

City of Miramar Fire-Rescue Department

Community Risk Assessment and Standards of Cover Study

September 2026

Table of Contents

SECTION 1. COMMUNITY AND ORGANIZATIONAL PROFILE 2
Introduction 3
The City of Miramar 5
Financial Overview 8
Overview of the Miramar Fire-Rescue Department 11
Staffing and Personnel 16
Emergency Medical Services 18
Life Safety and Public Education 24
Training and Continuing Medical Education 29
Emergency Communications 36
Capital Facilities and Apparatus Inventory 38

SECTION 2. COMMUNITY RISK ASSESSMENT 47
PART 1. INTRODUCTION AND METHODOLOGY 48
The Three-Axis Risk Assessment Methodology 51
PART 2. VARIABLE ANALYSIS 57
Hexbin Details 60
General Variables 61
Probability Variables 65
Historical Analysis 74
Topography, Geography, Climate, and Physiography 90
Consequence Variables 98
Impact Variables 104
PART 3. QUANTITATIVE RISK 111
Fire Suppression Risk — Structure Fires 116
Fire Suppression Risk — Non-Structure Fires 120
Wildland Fires 124
EMS Incidents 128
Technical Rescue Incidents 132
HazMat Incidents 137
Natural and Human-Made Disasters 141
COMMUNITY RISK ASSESSMENT CONCLUSION 146

SECTION 3. HISTORICAL SYSTEM PERFORMANCE 147
Historical System Performance Review 148
Historical Performance Summary and Strategic Implications 172
Resources, Critical Tasking, and Benchmark Goals 173
Performance Gap Analysis and Future Opportunities 193
Continuous Quality Improvement 195
Community Outcomes and System Effectiveness 198
Key Findings and Recommendations 205

APPENDIX 209



SECTION 1

Community and Organizational Profile

Introduction

In December 1996, the International Association of Fire Chiefs (IAFC) and the International City/County Management Association (ICMA) jointly established the Commission on Fire Accreditation International (CFAI) under the supervision of the Center for Public Safety Excellence (CPSE).

The primary objective of the CFAI is to develop a comprehensive system to assist local governments in evaluating risk management, setting performance goals, and integrating long-term strategic planning with the creation of a standards of cover (SOC) document. The SOC establishes a comprehensive, data-driven framework to evaluate the deployment, distribution, and concentration of resources within a jurisdiction, in this case, the City of Miramar. This document integrates the community risk assessment (CRA), historical system performance, organizational capabilities, and community expectations to determine the extent to which the City of Miramar Fire-Rescue Department (MFRD, the Department) effectively delivers emergency services in a manner consistent with the identified community risks and adopted performance objectives.

This SOC was developed in accordance with the accreditation model established by the CFAI and incorporates the continuous quality improvement principles outlined in Quality Improvement for the Fire and Emergency Services, 2nd edition. It includes a systematic evaluation of current deployment practices, operational performance, response reliability, and service capacity. In addition, this document identifies gaps between existing service delivery capabilities and the community's current and projected risk profiles, while establishing measurable benchmarks to support strategic planning, resource allocation, and future organizational decision-making.

The SOC is intended to serve as both an operational assessment and a long-term planning document. Through geographic analysis, incident demand modeling, historical response performance data, demographic trends, concentration and distribution analysis, and effective response force evaluation, the document provides a comprehensive understanding of the Department's ability to meet community expectations under both routine and high-risk emergency conditions.

The SOC is structured around three integrated and interdependent components:

- Standard of cover (SOC): Evaluation of the Department's deployment methodology, distribution of resources, concentration of staffing and apparatus, reliability of response capabilities, and overall system effectiveness
- Community risk assessment (CRA): Identification, classification, and analysis of community hazards and vulnerabilities, occupancy risks, demographic characteristics, historical incident trends, and service demands

- Standards of response performance (SORP): Establishment of measurable performance objectives, response time benchmarks, effective response force criteria, and deployment standards used to evaluate system performance and organizational outcomes

The three components are applied sequentially throughout this document. The CRA identifies and geographically categorizes community risks; the historical system performance analysis determines how effectively existing resources have responded to those risks; and the SORP establishes the measurable objectives used to evaluate future performance. Findings from all three components are then incorporated into the Department's performance-gap analysis, continuous improvement process, strategic planning, and future resource decisions.

This integrated approach ensures that deployment decisions are risk-based, performance-driven, data-supported, and aligned with the community's expectations, values, and service priorities. Furthermore, the SOC supports continuous organizational improvement by providing a defensible analytical framework for evaluating current operations, forecasting future service demands, and guiding decisions concerning policy, staffing, infrastructure, and capital investment.

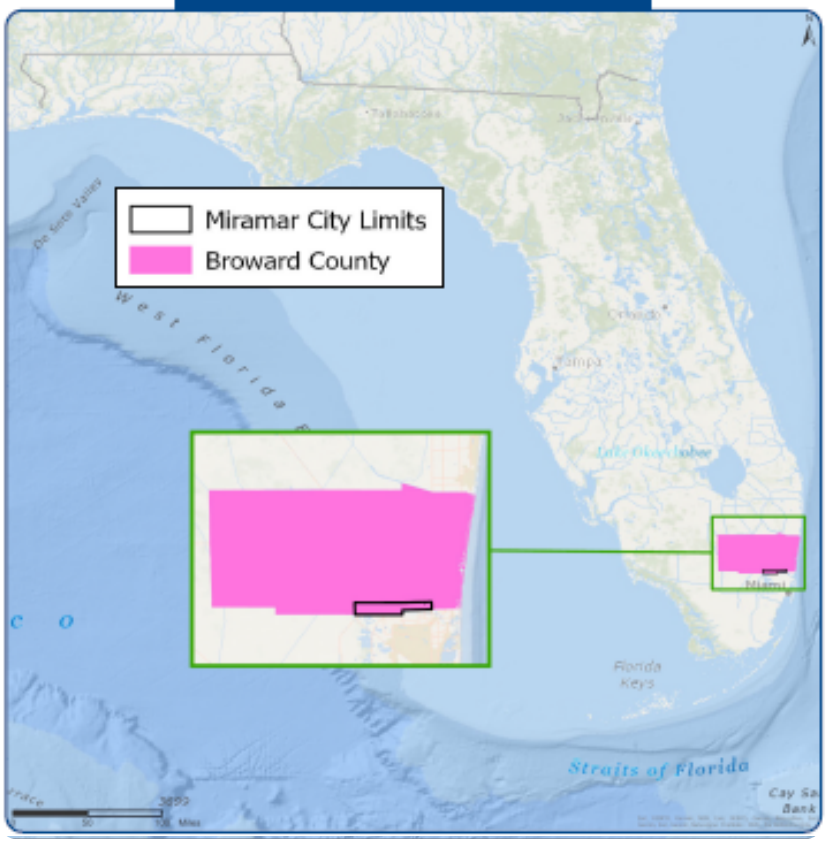
This Standards of Cover document establishes the foundation for evaluating current service delivery capabilities, identifying emerging community risks, assessing deployment effectiveness, and guiding future resource allocation decisions. The analysis is intended to support informed decision-making and continuous organizational improvement while ensuring emergency services remain aligned with community expectations and identified risks.

The City of Miramar

Located on the southeastern coast of Florida within the greater Miami metropolitan area, the City of Miramar is a diverse suburban community in southern Broward County **(Figure 1).** The city was originally incorporated on May 26, 1955, with fewer than 200 residents and an area of approximately 31 square miles. Since its incorporation, Miramar has experienced substantial and sustained growth in both population and geographic size, transforming from a small residential community into a large, vibrant municipality within South Florida.

Today, Miramar encompasses approximately 31 square miles and has an estimated population of 143,242 residents.[1] The community is characterized by a mixture of established residential neighborhoods, newer master-planned developments, commercial centers, educational institutions, healthcare facilities, parks, and recreational amenities. The city's strategic location near major transportation corridors and employment centers has contributed to continued residential and economic growth over several decades.

Figure 1: City of Miramar in Florida



Miramar is recognized for its cultural diversity and broad demographic composition. The community includes a wide range of age groups, household types, and cultural backgrounds, all of which contribute to the city's social character and community identity. Residential developments throughout the city range from low-density single-family neighborhoods to high-density multifamily housing and mixed-use developments. In addition, Miramar maintains an extensive network of public parks, community centers, schools, and civic facilities that support a high quality of life for residents.

The city's geographic layout reflects both historic and modern phases of development. The eastern portions of the community generally contain older and more established neighborhoods and commercial areas, whereas the western portions of the city have experienced significant planned growth and feature newer residential construction. This blend of mature and developing areas contributes to varied land use patterns throughout the community.

As one of the larger suburban communities in South Florida, Miramar continues to evolve through ongoing residential development, economic investment, infrastructure expansion, and demographic change. This growth shapes the overall community profile and provides important context for evaluating municipal services, community expectations, and long-term planning initiatives.

Miramar's climate is classified as warm and subtropical, with mild winters and hot, humid summers. Average annual temperatures range from 58°F to 91°F, and annual precipitation averages about 66 inches, with the highest rainfall typically occurring in late summer and early fall. The region's climate supports year-round outdoor activities and contributes to the community's residential appeal and recreational lifestyle. These environmental conditions also

[1] *QuickFacts, United States Census Bureau.*

translate into year-round demand for emergency services and influence operational considerations, such as heat exposure, storm-related incidents, and seasonal variations in call volume.

The Miramar community is diverse, with a population that is approximately 45% Black or African American, 38% Hispanic or Latino, 26% White, and nearly 20% identifying as two or more races. The city's demographic profile reflects a balanced distribution across multiple age groups. Approximately 5% of the population is under the age of 5, and nearly 22% of residents are under the age of 18. In addition, approximately 12.5% of residents are aged 65 or older. These age demographics are important considerations in understanding community characteristics, housing patterns, educational needs, healthcare utilization, and long-term municipal service planning priorities.

Miramar also includes populations with varying healthcare access and functional needs. Approximately 5% of residents under the age of 65 live with a disability, and an estimated 13.5% of individuals under age 65 do not have health insurance coverage. These demographic and socioeconomic indicators provide important context regarding healthcare accessibility, potential service utilization patterns, and community support needs.

HOUSING AND COMMUNITY DEVELOPMENT

Housing characteristics in Miramar reflect a stable, predominantly family-oriented suburban community. Between 2019 and 2023, approximately 70% of housing units were owner-occupied, with a median housing value of approximately $420,300. The average household size in the city is approximately three people, indicating the strong presence of family-based households throughout the community.

Residential development in Miramar includes established single-family neighborhoods, master-planned residential communities, multifamily housing developments, townhomes, and mixed-use residential areas. The city has experienced sustained residential and commercial growth over the past several decades, particularly in the western portions of the community, where newer development patterns and expanding infrastructure have continued to shape land-use characteristics.

The continued development of higher-density residential projects, multifamily housing, and mixed-use developments may influence future emergency service demand, vertical response requirements, and emergency medical utilization patterns.

ECONOMY AND INCOME

Miramar has a diverse and active economy. Between 2019 and 2023, approximately 72% of the population aged 16 and older was employed. In 2023, the median household income was approximately $86,109, and per capita income was estimated at $38,251[1]. Approximately 5% of the population lives below the poverty level.[2]

The city's residents are employed across a broad range of industries, including healthcare, education, public administration, retail, transportation, professional services, hospitality, and regional business sectors throughout the greater Miami metropolitan area.

Population, demographic composition, economic indicators, housing characteristics, and ongoing community development collectively provide important context for understanding the community's overall profile. These factors help establish the foundation of the CRA and SOC process by identifying the social, economic, demographic, and environmental characteristics that influence community expectations, service demand, and long-term planning considerations.

[1] *Ibid.*
[2] *Ibid.*

LEGAL FOUNDATION AND LINES OF AUTHORITY

The MFRD operates under the legal authority established by the municipal ordinances of the City of Miramar and the applicable laws and statutes of the State of Florida that govern fire protection, emergency medical services (EMS), public safety, and emergency management operations. These authorities establish the Department's responsibilities, powers, operational authority, and regulatory obligations related to the delivery of emergency services within the community.

The City of Miramar operates under a council-manager form of government. Under this structure, the elected city commission sets policy direction and appoints the city manager, who serves as the chief administrative officer. The city manager oversees municipal operations and services, including managing all city departments and ensuring implementation of policies, strategic priorities, fiscal management, and operational accountability throughout the organization.

The fire-rescue chief reports directly to the city manager and serves as the executive leader of the MFRD. The fire-rescue chief is responsible for the administration, planning, coordination, and operational oversight of all department functions, including emergency response operations, personnel management, training, fire prevention activities, EMS, budgeting, strategic planning, and regulatory compliance.

The MFRD's governance structure includes clear lines of authority, organizational accountability, and administrative oversight that are consistent with recognized municipal and fire service management practices.

Under applicable state and local authority, the Department is authorized to:

- Provide fire suppression and prevention services
- Deliver emergency medical services, including advanced life support (ALS) transport
- Enforce fire and life safety codes
- Conduct fire inspections, investigations, and public education activities
- Participate in automatic and mutual-aid agreements with neighboring jurisdictions
- Support emergency management operations

In addition, the Department operates in coordination with state and regional regulatory frameworks concerning firefighter certification, emergency medical licensure, occupational safety, emergency communications, hazardous materials (HazMat) response, and disaster preparedness. These authorities and governance structures collectively establish the legal and administrative foundation necessary for the Department to effectively carry out its mission and provide emergency services to the community. The relevant legal and organizational frameworks ensure clear authority, defined responsibilities, operational accountability, and alignment with applicable state statutes, local ordinances, and recognized public safety standards.

Financial Overview

The MFRD provides services to the city's residents from five city-owned stations via seven programs: Administration, Logistics, Fire Life Safety, Fire Protection, Fire-Rescue Training, Emergency Management, and EMS. The Department has 181.5 budgeted positions, of which 180 are full-time, and three are part-time (1.5 full-time equivalent [FTE] positions).

Table 1 summarizes the Department's general fund revenues and expenditures by program for fiscal years (FYs) 2022–2025 and the FY 2026 budget by program. **Table 2** outlines the Department's expenditures by category for the same time frame, and **Figure 2** illustrates the allocation of the FY 2026 budget by expenditure category.

Table 1: MFRD Revenues and Expenditures by Program (FYs 2022–2025) and FY 2026 Budget

Program	FY 2022 Actual[1]	FY 2023 Actual[2]	FY 2024 Actual[2]	FY 2025 Revised[2]	FY 2026 Budget[2]
Administration	164	487	283	400	400
Logistics	809,804				
Fire Life Safety	2,366,746	2,385,020	2,140,936	3,032,100	3,093,000
Fire Protection	22,231,072	22,360,978	26,416,496	26,484,000	26,684,000
Fire-Rescue Training	2,910	335	606	500	500
EMS	2,170,350	2,463,678	1,609,920	2,700,000	3,600,000
TOTAL REVENUES	**$27,581,046**	**$27,210,497**	**$30,168,242**	**$32,217,000**	**$33,377,900**
Administration	2,369,707	2,648,883	3,380,865	3,761,961	3,846,500
Logistics	1,976,466	1,690,276	1,650,427	1,826,218	1,723,600
Fire Life Safety	2,359,089	2,867,482	2,868,961	2,870,050	2,817,200
Fire Protection	19,922,787	18,763,745	19,506,034	29,488,611	21,683,700
Fire-Rescue Training	1,058,736	1,432,372	1,636,342	1,334,000	1,542,200
Emergency Management	709,129	989,697	1,433,827	1,468,831	1,554,250
EMS	15,271,985	14,699,199	14,816,618	16,466,946	17,481,100
TOTAL EXPENDITURES	**$43,667,899**	**$43,091,653**	**$45,293,074**	**$57,216,617**	**$50,648,550**
NET COSTS	**$16,086,853**	**$15,881,156**	**$15,124,832**	**$24,999,617**	**$17,270,650**

[1] City of Miramar FY 2025 Adopted Annual Budget.
[2] City of Miramar FY 2026 Adopted Annual Budget.

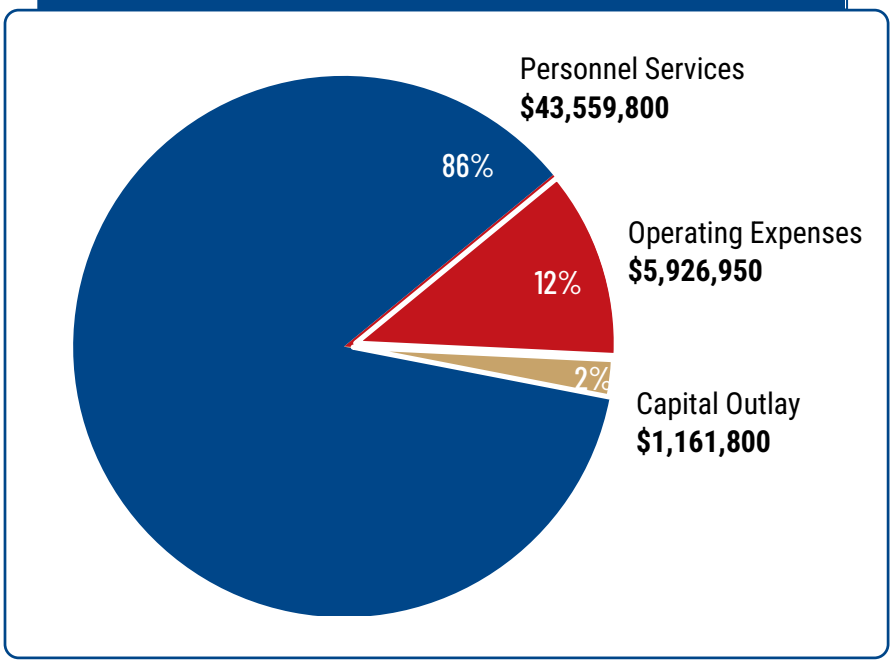
Table 2: MFRD Revenues and Expenditures by Category (FYs 2022–2025) and FY 2026 Budget

Category	FY 2022 Actual[1]	FY 2023 Actual[2]	FY 2024 Actual[2]	FY 2025 Revised[2]	FY 2026 Budget[2]
Personnel Services	37,940,041	37,304,631	38,519,841	42,093,679	43,559,800
Operating Expenses	4,304,988	4,958,094	5,579,605	5,694,350	5,926,950
Capital Outlay	1,422,871	828,929	1,193,628	9,428,588	1,161,800
TOTALS	**$43,667,899**	**$43,091,653**	**$45,293,074**	**$57,216,617**	**$50,648,550**

[1] City of Miramar FY 2025 Adopted Annual Budget.
[2] City of Miramar FY 2026 Adopted Annual Budget.

The total general fund budget for FY 2026 expenditures is approximately $50.6 million. The Department's operating expenditures (i.e., personnel services and operating expenses, excluding one-time capital outlay costs) increased by approximately 17% over the five-year period. This increase is primarily attributed to personnel services costs, which account for approximately 86% of the general fund operating budget. The primary components of the increase in salaries and benefits are the addition of firefighters, higher salaries due to collective bargaining constraints, rising healthcare costs, and increasing pension liabilities.

Figure 2: Allocation of MFRD Expenditures, FY 2026 Budget



The City of Miramar takes a proactive approach to addressing pensions and long-term liabilities through its Pension Trust Fund. This fund, which is separate from the city's core operating funds, provides an additional resource to help with smooth contribution volatility over time. MFRD's unfunded actuarial accrued pension liability is approximately $52.5 million, and the plan's funded ratio is approximately 79%.[1] The Firefighters' Retirement Plan minimum payment for FY 2026 is approximately $13.5 million, according to the Actuarial Valuation of City of Miramar Firefighters' Retirement Plan as of October 1, 2024. This total includes payment of annual normal cost and amortization of the unfunded actuarial accrued liability, and it must be met by the city and state contributions under Chapter 175. The FY 2026 amount represents a 34% increase over FY 2022. There is also a 72% increase in pension benefit costs, from $1.34 million to $2.3 million, which is partially due to the addition of 16 firefighter emergency medical technicians (EMTs) and paramedics, positions funded by the federal Staffing for Adequate Fire and Emergency Response (SAFER) grant.

The general fund is the primary funding source for the Department's operating budget, and grant funding remains a critical part of Miramar's financial strategy. The SAFER grant provided funding to hire 16 additional firefighters for a 3-year period, with funding ending in FY 2025. The 16 positions have been absorbed into the general fund in the FY 2026 budget. Based on the current fire services fee structure and rates, general fund revenues are insufficient to offset operating expenditures, resulting in a net cost of $17.3 million for FY 2026. The Fire Protection Special Assessment study conducted in FY 2026, with the goal of implementing full-cost recovery beginning in FY 2027, is a critical tool for long-term sustainability.

[1] Actuarial Valuation of City of Miramar Firefighters' Retirement Plan as of October 1, 2024.

Although no changes to the assessment rate are reflected in the FY 2026 adopted budget, the planned study will position the city to consider future adjustments that align revenues with the true cost of fire protection services, while maintaining equity across property types. The goal will be to maintain the fire protection assessment rate at a level that funds 100% of the cost of providing fire protection, eliminating the general fund subsidy.

Fire stations, apparatus, other vehicles, and firefighting and emergency medical equipment are essential capital resources for a fire department to carry out its mission. A comprehensive capital improvement and replacement program is key to the long-term financial and operational stability of any fire and EMS organization. Such programs provide systematic development and renewal of the agency's physical assets and rolling stock.

A capital program must align with the planning process to anticipate and schedule capital expenditures without adversely affecting the agency's operations or otherwise placing it in a negative financial position. MFRD requests capital improvement funds for facilities and major equipment each budget year. In FY 2025, the Department purchased new emergency responder self-contained breathing apparatuses (SCBAs), implemented the blood analyzer system obtained through a 2024 EMS Grant, and appropriated funds to replace five suppression apparatus units.

The FY 2026 budget includes funding for five APX Next radios, ensuring that both sworn and non-sworn personnel maintain reliable and effective communications in support of their operational duties. It also allocates resources for specialized training equipment to support rigorous scenarios, such as limited-visibility search and rescue, elevated-window ventilation, and forcible-entry training, further strengthening the Department’s readiness and response capabilities.

In addition, the Fire EMS fund was established to account for fire and EMS impact fees derived from new development and restricted by Ordinance for Fire and Emergency Medical Services Capital Improvements legislation. The funding will assist the city in providing the fire and emergency services and capital improvements required by growth and development.

Although MFRD remains financially stable, personnel costs continue to represent the largest component of departmental expenditures. Future budget planning efforts should consider the long-term impacts of pension obligations, healthcare cost increases, apparatus replacement needs, and future staffing requirements associated with community growth and increasing EMS demand.



Overview of the Miramar Fire-Rescue Department

HISTORY OF THE FIRE DEPARTMENT



Following the City of Miramar's incorporation in 1955, the MFRD was established in 1956 to provide fire protection and emergency response services to the growing community. Initially, the Department operated as a volunteer organization staffed by local community members and deployed from a single fire station that served a small residential population.

Miramar experienced significant population growth and geographic expansion during the 1960s and in subsequent decades, and the Department evolved to meet growing community expectations and service demands. Construction of an additional fire station began in 1961, marking one of the Department's earliest infrastructure expansions in response to the city's continued development.

Over time, MFRD transitioned from a volunteer-based organization to a fully career fire-rescue agency with expanded staffing, apparatus, and operational capabilities. The Department's growth paralleled the transformation of Miramar from a small suburban community into a major municipality within southern Broward County. As residential neighborhoods, commercial development, transportation infrastructure, and community services expanded throughout the city, the Department continued to adapt its operational model, deployment strategies, and service delivery capabilities.

Today, the MFRD operates from five strategically located fire stations positioned throughout the community to provide fire suppression, EMS, rescue response, and all-hazards emergency operations. The Department's deployment system has evolved over time to align with population distribution, community growth, transportation networks, and historical service demand patterns throughout the city.

In addition to emergency response operations, MFRD has expanded its organizational responsibilities to include fire prevention, public education, emergency preparedness, life safety initiatives, and regional coordination activities. The Department continues to evolve to meet the changing needs and expectations of the community it serves, demonstrating an ongoing commitment to maintaining effective and reliable emergency services for the residents and visitors of Miramar.

ORGANIZATIONAL OVERVIEW

MFRD is administered through a structured organizational framework that supports operational effectiveness, administrative oversight, regulatory compliance, and the delivery of emergency services throughout the community. The fire-rescue chief serves as the executive leader of the Department and is supported by three deputy chiefs and an administrative manager, each responsible for specific functional areas essential to Departmental operations and organizational management.

In addition to its full-time administrative and operational staff, the Department utilizes the services of chaplains and a contracted EMS medical director. Although these positions are not staffed by city employees, they provide critical support functions for personnel wellness, behavioral health support, spiritual care, medical oversight, clinical guidance, and regulatory compliance in EMS delivery.

The deputy chief of administration oversees the Department's administrative support functions, including logistics, resource management, fleet and equipment coordination, purchasing, and training operations. This position is

responsible for supporting organizational readiness, operational sustainability, personnel development, and long-term resource planning.

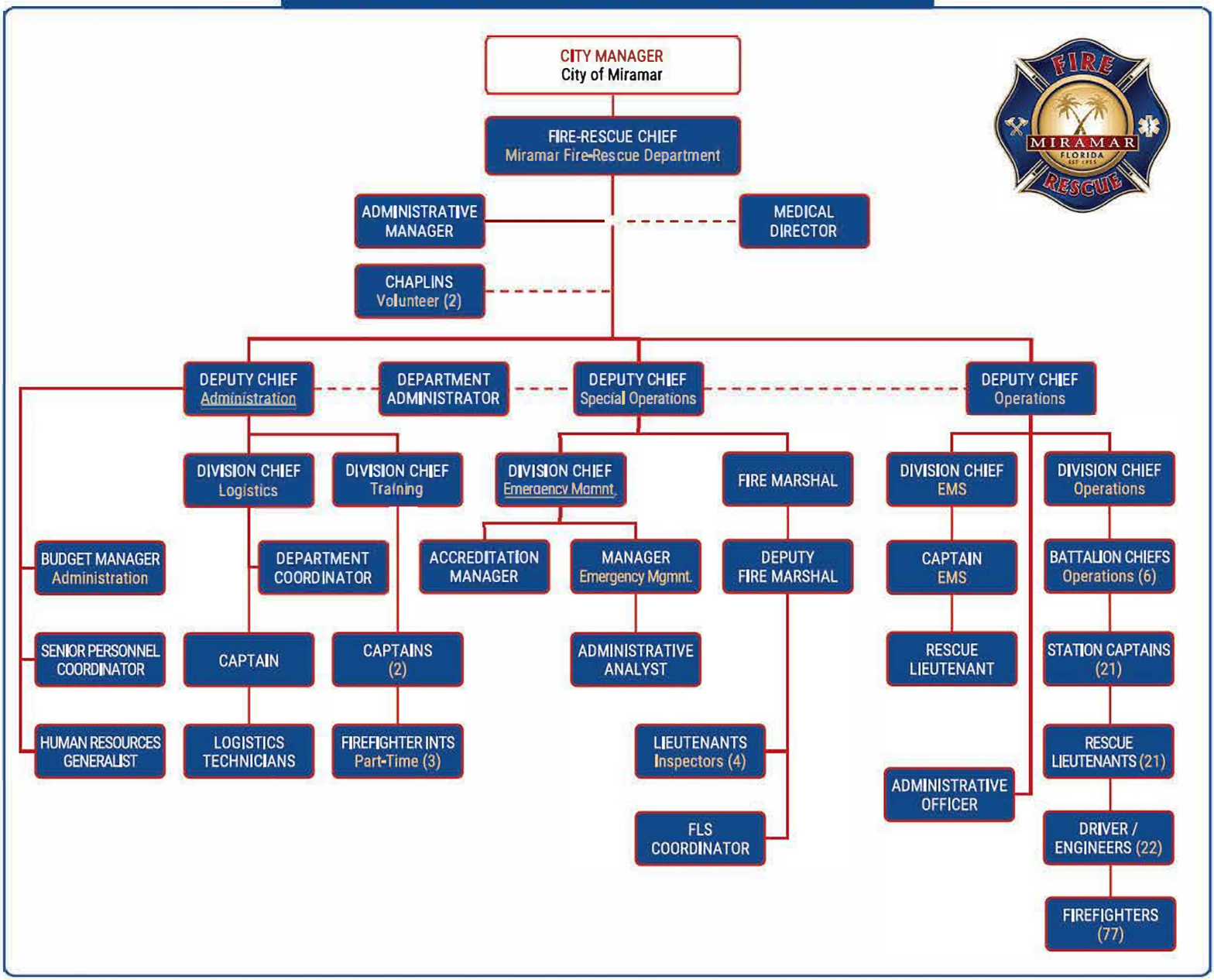
The deputy chief of special operations oversees emergency management and fire prevention functions, including the Fire Marshal's Office and associated regulatory responsibilities. This area of responsibility includes fire code enforcement, plan review, inspections, investigations, public education activities, emergency preparedness coordination, and support for disaster planning and community resilience initiatives.

The deputy chief of operations is responsible for the Department's core emergency service delivery functions, including field operations, EMS, deployment coordination, response readiness, and daily operational management of frontline personnel and apparatus.

To support these operational and administrative responsibilities, MFRD is organized into seven primary divisions:

- Administration Division
- Operations Division
- Emergency Management Division
- Fire Life Safety Division
- Emergency Medical Services Division
- Logistics Division
- Training Division

Figure 3: Miramar Fire-Rescue Department Organizational Chart



This organizational structure provides the defined supervisory responsibilities, operational coordination, and functional specialization necessary to support both emergency response operations and the Department's broader administrative, regulatory, and community service responsibilities. The structure also supports organizational accountability, continuity of operations, strategic planning, and alignment with accepted fire service management practices and accreditation principles.

SERVICES PROVIDED BY MFRD

MFRD provides a comprehensive range of emergency response, rescue, prevention, and public safety services designed to address the community's identified risks, service demands, and operational needs. Core services include fire suppression, rescue response, emergency medical first response, and ground emergency medical transport (GEMT) at the ALS level. These services are delivered through an integrated emergency response system designed to support rapid intervention, improve life-safety outcomes, stabilize emergency incidents, and reduce property and environmental losses.

EMS accounts for a substantial portion of the Department's overall incidents and operational activities. As with many modern fire-rescue agencies, medical-related incidents account for the majority of requests for service and significantly affect unit availability, deployment reliability, staffing utilization, and overall system workload. The provision of ALS-level transport services requires the Department to balance its emergency medical transport capability with fire suppression readiness, particularly during periods of elevated call volume, simultaneous incidents, and extended unit commitment times associated with hospital transport and patient transfer activities.

In addition to emergency response services, the Department provides fire prevention, life safety education, fire code enforcement, fire inspections, arson investigation support, emergency preparedness coordination, and community risk-reduction activities. These functions are intended to reduce community risk through proactive prevention efforts, regulatory compliance, public education, and hazard mitigation strategies.

At the time of this analysis, MFRD does not maintain fully staffed, internally deployable specialized teams dedicated to HazMat mitigation or technical rescue (e.g., confined space, trench, high-angle, structural collapse, and swiftwater rescue). For these low-frequency, high-risk incidents, the Department participates in regionalized response systems and mutual-aid agreements with neighboring jurisdictions and specialized response teams. This operational model is consistent with many regional all-hazards response systems and allows participating agencies to share specialized personnel, equipment, training, and technical expertise across jurisdictional boundaries.

Although the regionalized model provides access to specialized resources that might not be practical for a single agency to independently maintain, it introduces dependence on external resources and can affect the reliability of response times for low-frequency, high-risk incidents. It can also affect resource availability, response reliability, and overall response times during complex or large-scale incidents. Importantly, the availability of specialized resources can be influenced by travel distance, concurrent regional incidents, and partner-agency resource commitments.

DEPLOYMENT

The Department deploys personnel and apparatus from five fire stations strategically located throughout the approximately 31 square mile service area of Miramar. **Figure 4** shows MFRD's service area boundaries, fire station locations, and automatic-aid stations. The deployment model is designed to support both the geographic distribution of initial response resources and the concentration of additional personnel and apparatus necessary to manage escalating and high-risk incidents. Resource placement throughout the city is intended to support effective response coverage to residential, commercial, institutional, and transportation-related risks within the community.

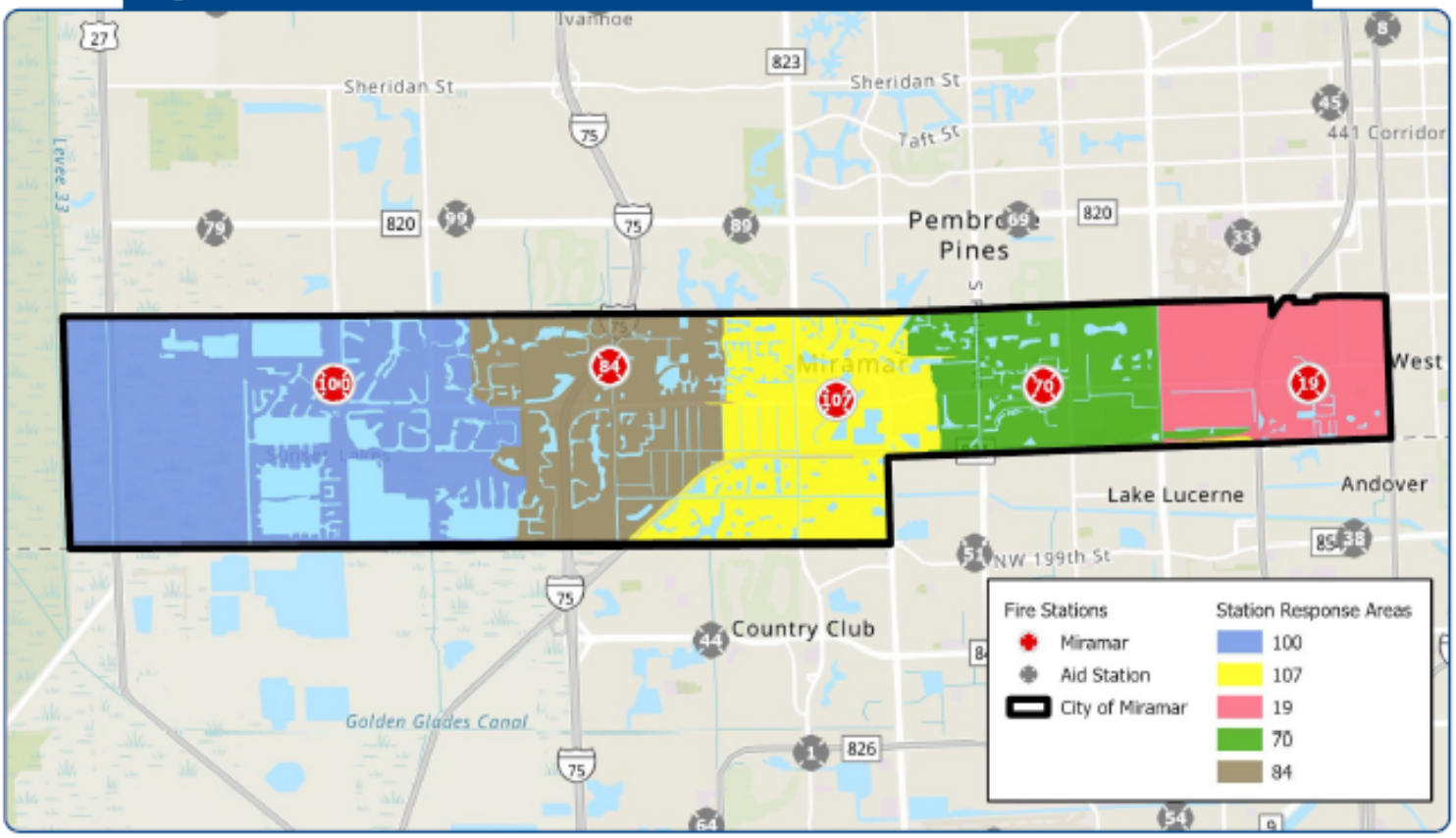
Two fire stations deploy a truck company and an ALS rescue transport unit, and the remaining three stations

operate an engine company and an ALS rescue transport unit. All frontline suppression apparatus and transport units are staffed with three personnel and equipped to provide ALS care and emergency response functions. This staffing configuration supports the Department's all-hazards operational model while balancing personnel availability, deployment reliability, and fiscal considerations.

In May 2023, the MFRD received a Public Protection Classification (PPC®) rating of Class 2/2X from the Insurance Services Office (ISO). The PPC program assesses components of the community's fire protection system, including emergency communications capabilities, fire department staffing and apparatus, training systems, operational resources, and water supply infrastructure. Miramar's rating places the Department among the nation's highly rated fire protection systems and can contribute to favorable property insurance considerations for multifamily residential and commercial property owners within the community.

Although the PPC classification provides a recognized external evaluation of selected fire protection system components, it does not independently measure total system effectiveness, response reliability, unit availability, deployment efficiency, or actual response time performance under day-to-day operational conditions.

Figure 4: MFRD Service Area Boundaries, Fire Station Locations, and Automatic-Aid Stations



OTHER LOCAL PUBLIC SAFETY SERVICES

Other public safety services that are utilized or available to the MFRD include emergency communications, healthcare facilities, air medical services, and mutual- and automatic-aid providers.

Healthcare Facilities

MFRD transports most of its patients to one of five local hospitals **(Table 3).**

Air Medical Services

The Broward Sheriff's Office (BSO) Air Rescue Unit provides emergency air medical transport for all Broward County municipalities and unincorporated areas. The helicopter is staffed by an EMT/pilot and two firefighters/paramedics.

Mutual and Automatic-Aid Providers

The MFRD has substantial access to fire departments and other providers for mutual and automatic aid. The following agencies can provide mutual and/or automatic aid for cases involving multi-alarm fires and special operations:

- Broward Sheriff Fire Rescue
- Coconut Creek Fire Rescue
- Coral Springs-Parkland Fire Department
- Davie Fire Rescue
- Fort Lauderdale Fire Rescue
- Hollywood Fire Rescue
- Lauderhill Fire Rescue
- Lighthouse Point Fire Rescue
- Margate Fire Rescue
- North Lauderdale Fire Rescue
- Oakland Park Fire Rescue
- Pembroke Pines Fire Rescue
- Plantation Fire Department
- Pompano Beach Fire Rescue
- Seminole Tribe Fire Rescue
- Sunrise Fire Rescue
- Tamarac Fire Rescue

Combined, these 17 agencies deploy their personnel and apparatus from 103 fire stations located throughout Broward County. They maintain approximately 79 engines, 45 aerial apparatus, and more than 125 rescue units. Although staffing varies among fire agencies, approximately 750 on-duty personnel are available daily.

Table 3: Healthcare Facilities and Locations

Healthcare Facility	Location
Memorial Regional Hospital Miramar	Miramar
Memorial Hospital West	Pembroke Pines
Memorial Hospital Pembroke	Pembroke Pines
Memorial Regional Hospital	Hollywood
Memorial Regional Hospital South	Hollywood

Staffing and Personnel

An organization's most valuable asset is its workforce, and managing human resources represents a significant financial investment. Therefore, effective personnel management is crucial to achieving optimal productivity and maintaining high levels of employee satisfaction. This effort involves implementing consistent management practices, fostering a safe working environment, ensuring fair treatment, providing opportunities for employee input, and recognizing and rewarding achievements.

A fire agency's goals for meeting community needs and its available revenue determine the size and structure of its staff. Several national organizations provide staffing guidance and recommendations, including the Occupational Safety and Health Administration (OSHA), the National Fire Protection Association (NFPA), and the CPSE. This section offers an overview of MFRD's staffing configuration and management practices.

The Department's staff can be categorized into two distinct groups. The first group, the administrative and support staffing section, works behind the scenes to support operational personnel to ensure effective emergency response. The second group, the operations staffing section, is comprised of emergency response personnel.

ADMINISTRATIVE AND SUPPORT STAFFING

Typical responsibilities of fire department administrative and support staff include planning, organizing, directing, coordinating, and evaluating the various programs within the organization. These responsibilities can include budgeting, policy development, personnel management, training oversight, logistics, regulatory compliance, strategic planning, emergency preparedness, accreditation activities, and operational support.

This list is not exhaustive, as fire service administrative responsibilities continually evolve in response to organizational needs, regulatory requirements, and community expectations. In many cases, these responsibilities occur concurrently, requiring the fire chief and administrative staff to simultaneously balance multiple priorities and operational responsibilities, while continuing to support daily emergency response operations and long-term organizational objectives.

Table 4 summarizes the staff members whose primary responsibilities entail administrative support functions and services, although some staff occasionally participate in emergency operations.

Notably, the current administrative and support staffing levels account for 19% of MFRD's total FTEs. There is no national standard that recommends a ratio of administrative support staff to operations staff; rather, it is based on the needs of the individual fire department.

OPERATIONS STAFFING

City leadership makes policy decisions concerning the total number of positions allocated to MFRD; these decisions are informed by service expectations, operational needs, fiscal considerations, and community priorities. Maintaining minimum staffing levels on a continuous 24-hours-per-day, seven-days-per-week basis requires personnel availability to accommodate both scheduled and unscheduled leave, including vacation, sick leave, training hours, injury leave, and other absences. To meet these rigorous operational staffing requirements, departments typically rely on overtime, callback personnel, and additional shifts to provide necessary relief coverage. The theoretical number of employees required to consistently staff a single position throughout the year is commonly referred to as the "staffing relief factor."

The staffing methodology used by MFRD is consistent with practices commonly used across the United States by fire departments operating 24-hour shift schedules. This staffing approach has generally proven effective for agencies with moderate call volume and workload demands, while supporting continuity of operations and minimum staffing reliability.

Table 5 depicts the budgeted MFRD operations staff positions.

Table 4: MFRD Administrative and Support Staff (2025)

Position Title	Number of FTEs	Average Hours Worked/Week
Fire rescue chief	1	40
Deputy fire chief	3	40
Fire marshal	1	40
Deputy fire marshal	1	40
Division chief	5	40
Captain–EMS, training, logistics	4	40
Department administrator	1	40
Administrative manager	1	40
Fire administrative officer	1	40
Fire accreditation manager	1	40
Emergency management manager	1	40
Emergency management planner	1	40
Fire administrative budget manager	1	40
Fire department coordinator	1	40
Fire life safety coordinator	1	40
Inspector lieutenant/Plans examiner	5	40
Logistics technician	2	40
Senior human resources generalist	1	40
Senior personnel coordinator	1	40
TOTAL FTEs	**33**	

Table 5: MFRD Operations Staff (2025)

Position Title	Number of FTEs	Average Hours Worked/Week
Battalion chief	6	48 hours
Captain (excluding 4 in administration)	21	48 hours
Rescue lieutenant	21	48 hours
Driver/engineer	22	48 hours
Firefighter paramedic	56	48 hours
Firefighter paramedic (SAFER grant)	14	48 hours
Firefighter EMT	5	48 hours
Firefighter EMT (SAFER grant)	2	48 hours
Firefighter Intern - (3 part-time)	1.5	48 hours
Total FTEs	**148.5**	

Emergency Medical Services

EMS is the primary driver of service demand for MFRD, accounting for approximately 70% of total incidents in 2025. This proportion is consistent with national trends observed among similarly sized urban and suburban fire-rescue agencies, where EMS-related incidents typically comprise between 65% and 80% of overall emergency response activity. The high percentage of EMS incidents significantly influences staffing utilization, unit availability, deployment reliability, workload distribution, and overall system performance throughout the Department.

MFRD operates a non-tiered, fire-based Advanced Life Support (ALS) emergency medical services system in which an ALS rescue unit is dispatched to every EMS incident, regardless of the reported complaint or dispatch determinant. Rescue units serve as the primary patient care and transport resource throughout the jurisdiction, providing comprehensive ALS assessment, treatment, and transportation to the appropriate medical facility. Engine and truck companies function as supplemental first responders when the assigned rescue unit is unavailable due to another incident, out of service, or otherwise committed. This deployment model ensures consistent ALS response capabilities while maintaining transport capacity and system reliability across the community.

The Department operates as a predominantly paramedic-based organization. Nearly all operational personnel are certified paramedics, with only a limited number of EMTs currently assigned, most of whom are actively completing paramedic training in accordance with the Department's employment requirements. This staffing model enables advanced life support interventions to begin immediately upon arrival, regardless of the responding apparatus, while providing continuity of patient care from initial assessment through transport. The Department's commitment to maintaining a highly trained paramedic workforce supports rapid clinical intervention, enhances operational flexibility, and contributes to improved patient outcomes during medical emergencies.

The Department’s EMS delivery system reflects a high-reliability response model that prioritizes rapid intervention for time-sensitive medical events such as cardiac arrest, stroke, respiratory emergencies, traumatic injury, overdoses, and other life-threatening conditions. Early ALS intervention has been shown to improve survival and patient outcomes in many emergency medical situations, particularly when advanced assessment, airway management, cardiac monitoring, medication administration, and other procedures are required before hospital arrival.

Because EMS incidents account for the majority of overall service demand, ambulance transport activity and hospital turnaround times directly impact system availability and operational readiness. Rescue unit commitment times for patient transport, transfer of care, and travel to medical facilities can temporarily reduce available coverage in parts of the city and increase reliance on neighboring units to maintain response reliability during simultaneous incidents.

The Department’s EMS workload also reflects broader demographic, healthcare access, and population trends within the community. Factors related to population growth, aging demographics, chronic medical conditions, behavioral health incidents, traffic-related injuries, and healthcare utilization patterns contribute to continued EMS demand and increasing pressure on emergency response resources. As a result, EMS system performance, unit-hour utilization, response reliability, hospital transport factors, and resource availability remain critical components of the overall SOC evaluation and play a significant role in determining future deployment, staffing, and service delivery considerations.

SYSTEM ORGANIZATION AND GOVERNANCE

The EMS functions of the MFRD are assigned within the Operations Division and managed by the EMS division chief, who oversees the Department’s EMS system administration, regulatory compliance, clinical coordination, quality improvement activities, protocol implementation, operational oversight, and EMS-related training and

performance management functions.

Supporting the EMS division chief are an EMS captain and a rescue lieutenant, who assist with coordinating field operations, supervising personnel, monitoring clinical performance, ensuring equipment readiness, and managing day-to-day EMS system operations. At the time of this analysis, the EMS Division has not assigned a dedicated administrative support position to assist with records management, data analysis, scheduling coordination, compliance documentation, billing support coordination, and other administrative functions associated with EMS system management. Given the significant operational demands associated with ALS transport services, regulatory reporting, continuing education requirements, clinical quality assurance, and system performance monitoring, the absence of dedicated administrative support staff could affect the distribution of administrative workload and the division's long-term program management capacity.

Regionally, EMS system coordination in Broward County involves collaboration among several organizations and stakeholder groups, including the Broward County Regional EMS Council, the Fire Chiefs' Association of Broward County, and Broward County Trauma Services. These organizations support regional coordination of EMS protocols, trauma system planning, mutual aid, disaster preparedness, communications interoperability, and broader emergency medical system initiatives throughout the county.

At the state level, EMS oversight is primarily administered through the Emergency Medical Services section of the Florida Department of Health. The state EMS office is responsible for the licensure, regulation, and oversight of EMS agencies, ambulances, EMTs, paramedics, public safety telecommunicators, training programs, and EMS medical directors operating within Florida.

State oversight responsibilities include provider certification standards, ambulance permitting, continuing education requirements, quality assurance expectations, clinical protocol standards, trauma system coordination, and regulatory compliance associated with the delivery of prehospital emergency medical care. These regional and state-level oversight systems help establish operational consistency, clinical accountability, and regulatory compliance for EMS delivery throughout the region.

MEDICAL DIRECTION AND CLINICAL OVERSIGHT

The Department's EMS system operates under the clinical oversight and medical authority of a contracted medical director. The medical director also serves as the Department's Moderate Complexity Laboratory director. The medical director is compensated $45,000 for EMS medical direction and $10,000 for responsibilities associated with the laboratory. The Department also maintains an associate medical director as a contingency resource to support continuity of medical direction if the medical director is unavailable. MFRD contracts with both physicians to provide medical direction, clinical oversight, protocol guidance, and regulatory support associated with the delivery of ALS services.

The medical director is responsible for providing physician oversight of the Department's EMS system in accordance with applicable Florida statutes, administrative codes, regional protocols, and accepted standards of prehospital emergency medical care. Responsibilities include overseeing ALS medical practices, participating in quality improvement activities, supporting provider education, and evaluating clinical performance and patient care outcomes.

The medical director actively participates in the Department's internal EMS quality management and quality improvement processes. This involvement includes regular meetings with EMS Division personnel, review of clinical documentation and patient care reports, analysis of selected incidents and treatment outcomes, and discussion of specific patient care cases for educational and system improvement purposes. These activities support continuous clinical evaluation, protocol compliance, provider accountability, and ongoing enhancement of patient care delivery throughout the EMS system.

The associate medical director provides additional clinical support and physician oversight to support continuity of medical direction, protocol implementation, and operational coordination. The employment of both a medical director and an associate medical director supports redundancy in physician oversight and enhances the Department's ability to maintain consistent clinical supervision and medical accountability across its ALS transport and emergency response operations.

EMS QUALITY MANAGEMENT AND PERFORMANCE IMPROVEMENT

MFRD has a well-structured EMS quality management (QM) program codified in APOM Policy Number 705.10, *Medical Quality Assessment & Quality Improvement*. The program is designed to support continuous clinical improvement, provider accountability, regulatory compliance, and system-wide evaluation of EMS operations and patient care delivery.

The Department's QM process utilizes a multi-tiered review system intended to identify clinical concerns, documentation deficiencies, operational issues, and opportunities for system improvement. The review process includes three levels of oversight:

1. Station captains review rescue unit reports from the previous shift and provide direct feedback to the officer assigned to the rescue unit.
2. Battalion chiefs review high-acuity incidents, unusual events, and reports identified as not meeting established standards or expectations.
3. The EMS Division conducts additional reviews of significant incidents, identified deficiencies, quality concerns, and broader system performance issues.

This layered review structure supports supervisory oversight at multiple organizational levels and allows the Department to address both individual provider performance and broader operational and clinical trends within the EMS system.

The EMS QM program evaluates both individual clinical performance and system performance:

- Clinical performance reviews focus on patient assessment, appropriateness of treatment, protocol compliance, clinical decision-making, and accurate completion of electronic patient care reports (ePCRs). Documentation quality is a significant component of the review process, with an emphasis on thoroughness, accuracy, continuity-of-care information, and compliance with legal and regulatory documentation standards.
- System-level performance reviews focus on operational effectiveness, service delivery trends, and identification of areas requiring organizational improvement. The EMS Division reviews operational issues, recurring trends, and identified deficiencies to support the ongoing evaluation of the Department's EMS delivery model and clinical processes.

At the time of this assessment, the Department's written QM policy framework does not formally incorporate specific key performance indicators (KPIs) or measurable clinical benchmarking metrics. The Department participates in the Cardiac Arrest Registry to Enhance Survival (CARES), allowing cardiac arrest outcomes, including Return of Spontaneous Circulation (ROSC), survival rates, and bystander CPR performance, to be benchmarked against regional and national agencies. All cardiac arrest incidents undergo detailed internal review to support case-specific quality assurance, training, protocol evaluation, and annual policy updates. MFRD also participates in the American Heart Association's Mission: Lifeline EMS recognition program, earning the Silver Award in 2026 for excellence in prehospital stroke and cardiac care. Additionally, the Department monitors hospital patient transfer and ambulance off-load times through monthly performance reports shared with receiving hospitals, supporting system-wide collaboration to improve EMS resource availability and patient care. Although the Department conducts ongoing reviews and quality improvement activities, the absence of formally established KPIs could limit its ability to

consistently measure long-term clinical trends beyond cardiac arrest, benchmark performance against regional and national standards, and quantitatively evaluate system improvement initiatives over time.

Patient Refusals, Complaints, and Frequent Users

Station captains review 100% of patient refusals within 72 hours of the incident to ensure appropriate patient assessment, accurate documentation, and protocol compliance, and to confirm that patients who refused treatment or transport were properly advised of the risks and follow-up care recommendations.

Patient complaints received by the Department are forwarded to administrative staff for review and follow-up. A chief officer is subsequently assigned to investigate the circumstances surrounding the complaint, gather information from involved personnel, and take follow-up actions as necessary. This process supports accountability, customer service evaluation, and identification of potential operational and clinical concerns.

Although the Department does not currently maintain a formal program for tracking frequent EMS system users, operational personnel can escalate concerns through the chain of command when repeat-use patterns are identified. In certain situations, the Miramar Police Department or MFRD chief officers may be involved in coordinating assistance and addressing ongoing issues associated with frequent system use.

Patient Outcomes and Clinical Research

Patient outcomes are documented and tracked electronically through the Department's ESO® records management system (RMS). The RMS utilizes health information exchange capabilities to provide EMS personnel and administrators with access to patient outcome information when available. This data supports clinical learning, provider feedback, and continuous quality improvement initiatives.

In addition, trauma and stroke specialty teams at Memorial Regional Hospital Miramar provide specific patient outcome feedback to the EMS Division for selected incidents. This information is shared with field personnel to reinforce clinical education, improve treatment consistency, and support ongoing provider development related to critical patient care incidents.

RECORDS MANAGEMENT AND DATA COLLECTION

MFRD uses the ESO® RMS to record patient data in its ePCRs. Patient records are integrated with the fire and other software reporting records. In addition, the RMS is integrated with the Broward County computer-aided dispatch (CAD) system. The RMS is compliant with the National Emergency Medical Services Information System (NEMSIS), the National Emergency Response Information System (NERIS), and the Health Insurance Portability and Accountability Act (HIPAA).

MFRD provides thorough documentation concerning patient care, as well as tracking times, which are valuable for evaluating system performance, including:

- Time call received
- Dispatch time
- Time unit began response
- Time of arrival at the scene
- Patient contact time
- En route to hospital (or other facility) time
- Arrival at the hospital time
- Unit back-in-service time

Patient-care reports are provided via the ESO® platform's Health Data Exchange (HDE) module. After the report author closes the prehospital report, the hospital can access the HDE module to review it.

SUPPLIES AND LOGISTICS

EMS staff members check the supplies and equipment on each apparatus daily. MFRD has a robust program for managing EMS disposable supplies, durable goods, medications, and controlled substances. Supplies inventory is managed through the Operative IQ® system, and controlled substances are managed through PSTrax™, both of which are online software applications.

BILLING AND FINANCE

The MFRD outsources its ambulance billing and collection activities to Digitech, a private company based in New York. Rescue operations are partially funded through transport fees and through the Florida Public Emergency Medical Transportation (PEMT) program for Medicaid patients.

OPERATIONS

As previously discussed, MFRD provides emergency medical services through an integrated system that includes both medical first response and ALS patient transport. All frontline suppression apparatus and transport units are equipped and staffed to provide ALS-level care, allowing for rapid medical intervention throughout the Department's response system. MFRD refers to its ambulances as "rescue" units, consistent with terminology commonly used in many fire-based EMS systems.

Rescue unit personnel operate on a 24-hours-on/48-hours-off shift schedule beginning at 0800 hours, and they average approximately 2,496 scheduled work hours annually. The Department currently staffs five ALS rescue units, providing a total of 120 scheduled daily unit hours dedicated to ambulance transport operations.

Each of MFRD's fire stations houses two ALS units, with both rescue units and engine or truck companies providing ALS capabilities to support integrated fire and EMS response coverage throughout the community. Under the provisions of the Department's labor agreement, rescue units are staffed with a minimum of three personnel. This staffing configuration differs from that of most public and private ambulance transport systems, which commonly use two-person ambulance crews. The use of three-person rescue staffing can provide operational advantages in certain situations, including improved scene management, simultaneous patient care tasks, reduced physical workload during patient movement, enhanced operational safety, and greater availability of personnel during complex incidents and multiple-patient events.

However, three-person ambulance staffing also increases the Department's personnel requirements and operational costs associated with maintaining transport unit availability. Because EMS incidents comprise the majority of overall service demand, rescue staffing configurations can significantly affect unit-hour utilization (UHU), personnel deployment flexibility, overtime requirements, and long-term system sustainability.

MFRD does not provide long-distance, scheduled, or non-emergency interfacility transport services as part of its routine operational responsibilities. Rather, its EMS transport system is primarily focused on emergency response, prehospital patient care, and emergent transport associated with 9-1-1 system activation. By reducing routine involvement in scheduled and non-emergency interfacility transports, the Department can prioritize ambulance availability for emergencies occurring within the community. This operational approach helps reduce the extended unit commitment times commonly associated with long-distance transports and allows rescue units to remain more consistently available for emergency response coverage within the city.

MFRD provides and receives mutual-aid ambulance transport support throughout the surrounding region. Through automatic- and mutual-aid agreements with neighboring fire departments and EMS agencies, MFRD can assist

adjacent jurisdictions during periods of elevated call volume, simultaneous incidents, disaster operations, and temporary resource shortages. Likewise, neighboring agencies can provide transport and response assistance within Miramar when local resources are committed or unavailable.

At the time of this assessment, the Department does not utilize critical care paramedics or maintain a formal community paramedicine or mobile integrated health (MIH) program, although there have been internal discussions concerning their potential development. These programs are increasingly used in fire-based EMS systems to address chronic healthcare utilization, reduce preventable EMS demand, improve patient follow-up care, and support vulnerable and high-frequency users through nontraditional healthcare interventions and referral systems.

MFRD's current deployment model relies on fixed station-based ambulance assignments. It does not currently utilize a formal system status management (SSM) deployment model or deploy peak-demand rescue units during periods of historically elevated EMS activity. SSM models are commonly used within EMS systems to dynamically reposition ambulance resources based on historical demand patterns, unit availability, geographic coverage, and real-time call volume trends. Similarly, peak-demand units are often used to supplement ambulance availability during predictable periods of high call volume.

Although station-based deployment provides operational consistency, crew familiarity, and stable geographic coverage areas, the absence of dynamic deployment strategies and peak-demand resources can limit system flexibility during periods of elevated EMS demand, simultaneous incidents, and extended hospital turnaround times. These factors can affect unit availability, travel distances, and overall EMS response reliability during periods of high workload.



Life Safety and Public Education

Life safety services and public education programs are the foundation of all community risk reduction and fire prevention activities within fire agencies. Effective prevention programs reduce the frequency and severity of fires, injuries, civilian and firefighter fatalities, environmental damage, and property loss. The proactive investment in prevention and public education initiatives can yield substantial returns by reducing emergency incidents, improving community resilience, and limiting long-term operational and financial impacts on the jurisdiction.

Effective life safety and prevention programs typically are built upon the following seven core components:

1. Code enforcement activities
2. General inspection programs
3. New construction inspections and involvement
4. Fire and life safety public education programs
5. Fire investigation programs
6. Pre-incident planning
7. Statistical collection and analysis

FIRE LIFE SAFETY DIVISION

The MFRD's Fire Life Safety (FLS) Division is responsible for administering the Department's community risk-reduction, fire-prevention, code enforcement, and public life safety programs. The division is managed by the fire marshal and deputy fire marshal and supported by five fire inspectors. In addition to conducting inspections, inspectors perform fire investigations, plan reviews, and code enforcement activities, providing a multifaceted approach to prevention and risk reduction. Additional positions within the division include the FLS coordinator.

FIRE LIFE SAFETY PROGRAMS

The most effective method of combatting fires is to prevent them from occurring. Through the enforcement of adopted fire codes, proactive inspections, public education, and hazard-mitigation activities, comprehensive life safety programs reduce the risk of injury, death, property loss, business interruption, and the community disruption associated with fire and other emergencies.

The division's general duties and responsibilities include conducting annual and periodic inspections of commercial occupancies, reviewing construction and renovation plans for code compliance, investigating fires to determine their origin and cause, enforcing applicable fire and life safety codes, participating in development and construction review processes, supporting public education initiatives, and maintaining the records and statistical data necessary for organizational planning and compliance reporting.

Code Enforcement and Fire Safety Inspections

Effective code enforcement and inspection programs support firefighter safety by identifying hazards before emergency incidents occur. MFRD has adopted the 2021 editions of NFPA 1: Fire Code and NFPA 101: Life Safety Code, as well as the applicable provisions of the Florida Fire Prevention Code. These codes establish the minimum standards for fire prevention, life safety, building fire-protection systems, HazMat management, emergency access,

and occupant safety within the community. The Fire Life Safety Division is responsible for enforcing these codes through inspections, plan reviews, permit processes, investigations, and ongoing occupancy compliance activities.

The division's general activities and duties related to code enforcement and fire safety inspections are outlined in **Table 6.**

Table 6: Fire Life Safety Division Inspection and New Construction Activities

Activity	Fire Life Safety Division Responsibilities
Fire Safety Inspections	
Citation process	Violation issued after two failed inspections
Inspections software	Recorded on MobileEyes Fire Inspection software
Occupancy inspections	Conducts annually per the Florida Fire Prevention Code (FFPC)
Special risk inspections	Annually as needed
Storage tank inspections	If part of the structure being inspected
Hydrant flow record maintenance	All new hydrant flow records are maintained
Inspection fees	Yes
New Construction Inspections	
Fire Life Safety Division consults on new construction	Division conducts pre-application meetings
Plan reviews	Yes
New construction approval	Permit cards and on-site inspections
Fees for reviews and inspections	Yes, for both

Fire Investigation and Fire Cause Determination

Investigating fires and determining their causes are critical components of comprehensive community risk-reduction and fire-prevention programs. In accordance with NFPA Standard 921: *Guide for Fire and Explosion Investigations,* fire investigations generally result in the identification of one of four classifications of fire causes: accidental, natural, incendiary, and undetermined. In addition, NFIRS requires fire departments to document the ignition factors and causes of all reported fires, further emphasizing the importance of accurate and consistent investigations.

Accurately determining the origin and cause of fires provides valuable information to reduce future incidents, improve public safety, and support enforcement actions. The identification of incendiary and intentionally set fires can assist law enforcement agencies in apprehending and prosecuting responsible individuals, potentially preventing additional criminal fire activity within the community. Likewise, identifying accidental and natural causes of fires provides critical insight into recurring hazards, unsafe behaviors, equipment failures, electrical issues, cooking-related incidents, and other contributing factors. This information enables the Department to develop targeted fire-prevention initiatives, public education campaigns, inspection priorities, and code-enforcement strategies to reduce similar incidents in the future.

The MFRD Fire Life Safety Division is responsible for conducting fire origin-and-cause investigations within the city. These activities include scene examinations, evidence documentation, witness interviews, photographic

documentation, coordination with law enforcement and insurance representatives, ignition source analysis, fire pattern evaluation, and completion of NFIRS-compliant reporting requirements. Fire investigation personnel also support arson-related investigations and coordinate with regional, state, and federal agencies when criminal activity and complex investigations are suspected.

Table 7 summarizes the primary activities performed by MFRD's Fire Life Safety Division related to fire cause determination, fire investigation, and arson investigation activities.

Table 7: Fire Life Safety Division Fire Cause Determination Activities

Activity	Fire Life Safety Responsibilities
Fire origin and cause determination	Yes
Arson investigation and prosecution	FLS with the Florida Bureau of Fire Prevention
Arson investigation training	No
Training and certification requirements	Origin and Cause Certificate
Persons responsible for investigations	On-scene officer and FLS Division inspectors
Process for handling juvenile suspects	MFRD with Miramar Police Department and Florida Bureau of Fire Prevention

Public Education

Fire and life safety public education programs are designed to reduce the frequency and severity of emergencies by educating community members on hazard recognition, prevention strategies, emergency preparedness, and appropriate actions during emergencies. Comprehensive public education initiatives provide communities with the knowledge necessary to reduce the impacts of fires, injuries, medical emergencies, and other hazards. In addition, effective public education programs can directly improve firefighter safety by reducing preventable incidents, promoting early notification, and encouraging safer community behaviors.

The MFRD Fire Life Safety Division does not directly manage or conduct the Department's public education programs. Rather, an administrative officer coordinates, schedules, and manages community outreach and public education activities. This approach allows the Department to maintain consistent public messaging and community engagement, while supporting a broad range of educational initiatives throughout the city.

NFPA Standard 1730: *Standard on Organization and Deployment of Fire Prevention Inspection and Code Enforcement, Plan Review, Investigation, and Public Education Operations* (2019 Edition) specifically identifies the importance of community risk-reduction and targeted public education programs. The standard recommends that public education initiatives be developed based on the Department's CRA and be tailored to identified community hazards, demographics, and vulnerable populations. NFPA 1730 further recommends that programs target specific age groups and audiences, when appropriate, and provide educational materials and information to caregivers, parents, educators, and adult supervisors.

MFRD's public education efforts are intended to support the Department's overall community risk-reduction strategy by increasing public awareness of fire and life safety hazards, promoting emergency preparedness, encouraging the installation and maintenance of smoke alarms, educating the public on fire-prevention practices, and enhancing community resilience. These programs can include school-based education, station tours, smoke alarm awareness campaigns, participation in community events, CPR and safety training, social media outreach, hurricane preparedness information, and other targeted life safety initiatives based on identified community risks and operational trends.

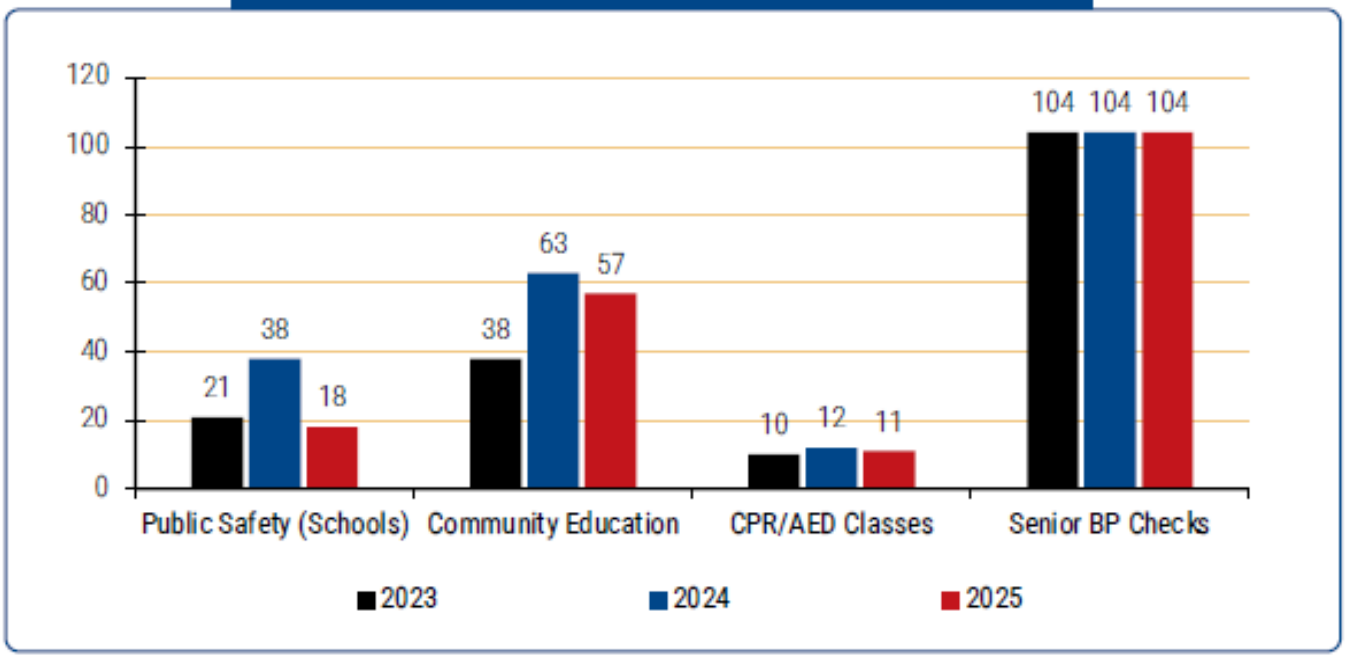
Table 8 outlines the primary public education and community outreach programs currently provided by MFRD.

