-mile ISO standard will be considered – based on current infrastructure development it is reasonable to anticipate that parts of this area will not meet the five-mile ISO standard and none of the area will be within 1.5 miles of an engine company. Additionally, this area will not meet the NFPA 1710 four-minute first arrival or eight-minute full alarm goal.

The recommendation is for staff to continue to monitor this area and its growth. As population and call volume increase and if growth projections prove accurate to consider both building and staffing a new fire station and alternative deployment strategies to meet the demand for service in this area in a way consistent with city council expectations and national response standards.

Software Upgrades

One of the limiting factors in evaluating the data from the emergency incident reporting system is the limited ability to quantify the data in the system. There are two important analyses that would strengthen the evaluation used throughout this report, which are not possible due to the limiting factors associated with the records management program.

Concurrency

The first analysis is the determination of concurrent emergency incidents in the same geographic area. In order to evaluate response times throughout response zones, it is important to understand if simultaneous, or overlapping, incidents occur. When there are concurrent incidents, the closest unit is assigned to one incident. For the second emergency, a response vehicle is assigned that is outside the expectations of the methodologies used for fire station locations. This is not to say that these figures are irrelevant, but rather to say that there outliers in the response times.

When evaluating concurrent incidents, data analyses begin to evaluate the number of overlapping incidents, the net effect in the districts that respond to the areas, and growth in the area involving the concurrency. At that point, emergency response apparatus reliability can be evaluated, leading to decisions to add additional response units.

Second Unit Arrival Analysis

The second analysis is looking at the distance for each "second due" company. Not all emergencies are created equal and often at the most critical incidents the arrival of the second due unit turns the tide. The National Institute of Standards and Technology (NIST) studies utilized to craft NFPA 1710 prove that at fire scenes the right manpower makes a significant impact. Greater understanding of the frequency of multi-company incidents and an analysis of second unit arrivals would provide data to decision makers about the calls that place the greatest strain on the system. Additionally, ensuring that the department can provide great service and adequate personnel to the situations requiring the greatest measure of each is a significant part of the department's responsibility.

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