Table 8: MFRD Public Education Programs

Program
Exit Drills in the Home (EDITH)
Calling 9-1-1
Smoke alarm program
Home safety education (space heaters, electrical, etc.)
Injury prevention (falls, burns, bike helmets, etc.)
Fire extinguisher use
Elderly care and safety
CPR courses and AED
Blood pressure checks

Figure 5 illustrates the various public education programs delivered by MFRD during 2023 through 2025.

Figure 5: MFRD Public Education Programs Provided, 2023–2025



MFRD conducts a variety of community education and outreach events designed to address identified community risks and improve overall public safety awareness. These educational programs are provided to residents of all ages and cover fire prevention, emergency preparedness, and general life safety awareness. Educational efforts have included fire prevention, bicycle safety, child passenger and car seat safety, drowning prevention, senior citizen safety, overdose and drug awareness, and other community risk-reduction topics identified through incident trends and local hazards.

In addition to in-person educational activities, MFRD conducts multiple public information, marketing, and social

media campaigns during Fire Prevention Month. These campaigns focus on increasing public awareness and promoting preparedness related to a variety of safety topics, including hurricane preparedness, holiday safety, smoke alarm installation and maintenance, child passenger safety and car seat checks, home safety awareness, emergency response actions during fires, home escape planning, bicycle safety, water safety and drowning prevention, and residential fire safety practices.

The Department's use of social media and community outreach initiatives enhances public engagement and expands its capacity to deliver timely life-safety messages to a broader audience. These programs support the Department's overall community risk-reduction strategy by increasing hazard awareness, encouraging preventative behaviors, and improving the community's ability to recognize, avoid, and respond appropriately to emergencies.



Training and Continuing Medical Education

Delivering safe, effective, and professional fire and emergency medical services requires a highly trained and competent workforce. Comprehensive initial training, continuing education, and ongoing skills development are essential components of any successful fire and EMS organization. Effective training programs directly influence operational performance, firefighter safety, emergency scene effectiveness, regulatory compliance, and the agency's overall ability to meet community expectations and service demands.

The initial training of newly hired firefighters is a critical process involving a structured recruit training program designed to develop the foundational knowledge, skills, abilities, and competencies necessary to perform emergency response duties safely and effectively. Recruit training programs typically include classroom instruction, manipulative skills training, scenario-based exercises, physical performance requirements, and formal testing and evaluation processes to validate competency prior to independent field assignment.

Following initial recruit training, ongoing and recurring training is necessary to maintain operational readiness, reinforce critical skills, and ensure continued competency in both routine and high-risk emergency operations. Continuing education and recurrent training also support compliance with state certification requirements, occupational safety regulations, medical licensure standards, and evolving industry best practices. Training programs include both cognitive and practical performance evaluations to verify learning, knowledge retention, and skill proficiency.

Providing high-quality training requires a substantial organizational commitment, including dedicated personnel, training facilities, equipment, scheduling coordination, and administrative oversight. Departments can utilize internal training divisions and instructors, regional partnerships, training consortiums, and/or external educational providers to deliver specialized instruction and certifications. Effective training systems also require clearly defined written objectives, lesson plans, standardized curricula, performance benchmarks, and documented methods for evaluating participant comprehension and competency.

Comprehensive training and professional development programs enhance firefighter safety, improve emergency scene performance, reduce organizational liability, support succession planning, and strengthen a fire department's ability to deliver consistent, effective service to the community.

GENERAL TRAINING PROGRAM

Training Administration

MFRD maintains a comprehensive training and professional development program under the direction of the division chief of training, with operational and instructional support provided by two training captains. The Training Division is responsible for coordinating and delivering training programs designed to maintain operational readiness, ensure regulatory compliance, support firefighter safety, and enhance organizational effectiveness across all emergency service disciplines.

In addition to fire service training responsibilities, the Training Division supports the Department's EMS Division by facilitating continuing medical education (CME) activities for EMS personnel. Although the Training Division assists in the delivery and coordination of CME programs, the EMS Division retains responsibility for the development, planning, content management, and scheduling of EMS-specific CME requirements. This collaborative approach supports ongoing paramedic and EMT certification compliance while integrating EMS training into the Department's overall professional development system.

MFRD currently allocates approximately $184,000 annually for training-related expenses. These funds support

instructor development, training materials, certifications, outside educational opportunities, training props and equipment, compliance training, and other professional development activities. Although the Department maintains a structured training program, there is currently no clerical or administrative staff assigned specifically to the Training Division; administrative responsibilities such as scheduling, records management, documentation, reporting, and course coordination are managed by existing training personnel in addition to their operational and instructional duties.

The Training Division utilizes personnel certified as Instructor I, Officer I, and Live-Fire Training instructors to support the delivery of Department training programs. These certified instructors provide classroom instruction, hands-on training with manipulatives, company-level drills, live-fire evolutions, officer development, and specialized operational training. The use of qualified instructors helps ensure training programs are delivered in accordance with applicable professional standards, safety requirements, and state certification guidelines; while supporting competency verification and organizational consistency.

Training Facilities and Resources

MFRD does not currently maintain or operate a standalone fire training center within the city. Department staff consider the existing office space, training equipment, and instructional materials to be generally sufficient to support the Department's current training delivery needs. MFRD relies on regional partnerships and cooperative training arrangements to access specialized facilities and live-fire training environments.

MFRD primarily utilizes the Pembroke Pines Fire Rescue Training Facility **(Figure 6),** located less than 10 miles from the Department, with an estimated travel time of approximately 20 minutes under normal conditions. It is a state-of-the-art regional training center featuring multiple training props, drill grounds, classroom space, training towers, and live-fire capabilities. Access to this facility provides MFRD personnel with opportunities to conduct realistic, hands-on training evolutions, live-fire exercises, driver and apparatus operations training, technical skill development, and multi-company operational drills in a controlled environment.

The Department has developed internal professional development and competency-based training materials, including a recruit manual and both officer and driver task books. These materials assist in standardizing training expectations, documenting competency progression, supporting promotional development, and ensuring personnel demonstrate proficiency in required operational knowledge and skills. Structured task books and training manuals also support accountability, consistency, succession planning, and long-term workforce development within the organization.

EMS Training Resources

Located within the department's logistics facility is a dedicated EMS Skills Lab designed to support CME, hands-on skills training, and scenario-based instruction. The standalone lab includes classroom space and three breakout training stations, each equipped with audiovisual capabilities to support lecture-based and interactive training activities. It maintains adult and pediatric manikins for EMS skills development, patient assessment training, airway management, resuscitation practice, and medical simulation exercises. In addition, the lab contains a variety of EMS-specific equipment and training props,

Figure 6: Pembroke Pines Fire Rescue Training Facility



including jump bags, medication and drug boxes, and ZOLL cardiac monitoring equipment for use during training scenarios and competency evaluations. These resources enable personnel to train using equipment and procedures consistent with actual field operations, thereby improving skill retention and operational readiness.

Each MFRD fire station also features a designated training room equipped with EMS skills kits and related instructional equipment to support company-level drills, routine skills maintenance, and decentralized CME activities. However, larger group training sessions, formal CME programs, multi-company drills, and structured simulation exercises are typically conducted at the EMS Skills Lab to leverage its specialized equipment, classroom configuration, and instructional capabilities.

The Department's investment in dedicated EMS training facilities and equipment supports ongoing clinical competencies, enhances training realism, and strengthens the agency's ability to maintain high-quality EMS delivery across the organization.

GENERAL TRAINING COMPETENCIES

The Training Division identifies the annual hours necessary to meet MFRD's training goals and objectives. **Table 9** summarizes the general training topics provided by MFRD.

Table 9: MFRD General Training Competencies

Competency	MFRD Training Level
Incident command system	ICS 100, 200, 300, 400, 700, 800
Accountability procedures	Yes
Formal training standard operating guidelines (SOGs)	Yes
Recruit academy	Internal; 12–13 weeks in duration
Special rescue training	Technical rescue team (TRT) in training phase; not operational
HazMat certifications	HazMat awareness
Vehicle extrication training	Vehicle and mechanical
Driver certification	Emergency vehicle operator course
Radio operations and dispatch	Policies established for review

EMS CLINICAL SKILLS

MFRD maintains documentation and tracks performance for a variety of specific EMS clinical skills and procedures, including ALS competencies such as endotracheal intubation and venipuncture. The Department monitors procedure completion and success rates to evaluate clinical proficiency, identify training needs, support quality assurance activities, and maintain competency among EMS personnel. Tracking procedural outcomes and success rates also provides valuable data for continuous quality improvement and helps ensure that personnel maintain proficiency in low-frequency, high-risk medical skills.

Portions of the Department's CME program are delivered through the Vector Solutions software platform. The use of online learning management systems enables personnel to complete assigned training, compliance coursework, policy reviews, and educational modules in a flexible, standardized manner, while improving documentation and tracking training completion. The combination of online education, classroom instruction, hands-on simulation, and scenario-based training supports a blended learning approach to EMS continuing education and professional development.

Although MFRD maintains structured EMS training and CME programs, the Department does not currently utilize a formal EMS field training and evaluation program (FTEP) or designated EMS field training officers (FTOs). Formalized FTEPs are common within fire and EMS organizations to standardize the onboarding, evaluation, mentorship, and competency verification processes for newly hired and newly certified personnel. The absence of a formal EMS FTEP and assigned EMS FTO personnel could limit the Department's ability to consistently standardize clinical evaluation, field performance documentation, and mentorship processes for probationary personnel. Establishing a formalized EMS FTEP could enhance operational consistency, improve documentation of competency progression, strengthen quality assurance efforts, and support long-term clinical performance and workforce development objectives.

Table 10 lists MFRD's emergency medical training competencies.

Table 10: MFRD EMS Training Competencies

Competency	MFRD Training Interval
Initial EMT and paramedic training	External schools
Basic and advanced life support skills practice	Every 2 years
Other EMS-related training	Annual EMS skills testing



TRAINING DELIVERY AND SCHEDULING

Table 11 summarizes the training methodologies utilized by MFRD.

Table 11: Methodologies Utilized in Training

Topics	MFRD Training Durations
Manipulative skills and tasks	Monthly
Skills performance evaluations	Annually
Annual Fire Training Hour Requirements	
Facility hours	18 hours
Company training	192 hours
Driver training	12 hours
Officer training	12 hours
Annual EMS training requirements	64 hours/person
Use of lesson plans	Created internally
Multi-company drills	Semi-annually
Night drills	Annually
Multi-agency drills	Yes
Inter-station drills	Monthly
Disaster drills	Semi-annually
Pre-fire planning included in training	Yes

PERSONNEL TRAINED AND RECORDKEEPING

The MFRD provides 240 hours of fire-related training and six hours of hazardous materials training per person annually. In addition, each person receives at least 64 hours of EMS-related training annually. In 2025, 172 personnel were trained, totaling 47,842 hours.

Table 12 shows MFRD's training recordkeeping methods. The division chief of training is responsible for ensuring complete and accurate documentation of individual and other training records. Individual EMS certifications are tracked electronically.

Table 12: MFRD Training Recordkeeping

Type of Record	MFRD Recordkeeping
Individual training files are maintained	Yes
Records and files digitized	Using Target Solutions™
Daily training records are maintained	Yes
Company training records are maintained	Yes
Training equipment inventoried	Semi-Annually
Fire, EMS, and other certifications tracked	Yes

ISO TRAINING CREDIT

The Insurance Services Office (ISO) reviewed MFRD in January 2023. **Table 13** lists the credit given for training.

Table 13: ISO Credit for Training at MFRD, January 2023

Topics	Earned Credit	Credit Available
A. Facilities and use	**35.00**	35
B. Company training	**21.72**	25
C. Classes for officers	**11.52**	12
D. New driver and operator training	**5.00**	5
E. Existing driver and operator training	**4.20**	5
F. HazMat training	**1.00**	1
G. Recruit training	**5.00**	5
H. Pre-fire planning inspections	**12.00**	12

When assigning a PPC grade, ISO awards up to 9 points for training. In the 2023 review, MFRD was awarded 8.59 points for training.

TRAINING DIVISION ANALYSIS

Although the MFRD does not currently maintain a standalone fire training facility, the Department has established a robust and effective Training Division that supports ongoing operational readiness, professional development, and continuing education requirements. MFRD benefits from access to the Pembroke Pines Fire Rescue training facility, which provides high-quality regional training resources, live-fire capabilities, drill grounds, and specialized instructional environments that support a broad range of training activities.

Access to the Pembroke Pines Training Facility provides significant operational and instructional benefits; however, the distance between Miramar and the facility can create logistical and operational challenges, particularly when scheduling training for on-duty companies. The travel time required to transport personnel and apparatus to and from the regional training center can reduce unit availability, increase out-of-service time, complicate scheduling, and potentially affect system coverage during training activities. These challenges could become more significant as service demands, staffing levels, and training requirements continue to increase.

As training requirements continue to evolve, MFRD may benefit from periodically evaluating opportunities to expand local training capacity through either a dedicated training facility or enhanced regional training partnerships. Although the Department currently benefits from access to the Pembroke Pines Fire Rescue Training Facility, future increases in staffing, specialized training requirements, certification demands, and multi-company training activities may increase the value of additional training resources located within closer proximity to MFRD operations.

Potential benefits of expanded local training capacity include increased scheduling flexibility, reduced travel-related impacts on operational resources, enhanced opportunities for multi-company training, improved access to specialized training environments, and greater support for long-term workforce development initiatives. Any future evaluation should consider operational needs, projected service demand, available regional resources, capital costs, and long-term organizational priorities.

If financially necessary, the development of a dedicated training facility could be implemented through a phased, multi-year approach. Individual components, such as classroom space, training props, drill pads, driver training areas, and live-fire structures, could be constructed incrementally based on available funding, capital improvement planning, grant opportunities, and long-term organizational priorities. A phased development strategy would allow the Department to progressively expand training capabilities while minimizing the immediate fiscal impacts on the organization and the city.



Emergency Communications

The Broward County Office of Regional Communications and Technology (ORCAT) oversees and manages the regional 9-1-1 emergency communications system and Broward County Regional Communications (BCRC). BCRC operates three primary public safety answering points (PSAPs) strategically located in Coconut Creek, Pembroke Pines, and Sunrise to provide emergency call processing and dispatch services throughout Broward County. The communications system is accredited through the Commission on Accreditation for Law Enforcement Agencies, demonstrating compliance with nationally recognized public safety communications standards and best practices.

BCRC provides emergency communications and dispatch services to approximately 1.8 million residents and supports 28 municipalities and agencies throughout Broward County, including the City of Miramar and the MFRD. Services provided by BCRC include 9-1-1 call receipt and processing, emergency medical dispatching, fire and law enforcement dispatching, radio communications coordination, and regional interoperability support for participating agencies.

The regional communications system is funded through a dedicated special tax assessment, enabling participating jurisdictions to share the operational costs of maintaining a consolidated emergency communications system. Regionalized communications systems such as BCRC can provide operational efficiencies, standardized dispatch procedures, improved interoperability, consolidated technology infrastructure, and enhanced redundancy capabilities during major incidents and system disruptions.

BCRC STAFFING AND TRAINING

BCRC employs 449 personnel, including 370 dispatchers and 45 management staff who supervise and support regional emergency communications operations. Communications personnel work a 42-hour workweek, consisting of three 12-hour shifts and one 6-hour shift, providing continuous 24-hour staffing coverage for the regional communications system and participating public safety agencies.

Dispatch personnel are trained and certified in accordance with the APCO International Project 33 training program, which establishes nationally recognized minimum training standards and competencies for public safety telecommunicators. This training framework supports standardized emergency call processing, radio communications procedures, incident prioritization, and dispatcher competency development within the regional communications environment.

In addition, the Florida Department of Health in Broward County oversees dispatcher training requirements for emergency medical dispatch (EMD) and certifies communications personnel in approved EMD protocols and procedures. EMD-certified dispatchers provide medically approved pre-arrival instructions, caller interrogation, and emergency medical prioritization, assisting callers before field personnel arrive. Properly trained EMD personnel play a critical role in improving patient outcomes, reducing response delays, prioritizing resources, and enhancing the overall effectiveness of the emergency response system.

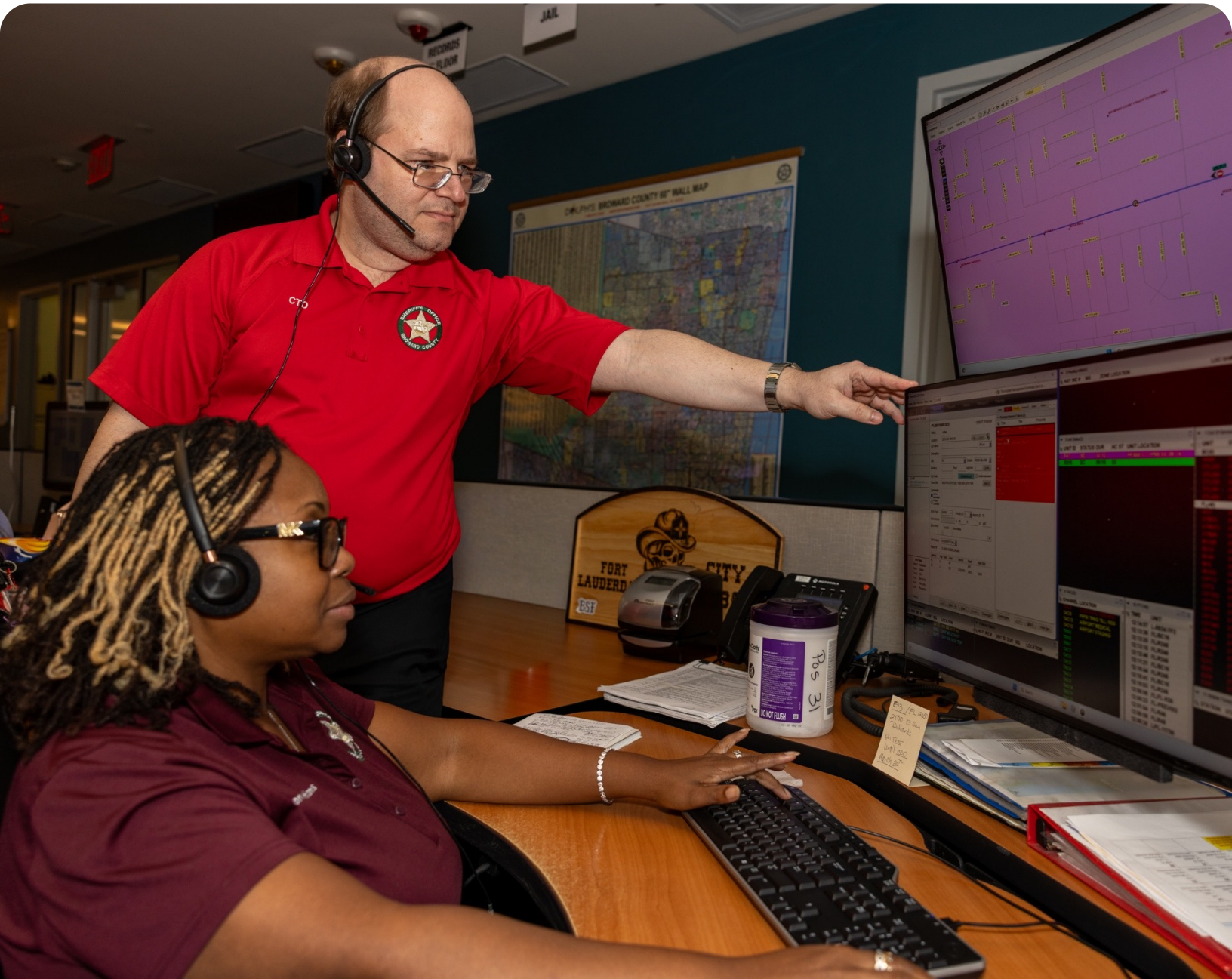
COMMUNICATION TECHNOLOGIES AND STANDARDS

BCRC utilizes the Honeywell US Digital Designs station alerting system for initial fire station notification and alerting, followed by live dispatcher voice communications to responding units. This layered alerting approach enhances reliability, improves notification efficiency, and supports rapid turnout and response initiation for emergency incidents.

BCRC operates on a regional 700 MHz public safety radio system with backup communications capabilities to support redundancy and continuity of operations during system failures and major incidents. All responding units are equipped with automatic vehicle location (AVL) technology, allowing dispatch personnel to monitor apparatus locations in real time, improve unit selection, support resource deployment decisions, and enhance operational awareness throughout the response system.

EMD operations use Priority Dispatch ProQA Paramount software to provide standardized interrogation, prioritization, and pre-arrival instructions during emergency medical calls. The use of structured EMD protocols supports consistent call processing, improves patient care prior to responder arrival, assists with resource prioritization, and enhances the overall effectiveness of the EMS system.

BCRC maintains 15 dedicated dispatcher workstations for fire department communications operations. The regional communications facilities which processes approximately 2.3 million calls annually, including approximately 1.7 million 9-1-1 emergency calls. According to available performance data, calls are answered within 15 seconds in 90% of incidents, demonstrating compliance with the performance objectives identified in NFPA Standard 1225: *Standard for Emergency Services Communications*. Compliance with nationally recognized communications performance standards supports efficient emergency call processing, timely dispatch, and the overall effectiveness of the emergency response system.



Capital Facilities and Apparatus Inventory

Fire departments require the essential capital resources of apparatus, emergency response vehicles, trained personnel, firefighting and emergency medical equipment, and fire stations to effectively fulfill their mission. Regardless of staffing levels or personnel competency, the absence of any of these resources would significantly limit MFRD's ability to deliver effective emergency services, maintain operational readiness, and protect the community. The planning, maintenance, and long-term replacement of these capital assets are critical components of organizational sustainability and service delivery.

The primary capital assets supporting emergency operations include fire stations, frontline apparatus, reserve apparatus, specialty response vehicles, and the associated support infrastructure. These resources directly influence emergency response capabilities, response times, firefighter safety, operational effectiveness, and the Department's overall ability to meet community expectations. This section of the report evaluates MFRD's fire stations, facilities, and frontline emergency response apparatus.

FIRE STATIONS AND FACILITIES

Fire stations serve a critical role in delivering emergency services and are among the most important infrastructure assets within a fire department. Station location is strategic, as it significantly influences emergency response performance, travel times, unit reliability, and overall system effectiveness. Appropriately located and updated fire stations improve the Department's ability to confine fires to the area of origin, reduce property loss, improve patient survivability during medical emergencies, and enhance firefighter safety. Conversely, poorly located and outdated facilities can adversely affect response performance, operational efficiency, and service delivery.

In addition to geographic location, fire stations must be properly designed and maintained to support emergency operations, accommodate personnel, house apparatus and equipment, and meet current operational, health, safety, and workforce needs. Modern fire stations function as both emergency response facilities and residential living environments for personnel assigned to 24-hour shifts. As a result, station design, functionality, and condition directly affect firefighter health, safety, wellness, morale, and operational readiness.

Fire station activities and facilities should be regularly evaluated to ensure they remain adequate in size, functional, and capable of supporting both current and future operational demands. Examples of critical fire station functions and facility components include:

- Kitchen facilities, appliances, food preparation areas, and storage
- Residential living areas and sleeping quarters capable of accommodating on-duty personnel of all genders
- Bathrooms, showers, and hygiene facilities for all genders
- Training rooms, classroom space, conference areas, and library resources
- Firefighter health, wellness, and fitness areas
- Apparatus bays and equipment storage areas designed to support cleaning, maintenance, decontamination, and biohazard disposal activities
- Administrative offices, supervisory workspaces, computer stations, and operational support areas
- Communications systems, alerting systems, and technology infrastructure
- Secure storage and support areas for EMS equipment, medical supplies, and specialty response equipment
- Adequate parking, site access, and apparatus circulation space for emergency operations

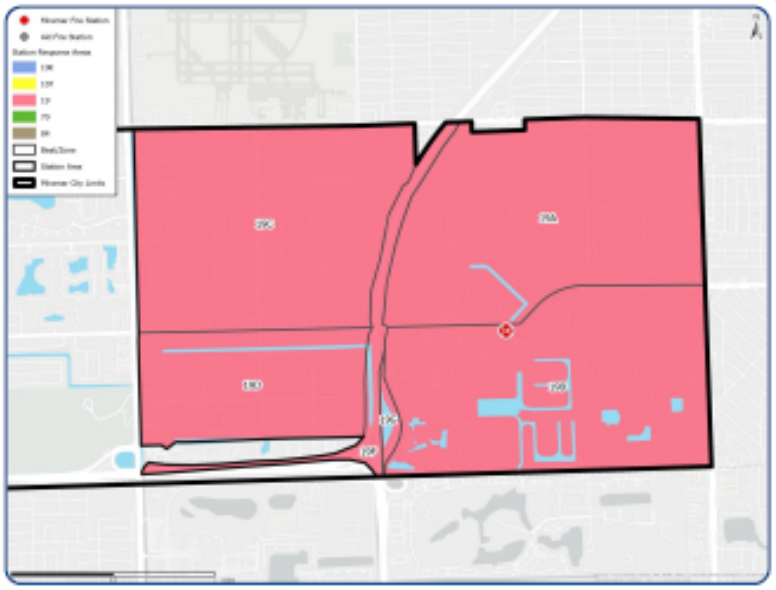
Modern fire station design should also incorporate firefighter cancer-reduction initiatives, contamination-control practices, separation of living and apparatus areas, energy efficiency, storm-hardening measures, backup power systems, and long-term adaptability to evolving operational and staffing requirements.

Figures 7 through 11 describe the MFRD's five fire stations, apparatus assigned to each station, and the total number of assigned personnel per day.

Figure 7: MFRD Station 19

6700 Miramar Parkway, Miramar, FL. 33023





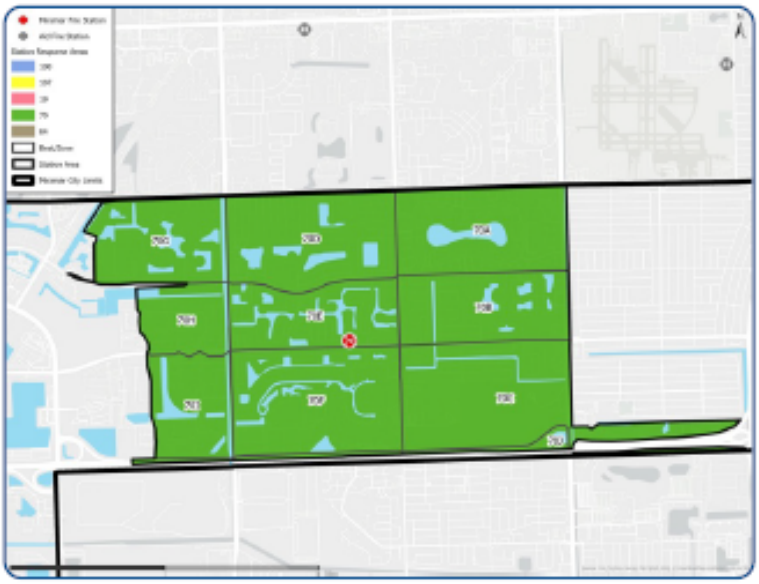
Apparatus ID	Apparatus Type	Staff Positions	Number of Personnel
Engine 19 (E19)	2016 E-One Type 1 fire engine	Captain, Driver Engineer, and Firefighter	3
Rescue 19 (R19)	2023 FTLR/AEV rescue unit	Rescue Lieutenant and Firefighter / Paramedic	3
TOTAL DAILY STAFFING			**6**

Figure 8: MFRD Station 70

9001 Miramar Parkway, Miramar, FL. 33025

15,814 sq. ft. | Year of original construction | **2007**





Apparatus ID	Apparatus Type	Staff Positions	Number of Personnel
Quint 70 (Q70)	2019 E-One/Typhoon Quint 70' aerial ladder	Captain, Driver Engineer, and Firefighter	3
Rescue 70 (R70)	2023 FTLR/AEV rescue unit	Rescue Lieutenant and Firefighter / Paramedic	3
Battalion 19 (BC19)	2022 Ford F-250 truck	Battalion Chief	1
TOTAL DAILY STAFFING			**7**

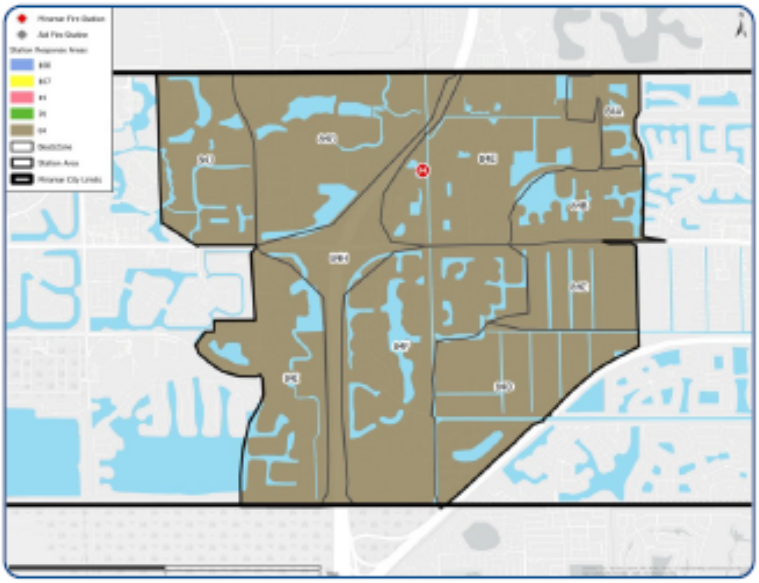
Figure 9: MFRD Station 84

14801 S.W. 27th Street, Miramar, FL. 33027

22,383 sq. ft. | Year of original construction | **1994**



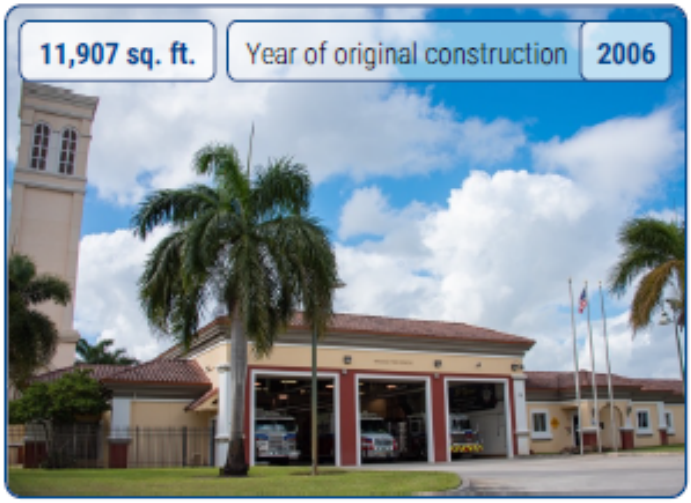
Note: MFRD Fire Administration is located on the second floor of Fire Station 84.

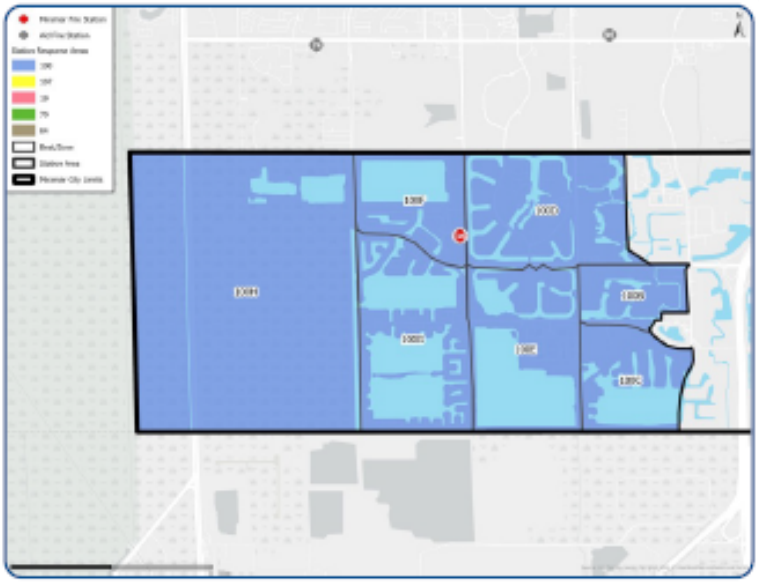


Apparatus ID	Apparatus Type	Staff Positions	Number of Personnel
Quint 84 (Q84)	2013 E-One/Quest Quint 100' aerial ladder	Captain, Driver Engineer, and Firefighter	3
Rescue 84 (R84)	2016 FTLR/AEV rescue unit	Rescue Lieutenant and Firefighter / Paramedic	3
TOTAL DAILY STAFFING			**6**

Figure 10: MFRD Station 100

2800 S.W. 184th Avenue, Miramar, FL. 33029

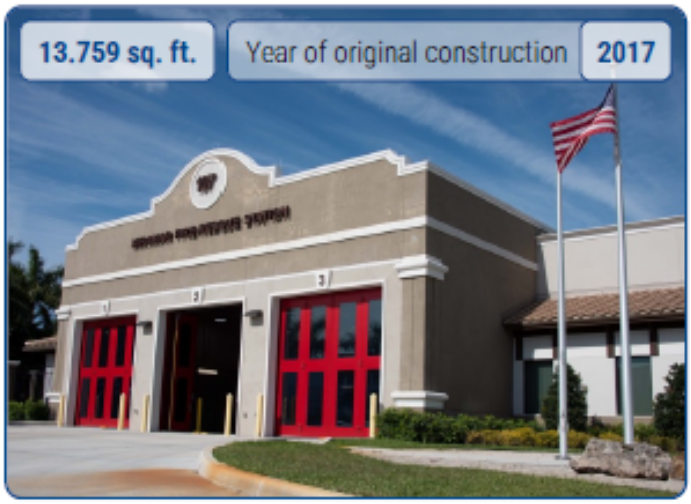


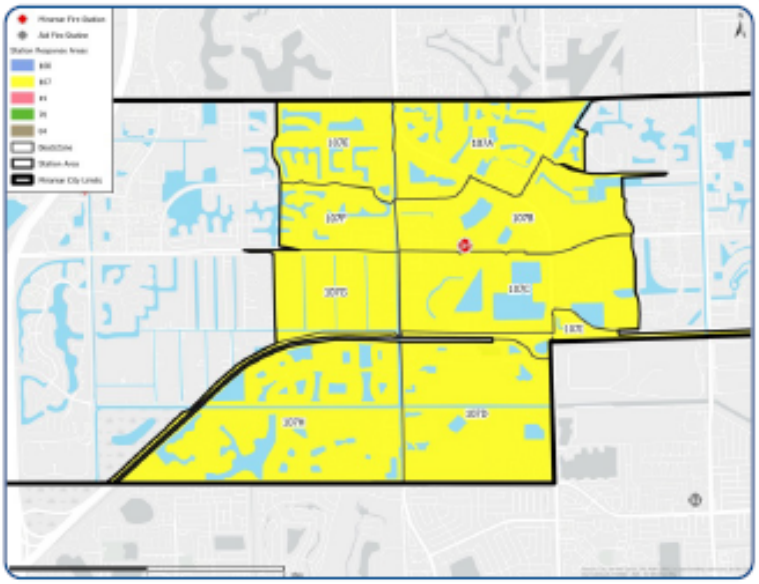


Apparatus ID	Apparatus Type	Staff Positions	Number of Personnel
Engine 100 (E100)	2017 E-One Type 1 fire engine	Captain, Driver Engineer, and Firefighter	3
Rescue 100 (R100)	2016 FTLR/AEV rescue unit	Rescue Lieutenant and Firefighter / Paramedic	3
TOTAL DAILY STAFFING			**6**

Figure 11: MFRD Station 107

11811 Miramar Parkway, Miramar, FL. 33025





Apparatus ID	Apparatus Type	Staff Positions	Number of Personnel
Engine 107 (E107)	2017 E-One Type 1 fire engine	Captain, Driver Engineer, and Firefighter	3
Rescue 107 (R107)	2018 FTLR/AEV rescue unit	Rescue Lieutenant and Firefighter / Paramedic	3
Battalion 84 (BC84)	2019 Ford F-250 truck	Battalion Chief	1
TOTAL DAILY STAFFING			**7**

Table 14 summarizes the primary features of MFRD's five fire stations.

Table 14: Summary of MFRD Fire Station Features

Station	Square Footage	Apparatus Bays	Daily Staffing	General Condition	Station Age
Station 19	12,931	3	6	Good	18 years
Station 70	15,814	4	7	Good	19 years
Station 84*	22,383	3	6	Good	32 years
Station 100	11,907	3	6	Good	20 years
Station 107	13,759	3	7	Good	9 years
TOTALS AND AVERAGES	**76,794**	**16**	**32**		**Average 20 years**

**Does not include the second floor.*

Collectively, the five fire stations provide an effective foundation for emergency service delivery throughout Miramar. Continued monitoring of community growth patterns, apparatus deployment, and future service demand will be necessary to ensure station locations and facility capacities remain aligned with long-term community needs.

APPARATUS AND VEHICLES

Fire apparatus, rescue units, command vehicles, and other emergency response vehicles are critical operational assets necessary for the effective delivery of fire suppression, emergency medical services, rescue operations, and other emergency response functions. These vehicles must be reliable, properly maintained, and appropriately equipped to safely and efficiently transport personnel and equipment to emergency incidents. The operational readiness and reliability of emergency response vehicles directly affect emergency response times, firefighter safety, patients, service continuity, and the Department's ability to meet community expectations and operational performance objectives.

In addition to transportation functions, frontline and reserve emergency vehicles must carry specialized firefighting, rescue, medical, communications, and safety equipment to respond to a wide range of emergencies. Apparatus failures, mechanical issues, and insufficient equipment can negatively affect operational effectiveness, increase out-of-service time, reduce system reliability, and potentially compromise emergency scene operations and firefighter safety. As a result, fire agencies must conduct comprehensive fleet management, preventive maintenance, replacement planning, and life-cycle evaluation programs to ensure that apparatus remain safe, dependable, and operationally effective throughout their service life.

Inventory and Condition

For this analysis, MFRD provided a comprehensive inventory of its emergency response fleet, including suppression apparatus, rescue units, command vehicles, specialty response vehicles, support vehicles, reserve apparatus, and other operational equipment. MFRD also evaluated and rated the condition of each vehicle in its fleet inventory using standardized assessment criteria shown in **Table 15.**

The evaluation of apparatus condition assists the Department in identifying aging equipment, establishing

replacement priorities, forecasting future capital expenditures, evaluating fleet reliability, and supporting long-term capital improvement planning. Regular apparatus condition assessments are important components of effective asset management and help ensure the Department maintains operational readiness while minimizing mechanical failures and service interruptions.

Table 15: Criteria Used to Determine MFRD Apparatus and Vehicle Condition

Components	Criteria for Point Assignment
Age	One point is assigned for every year of chronological age, based on the date the unit was originally placed into service.
Miles/Hours	One point is assigned for every 10,000 miles or 1,000 hours
Service	1, 3, or 5 points are assigned based on the service type (e.g., a pumper is classified as severe duty and assigned 5 points).
Condition	Points are based on body condition, rust, interior condition, accident history, anticipated repairs, etc. The better the condition, the lower the number of points.
Reliability	1, 3, or 5 points are assigned, depending on the frequency a vehicle is in the shop for repair (e.g., a 5 is assigned to a vehicle in the shop two or more times per month on average, whereas a 1 is assigned if it is in the shop on average once every three months or less).

Point Ranges	Rating	Condition Description
Under 18 points	Condition I	Excellent
18–22 points	Condition II	Good
23–27 points	Condition III	Fair (consider replacement)
28 points or higher	Condition IV	Poor (immediate replacement)



Table 16 outlines MFRD's current frontline apparatus, rescue units, and other vehicles, including condition and status. As shown, MFRD operates eight engines, two Quints, nine rescue units, and three command units (battalion wagons).

Table 16: MFRD Frontline Fleet Inventory (2026)

Unit	Type	Manufacturer	Year Purchased	Condition	Unit Assignment
Engines and Aerials					
FD-056	Type 1	Pierce	2001	Poor	Reserve
FD-057	Type 1	Pierce	2001	Poor	Reserve
FD-076	Type 1	Pierce	2007	Fair	Reserve
FD-085	Type 1	E-One	2011	Good	Reserve
FD-086	Type 1	E-One	2011	Good	Reserve
FD-105	Type 1	E-One	2016	Good	E19
FD-110	Type 1	E-One	2017	Good	E107
FD-112	Type 1	E-One	2017	Good	E100
FD-090	Quint	E-One/Quest	2013	Fair	Q84
FD-106	Quint	E-One/Typhoon	2016	Good	Q70
Rescue Units					
FD-069	Rescue	Medic Master	2003	Poor	Reserve
FD-074	Rescue	Medic Master	2007	Poor	Reserve
FD-078	Rescue	Horton	2010	Poor	Reserve
FD-092	Rescue	FTLR/AEV	2015	Fair	Reserve
FD-103	Rescue	FTLR/AEV	2016	Fair	R84
FD-104	Rescue	FTLR/AEV	2016	Fair	R100
FD-111	Rescue	FTLR/AEV	2018	Good	R107
FD-138	Rescue	FTLR/AEV	2023	Excellent	R19
FD-139	Rescue	FTLR/AEV	2023	Excellent	R70
Command Units					
FD-135	Battalion Wagon	Ford F-250	2022	Excellent	BC19
FD-102	Battalion Wagon	Ford F-350	2016	Fair	Reserve
FD-121	Battalion Wagon	Ford F-350	2019	Good	BC84

Of MFRD's eight engines and two Quints, six frontline apparatus (60%) were rated as "Good," and the others either in "Fair" or "Poor" condition. Of the nine rescue units, only three (33%) were rated as "Excellent" or "Good," with the six (67%) others rated as either in "Fair" or "Poor" condition. MFRD's engines range in age from 9 to 25 years, with an average age of 16 years. The rescue units range in age from 3 to 23 years, with an average of just over 11 years.

Maintenance and Replacement Planning

As fire apparatus, rescue units, and support vehicles age, maintenance and repair requirements typically become more frequent, more costly, and increasingly complex. Replacement parts often become more difficult to obtain, repair downtime increases, and the overall reliability of the apparatus declines. Because fire suppression and emergency medical services are mission-critical public safety functions, apparatus reliability and availability are essential operational considerations. As a result, excessive downtime is one of the most frequently cited reasons for replacing frontline emergency vehicles.

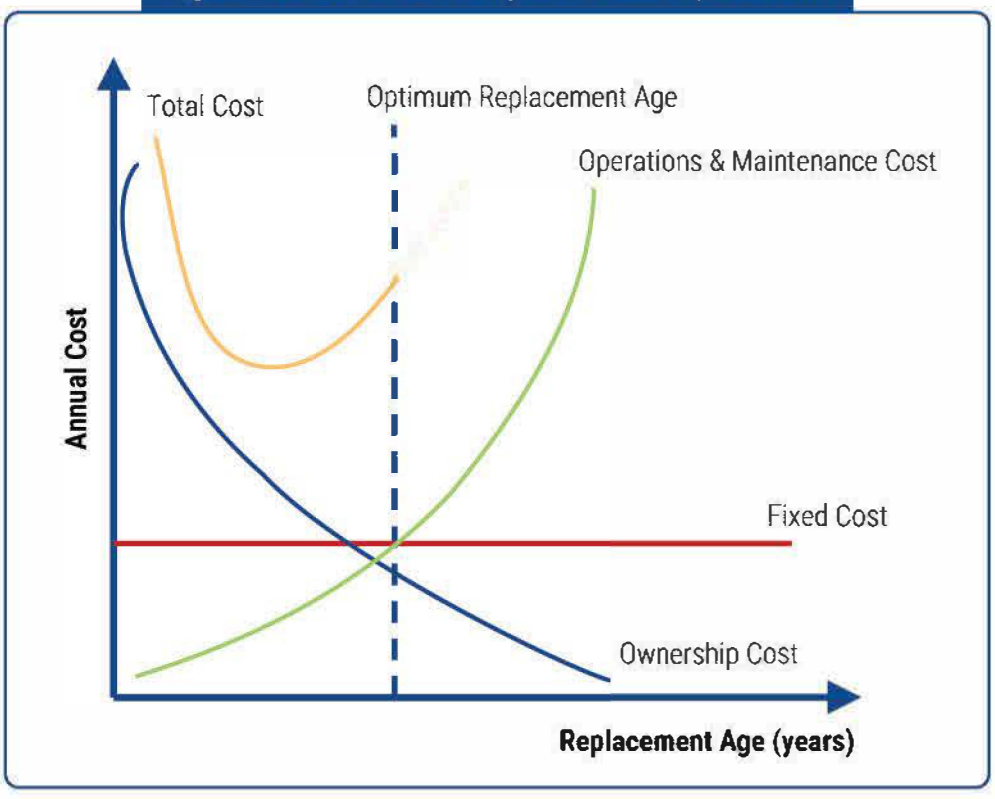
Due to the substantial cost associated with purchasing fire apparatus and ambulances, most fire departments and local governments establish long-term apparatus replacement programs and capital improvement plans. These plans often utilize predetermined apparatus life cycles to estimate future replacement dates and forecast funding needs. Establishing planned replacement cycles helps organizations manage capital expenditures, maintain fleet reliability, reduce unexpected failures, and support operational continuity.

Although predetermined replacement schedules are useful for financial planning, the actual replacement timeline for an apparatus should also account for operational performance, maintenance history, reliability, safety, technological obsolescence, and life cycle operating costs. In many cases, agencies achieve greater long-term cost-effectiveness by combining life cycle planning with comprehensive maintenance and performance evaluations to determine the optimal replacement time frame for each vehicle.

Economic Theory of Apparatus Replacement

The Economic Theory of Vehicle Replacement is a commonly used fleet management concept that suggests that, as a vehicle ages, the cost of capital ownership declines, while operating and maintenance costs increase **(Figure 12).** The intersection of these factors creates a total cost curve that identifies the optimal replacement window for a vehicle or apparatus. Using this model, the most cost-effective time to replace apparatus generally occurs when rising operating and maintenance costs begin to exceed declining capital costs. In practice, this optimal replacement point is often viewed as a replacement range rather than a single fixed date.

Figure 12: Economic Theory of Vehicle Replacement



The Economic Theory of Vehicle Replacement posits that as a vehicle ages, the cost of capital ownership declines, while operating and maintenance costs increase.

Adhering to planned replacement cycles within this optimal range can reduce long-term fleet costs, improve operational reliability, and minimize unexpected maintenance expenditures. Conversely, delaying apparatus replacement beyond the optimal life cycle window can initially reduce short-term capital expenditures, but ultimately result in increased operating costs, higher repair expenses, reduced apparatus availability, and greater long-term replacement costs.

Agencies considering deferred apparatus replacement as a budget-balancing strategy should recognize several potential consequences associated with extended replacement cycles:

- Costs can shift from the capital budget to the operating and maintenance budget.
- Deferred replacement can increase overall fleet life cycle costs.
- Apparatus reliability and operational availability can decline.
- Maintenance downtime and reserve apparatus utilization can increase.
- Safety risks associated with aging equipment can increase.
- Technological limitations and compatibility issues can affect operational efficiency.

Although replacement deferrals can temporarily reduce current capital expenditures, they often increase future replacement funding requirements and can negatively affect operational readiness, response reliability, and firefighter safety.

MFRD FLEET MAINTENANCE

The MFRD performs much of its fleet and apparatus maintenance internally, while major and more technically complex repairs and projects are outsourced to external vendors or specialized service providers. The city employs emergency vehicle technicians (EVTs), who maintain certifications and qualifications consistent with applicable NFPA standards and industry practices.

Preventive maintenance inspections and servicing are conducted on apparatus and vehicles at established time- and mileage-based intervals to support reliability, safety, and operational readiness. Maintenance documentation and service records are routinely maintained to track repairs, inspections, testing, and life cycle performance. In addition, annual fire pump testing is conducted in accordance with NFPA Standard 1911: *Standard for the Inspection, Maintenance, Testing, and Retirement of In-Service Emergency Vehicles.*[1]

ANALYSIS OF MFRD APPARATUS

Review of the MFRD's fleet inventory and apparatus condition information indicates that several frontline apparatus and rescue units are in less-than-ideal operational condition. Evaluation of the Department's frontline fleet indicates that multiple apparatus and transport units might be approaching or exceeding recommended frontline service life expectations and should be considered for replacement planning.

Many fire departments use a general apparatus life-cycle model of approximately 20 years for Type I fire engines, typically comprising 15 years of frontline service followed by 5 years in reserve status. NFPA guidance generally states that a 10- to 15-year life expectancy is typical for a frontline apparatus, depending on operational demands, maintenance practices, and apparatus condition.[2] This guidance is also supported in a publication by the Fire Underwriters Survey™ (FUS): *Insurance Grading Recognition of Used and Rebuilt Fire Apparatus.*

As apparatus age and operational demands continue to increase, MFRD should continue evaluating fleet reliability, maintenance costs, reserve apparatus availability, and replacement funding strategies to ensure the Department maintains safe, dependable, and operationally effective emergency response capabilities.

[1] *NFPA 1911: Standard for the Inspection, Maintenance, Testing, and Retirement of In-Service Emergency Vehicles.*
[2] *NFPA 1911: Standard for the Inspection, Maintenance, Testing, and Retirement of In- Service Automotive Fire Apparatus.*



SECTION 2

Community Risk Assessment

SECTION 2

PART I

Introduction and Methodology



Introduction

A Community Risk Assessment (CRA) provides a systematic evaluation of the risks that exist within a jurisdiction by identifying the probability, consequences, and potential impacts of emergencies on the community. The assessment serves as the foundation for understanding current and emerging risks, identifying community vulnerabilities, and evaluating the relationship between those risks and the delivery of fire and emergency services. By integrating historical incident data with demographic, socioeconomic, built environment, and infrastructure information, the CRA provides an objective, data-driven framework for assessing community risk and supporting informed decision-making.

The results of the Community Risk Assessment are used throughout this report to guide resource deployment, establish response performance objectives, evaluate Effective Response Force (ERF) requirements, prioritize community risk reduction initiatives, and support strategic planning and continuous quality improvement. The assessment also assists department leadership and elected officials in making informed decisions regarding staffing, station locations, apparatus deployment, capital improvements, emergency preparedness, and the allocation of resources to address both current and future community needs.

For this report, the three-axis risk assessment methodology was employed to evaluate community risk within the City of Miramar and the Miramar Fire-Rescue Department (MFRD). MFRD provides all-hazards emergency services from five strategically located fire stations, deploying ten frontline fire suppression and rescue apparatus and two command vehicles to protect approximately 31 square

miles. The three-axis methodology evaluates community risk by analyzing the probability of an incident occurring, the potential consequences should an incident occur, and the operational impacts associated with the Department's ability to effectively respond. Together, these three dimensions provide a comprehensive, spatially based assessment of community risk that serves as the analytical foundation for the Department's Community Risk Assessment and Standards of Cover. The community risk assessment (CRA) begins with an examination of the MFRD service area, including community demographics, characteristics of the built environment, critical infrastructure, identified hazards, historical incident activity, and current Department deployment and staffing practices. Computer-aided dispatch (CAD) and National Fire Incident Reporting System (NFIRS) data from calendar years (CYs) 2021 through 2025 were the primary data sources used for the analysis.

Following the identification of key risk variables, the three-axis risk assessment methodology, as recommended by the Center for Public Safety Excellence (CPSE), was applied to evaluate community risk by considering the interactions among probability, consequence, and organizational impact dimensions. These factors are discussed in greater detail below. In addition, to quantify risk geographically, MFRD’s entire service area was divided into a grid of hexagonal cells. Individual risk scores were calculated for each cell based on the identified variables and then aggregated into larger response zones corresponding to each of the Department's five fire stations. This approach provides a detailed, spatially based assessment of community risk and enables the direct comparison of risk levels throughout the city. The hexagonal approach offers two advantages: First, it divides the complete service area into small, manageable units, allowing risk to be characterized and compared at a granular level to inform resource allocation. Second, because hexbins are independent of jurisdictional and station boundaries, the methodology remains consistent even when those boundaries and underlying data points change over time — providing a repeatable, data-driven framework for future updates.

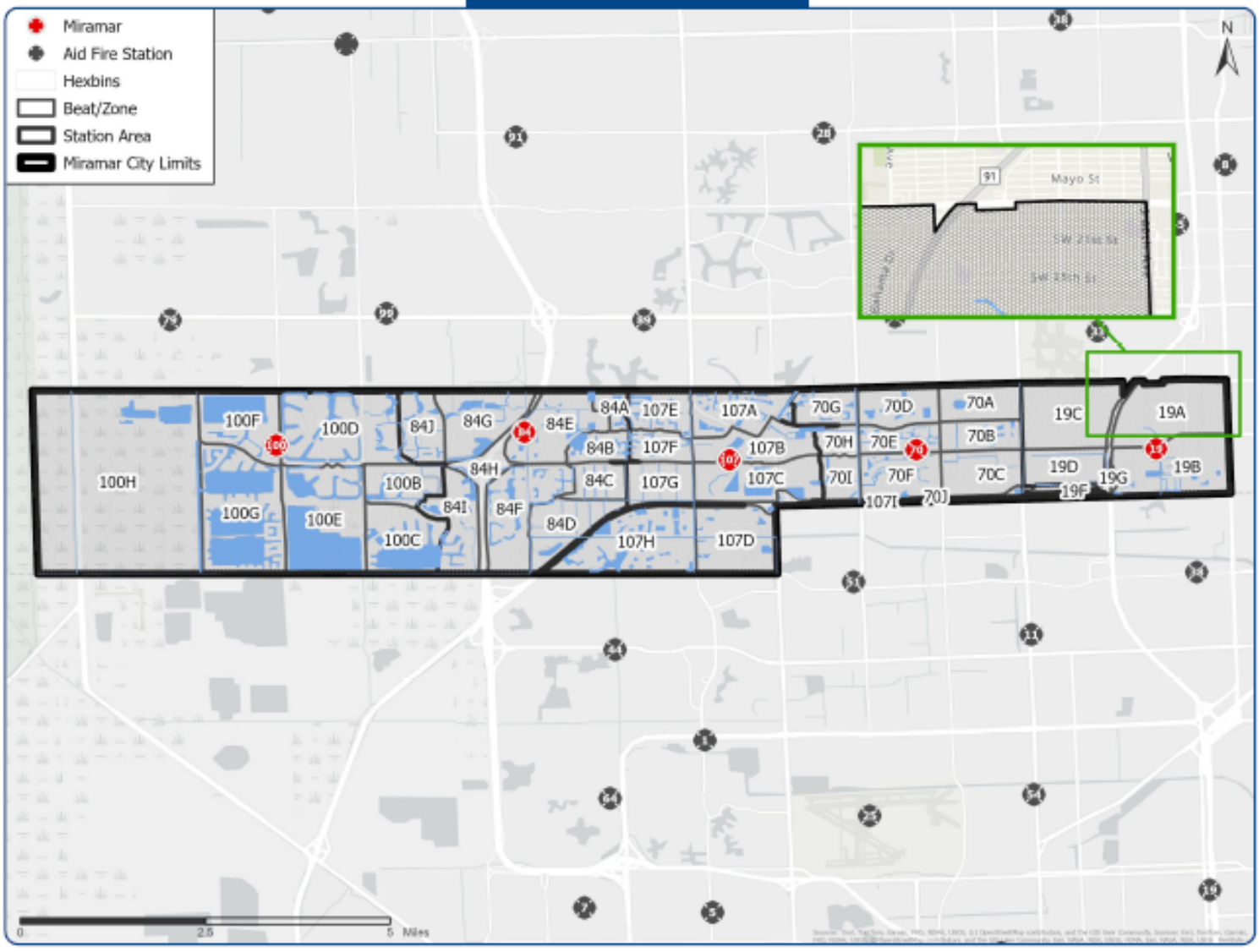
The maps, tables, and risk scores developed through this assessment identify concentrations of community risk and establish a baseline for future evaluation. MFRD will use these findings to support Standards of Cover deployment analysis, Effective Response Force requirements, community risk-reduction initiatives, strategic and capital planning, staffing and resource-allocation decisions, and continuous performance evaluation. Periodic updates will allow the Department to determine whether changes in community conditions, service demand, and organizational performance warrant modifications to programs or deployment strategies.

The Three-Axis Risk Assessment Methodology

The three-axis risk assessment methodology was selected for this analysis because it aligns with the risk assessment framework recommended by the CPSE, the Commission on Fire Accreditation International (CFAI), and CPSE's Quality Improvement for the Fire and Emergency Services manual. This methodology evaluates risk by analyzing three interconnected dimensions: probability, consequence, and impact. Together, these dimensions provide a comprehensive understanding of where emergency incidents are most likely to occur, the severity of their potential effects, and the operational demands they place on MFRD.

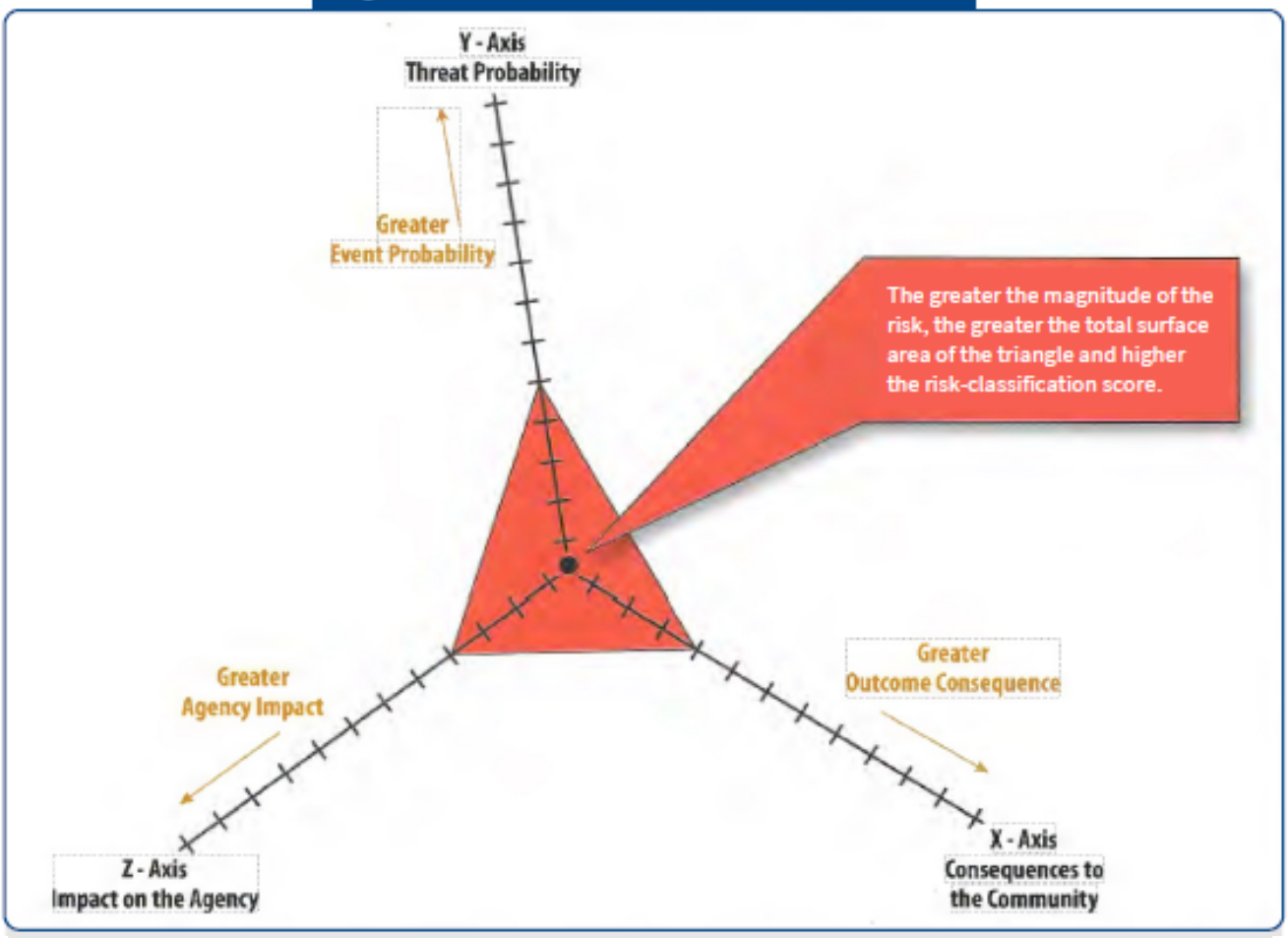
To quantify risk geographically, the MFRD's service area was divided into a hexagonal grid system consisting of 82,810 hexagonal cells (hexbins), of which 51,390 were located within the city's service boundaries and included in the final analysis. The hexbins serve solely as analytical units for evaluating community risk; they do not represent dispatch zones, first-due areas, political boundaries, or operational response districts. The use of a standardized hexagonal grid allows risk variables to be applied consistently across the entire community, while maintaining flexibility for future changes in jurisdictional boundaries, development patterns, and service delivery areas. **Figure 13** shows the City of Miramar, the fire department districts used as planning zones, and an example of a hexbin.

Figure 13: Hexbin Example



The three-axis risk assessment methodology creates a repeatable, data-driven process for measuring community risk and establishes a baseline that can be updated as community conditions, incident patterns, and operational capabilities evolve over time. **Figure 14** illustrates the three-axis risk assessment model and demonstrates how probability, consequence, and impact factors are used to generate an overall risk score for each geographic area.

Figure 14: Three-Axis Risk Classification Process



Reprinted with permission from Center for Public Safety Excellence: Quality Improvement for the Fire and Emergency Services Handbook.

Using the three-axis method, various geographic and fixed variables were analyzed to calculate a risk score for each hexbin and each risk. The sections below explain the types of variables that were incorporated into each axis of the diagram in **Figure 14** (i.e., probability, consequence, and impact). The overall score for each hexbin was then compared against all of the other hexbins in the service area to create a risk map for MFRD. As part of the analysis, some hexbin variables were normalized using *percent rank,* a statistical function that orders items within a group and expresses each value as its relative position, on a scale of 0 to 100, within that group. This allows variables with different underlying distributions to be compared on a standard scale. Other variables were normalized using simple rank scores, which assign a numerical value based on a value's relative position or standing within a set, without converting it to a percentile.

Each variable used in the analysis is described in greater detail in ~~**Part II: Variable Analysis**~~. The resulting risk scores will assist MFRD in understanding the relative distribution of risk throughout the community and evaluating the level of service, deployment strategies, and resources necessary to effectively mitigate identified hazards.

Probability

Probability represents the likelihood that a specific type of incident will occur within a geographic area. Variables that affect probability include historical incident frequency, population density, land use characteristics, occupancy patterns, development intensity, and other factors associated with future incident occurrence.

Historical incident occurrence is an important predictor of future service demand, but it is not sufficient as a standalone measure of probability. Locations with limited prior incident activity can still contain conditions that create substantial future demand, particularly when population, development, occupancy, transportation, or infrastructure characteristics are changing. Conversely, an isolated incident can create a temporary concentration in historical data without establishing a continuing pattern of risk.

For this reason, the probability analysis combines historical frequency and persistence with variables representing the current and future exposure environment. Population and address density identify concentrations of people and developed properties; land use and occupancy characteristics identify activities associated with specific incident types; transportation systems identify locations with elevated traffic and mobility-related exposure; critical infrastructure and regulated facilities identify specialized hazards; and demographic or social conditions identify areas where service demand could be influenced by population characteristics. Using multiple variables provides a more stable and defensible estimate of future incident probability than reliance on historical occurrence alone.

Consequence

Consequence represents the potential severity of an incident if it occurs. Variables that affect consequence include life safety concerns, community vulnerability, occupancy characteristics, property values, critical infrastructure, environmental sensitivity, and the potential disruption to community functions.

Impact

Impact represents the operational effect an incident can have on the Department's ability to maintain emergency service delivery throughout the community. Variables that affect impact include travel times, resource availability, unit workload, commitment duration, effective response force (ERF) requirements, and the potential for concurrent incidents.



RISK CATEGORIES

The seven hazard categories evaluated in this CRA are:

1. Fire suppression risk – structure fires (residential and commercial)
2. Fire suppression risk – non-structure fires
3. Emergency medical services (EMS) incidents
4. Technical rescue incidents
5. Hazardous materials (HazMat) incidents
6. Wildland fires
7. Natural and human-made disasters

Each risk category was analyzed using a unique combination of variables that were selected for their relationship to the evaluated hazard. Consequently, variable weightings differ among the various assessments. For example, structure fire risk places greater emphasis on population density, building concentration, occupancy characteristics, and historical fire occurrence, whereas wildland fire risk relies more heavily on vegetation, undeveloped land, environmental conditions, and open-space characteristics.

DATA STANDARDIZATION

To ensure consistency among variables with differing units of measurement, all data were standardized prior to analysis. Standardization was accomplished primarily through percentile ranking and rank-based scoring methodologies, allowing diverse variables (e.g., incident frequency, travel times, population density, property values, and community vulnerability indicators) to contribute proportionally to the overall risk calculation.

RISK CALCULATION

After the probability, consequence, and impact scores were calculated for each hexbin, they were combined into a single risk score using a modification of Heron's formula — the same geometric approach used in CPSE's three-axis risk categorization methodology, which computes the area of a triangle from the three risk components. In this application, each of the three scores (i.e., probability, consequence, and impact) defines a point along its own axis, and the resulting triangular area represents the overall risk score: the greater the area, the greater the risk (see Figure 14). This approach naturally balances the three factors rather than allowing a single extreme value to dominate the score, producing a more realistic measure of risk than simply adding the three scores.

The following equation (Heron's formula from the CPSE guide) was used to calculate overall risk:

$$Risk = \sqrt{\frac{(Probability * Consequence)^2 + (Consequence * Impact)^2 + (Impact * Probability)^2}{2}}$$

This modification of Heron's formula is used to calculate the final risk score.

The resulting risk score for each hexbin was then compared across the service area to identify the locations with the highest risk. Scores were further summarized by each planning zone within each station area to determine cumulative risk and support resource allocation decisions. These risk scores are described as relative values based on local characteristics and are independent of response protocols and on-scene conditions at the time of dispatch. This analysis is designed to support planning and resource allocation by balancing key factors across the jurisdiction, rather than focusing on isolated worst-case scenarios or relying on incomplete qualitative data.

FUTURE RISK CONSIDERATIONS

Consistent with CFAI guidance, the assessment incorporates both current and emerging community conditions. In addition to historical incident activity, the analysis considers variables associated with future service demand, including:

- Population growth
- Redevelopment trends
- Changes in occupancy patterns
- Transportation network expansion
- Demographic shifts
- Healthcare utilization trends
- Environmental and climate-related hazards

By incorporating these variables, the assessment can identify areas where future risks might emerge, even when historical incident activity has been limited. This approach supports proactive planning and ensures the assessment remains relevant as community conditions evolve.

INTERPRETATION OF RESULTS

Risk scores represent relative values within each individual hazard category and should not be interpreted as absolute measures of community risk. Higher scores identify locations with greater relative probability, consequence, and operational impact compared with other areas evaluated for the same hazard. Because each risk category incorporates different variables and weightings, numerical scores should not be compared directly across hazard categories. The results are intended to identify geographic concentrations of risk and support planning, deployment, community risk reduction, and resource-allocation decisions.

METHODOLOGICAL LIMITATIONS AND DATA CONSIDERATIONS

This Community Risk Assessment was developed using the most complete and reliable information available during the study period. However, as with any quantitative assessment, the findings must be interpreted within the limitations of the underlying data, analytical methods, and assumptions used to construct the risk model.

Historical incident information was obtained primarily from the regional computer-aided dispatch system and the Department's records management system. CAD data provide a reliable record of emergency service demand and response activity, but they can contain incomplete locations, delayed status changes, duplicate records, unit-status anomalies, or classifications that reflect information available at dispatch rather than the conditions ultimately found on scene. NFIRS data provide greater incident detail but are dependent on accurate incident classification and complete report entry. Missing or incomplete NFIRS classifications were supplemented with available CAD information when practical, but not every incident could be assigned the same level of descriptive detail.

Population, demographic, socioeconomic, and housing information was obtained from the U.S. Census Bureau, the American Community Survey, and the Centers for Disease Control and Prevention Social Vulnerability Index. Census-derived estimates provide valuable community-level information but are subject to reporting periods, margins of error, geographic aggregation, and the time required for updated data to become publicly available. This data describes population characteristics within geographic areas and should not be interpreted as predictions of individual behavior or individual vulnerability.

FEMA National Risk Index information was used to supplement local incident history and identify low-frequency hazards that could produce significant consequences. The National Risk Index is a comparative national dataset and is not a substitute for local emergency management planning, engineering analysis, flood studies, facility-specific hazard assessments, or incident preplanning. NRI ratings identify relative risk among geographic areas and might not reflect recent local mitigation projects, infrastructure improvements, land-use changes, or newly identified hazards.

The hexagonal grid provides a consistent and repeatable method for comparing risk throughout the service area, but the boundaries of individual hexbins do not represent operational response areas, property boundaries, dispatch districts, or exact hazard limits. Information assigned to a hexbin represents the conditions associated with that geographic cell and can be influenced by the scale and resolution of the source data. Some community features, such as roadways, waterways, census blocks, parcels, and critical infrastructure, cross multiple hexbins and therefore require spatial assignment or proportional allocation.

Percentile ranking and normalization allow variables with different units of measurement to be combined within a common risk model. These methods identify relative differences within Miramar but do not establish an absolute level of risk or permit direct comparison of numerical scores across different hazard categories. A high score indicates that a location has greater relative risk than other locations evaluated for the same hazard. It does not predict that an incident will occur at a specific location or determine the exact resources required for an individual emergency.

The CRA should therefore be used as a planning and decision-support tool rather than as the sole basis for operational, fiscal, or policy decisions. Risk findings should be considered together with professional judgment, field experience, pre-incident information, current development activity, stakeholder input, historical performance, resource availability, and applicable legal and regulatory requirements. The methodology and underlying datasets should be reviewed during annual CRA/SOC updates and revised when improved information or material changes in community conditions become available.

SECTION 2

PART II

Variable Analysis



Introduction

A systematic, data-driven process was used to identify, evaluate, and classify variables for inclusion in the quantitative risk assessment. Each variable was analyzed to determine its relationship to one or more dimensions of the three-axis risk assessment model, including probability, consequence, and impact. Variables were also evaluated based on their relevance to each of the seven risk categories: fire suppression risk – structure fires, fire suppression risk – non-structure fires, EMS incidents, technical rescue incidents, HazMat incidents, wildland fires, and natural and human-made disasters. For example, population density is a probability variable in the EMS risk assessment, but a consequence variable in the HazMat risk assessment. The risk formulas and variable weightings were developed using historical system performance data, data validation, and input from subject matter experts to accurately represent the hazards and risks within the community.

Data accuracy is critical to developing meaningful risk assessments, as the resulting risk scores are directly influenced by the quality of the underlying information. As part of the evaluation process, the quality, completeness, and reliability of available data sources were assessed. The sources reviewed during the analysis included CAD records, NFIRS data, inspection records, geographic information system (GIS) datasets, demographic information, land use data, critical infrastructure inventories, and other community-specific information.

Each variable was evaluated to determine its predictive value, relationship to the assessed hazard, geographic applicability, and overall contribution to the risk model. Variables were selected through a structured screening process designed to ensure that each one contributed meaningful explanatory value to the risk model. Selection criteria included:

- Documented historical relationships to incident occurrence
- Demonstrated influence on community vulnerability
- Recognized associations with occupancy and land use characteristics

- Relationships to identified hazards
- Influence on emergency response workload
- Impact on community outcomes
- Availability of reliable data
- Geographic relevance to the MFRD service area

Variables that exhibited substantial overlap with other variables were reviewed to minimize duplication, and variables that lacked sufficient data quality, predictive value, or a defensible relationship to community risk were excluded from the analysis. This process helped minimize multicollinearity among variables and prevented individual factors from exerting disproportionate influence on the overall risk score. This methodology provides a transparent and repeatable process for future CRA updates. Based on these evaluations, variables were incorporated into the analysis using one of three approaches **(Table 17).**

Table 17: Approach to Incorporating Variables into the CRA Analysis by Type

Type of Variable	Description	Analytic Approach	Examples
Geographically Stratified Variable	Variables that vary across the service area	Assigned to individual hexbins based on location	• Population density • Historical incident occurrence • Property values • Travel times • Community vulnerability indicators
Presence/Absence Variable	Dichotomous variables that indicate whether a condition or feature exists within a hexbin	Assigned a value based on whether a specific characteristic is present	• Critical infrastructure • Hazardous occupancies • Transportation corridors
Uniform Variable	Variables that apply equally throughout the service area and contribute consistently across all hexbins	Assigned a single value for entire service area	• Department-wide operational characteristics • Community-wide conditions

This classification process ensured that each variable was incorporated into the model in a manner consistent with its relationship to the evaluated hazards, while maintaining methodological consistency throughout the analysis. The resulting approach provides a repeatable and defensible framework for quantifying community risk and allows future updates as new data becomes available and community conditions change.

The following sections describe the variables used in the analysis and summarize how each contributes to the overall risk assessment methodology. Variable selection and assignment to the probability, consequence, and impact categories were reviewed collectively to ensure balanced representation of community hazards, vulnerability factors, occupancy characteristics, geographic influences, and organizational considerations. No single variable independently determines risk. Rather, risk scores are derived from the combined influence of multiple variables that collectively describe the likelihood, consequences, and operational impacts associated with each hazard category. This approach reduces dependence on any individual dataset and provides a comprehensive representation of community risk. Detailed variable definitions, scoring methodologies, weighting factors, and individual risk calculations are provided in **Part III: Quantitative Risk Assessment.**

Hexbin Details

Key statistics regarding the hexbins include:

51,390

Total number of hexbins analyzed

23%

Percentage of hexbins with incident activity

77%

Percentage of hexbins without incident activity

Approximately 15% of the analyzed hexbins are located wholly or partially within water-covered areas, including lakes, canals, wetlands, and associated drainage systems. These areas generally generate little or no emergency incident activity, but they were retained in the analysis to accurately represent the community's geographic characteristics and support the evaluation of water-related hazards, access limitations, and environmental risks.

In addition to incident frequency, the analysis evaluated incident persistence, which measures the number of years during the study period in which a hexbin experienced at least one incident. Areas that demonstrated recurring incident activity across multiple years received higher probability scores than areas with isolated or infrequent incident occurrences. This approach helps distinguish between locations with sustained service demand and those that experience occasional or anomalous incidents.

Population density and address point density (i.e., the number of specific physical property or building locations found within a defined geographic area) were also incorporated into the probability analysis because they identify concentrations of people, structures, and activities that can generate a future demand for emergency services. Areas with higher population densities and greater numbers of addresses generally represent increased opportunities for fires, medical emergencies, hazardous conditions, and other incidents that require an emergency response.

The hexbins were ranked by percentile, and the percentile ranking was used as a factor in the risk calculations. Each percentile rank was multiplied by 10 to obtain a score from 0 to 10 for normalization with the other variables analyzed. In addition, a normalized score was calculated, using the maximum number of incidents as the normalization basis. Throughout the five-year period, the lowest number of incidents per hexbin was 0, and the highest was 884. Of note, one hexbin in the service area, at Glades West Rehabilitation and Nursing Center, had 206 incidents in 2024 and a total of 884 incidents over the five-year period.

Collectively, these variables provide a data-driven estimate of future incident occurrence and form a foundational component of the probability calculations used throughout the risk assessment. Hexbin scores represent relative geographic risk and are intended for planning and resource allocation purposes rather than incident-specific response decisions.

General Variables

Several variables used throughout the risk assessments are derived from population characteristics and measures of the social vulnerability index (SVI), as calculated by the Centers for Disease Control and Prevention (CDC). These variables help identify areas in which community conditions can influence the occurrence of incidents, emergency service demand, residents' ability to prepare for and recover from emergencies, and the overall consequences of incidents.

POPULATION CHARACTERISTICS

The population characteristics incorporated into the analysis were obtained from publicly available data sources, including the U.S. Census Bureau's American Community Survey (ACS) and the CDC's SVI. These datasets provide demographic, socioeconomic, housing, and community resilience indicators that are commonly used in CRAs and emergency management planning.

Depending on the risk category being evaluated, variables such as population density, housing characteristics, economic indicators, age demographics, and other community attributes were incorporated into the probability and consequence components of the risk model. In certain cases, economic indicators were inversely ranked so that areas with greater economic vulnerability received higher relative risk scores. This approach reflects the increased challenges that vulnerable populations can face in preparing for, responding to, and recovering from emergencies.

SOCIAL VULNERABILITY INDEX

The CDC's SVI was also incorporated throughout the analysis. The SVI is a nationally recognized methodology that measures a community's capacity to prepare for, respond to, and recover from adverse events, including natural disasters, public health emergencies, and other community disruptions. The index evaluates multiple social and economic characteristics that can influence a community's resilience during emergencies.

The SVI is organized into four primary themes:

1. Socioeconomic Status
2. Household Characteristics
3. Racial and Ethnic Minority Status
4. Housing Type and Transportation

Collectively, these themes incorporate 16 underlying social factors that are used to calculate an overall social vulnerability score. For this analysis, the SVI was incorporated as one of many variables that contribute to the overall probability and consequence calculations within the risk assessment model; it was not used as a standalone determinant of risk.

Components of the SVI were incorporated into the fire suppression risk — structure fire, EMS, wildland fire incidents, and natural and human-made disaster risk assessments. These variables were used to identify areas where social, economic, and housing characteristics could contribute to increased emergency service demand or amplify the consequences of incidents.

Of the 16 factors included within the CDC's SVI methodology, 15 are identified in **Table 18.** Note that *SVI Theme 3: Racial and Ethnic Minority Status* was not used as an independent variable in the risk model in order to prevent duplicate weighting and preserve the influence of the overall CDC methodology. However, the theme remains reflected in the CDC's overall SVI score, which was used as a component in several risk calculations. This approach maintains consistency with the CDC methodology, while avoiding variable duplication within the model.

Table 18: Factors in the CDC Social Vulnerability Index (SVI)

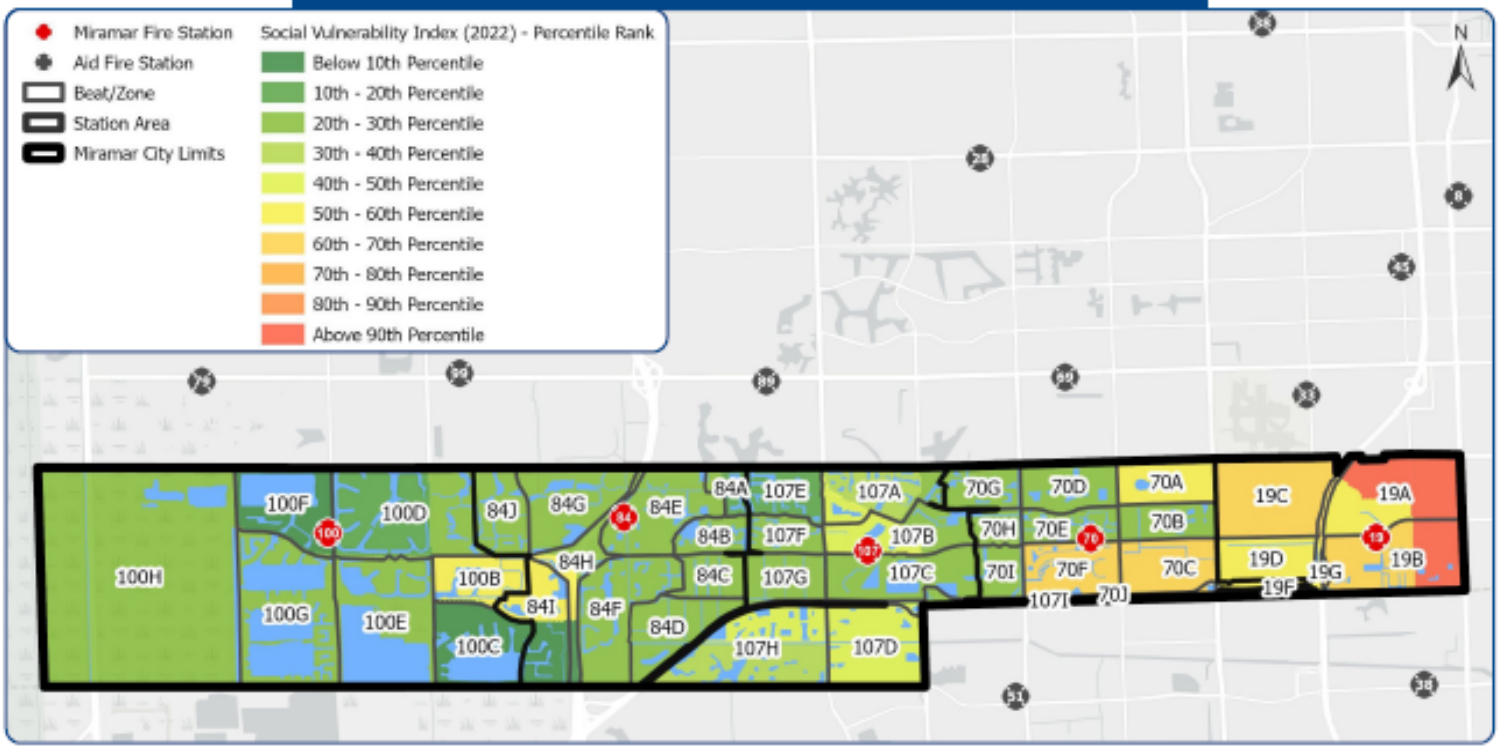
SVI Theme 1 Socioeconomic Status	SVI Theme 2 Household Characteristics	SVI Theme 4 Housing Type and Transportation Status
Below 150% of federal poverty level	Aged 65 and older	Multi-unit structures
Unemployed	Aged 17 and younger	Mobile homes
Housing cost burden	Civilian with a disability	Crowding
No high school diploma	Single-parent households	No vehicle
No health insurance	English language proficiency	Group quarters

Social Vulnerability Index information available at CDC website https://www.atsdr.cdc.gov/place-health/php/svi/index.html; fields from SVI database.

Importantly, social vulnerability indicators are not predictive of individual behavior and should not be interpreted as measures of individual risk. Rather, they are community-level indicators used to identify areas where additional preparedness, prevention, education, and emergency response resources might be warranted.

Figure 15 illustrates the overall SVI percentile ranks within the MFRD service area. The overall score reflects the CDC's composite SVI calculation, which incorporates all 15 underlying social vulnerability indicators.

Figure 15: Social Vulnerability Index (SVI), Percentile Rank, CY 2022

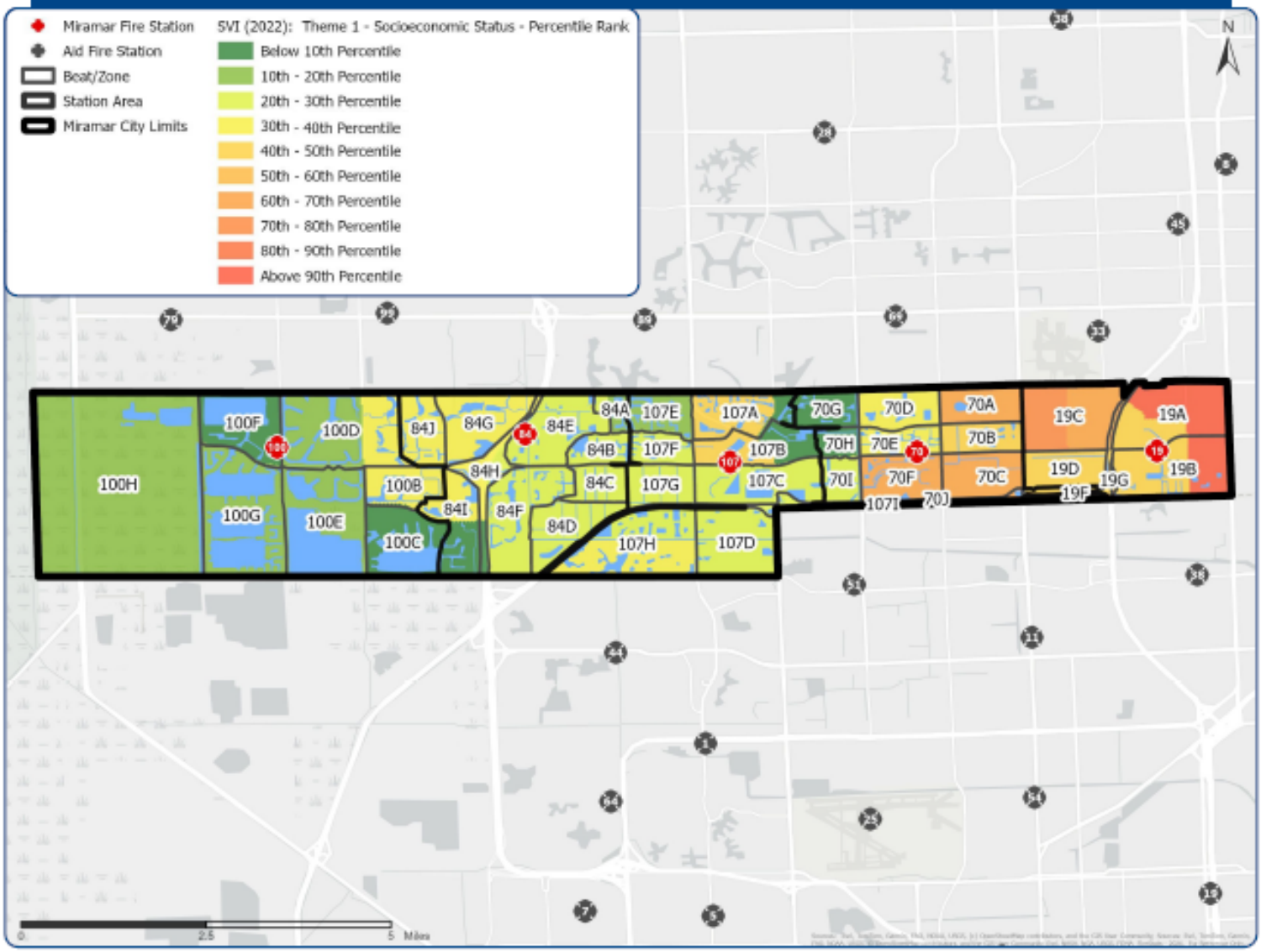


SVI THEME 1: Socioeconomic Status

Figure 16 displays the geographic distribution of social vulnerability within the MFRD service area using data from SVI Theme 1: Socioeconomic Status and percentile rank. The data were normalized using percentile rankings to identify areas with relatively high concentrations of socioeconomic vulnerability compared with the rest of the service area.

Areas with higher percentile rankings indicate greater concentrations of socioeconomic vulnerability and the potential for greater challenges during emergencies and disaster recovery efforts. As a result, these areas can experience a higher demand for emergency services and be more susceptible to the consequences of fire, medical, and disaster-related incidents.

Figure 16: Social Vulnerability Index (SVI) Theme 1 — Socioeconomic Status by Hexbin, Percentile Rank CY 2022

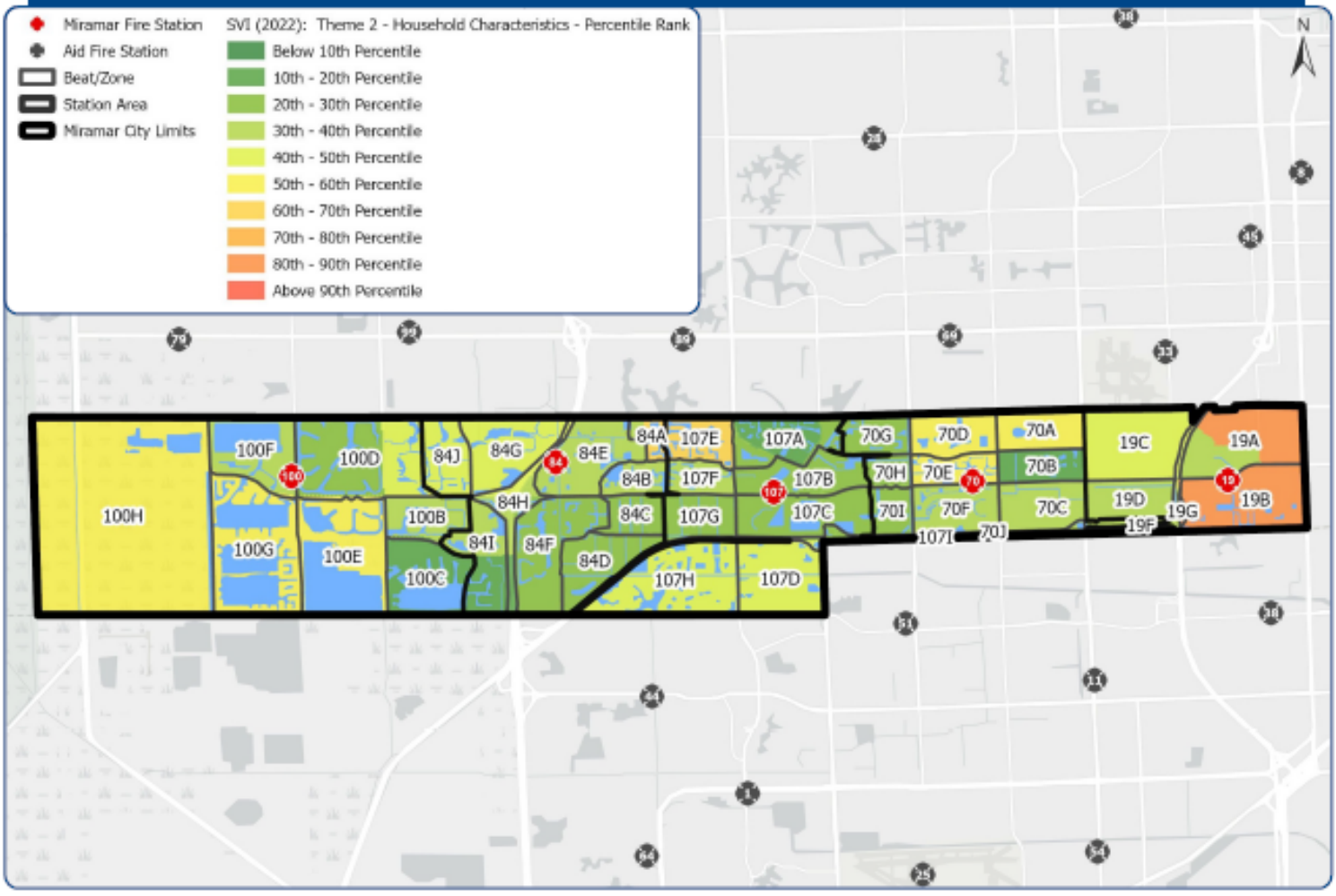


SVI THEME 2: Household Characteristics

Figure 17 displays the geographic distribution of social vulnerability within the MFRD service area using data from SVI Theme 2: Household Characteristics and Percentile Rank. The data was normalized using percentile rankings to identify areas with relatively high concentrations of household-related vulnerability compared with the rest of the service area.

Areas with higher percentile rankings indicate greater concentrations of potentially vulnerable populations that could require additional assistance during emergencies, evacuations, public health incidents, and disaster recovery efforts. These populations can have increased needs related to mobility, communication, transportation, healthcare access, and support services, all of which can influence emergency service demand and the potential consequences of incidents. The inclusion of household characteristics in the risk assessment helps identify areas where demographic factors might increase community vulnerability and supports MFRD's efforts to align emergency response, preparedness, and community risk-reduction strategies with population needs.

Figure 17: Social Vulnerability Index Theme 2 — Household Characteristics, by Hexbin, Percentile Rank, CY 2022



Collectively, the SVI analysis identifies meaningful geographic differences in socioeconomic and household vulnerability within Miramar. The eastern portions of the city generally exhibit higher relative vulnerability in several areas, while other localized concentrations occur throughout the developed service area. These findings do not identify individual residents as being at risk; rather, they identify community conditions that can influence preparedness, access to services, evacuation, emergency communication, healthcare needs, and recovery. The results support consideration of targeted, accessible, and culturally appropriate preparedness and community risk-reduction activities within areas exhibiting higher relative vulnerability.

Probability Variables

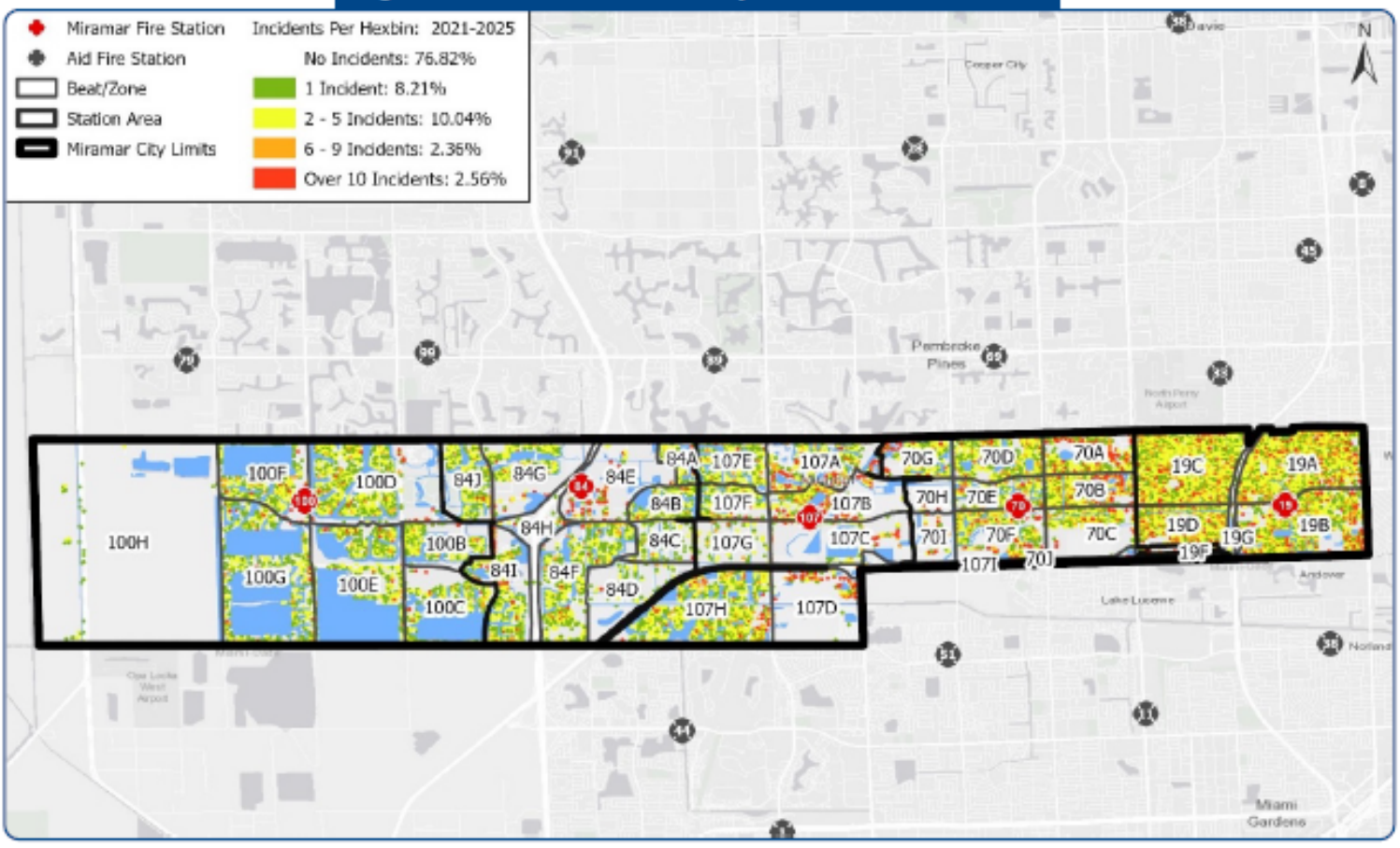
Probability variables are used to estimate the likelihood that a particular type of incident will occur within a specific geographic area. For the MFRD risk assessment, key probability variables include historical service demand, incident persistence, address point density, and population density. Additional probability variables were incorporated within specific risk assessments and are explained later in this report, including factors derived from critical infrastructure inventories, the Federal Emergency Management Agency's (FEMA's) National Risk Index (NRI), and the CDC's SVI.

HISTORICAL SERVICE DEMAND

Historical incident activity is one of the strongest predictors of future emergency service demand. To evaluate incident occurrence geographically, CAD and NFIRS records from CYs 2021 through 2025 were geocoded and assigned to the hexagonal grid system developed for the analysis. Incident activity was then summarized by calendar year and analyzed to identify patterns of recurring service demand throughout the community.

Figure 18 illustrates the geographic distribution of historical incident activity across the MFRD service area. During the five-year study period, approximately 23% of the 51,390 analyzed hexbins experienced at least one recorded incident, while approximately 77% had no recorded incidents. Additionally, 15% of the hexbins contained only water; they were retained in the geographic model, but risk scores were assigned only when applicable to the specific hazard. This distribution is typical of geographic risk analyses, in which emergency incidents tend to concentrate.

Figure 18: Historical Incidents, by Hexbin, CYs 2021–2025



INCIDENT PERSISTENCE

Historical service demand was further analyzed to identify the geographic areas that experienced recurring incident activity over time. Although *incident frequency* provides insight into the volume of emergency responses within a location, *incident persistence* measures the consistency of those responses across multiple years and serves as an indicator of sustained emergency service demand.

The analysis considered incident persistence for all incidents and for EMS incidents.

All Incidents

As noted above, approximately 77% of the analyzed hexbins experienced no recorded incidents during the five-year study period. An additional 10% of hexbins recorded only a single incident between 2021 and 2025. In contrast, approximately 4% of the hexbins exhibited persistent incident activity, defined as at least one incident annually for four or more years of the study period.

Areas with persistent incident activity are generally associated with a greater likelihood of future emergency service demand than locations with isolated or infrequent incidents. As a result, persistence was incorporated as a probability variable within the risk model and used to differentiate locations with recurring service demands from those that experienced sporadic incident activity.

Based on the analysis results, persistence scores were assigned to individual hexbins according to the number of study years during which incident activity occurred. Hexbins with recurring incident activity across multiple years received higher probability scores than hexbins with limited or one-time incidents. This approach helps identify locations where historical demand patterns indicate a higher likelihood of future incidents, providing an additional layer of analysis beyond incident frequency alone.

Figure 19 and **Table 19** summarize the distribution of incident persistence for all incidents throughout the MFRD service area and illustrate the geographic concentration of recurring emergency service demand.

Figure 19: Incident Persistence for All Incidents, by Hexbin, CYs 2021–2025

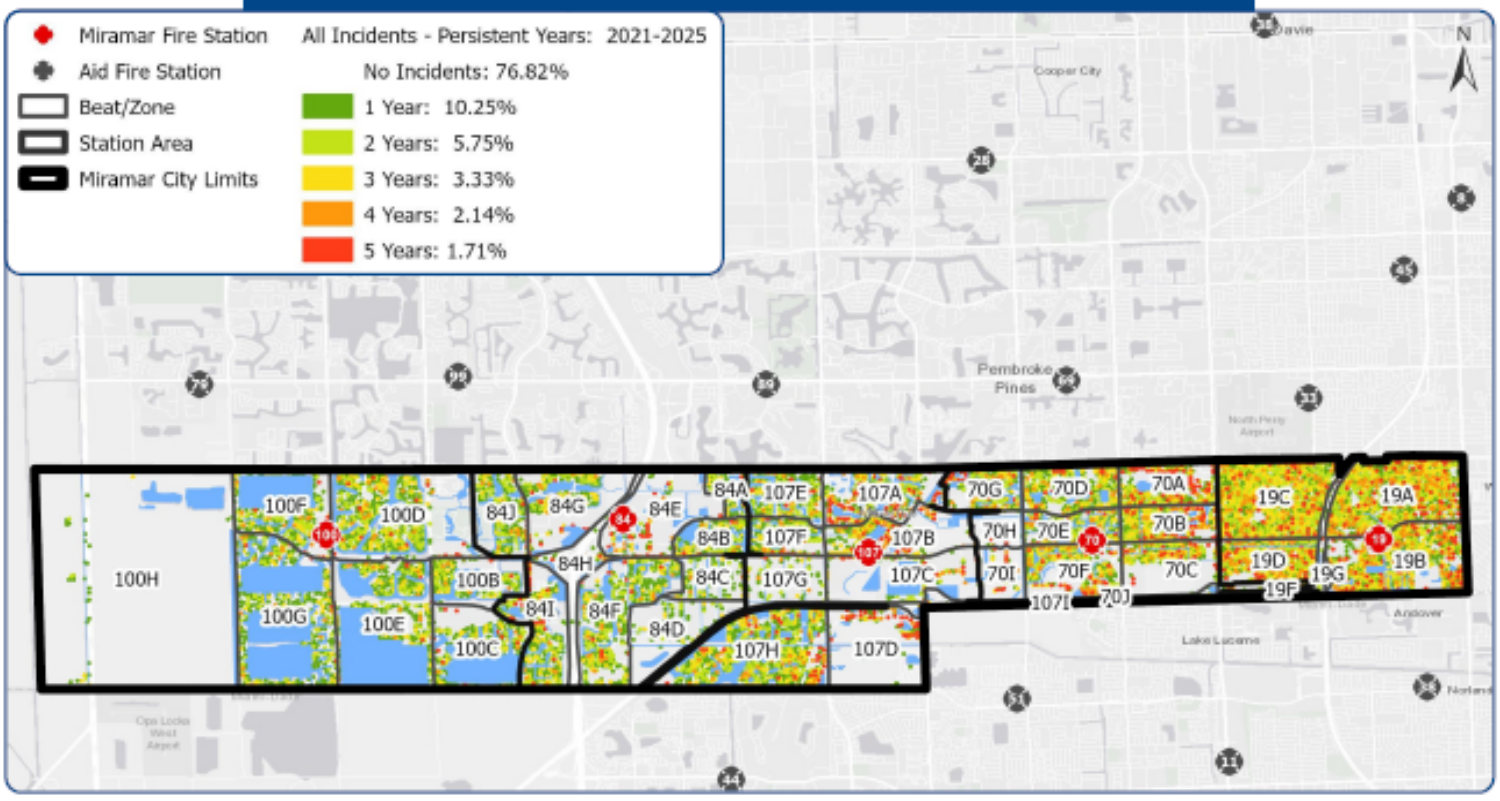


Table 19: Incident Persistence for All Incidents, with Percentages and Scoring, CYs 2021–2025

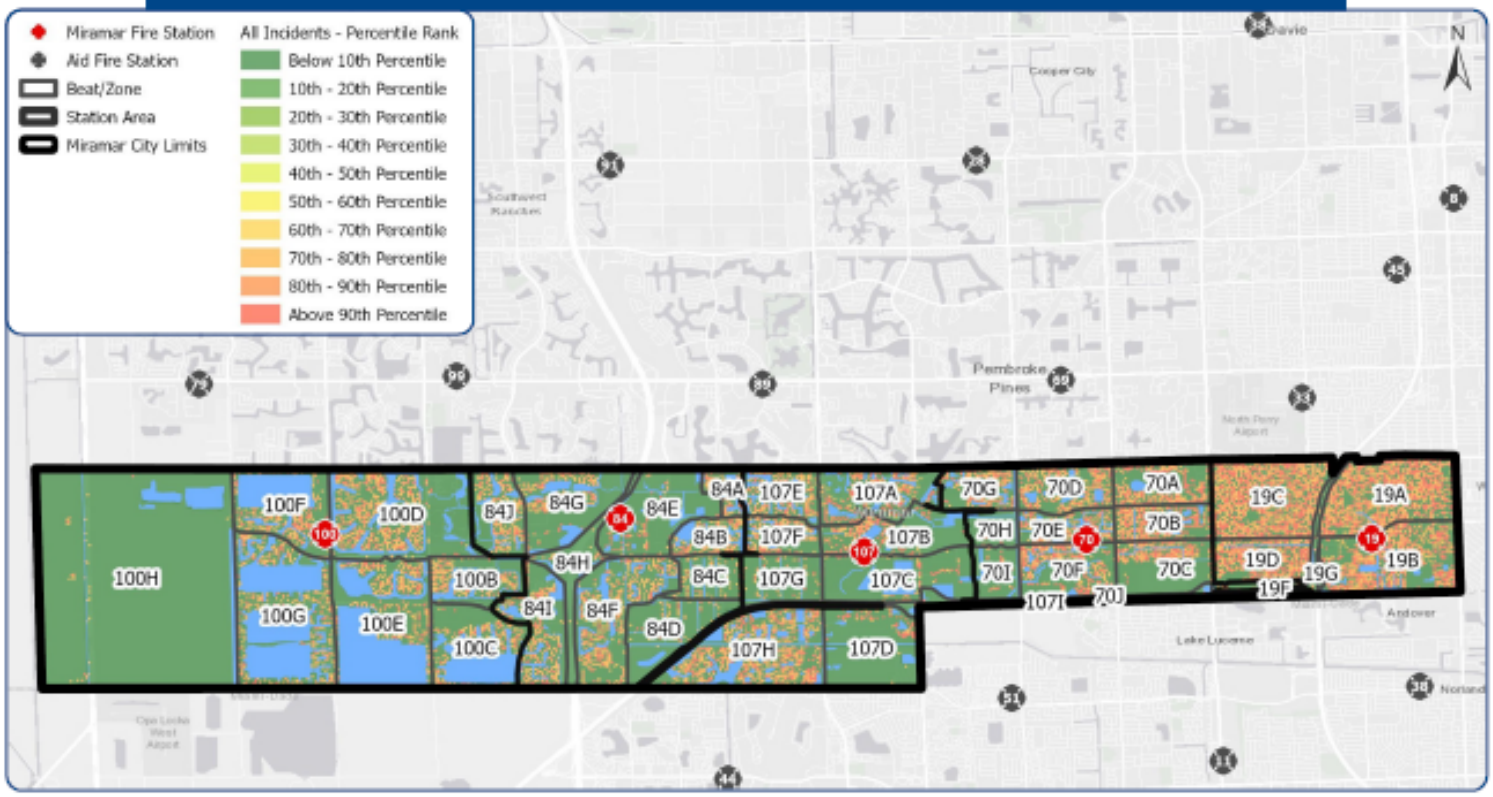
Number of Persistent Year of Incidents	Number of Incidents	Percentage of Service Area	Hexbin Risk Score
0	39,479	76.82%	0
1	5,267	10.25%	2
2	2,956	5.75%	4
3	1,709	3.33%	6
4	1,098	2.14%	8
5	881	1.71%	10
TOTAL	**51,390**	**100.00%**	

All-Incident Frequency Scoring

Overall incident frequency was evaluated using a percentile-rank approach to derive a probability variable that reflects historical service demand. Each hexbin's total incident count was normalized to the total across all other hexbins in the study area, yielding a standardized value on a scale of 0 to 100. This relative approach automatically adjusts to the underlying distribution of incident activity and reduces sensitivity to outliers, unlike fixed-threshold classification.

The resulting percent-rank value was used as a probability variable within the risk model, with historical incident activity serving as an indicator of the relative likelihood of future service demand. Hexbins with a higher percent rank were identified as having a greater probability of future incident activity across all incident types, whereas hexbins with lower percent ranks were assigned a correspondingly lower probability **(Figure 20)**.

Figure 20: Incident Frequency for All Incidents, Percentile Rank, by Hexbin, CYs 2021–2025



EMS Incidents

Historical EMS service demand was further analyzed to identify the geographic areas that exhibited recurring EMS incident activity over time **(Figure 21).** EMS *incident frequency* provides insight into the volume of emergency medical responses within a location, and *incident persistence* measures the consistency of those responses across multiple years and serves as an indicator of sustained EMS service demand.

The analysis found that approximately 80% of the analyzed hexbins experienced no recorded EMS incidents during the five-year study period. An additional 10.1% of hexbins recorded only a single EMS incident between 2021 and 2025. In contrast, approximately 1.6% of the hexbins exhibited persistent EMS incident activity, defined as at least one EMS incident annually for four or more years of the study period **(Table 20).**

Areas with persistent EMS incident activity are generally considered to have a greater likelihood of future EMS service demand than locations with isolated or infrequent EMS incidents. As a result, persistence was incorporated as a probability variable within the risk model and used to differentiate locations with recurring EMS service demands from those experiencing sporadic EMS incident activity.

Based on the analysis results, persistence scores were assigned to individual hexbins according to the number of study years during which EMS incident activity occurred. Hexbins with recurring EMS incident activity across multiple years received higher probability scores than hexbins with limited or one-time incidents. This approach helps identify locations where historical EMS demand patterns indicate a higher likelihood of future incidents, providing an additional layer of analysis beyond EMS incident frequency alone.

Figure 21: Incident Persistence for EMS Incidents, by Hexbin, CYs 2021–2025

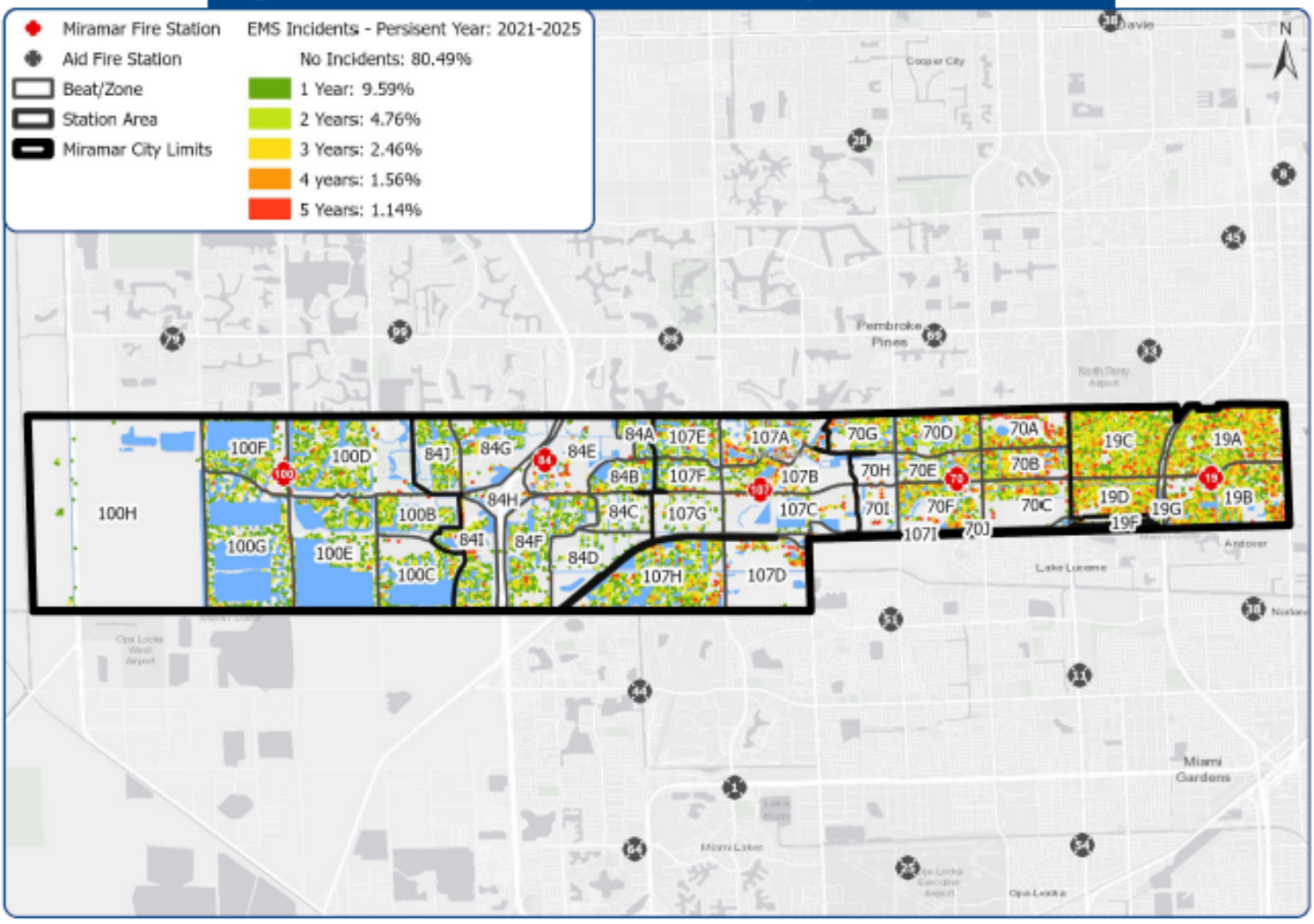


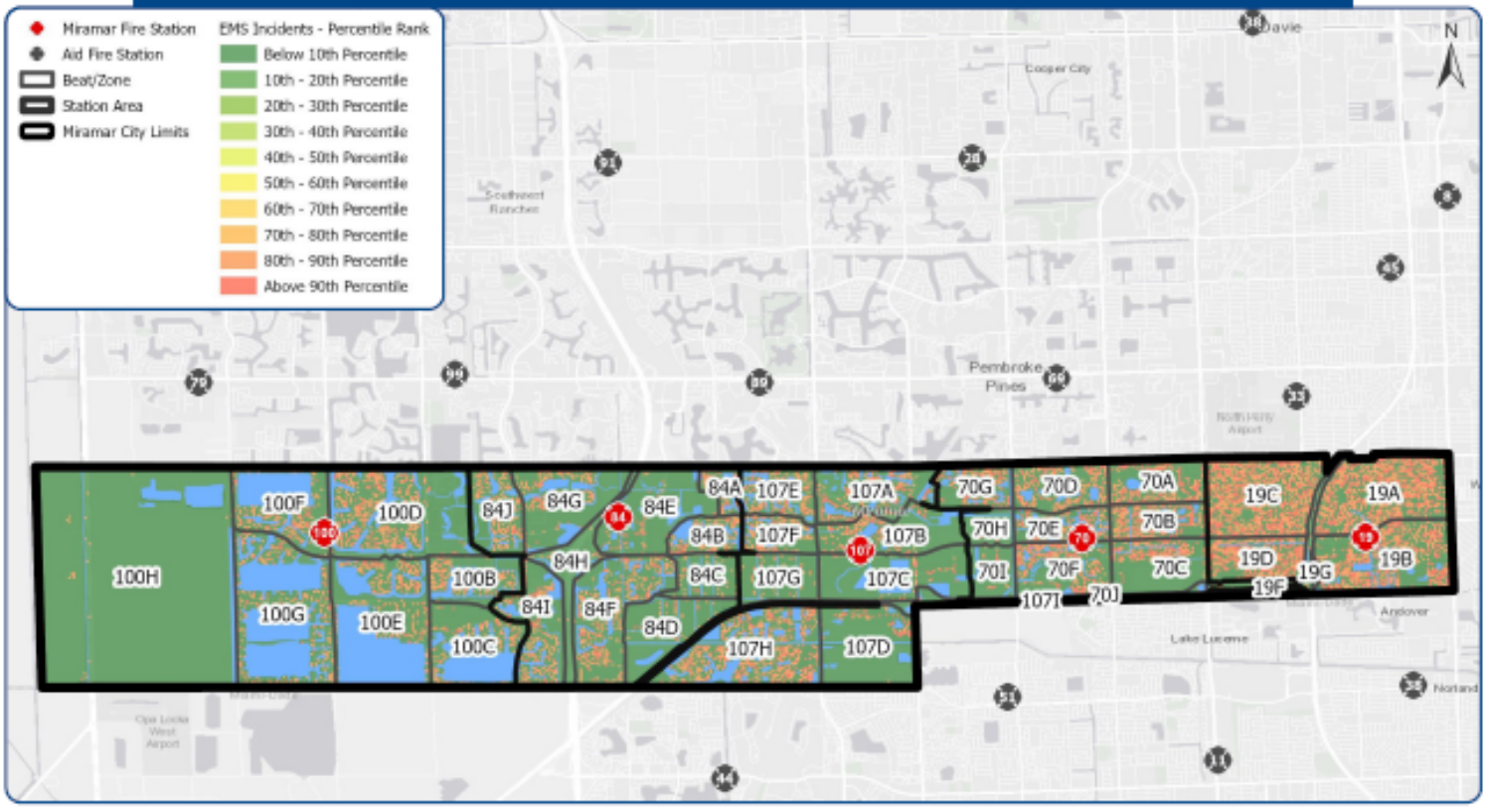
Table 20: Incident Persistence for EMS Incidents, with Percentages and Scoring, CYs 2021–2025

Number of Persistent Year of EMS Incidents	Number of Incidents	Percentage of Service Area	Hexbin Risk Score
0	41,366	80.49%	0
1	4,928	9.59%	2
2	2,446	4.76%	4
3	1,262	2.46%	6
4	800	1.56%	8
5	588	1.14%	10
TOTAL	**51,390**	**100.00%**	

EMS Incident Frequency Scoring

EMS incident frequency was independently evaluated using the same percentile-rank methodology and applied specifically to EMS incidents within each hexbin, yielding an EMS-specific probability variable on a scale of 0 to 100. Evaluating EMS activity separately from the all-incident measure is important because EMS calls comprise a majority of emergency incidents, drive most of the total service demand, and can follow distinct geographic patterns than fire, HazMat, and other incident types. As with the all-incident measure, hexbins with a higher percent rank were identified as having a greater probability of future EMS demand, whereas hexbins with lower percent ranks were assigned a correspondingly lower probability **(Figure 22)**. This EMS-specific variable was incorporated into the risk model along with EMS persistence and other risk factors to identify where recurring EMS demand is concentrated, independent of other emergency service activity.

Figure 22: Incident Frequency for EMS Incidents, Percentile Rank, by Hexbin, CYs 2021–2025



ADDRESS POINT DENSITY

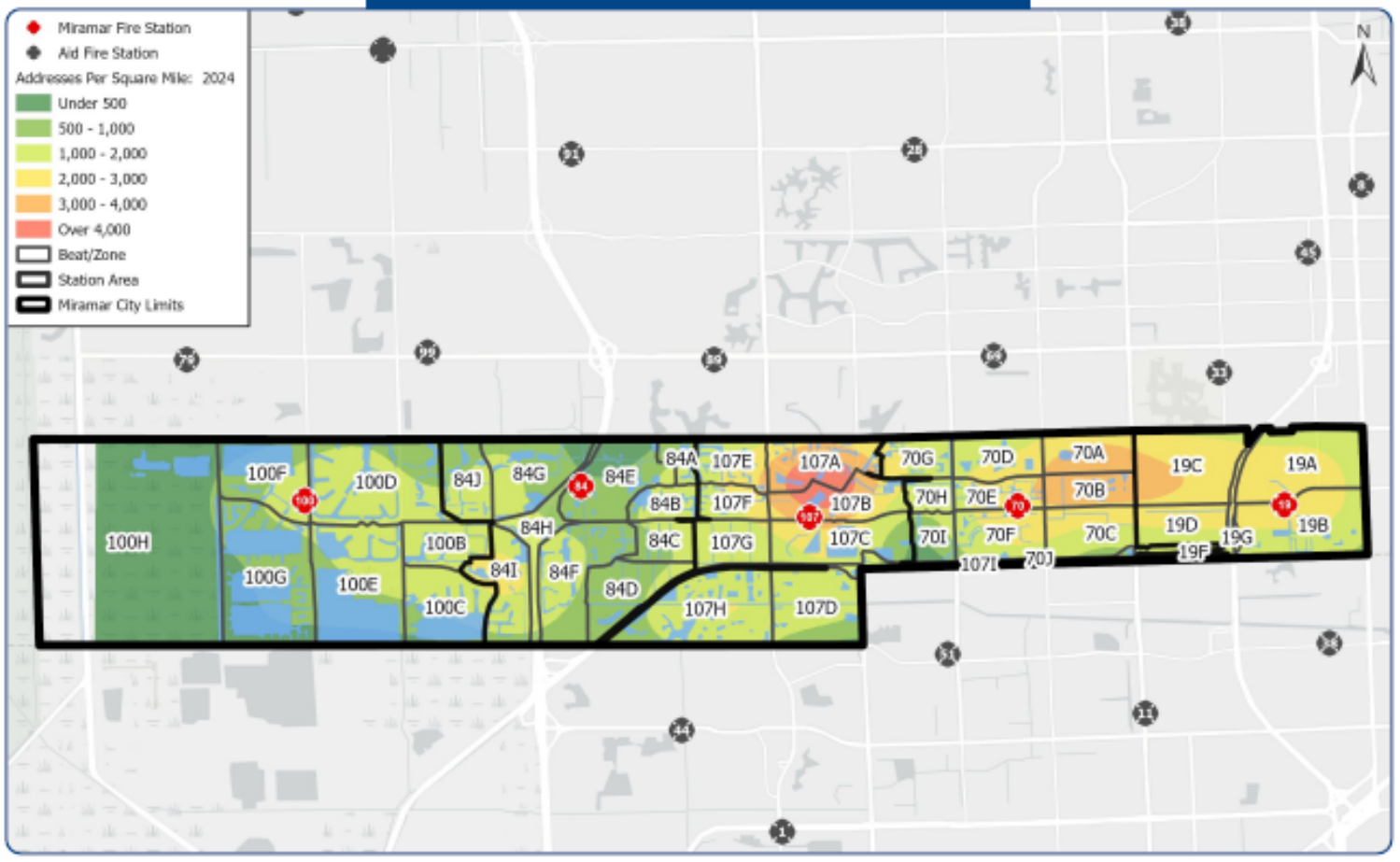
City parcel and address point data were analyzed to determine the concentration of structures within each hexbin and to determine occupancy-related risk throughout the MFRD service area (**Figure 23**). The number of addresses located within a hexbin serves as a proxy for both development density and the potential concentration of residential, commercial, industrial, and institutional occupancies.

As identified in CFAI's CRA framework, occupancy characteristics represent a key component of community risk. Areas with higher concentrations of structures generally present increased opportunities for fire, medical, HazMat, and other emergency incidents due to the greater presence of people, buildings, and associated activities. Conversely, areas with fewer structures typically exhibit lower levels of occupancy-related risk.

For this assessment, address point density was classified as an occupancy risk variable and incorporated into multiple risk calculations as a measure of the built environment. Hexbins with higher address concentrations received higher relative scores because increased occupancy concentrations create additional opportunities for fire occurrences, medical emergencies, HazMat incidents, technical rescue events, and other emergency response needs. Occupancy concentration also increases the potential life safety, property conservation, economic, and operational consequences associated with emergency incidents. As a result, address point density functions as both an occupancy risk indicator and a predictor of future emergency service demand within the MFRD service area.

Figure 23 illustrates the distribution of address point density throughout the MFRD service area and highlights areas with higher concentrations of development. These occupancy characteristics provide important context for understanding community risk and were incorporated into the probability and consequence calculations where appropriate for the specific hazards being evaluated.

Figure 23: Address Point Density by Hexbin, CY 2024



POPULATION DENSITY

Population density was calculated at the census block level using population divided by land area, consistent with the density-based approach used in both Census Bureau urban area delineation and the demand zone classification outlined in National Fire Protection Association (NFPA) Standard 1710: *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments.* However, rather than applying fixed thresholds, population density was evaluated using a percent-rank approach, normalizing each hexbin's density relative to all other hexbins in the study area on a scale of 0 to 10. This relative approach automatically adjusts to the density distribution observed within Miramar's jurisdictional boundaries, rather than relying on national or generalized breakpoints that might not reflect local conditions. In spatial analysis, breakpoints act as predefined cutoff points used to group data into actionable density tiers across geographical zones.

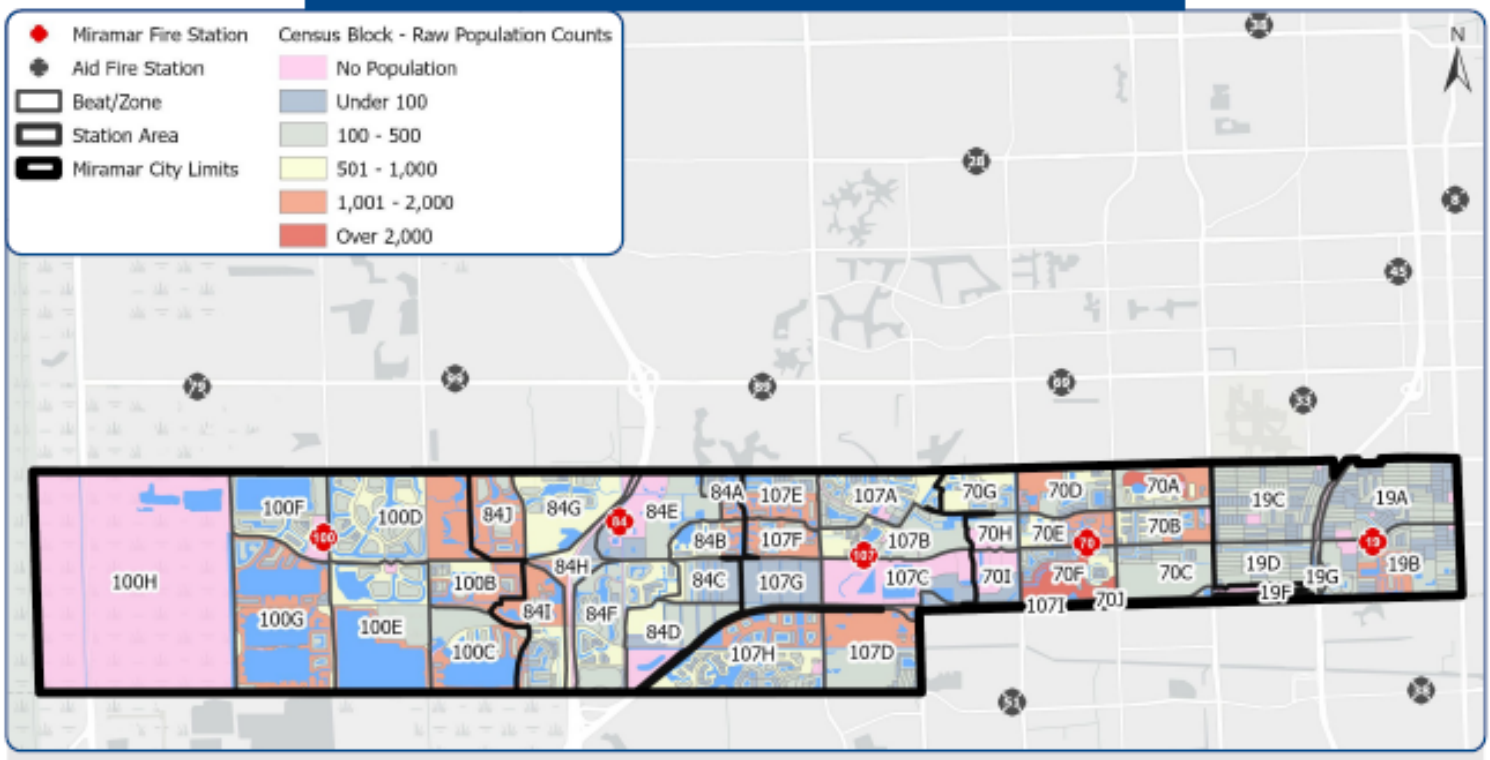
Hexbins with a higher percent-rank score reflected relatively greater population density compared with other hexbins in the study area, and lower scores reflected comparatively lower density. Higher population concentrations can increase the likelihood of fire, EMS, HazMat, and disaster-related incidents, as well as the number of people potentially affected.

The resulting percentile-rank value was incorporated into the risk model as a demographic exposure variable, complementing incident frequency and incident persistence, to identify areas with an elevated likelihood of emergency service demand and greater life safety consequences following incidents.

Unlike the Census Bureau's and NFPA 1710's discrete classification schemes, the percent-rank method preserves population density as a continuous variable scaled specifically to Miramar's local population distribution, allowing for more granular differentiation among hexbins. Population density serves as both a probability and consequence indicator, because areas with larger concentrations of residents generally experience increased emergency service demand.

Figure 24 shows the City of Miramar's population by 2020 census block (the latest available census block population count), **Figure 25** classifies population density using the applicable NFPA 1710 density categories, and **Figure 26** shows population density using a percentile-rank approach[1].

Figure 24: City of Miramar's Population by Census Block, CY 2020



[1] *Esri Federal Data, U.S. Census Blocks, ArcGIS Hub,*
https://hub.arcgis.com/datasets/fedmaps::u-s-census-blocks-1/explore?location=25.989879%2C-80.299454%2C16

Figure 25: Population Density by Census Block, NFPA 1750 Classification, CY 2020

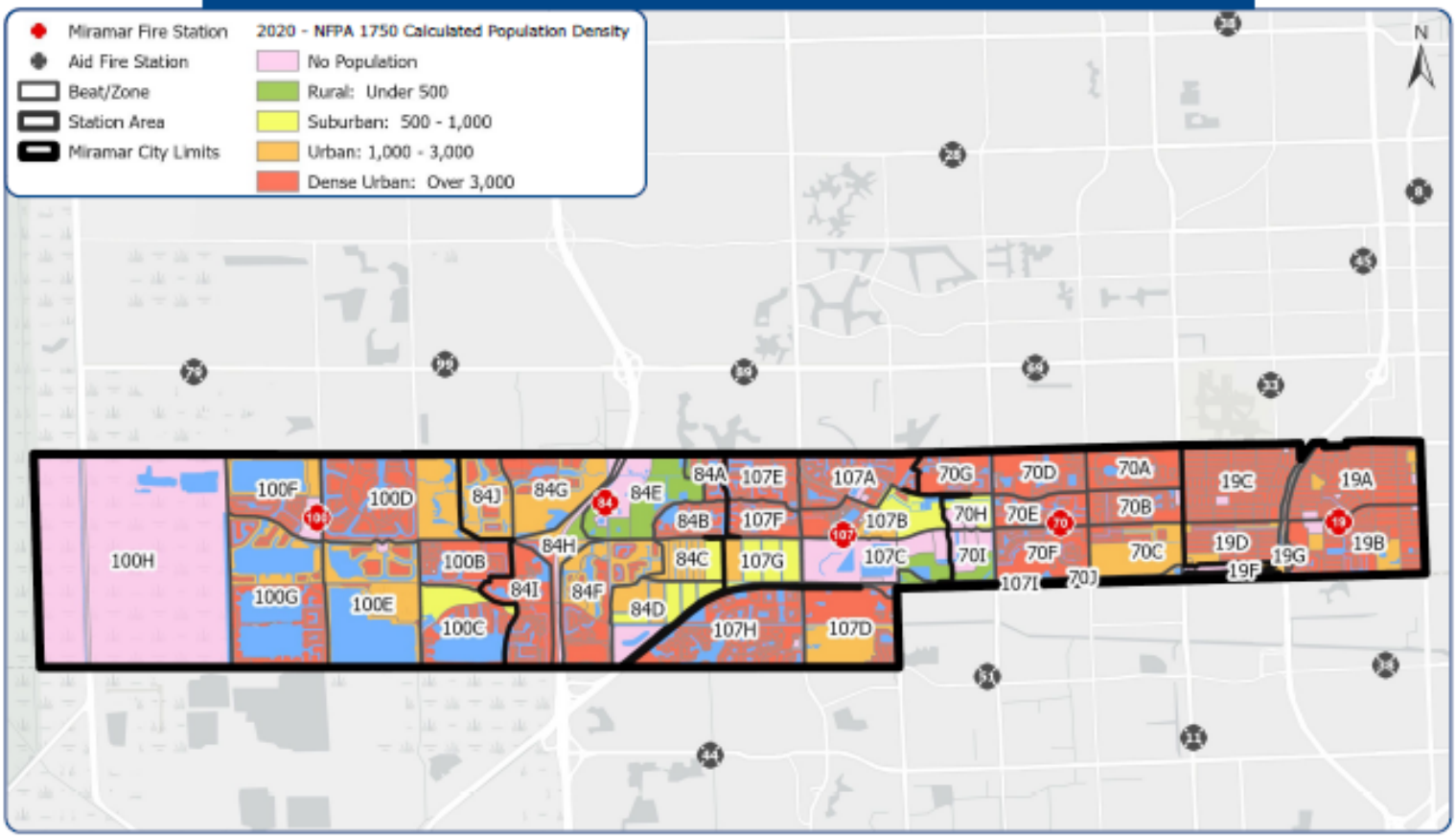
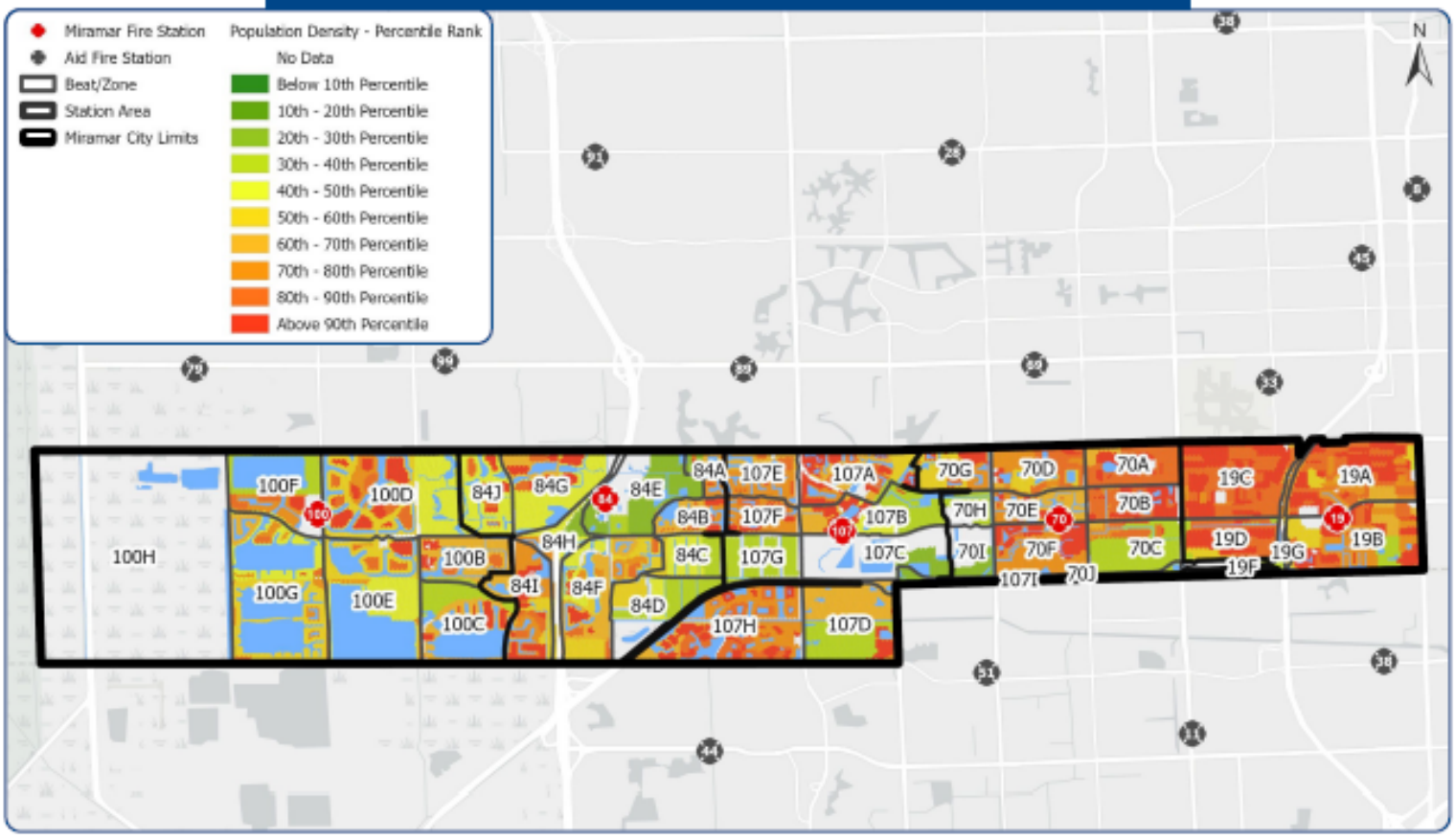


Figure 26: Population Density, Percentile Rank Score by Hexbin, CY 2020



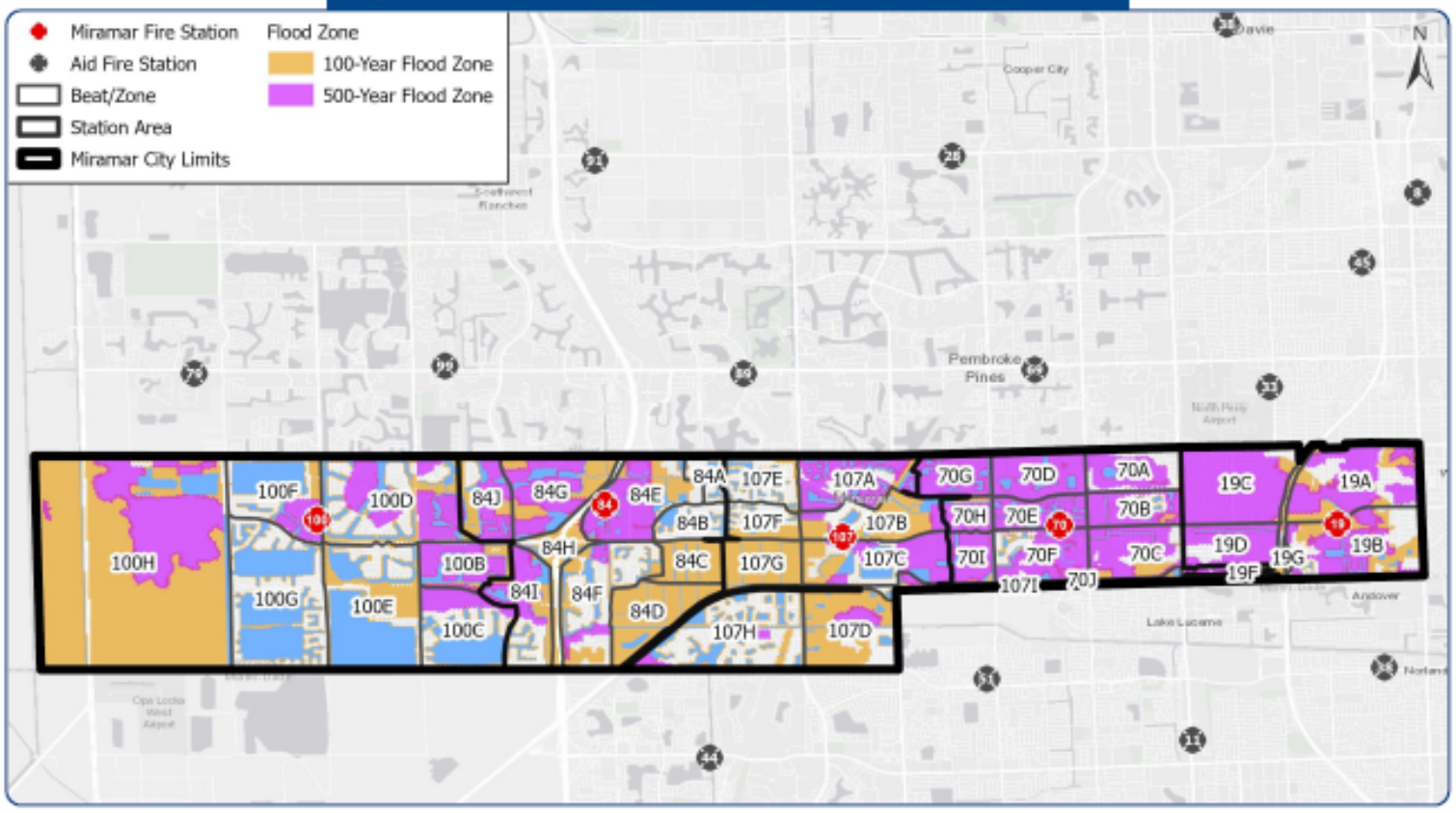
The population-density analysis demonstrates that Miramar contains a range of development environments, including densely populated residential areas, lower-density neighborhoods, commercial and institutional areas, open space, wetlands, and water-covered locations. Higher-density areas create a greater probability of emergency service demand and increase the number of people potentially affected by an incident. These findings support maintaining sufficient distribution of first-due resources throughout the developed portions of the city and provide demographic context for evaluating response-time performance, station planning zones, and future changes in service demand.

FLOOD ZONES

Flood exposure was evaluated using FEMA Special Flood Hazard Area (SFHA) data, which delineates the 100-year and 500-year floodplains. The 100-year floodplain, also referred to as Zone AE or Zone A, represents an area with a 1% annual chance of flooding. This designation is the regulatory standard used for floodplain management and mandatory flood insurance requirements, which appears in orange in **Figure 27.** The 500-year floodplain, or Zone X, which appears in purple in the same Figure, reflects a low-probability area with a 0.2% annual chance of flooding.

To incorporate flood exposure into the risk model, each hexbin was assigned a flood zone score based on the flood zone designation covering the largest proportion of its area: Hexbins with no majority overlap in a mapped floodplain received a score of 0, hexbins with the largest overlapping area falling within the 500-year floodplain received a score of 2, and hexbins with the largest overlapping area falling within the 100-year floodplain received a score of 5. This tiered scoring approach reflects the increasing probability of catastrophic flooding as proximity to the regulatory floodplain increases, with the 100-year zone weighted more heavily due to its higher annual likelihood of flood occurrence. Incorporating flood zone designation as a graduated risk variable, rather than a binary in/out classification, allows the model to more accurately differentiate areas of elevated flood risk and recognize the compounding effect flooding can have on emergency service demand, including water rescue incidents, infrastructure damage, and access and mobility constraints during response.

Figure 27: FEMA Flood Hazard Zones within Miramar, CY 2024



Historical Analysis

Historical service demand data were analyzed to assess the probability of future incidents based on documented emergency response activity. Historical incident occurrence is one of the strongest predictors of future service demand, and this variable was incorporated into the risk model to identify areas where specific types of emergencies have occurred repeatedly over time.

HISTORICAL INCIDENT TYPE

NFIRS incident classifications were used to categorize incidents by hazard type and assign weighting factors within each hexbin **(Table 21).** Incident records were grouped according to the seven risk categories evaluated in this assessment. To account for differences in incident frequency across hazard categories, a percentile-rank methodology was applied to normalize incident counts and create a consistent weighting process. This approach converts raw incident totals into standardized scores that can be compared across the service area, while reducing the influence of extreme values. The resulting percentile-rank scores were used as probability-weighting factors within the risk model.

In addition to overall incident frequency, specialized analyses were conducted for fire suppression risk – non-structure fires and technical rescue incidents. These incident categories encompass a wide range of event types that vary significantly in complexity, resource requirements, and potential consequences. To more accurately reflect these differences, sub-incident weighting factors were developed using specific NFIRS classifications and incident characteristics. These sub-incident scores were incorporated into the analysis to provide additional differentiation among specialty incident types and ensure that high-risk events were appropriately weighted within the overall risk assessment **(Table 22).**

By incorporating both incident frequency and incident-specific weighting factors, the analysis provides a more accurate representation of historical service demand and improves the model's ability to identify areas with a higher likelihood of future emergency incidents.

Table 21: NFIRS Codes, Descriptions, Incident Counts, and Percentages, CYs 2021–2025

NFIRS Code Group	NFIRS Description	Incident Count	Percentage
100	Fire	702	1.01%
200	Rupture/explosion	32	0.05%
300	EMS/rescue	48,745	70.19%
400	Hazardous condition	670	0.96%
500	Service call	3,381	4.87%
600	Good intent	10,659	15.35%
700	Alarm	4,503	6.48%
800	Severe weather or natural disaster	22	0.03%
900	Special incident type	30	0.04%
	Not Reported/Outside of Miramar[1]	704	1.02%
TOTAL		**69,448**	**100.00%**

[1] Based on available NFIRS incidents. Supplemented with call incident categories for the 1.01% of all incidents that were missing an NFIRS code and 3,987 incidents occurring outside of Miramar.

Table 22: NFIRS Incident Codes, Risk Categories, Incident Counts, and Percentage, CYs 2021–2025

NFIRS Sub-Incident Type Codes	Risk Category	Incident Count	Percentage
110 and 120 series	Structure fire	245	0.35%
100, 130, 140, 150, 160, 170 series	Non-structure fire	399	0.57%
140 series	Wildland fire	65	0.09%
310 and 320 series	EMS	45,548	65.6%
330, 340, 350, 360, 370 series	Technical rescue incident	529	0.76%
400 series	Hazardous materials incident	653	0.94%
800 series	Natural and human-made disaster	22	0.03%
Other[1]		21,987	31.66%
TOTAL		**69,448**	**100.00%**

[1] The 22,052 incidents in the 'Other' category comprise NFIRS codes within the 200, 500, 600, 700, and 900 groups, as well as 381, which are not included in the risk analysis.

HISTORIC INCIDENT DENSITY BY RISK CATEGORY

The maps illustrate the geographic distribution of historical incident activity within the MFRD service area by risk category. These maps identify areas where specific incident types have historically occurred and provide an important foundation for evaluating the probability of future emergency events.

Historical incident locations were analyzed with land use classifications to identify relationships between incident occurrence and the built environment. This analysis was used to develop land use weighting factors that contributed to the probability component of the risk assessment model. By examining where incidents have historically occurred and the types of land use associated with those incidents, the analysis provides a more accurate representation of future risk potential across the community.

The resulting land use scores were incorporated into the probability calculations for each risk category and are discussed in greater detail in the following section.



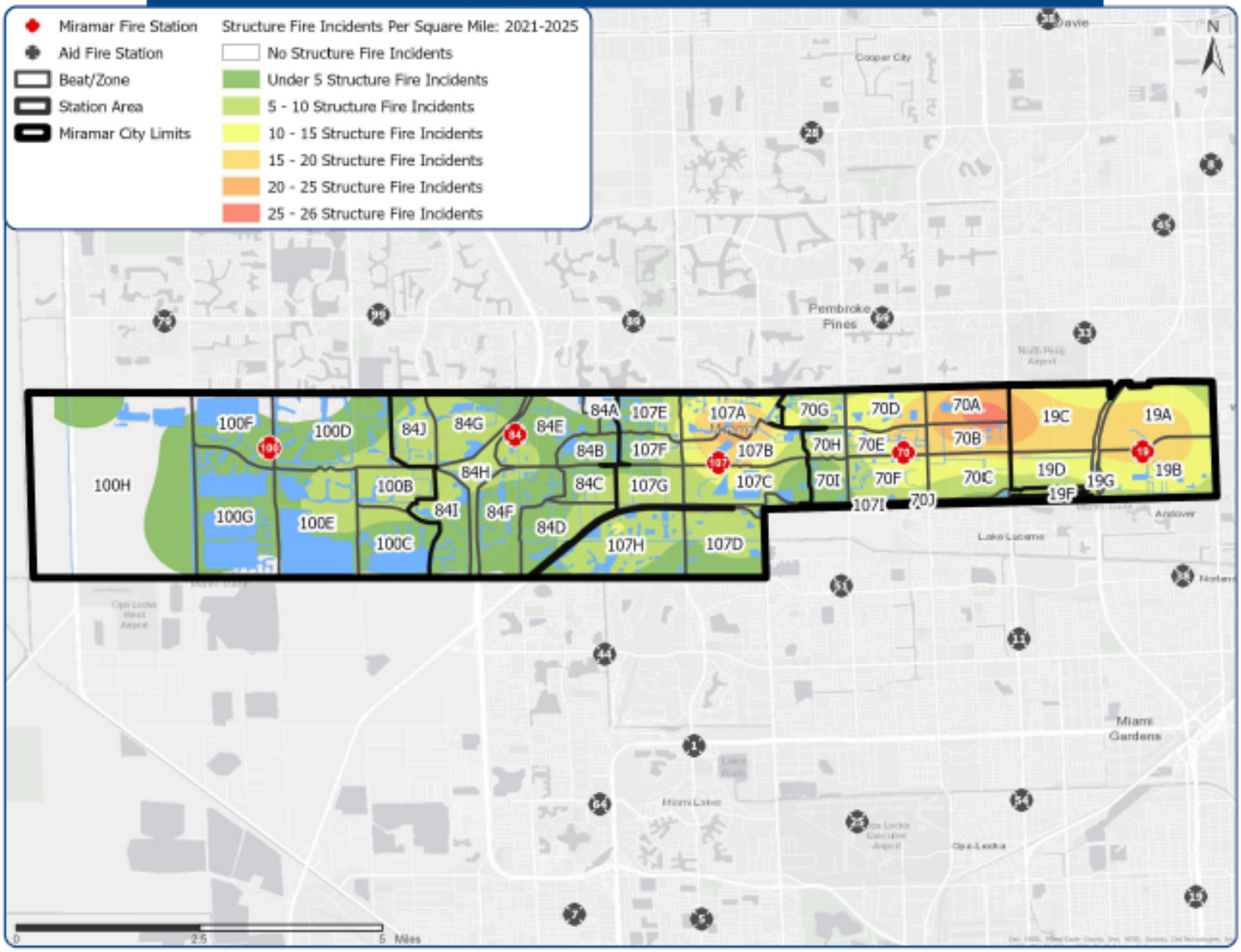
Fire Suppression Risk – Structure Fires

Figure 28 illustrates the geographic distribution of structure fire incidents occurring between CYs 2021 and 2025. The map identifies areas where residential, commercial, industrial, and other building-related fires have historically occurred and highlights concentrations of structure fire activity throughout the community.

Historical structure fire occurrence serves as an important indicator of probability because locations that have experienced structure fires in the past often share characteristics associated with future fire risk, including occupancy type, development density, building age, land use patterns, and human activity. As a result, historical structure fire density was incorporated into the probability component of the structure fire risk assessment and used to identify areas where future structure fire incidents are more likely to occur.

The geographic patterns shown in **Figure 28** also support the development of land use weighting factors by identifying the occupancy and development characteristics most commonly associated with historical structure fire activity within the MFRD service area.

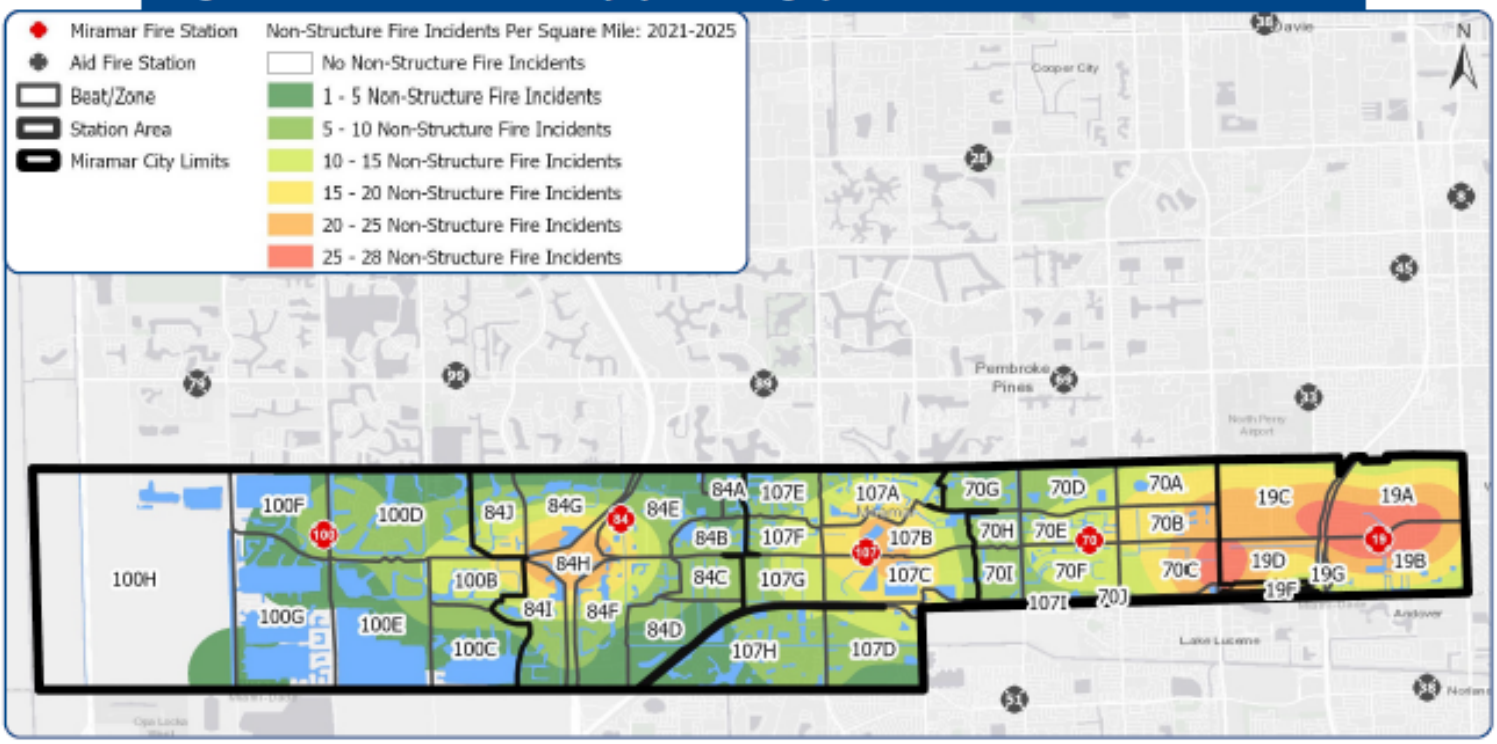
Figure 28: Historic Incident Density by Risk Category — Structure Fires, CYs 2021–2025



Fire Suppression Risk – Non-Structure Fires

Figure 29 shows MFRD's historic concentration of non-structure fire incidents from 2021–2025.

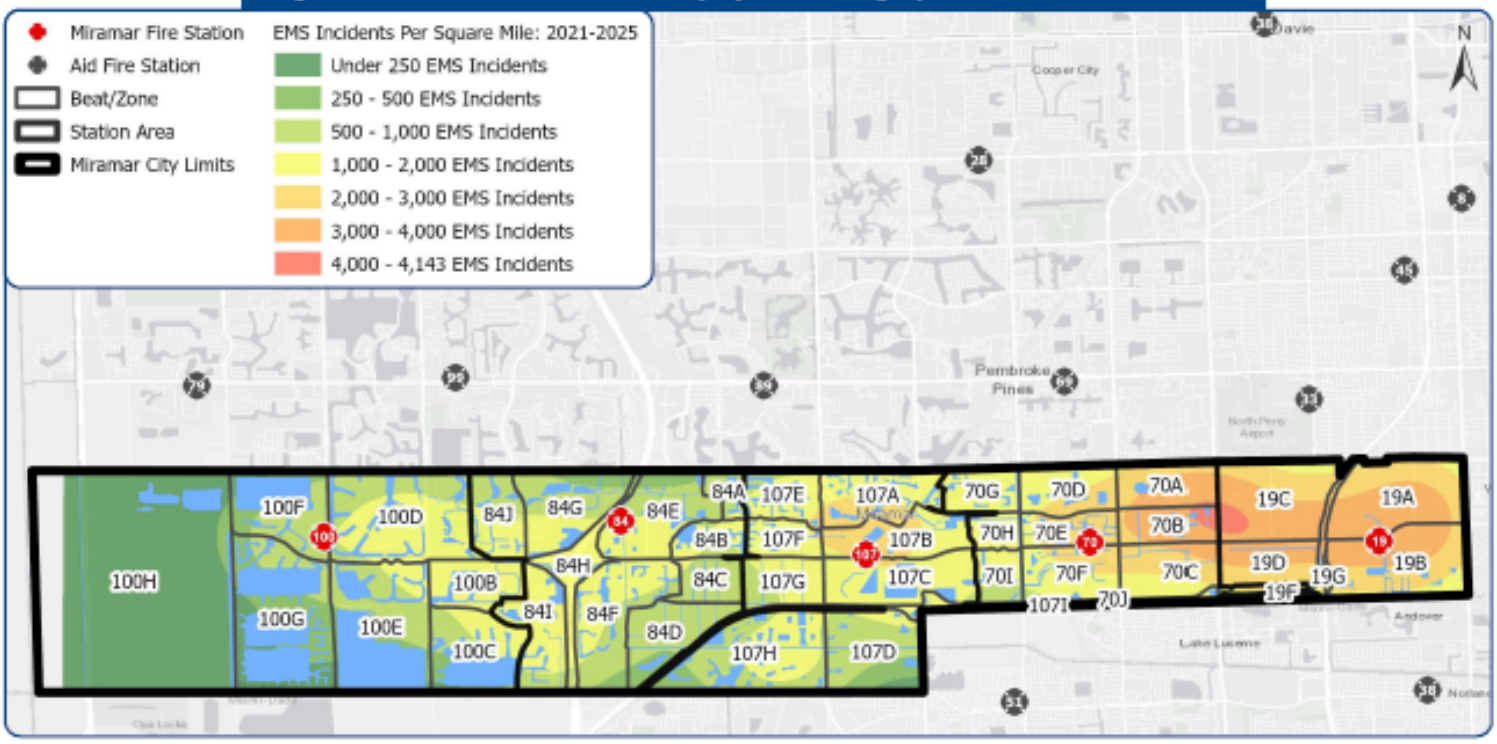
Figure 29: Historic Incident Density by Risk Category — Non-Structure Fires, CYs 2021–2025



EMS Responses

Figure 30 illustrates the Department's historic concentration of EMS incidents from 2021–2025.

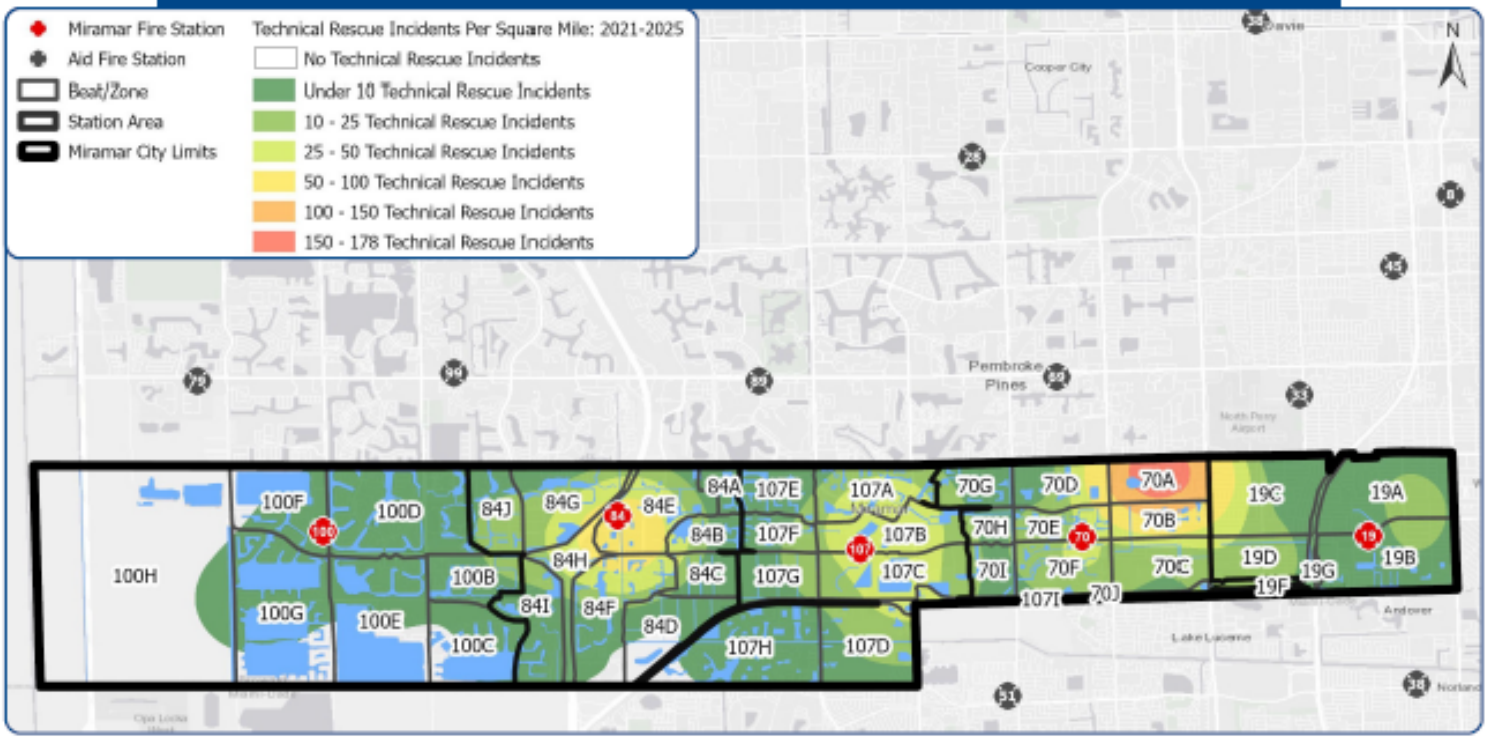
Figure 30: Historic Incident Density by Risk Category — EMS, CYs 2021–2025



Technical Rescue Incidents

Figure 31 displays the Department's historic concentration of technical rescue incidents from 2021–2025.

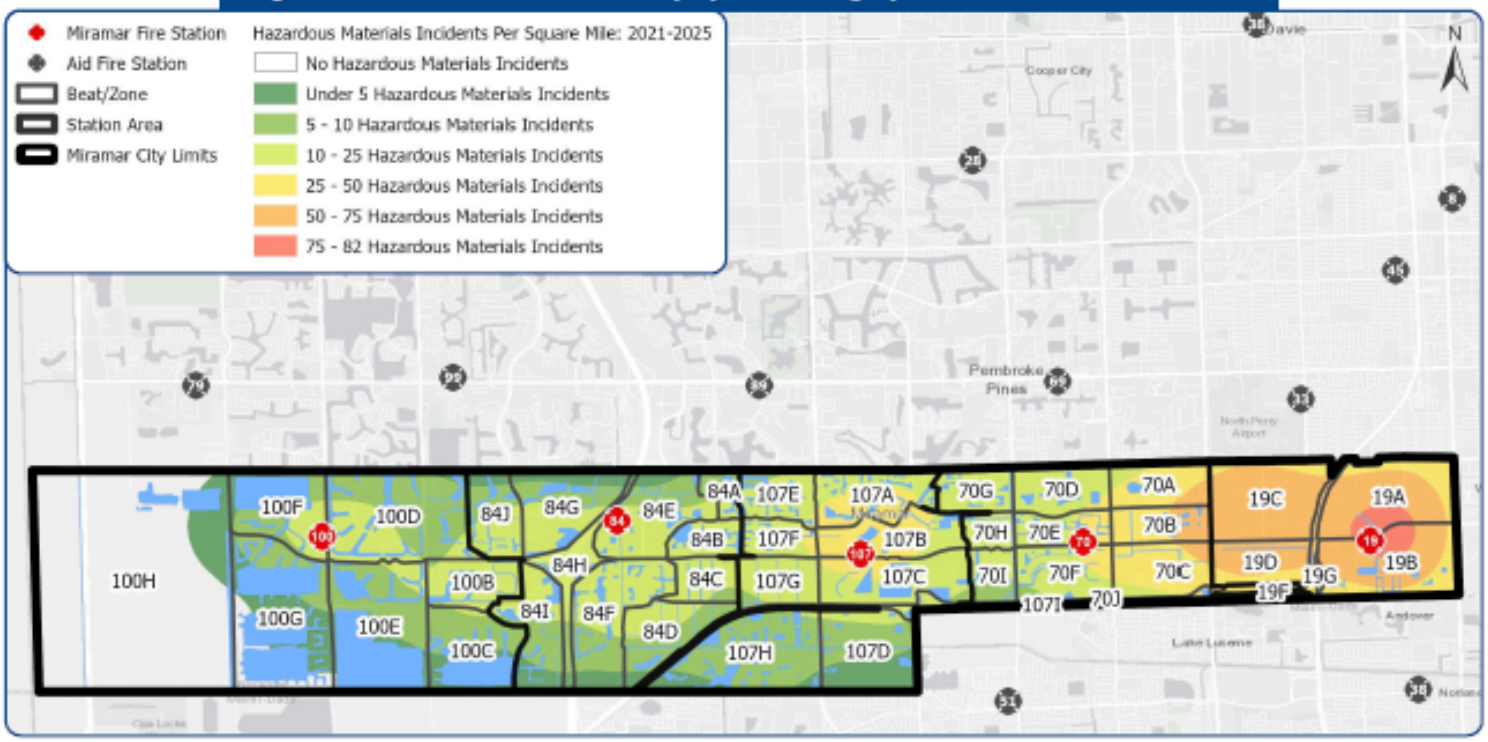
Figure 31: Historic Incident Density by Risk Category — Technical Rescue, CYs 2021–2025



HazMat Responses

Figure 32 illustrates MFRD's historic concentration of Hazardous Material incidents during the five-year period of 2021–2025.

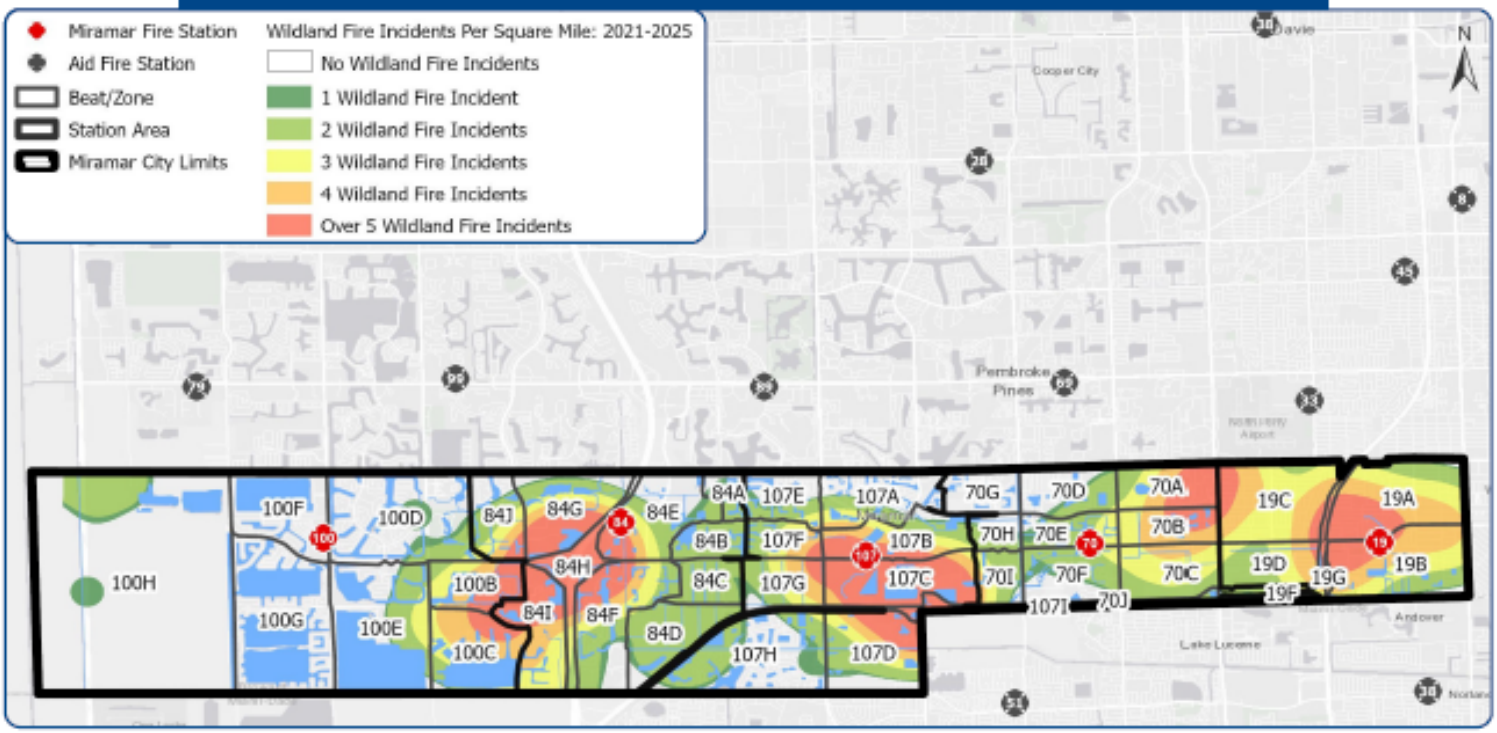
Figure 32: Historic Incident Density by Risk Category — HazMat, CYs 2021–2025



Wildland Fires

Figure 33 displays the Department's historic concentration of wildland fires from 2021–2025.

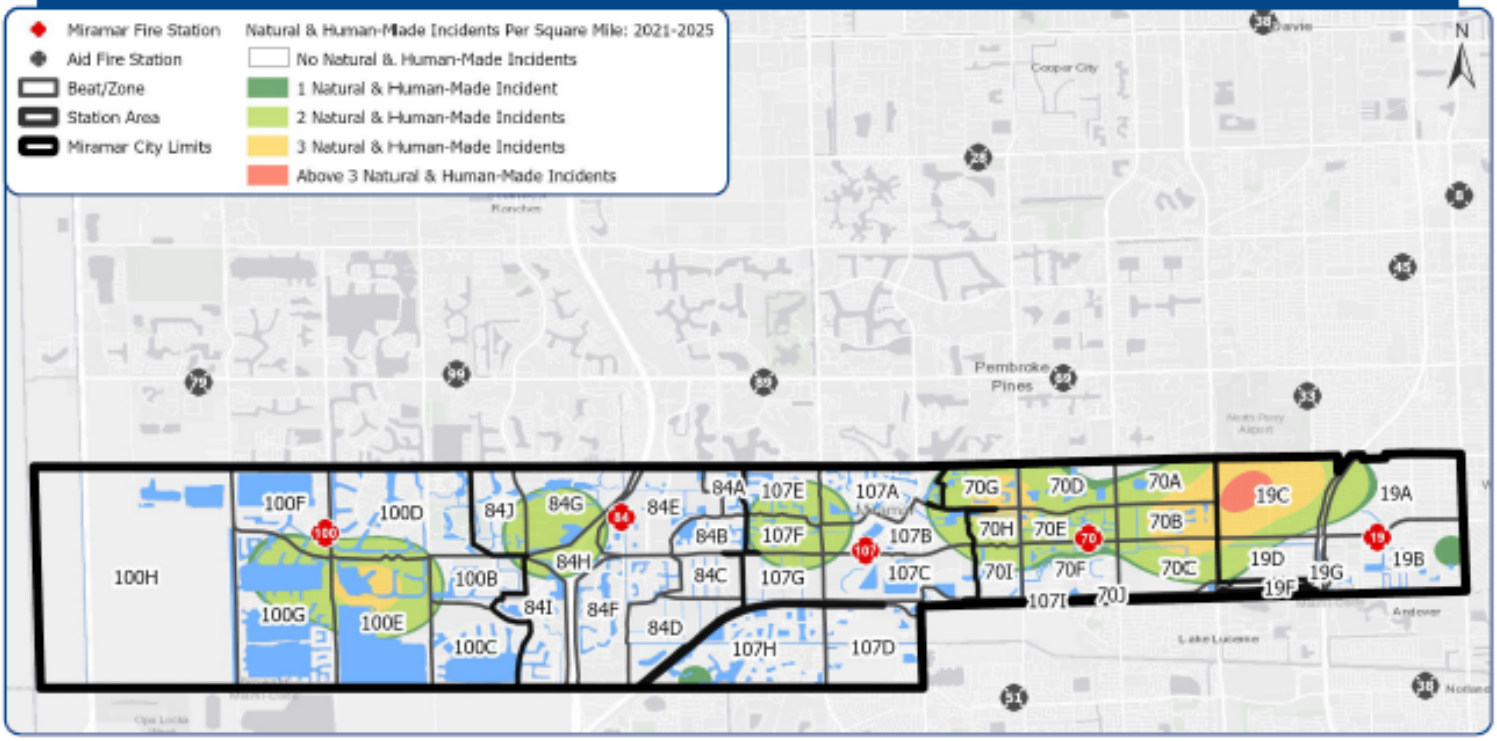
Figure 33: Historic Incident Density by Risk Category — Wildland Fires, CYs 2021–2025



Natural and Human-Made Disasters

Figure 34 illustrates the historic concentration of natural and human-made disasters within the MFRD service area from 2021—2025.

Figure 34: Historic Incident Density by Risk Category — Natural and Human-Made Disasters, CYs 2021–2025



LAND USE

Land use characteristics were incorporated into the risk assessment as a geographic risk classification variable to assess how the community's physical development patterns affect the probability of future emergency incidents. Land use is a well-established predictor of emergency service demand because different land use types are associated with varying occupancy characteristics, development densities, population concentrations, and operational hazards.

Land-use classifications also serve as a surrogate measure of occupancy risk because specific occupancy types are frequently associated with patterns of emergency incidents. This analysis allows the CRA to identify where incidents have occurred historically and where future emergency service demand can reasonably be expected to occur, based on community development patterns.

Occupancy risk extends beyond the physical presence of structures and encompasses the activities that occur within those occupancies, the concentration of occupants, the complexity of operations, and the potential consequences of an emergency. Certain occupancy types, such as education facilities, healthcare occupancies, assembly occupancies, industrial facilities, and large commercial developments, are associated with increased life safety challenges, evacuation concerns, economic consequences, and/or operational demands. By incorporating land use characteristics into the risk model, the analysis evaluates both current occupancy-related hazards and areas where future development patterns might influence community risk.

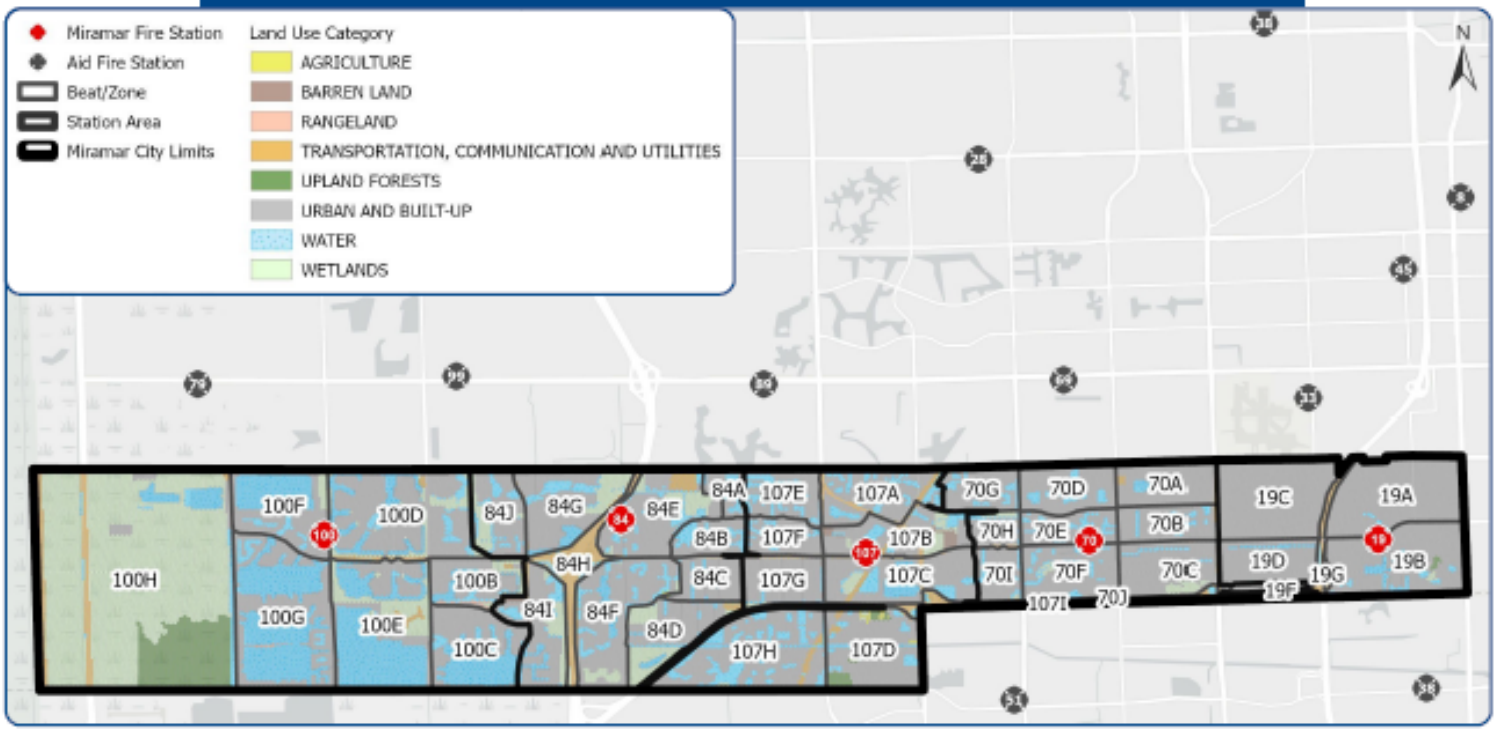
GIS land use data were available for a substantial portion of the MFRD service area and were used to evaluate the relationship between historical incident occurrence and specific land use classifications. Historical incident data were analyzed by risk category and compared across land use types to identify the categories most strongly associated with future emergency service demand.

To develop land use risk scores, the number of historical incidents in each land use category was summarized by risk type and then normalized using a percentile ranking. The resulting scores quantify the relative probability that a specific incident type will occur within a particular land use classification, based on historical experience. For example, land use categories with a higher concentration of historical structure fires received higher probability scores in the structure fire risk assessment. Similarly, land use classifications that were associated with elevated EMS activity, HazMat incidents, technical rescues, and other emergency responses received proportionally higher scores within their respective risk models.

Because the relationship between land use and emergency incidents varies by hazard type, separate land use weighting factors were developed for each risk category. This approach allows the analysis to recognize the unique characteristics of each hazard, while maintaining consistency throughout the risk assessment methodology.

Figure 35 illustrates the land use classifications within the MFRD service area. These geographic characteristics provide an important foundation for understanding where emergency incidents are most likely to occur and serve as a key component of the probability calculations used throughout the CRA.

Figure 35: Land Use Categories in the Miramar Fire-Rescue Department Service Area



Incident Data

Incident data was spatially joined to the hexagonal grid, and the land use category most frequently associated with incidents within each hexbin was assigned to that grid cell. In locations where no incidents occurred during the study period and no property use information was available in incident records, City of Miramar land use data was used to assign the most appropriate classification to the hexbin. This approach ensured that all hexbins within the service area received a land use designation and could be included in the analysis.

Land use scores were developed by evaluating the relationship between historical incident occurrence and land use classifications for each risk category. The total number of incidents in each land use category was summarized and then normalized using a percentile-ranking method. The resulting percentile rank represents the relative likelihood that a specific incident type is associated with a particular land use classification and serves as a probability factor in the risk assessment.

For example, assume the structure fire analysis identified the following number of historical incidents by land use category:

Land Use Category	Structure Fire Incidents
Agriculture	0
Barren land	0
Rangeland	0
Transportation, Communication, and Utilities	8
Upland forests	3
Urban and built-up	232
Wetlands	2
TOTAL	**245**

After ranking the land use categories based on historical incident occurrence, the multi-family residential category, labeled as “Urban and built-up” would receive the highest percentile rank because it experienced the highest number of structure fire incidents. Open Space, labeled as “Barren land”, would receive one of the lowest scores due to the limited number of historical structure fire incidents involving that land or Rangeland use category. These percentile-ranked values were then assigned to hexbins based on their associated land use classification and incorporated into the probability calculations for the structure fire risk assessment.

This process was repeated independently for each risk category to account for the differing relationships between land use and incident occurrence. As a result, a land use classification that receives a high probability score for structure fires could receive a different score for EMS, HazMat incidents, technical rescue incidents, and other hazards. Land use score reference maps are located in the Appendix.

Table 23 summarizes the land-use scoring methodology and the associated percentile ranks used for each risk category.

Table 23: Land Use Categories — Percentile Ranks by Risk Category, CYs 2021–2025

Land Use Category	Percentile Ranks per Risk Category						
	Fires	Non-Structure Fires	EMS Responses	Technical Rescue	HazMat Incidents	Wildland Fires	Natural and Human-Made Disasters
Agriculture	0	0	5	0	10	0	0
Barren land	0	0	6.7	0	0	0	0
Rangeland	0	0	0	0	0	0	0
Transportation, communication, and utilities	8.3	10	10	10	8.3	10	0
Upland forests	6.7	0	3.3	0	0	0	0
Urban and built-up	10	8.3	8.3	8.3	6.7	8.3	10
Water	5	6.7	1.7	6.7	5	6.7	0
Wetlands	0	0	5	0	10	0	0

CRITICAL INFRASTRUCTURE

Critical infrastructure throughout the MFRD service area was analyzed to assess how essential community assets affect the probability, consequence, and impact components of the risk assessment. Critical infrastructure comprises facilities, systems, and resources that are vital to the health, safety, economic stability, and daily functioning of the community. Disruptions to these assets can significantly increase the consequences of emergency incidents and affect the Department's ability to maintain service delivery during large-scale events.

As part of the analysis, critical infrastructure features were identified, geocoded, and assigned to individual hexbins. The density and concentration of critical infrastructure assets within each hexbin were then summarized and normalized using a percentile-ranking methodology. This process allowed different infrastructure types to be evaluated on a common scale and incorporated into the risk model as standardized variables.

The critical infrastructure categories were specifically developed to reflect community-specific hazards and consequence factors identified within the MFRD service area. Depending on the risk category being evaluated, critical infrastructure variables can contribute to the probability, consequence, or impact dimensions of the three-axis risk assessment model. For example, transportation-related infrastructure was incorporated as a probability variable within the non-structure fire risk assessment because historical incident patterns indicate a strong relationship between transportation corridors and non-structure fire incidents. Conversely, within the wildland fire risk assessment, the overall critical infrastructure score was incorporated as a consequence variable because damage to critical infrastructure during a wildland fire can significantly affect community operations, economic activity, and emergency response capabilities.

This hazard-specific application of critical infrastructure variables enables the analysis to more accurately represent the localized influence of critical facilities on community risk, recognizing that the significance of a specific asset can vary with the hazard being evaluated.

Figure 36: City of Miramar Total Critical Infrastructure Percentile Rank

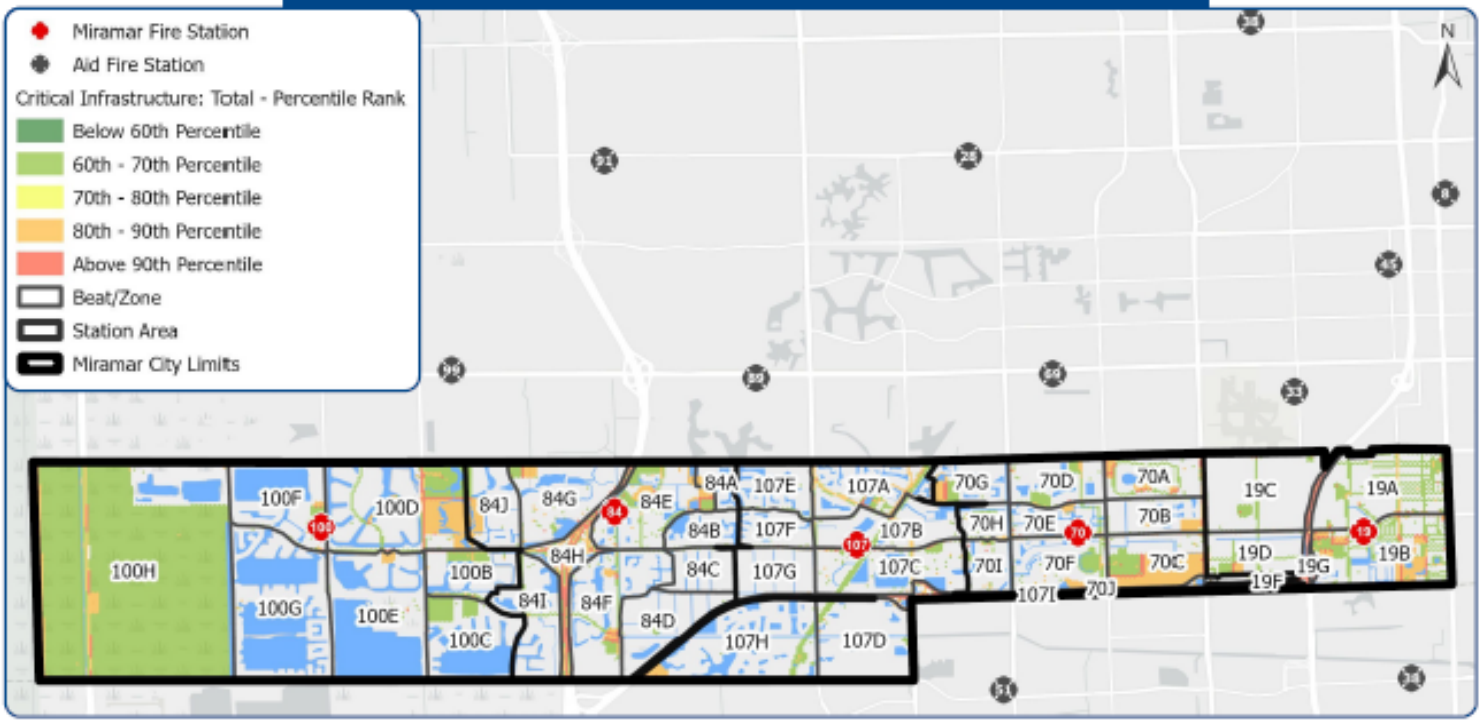


Figure 36 illustrates the distribution of critical infrastructure throughout the City of Miramar using percentile-ranked scores. Highly ranked areas represent locations that contain greater concentrations of critical infrastructure assets and, therefore, a greater potential for community disruption if those assets were impacted by an emergency incident.

The critical infrastructure categories incorporated into the analysis include:

- **Transportation infrastructure:** Major transportation corridors, roadways, bridges, and other transportation-related assets critical to community mobility and emergency access
- **Recreation facilities:** Parks, recreational complexes, and community gathering areas that can generate significant public activity and demand for emergency services
- **HazMat sites:** Facilities associated with the storage, use, and/or transportation of hazardous materials that can increase incident complexity and the potential consequences
- **Major utilities and other critical facilities:** Electrical transmission infrastructure, substations, communication systems, water and wastewater facilities, and other assets that are essential to community operations

Critical infrastructure assets were evaluated not only for their presence but also for their potential influence on community continuity, economic stability, public safety, and emergency response operations. Facilities that could significantly affect community function if they were disrupted were assigned high relative consequence values within the risk model.

Detailed descriptions of the individual infrastructure features included within each category are provided in the Critical Infrastructure Analysis and supporting appendices.

Transportation Systems

Transportation infrastructure was identified as a critical component in the risk assessment because it supports community mobility, economic activity, emergency response operations, and evacuation capabilities. Transportation systems can influence both the probability of emergency incidents and the consequences of service disruptions that result from them.

Data related to major transportation assets, including freeways, highways, expressways, principal arterials, and other significant transportation corridors, were incorporated into the analysis. Public transportation routes and facilities were also evaluated and incorporated, using presence/absence factors when appropriate, into the probability and consequence calculations for specific risk categories.

Transportation infrastructure can increase the probability of certain incident types due to higher traffic volumes, vehicle activity, and the movement of people and goods throughout the community. Additionally, transportation assets can increase the potential consequences of an incident because disruptions can affect emergency response access, evacuation operations, regional mobility, and economic activity.

Figure 37: City of Miramar Critical Infrastructure — Transportation Systems Percentile Rank

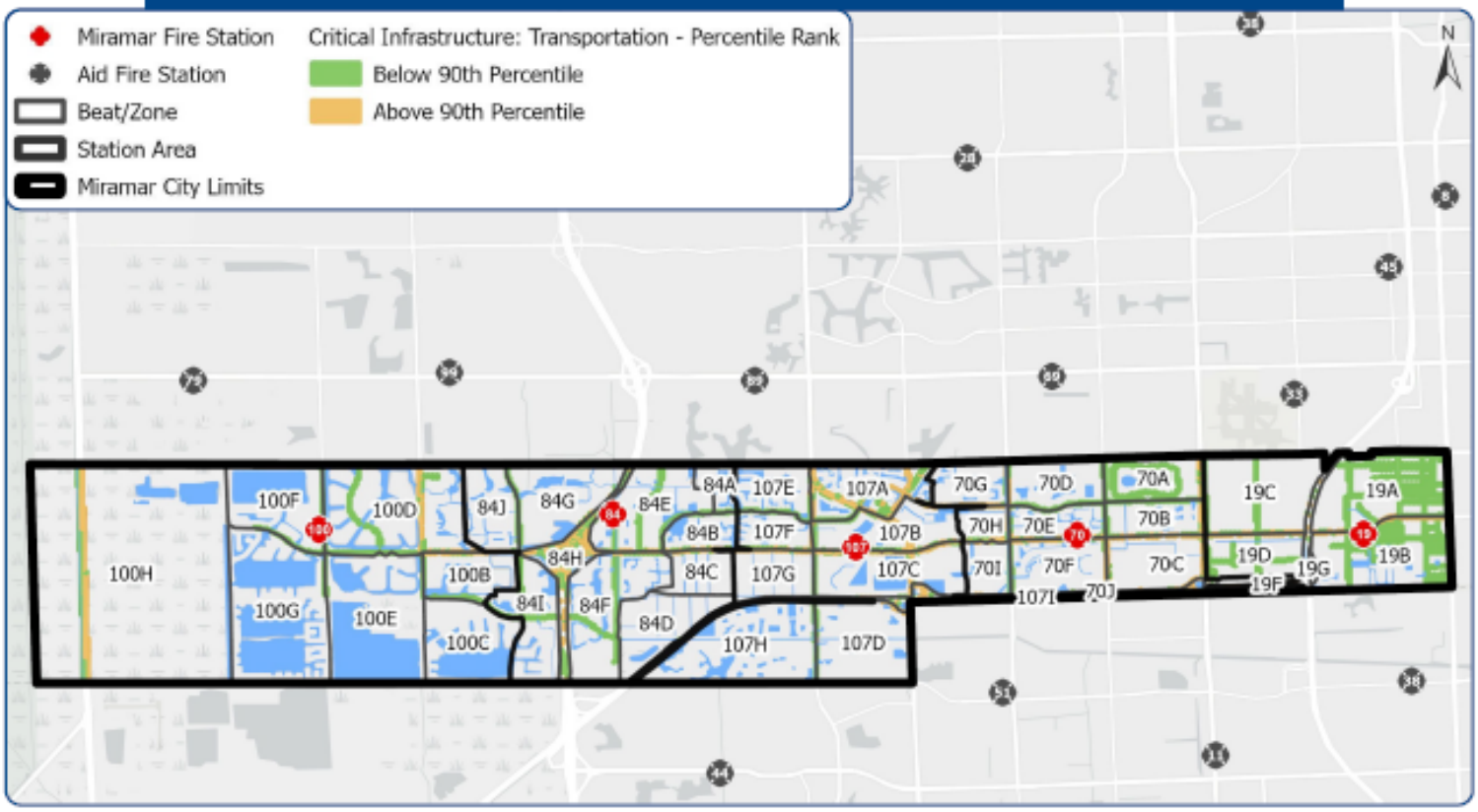


Figure 37 illustrates the percentile-ranked transportation infrastructure scores for the MFRD service area. Highly ranked areas represent locations with greater concentrations of transportation-related assets and, therefore, a greater potential to influence community risk.

The transportation infrastructure analysis includes the following components:

- **Freeways and major roadways:** Primary transportation corridors that support regional travel and commercial activity
- **Evacuation routes:** Designated transportation routes that are critical to emergency evacuation and disaster response operations
- **Aviation facilities and structures:** Aviation-related infrastructure that can pose unique operational risks and require specialized emergency response
- **Bridges:** Transportation structures that serve as critical points of connectivity within the transportation network
- **Bus routes and transit stations:** Public transportation infrastructure that supports community mobility and can generate concentrated population activity

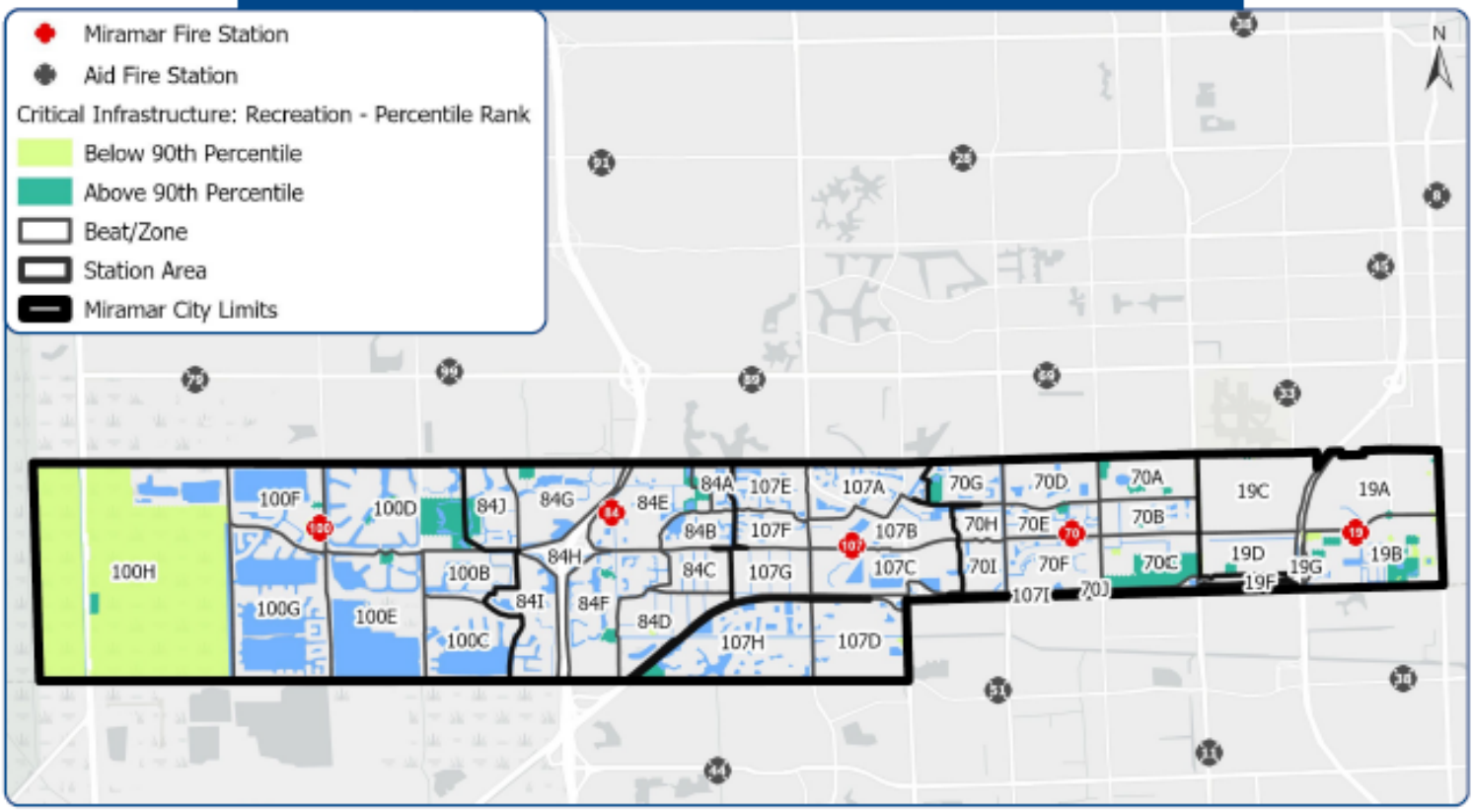
Location maps for all transportation infrastructure assets, as well as the remaining critical infrastructure categories used throughout the analysis, are provided in the Appendix.

Recreation Infrastructure

A portion of the Florida Everglades wetlands is located within the MFRD service area. This nationally significant ecosystem provides recreational opportunities, scenic resources, and access to trails and natural areas. Although this area offers substantial community benefits, it also presents unique emergency response challenges due to the remote location, limited access routes, environmental conditions, and potential need for specialized rescue resources.

Incidents occurring within the Everglades and other remote recreational areas can require longer response and access times, specialized equipment, and personnel trained in wilderness, environmental, and/or technical rescue operations. As a result, these areas were incorporated into the risk assessment as factors influencing both consequence and operational impact.

Figure 38: City of Miramar Critical Infrastructure — Recreation Percentile Rank



Trails and recreational features were incorporated into the analysis using a presence/absence methodology. Hexbins that intersect designated trails or recreational facilities received a score that reflects the potential for increased emergency service demand and the operational challenges associated with incidents occurring in these locations.

Figure 38 illustrates the percentile-ranked recreation infrastructure score within the MFRD service area. Highly ranked areas are locations with recreational features that could affect emergency response operations, incident complexity, and/or community consequences.

The recreation infrastructure analysis includes:

- **Everglades areas:** Wetlands, natural areas, and associated recreational access points located within the Everglades ecosystem
- **Parks and recreational facilities:** Community parks, athletic facilities, open spaces, and other recreational destinations that attract public use

Location maps for all recreation infrastructure assets incorporated into the analysis are provided in the Appendix.

Hazardous Materials Sites

Facilities and locations associated with hazardous materials were identified and incorporated into the CRA to evaluate the probability and potential consequences of HazMat emergencies within the MFRD service area. HazMat facilities present unique risks due to the storage, use, processing, and/or transportation of regulated substances that could threaten public health, responder safety, property, critical infrastructure, and the environment. Although HazMat incidents occur infrequently, they often require specialized response capabilities and can have significant operational and community impacts.

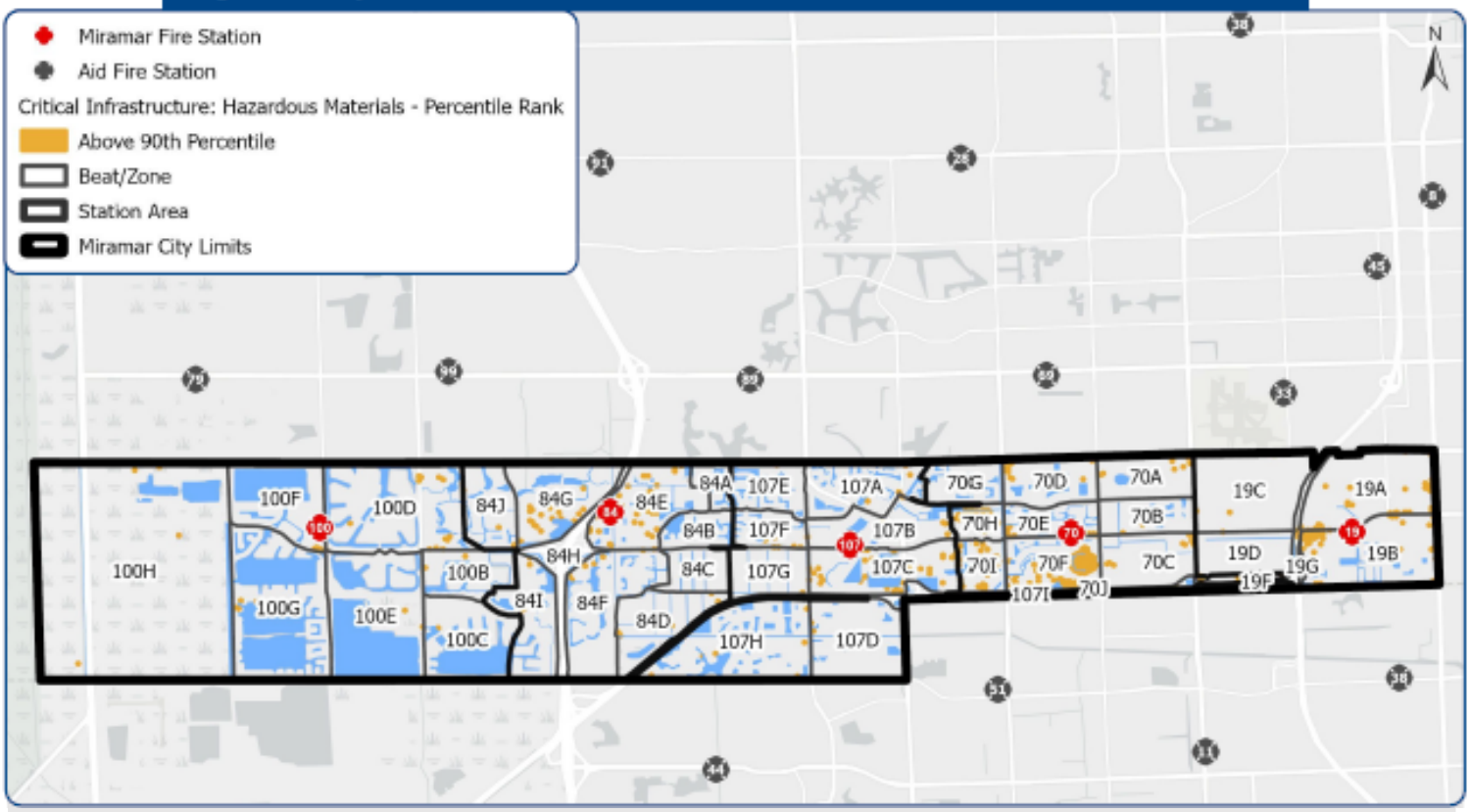
HazMat infrastructure was identified using publicly available datasets from the Florida Department of Environmental Protection (FDEP) and the U.S. Environmental Protection Agency (EPA).[1] These databases include facilities that are subject to state and federal environmental reporting requirements and were used to identify locations where regulated hazardous materials are manufactured, stored, processed, used, or otherwise managed within the jurisdiction. These locations represent areas where specialized response capabilities, interagency coordination, and pre-incident planning can be necessary to effectively manage HazMat emergencies. Additional transportation corridors and other known HazMat locations were also considered, when applicable, to ensure a complete representation of community risk.

For the HazMat risk model, the presence of one or more regulated HazMat facilities within a hexbin was used as a probability variable. Because the existence of a single HazMat facility can substantially increase the likelihood and complexity of an emergency incident, each hexbin containing one or more identified facilities received an elevated probability score. This methodology recognizes that HazMat risks are location-specific and that the consequences of an incident can extend beyond the facility itself to affect adjacent properties and surrounding populations.

The resulting analysis identified geographic areas where HazMat incidents are more likely to occur, providing valuable information for emergency response planning, resource deployment, pre-incident planning, training priorities, and community risk-reduction initiatives. Incorporating HazMat infrastructure into the CRA ensures that these low-frequency, high-consequence hazards are appropriately represented in the Department's overall risk model.

Figure 39 illustrates the distribution of HazMat infrastructure throughout the MFRD service area, including facilities identified through state and federal environmental databases. Detailed maps of all HazMat infrastructure facilities are incorporated into the CRA are provided in the Appendix.

Figure 39: City of Miramar Critical Infrastructure — Hazardous Materials Percentile Rank



[1] *Florida Department of Environmental Protection (FDEP): https://floridadep.gov/; Environmental Protection Agency (EPA): https://www.epa.gov/*

The key HazMat facilities within the City of Miramar include:

- Hazardous materials tier II facilities
- Hazardous materials waste facilities
- EPA-regulated air emission facilities
- Dry cleaning facilities
- Biomedical waste facilities
- Large generators of hazardous waste
- Petroleum containment monitoring sites
- Gun stores
- Perfluoroalkyl and polyfluoroalkyl substances (PFAS) sites
- Toxic release locations
- Hazardous water regulated facilities
- Hazardous materials – Brown Fields
- Hazardous open cleanup sites
- Hazardous materials tier II chemical sites

Other Critical Infrastructure

In addition to transportation systems, recreational facilities, and HazMat sites, several categories of critical infrastructure were incorporated into the CRA to evaluate their effect on community vulnerability and emergency service demand, as well as the potential consequences of emergency incidents. These facilities provide essential services that support the daily operation, health, safety, and economic stability of the community. Disruptions to these assets can have impacts that extend well beyond the immediate incident area, increasing operational complexity and requiring specialized response strategies.

These other critical infrastructure assets were evaluated as consequence and impact variables within the risk model because incidents involving these facilities can affect large populations, interrupt essential public services,

and/or require coordinated, multiagency response and recovery efforts. By incorporating these assets into the assessment, the risk model more accurately reflects not only the probability of an incident occurring, but also the potential consequences to the community when critical infrastructure is compromised.

The following categories of critical infrastructure were included in the analysis:

- **Healthcare facilities:** Hospitals, medical offices, assisted living facilities, nursing homes, and other healthcare occupancies that provide essential medical care and residential services to vulnerable populations
- **Communications infrastructure:** Public safety communications centers, radio transmission facilities, and FM and AM broadcast towers that support emergency communications and community information systems
- **Electrical infrastructure:** High-voltage transmission lines, electrical substations, and associated utility infrastructure essential for maintaining reliable electrical service throughout the community
- **Cultural and community resources:** Museums, libraries, cultural centers, and similar facilities that support community identity, public engagement, and civic activities
- **Educational facilities:** Public and private schools, colleges, educational campuses, and related facilities serving students, faculty, staff, and visitors
- **Water and waste management facilities:** Water treatment plants, wastewater treatment facilities, pumping stations, and solid waste management facilities that provide essential public health and environmental services
  Community centers: Public facilities that provide recreational programs, community services, emergency sheltering capabilities, and locations for public assembly during both routine operations and disaster response

Each infrastructure category was spatially summarized within the hexagonal grid system and standardized using percentile-ranking techniques to produce a composite critical infrastructure score. Hexbins containing higher concentrations of critical infrastructure received higher scores, reflecting the increased potential for community disruption, operational complexity, and cascading impacts during emergencies.

Figure 40: City of Miramar Critical Infrastructure — Other Percentile Rank

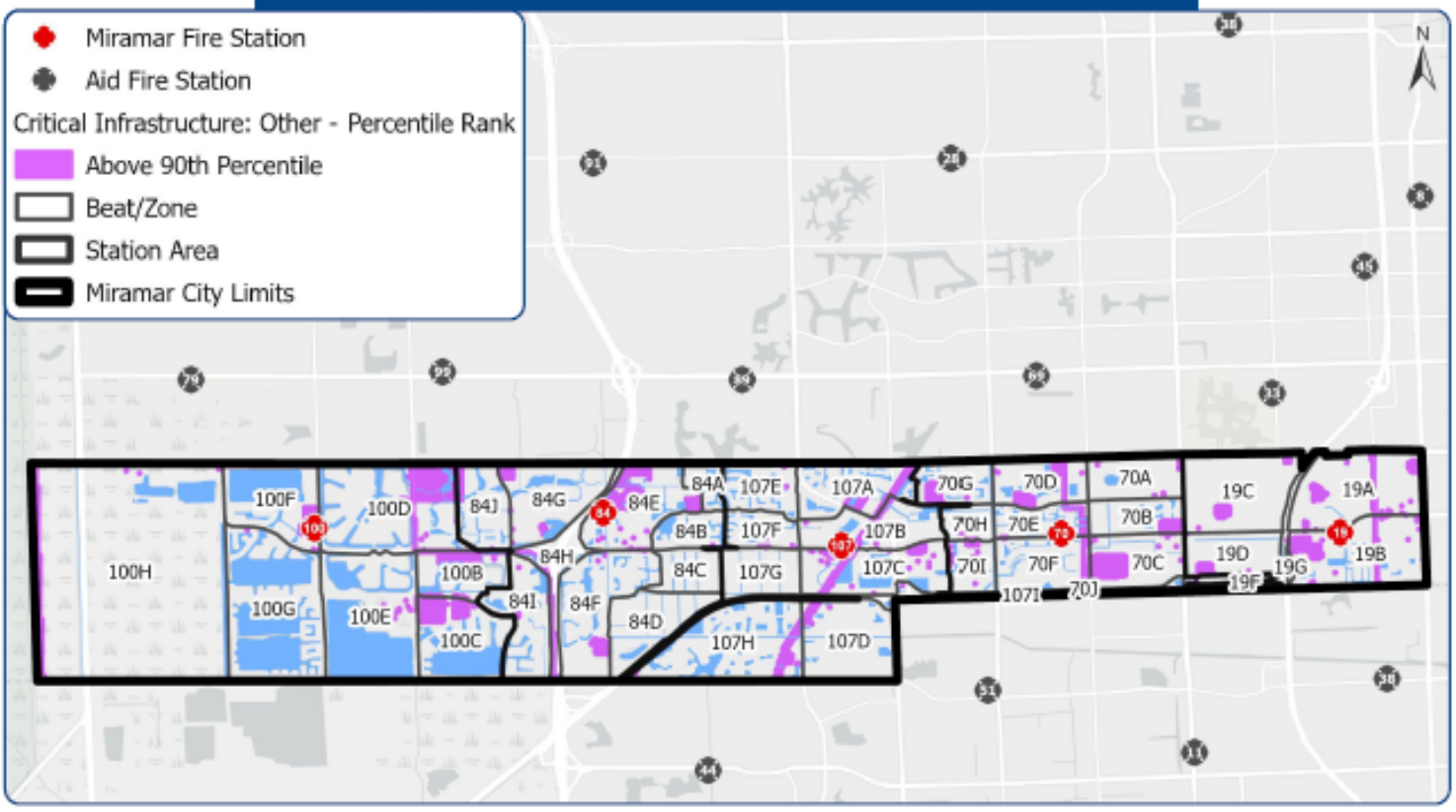


Figure 40 illustrates the distribution and relative concentration of other critical infrastructure throughout the MFRD service area. This data was incorporated into the applicable consequence and impact components of the risk assessment to more completely represent the operational significance of protecting essential community assets and maintaining the continuity of critical public services during emergency incidents.

Location maps for each critical infrastructure dataset incorporated into the CRA are provided in the Appendix.

Collectively, the critical infrastructure analysis demonstrates that essential community assets are distributed throughout the developed service area, with localized concentrations associated with transportation corridors, utilities, healthcare facilities, educational properties, public facilities, and regulated hazardous materials locations. An incident affecting these assets could create consequences that extend beyond the immediate property by disrupting transportation, communications, healthcare, utilities, public services, or economic activity.



Topography, Geography, Climate, and Physiography

This risk assessment incorporates data from FEMA's National Risk Index (NRI) to evaluate natural hazards and environmental risk factors related to topography, geography, climate, and physiography that could affect the MFRD service area. The NRI is a nationally recognized dataset that combines hazard exposure, expected annual losses, social vulnerability, and community resilience indicators to assess risk from a variety of natural hazards across the United States.

The NRI provides risk information at both the county and census tract levels. This data was incorporated into the CRA to supplement local historical incident data and identify hazards that might occur infrequently but have the potential to create significant community consequences. By incorporating NRI data, the analysis incorporates both historical emergency activity and broader hazard conditions that could influence future risk within the jurisdiction.

The NRI is periodically updated by FEMA as new hazard, demographic, and resilience data become available. This assessment utilized data from the March 2023 NRI release (Version 1.19.0).[1] Incorporating NRI data provides additional context for evaluating long-term community risk and helps ensure that the assessment considers both local incident history and broader environmental hazard conditions that can affect emergency service demand and community vulnerability.

HAZARD CATEGORIES

The NRI evaluates the following 18 natural hazard categories:

1. Avalanche
2. Coastal flooding
3. Cold wave
4. Drought
5. Earthquake
6. Hail
7. Heat wave
8. Hurricane
9. Ice storm
10. Landslide
11. Lightning
12. Riverine flooding
13. Strong wind
14. Tornado
15. Tsunami
16. Volcanic activity
17. Wildfire
18. Winter weather

However, only hazards applicable to the MFRD service area were incorporated into the risk calculations. Hazard selection was based on geographic relevance, historical occurrence, environmental conditions, and the potential to affect community risk within South Florida.

The following 10 NRI hazard categories were included in the analysis:

1. Lightning
2. Drought
3. Strong winds
4. Wildfire
5. Landslide
6. Riverine flooding
7. Hurricane
8. Earthquake
9. Hail
10. Tornado

These hazard variables were incorporated into the appropriate probability and consequence calculations depending on their relationship to the specific risk category being evaluated. The use of NRI hazard data provides additional insight into community vulnerabilities that may not be fully reflected through historical incident data alone.

RISK RATINGS

For each hazard type, FEMA[1] assigns a risk rating and a corresponding percentile-based risk score. Risk ratings are categorized as:

- Very high
- Relatively high
- Relatively moderate
- Relatively low
- Very low
- No rating
- Not applicable
- Insufficient data

These ratings provide a standardized measure of relative hazard risk compared with other geographic areas across the United States. For the purposes of this assessment, the NRI risk ratings were converted to normalized scores and incorporated into the applicable risk calculations. **Table 24** summarizes the NRI risk rating categories, associated risk score value ranges, and the corresponding scoring values used within the MFRD risk model.

The NRI data was utilized primarily as geographic risk variables within the probability and consequence components of the analysis. Depending on the hazard being evaluated, individual NRI factors were incorporated into the applicable risk categories to reflect local exposure to natural hazards and their potential effects on the community.

Table 24: National Risk Index (NRI) Rating Categories, Score Value Ranges, and Scoring Values

NRI Risk Rating Categories	NRI Risk Score Value Ranges	Risk Assessment Scoring Values
Very high	$80^{th} - 100^{th}$	10
Relatively high	$60^{th} - 80^{th}$	8
Relatively moderate	$40^{th} - 60^{th}$	6
Relatively low	$20^{th} - 40^{th}$	4
Very low	$0 - 20^{th}$	2

[1] https://www.fema.gov/flood-maps/products-tools/national-risk-index

In addition to the individual hazard ratings, two broader NRI indicators were incorporated into the risk assessment: the NRI composite risk rating and community resilience rating. Both ratings were incorporated into the MFRD risk model as geographic risk variables to provide additional context regarding overall hazard exposure and community vulnerability.

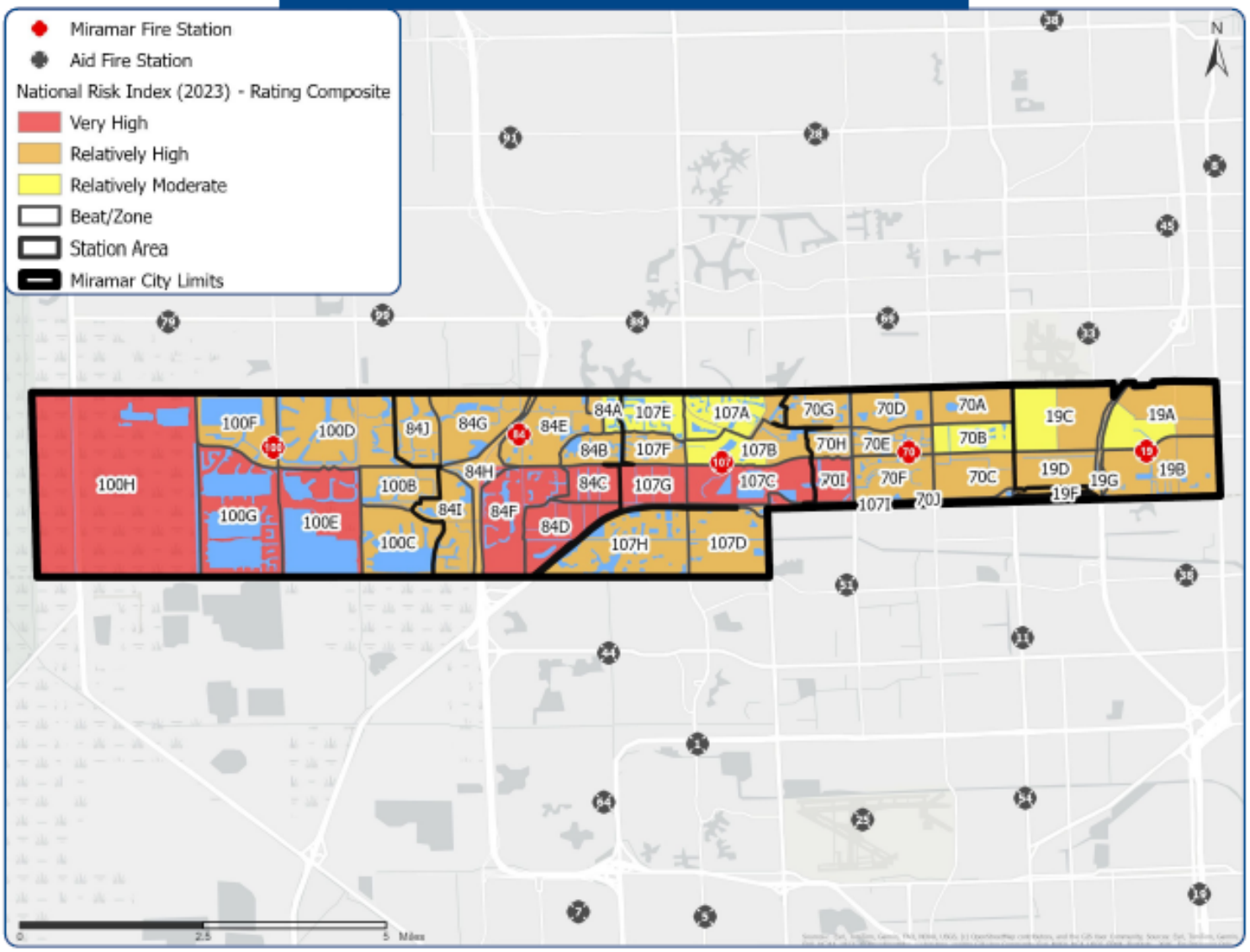
NRI Composite Risk Rating

The NRI composite risk rating provides an overall measure of a community's relative natural hazard risk by combining FEMA's assessment of all hazards included within the NRI. The rating compares a community's composite risk score with those of similarly analyzed jurisdictions across the United States and provides a standardized measure of overall hazard exposure and vulnerability.[1]

Figure 41 illustrates the NRI composite risk rating for the census tracts located within the MFRD service area. The map identifies areas with relatively higher and lower overall natural hazard risk based on FEMA's national methodology and provides a broad assessment of community exposure to environmental hazards.

The composite risk rating was incorporated into the risk calculations to account for the cumulative effects of multiple hazard types and to provide a community-wide measure of natural hazard risk beyond any single hazard category. Areas with higher composite risk ratings received proportionally higher scores in the applicable risk assessments, reflecting a greater potential for hazard-related impacts on the community.

Figure 41: National Risk Index — Composite Risk Rating, 2023



[1] https://hazards.fema.gov/nri/determining-risk

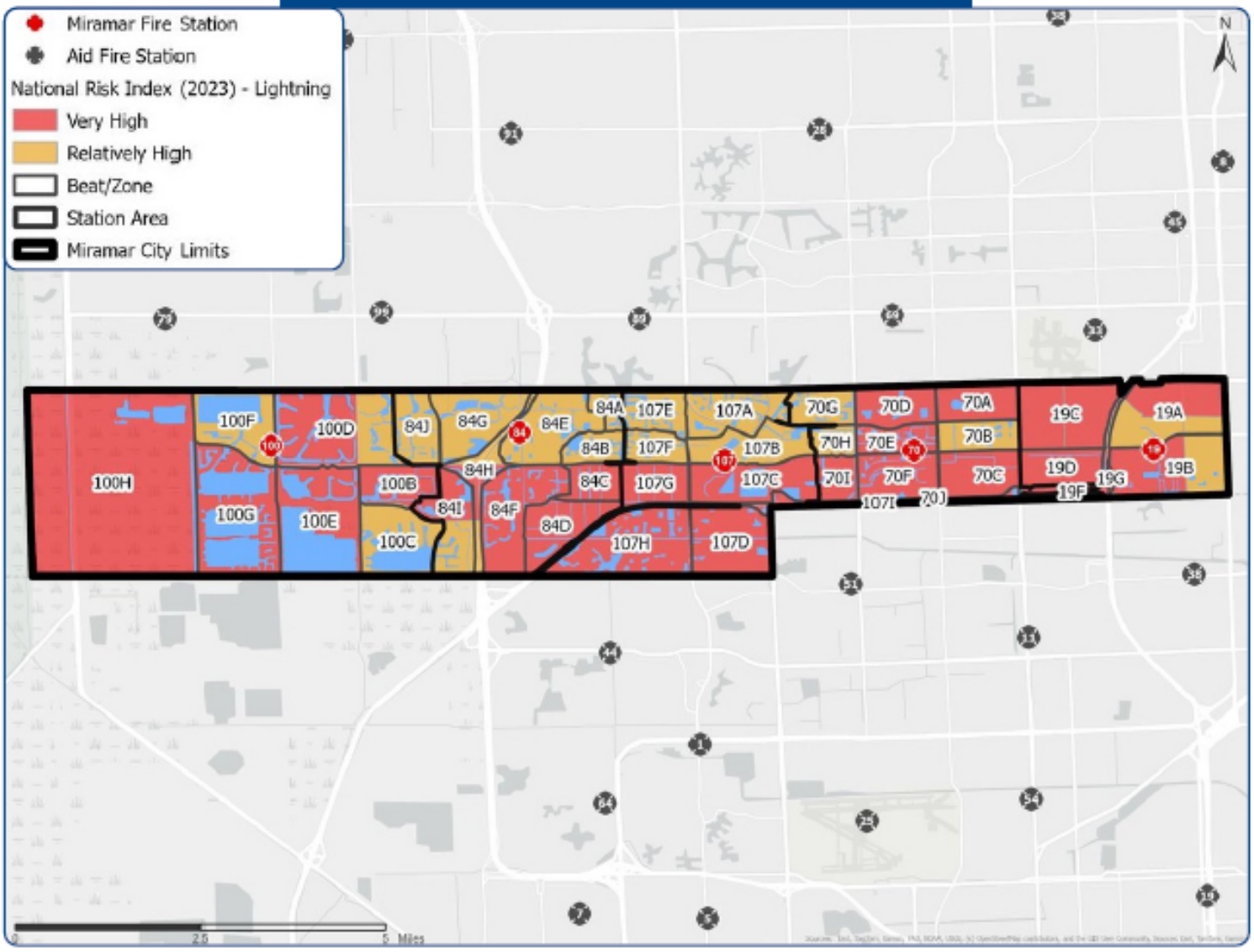
NRI Community Resilience Rating

The National Risk Index (NRI) Community Resilience Score is discussed in greater detail later in this report as a component of the impact assessment. Community resilience represents the capacity of individuals, neighborhoods, and institutions to prepare for, withstand, respond to, and recover from natural and human-caused hazards. Within this Community Risk Assessment, the resilience score is used as one of several variables influencing the impact axis of the three-axis risk model. Areas with lower community resilience may experience greater consequences following an emergency due to socioeconomic conditions, housing characteristics, transportation limitations, language barriers, access to healthcare, and other factors that affect a community's ability to mitigate and recover from disasters. Incorporating the NRI Community Resilience Score into the impact analysis provides a more comprehensive evaluation of community vulnerability and supports data-driven decisions regarding emergency response deployment, community risk reduction initiatives, and long-term strategic planning.[1]

NRI Lightning Risk Rating

Figure 42 illustrates the NRI lightning risk rating for the Department's census tracts. The rank score for the lightning risk rating was used to calculate the wildland fire risk.

Figure 42: National Risk Index — Lightning Risk Rating, 2023

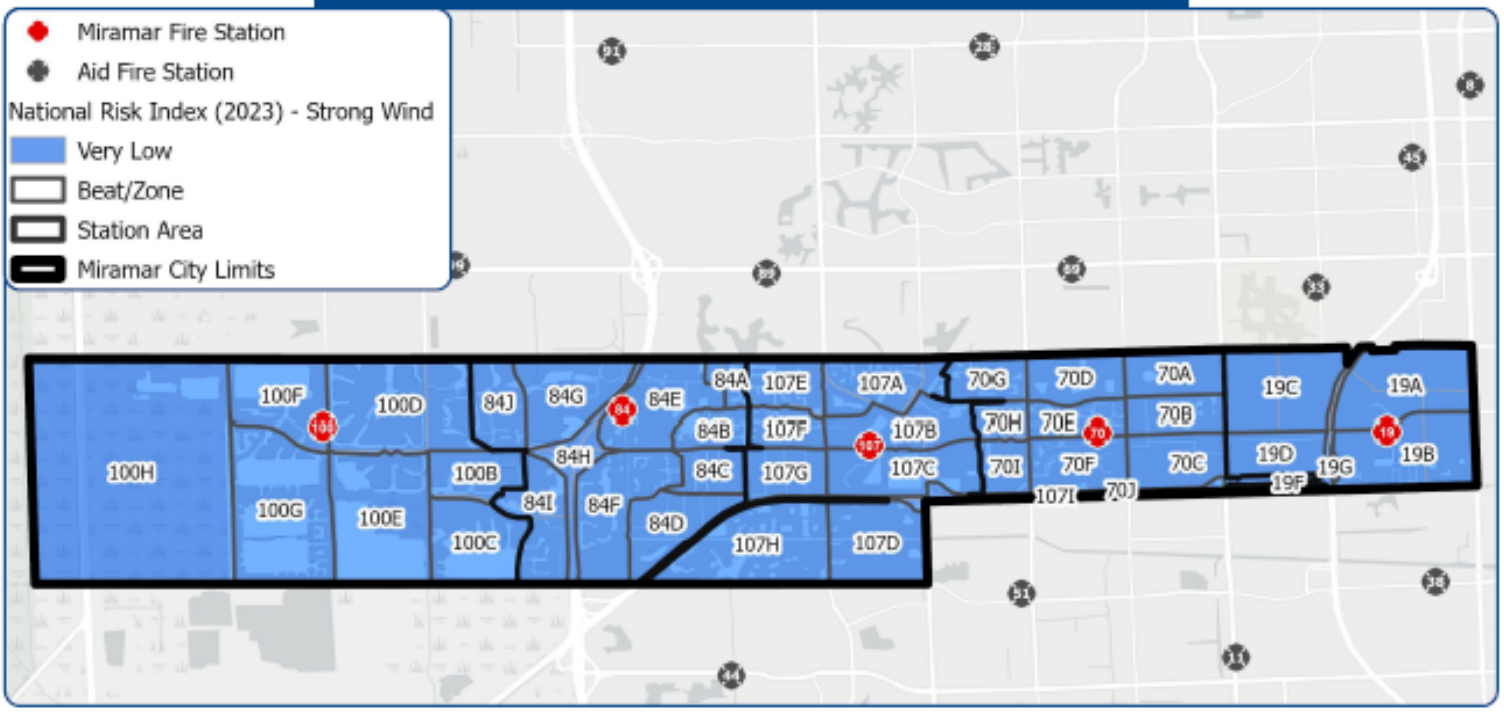


[1] https://hazards.fema.gov/nri/community-resilience

NRI Strong Winds Risk Rating

Figure 43 illustrates the NRI strong winds risk rating for the MFRD census tracts. The rank score for the strong winds risk rating was also used to calculate the wildland fire risk.

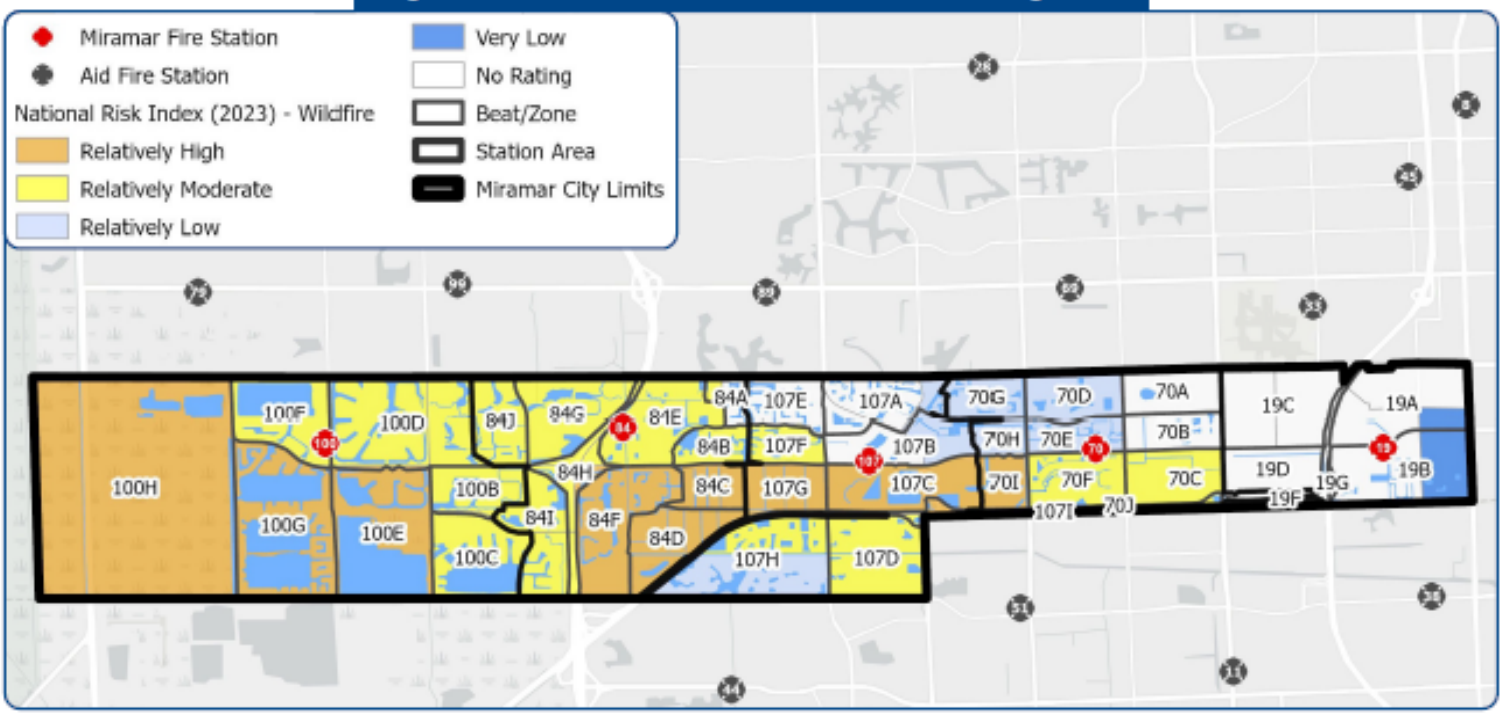
Figure 43: National Risk Index — Strong Winds Risk Rating, 2023



NRI Wildfire Risk Rating

Figure 44 shows the NRI wildfire risk rating for the census tracts within the Department. The rank score for the wildfire risk rating was also used to calculate the wildland fire risk.

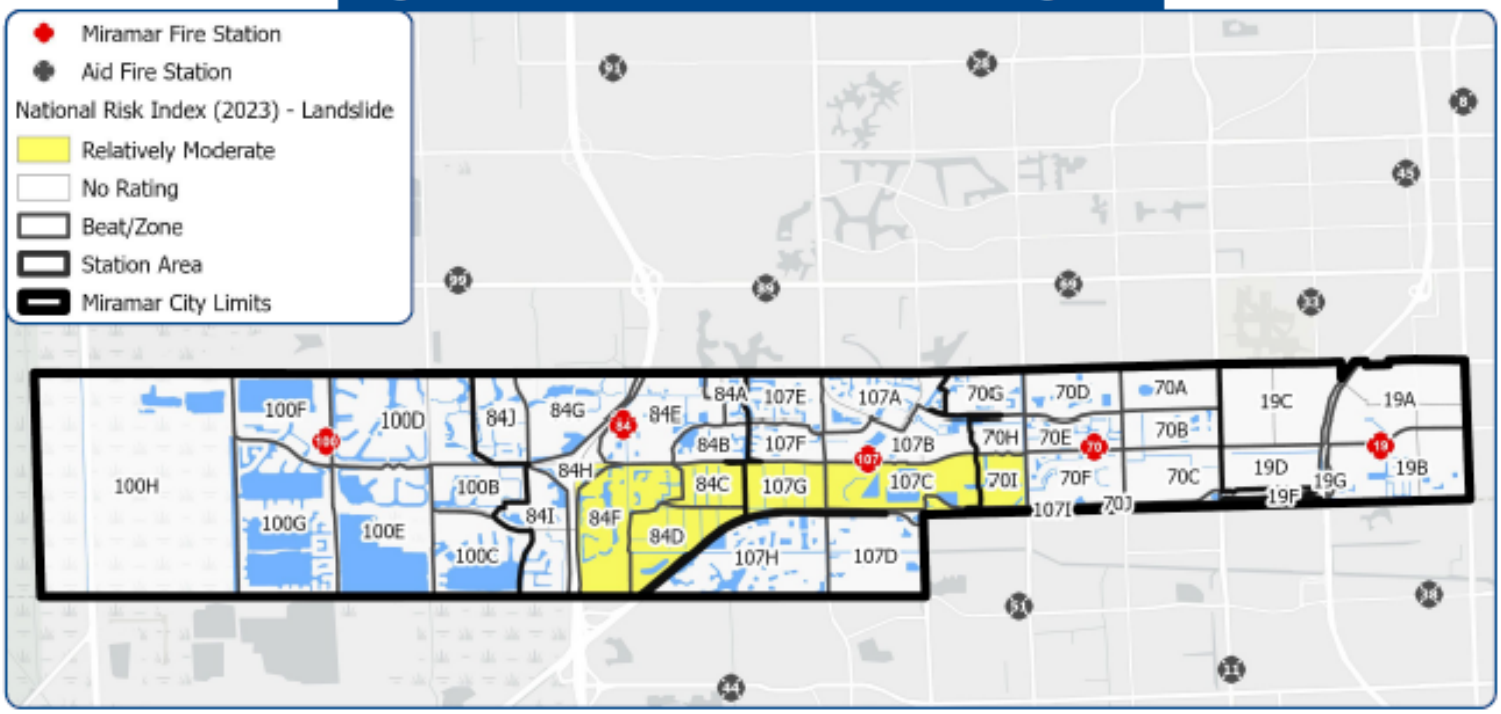
Figure 44: National Risk Index — Wildfire Risk Rating, 2023



NRI Landslide Risk Rating

Figure 45 illustrates the NRI landslide risk rating for the MFRD census tracts. The rank score for the landslide risk rating was used to calculate the natural and human-made disaster risk.

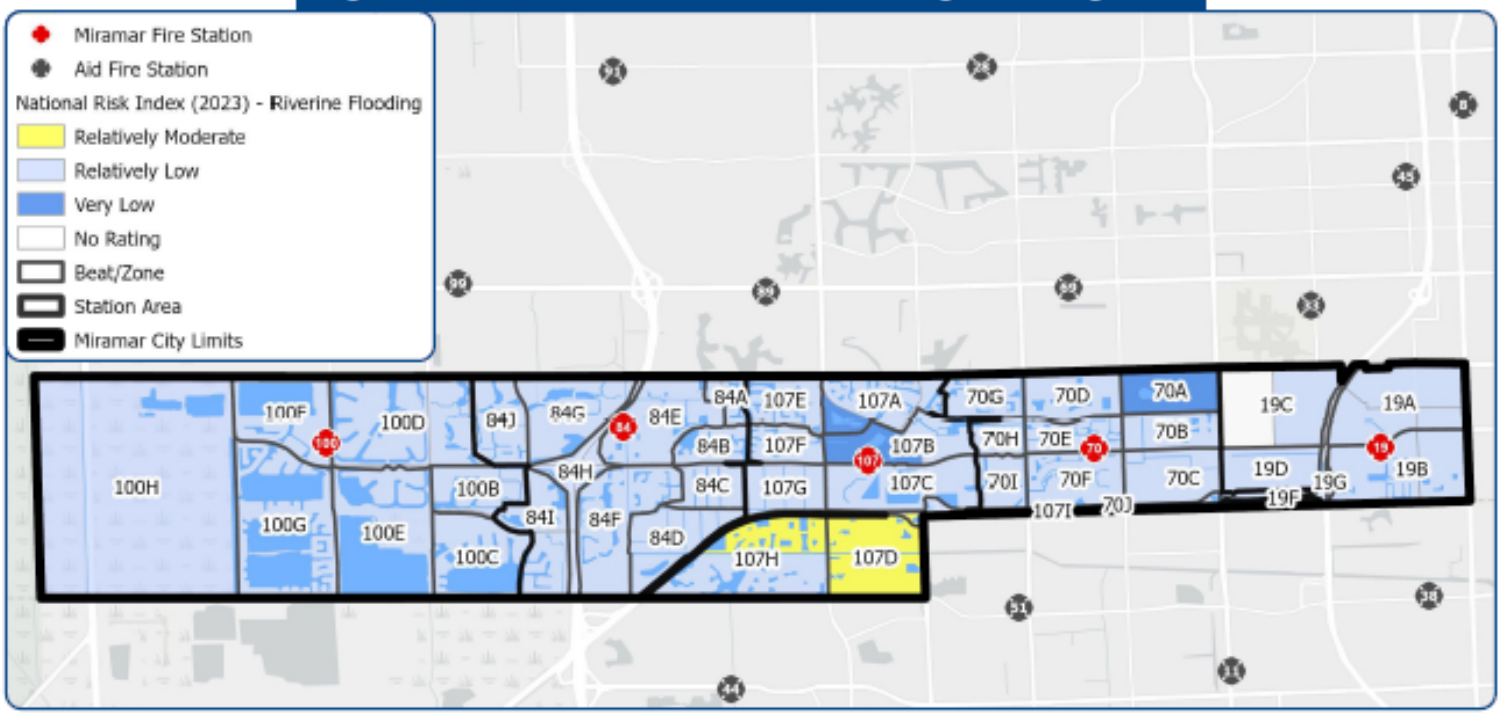
Figure 45: National Risk Index — Landslide Risk Rating, 2023



NRI Riverine Flooding Risk Rating

Figure 46 illustrates the NRI's riverine flooding risk rating for the census tracts within MFRD. The rank score for the riverine flood risk rating was also used to calculate the natural and human-made disaster risk.

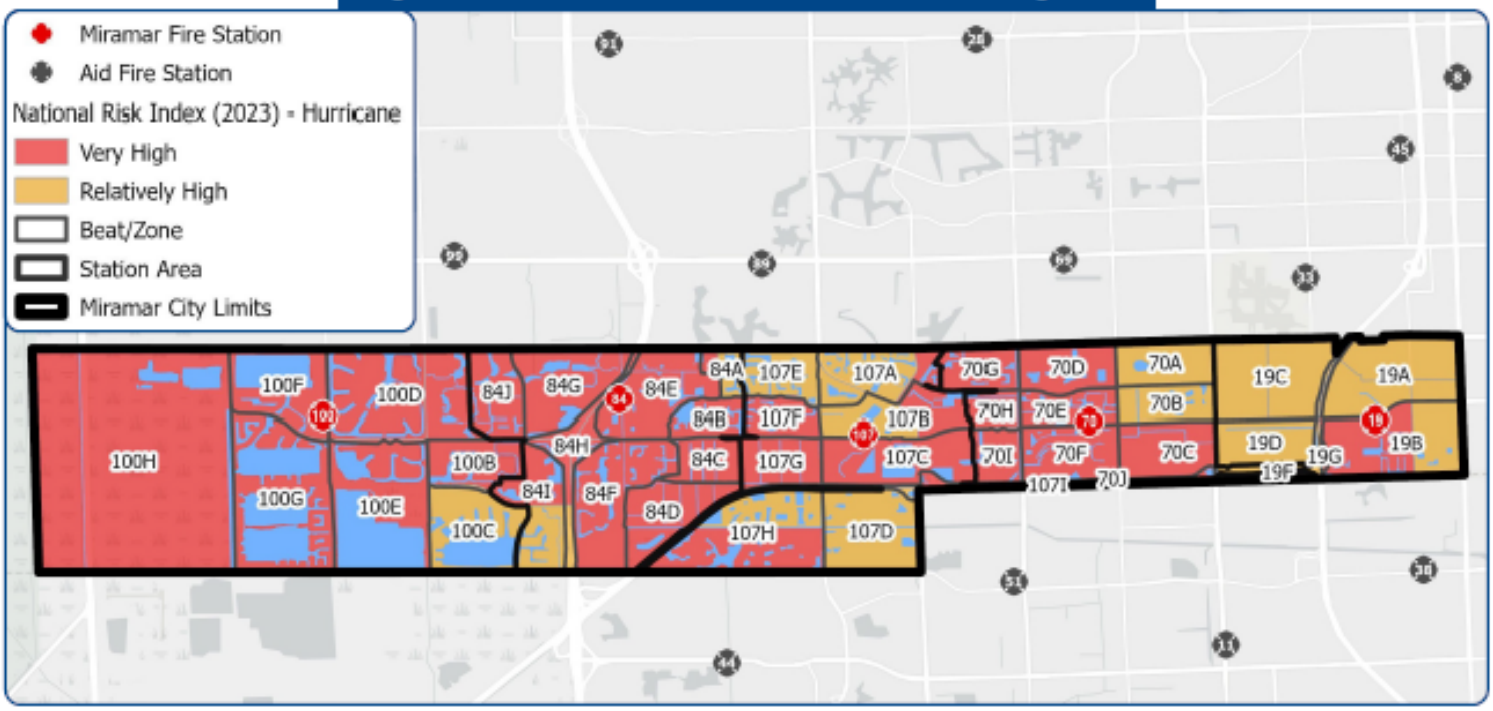
Figure 46: National Risk Index — Riverine Flooding Risk Rating, 2023



NRI Hurricane Risk Rating

Figure 47 illustrates the NRI hurricane risk rating for the census tracts within the Department. The rank score for the hurricane risk rating was also used to calculate the natural and human-made disasters risk.

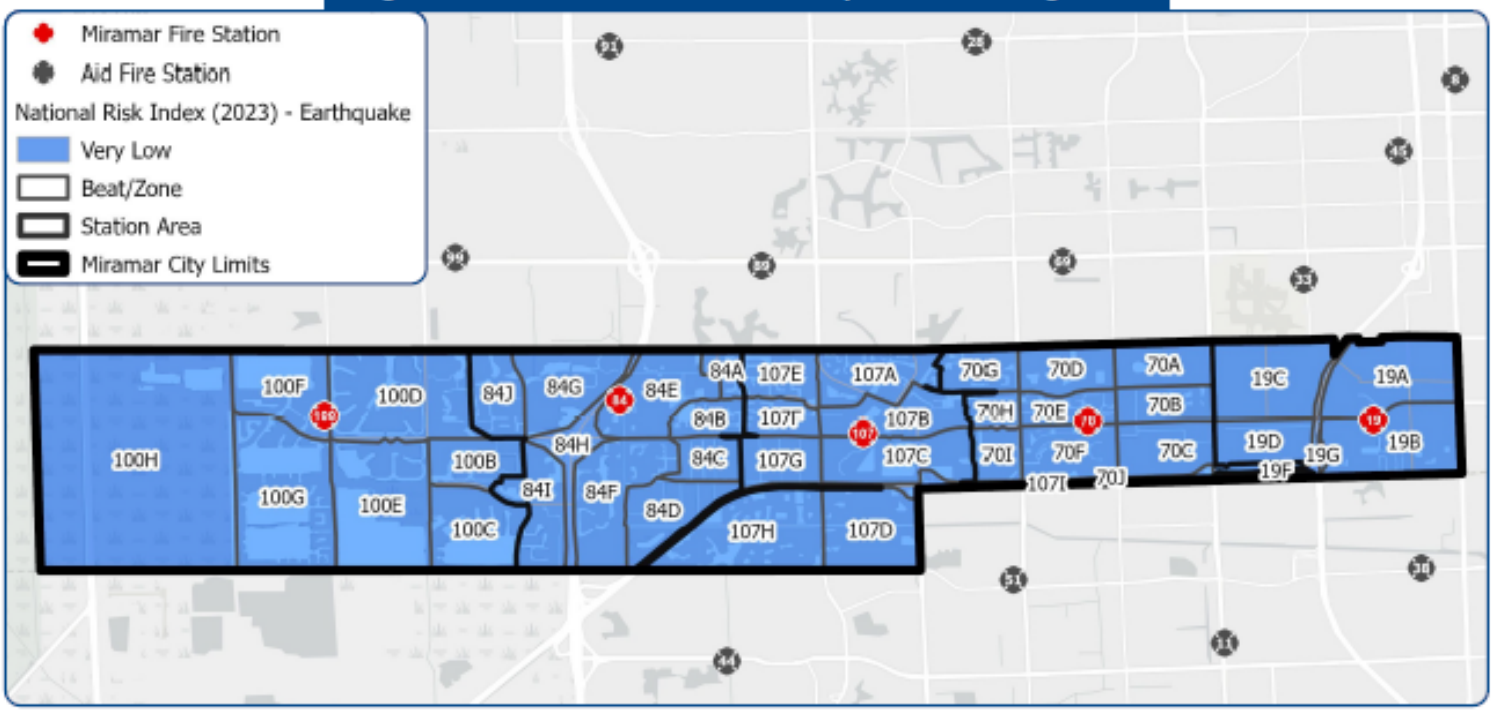
Figure 47: National Risk Index — Hurricane Risk Rating, 2023



NRI Earthquake Risk Rating

Figure 48 shows the NRI earthquake risk rating for the MFRD census tracts. The rank score for the earthquake risk rating was also used to calculate the natural and human-made disasters risk.

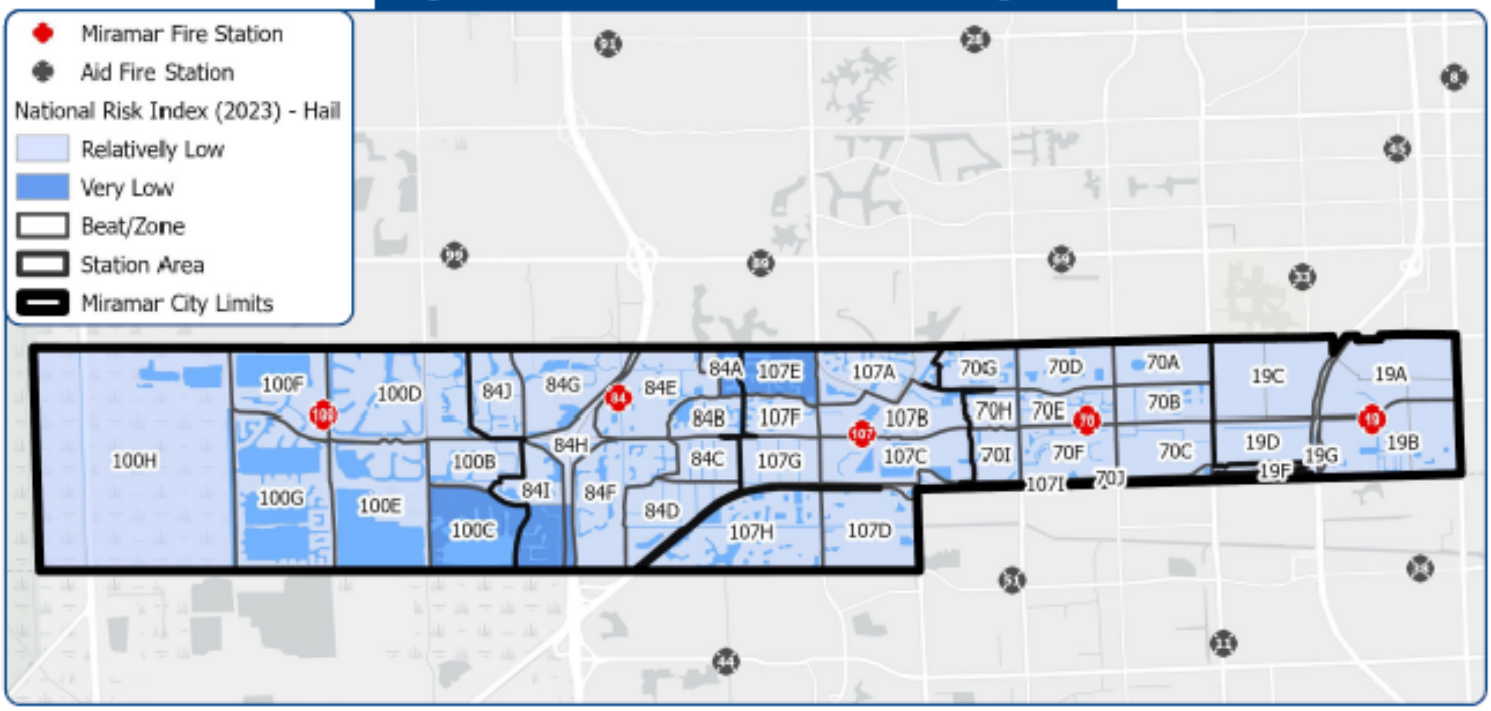
Figure 48: National Risk Index — Earthquake Risk Rating, 2023



NRI Hail Risk Rating

Figure 49 illustrates the NRI hail risk rating for the census tracts within the Department. The rank score for the hail risk rating was also used to calculate the risk of natural and human-made disasters.

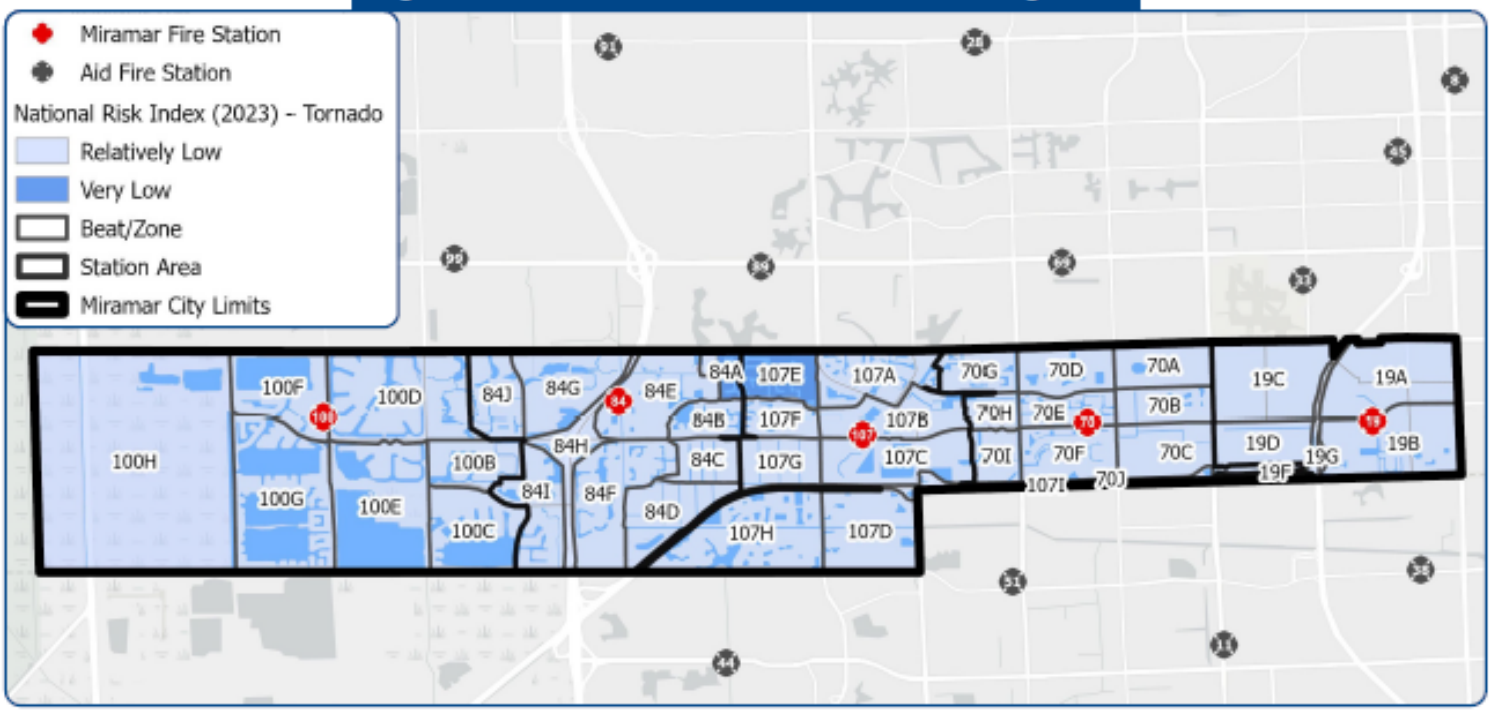
Figure 49: National Risk Index — Hail Risk Rating, 2023



NRI Tornado Risk Rating

Figure 50 illustrates the NRI tornado risk rating for the census tracts within MFRD. The rank score for the tornado risk rating was also used to calculate the risk of natural and human-made disasters.

Figure 50: National Risk Index — Tornado Risk Rating, 2023



Consequence Variables

Consequence variables measure the potential severity of an incident when it occurs within a given geographic area. Unlike probability variables, which estimate the likelihood of an event occurring, consequence variables evaluate the magnitude of its effects on the community, property, critical infrastructure, and emergency response system.

Consequence factors can increase or decrease the overall level of risk, depending on their characteristics. Some variables represent conditions that increase the potential for loss, disruption, and/or impact, whereas others reflect mitigation measures that reduce the severity of an incident or improve community resilience. For example, areas that contain critical infrastructure, vulnerable populations, or concentrations of high-value property can experience greater consequences from emergency incidents. Conversely, locations protected by automatic fire sprinkler systems, enhanced fire-protection features, and other risk-reduction measures can experience reduced consequences because these systems are designed to limit incident severity and property loss.

By incorporating both risk-increasing and risk-mitigating factors, the consequence analysis provides a comprehensive evaluation of community risk, recognizing that the severity of an incident is influenced not only by the hazard itself but also by the characteristics of the people, property, infrastructure, and protective measures present within the affected area.

For the MFRD risk assessment, consequence variables were selected to represent the potential effects of emergency incidents on life safety, property conservation, community function, and critical infrastructure. These variables include:

- Critical infrastructure and essential community facilities
- Fire-protection and risk-reduction systems
- Property characteristics and development patterns
- Social vulnerability indicators
- Population distribution and density
- Community resilience factors
- High-consequence occupancies and facilities

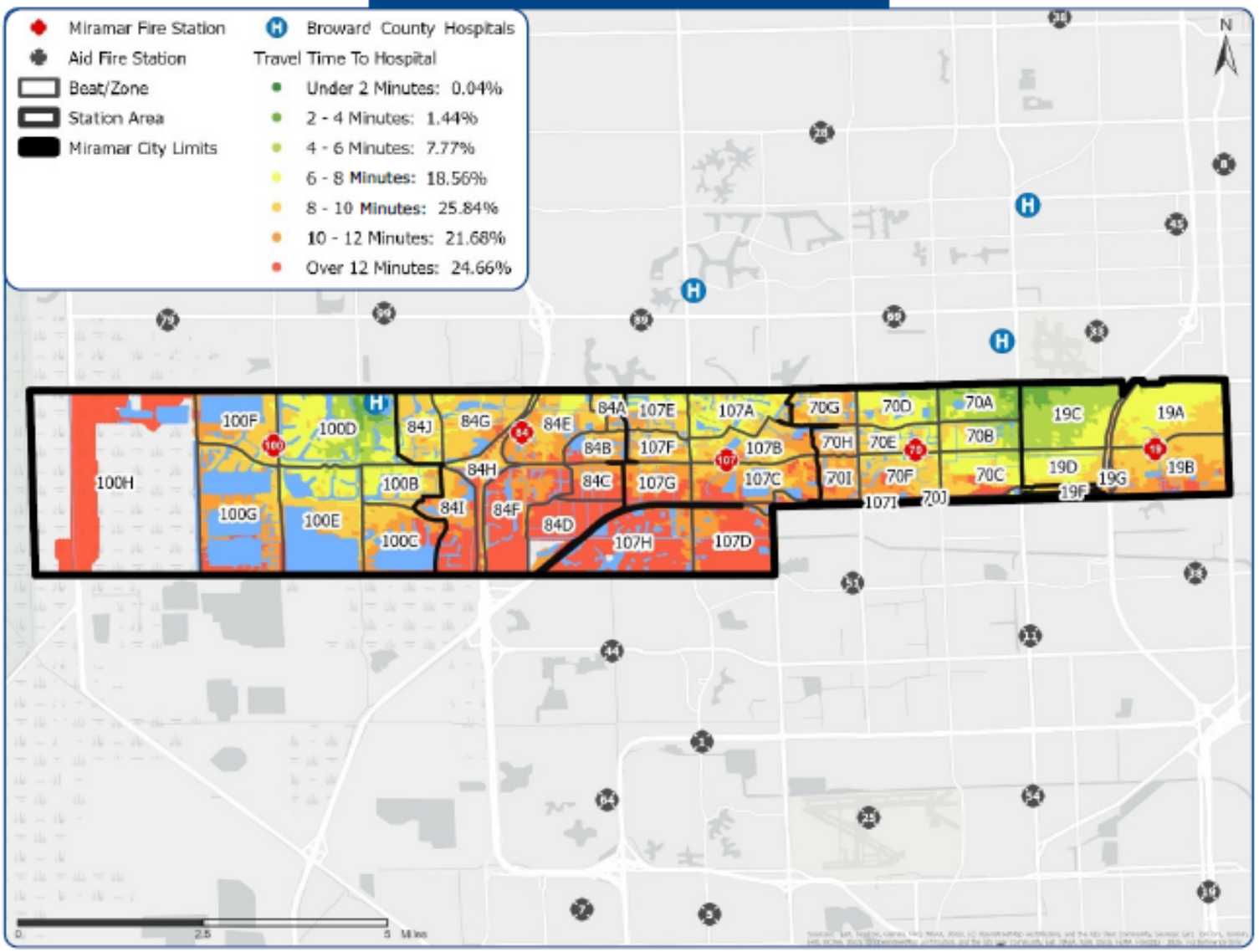
The following sections describe how the consequence variables were incorporated into the analysis and summarize how each variable contributes to the overall risk assessment methodology.

TRAVEL TIME TO HOSPITAL

Travel time to hospital acts as a consequence amplifier in risk analysis because, while it does not trigger an emergency, it directly dictates the final severity of the event. For any given physical trauma, delayed medical transport can rapidly shift the outcome from a treatable injury to permanent disability or fatality. Consequently, longer travel times directly multiply expected mortality and financial loss metrics within quantitative risk models. This dynamic becomes especially critical during disasters when damaged infrastructure increases transport delays, turning otherwise manageable injuries into life-threatening crises. Ultimately, shorter travel times suppress the human toll of an emergency, whereas longer travel times significantly escalate it.

Figure 51 illustrates the predicted travel time to the closest hospital from each hexbin center.

Figure 51: Travel Time to Hospital, by Hexbin



RISK-REDUCTION AND RISK-MITIGATION VARIABLES

In addition to evaluating factors that increase community risk, quantitative risk assessment incorporates variables that reduce risk or mitigate the consequences of emergencies. These mitigation variables represent community risk-reduction measures that can decrease the likelihood of incidents, limit their severity, or improve outcomes during an emergency.

For the MFRD risk assessment, mitigation variables included fire-protection systems, public education initiatives, and community risk-reduction activities. These variables were evaluated for inclusion within the risk model where reliable and geographically relevant data were available. The ability to quantitatively incorporate mitigation activities into a risk assessment often depends on the availability, quality, and completeness of supporting data. Fire inspection and code-enforcement activities can serve as important risk-reduction indicators; however, inspection data were not available for inclusion in this analysis, so those activities could not be geographically quantified within the risk model. Future updates to the CRA could benefit from incorporating data on inspections, code-enforcement, and community risk-reduction programs as additional mitigation factors.

The following sections describe how the mitigation variables were incorporated into the assessment and the methodology used to calculate their effect on community risk.

Fire-Protection Systems

Fire-protection systems were incorporated into the risk assessment as a mitigation factor because they have been demonstrated to reduce fire occurrence, limit fire growth, improve occupant notification, enhance life safety, and decrease property loss. The presence of these systems can significantly influence both the probability and the consequences of structure fire incidents.

MFRD provided a comprehensive database that links fire-protection systems to individual buildings and addresses. This is the most effective way to incorporate fire-protection data into a quantitative risk assessment. Such datasets identify protected occupancies and where to apply risk-reduction factors at a highly detailed geographic level.

The fire-protection features commonly considered within CRAs include automatic fire sprinkler systems, fire alarm systems, smoke detection devices, emergency voice/alarm communication systems, and other engineered fire-protection measures. These systems serve as community risk-reduction tools by detecting fires earlier, notifying occupants more quickly, and suppressing them before they grow into larger incidents.

For the MFRD analysis, available data regarding detector systems and fire-protection features were incorporated into the structure fire risk assessment as risk-reduction variables. Locations with documented fire detection and protection systems received an adjustment in the probability calculations to reflect the reduced likelihood of a significant fire event and the enhanced level of built-in fire protection in those occupancies.

Tables 25 and 26 summarize the fire-protection system classifications and associated risk-reduction values applied within the structure fire probability calculations. These variables were incorporated as mitigation factors and represent the positive influence of fire prevention and life safety systems in reducing community fire risk.

Table 25: Detector Types, Counts, and Percentages, CYs 2021–2025

Detector Type	Count	Detector Type Percentage
Combination of smoke and heat in a single unit	10	0.53%
Heat	17	0.90%
More than one type of detector present	270	14.25%
Other detector type	13	0.69%
Smoke	358	18.90%
Undetermined	325	17.16%
Water flow detection sprinkler	901	47.57%
TOTAL	**1,894**	**100.00%**

Detectors and Sprinkler Data Source: Structures_Sprinklers_Detectors.xlsx

Table 26: Buildings with Detectors — Counts, Percentages, and Risk Score Values, by Station, CYs 2021–2025

Station	Number of Buildings with Detectors or Sprinklers	Station Area Percentage of the Distribution of all Buildings with Detectors or Sprinklers	Buildings within the Station Area	Percentage of Buildings within the Station Area with Detectors or Sprinklers	Risk Score Values
19	314	16.58%	9,394	3.34%	5.2
70	594	31.36%	4,815	12.34%	7.3
84	264	13.94%	5,228	5.05%	3.0
100	119	6.28%	6,791	1.75%	1.3
107	603	31.84%	4,860	12.41%	8.2
ALL	**1,894**	**100.00%**	**31,088**	**6.09%**	**25.0**

Public Education and Community Outreach

The Department provides several classes and events for the public, including:

- Fire station open houses
- Fire safety demonstrations at schools
- Senior outreach events
- Hurricane preparedness sessions
- Urban Areas Security Initiative (UASI)-funded projects
- Smoke detector installation
- Pre-incident fire plans
- CPR classes
- Community Emergency Response Team (CERT) classes
- Stop the Bleed training
- Active shooter training
- Fire drills in city buildings

PARCEL AND PROPERTY VALUES

Property and parcel valuation data were provided by the City of Miramar and incorporated into the risk assessment as a consequence variable. Property improvement values represent the assessed value of structures and other built improvements located on a parcel and serve as an indicator of the potential economic loss associated with an emergency incident. These values were incorporated into the consequence calculations because areas containing high-value structures can experience greater economic impacts when affected by fire, natural disasters, HazMat incidents, and other emergency events. Although property value alone does not determine overall risk, it provides an important measure of the potential financial consequences associated with property damage and community disruption.

For this analysis, property improvement values were spatially assigned to the hexagonal grid system, and the median property improvement value was calculated for each hexbin. The resulting values were then normalized using a percentile-ranking method to establish a standardized scoring system that was applied consistently throughout the risk model.

Table 27 summarizes the distribution of median property improvement values throughout the MFRD service area, including the count of hexbins within each value range, the percentage of total hexbins represented, and the associated risk scores assigned through the percentile-ranking process. Higher percentile rankings correspond to higher median property improvement values and therefore contribute greater weight within the consequence component of the risk assessment.



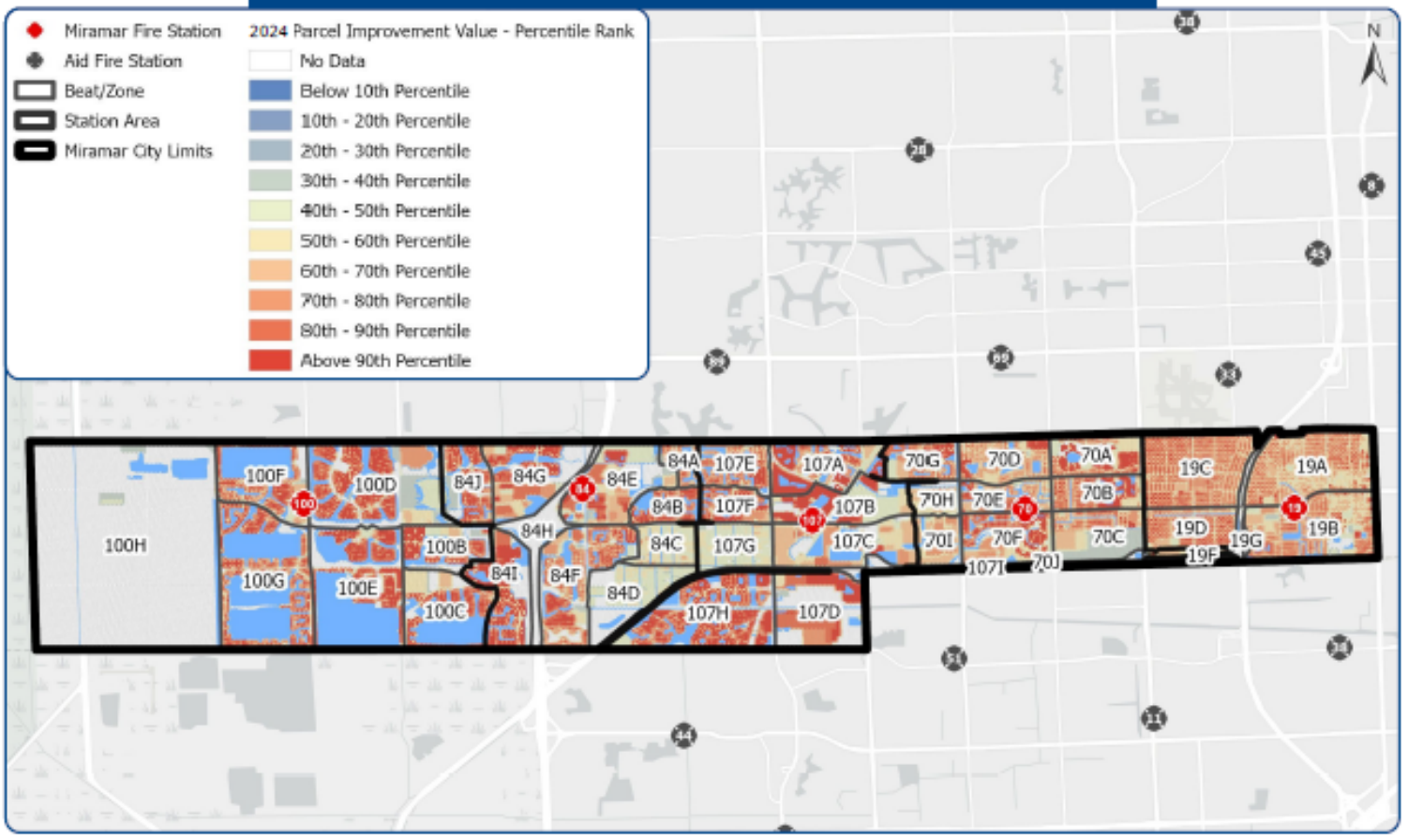
Table 27: Median Property Improvement Values, Counts, Percentages, and Risk Scores, CY 2024

Median Property Improvement Value	Number of Hexbins with Median Property Improvement Value Scores	Percentage of Total Hexbins	Risk Score
< $ 1,000	19,392	37.73%	1
$1,001 – $50,000	2,914	5.67%	2
$50,001 – $150,000	2,485	4.84%	3
$150,001 – $300,000	2,983	5.80%	4
$300,001 – $500,000	4,283	8.33%	5
$500,001 – $750,000	5,973	11.62%	6
$750,001 – $1,000,000	5,401	10.52%	7
$1,000,001 – $1,200,000	3,041	5.92%	8
$1,200,001 – $1,500,000	2,627	5.11%	9
> $1,500,001	2,291	4.46%	10
TOTAL		**100%**	

Median Parcel Improvement Value

Figure 52 illustrates the median parcel improvement value by parcel for each hexbin. This value was used as a consequence variable for the structure fire risk calculations.

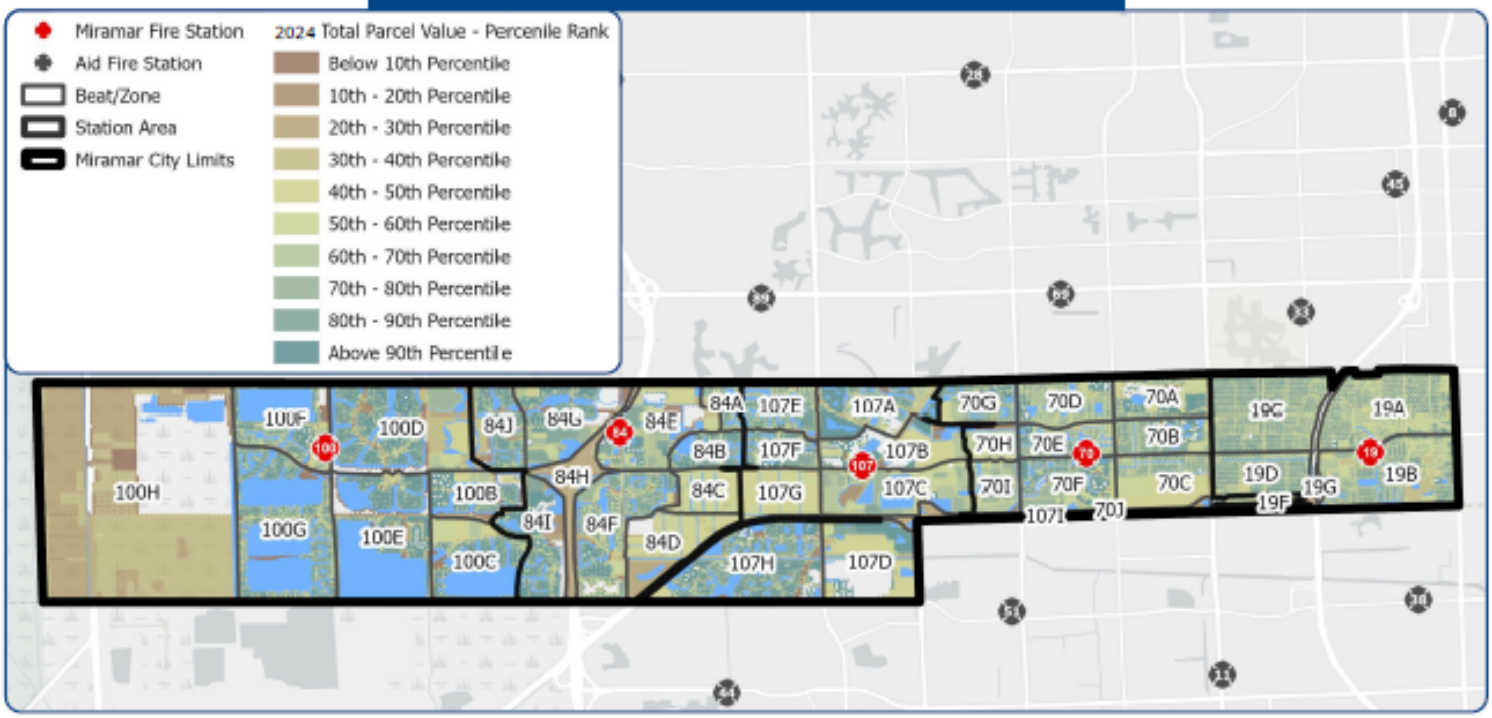
Figure 52: Median Parcel Improvement Value – Percentile Rank, CY 2024



Total Parcel Value

Figure 53 illustrates the total parcel value by percentile rank for each hexbin. This value was used as a consequence variable for the structure fire risk calculations.

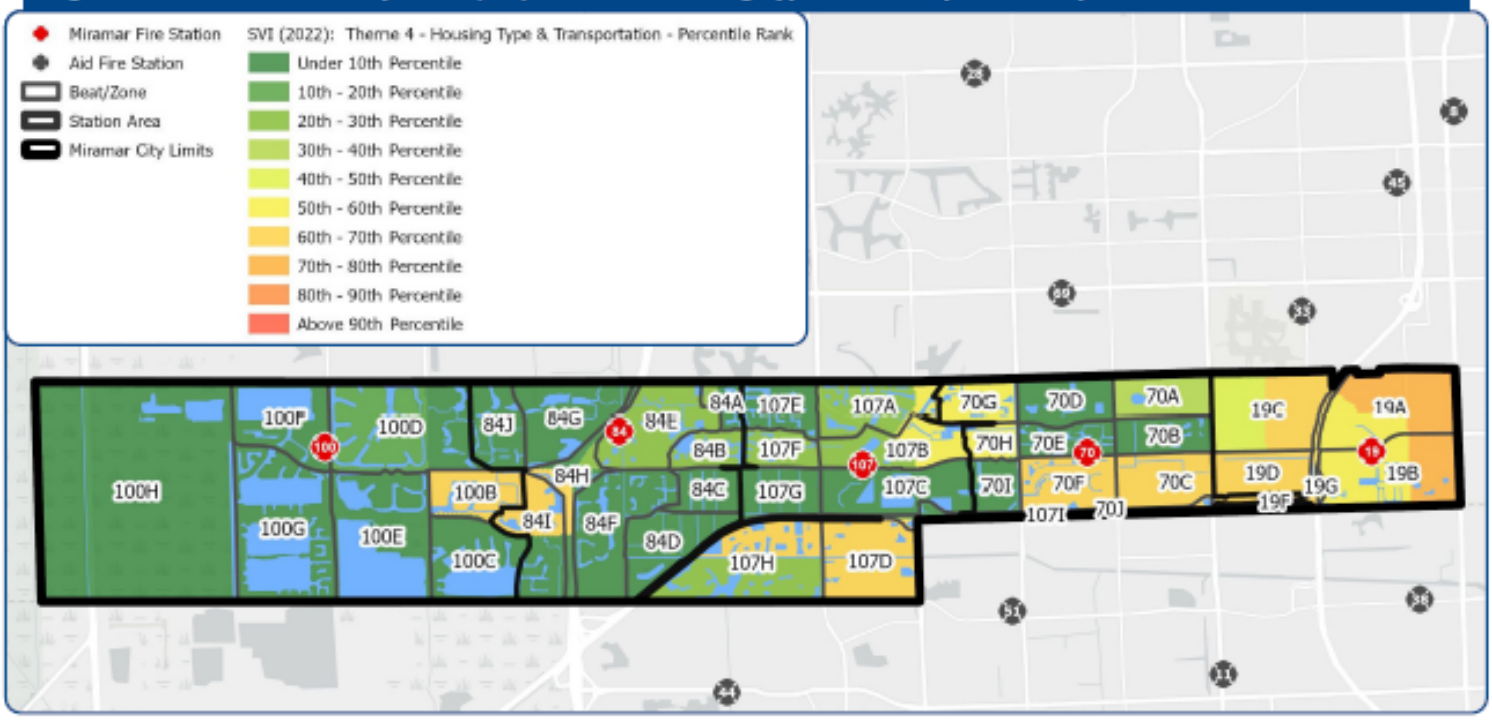
Figure 53: Total Parcel Value – Percentile Rank, CY 2024



SVI THEME 4: HOUSING TYPE AND TRANSPORTATION

Figure 54 applies data from the CDC's SVI Theme 4: Housing Type and Transportation, percentile ranked for MFRD's service area. The SVI Theme 4 housing types include multi-unit structures, mobile homes, crowding, no vehicle, and group quarters.

Figure 54: Social Vulnerability Index (SVI) Theme 4: Housing Type and Transportation, by Hexbin, Percentile Rank, 2022



Impact Variables

Impact variables assess the effects an emergency incident could have on MFRD's ability to maintain emergency response capabilities throughout the community. Unlike probability variables, which estimate the likelihood of an incident occurring, or consequence variables, which measure the severity of an event, impact variables evaluate how an incident could affect the Department's operational capacity and ability to respond to concurrent emergencies.

The impact component of the risk assessment considers factors that influence resource availability, response effectiveness, and system workload. For the MFRD analysis, key impact variables included travel times from stations, water supply (hydrant proximity), unit commitment times, and deployment capability. These factors help quantify the operational challenges associated with mitigating emergencies and maintaining adequate service levels across the jurisdiction.

An underlying premise of the impact analysis is that, when travel distances from fire stations increase, response resources become more heavily committed, and specialized resources are required, the Department's ability to provide timely service to the remainder of the community can be reduced. Consequently, areas that require greater response effort or longer resource commitments receive higher impact scores within the risk model.

Several methodologies exist for quantifying organizational impact. Common approaches include evaluating historical resource drawdown, unit availability, deployment performance, commitment times, specialty resource availability, and workforce impacts such as injuries and personnel availability. Available data were evaluated to identify variables that could be consistently measured and geographically applied throughout the MFRD service area. The impact variables in this assessment primarily focus on resource availability, travel performance, deployment effectiveness, and operational capacity. These measures provide a quantitative representation of the effect an incident can have on the Department's ability to maintain service levels throughout the community.

Following a review of the available operational data, unit commitment time and deployment utilization were identified as the most appropriate measures of organizational impact for the MFRD risk assessment. These variables directly reflect the demand placed on Department resources and the potential effect emergency incidents can have on the agency's ability to maintain response capabilities throughout the community.

TRAVEL TIME FROM FIRE STATIONS

The proximity of fire stations and the availability of response resources were incorporated into the impact assessment as measures of emergency response capability. Travel time is a critical factor because it affects incident outcomes, resource availability, and the Department's ability to provide effective emergency response throughout the service area.

To evaluate travel times, GIS modeling and network analysis were performed using ArcGIS Pro Network Analyst to estimate travel times from fire stations to locations throughout the jurisdiction. Travel time variables were incorporated both as an overall measure of station coverage and, where applicable, as specialized resource variables for hazards that require specific apparatus or personnel capabilities.

Travel time scores were assigned to individual hexbins based on their relative proximity to responding resources. Areas that require longer travel times received higher impact scores because emergency incidents occurring in these locations could experience delayed intervention and extended resource commitments, reducing the Department's system capacity to respond to additional emergencies.

Figure 55 illustrates the average historical travel time from MFRD fire stations to incidents, based on emergency response data between CYs 2021 and 2025. These data represent actual travel performance across the service area and were incorporated as an impact variable in all risk category calculations. **Figure 56** shows travel time from fire

stations when fire units are responding from their assigned fire stations during the study period.

Historical travel time data were used because they reflect real-world roadway conditions, traffic patterns, development characteristics, and operational response practices within the community. Areas with longer average travel times received higher impact scores in the risk model, reflecting the increased operational challenges of providing emergency response in those locations.

By incorporating travel time into the impact calculations, the assessment recognizes the fact that incidents occurring farther from available resources can require additional response effort and can have a greater effect on overall system performance and community risk.

Figure 55: Historic Travel Time from Fire Stations to Incidents, CYs 2021–2025

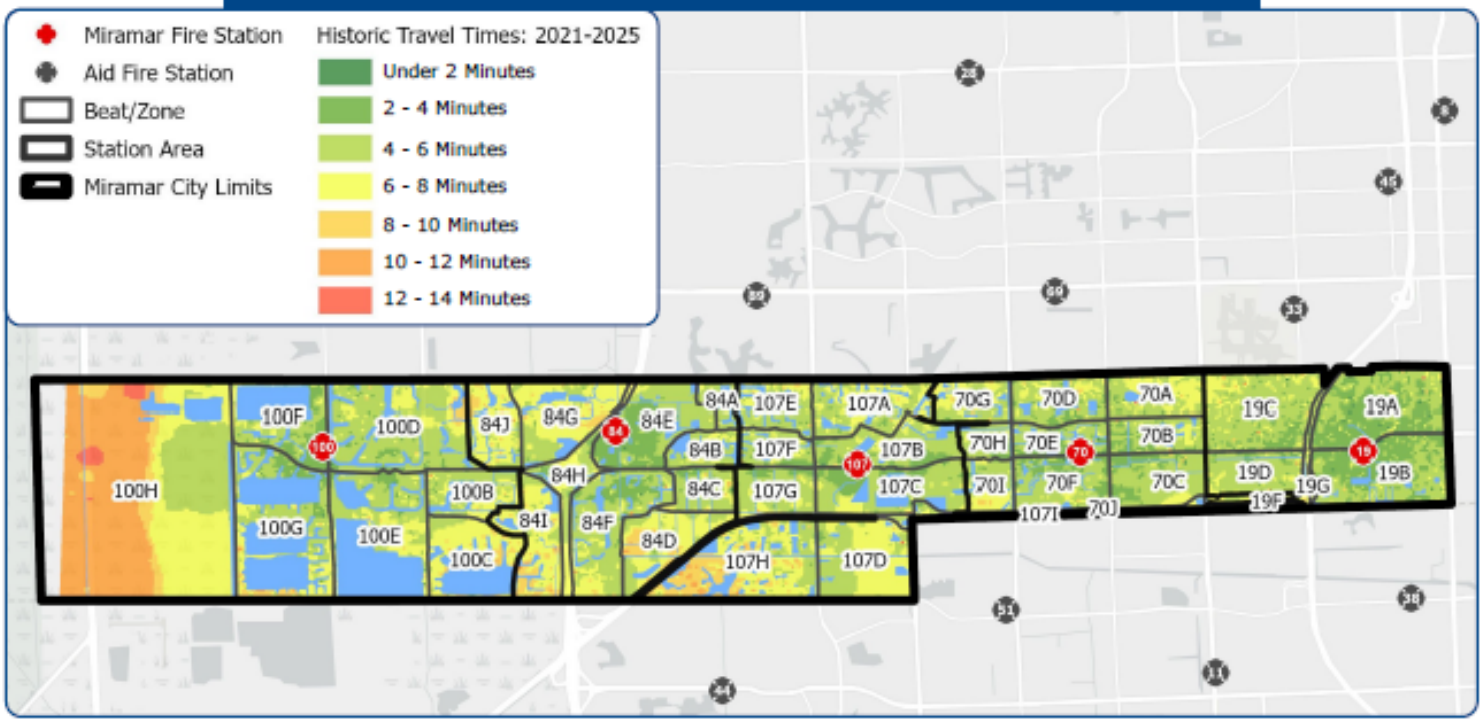
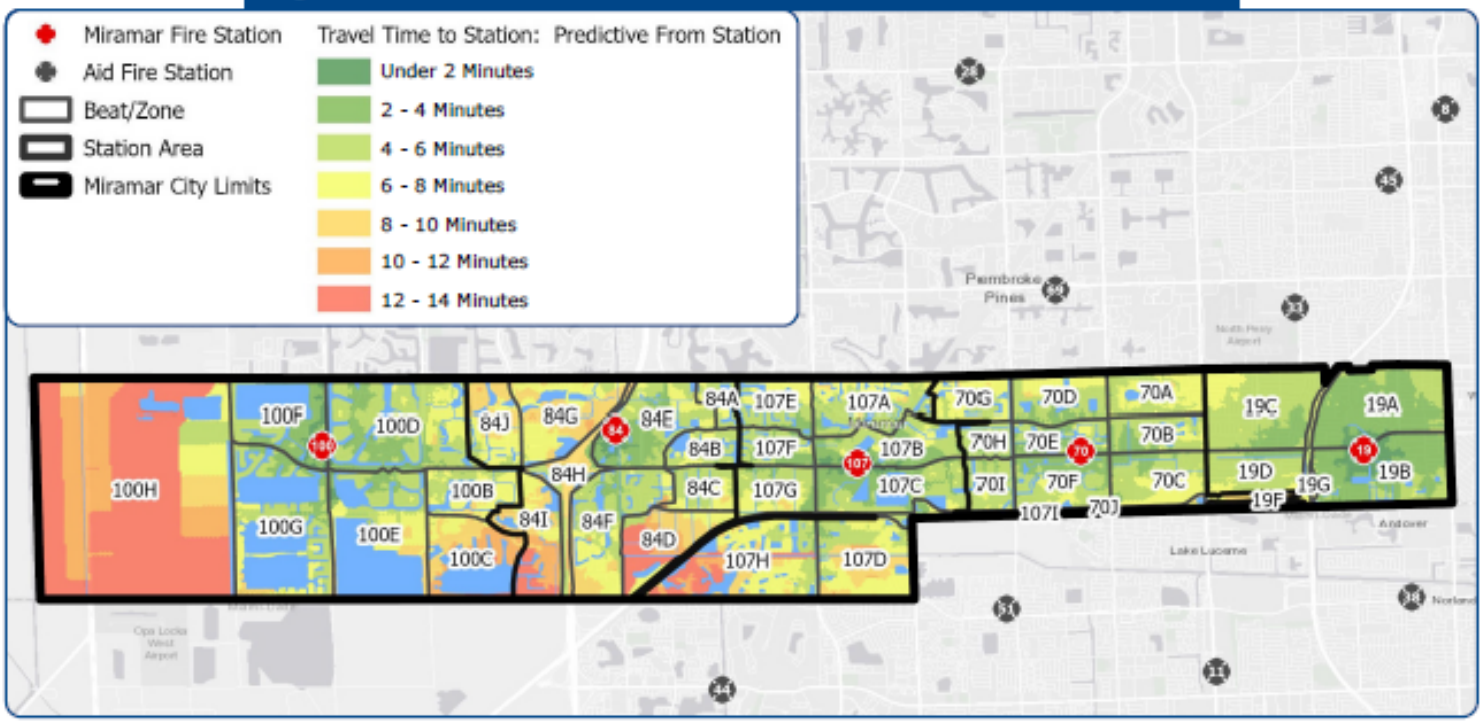


Figure 56: Travel Time from Fire Stations When in Quarters, CYs 2021–2025



WATER SUPPLY (HYDRANT PROXIMITY)

Water supply availability was used in the risk assessment as an operational impact variable in the calculations of structure, non-structure, and wildland fire risk. The proximity of a hydrant can significantly affect fire suppression operations by improving water access, reducing deployment complexity, and enhancing overall firefighting effectiveness.

Analysis of the MFRD service area determined that approximately 89.58% of all land-based hexbins are located within the coverage area of an available fire hydrant. To evaluate hydrant accessibility, geographic buffers were established around each hydrant, using distances representative of the standard fire hose deployment capabilities carried on frontline apparatus.

Hydrant coverage was evaluated using three distance thresholds:

- Within 250 feet of a hydrant
- Between 250 and 500 feet from a hydrant
- Greater than 500 feet from a hydrant

These distances were used to assign impact scores within the risk model. Areas closer to a hydrant were assigned lower impact scores due to improved water availability during fire suppression operations. Areas farther from a hydrant received higher impact scores due to increased operational challenges in establishing and maintaining an adequate water supply.

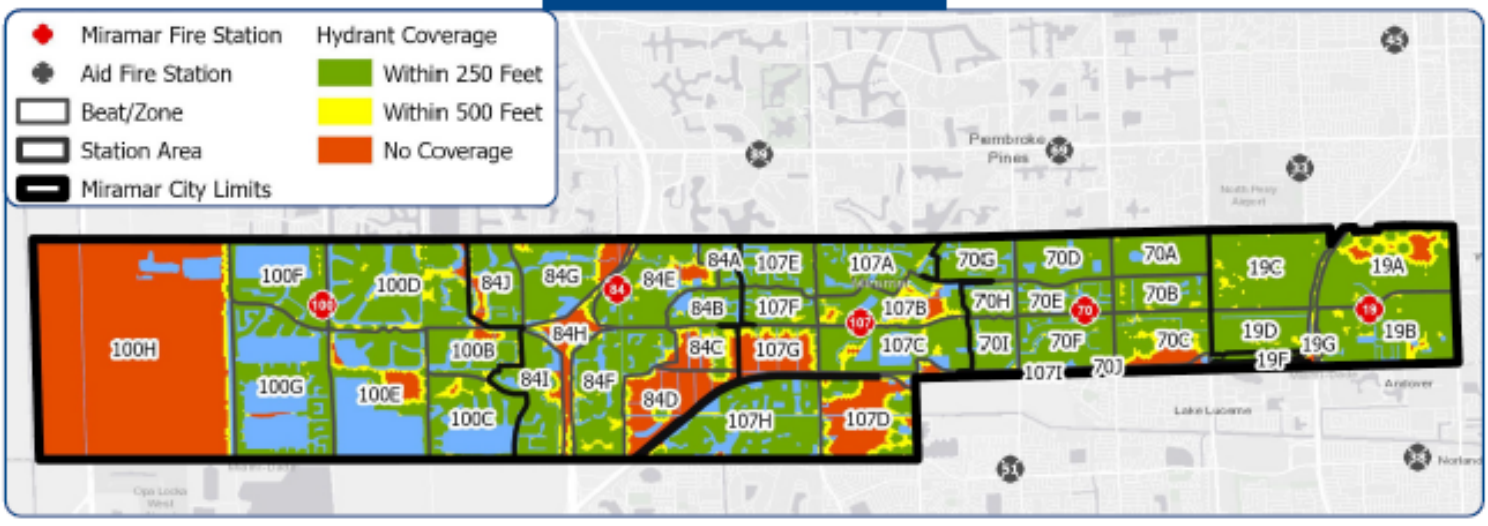
The following scoring methodology was applied:

Distance from Hydrant	Impact Score
Within 250 feet	0
Greater than 250 feet and within 500 feet	5
Greater than 500 feet	10

Figure 57 illustrates hydrant coverage throughout the MFRD service area and identifies areas where increased distances to available water supply could affect fire suppression operations. These scores were incorporated into the applicable fire-related risk calculations to reflect the operational impact of water supply accessibility.

Although hydrant availability does not directly affect the probability of a fire, it can significantly impact incident mitigation capabilities, resource requirements, and overall operational effectiveness during fire suppression. As a result, hydrant proximity is an important impact variable in fire risk assessments.

Figure 57: Hydrant Coverage



COMMITMENT TIME SCORE

Commitment time represents the total time that units are unavailable for additional emergency responses while assigned to an incident. As commitment times increase, the availability of emergency resources decreases, potentially reducing the Department's capacity to respond to concurrent incidents and increasing organizational risk.

To evaluate commitment time, historical incident data were analyzed by NFIRS incident type, and the total time units committed to emergency incidents within each station response area were calculated. Commitment time data were evaluated for the five-year study period from CYs 2021 through 2025 and summarized by station area (**Table 120** in Appendix).

Station areas with higher cumulative commitment times were considered to have a greater organizational impact, because resources assigned to those areas are unavailable for longer periods, increasing the likelihood of resource drawdown and reducing system-wide response capacity. To incorporate this variable into the risk model, station areas were ranked by total commitment time and assigned a normalized score from 0 to 10.

Under this methodology:

- A score of 10 represents the station area with the highest cumulative commitment time and, therefore, the greatest organizational impact.
- A score of 0 represents the station area with the lowest cumulative commitment time and the least organizational impact.

These scores were incorporated into the impact calculations to account for variations in workload and resource availability across the jurisdiction.

DEPLOYMENT TIME SCORE

In addition to commitment time, deployment utilization was evaluated as a measure of organizational impact. Deployment utilization reflects the frequency with which personnel and apparatus are required to respond to emergencies, which provides insight into the relative demand placed on individual station response areas.

Deployment characteristics were reviewed as part of the MFRD standard of cover analysis and incorporated into the risk assessment using a rank-scoring methodology based on historical response activity. Deployment scores were determined by analyzing incident volume by NFIRS incident type and station response patterns using historical deployment data (**Table 121** in Appendix).

Station areas with higher incident activity and apparatus utilization were assigned higher deployment impact scores, because increased response demand can affect resource availability, response reliability, and operational flexibility. Conversely, station areas with lower utilization rates received lower impact scores.

Deployment scores were normalized on a scale from 1 to 10, where:

- A score of 10 represents the station area with the highest operational demand and greatest impact on organizational resources.
- A score of 1 represents the station area with the lowest operational demand and least impact on organizational resources.

Together, commitment time and deployment utilization provide a quantitative measure of organizational impact by evaluating both resource workload and operational demand. Incorporating these variables into the risk model helps identify areas where emergency incidents place the greatest strain on Department resources, which supports data-driven decisions regarding deployment, staffing, resource allocation, and future service delivery planning.

NRI COMMUNITY RESILIENCE SCORE

Recall that FEMA defines community resilience as the ability of a community to prepare for anticipated hazards, adapt to changing conditions, withstand disruptions, and recover from emergency events in a timely and effective manner. Community resilience reflects the collective capacity of residents, institutions, infrastructure systems, and community organizations to respond to and recover from adverse events.

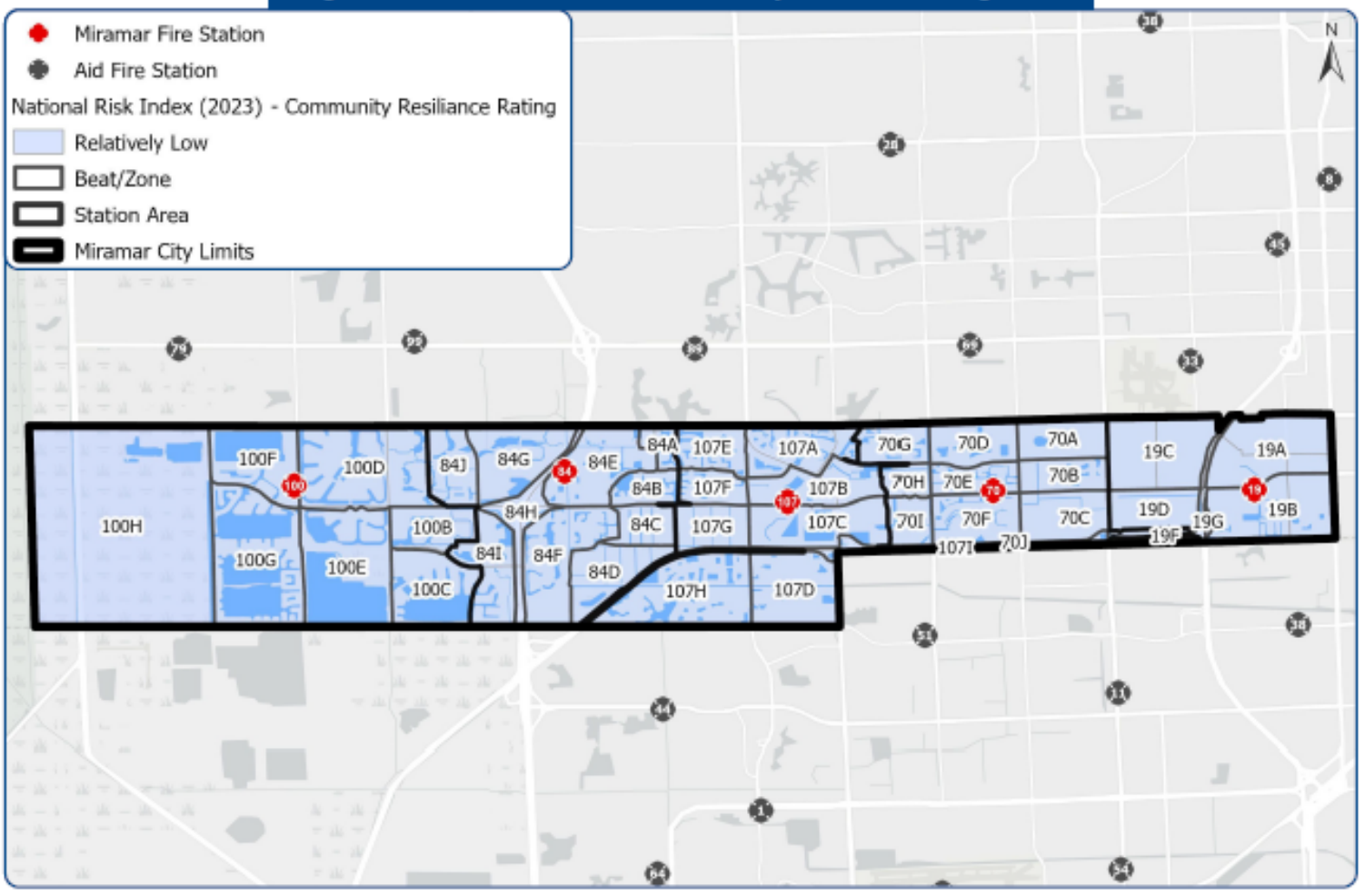
As part of the NRI, FEMA calculates a community resilience rating that measures a community's relative resilience compared with similar jurisdictions across the United States. The score incorporates a variety of social, economic, infrastructure, and community capacity indicators that affect a community's ability to recover from disasters and other significant disruptions.

For the MFRD risk assessment, the community resilience rating was incorporated as a risk-reduction factor within the consequence component of the risk model. Areas with higher resilience scores received lower consequence values, because communities with greater resilience generally have a stronger ability to withstand and recover from emergencies. Conversely, areas with lower resilience scores received higher consequence values, because emergency incidents in these locations can result in greater long-term impacts on residents, infrastructure, and community functions.

The inclusion of community resilience within the consequence calculations recognizes that the severity of an incident is influenced not only by the hazard itself, but also by the community's capacity to respond, adapt, and recover from the event. As a result, resilience is an important mitigating factor in the overall risk assessment methodology.

Figure 58 illustrates the distribution of NRI community resilience rating throughout the MFRD service area.

Figure 58: National Risk Index: Community Resilience Rating, 2023



EMERGING AND FUTURE COMMUNITY RISKS

MFRD recognizes that community risk is dynamic and influenced by changing demographic, environmental, economic, and development conditions. Although this assessment primarily utilizes historical data from CYs 2021–2025, future risks were also considered. Factors likely to influence future service demand include population growth, continued commercial development, increasing healthcare and senior-service demands, changing weather patterns, evolving transportation systems, and regional hazard trends. These factors should be reevaluated during future CRA updates to ensure that deployment strategies, community risk-reduction programs, and resource allocation decisions remain aligned with community needs.

The City of Miramar continues to experience gradual population growth, increasing from approximately 137,000 residents in 2020 to more than 142,000 residents in 2025. Although this growth rate has remained relatively modest, continued residential and commercial development will likely increase the demand for emergency services over time. Additional population growth increases the likelihood of emergencies and the number of residents, businesses, and community assets that could be affected by them.

Demographic trends also suggest that the community's healthcare and EMS needs will continue to evolve. Like many communities throughout Florida, Miramar is experiencing growth in its older adult population. As residents age, their demand for EMS, chronic disease interventions, fall-related responses, community paramedicine initiatives, and other healthcare-related services can increase. Given that EMS incidents already account for the majority of MFRD's annual service demand, future increases in medical responses would likely place additional workload pressures on personnel, apparatus, and transport resources.

Continued commercial and mixed-use development can also alter community risk profiles. New commercial occupancies, multi-family residential developments, healthcare facilities, educational institutions, and assembly occupancies can increase both the probability and consequences of emergency incidents. As development patterns change, periodic reevaluation of occupancy risks, critical infrastructure, and service-demand concentrations will be necessary to ensure that deployment strategies remain aligned with community needs.

Environmental and climate-related hazards will likely remain a significant consideration for the Miramar community. Located within South Florida, the city remains susceptible to hurricanes, severe storms, flooding, lightning, strong winds, and other weather-related events. Future changes in weather patterns, sea-level conditions, rainfall intensity, and storm frequency can influence both emergency response demand and community vulnerability. These hazards have the potential to affect critical infrastructure, transportation systems, utility networks, and emergency response operations throughout the community.

Transportation systems and community mobility patterns can also influence future risk. Changes in traffic volumes, roadway development, public transportation usage, and commercial transportation activities can affect incident occurrence, emergency response times, evacuation planning, and overall service demand. Continued monitoring of transportation-related risks will help MFRD identify emerging operational challenges and opportunities.

Changes in technology and the built environment could also introduce risks that are not fully represented by historical incident data. Continued adoption of electric vehicles, lithium-ion battery-powered equipment, photovoltaic systems, battery energy storage systems, and other alternative-energy technologies can change fire behavior, increase extinguishment and overhaul requirements, create reignition concerns, and require specialized responder training and equipment. MFRD should monitor the location and scale of these technologies through the development review, inspection, pre-incident planning, and incident reporting processes.

Continued commercial and industrial development could increase the number of large-footprint buildings, warehouse and distribution facilities, data-intensive occupancies, and properties with complex fire protection or hazardous materials systems. These occupancies can present extended travel distances within structures, large fire-flow demands, complex evacuation conditions, high property values, and substantial economic consequences. Future CRA updates should

evaluate whether new development materially changes the location or concentration of structure fire, hazardous materials, technical rescue, or critical infrastructure risk.

Healthcare-system conditions could also affect future emergency medical demand. Population aging, chronic health conditions, behavioral health emergencies, substance-use incidents, limited access to primary care, and hospital emergency department congestion can increase the number and duration of EMS responses. Extended patient transfer times at receiving facilities can reduce rescue unit availability even when incident frequency remains relatively stable. Future evaluations should therefore consider emergency medical demand together with transport rates, receiving-facility destinations, hospital turnaround time, recurring system users, and rescue unit utilization.

The Department should also monitor technology-related threats that can affect emergency communications and municipal continuity. Cybersecurity incidents, CAD interruptions, public-safety radio failures, telecommunications outages, and disruptions affecting utility or healthcare systems could simultaneously increase community demand and reduce normal response capabilities. These conditions should be considered through continuity planning, emergency management exercises, communications-system evaluations, and future updates to the natural and human-made disaster risk assessment.

Climate-related conditions could alter the frequency, duration, or consequences of hurricanes, extreme heat, flooding, drought, severe storms, and vegetation fires. Changes in rainfall intensity, drainage capacity, sea-level conditions, heat exposure, and storm-related utility failures can also affect access, responder safety, infrastructure reliability, and community recovery. MFRD should continue coordinating CRA updates with the City’s emergency management, planning, public works, utilities, and resilience activities to ensure that changing environmental conditions are reflected in future risk and service-delivery decisions.

Community vulnerability factors should also be monitored as economic, social, and housing conditions evolve. Changes in socioeconomic conditions, housing affordability, healthcare access, population density, and other social vulnerability indicators can affect a community's ability to prepare for, respond to, and recover from emergencies. Ongoing evaluation of these factors supports the Department's community risk-reduction efforts and helps identify areas where prevention, preparedness, and public education initiatives would be most beneficial.

The findings of this CRA establish a baseline for understanding current community risk and provide a framework for evaluating future changes. MFRD should periodically review demographic trends, development patterns, hazard data, service demand indicators, critical infrastructure inventories, and operational performance measures to ensure that future deployment strategies, community risk-reduction programs, staffing models, capital improvement plans, and resource allocation decisions remain aligned with the community's evolving needs.

By incorporating both historical performance data and emerging risk considerations, MFRD can maintain a proactive approach to community risk management and better position the Department to address future challenges, while continuing to provide effective and efficient emergency services to the residents and visitors of the City of Miramar.

SECTION 2

PART III

Quantitative Risk

Introduction

While the preceding sections identify the physical, demographic, socioeconomic, and historical characteristics of the community, they do not independently identify where community risk is greatest. The purpose of the quantitative community risk assessment is to integrate each variable into a standardized methodology that objectively evaluates relative risk throughout the jurisdiction.

The methodology developed for this assessment combines probability, consequence, and community impact into a single composite risk score for each hexagonal analysis cell. The resulting risk values allow comparison of all areas of the jurisdiction using a consistent analytical framework while minimizing subjective interpretation.

The quantitative assessment serves as the foundation for deployment analysis, critical task development, and future community risk reduction initiatives. Because all seven emergency service disciplines utilize the same underlying methodology, the resulting risk scores provide a common framework for evaluating both current service delivery and future community needs.

The following narratives and accompanying tables explain how the variables for each risk type were used to calculate probability, consequence, and impact scores. For each of the seven risk types, a brief description of the variables and the specific formulas used is provided.

Using the variables applied to the hexagonal grid, percentile-rank tables were developed to distribute each variable across the risk analysis area. These percentile-rank and normalized values were then used to calculate the probability, consequence, and impact scores for each hexbin.

Once the individual scores were calculated, the CPSE three-axis methodology formula was applied to produce a total risk score. Recall that the formula measures the surface area of the triangle formed by the three variables (probability, consequence, and impact) each measured relative to all hexbins within MFRD's service area. The absolute value of the score is less important than the relative comparison between hexbins.

The graphs within each risk category section illustrate the type of data collected and used in the analysis. Accordingly, risk scores should be interpreted only within the individual hazard category in which they were calculated and should not be compared directly with different hazard categories.



STEP-BY-STEP EXAMPLE: EMS RISK ASSESSMENT

This section shows how each risk area was calculated using the hexbin methodology and the EMS risk assessment as an example.

1. First, each hexbin's risk value was calculated using the risk matrix formula for probability, consequence, and impact. An example calculation for a single hexbin is shown below:

Probability Score

Probability = EMS Incidents + SVI Theme 2 + Population Density + Land Use Category + Persistent Incidents

43.4

Hexbin ID	Historical EMS Incidents	SVI Theme 2	Population Density	Land Use	Persistent Incidents
XE-72	9.8	8.8	8.5	8.3	8
	Ranked 98% in the number of EMS Incidents	SVI Theme 2 score from NRI	Ranked 84% in the most densely populated hexbins	Score based on URBAN land use score	This grid square had at least one incident in four of five consecutive years

Consequence Score

Consequence = SVI Theme 1 + SVI Theme 4 + Distance to Hospital

23.0

Hexbin ID	SVI Theme 1	SVI Theme 4	Distance To Hospital
XE-72	9.2	7.7	6.1
	SVI Theme 1 score from CDC SVI Theme 1	SVI Theme 4 score from CDC SVI Theme 4	Ranked 61% in the farthest hexbin from a hospital.

Impact Score

Impact = Deployment Score + Commitment Score + Travel Time

14.0

Hexbin ID	Deployment Score	Commitment Score	Travel Time
XE-72	8.3	3.3	2.4
	Deployment score for Station 19 EMS	Commitment score for Station 19 EMS	Ranked 24% in distance from Station 19

Total Risk Score

857.1

2. After each hexbin is assigned a risk score, the resulting hexbin scores are compiled and analyzed to determine the distribution of risk across the service area and within each planning zone **(Figure 59).**

3. All hexbins within a given planning zone are averaged to produce a zone score, which is used to determine that planning zone's relative risk.

4. The overall risk category assigned to a planning zone is based on how its average hexbin score compares with the distribution of all hexbin scores across the response area. The figure below shows how each planning zone was assigned an overall risk category, and why a given category might not appear in every planning zone for every risk measure:

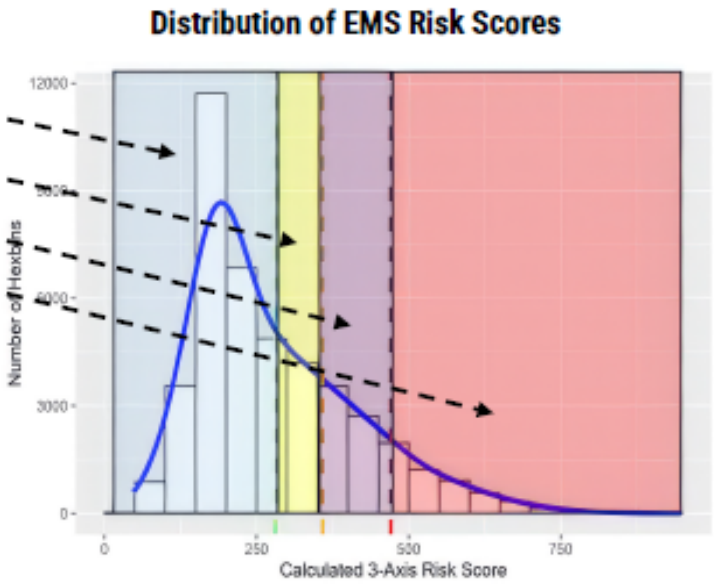
Figure 59: Risk Assessment Methodology Example

All Hexbin Scoring

Risk Grouping	Description	Score Range
Low	Less than average	47.6 – 280.1
Moderate	Average to 75th percentile	280.1 – 358.8
High	75th to 90th percentile	358.8 – 470.6
Maximum	Over 90th percentile	470.6 – 947.7

Planning Zone Average Hexbin Scoring

Station Number	Planning Zone	3-Axis Score Min	3-Axis Score Max	3-Axis Score Average	Overall Score
100	100B	112.7	582.4	308.1	Moderate
100	100C	123.4	542.2	245.5	Low
19	19A	171.8	814.7	481.9	Maximum
19	19C	214.8	653.7	434.5	High



RANK SCORE AND SCORE DEFINITIONS

Many of the variables in this section use the PERCENTRANK statistical function, referred to throughout as the "rank score." This function was chosen because it allows values measured with different scales or units to be compared on a common, standardized basis, which is useful for identifying relative risk, priority, and significance across categories.

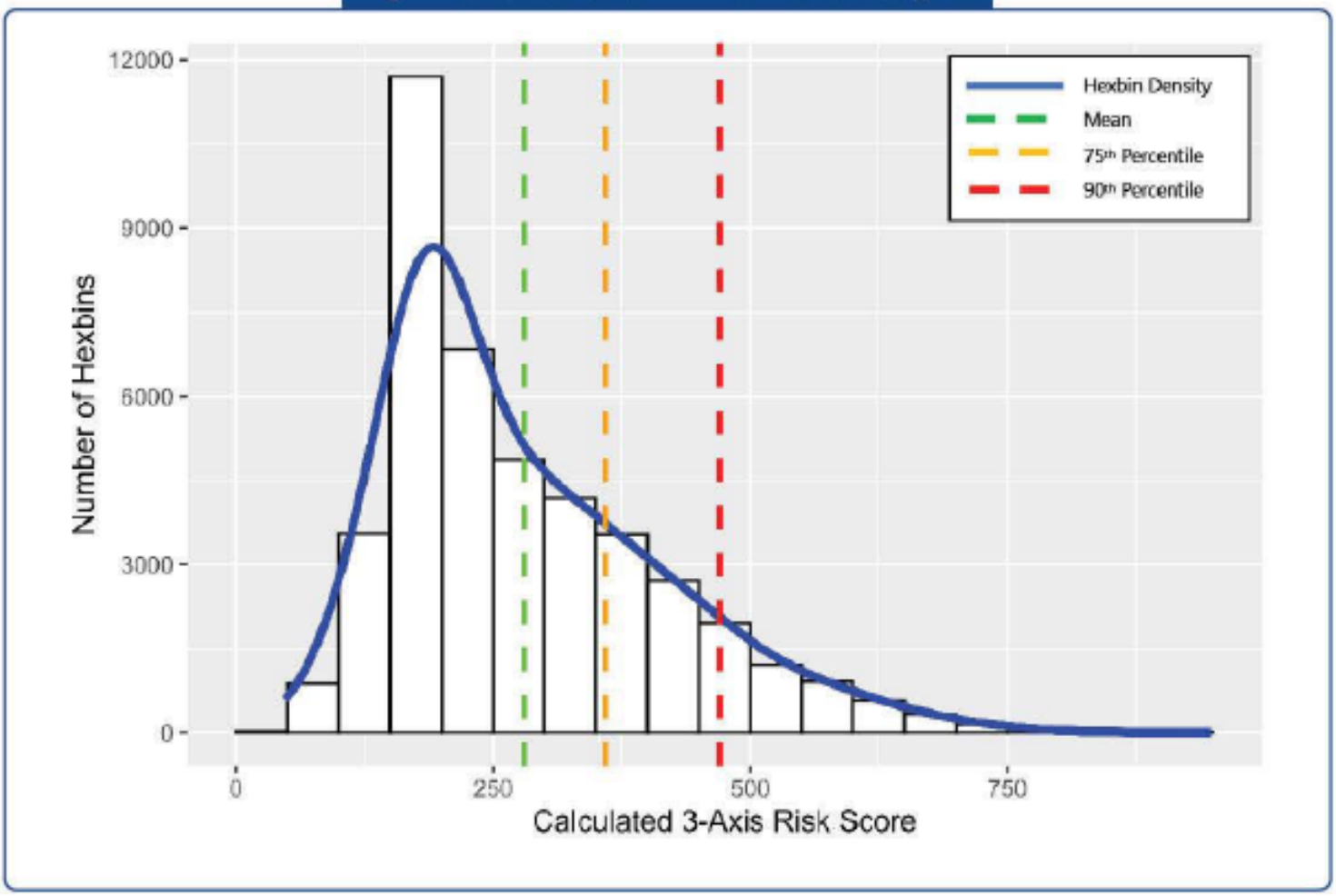
All other variables are referred to simply as the "score." Regardless of risk type, every variable was scaled to a value between 0 and 10 to prevent any single characteristic from being overweighted.

INTERPRETING THE RISK DISTRIBUTION HISTOGRAM

Figure 60 shows the relative count of hexbins (y-axis) at each calculated 3-axis risk score (x-axis), using the EMS risk assessment as an example to illustrate the overall distribution of EMS risk across MFRD's service area. Bar height reflects the number of hexbins with a similar risk score. Four reference lines aid interpretation:

- The **Hexbin Density** line (blue) shows the relative density of hexbins, indicating whether risk is concentrated in specific areas or spread evenly across the service area. This data helps determine whether a targeted or general risk-reduction approach is needed.
- The **Mean** (green), **75th Percentile** (yellow), and **90th Percentile** (red) lines mark key points in the distribution that are used to establish the low, moderate, high, or maximum risk category thresholds used to summarize station area risk

Figure 60: Distribution of EMS Risk Scores Histogram



Quantitative Risk: Fire Suppression Risk — Structure Fires

Using the analysis of each variable, as described in Part I: Introduction and Methodology, fire suppression risk – structure fires were calculated by applying relevant variables within each hexbin to determine probability, consequence, and impact.

VARIABLES USED IN CALCULATIONS

The tables below summarize which variables from the variable analysis were included in the final structure fire risk calculation. For this analysis, any land categorized as "water" was given a 0 score to more accurately represent the risk of fire in the area. The hexbins within commercial land use had a risk reduction applied due to the presence of automatic fire sprinkler systems.

The following formula was used to calculate the probability of structure fires **(Table 28):**

Probability (Structure Fires) = Structure Fire Historical Incidents + Address Point Density + Population Density + Socioeconomic Status (SVI Theme 1 Score) + Land Use Score (Structure Fire) – Sprinkler and Detector Score

Table 28: Probability of Structure Fires — Variables and Normalization Methods

Variable	Normalization Method
Structure fire incidents: historical (NFIRS Codes 111-123)	Rank score
Address point density	Rank score
Population density	Rank score
Socioeconomic status (SVI Theme 1)	SVI Percent x 10
Land use score (structure fire)	Calculated score
Sprinkler and detector score	Calculated score

The following formula was used to calculate the consequence of structure fires **(Table 29):**

Consequence (Structure Fires) = Presence of Critical Infrastructure (Total) + Median Parcel Improvement Value + Household Characteristics (SVI Theme 2 Score) + Housing and Transportation Characteristics (SVI Theme 4 Score) – Sprinkler and Detector Score

Table 29: Consequence of Structure Fires — Variables and Normalization Methods

Variable	Normalization
Presence of critical infrastructure — total	Rank score
Median parcel improvement value	Rank score
Household characteristics (SVI Theme 2)	SVI percent x 10
Housing and transportation characteristics (SVI Theme 4)	SVI percent x 10
Sprinkler and detector score	Calculated score

The following formula was used to calculate the impact of structure fires **(Table 30):**

Impact (Structure Fires) = Hydrant Distance + Deployment Score + Commitment Score + Travel Time to Station

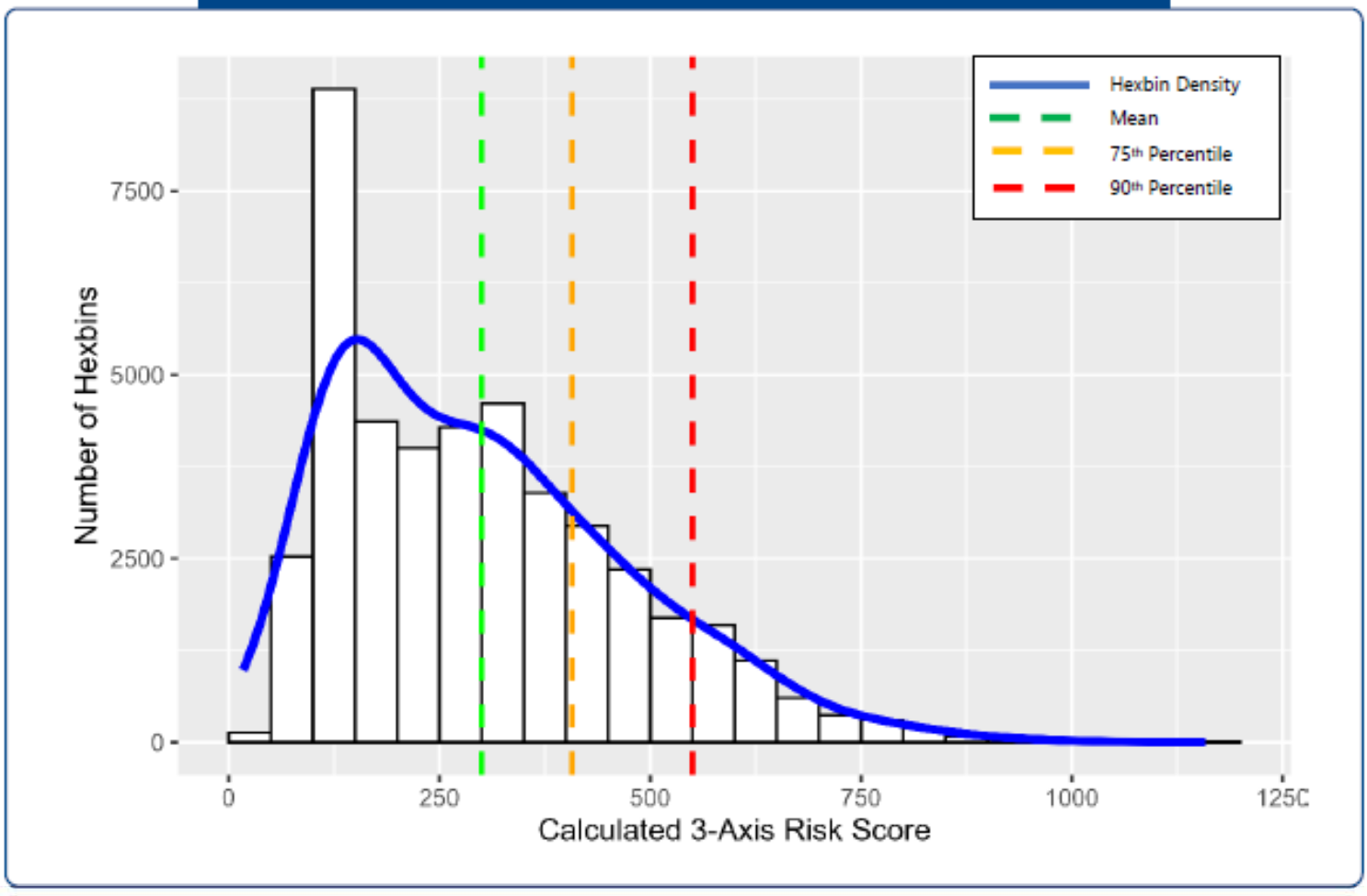
Table 30: Impact of Structure Fires — Variables and Normalization Methods

Variable	Normalization
Distance to a hydrant	Rank score
Deployment time	Calculated score
Commitment time	Calculated score
Travel time to station	Rank score

ANALYSIS: STRUCTURE FIRES

Figure 61 shows the quantified risk scores for structure fires throughout the MFRD service area, considering structure fire risk scoring throughout the hexagonal grid cells, not by station area or city.

Figure 61: Distribution of Structure Fire Risk Scores Histogram, CYs 2021–2025



STATION RESPONSE ZONE SCORES: STRUCTURE FIRES

Once each hexagonal grid was scored, the structure fire risk scores were aggregated at the station level to understand the risks by planning zone. Each grid cell in the planning zones contributed to the overall, minimum, maximum, and average scores, as outlined in **Table 31.** Note: It is important to consider the overall distribution of the scored hexbins from **Figure 61** when reviewing the table.

Table 31: Structure Fires — Three-Axis Risk Score by Station and Planning Area, CYs 2021–2025

Station Number	Planning Zone	Three-Axis Score Min	Three-Axis Score Max	Three-Axis Score Average	Overall Risk Category
100	100B	115.7	625.3	368.6	Moderate
100	100C	88.4	448.5	254.9	Low
100	100D	47.3	532.8	254.9	Low
100	100E	53.0	529.8	265.0	Low
100	100F	56.6	391.1	186.2	Low
100	100G	57.2	592.9	276.3	Low
100	100H	49.0	508.4	131.4	Low
107	107A	92.7	642.3	279.1	Low
107	107B	30.0	528.8	189.4	Low
107	107C	17.1	287.2	107.1	Low
107	107D	71.8	575.7	223.2	Low
107	107E	58.0	506.2	268.0	Low
107	107F	60.6	470.9	268.7	Low
107	107G	41.3	268.7	107.7	Low
107	107H	77.7	673.7	345.7	Moderate
107	107I	55.3	549.3	197.1	Low
19	19A	201.7	1157.7	620.3	Maximum
19	19B	243.5	1158.8	591.9	Maximum
19	19C	360.6	854.1	584.8	Maximum
19	19D	226.5	817.2	534.7	High
19	19F	150.1	847.9	421.0	High
19	19G	250.3	628.8	490.0	High
70	70A	180.9	769.4	449.6	High
70	70B	121.3	611.7	359.4	Moderate
70	70C	63.8	671.7	354.1	Moderate
70	70D	133.1	646.7	351.9	Moderate
70	70E	174.8	474.3	318.7	Moderate
70	70F	185.1	759.1	409.3	High
70	70G	173.9	671.9	346.4	Moderate
70	70H	59.8	395.9	161.4	Low
70	70I	76.4	359.7	156.2	Low
70	70J	142.3	462.6	289.7	Low
84	84A	196.0	550.6	391.4	Moderate
84	84B	144.5	637.4	416.4	High
84	84C	97.0	455.4	244.5	Low
84	84D	70.7	518.4	191.3	Low
84	84E	76.3	541.5	237.4	Low
84	84F	96.4	628.0	353.2	Moderate
84	84G	86.7	749.1	360.5	Moderate
84	84H	99.6	528.1	270.6	Low
84	84I	96.8	858.8	424.1	High
84	84J	68.4	670.8	397.2	Moderate

RISK CATEGORIZATION: STRUCTURE FIRES

Using the distribution of structure fire risk scores throughout the hexbins, the scores by station were categorized into low, moderate, high, and maximum risk, as outlined in **Table 32. Figure 62** represents the overall structure fire risk scores for MFRD, and **Figure 63** shows the structure fire risk score by category.

Table 32: Structure Fire Risk Score Categories

Risk Category	Description	Risk Score Range
Low	Less than average	17.1 – 300.1
Moderate	Average to 75th percentile	300.1 – 470.6
High	75th to 90th percentile	470.6 – 550.3
Maximum	Over 90th percentile	550.3 – 1158.8

Figure 62: Structure Fire Risk Scores, CYs 2021–2025

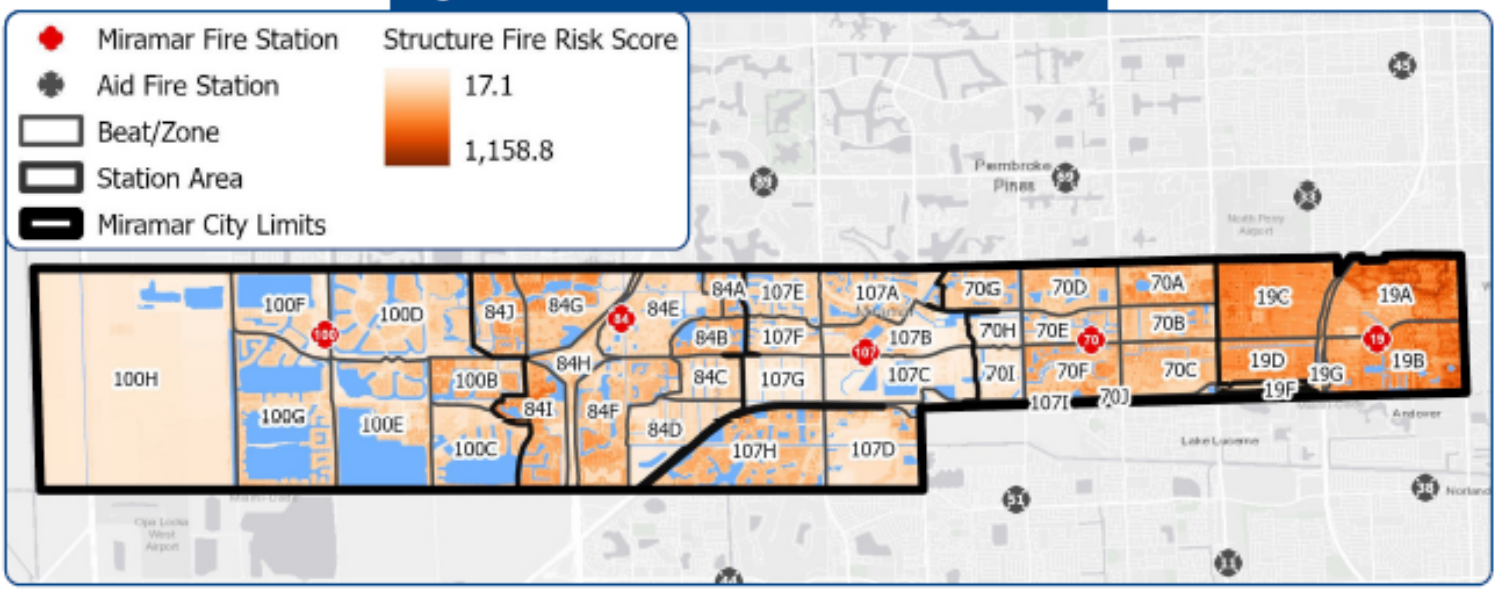
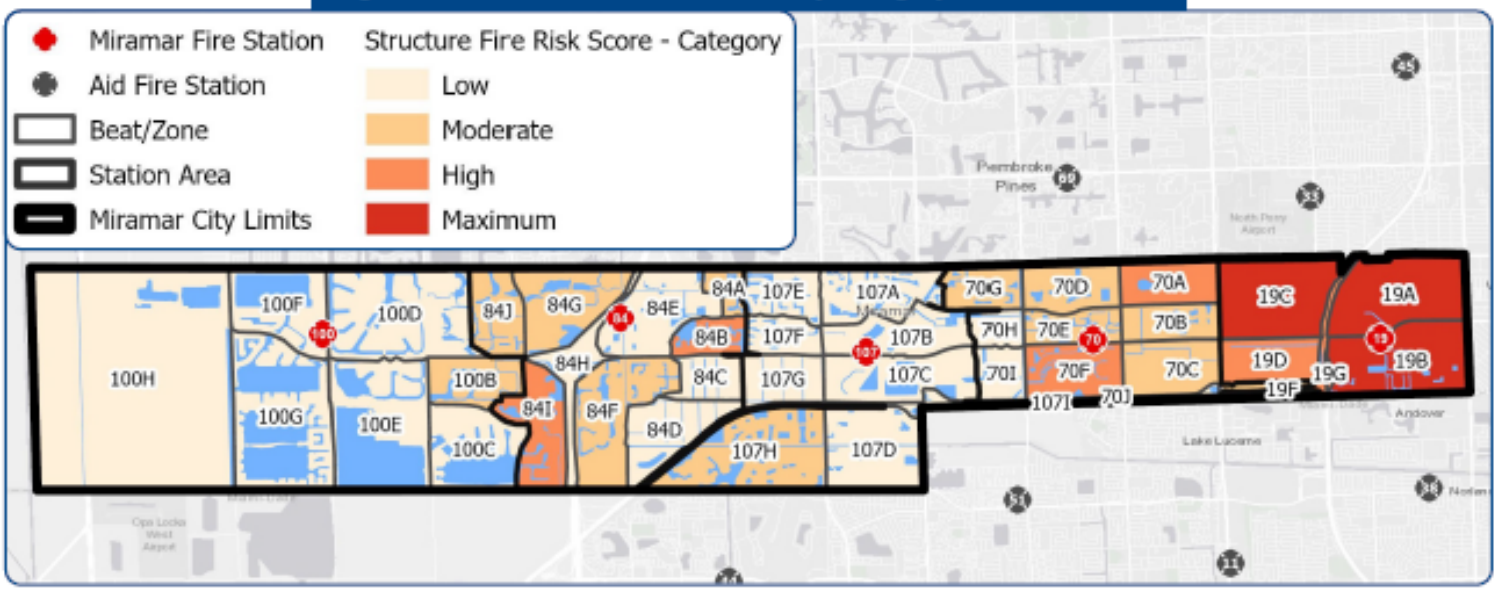


Figure 63: Structure Fire Risk Scores by Category, CYs 2021–2025



Quantitative Risk: Fire Suppression Risk — Non-Structure Fires

Non-structure fires include, for example, vehicle fires, rubbish fires, and outside fires. Using the analysis of each variable, as described in **Part I: Introduction and Methodology**, fire suppression risk—non-structure fires was calculated by applying relevant variables in each hexbin to determine probability, consequence, and impact.

VARIABLES USED IN CALCULATIONS

The tables below summarize which variables were included in the final non-structure fire risk calculations. For this analysis, any land categorized as "water" was given a 0 score to more accurately represent the risk of fire in the area.

The following formula was used to calculate the probability of non-structure fires **(Table 33):**

Probability (Non-Structure Fires) = Non-Structure Fire Historical Incidents + Critical Infrastructure (Transportation) + Land Use Score (Non-Structure Fire)

Table 33: Probability of Non-Structure Fires — Variables and Normalization Methods

Variable	Normalization
Non-structure fire incidents — historical	Rank score
Presence of critical infrastructure — transportation	Rank score
Land use score — non-structure fire	Calculated score

The following formula was used to calculate the consequence of non-structure fires **(Table 34):**

Consequence (Non-Structure Fires) = Total Property Value + Critical Infrastructure (Total) + Population Density

Table 34: Consequence of Non-Structure Fires — Variables and Normalization Methods

Variable	Normalization
Total property value	Rank score
Presence of critical infrastructure — total	Rank score
Population density	Rank score

The following formula was used to calculate the impact of non-structure fires **(Table 35):**

Impact (Non-Structure Fires) = Hydrant Distance + Deployment Score + Commitment Score + Travel Time to Station

Table 35: Impact of Non-Structure Fires — Variables and Normalization Methods

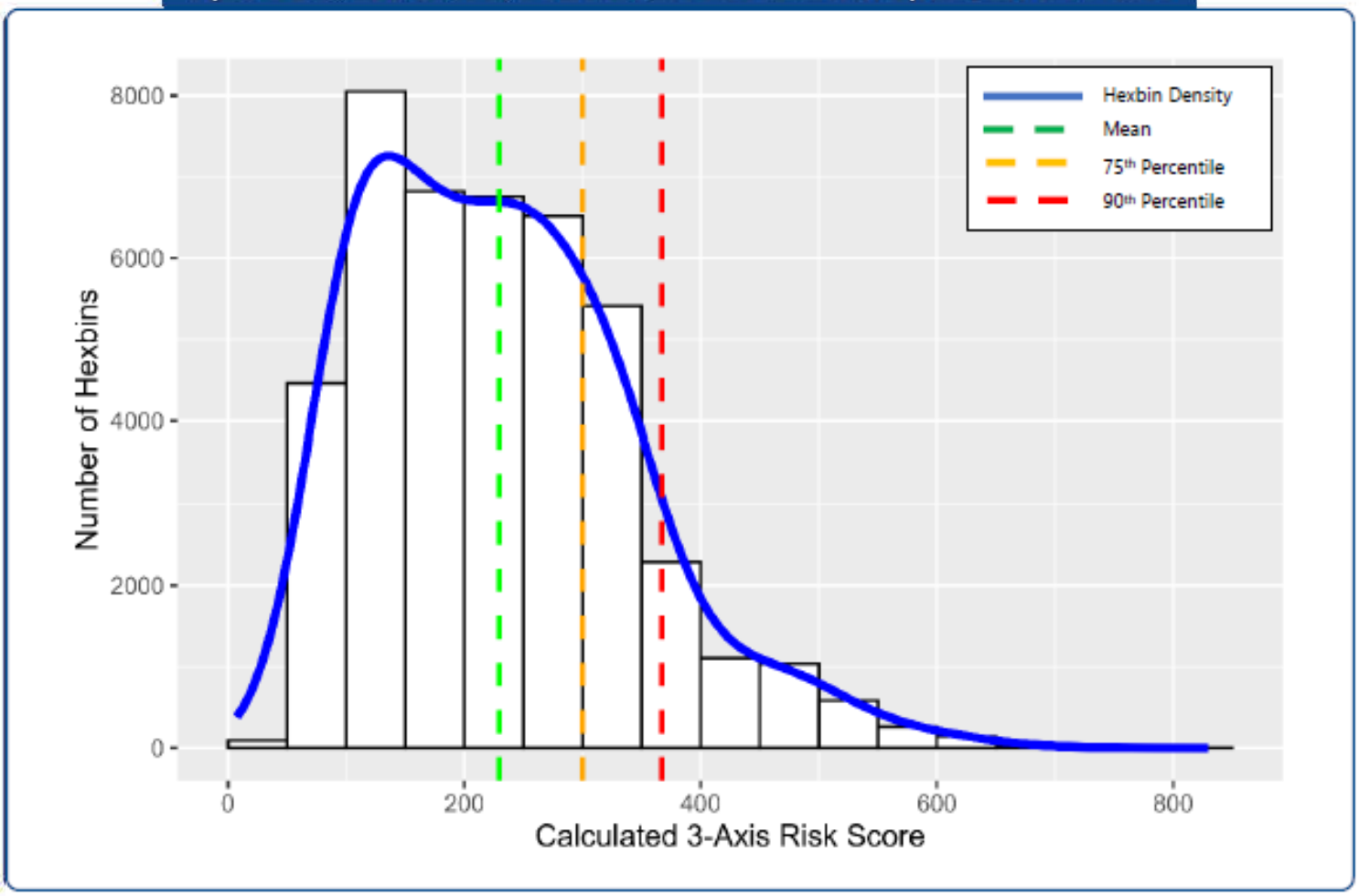
Variable	Normalization
Distance to a hydrant	Rank score
Deployment time	Calculated score
Commitment time	Calculated score
Travel time to station	Rank score



ANALYSIS: NON-STRUCTURE FIRES

Figure 64 shows the quantified risk scores for non-structure fires throughout the MFRD service area, considering non-structure fire risk scoring throughout the hexagonal grid cells, not by station area or city.

Figure 64: Distribution of Non-Structure Fire Risk Scores Histogram , CYs 2021–2025



STATION RESPONSE ZONE SCORES: NON-STRUCTURE FIRES

Once each hexagonal grid was scored, the non-structure fire risk scores were aggregated at the station level to understand the risks by planning zone. Each grid cell in the planning zones contributed to the overall, minimum, maximum, and average scores, as outlined in **Table 36.** Note: It is important to consider the overall distribution of the scored hexbins from **Figure 64** when reviewing the table.

Table 36: Non-Structure Fires — Three-Axis Risk Score by Station and Planning Area, CYs 2021–2025

Station Number	Planning Zone	Three-Axis Score Min	Three-Axis Score Max	Three-Axis Score Average	Overall Risk Category
100	100B	50.9	389.0	197.1	Low
100	100C	90.9	371.6	203.2	Low
100	100D	41.1	410.1	185.4	Low
100	100E	34.5	334.3	155.5	Low
100	100F	49.7	335.2	135.4	Low
100	100G	37.9	327.7	159.3	Low
100	100H	7.4	318.6	106.2	Low
107	107A	127.8	637.6	329.2	High
107	107B	64.2	561.3	230.7	Moderate
107	107C	66.3	633.1	183.3	Low
107	107D	99.7	642.5	244.2	Moderate
107	107E	104.1	521.4	278.6	Moderate
107	107F	108.0	491.1	278.3	Moderate
107	107G	93.5	458.3	157.1	Low
107	107H	108.3	619.8	309.9	High
107	107I	69.2	706.0	353.4	High
19	19A	142.6	808.6	351.7	High
19	19B	120.6	743.3	338.6	High
19	19C	186.8	829.4	345.2	High
19	19D	161.7	621.7	351.3	High
19	19F	136.9	669.0	443.1	Maximum
19	19G	148.1	667.2	468.9	Maximum
70	70A	150.3	716.2	331.4	High
70	70B	142.5	575.2	294.0	Moderate
70	70C	103.6	568.0	262.5	Moderate
70	70D	124.3	705.8	276.8	Moderate
70	70E	139.6	551.5	246.3	Moderate
70	70F	129.3	644.5	262.4	Moderate
70	70G	163.9	527.0	296.9	Moderate
70	70H	98.1	393.1	175.6	Low
70	70I	102.2	421.2	167.1	Low
70	70J	138.6	550.4	430.0	Maximum
84	84A	138.1	552.6	252.4	Moderate
84	84B	107.4	453.3	263.3	Moderate
84	84C	95.8	373.0	173.7	Low
84	84D	78.0	361.4	149.9	Low
84	84E	72.4	558.8	198.1	Low
84	84F	95.8	585.6	248.2	Moderate
84	84G	71.8	583.7	256.4	Moderate
84	84H	96.2	697.1	341.3	High
84	84I	95.2	703.1	294.4	Moderate
84	84J	43.7	506.7	265.9	Moderate

RISK CATEGORIZATION: NON-STRUCTURE FIRES

Using the distribution of non-structure fire risk scores throughout the hexbins, the scores by station were categorized into low, moderate, high, and maximum risk, as outlined in **Table 37. Figure 65** presents the overall non-structure fire risk scores for MFRD, and **Figure 66** shows the non-structure fire risk scores by category.

Table 37: Non-Structure Fire Risk Score Categories

Risk Category	Description	Risk Score Range
Low	Less than average	7.4 – 229.3
Moderate	Average to 75th percentile	229.3 – 299.8
High	75th to 90th percentile	299.8 – 367.2
Maximum	Over 90th percentile	367.2 – 829.4

Figure 65: Non-Structure Fire Risk Scores, CYs 2021–2025

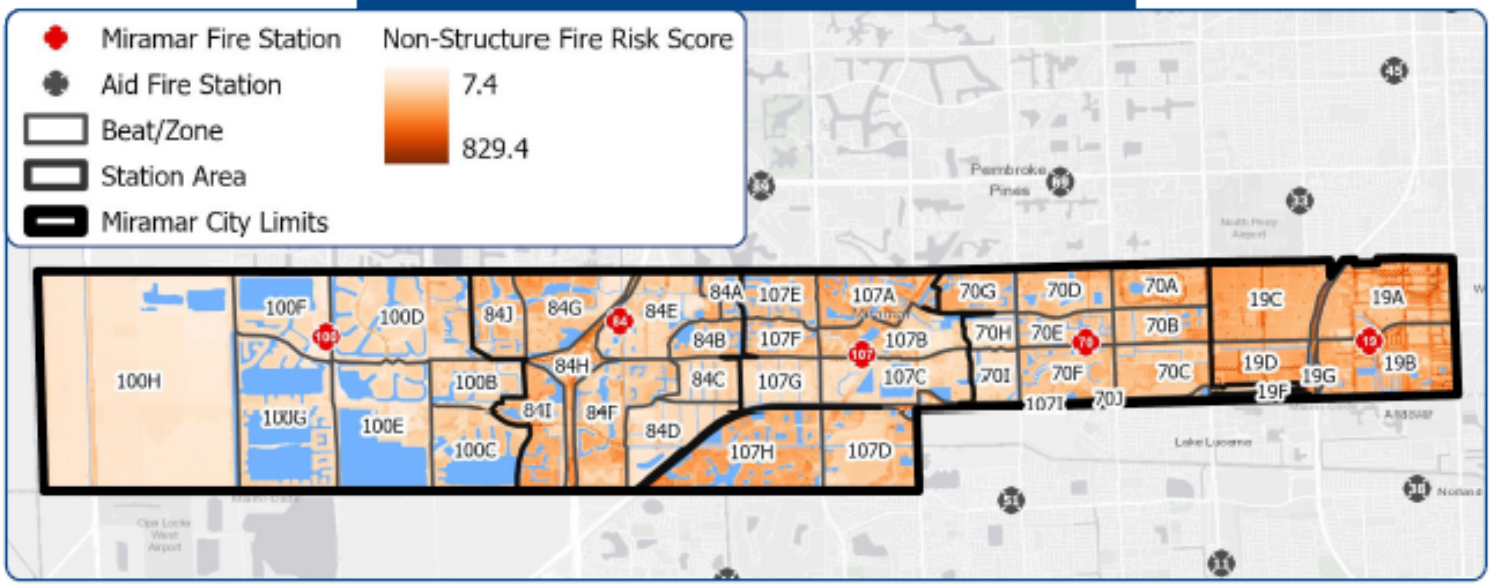
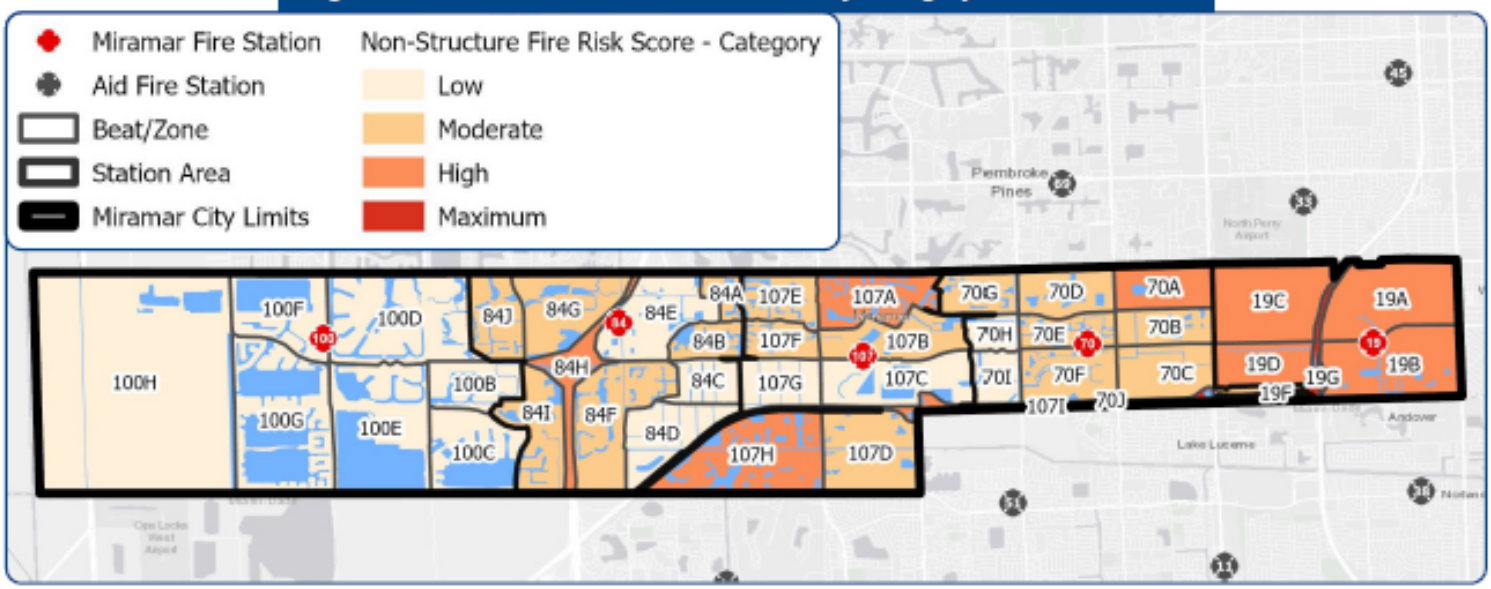


Figure 66: Non-Structure Fire Risk Scores by Category, CYs 2021–2025



Quantitative Risk: Wildland Fires

Using the analysis of each variable, as described in Part I: Introduction and Methodology, wildland fire risk was calculated by applying relevant variables in each hexbin to determine probability, consequence, and impact.

VARIABLES USED IN CALCULATIONS

The tables below summarize which variables from the variable analysis were included in the final wildland fire risk calculations. For this analysis, any land categorized as "water" was given a 0 score to more accurately represent the risk of wildland fire in the area.

The following formula was used to calculate the probability of wildland fires **(Table 38):**

Probability (Wildland Fires) = Historical Wildland Fire Incidents + NRI Lightning Risk + NRI Drought Risk + NRI Strong Winds Risk + NRI Wildland Fire Risk + Land Use Score (Wildland)

Table 38: Probability of Wildland Fires – Variables and Normalization Methods

Variable	Normalization Method
Wildland fire incidents – historical	Rank score
NRI lightning risk	Rank score
NRI drought risk	Rank score
NRI strong winds risk	Rank score
NRI wildland fire risk	Rank score
Land use score – wildland	Calculated score

The following formula was used to calculate the consequence of wildland fires **(Table 39):**

Consequence (Wildland Fires) = Critical Infrastructure (Total) + Total Property Value + Household Characteristics (SVI Theme 2 Score) + Housing and Transportation Characteristics (SVI Theme 4 Score) + Population Density

Table 39: Consequence of Wildland Fires – Variables and Normalization Methods

Variable	Normalization
Presence of critical infrastructure – total	Rank score
Total property value	Rank score
Household characteristics (SVI Theme 2)	SVI percent x 10
Housing and transportation characteristics (SVI Theme 4)	SVI percent x 10
Population density	Rank score

The following formula was used to calculate the impact of wildland fires **(Table 40):**

Impact (Wildland Fires) = Hydrant Distance + Deployment Score + Commitment Score + Travel Time to Station

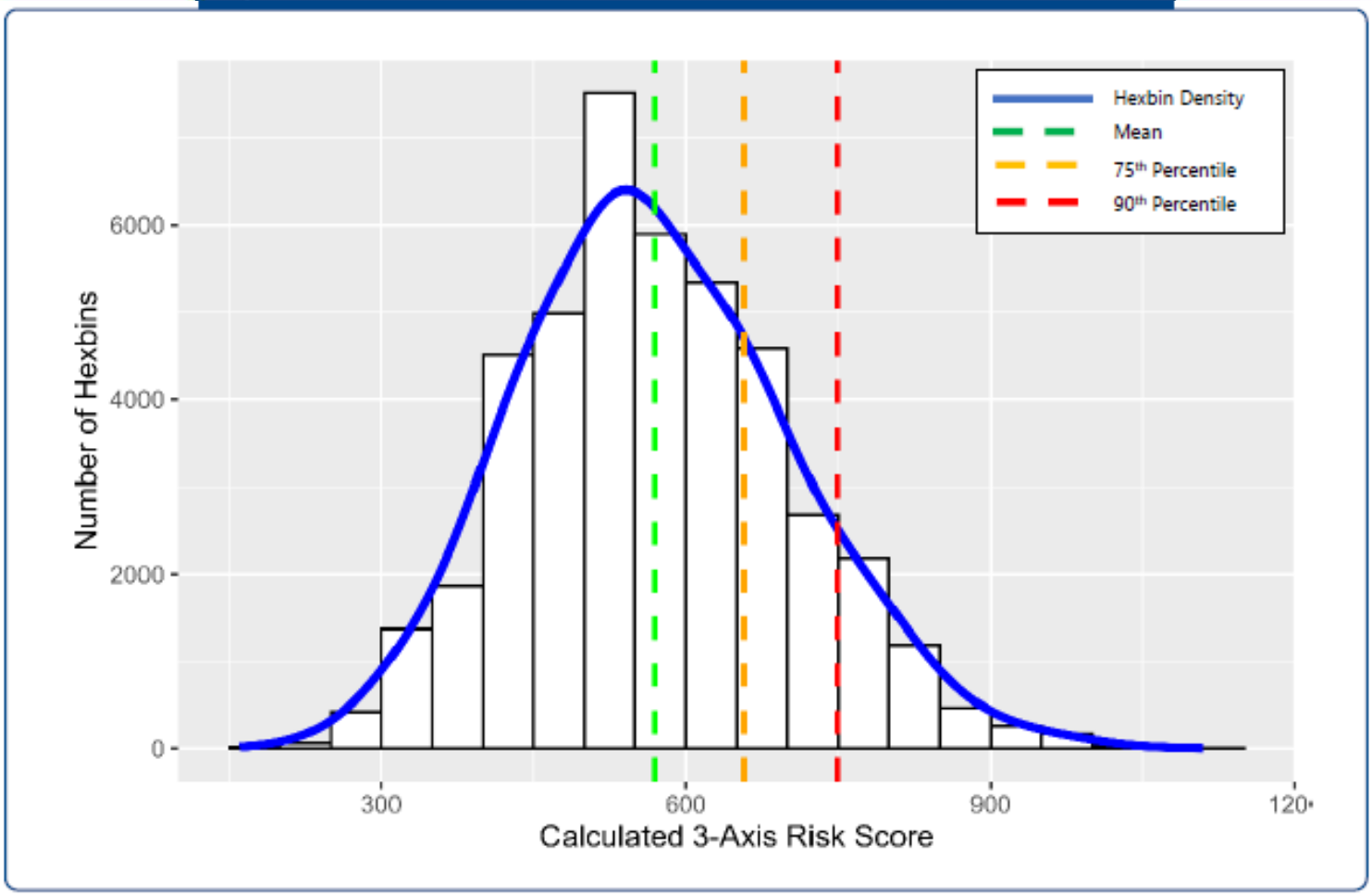
Table 40: Impact of Wildland Fires – Variables and Normalization Methods

Variable	Normalization
Distance to a hydrant	Rank score
Deployment time	Calculated score
Commitment time	Calculated score
Travel time to station	Rank score

ANALYSIS: WILDLAND FIRES

Figure 67 shows the quantified risk scores for wildland fires throughout the MFRD service area, considering wildland fire risk scoring throughout the hexagonal grid cells, not by station area or city.

Figure 67: Distribution of Wildland Fire Risk Scores Histogram, CYs 2021–2025



STATION RESPONSE ZONE SCORES: WILDLAND FIRES

Once each hexagonal grid was scored, the wildland fire risk scores were aggregated at the station level to understand the risks by planning zone. Each grid cell in the planning zones contributed to the overall, minimum, maximum, and average scores, as outlined in **Table 41.** Note: It is important to consider the overall distribution of the scored hexbins from **Figure 67** when reviewing the tabular data.

Table 41: Wildland Fires — Three-Axis Risk Score by Station and Planning Area, CYs 2021–2025

Station	Planning Zone	Three-Axis Score Min	Three-Axis Score Max	Three-Axis Score Average	Overall Risk Category
100	100B	376.7	886.6	657.4	High
100	100C	312.4	786.8	513.3	Low
100	100D	253.2	784.8	528.7	Low
100	100E	324.2	961.5	636.9	Moderate
100	100F	243.8	660.2	418.2	Low
100	100G	335.7	1103.4	641.2	Moderate
100	100H	320.0	917.3	517.1	Low
107	107A	217.7	933.8	439.7	Low
107	107B	159.8	686.8	384.6	Low
107	107C	192.0	638.0	394.3	Low
107	107D	303.6	1109.4	662.0	High
107	107E	205.3	878.2	430.9	Low
107	107F	264.9	701.6	507.1	Low
107	107G	239.4	608.1	363.6	Low
107	107H	297.2	950.7	638.0	Moderate
107	107I	257.3	1028.3	578.0	Moderate
19	19A	348.9	1030.2	675.8	High
19	19B	382.4	1032.1	700.4	High
19	19C	467.9	980.2	650.1	Moderate
19	19D	501.6	859.9	688.2	High
19	19F	471.3	958.5	681.4	High
19	19G	451.4	968.6	766.8	Maximum
70	70A	444.6	1004.4	643.7	Moderate
70	70B	296.4	935.1	470.2	Low
70	70C	275.8	1063.6	758.6	Maximum
70	70D	408.2	901.5	614.3	Moderate
70	70E	428.4	841.1	578.2	Moderate
70	70F	569.4	1067.7	791.0	Maximum
70	70G	469.4	958.2	648.1	Moderate
70	70H	366.3	701.4	470.8	Low
70	70I	393.5	818.4	503.2	Low
70	70J	554.8	1028.8	777.4	Maximum
84	84A	333.7	678.2	492.2	Low
84	84B	340.6	762.4	565.9	Low
84	84C	327.9	748.5	478.0	Low
84	84D	294.0	803.6	463.8	Low
84	84E	272.0	731.2	467.6	Low
84	84F	342.7	891.1	583.9	Moderate
84	84G	265.7	854.6	550.8	Low
84	84H	269.4	912.6	590.7	Moderate
84	84I	262.8	1021.5	641.8	Moderate
84	84J	253.2	763.9	569.3	Moderate

RISK CATEGORIZATION: WILDLAND FIRES

Using the distribution of wildland fire risk scores throughout the hexbins, the scores by station were categorized into low, moderate, high, and maximum risk, as outlined in **Table 42. Figure 68** presents the overall wildland fire risk scores for MFRD, and **Figure 69** shows the wildland fire risk scores by category.

Table 42: Wildland Fire Risk Score Categories

Risk Category	Description	Risk Score Range
Low	Less than average	159.8 – 568.8
Moderate	Average to 75th percentile	568.8 – 656.9
High	75th to 90th percentile	656.9 – 749.1
Maximum	Over 90th percentile	749.1 – 1,109.4

Figure 68: Wildland Fire Risk Scores, CYs 2021–2025

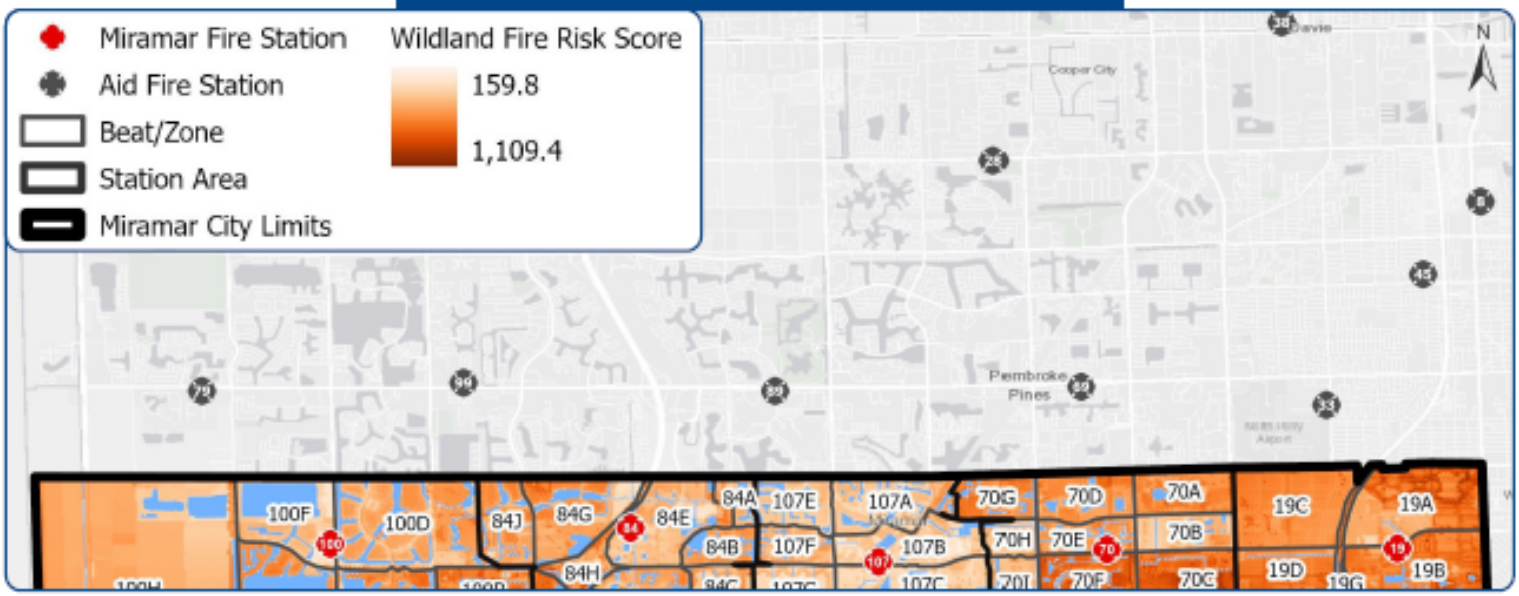
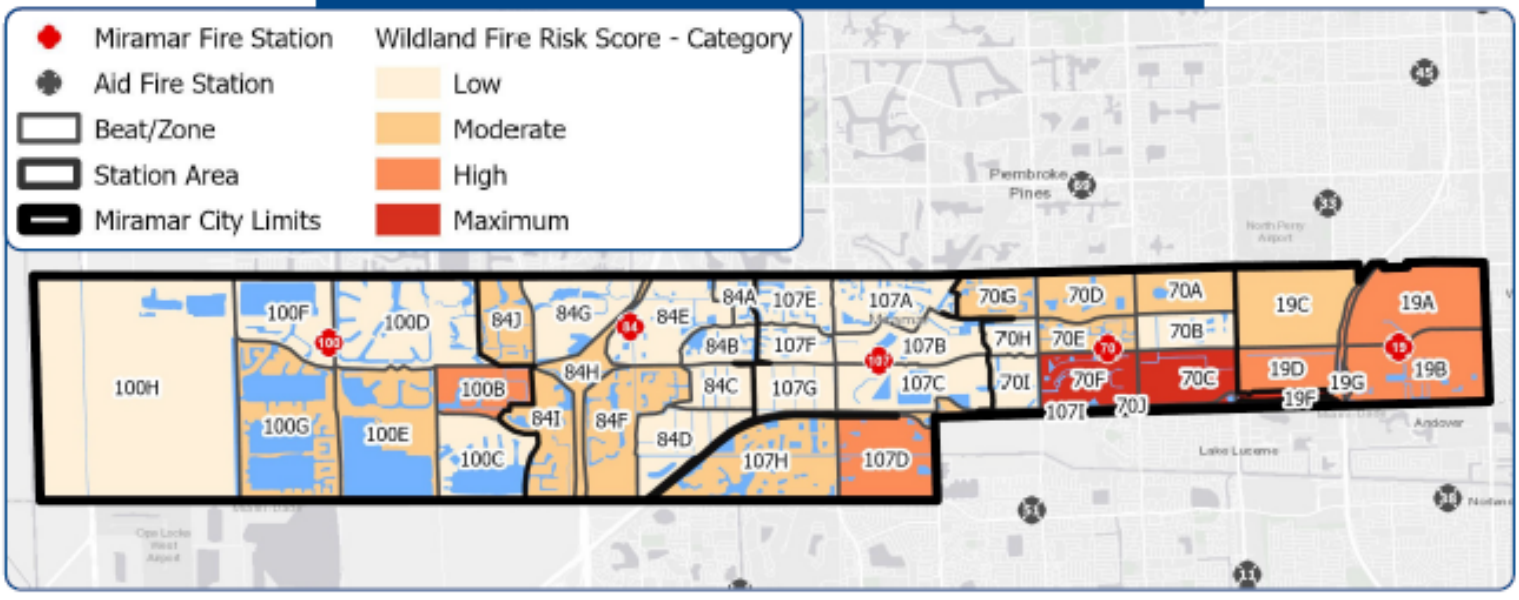


Figure 69: Wildland Fire Risk Scores by Category, CYs 2021–2025



Quantitative Risk: EMS Incidents

Examples of EMS incidents include medical emergencies, traumatic injuries, and motor vehicle accidents. The spectrum of EMS events spans from critical, life-threatening events to low-acuity events. The risks represented in these calculations encompass the full spectrum of EMS risk. Using the analysis of each variable, as described in Part I: Introduction and Methodology, EMS risk was calculated by applying relevant variables within each hexbin to determine probability, consequence, and impact.

VARIABLES USED IN CALCULATIONS

This section explains how the variables were included in the EMS risk calculations.

The following formula was used to calculate the probability of EMS incidents (**Table 43**):

Probability (EMS) = Historical EMS Incidents + Household Characteristics (SVI Theme 2 score) + Population Density + Land Use Score (EMS) + Persistent Years of EMS Incidents

Table 43: Probability of EMS Incidents – Variables and Normalization Methods

Variable	Normalization Method
EMS incidents – historical	Rank score
Household characteristics (SVI Theme 2)	SVI percent x 10
Population density	Rank score
Land use score - EMS	Calculated score
Persistent Years of EMS incidents	Rank score

The following formula was used to calculate the consequence of EMS incidents (**Table 44**):

Consequence (EMS) = Socioeconomic Status (SVI Theme 1 Score) + Housing and Transportation Characteristics (SVI Theme 4 Score) + Travel Time to Hospital

Table 44: Consequence of EMS Incidents – Variables and Normalization Methods

Variable	Normalization
Socioeconomic status (SVI Theme 1)	SVI percent x 10
Housing and transportation characteristics (SVI Theme 4)	SVI percent x 10
Travel time to hospital	Rank score

The following formula was used to calculate the impact of EMS incidents (**Table 45**):

Impact (EMS) = Deployment Score + Commitment Score + Travel Time to Station

Table 45: Impact of EMS Incidents – Variables and Normalization Methods

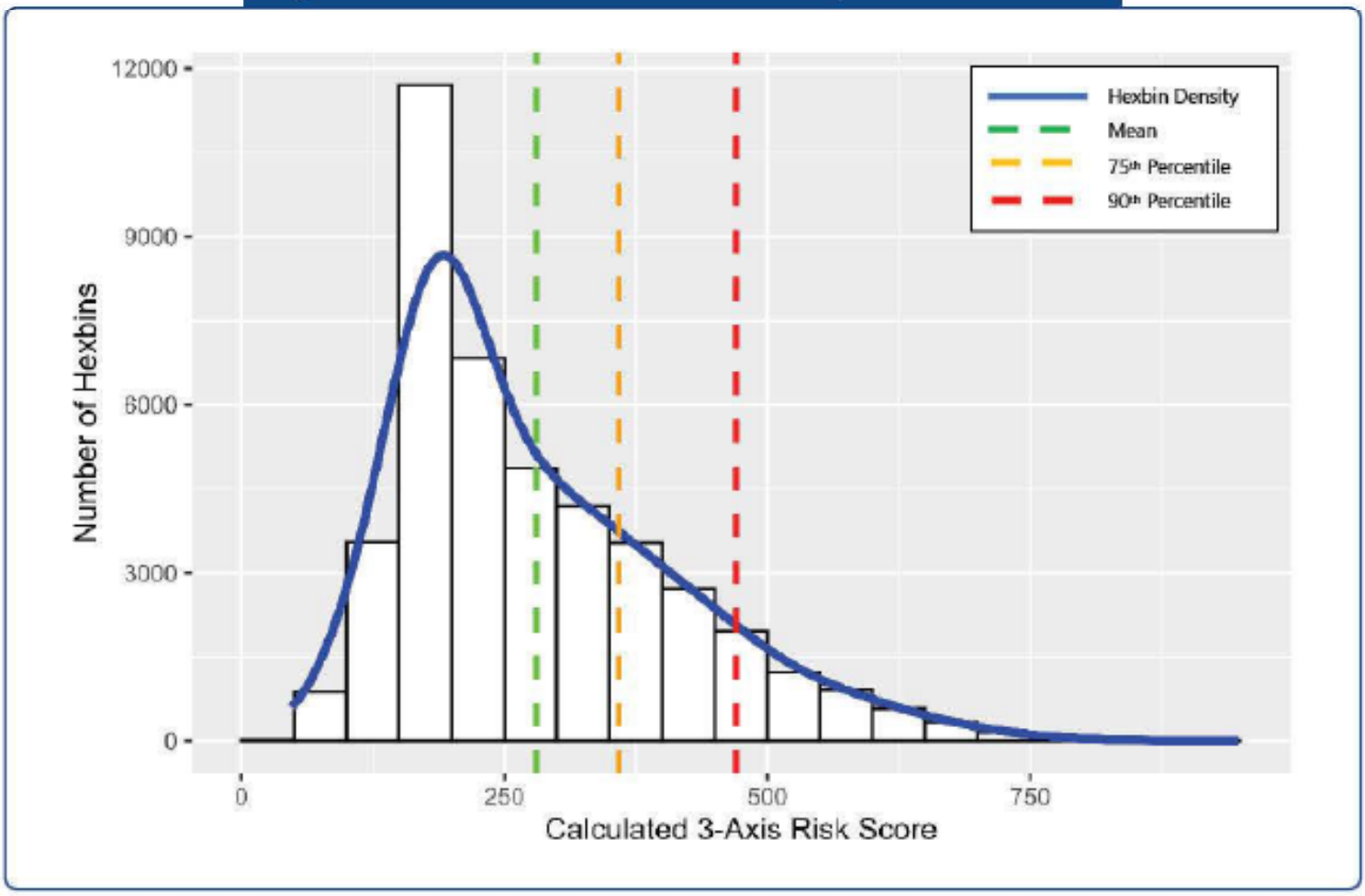
Variable	Normalization
Deployment time	Calculated score
Commitment time	Calculated score
Travel time to station	Rank score



ANALYSIS: EMS INCIDENTS

Figure 70 shows the quantified risk scores for EMS incidents throughout the MFRD service area, considering EMS risk scoring throughout the hexagonal grid cells, not by station area or city.

Figure 70: Distribution of EMS Risk Scores Histogram, CYs 2021–2025



STATION RESPONSE ZONE SCORES: EMS INCIDENTS

Once each hexagonal grid was scored, the EMS risk scores were aggregated at the station level to understand the risks by planning zone. Each grid cell in the planning zones contributed to the overall, minimum, maximum, and average scores, as outlined in **Table 46.** Note: It is important to consider the overall distribution of the scored hexbins from **Figure 70** when reviewing the tabular data.

Table 46: EMS Risk — Three-Axis Risk Score by Station and Planning Area, CYs 2021–2025

Station Number	Planning Zone	Three-Axis Score Min	Three-Axis Score Max	Three-Axis Score Average	Overall Risk Category
100	100B	112.7	582.4	308.1	Moderate
100	100C	123.4	542.2	245.5	Low
100	100D	47.6	419.7	193.4	Low
100	100E	95.0	556.0	231.4	Low
100	100F	68.2	404.1	173.0	Low
100	100G	108.8	581.3	264.5	Low
100	100H	119.4	456.6	194.4	Low
107	107A	128.9	662.5	291.9	Moderate
107	107B	79.0	601.5	237.4	Low
107	107C	90.5	436.7	178.2	Low
107	107D	229.3	731.7	377.2	High
107	107E	133.6	669.5	313.4	Moderate
107	107F	131.5	527.7	301.6	Moderate
107	107G	102.1	500.3	219.4	Low
107	107H	194.6	796.1	453.0	High
107	107I	90.7	695.4	291.4	Moderate
19	19A	171.8	814.7	481.9	Maximum
19	19B	232.7	947.7	494.9	Maximum
19	19C	214.8	653.7	434.5	High
19	19D	207.1	655.4	412.6	High
19	19F	224.0	597.0	362.9	High
19	19G	343.8	725.5	467.7	High
70	70A	138.9	648.7	384.2	High
70	70B	107.7	613.7	292.4	Moderate
70	70C	219.6	643.0	348.1	Moderate
70	70D	143.3	573.0	313.6	Moderate
70	70E	154.8	597.0	293.1	Moderate
70	70F	202.0	708.1	425.2	High
70	70G	180.5	597.1	338.2	Moderate
70	70H	123.6	446.8	210.3	Low
70	70I	133.9	612.3	196.8	Low
70	70J	207.8	689.0	384.9	High
84	84A	90.4	348.0	195.6	Low
84	84B	101.0	411.5	228.9	Low
84	84C	104.8	371.2	179.1	Low
84	84D	87.9	445.2	188.1	Low
84	84E	48.1	394.9	125.4	Low
84	84F	58.0	451.8	220.4	Low
84	84G	71.6	435.0	199.1	Low
84	84H	62.2	561.6	200.0	Low
84	84I	89.2	587.0	266.8	Low
84	84J	74.3	418.9	201.9	Low

RISK CATEGORIZATION: EMS INCIDENTS

Using the distribution of EMS risk scores throughout the hexbins, the scores by station were categorized into low, moderate, high, and maximum risk, as outlined in **Table 47. Figure 71** presents the overall EMS risk scores for MFRD, and **Figure 72** shows the EMS risk scores by category.

Table 47: EMS Risk Score Categories

Risk Category	Description	Risk Score Range
Low	Less than average	47.6 – 280.1
Moderate	Average to 75th percentile	280.1 – 358.8
High	75th to 90th percentile	358.8 – 470.6
Maximum	Over 90th percentile	470.6 – 947.7

Figure 71: EMS Risk Scores, CYs 2021–2025

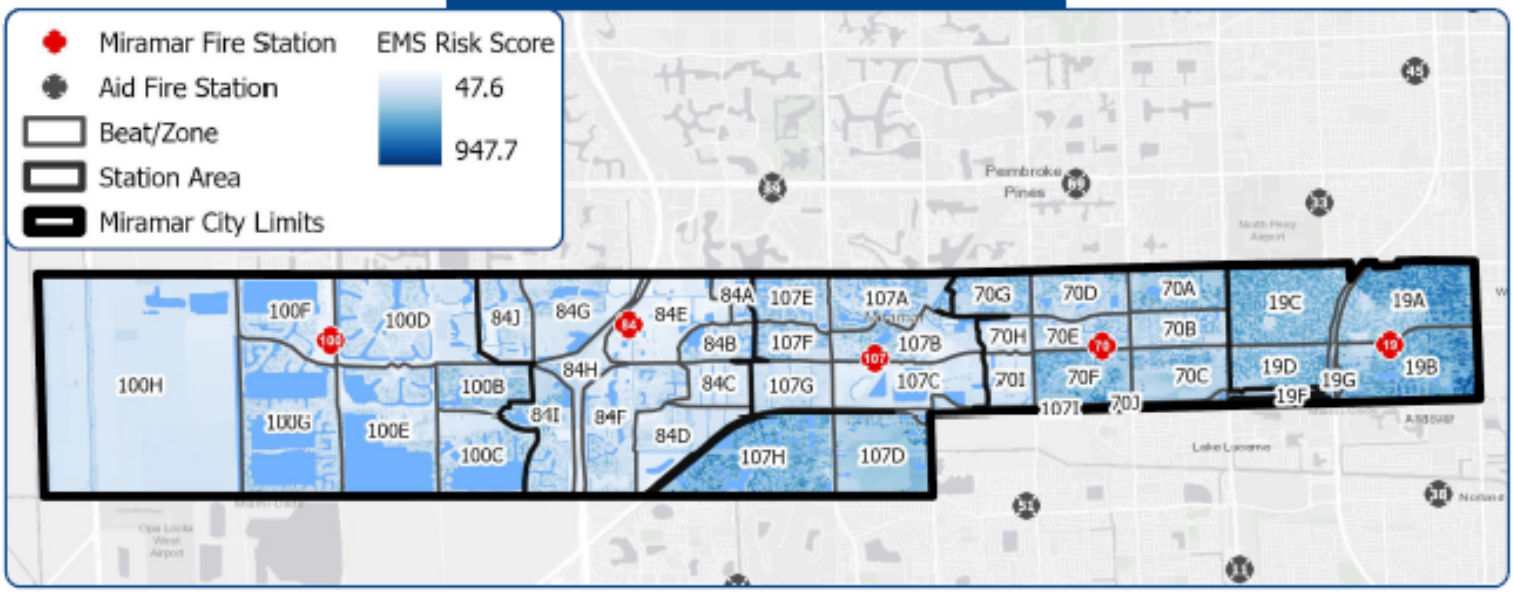
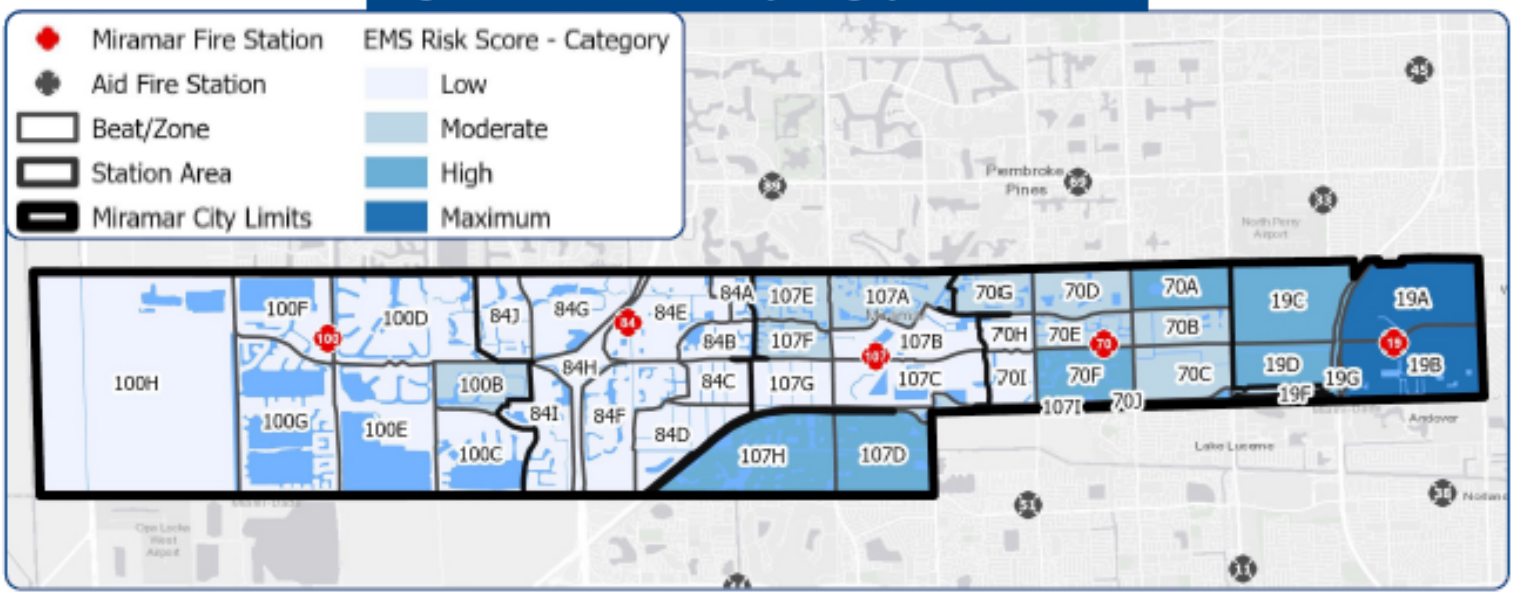


Figure 72: EMS Risk Scores by Category, CYs 2021–2025



Quantitative Risk: Technical Rescue Incidents

Examples of technical rescue incidents include entrapments, confined space incidents, and trench, water, and other types of rescues. The presence of certain geographical features and human-made factors, such as high-speed highways, are variables that affect the probability of technical rescue incidents and their associated hazards. Using the analysis of each variable, as described in Part I: Introduction and Methodology, technical rescue risk was calculated by applying relevant variables within each hexbin to determine probability, consequence, and impact.

VARIABLES USED IN CALCULATIONS

This section explains how the variables were included in the technical rescue risk calculations.

The following formula was used to calculate the probability of technical rescue incidents **(Table 48)**:

Probability (Technical Rescue) = Historical Technical Rescue Incidents + Critical Infrastructure (Recreation) + Land Use Score (Technical Rescue) + Flooding Risk

Table 48: Probability of Technical Rescue Incidents – Variables and Normalization Methods

Variable	Normalization Method
Technical rescue incidents – historical	Rank score
Critical infrastructure - recreation	Rank score
Land use score – technical rescue	Calculated score
Flooding risk	Value

The following formula was used to calculate the consequence of technical rescue incidents **(Table 49)**:

Consequence (Technical Rescue) = Critical Infrastructure (Total) + Housing and Transportation Characteristics (SVI Theme 4 Score) + Travel Time to Hospital

Table 49: Consequence of Technical Rescue Incidents – Variables and Normalization Methods

Variable	Normalization
Presence of critical infrastructure – total	Rank score
Housing and transportation characteristics (SVI Theme 4)	SVI percent x 10
Travel time to hospital	Rank score

The following formula was used to calculate the impact of technical rescue incidents **(Table 50)**:

Impact (Technical Rescue) = Deployment Score + Commitment Score + Travel Time to Station

Table 50: Impact of Technical Rescue Incidents – Variables and Normalization Methods

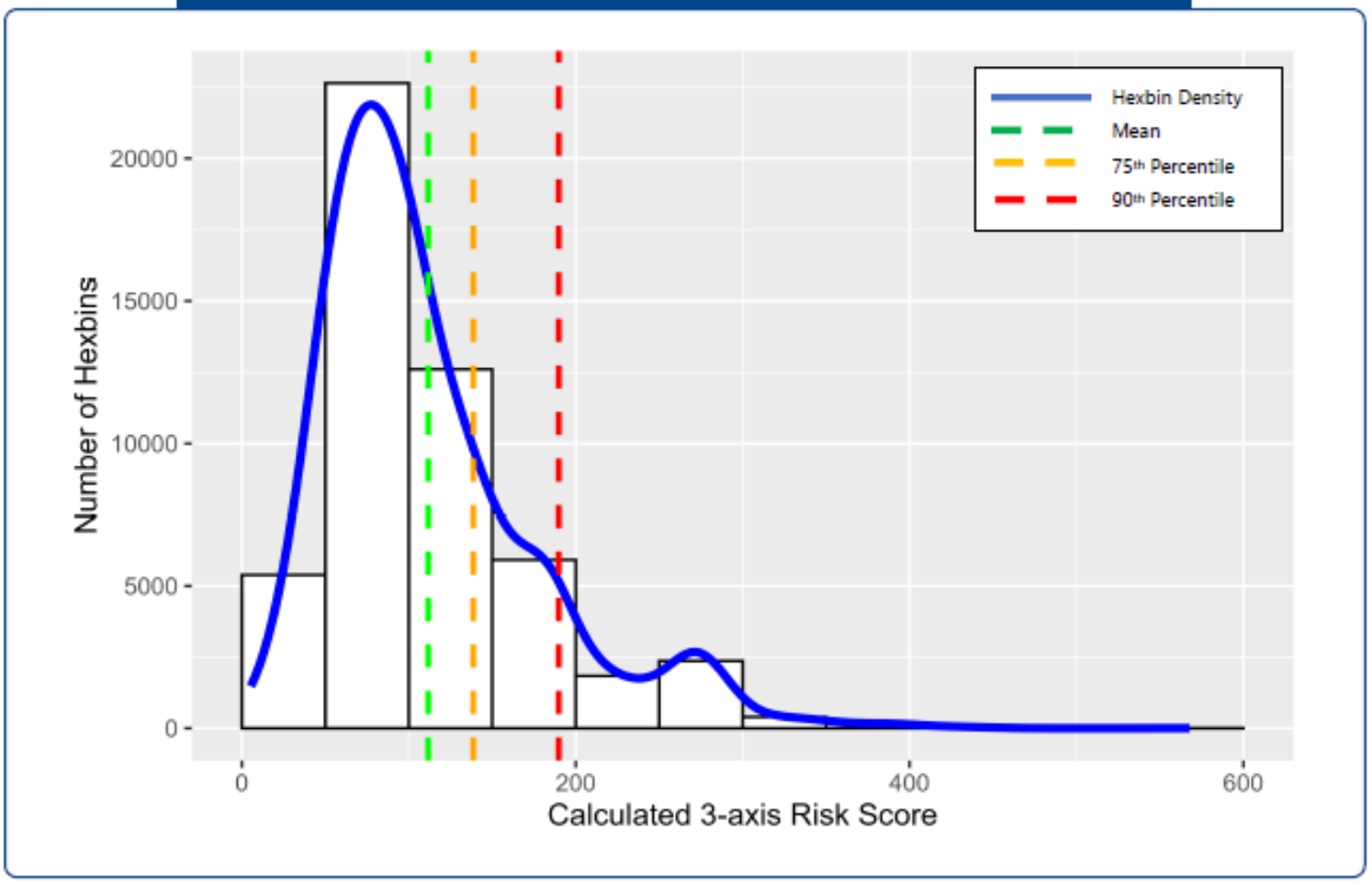
Variable	Normalization
Deployment time	Calculated score
Commitment time	Calculated score
Travel time to station	Rank score



ANALYSIS: TECHNICAL RESCUE

Figure 73 shows the quantified risk scores for technical rescue incidents throughout the MFRD service area, considering technical rescue risk scoring throughout the hexagonal grid cells, not by station area or city.

Figure 73: Distribution of Technical Rescue Risk Scores Histogram, CYs 2021–2025



STATION RESPONSE ZONE SCORES: TECHNICAL RESCUE

Once each hexagonal grid was scored, the technical rescue risk scores were aggregated at the station level to understand the risks by planning zone. Each grid cell in the planning zones contributed to the overall, minimum, maximum, and average scores, as outlined in **Table 51.** Note: It is important to consider the overall distribution of the scored hexbins from **Figure 73** when reviewing the table below.

Table 51: Technical Rescue Incidents — Three-Axis Risk Score by Station and Planning Area, CYs 2021–2025

Station Number	Planning Zone	Three-Axis Score Min	Three-Axis Score Max	Three-Axis Score Average	Overall Risk Category
100	100B	91.3	320.1	169.6	Low
100	100C	89.7	493.8	156.1	Low
100	100D	54.6	430.5	127.4	Low
100	100E	55.3	504.2	120.2	Low
100	100F	45.2	288.8	103.6	Low
100	100G	56.8	502.6	115.6	Low
100	100H	100.6	563.1	351.5	High
107	107A	75.1	497.0	162.7	Low
107	107B	37.0	364.1	150.1	Low
107	107C	67.5	312.7	139.7	Low
107	107D	88.7	409.3	235.5	Moderate
107	107E	68.6	271.2	115.5	Low
107	107F	78.8	338.2	132.5	Low
107	107G	120.1	317.9	168.7	Low
107	107H	110.5	552.7	217.3	Moderate
107	107I	133.8	542.8	278.4	High
19	19A	98.7	538.6	177.2	Low
19	19B	111.7	678.6	241.3	Moderate
19	19C	113.2	400.1	151.6	Low
19	19D	122.1	455.7	180.2	Low
19	19F	171.1	521.6	332.4	High
19	19G	240.3	461.9	393.0	Maximum
70	70A	78.7	416.9	164.0	Low
70	70B	75.0	521.6	124.6	Low
70	70C	100.4	584.5	285.1	High
70	70D	83.1	266.3	124.6	Low
70	70E	77.7	392.7	123.6	Low
70	70F	103.2	356.2	180.2	Low
70	70G	135.7	503.3	224.6	Moderate
70	70H	115.3	279.1	176.3	Low
70	70I	95.2	291.1	145.6	Low
70	70J	207.6	552.1	334.2	High
84	84A	78.4	368.9	127.9	Low
84	84B	89.1	293.3	140.2	Low
84	84C	129.1	248.0	176.9	Low
84	84D	125.2	430.5	216.0	Moderate
84	84E	81.5	401.4	163.3	Low
84	84F	92.4	429.7	168.8	Low
84	84G	112.1	421.2	169.8	Low
84	84H	89.3	435.6	255.4	Moderate
84	84I	134.0	518.8	202.6	Low
84	84J	76.7	418.1	174.4	Low

RISK CATEGORIZATION: TECHNICAL RESCUE

Using the distribution of technical rescue risk scores throughout the hexbins, the scores by station were categorized into low, moderate, high, and maximum risk, as outlined in **Table 52**. **Figure 74** presents the overall technical rescue risk scores for MFRD, and **Figure 75** shows the technical rescue risk scores by category.

Table 52: Technical Rescue Risk Score Categories

Risk Category	Description	Risk Score Range
Low	Less than average	37.0 – 207.2
Moderate	Average to 75th percentile	207.2 – 269.8
High	75th to 90th percentile	269.8 – 377.2
Maximum	Over 90th percentile	377.2 – 678.6

Figure 74: Technical Rescue Risk Scores, CYs 2021–2025

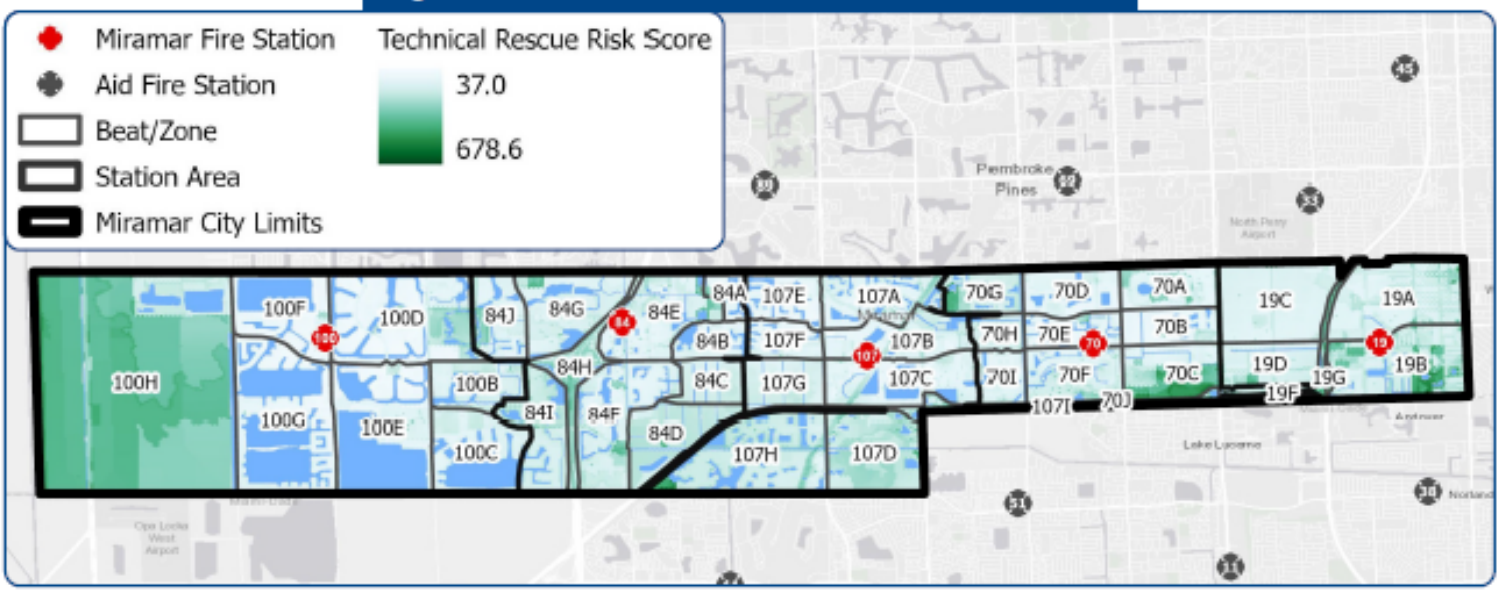
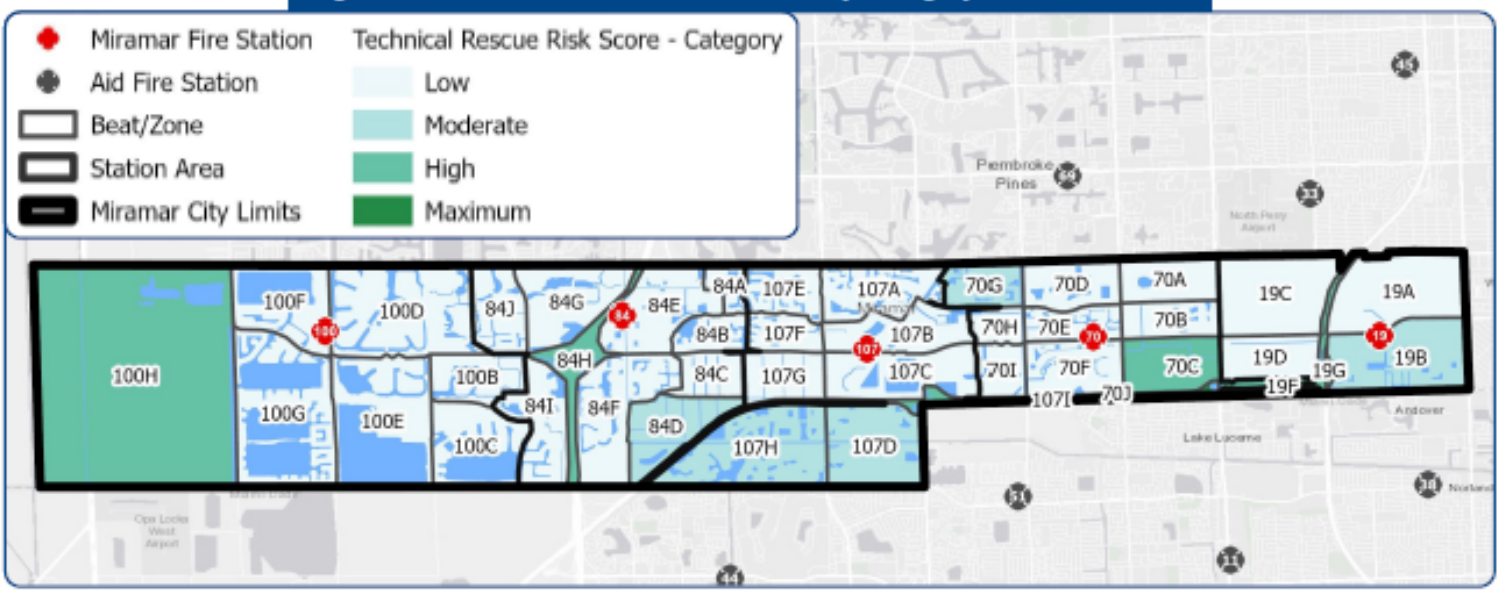


Figure 75: Technical Rescue Risk Scores by Category, CYs 2021–2025

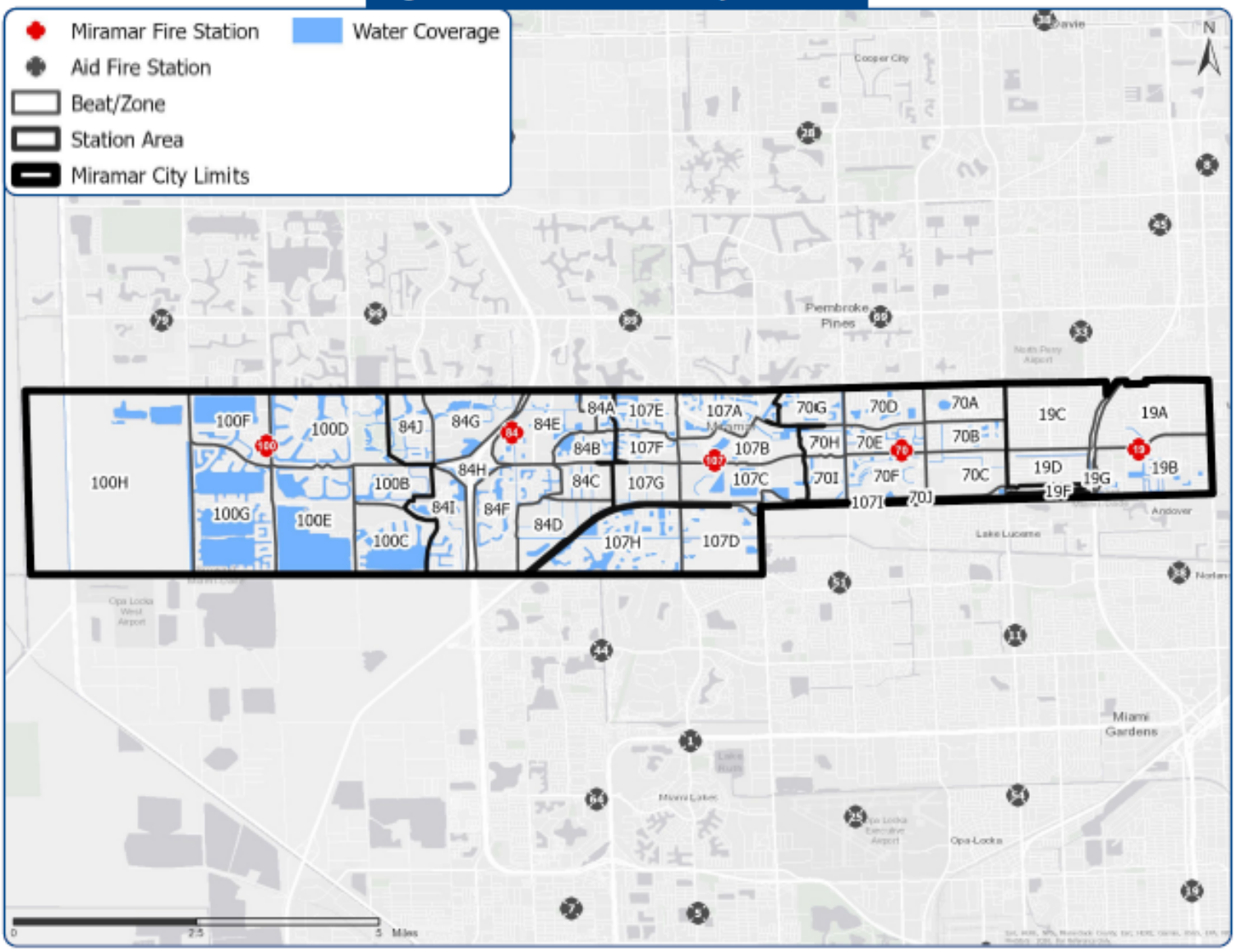


WATER RISKS AND RESCUE

Waterways within a community pose inherent risks for accidental drownings and other water-related emergencies. Lakes, streams, reservoirs, marshes, and canals attract recreational users and outdoor adventurers. Most of these areas lack lifeguard supervision and other protective measures. These areas pose increased risks during warm weather months, weekends, and holidays, when usage typically spikes. Contributing factors include alcohol use, limited swimming skills, sudden changes in water depth, and swift currents. Drowning incidents often lead to life-threatening emergencies that require an immediate response, specialized rescue equipment, and advanced water rescue training. The Department should reference NFPA Standard 1670: *Standard on Operations and Training for Technical Search and Rescue Incidents*.

Within the risk classification framework, waterways and drowning hazards are categorized as a special risk. This classification acknowledges that, although such incidents are relatively infrequent, their consequences are severe, including potential loss of life and significant organizational impact. Water areas comprise approximately 3,105 acres in the City of Miramar, accounting for 15.6% of its total land area. **Figure 76** illustrates all water areas within the City of Miramar.

Figure 76: Water Areas in the City of Miramar



Quantitative Risk: HazMat Incidents

HazMat incidents can involve a range of hazards, from spills of gasoline and other flammable liquids to radiation leaks and toxic chemical releases. Using the analysis of each variable, as described in **Part I: Introduction and Methodology**, HazMat risk was calculated by using relevant variables in each hexbin to calculate probability, consequence, and impact.

VARIABLES USED IN CALCULATIONS

The tables below summarize which variables from the variable analysis were included in the final HazMat risk calculations.

The following formula was used to calculate the probability of HazMat incidents **(Table 53)**:

Probability (HazMat) = Historical HazMat Incidents + Critical Infrastructure (HazMat) + Land Use Score (HazMat)

Table 53: Probability of HazMat Incidents – Variables and Normalization Methods

Variable	Normalization Method
HazMat incidents – historical	Rank score
Critical infrastructure – HazMat	Rank score
Land use score – HazMat	Calculated score

The following formula was used to calculate the consequence of HazMat incidents **(Table 54)**:

Consequence (HazMat) = Critical Infrastructure (Total) + Total Property Value + Population Density

Table 54: Consequence of HazMat Incidents – Variables and Normalization Methods

Variable	Normalization
Presence of critical infrastructure – total	Rank score
Total property value	Rank score
Population density	Rank score

The following formula was used to calculate the impact of HazMat incidents **(Table 55)**:

Impact (HazMat) = Deployment Score + Commitment Score + Travel Time to Station

Table 55: Impact of HazMat Incidents – Variables and Normalization Methods

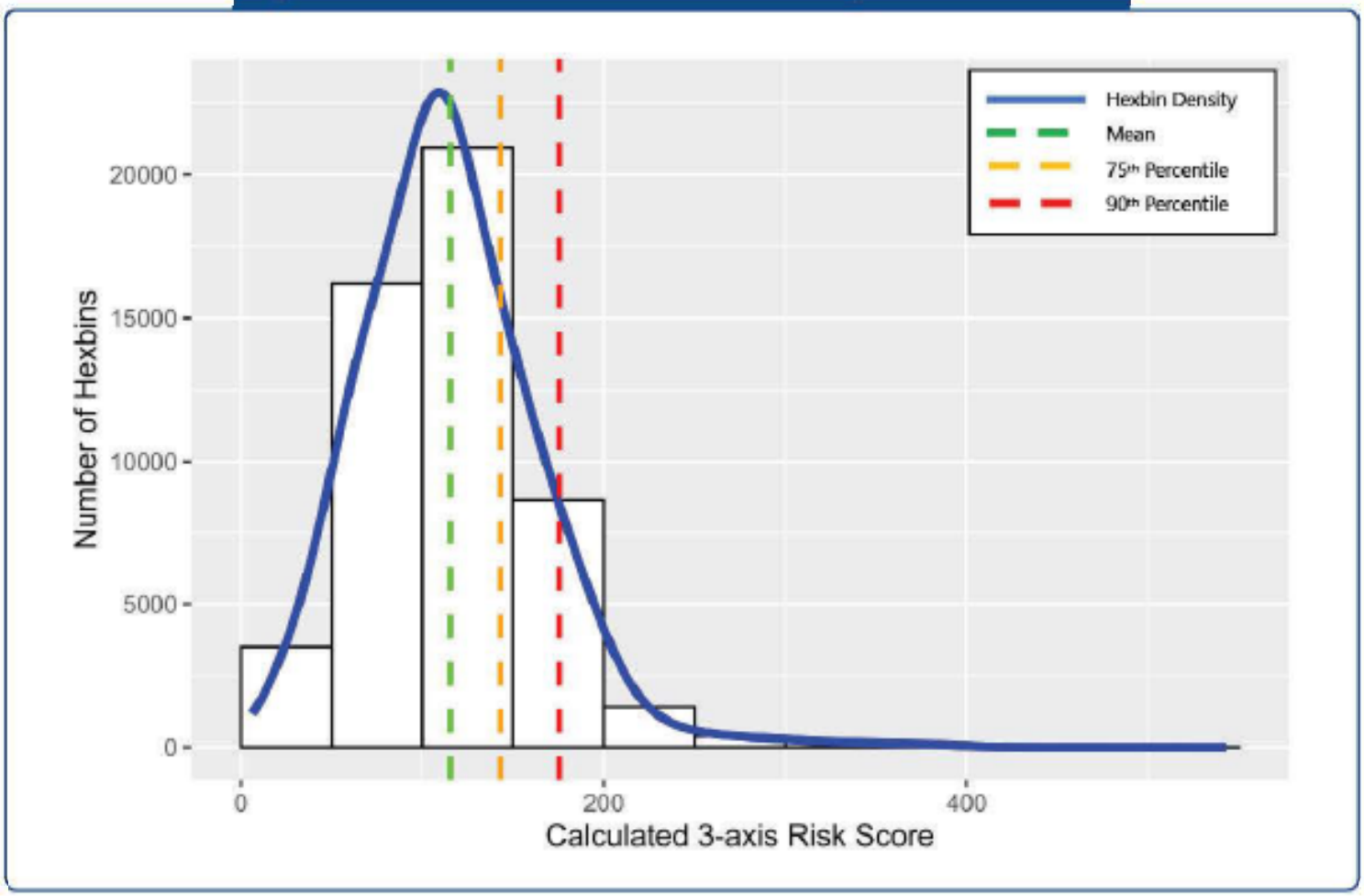
Variable	Normalization
Deployment time	Calculated score
Commitment time	Calculated score
Travel time to station	Rank score



ANALYSIS: HAZMAT INCIDENTS

Figure 77 shows the quantified risk scores for HazMat incidents throughout the MFRD service area, considering HazMat risk scoring throughout the hexagonal grid cells, not by station area or city.

Figure 77: Distribution of HazMat Risk Scores Histogram, CYs 2021–2025



STATION RESPONSE ZONE SCORES: HAZMAT INCIDENTS

Once each hexagonal grid was scored, the HazMat risk scores were aggregated at the station level to understand the risks by planning zone. Each grid cell in the planning zones contributed to the overall, minimum, maximum, and average scores, as outlined in **Table 56.** Note: It is important to consider the overall distribution of the scored hexbins from **Figure 77** when reviewing the tabular data.

Table 56: HazMat Incidents — Three-Axis Risk Score by Station and Planning Area, CYs 2021–2025

Station Number	Planning Zone	Three-Axis Score Min	Three-Axis Score Max	Three-Axis Score Average	Overall Risk Category
100	100B	69.7	331.9	169.6	Moderate
100	100C	73.6	353.2	183.5	Moderate
100	100D	49.4	396.1	153.8	Low
100	100E	48.7	459.7	141.8	Low
100	100F	39.8	285.2	116.4	Low
100	100G	44.8	380.7	144.4	Low
100	100H	46.9	283.1	125.9	Low
107	107A	53.3	357.9	163.7	Low
107	107B	34.5	282.5	107.1	Low
107	107C	27.5	316.4	82.9	Low
107	107D	51.1	359.9	142.3	Low
107	107E	36.1	495.0	145.1	Low
107	107F	39.0	382.7	144.4	Low
107	107G	41.2	297.8	87.7	Low
107	107H	39.3	419.4	176.3	Moderate
107	107I	52.7	344.9	151.8	Low
19	19A	83.8	470.9	213.4	High
19	19B	74.3	521.7	211.7	High
19	19C	120.6	484.2	235.2	High
19	19D	99.5	596.6	236.0	High
19	19F	79.0	378.3	220.1	High
19	19G	117.9	400.8	235.4	High
70	70A	90.0	544.2	198.6	Moderate
70	70B	80.2	345.8	179.5	Moderate
70	70C	57.4	386.6	166.6	Moderate
70	70D	68.1	499.4	172.7	Moderate
70	70E	78.4	489.7	149.5	Low
70	70F	72.4	481.8	170.3	Moderate
70	70G	98.1	352.1	190.7	Moderate
70	70H	51.0	324.0	101.8	Low
70	70I	50.5	302.2	103.9	Low
70	70J	110.2	410.5	198.2	Moderate
84	84A	109.6	355.0	209.3	High
84	84B	81.0	385.5	218.4	High
84	84C	94.2	287.2	150.9	Low
84	84D	76.7	385.5	140.8	Low
84	84E	51.3	454.8	154.9	Low
84	84F	54.1	413.0	203.5	High
84	84G	65.9	516.9	213.6	High
84	84H	98.3	427.2	222.7	High
84	84I	68.6	552.8	247.5	Maximum
84	84J	59.3	420.0	221.6	High

RISK CATEGORIZATION: HAZMAT INCIDENTS

Using the distribution of HazMat risk scores throughout the hexbins, the scores by station were categorized into low, moderate, high, and maximum risk, as outlined in **Table 57. Figure 78** presents the overall HazMat risk scores for MFRD, and **Figure 79** shows the HazMat risk scores by category.

Table 57: HazMat Risk Score Categories

Risk Category	Description	Risk Score Range
Low	Less than average	27.5 – 164.1
Moderate	Average to 75th percentile	164.1 – 200.7
High	75th to 90th percentile	200.7 – 243.4
Maximum	Over 90th percentile	243.4 – 596.6

Figure 78: HazMat Risk Scores, CYs 2021–2025

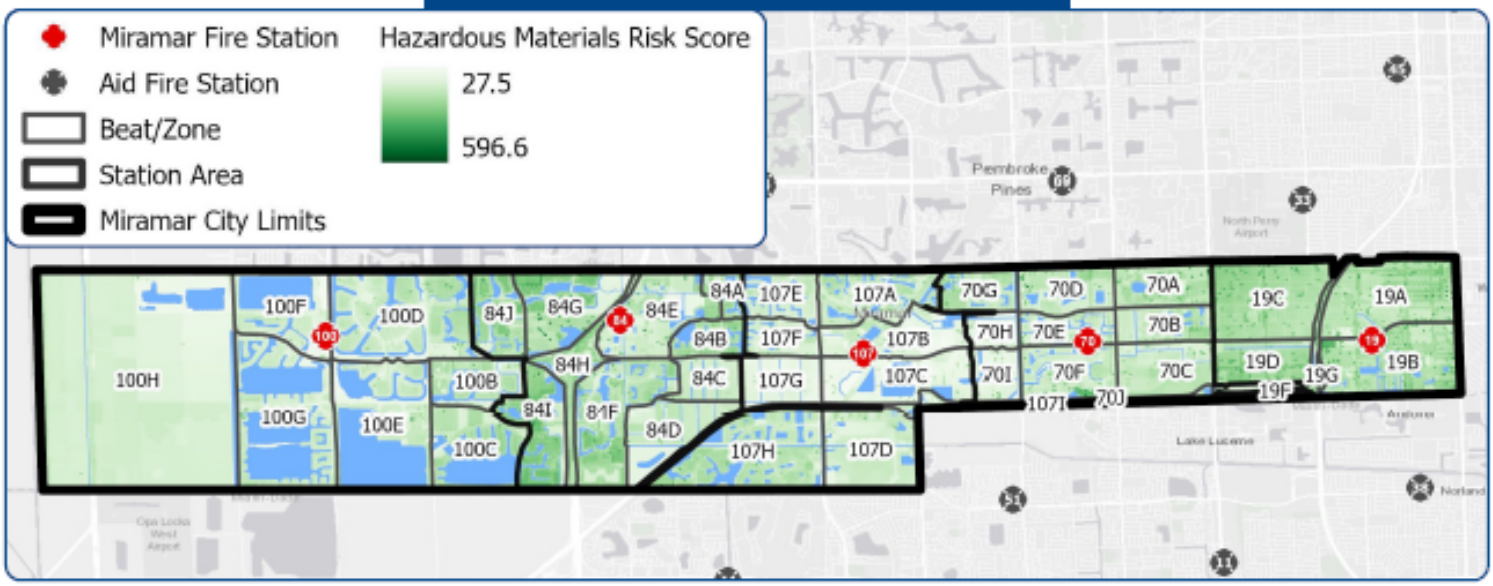
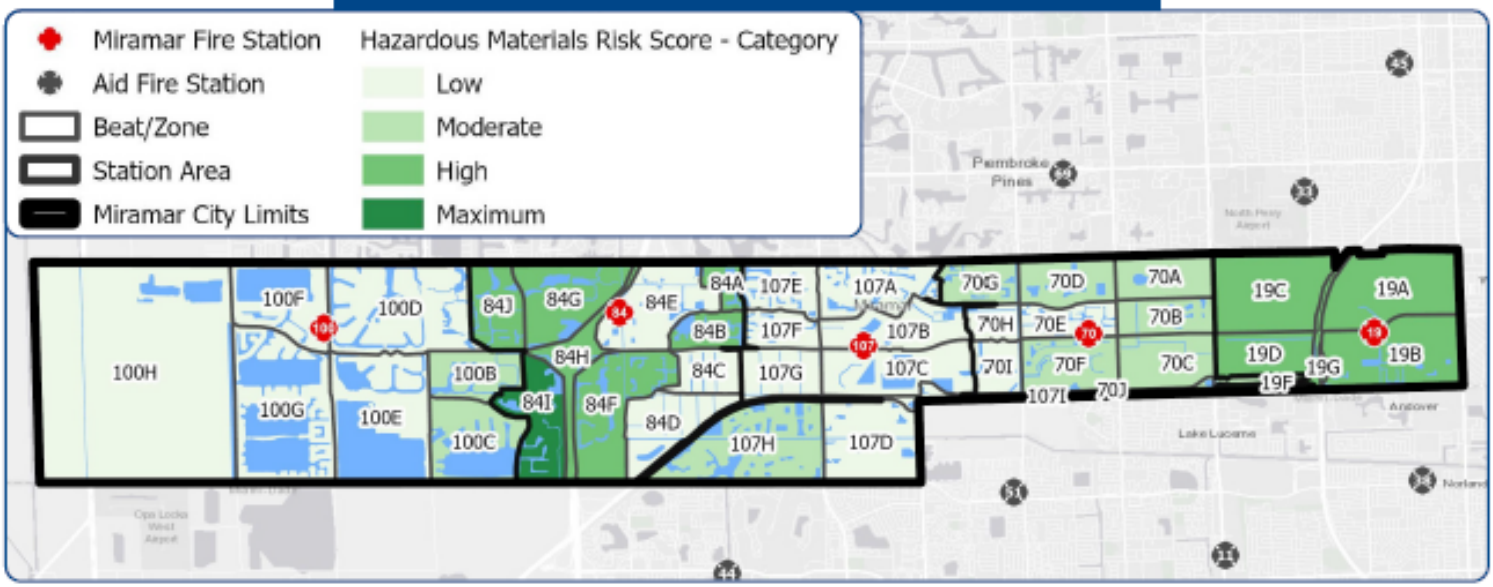


Figure 79: HazMat Risk Scores by Category, CYs 2021–2025



Quantitative Risk: Natural and Human-Made Disasters

Examples of natural and human-made disasters include events such as earthquakes, landslides, tsunamis, terrorism, and active shooter events. These events have a low probability of occurrence, but they can have high consequences and impacts when they do occur. Using the analysis of each variable, as described in Part I: Introduction and Methodology, the risks of natural and human-made disasters were calculated by applying relevant variables to each hexbin to determine probability, consequence, and impact.

VARIABLES USED IN CALCULATIONS

The tables below summarize which variables from the variable analysis were included in the final risk calculations.

The following formula was used to calculate the probability of natural and human-made disasters **(Table 58):**

Probability (Natural and Human-Made Disasters) =

Historical Natural and Human-made Disasters + NRI Hail Risk + NRI Hurricane Risk + NRI Landslide Risk + NRI Riverine Flooding Risk + NRI Earthquake Risk + NRI Tornado Risk + NRI Overall Risk

Table 58: Probability of Natural and Human-Made Disasters — Variables and Normalization Methods

Variable	Normalization Method
Natural and human-made disaster incidents – historical (NFIRS codes 811-815)	Rank Score
NRI risk – hail	Rank score
NRI risk – hurricane	Rank score
NRI risk – landslide	Rank score
NRI risk – riverine flooding	Rank score
NRI risk – earthquake	Rank score
NRI risk – tornado	Rank score
NRI overall (composite) risk score	Rank score

The following formula was used to calculate the consequence of natural and human-made disasters **(Table 59):**

Consequence (Natural and Human-Made Disasters) =

Critical Infrastructure (Total) + Population Density + Socioeconomic Status (SVI Theme 1 Score) + Household Characteristics (SVI Theme 2 Score) + Housing and Transportation Characteristics (SVI Theme 4 Score) + Total Property Value – NRI Community Resilience Rating

Table 59: Consequence of Natural and Human-Made Disasters — Variables and Normalization Methods

Variable	Normalization
Presence of critical infrastructure — total	Rank score
Population density	Rank score
Socioeconomic status (SVI Theme 1)	SVI percent x 10
Household characteristics (SVI Theme 2)	SVI percent x 10
Housing and transportation characteristics (SVI Theme 4)	SVI percent x 10
Total property value	Rank score
NRI community resilience rating	Rank score

The following formula was used to calculate the impact of natural and human-made disasters **(Table 60)**:

Impact (Natural and Human-Made Disasters) = Deployment Score + Commitment Score + Travel Time to Station + NRI Community Resilience Rating

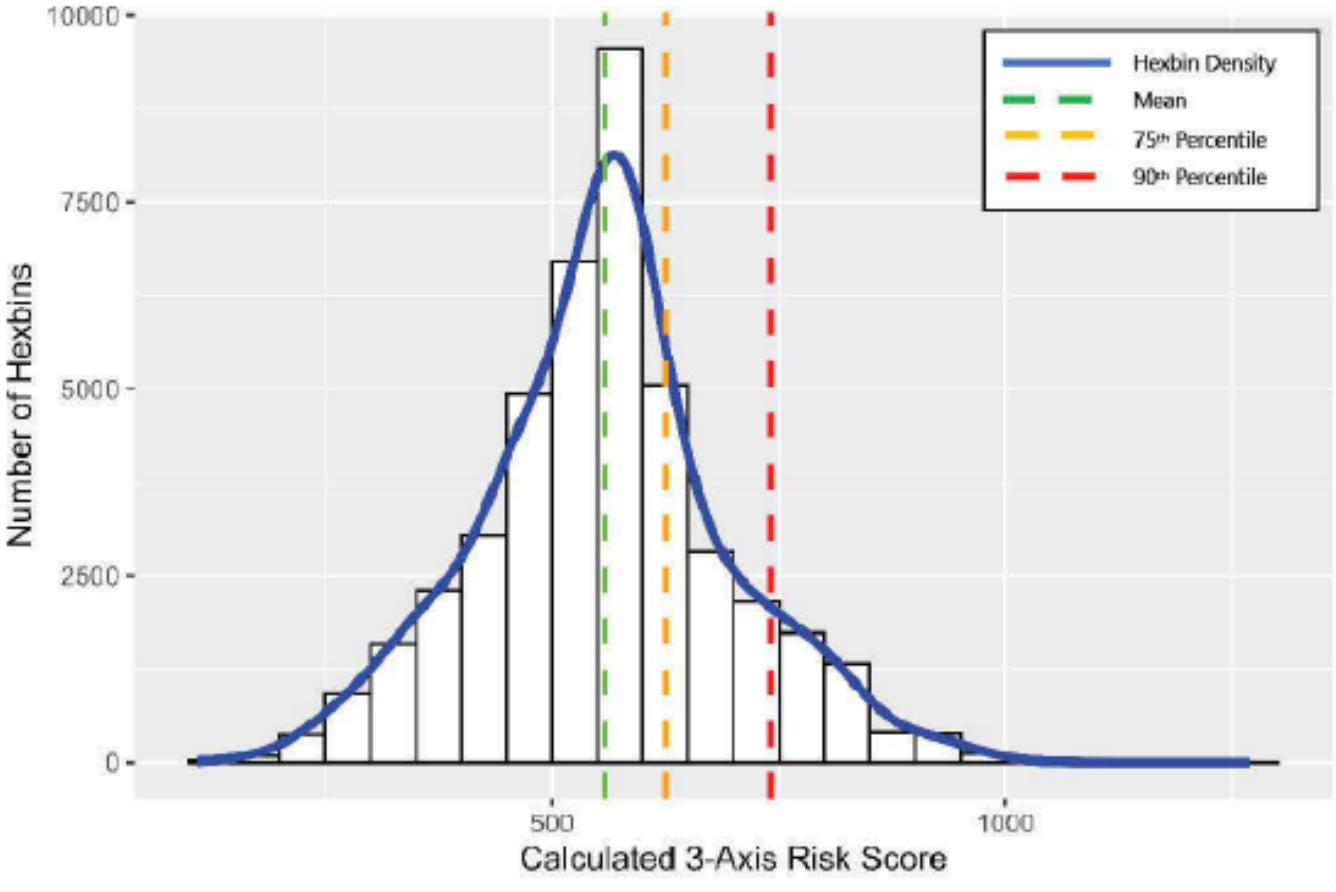
Table 60: Impact of Natural and Human-Made Disasters – Variables and Normalization Methods

Variable	Normalization
Deployment time	Calculated score
Commitment time	Calculated score
Travel time to station	Rank score
NRI community resilience rating	Rank score

ANALYSIS: NATURAL AND HUMAN-MADE DISASTERS

Figure 80 shows the quantified risk scores for natural and human-made disasters throughout the MFRD service area, considering the risk scoring throughout the hexagonal grid cells, not by station area or city.

Figure 80: Distribution of Natural and Human-Made Disaster Risk Scores Histogram, CYs 2021–2025



STATION RESPONSE ZONE SCORES: NATURAL AND HUMAN-MADE DISASTERS

Once each hexagonal grid was scored, the natural and human-made disaster scores were aggregated at the station level to understand the risks by planning zone. Each grid cell in the planning zones contributed to the overall, minimum, maximum, and average scores, as outlined in **Table 61.** Note: It is important to consider the overall distribution of the scored hexbins from **Figure 80** when reviewing the tabular data.

Table 61: Natural and Human-Made Disasters: Three-Axis Risk Score by Station and Planning Zone, CYs 2021–2025

Station Number	Planning Zone	Three-Axis Score Min	Three-Axis Score Max	Three-Axis Score Average	Overall Risk Category
100	100B	317.5	871.4	676.7	High
100	100C	318.2	685.7	438.3	Low
100	100D	239.9	775.1	524.3	Low
100	100E	325.8	853.5	549.4	Low
100	100F	213.7	566.6	398.9	Low
100	100G	279.4	872.3	548.5	Low
100	100H	344.0	819.4	553.7	Low
107	107A	190.9	844.3	448.9	Low
107	107B	191.4	617.6	362.6	Low
107	107C	127.2	649.7	321.7	Low
107	107D	359.7	738.9	551.7	Low
107	107E	109.6	943.1	362.1	Low
107	107F	152.9	698.3	473.6	Low
107	107G	152.5	646.6	327.7	Low
107	107H	209.8	746.2	555.7	Low
107	107I	138.0	736.4	508.6	Low
19	19A	288.2	1068.6	716.8	High
19	19B	332.9	1268.1	760.2	Maximum
19	19C	353.5	878.4	588.2	Moderate
19	19D	417.8	756.8	597.7	Moderate
19	19F	411.0	884.1	585.1	Moderate
19	19G	474.3	905.7	671.7	High
70	70A	472.8	1089.9	696.4	High
70	70B	307.8	876.8	509.3	Low
70	70C	291.2	1093.6	736.7	High
70	70D	366.1	924.0	604.8	Moderate
70	70E	397.8	790.2	569.3	Moderate
70	70F	544.7	973.8	755.7	Maximum
70	70G	427.8	861.2	622.0	Moderate
70	70H	332.3	669.7	430.3	Low
70	70I	341.7	797.2	484.7	Low
70	70J	526.1	943.6	722.3	High
84	84A	296.9	666.0	464.8	Low
84	84B	302.0	786.5	563.7	Moderate
84	84C	398.8	694.1	526.9	Low
84	84D	394.9	741.6	566.3	Moderate
84	84E	254.0	783.9	447.9	Low
84	84F	316.9	986.3	627.4	High
84	84G	354.2	868.9	574.3	Moderate
84	84H	281.9	842.5	578.3	Moderate
84	84I	273.4	991.6	585.6	Moderate
84	84J	362.6	808.0	588.4	Moderate

RISK CATEGORIZATION: NATURAL AND HUMAN-MADE DISASTERS

Using the distribution of the natural and human-made disaster risk scores throughout the hexbins, the scores by station were categorized into low, moderate, high, and maximum risk, as outlined in **Table 62. Figure 81** presents the overall natural and human-made disaster risk scores for MFRD, and **Figure 82** shows the natural and human-made disaster risk scores by category.

Table 62: Natural and Human-Made Disaster Risk Score Categories

Risk Category	Description	Risk Score Range
Low	Less than average	109.6 – 558.3
Moderate	Average to 75th percentile	558.3 – 625.8
High	75th to 90th percentile	625.8 – 741.7
Maximum	Over 90th percentile	741.7 – 1268.1

Figure 81: Natural and Human-Made Disaster Risk Scores, CYs 2021–2025

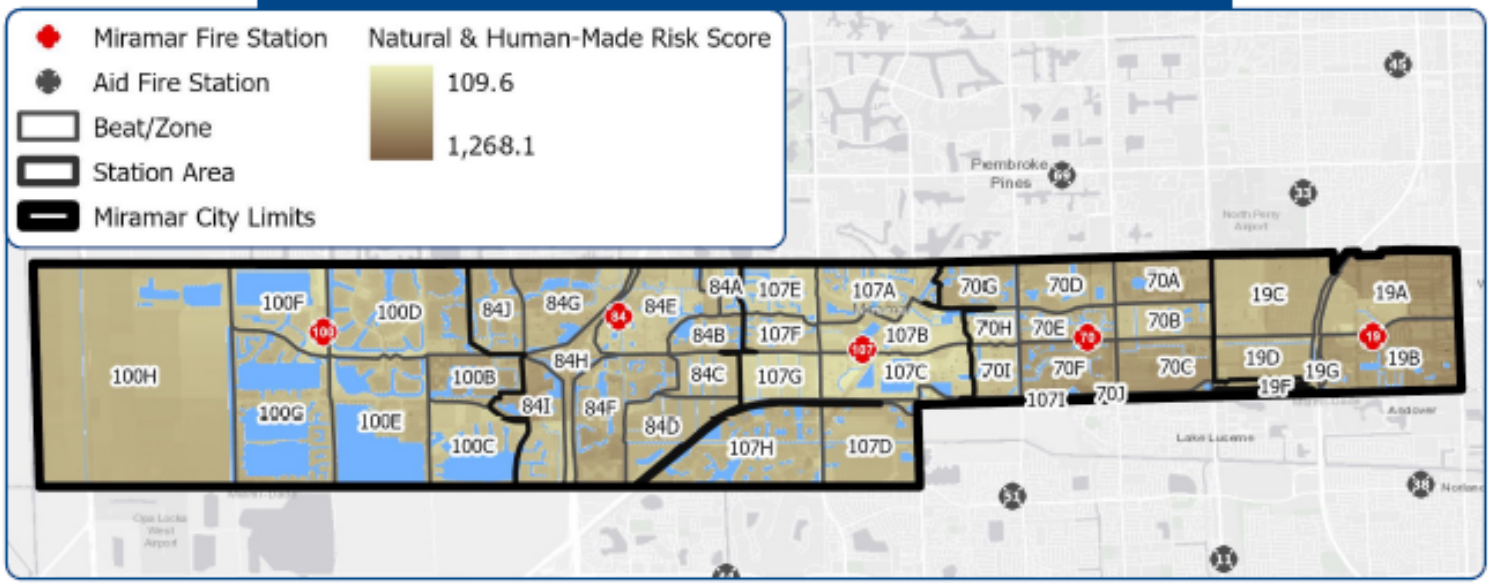
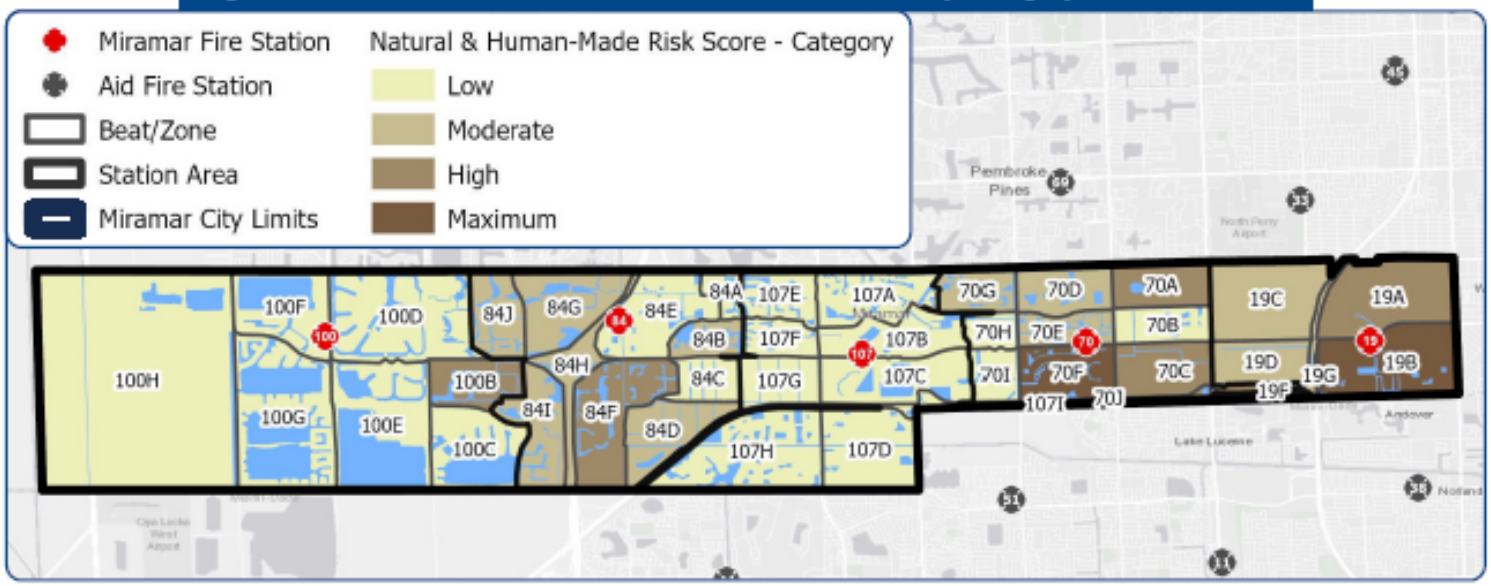


Figure 82: Natural and Human-Made Disaster Risk Scores by Category, CYs 2021–2025



The Community Risk Assessment is intended to support deployment more than emergency response. Its findings also provide a data-driven basis for prioritizing prevention, preparedness, public education, code enforcement, emergency management, and other community risk-reduction activities. The quantitative risk results identify where specific hazards are concentrated, which populations and occupancies could be disproportionately affected, and which community conditions could increase the probability, consequence, or organizational impact of an emergency.

Structure fire risk is concentrated primarily in developed areas containing residential, commercial, institutional, and other occupied properties. These findings support continued inspection, code enforcement, fire investigation, smoke alarm, public education, and pre-incident planning activities, with particular attention given to multifamily residential properties, high-occupancy facilities, healthcare occupancies, older development areas, and locations exhibiting recurring fire activity. Fire prevention and community outreach efforts should be periodically compared with the geographic distribution of structure fire risk to determine whether existing programs are reaching the locations and populations with the greatest identified need.

Emergency medical service risk is broadly distributed throughout the developed portions of Miramar but is most concentrated in areas with greater population density, recurring historical EMS activity, healthcare occupancies, older adults, and other populations that can experience increased medical vulnerability. These findings support continued community CPR and automated external defibrillator education, injury-prevention activities, senior outreach, fall-prevention efforts, and evaluation of recurring EMS system use. As EMS demand changes, the Department should use the CRA findings with unit workload, transport activity, hospital turnaround time, and response reliability data to evaluate whether additional prevention, referral, or alternative service-delivery strategies are warranted.

Technical rescue risk is associated with transportation corridors, developed areas, recreational locations, water features, construction activity, and occupancies or infrastructure that could generate vehicle extrication, machinery, structural collapse, confined-space, rope rescue, or related incidents. The findings support continued development of the Department's technical rescue capability, pre-incident identification of target hazards, regional training and mutual-aid coordination, and periodic evaluation of whether specialized personnel and equipment remain appropriate for the identified risk.

Hazardous materials risk is concentrated near regulated facilities, transportation corridors, commercial and industrial properties, utility infrastructure, and locations where hazardous substances are stored, used, processed, or transported. These findings support continued facility inspections, hazardous materials inventory review, pre-incident planning, responder training, regional team coordination, and periodic validation of specialized response capabilities. Facilities with the greatest potential life-safety, environmental, economic, or operational consequences should receive priority consideration for planning and interagency coordination.

Wildland and non-structure fire risk is influenced by vegetation, open space, transportation activity, land use, drought, lightning, and the interface between developed and undeveloped properties. These findings support continued vegetation management, public education, access evaluation, water-supply planning, and coordination with property owners and regional response partners. Locations where development interfaces with wetlands, open space, or vegetated areas should be periodically reviewed as land use and environmental conditions change.

Natural and human-made disaster risk is influenced by hurricanes, flooding, severe weather, critical infrastructure, social vulnerability, transportation limitations, and community resilience. These findings support emergency planning, continuity of operations, public preparedness education, evacuation planning, shelter coordination, infrastructure protection, and interagency exercises. Areas with lower community resilience or higher social vulnerability might require additional communication, preparedness, transportation, healthcare, or recovery support before, during, and after a major emergency.

MFRD should incorporate the results of this CRA into the annual evaluation of community risk-reduction programs. Each program should be reviewed to determine whether it addresses an identified risk, reaches the appropriate geographic areas or populations, includes measurable objectives, and produces results that can be evaluated over time. This process will help ensure that prevention and preparedness resources remain aligned with documented community conditions and that changes in risk are reflected in future program priorities.

Community Risk Assessment Conclusion

The Miramar Community Risk Assessment establishes a comprehensive, repeatable, and data-driven evaluation of the hazards, vulnerabilities, and operational conditions that influence emergency service delivery throughout the city. The analysis integrates historical incidents, population and demographic characteristics, social vulnerability, land use, property values, critical infrastructure, natural hazards, fire protection features, travel conditions, water supply, resource commitment, deployment requirements, and community resilience within a three-axis framework based on probability, consequence, and impact.

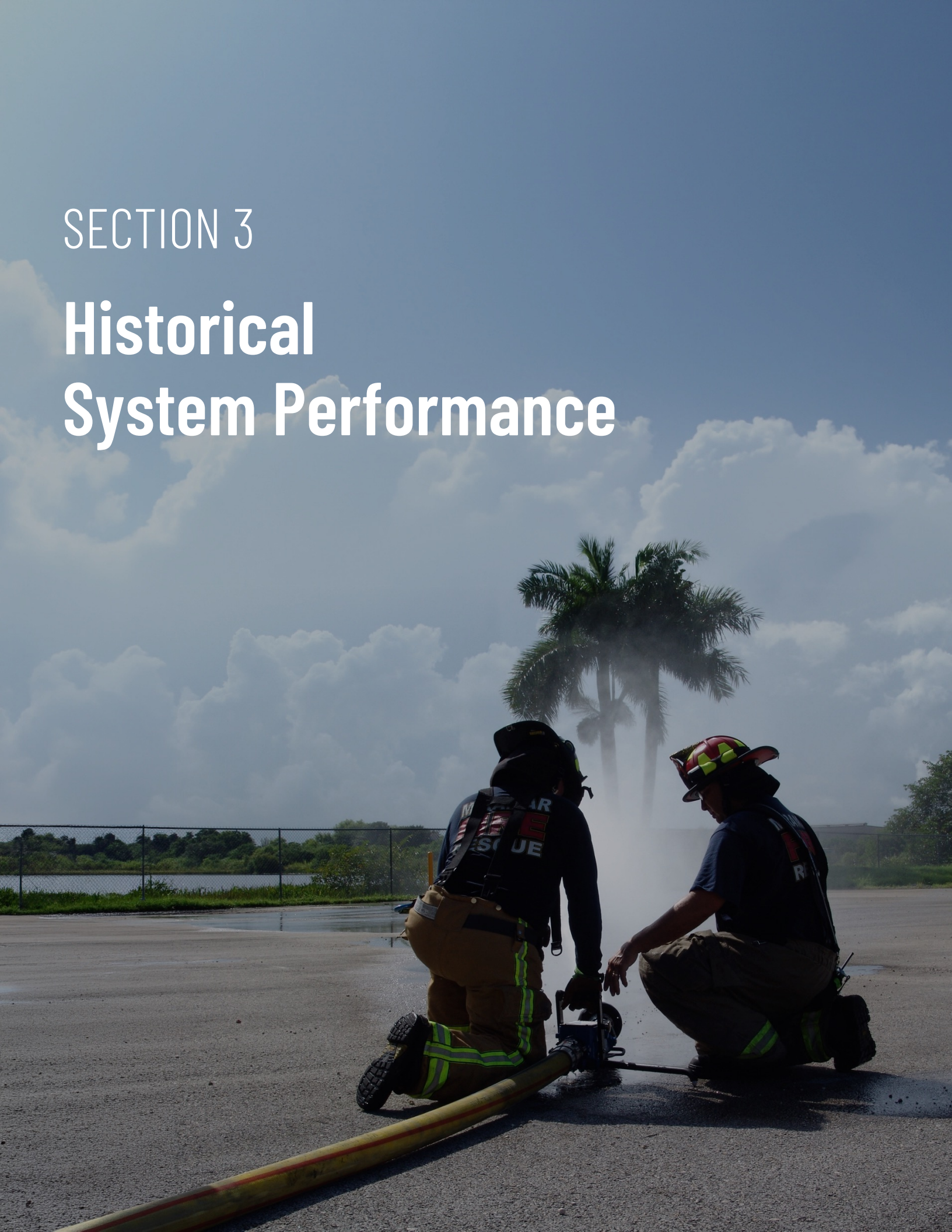
The results demonstrate that community risk is not distributed uniformly throughout Miramar. Structure fire, emergency medical, hazardous materials, technical rescue, wildland, non-structure fire, and disaster risks each exhibit distinct geographic patterns and contributing conditions. Developed areas with greater population, occupancy, transportation, and infrastructure concentrations generally produce the greatest recurring service demand, while lower-frequency hazards can create substantial consequences and operational requirements in other portions of the jurisdiction.

The CRA also demonstrates that historical incident frequency alone does not fully describe community risk. Locations with limited previous activity can contain vulnerable populations, critical infrastructure, hazardous occupancies, environmental exposure, access constraints, or emerging development that materially affect future service needs. The use of multiple geographic and organizational variables allows MFRD to evaluate both documented demand and the conditions that could influence future incidents and consequences.

Findings from this assessment provide the foundation for the Standards of Cover, including evaluation of resource distribution and concentration, critical task requirements, Effective Response Force objectives, Standards of Response Performance, community risk-reduction priorities, and future deployment decisions. The CRA should be considered together with historical system performance, professional judgment, stakeholder expectations, fiscal conditions, and applicable laws and standards when evaluating changes to staffing, stations, apparatus, specialized capabilities, prevention programs, training, or capital investment.

SECTION 3

Historical System Performance



Historical System Performance Review

This section evaluates historical emergency response performance within the MFRD service area and establishes the operational foundation for deployment analysis, standards of response performance (SORP), and future system planning. Historical incident and unit response data provide an objective assessment of the agency's service demand, workload distribution, resource utilization, response reliability, and overall system effectiveness.

The analysis supports the CRA by identifying historical response patterns, validating deployment assumptions, and evaluating the Department's ability to deliver services consistent with community expectations and adopted performance objectives. The results will assist MFRD in understanding current operational performance, identifying opportunities for improvement, and establishing a baseline for continuous evaluation and future decision-making.

Historical incident and response data from January 1, 2021, through December 31, 2025, were analyzed as part of this assessment. Data were obtained from the Department's RMS and the regional CAD system. To maintain consistency with industry practices and accreditation methodologies, the analysis primarily focuses on emergency incidents that required a Code 3 response and occurred within the legally defined MFRD service area.

The analysis establishes a baseline understanding of community service demand, emergency response workload, geographic distribution of incidents, and overall system performance. The results support evaluation of deployment strategies, identification of operational strengths and gaps, and development of future service delivery and resource allocation strategies.

DATA METHODOLOGY AND ANALYTICAL APPROACH

Emergency response performance was evaluated using statistical methods that are commonly accepted in the fire service, including categorization, percentile analysis, trend analysis, and geographic distribution modeling. Consistent with CFAI guidance and NFPA performance measurement practices, response performance is reported primarily at the 90th percentile.

Emergency response systems operate in highly dynamic environments that are influenced by numerous factors, including call-processing procedures, staffing levels, turnout performance, traffic conditions, weather, resource availability, concurrent incidents, and geographic constraints. Because these factors often create skewed distributions, average response times alone might not accurately represent actual system performance. Percentile-based analysis provides a more representative evaluation by measuring performance across both routine and high-demand operational conditions.

This methodology supports a disciplined and defensible evaluation of deployment effectiveness, while recognizing that statistical analysis must be interpreted within the context of operational realities, professional judgment, and community expectations.

Statistics Discussion

Emergency response is a complex operational process that is influenced by numerous interconnected factors. Accordingly, mathematical and technological analyses must be interpreted carefully and within an appropriate operational context. Historical examples within the fire service have demonstrated that incomplete and improperly interpreted data analyses can result in deployment decisions that do not adequately reflect community risk or operational context.

This assessment was designed to quantify and evaluate available performance data to better understand historical system behavior and operational trends. Although statistical analysis provides valuable insights into performance patterns and the effectiveness of resource deployment, it should not serve as the sole basis for organizational and

policy decisions. Effective performance evaluation requires integration of data-driven analysis, operational experience, professional judgment, and local community context.

Data Validation and Threshold Parameters

To improve the reliability and consistency of the analysis, threshold parameters were applied to call processing, turnout, and travel time data. These thresholds were established to identify and remove records that contain incomplete time stamps, system anomalies, delayed status changes, data-entry errors, and other conditions that do not accurately reflect typical emergency response operations.

Lower thresholds were established at:

- 5 seconds for call-processing time
- 5 seconds for turnout time
- 10 seconds for travel time

Upper thresholds were established at:

- 300 seconds for call-processing time
- 240 seconds for turnout time
- 1,200 seconds for travel time

Records that fell outside these threshold parameters were excluded from response-time performance calculations to improve data consistency and eliminate anomalies that could distort system performance results. Less than 3% of records fell outside the established thresholds, limiting the effect of the exclusions on overall performance results.

The majority of incidents that fell outside of the thresholds involved multi-unit fire responses and effective response force (ERF) calculations. A review of the CAD data indicates that MFRD frequently dispatches additional resources after an initial assignment. This appears to occur when information obtained during the ProQA EMD process or from subsequent caller updates indicates that a more significant event might be developing. In these situations, additional units are dispatched after the initial call-processing and alerting sequence has begun, resulting in response times that deviate from the performance analysis thresholds.

As a result, 24 incidents were excluded from the moderate risk ERF analysis because one or more required resources were added after the established upper threshold was exceeded. The number of excluded incidents for the remaining ERF risk categories was substantially lower. Although these exclusions reduced the sample size for some ERF analyses, overall, they helped ensure that the performance calculations more accurately reflected the Department's initial response capabilities and deployment model rather than later modifications to the response assignment.

90th Percentile

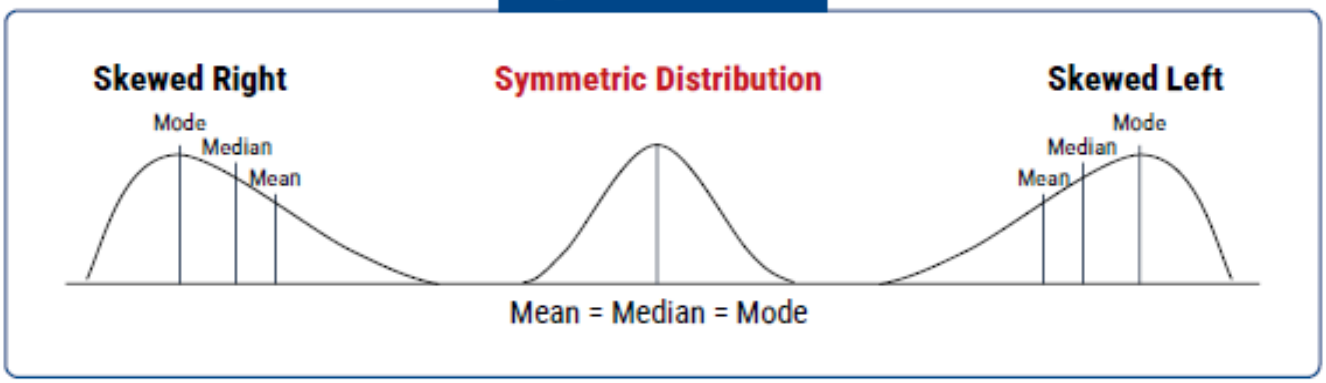
The time-based performance measures in this report are presented using the 90th percentile methodology. Although a detailed mathematical explanation of this methodology is beyond the scope of this document, the use of the 90th percentile is well established within the fire service and emergency response professions.

The primary reason for utilizing the 90th percentile is consistency with nationally recognized standards, accreditation methodologies, and industry best practices. Fire departments that evaluate operational performance against recognized benchmarks or peer agencies must utilize percentile-based measurements to ensure comparability and consistency. NFPA standards rely on the 90th percentile for response-time reporting, and CFAI accreditation processes similarly require that performance measures be evaluated using percentile methodologies.

From a statistical perspective, the 90th percentile provides a more accurate and operationally meaningful representation of emergency response system performance than average values alone. Emergency response data

are typically skewed rather than normally distributed; thus, averages can either overstate or understate actual operational performance. Percentile-based measurements reduce these distortions and provide a more accurate representation of how a system performs under real-world operating conditions. **Figure 83** illustrates a generalized example of data skew.

Figure 83: Data Skew



In a symmetric distribution, the mean, median, and mode are equal. When a distribution is skewed, these measures diverge. In a left-skewed distribution, using the average would underrepresent the majority of responses. In a skewed-right distribution, the average would overrepresent performance. Percentile-based measures reduce these distortions and provide a more accurate reflection of operational performance.

Performance Measures

Historical performance data were evaluated across all response areas served, with comparisons made among differing response environments. The evaluation included the following performance components:

- Unique incidents
- Unit commitments
- Call-processing times
- Turnout times
- Travel times
- Response times (dispatch to arrival time)
- On-scene times
- Total response times (inclusive of call processing through arrival time)
- Committed times

Performance was further evaluated by station area, jurisdiction served, time of day, day of week, month of year, and incident type. MFRD reviewed all historical incident data to support this assessment.

SERVICE DEMAND AND INCIDENT DISTRIBUTION

The analysis of service demand included overall incident volume, response priorities, incident types, geographic distribution, and temporal demand patterns throughout the study period. Incident activity was reviewed annually and by station response area to identify operational trends and concentrations of service demand throughout the community.

The analysis reveals that overall service demand remained relatively stable during the five-year study period, with only moderate year-to-year variation. Emergency medical incidents represented the dominant category of service demand, accounting for more than two-thirds of all emergency responses. Although fire incidents occurred less frequently, they remained high-risk, resource-intensive events that required sustained deployment capability and effective response performance.

Temporal analysis identified predictable demand patterns by time of day and day of week, demonstrating that service demand was generally highest during daytime and early evening hours. These findings support the evaluation of unit workload, resource deployment strategies, system reliability, and operational coverage during peak demand periods.

Volume Analysis

A basic incident volume analysis provides insight into how frequently the MFRD is requested to respond to emergencies and the overall demand on the emergency response system. The evaluation of incident volume is an essential component of deployment analysis, staffing evaluation, workload assessment, and long-term resource planning. Incident frequency directly influences apparatus utilization, unit availability, personnel workload, response reliability, and future service delivery requirements.

The initial analysis examined total incident activity grouped by the primary incident categories identified by NFIRS. Incident categorization allows the Department to evaluate the types of emergencies that occur in the community and identify trends in fire incidents, EMS, HazMat conditions, rescues, service calls, false alarms, and other response activities. Grouping incidents by NFIRS categories also allows for comparison with regional and national fire service data and assists with accreditation and performance reporting requirements.

To ensure the accuracy of the jurisdictional analysis, incident locations were validated by comparing geocoded incident information with the legally defined geographic boundaries of the MFRD service area. This process ensured that only incidents occurring within the Department's designated response jurisdiction were included in the analysis. Accurate geographic validation is critical for evaluating service demand, station workload, response distribution, deployment effectiveness, and future planning considerations.

For purposes of this report, a "unique incident" is defined using NFIRS terminology as a distinct incident number assigned to an event attended by the fire department, ensuring that no two incidents within the same calendar year are assigned the same identifying number. Within MFRD operational terminology, "unique incident" is synonymous with the Department's use of "call." Each incident may involve the response of one or more apparatus and units, depending on the nature and complexity of the emergency.

As shown in **Tables 63 through 65,** MFRD's overall service demand remained generally stable, with a modest increase over the five-year study period. Unique incidents increased from 13,469 in calendar year (CY) 2021 to 14,180 in (CY) 2025, a 5.3% increase over the five years. **Table 65** shows that unit commitments remained comparatively stable, ranging from 21,921 to 22,223 annually. The relationship between unique incidents and unit commitments is important because a single incident can require multiple units, and unit commitments more accurately represent total system workload.

Similarly, the City of Miramar experienced modest population growth during the same time frame. The city's population increased by approximately 3.82% over the five years, with an average annual growth rate of 0.94%. This relatively slow rate of population growth contributed to the minimal increase in overall service demand experienced by MFRD.

Table 63: Miramar Fire-Rescue Department Total Incidents, CYs 2021–2025

2021	2022	2023	2024	2025	TOTAL
13,469	13,646	13,981	14,172	14,180	**69,448**

Table 64: Miramar Fire-Rescue Department Total Incidents and Jurisdiction, CYs 2021–2025

Jurisdiction	2021	2022	2023	2024	2025	TOTAL
Miramar	13,389	13,446	13,243	13,552	13,506	**67,136**
Pembroke Pines	57	124	448	363	404	**1,396**
West Park	7	16	128	134	150	**435**
Hollywood	6	47	152	104	111	**420**
Pembroke Park	3	7	7	9	3	**29**
Davie	4	2	3	7	6	**22**
Hallandale Beach	1	3	0	2	0	**6**
Margate	1	0	0	1	0	**2**
Aventura	0	1	0	0	0	**1**
Sunrise	1	0	0	0	0	**1**
TOTAL	13,469	13,646	13,981	14,172	14,180	**69,448**

Table 65: Miramar Fire-Rescue Department Total Incidents and Unit Commitments, CYs 2021–2025

Year	No. Incidents	No. Unit Commitments
2021	13,469	21,935
2022	13,646	22,223
2023	13,981	21,921
2024	14,172	22,147
2025	14,180	22,094
TOTAL	**69,448**	**110,320**

The five-year trend shows the system is managing a relatively stable yet slowly growing demand profile. Although overall growth appears moderate, small increases in annual call volume can have significant operational impacts when growth occurs in already busy station areas during peak hours and when rescue units are committed to extended EMS incidents. As a result, incident growth should be evaluated along with concurrency, response reliability, unit-hour utilization (UHU), and ERF assembly performance.

Incident Type Distribution

Table 66 outlines the total number of MFRD incidents by NFIRS code over the five-year period and shows each category's percentage of the total responses.

Table 66: Miramar Fire-Rescue Department Incidents by NFIRS Category/Code, CYs 2021–2025

Category	2021	2022	2023	2024	2025	TOTAL	% of Total
Fire **(100)**	145	123	153	150	131	702	1.0%
Rupture, explosion — no fire **(200)**	10	7	8	2	5	32	0.0%
Medical **(300)**	9,460	9,481	9,718	9,842	10,244	48,745	70.2%
HazMat/Hazardous Condition **(400)**	125	146	123	134	142	670	1.1%
Service call/Other **(500)**	584	767	690	651	689	3,381	4.9%
Canceled/Good Intent **(600)**	2,280	2,220	2,306	2,048	1,805	10,659	15.3%
Alarm **(700)**	842	876	912	981	892	4,503	6.5%
Severe weather or natural disaster **(800)**	4	6	7	3	2	22	0.0%
Special type/Other **(900)**	9	11	6	2	2	30	0.0%
(No NFIRS code/unclassified)	10	9	58	359	268	704	1.0%
TOTAL	**13,469**	**13,646**	**13,981**	**14,172**	**14,180**	**69,448**	**100.0%**

Medical incidents accounted for 48,745 incidents, or approximately 70.2% of the five-year total, confirming that MFRD functions as a fire-rescue agency with a primarily EMS-driven workload. Canceled and good intent incidents accounted for approximately 15.3% of all calls. Although these types of incidents do not always require emergency intervention, they still consume time for call processing, turnout, travel, and unit availability. Fire, HazMat, and severe weather incidents were comparatively infrequent, but they remain important from a risk perspective because they require more complex resource coordination and can produce greater consequences when they occur. Fire incidents accounted for less than 1% of total incidents, but they remain high-risk, low-frequency events that require rapid deployment, adequate staffing, incident command, water supply, search and rescue, ventilation, and coordinated fire attack capability.

Station Area Incident Demand

Station area analysis demonstrates that workload is not evenly distributed across the system. Station 19 responded to the highest number of incidents during the study period, followed by Station 70 and Station 107. This distribution should be considered when evaluating unit reliability, concurrent incident exposure, resource movement, and future deployment alternatives.

Table 67 shows the total number of incidents for each station area over the five-year period.

Table 67: Miramar Fire-Rescue Department Total Incidents by Station Area, including Aid, CYs 2021–2025

Station Area	2021	2022	2023	2024	2025	TOTAL	% of Total
19	4,295	4,208	4,100	4,204	4,119	20,926	30.1%
70	3,321	3,363	3,245	3,170	3,279	16,378	23.6%
107	2,701	2,540	2,694	2,825	2,722	13,482	19.4%
84	1,522	1,672	1,692	1,797	1,924	8,607	12.4%
100	1,550	1,663	1,512	1,556	1,462	7,743	11.2%
Outgoing aid	80	200	738	620	674	2,312	3.3%
TOTAL	**13,469**	**13,646**	**13,981**	**14,172**	**14,180**	**69,448**	**100.0%**

Station 19 responded to 20,926 incidents, or approximately 30.1% of the incident total. Station 70 managed 16,378 incidents, or approximately 23.6%. Combined, these two station areas accounted for more than one-half of the Department's incident demand. This concentration has implications for first-due reliability, unit wear, crew workload, and availability during simultaneous incidents.

Future deployment analysis should evaluate whether the current station and apparatus configuration aligns with the geographic distribution of incidents, population density, future growth, occupancy risk, and response-time performance. Areas with high incident density should be monitored annually to determine whether workload growth is affecting travel time, turnout consistency, rescue availability, or ERF assembly.

Response Priority Distribution

MFRD classifies calls for service into four primary response categories: Priorities 1 through 4. Priority 1 is the highest priority, and Priority 4 is the lowest. These classifications assist the Department and dispatch system in prioritizing incidents, managing resource deployment, and aligning response modes with the reported severity and risks associated with each incident type.

Urgent emergency calls require a Code 3 response, which includes the use of emergency warning devices such as lights and sirens by all responding units. These incidents typically involve situations that pose an immediate threat to life, significant property risk, active fire conditions, serious medical emergencies, hazardous conditions, or other time-sensitive events requiring the rapid deployment of emergency resources. Code 3 responses are intended to reduce response times and improve the Department's ability to intervene quickly during high-risk incidents.

Non-urgent calls require an immediate response by fire department personnel; however, responding units do not utilize lights and sirens while traveling to the incident. These incidents generally involve situations in which a timely response is appropriate, but the reported conditions do not indicate an immediate life-threatening emergency or a significant hazard warranting emergency driving operations. Utilizing nonemergency response modes for appropriate incidents can reduce unnecessary risk to the public and responding personnel, while maintaining effective service delivery.

The other category includes incidents classified as nonemergency service calls that generally do not pose an immediate threat to life or property. Examples include assisting individuals who have fallen and need help getting up when no medical emergency exists, helping residents gain access to locked residences, securing leaking fire hydrants, replacing or assisting with residential smoke detector batteries, and similar public assistance and service-

related calls. Although these incidents are nonemergent in nature, they remain important community service functions that support public safety, customer service, and positive community relations.

Categorizing incidents by response priority and emergency response mode allows MFRD to better evaluate service demand, analyze workload distribution, assess operational risk, and support deployment and operational planning decisions.

Table 68 shows that Priority 2 incidents accounted for the largest share of priority-coded incidents, followed by Priority 3 and Priority 1 incidents. The Department should continue to evaluate whether the response mode associated with each priority level remains aligned with actual risk, patient acuity, incident severity, and responder safety. This analysis is particularly important in systems with high EMS demand, where unnecessary emergency driving can increase risk without improving measurable outcomes.

Table 68: Miramar Fire-Rescue Department Total Incidents by Response Priority, CYs 2021–2025

Response Priority	2021	2022	2023	2024	2025	TOTAL	% of Total
1	3,085	3,019	3,223	3,224	3,175	15,726	22.6%
2	4,745	4,694	4,596	4,697	4,606	23,338	33.6%
3	3,419	3,409	3,611	3,712	3,684	17,835	25.7%
4	2,220	2,524	2,551	2,539	2,715	12,549	18.1%
TOTAL	**13,469**	**13,646**	**13,981**	**14,172**	**14,180**	**69,448**	**100.0%**

Temporal Demand Patterns

Temporal analysis evaluates when incidents occur and helps determine whether workload varies by day of week, hour of day, and/or season. This analysis is important for scheduling nonemergency duties, training, inspections, public education events, station coverage, and administrative work at times that minimize the impact on emergency readiness. The analysis showed that the workload of MFRD units remains relatively consistent throughout the week, as illustrated in Table 69.

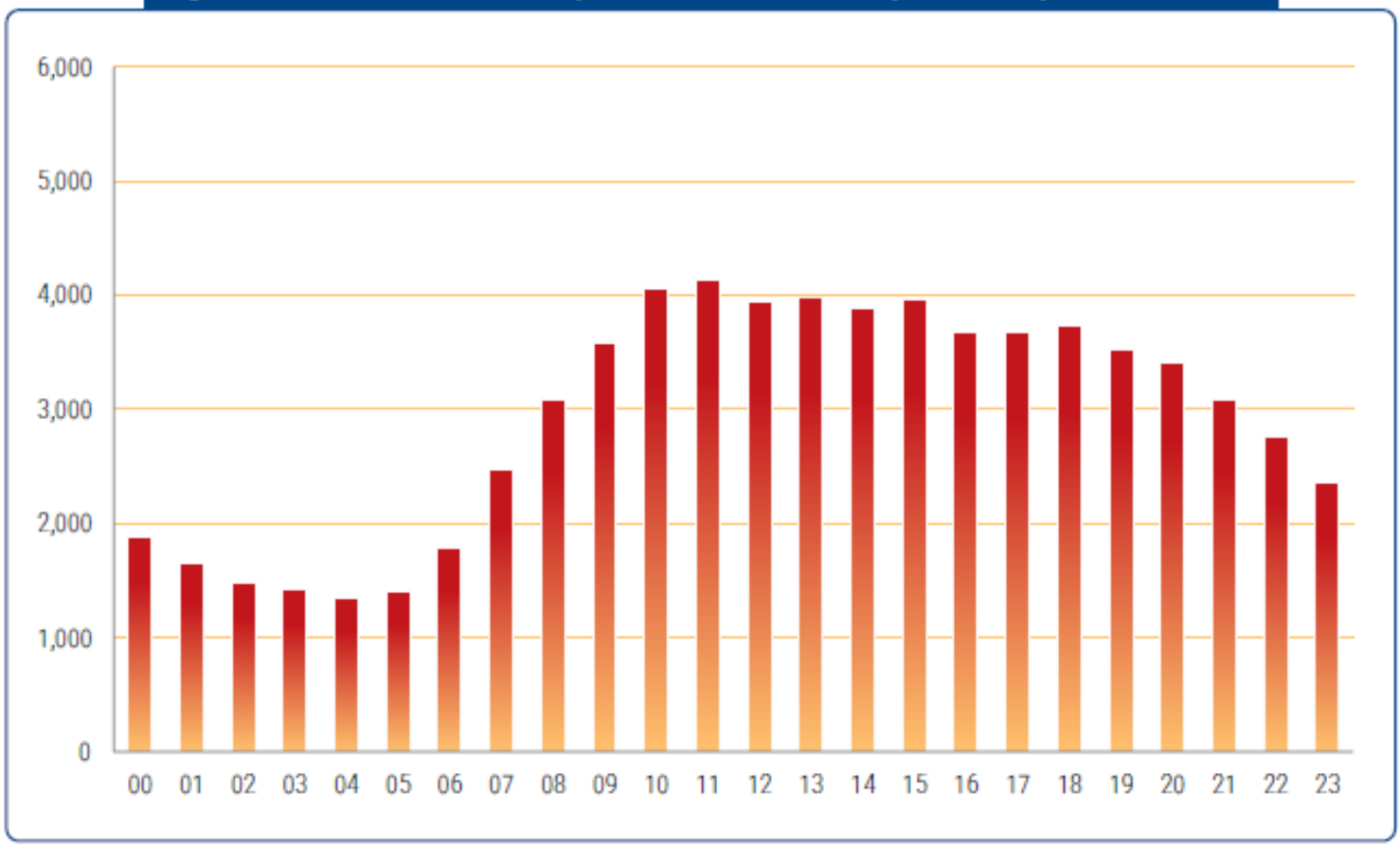
Table 69: Miramar Fire-Rescue Department Total Incidents by Day of Week, CYs 2021–2025

Day of Week	2021	2022	2023	2024	2025	TOTAL
Monday	1,923	2,047	1,959	2,052	2,069	10,050
Tuesday	1,909	1,941	1,992	2,072	2,081	9,995
Wednesday	1,982	1,956	2,015	2,085	2,173	10,211
Thursday	1,959	1,951	2,023	2,071	2,045	10,049
Friday	1,950	1,954	2,038	2,103	2,044	10,089
Saturday	1,890	1,927	2,010	1,892	1,928	9,647
Sunday	1,856	1,870	1,944	1,897	1,840	9,407
TOTAL	**13,469**	**13,646**	**13,981**	**14,172**	**14,180**	**69,448**

Although some variation exists between the number of incidents by day of week, the differences are minimal. Wednesday was the busiest day during the five-year study period, with 10,211 incidents, and Sunday was the least active, with 9,407 incidents. This relatively stable distribution of incidents by day of the week indicates that service demand remains generally consistent throughout the week and does not vary significantly between weekdays and weekends. This pattern suggests that baseline staffing and response capacity must be maintained throughout the week rather than concentrated only on traditional weekday business periods.

Hourly response workload data typically show that fire department activity is higher during daytime hours, which generally corresponds to periods when the community is most active. This trend was observed during the MFRD analysis period. As shown in **Figure 84,** MFRD incident activity began increasing around 7:00 a.m. and reached its initial peak at approximately 11:00 a.m. Incident volume generally remained at elevated levels throughout the day until approximately 9:00 p.m., after which activity declined more rapidly during the evening and overnight hours. This daily workload pattern is consistent with operational trends commonly observed in urban fire departments, where service demand is closely tied to daytime population activity, business operations, traffic volume, and general community movement.

Figure 84: Miramar Fire-Rescue Department Total Incidents by Hour of Day, CYs 2021–2025



These demand patterns should be considered when evaluating unit availability, nonemergency workload scheduling, training windows, inspection scheduling, and move-up or coverage strategies. The temporal profile does not support reductions in baseline response capacity during any day of the week. However, the daytime and early evening patterns support careful scheduling of prevention, training, public education, and administrative activities during windows of time when crews can remain available, but activity can be paused or interrupted as necessary.

UNIT WORKLOAD, UTILIZATION, AND RELIABILITY

A unit-level workload analysis was conducted to evaluate resource utilization, unit availability, operational resiliency, and workload distribution throughout the emergency response system. The analysis provides a more detailed understanding of how individual resources contribute to overall system performance and identifies units experiencing elevated demand that may affect response reliability, deployment effectiveness, and future resource allocation decisions. Unit commitment data differ from incident counts because each responding apparatus is counted separately, providing a more useful measure for evaluating staffing demand, apparatus utilization, firefighter workload, and the probability that a first-due unit will be unavailable for a subsequent incident. Unit commitments were analyzed by apparatus type, station area, and incident classification to determine how frequently resources are engaged and unavailable to respond to additional incidents.

The analysis demonstrated noticeable variability in workload across stations and unit types, reflecting differences in incident density, geographic coverage, deployment patterns, and overall service demand. These findings are important for evaluating the reliability of first-due response coverage and understanding how unit availability can influence response times, travel distances, and overall service consistency throughout the jurisdiction.

Several factors that affect response reliability were identified and documented during the analysis, including unit availability, simultaneous incidents, training activities, apparatus maintenance and mechanical issues, and geographic constraints. Evaluation of these factors provides a more comprehensive understanding of deployment effectiveness and highlights conditions that can contribute to delayed responses, increased reliance on station move-ups, and redistributed coverage from surrounding stations.

Unit Commitment

MFRD deploys fire engines, quint-type ladder trucks capable of pumping water and equipped with aerial ladders, rescue ambulance units, command vehicles, and specialty response apparatus. Many emergency incidents require dispatching multiple response units to effectively manage operational tasks, ensure firefighter safety, and meet incident demands. Table 70 shows the number of unit commitments by NFIRS incident code for each unit during the study period. When multiple units respond to a single emergency incident, each individual unit response is counted as a separate unit commitment. As a result, total unit commitments are significantly higher than total incident volume, providing a more accurate representation of actual system workload and resource utilization.

Table 70: Miramar Fire-Rescue Department Total Unit Commitments by NFIRS Category/Code, CYs 2021–2025

Category	2021	2022	2023	2024	2025	TOTAL
Fire (100)	679	565	753	731	554	3,282
Rupture, explosion — no fire (200)	53	26	33	14	19	145
Medical (300)	13,881	14,292	14,393	14,511	15,055	72,132
HazMat/Hazardous Condition (400)	374	428	321	413	389	1,925
Service call/Other (500)	933	1,144	1,004	977	1,055	5,113
Canceled/Good Intent (600)	4,172	3,879	3,711	3,204	2,981	17,947
Alarm (700)	1,804	1,858	1,609	1,705	1,530	8,506
Severe weather or natural disaster (800)	10	7	8	9	3	37
Special type/Other (900)	12	11	6	2	2	33
(No NFIRS code/unclassified)	17	13	83	581	506	1,200
TOTAL	**21,935**	**22,223**	**21,921**	**22,147**	**22,094**	**110,320**

Table 71 shows the number of unit commitments by station area for the five-year period.

Table 71: Miramar Fire-Rescue Department Total Unit Commitments by Station Area, CYs 2021–2025

Station Area	2021	2022	2023	2024	2025	TOTAL	% of Total
19	6,949	6,897	6,483	6,504	6,396	33,229	30.1%
70	5,388	5,451	5,192	4,878	5,005	25,914	23.5%
107	4,505	4,262	4,409	4,836	4,521	22,533	20.4%
84	2,579	2,821	2,831	3,043	3,206	14,480	13.1%
100	2,368	2,523	2,169	2,175	2,217	11,452	10.4%
Outgoing aid	146	269	837	711	749	2,712	2.5%
TOTAL	**21,935**	**22,223**	**21,921**	**22,147**	**22,094**	**110,320**	**100.0%**

Station 19 accounted for 33,229 dispatches, or approximately 30.1% of all unit commitments. Station 70 accounted for 25,914 dispatches, or approximately 23.5%. This data mirrors the incident demand analysis and reinforces the finding that workload is concentrated in the eastern and central portions of the city. Workload concentration is not inherently a problem, but it must be monitored; high-volume areas are more likely to experience first-due unit unavailability and increased reliance on adjacent companies.

Table 72 shows the unit commitments by apparatus, and **Table 73** shows the unit commitments by apparatus type.

Table 72: Miramar Fire-Rescue Department Total Unit Commitments by Apparatus, CYs 2021–2025

Unit	2021	2022	2023	2024	2025	TOTAL	% of Total
BC19	464	449	419	458	460	2,250	2.04%
BC84	405	376	370	461	442	2,054	1.86%
E19	2,263	2,341	2,335	2,358	2,298	11,595	10.51%
E70/Q70	2,517	2,704	2,602	2,519	2,525	12,867	11.66%
E84/Q84	1,494	1,526	1,362	1,449	1,463	7,294	6.61%
E100	991	1,098	969	1,040	997	5,095	4.62%
E107	2,048	2,023	2,062	2,027	1,984	10,144	9.20%
R19	3,353	3,220	3,177	3,292	3,277	16,319	14.79%
R70	3,066	3,074	3,055	3,019	3,040	15,254	13.83%
R84	1,545	1,632	1,673	1,656	1,769	8,275	7.50%
R100	1,336	1,431	1,366	1,384	1,307	6,824	6.19%
R107	2,453	2,349	2,531	2,484	2,532	12,349	11.19%
TOTAL	**21,935**	**22,223**	**21,921**	**22,147**	**22,094**	**110,320**	**100.00%**

Table 73: Miramar Fire-Rescue Department Total Unit Commitments by Unit Type, CYs 2021–2025

Unit Type	2021	2022	2023	2024	2025	TOTAL
Engines/Quints	9,311	9,692	9,330	9,387	9,258	46,978
Ambulances	11,743	11,704	11,802	11,829	11,917	58,995
Combined	**21,054**	**21,396**	**21,132**	**21,216**	**21,175**	**105,973**

Rescue 19, Rescue 70, Rescue 107, Engine 19, and Quint 70 were among the most frequently dispatched units in the system. This distribution is consistent with the Department's EMS-dominant workload and station area demand patterns. Unit dispatch frequency should be evaluated along with committed time, as two units can have similar dispatch counts yet materially different impacts on workload, depending on incident duration, transport activity, and return-to-service time.

Reliability of First-Due Response

When evaluating emergency response performance, it is important to measure how consistently the expected first-due resource arrives first within its assigned response area. Several operational factors can prevent this from occurring, but most situations generally fall into one of the following categories:

- The unit is out of position and is not the closest available resource by travel distance.

For example, a unit might be operating on the opposite side of its first-due area, attending training, completing inspections, or returning from another activity when an incident occurs. In these situations, a unit from an adjacent response area might be geographically closer and therefore dispatched first, resulting in that unit arriving on scene before the assigned first-due company.

MFRD utilizes a GPS-based AVL dispatch system to identify and dispatch the closest available unit at the time of the incident. MFRD personnel are generally expected to remain in service while traveling to and from training, maintenance activities, public education events, and other assignments. As units travel throughout the city, they can be temporarily positioned closer to incidents outside their normal first-due area, resulting in dynamic response patterns.

- The unit is already assigned to another incident.

Concurrent incidents are a common operational challenge within fire and emergency medical systems. When a first-due unit is committed to another emergency, dispatch must assign the next closest available resource to maintain service continuity.

- The unit is temporarily out of service.

Apparatus can be unavailable due to mechanical issues, scheduled maintenance, equipment problems, and staffing limitations. In some cases, ambulance or rescue personnel are temporarily unavailable while completing patient transfers or returning from hospitals, reducing the availability of immediate response.

- The responding unit is impeded or diverted during response operations.

Units can encounter delays caused by railroad crossings, traffic congestion, roadway obstructions, and other physical barriers. On rare occasions, responding apparatus are involved in traffic collisions or other unexpected events that interrupt response operations.

The reliability with which station crews respond within their assigned first-due areas is critically important from both operational and performance standpoints. When first-due companies are unavailable, neighboring stations must cover incidents outside their normal response zones, which can increase travel times and reduce overall system resiliency. This issue becomes even more significant during working fires and other large-scale incidents that require multiple units from several stations to operate simultaneously.

Managing these operational variables requires continuous situational awareness, effective deployment planning, and active resource management to maintain consistent emergency response coverage throughout the jurisdiction.

Resource Reliability

This section evaluates MFRD workload at the individual unit level rather than from the broader department-wide perspective to provide additional insight into apparatus utilization, operational stress, and the demands placed on firefighters and emergency response resources.

As described above, emergency response units are most effective when available within their assigned first-due areas. When a unit is already committed to another incident, a new emergency requires another resource to respond from farther away, often resulting in longer travel times and reduced response reliability. As unit commitments increase, system resiliency and first-due coverage can become more difficult to maintain, particularly during periods of high call volume and concurrent incidents.

Unit hour utilization (UHU) is a commonly used measure of workload that represents the percentage of time a unit is unavailable for additional responses due to its commitment to an incident during a calendar year. This measurement provides valuable insight into how heavily individual units are utilized and how frequently they are unavailable to respond to additional emergencies.

Generally, the higher the UHU percentage, the greater the operational workload and the less available the unit is for subsequent incidents. Elevated UHU levels can contribute to increased reliance on neighboring stations, longer travel distances, and higher probabilities of concurrent incident responses.

It is important to note that this analysis measures only the time associated with emergency incident responses in the dataset. It does not include other daily operational activities, such as training, inspections, station duties, equipment maintenance, public education, administrative responsibilities, or other workload demands placed on personnel unrelated to incidents.

Table 74 lists the total number of hours each unit was committed to emergency incidents during the study period.

Table 74: Total Commitment Times of Miramar Fire-Rescue Department Units, in Hours:Minutes:Seconds, CYs 2021–2025

Unit	2021	2022	2023	2024	2025	Average	TOTAL
R19	1812:10:08	1819:56:42	1993:03:47	2064:42:19	2170:18:51	1972:02:21	9860:11:47
R70	1587:00:48	1611:01:37	1971:33:52	1854:27:41	1862:01:07	1777:13:01	8886:05:05
R107	1291:18:02	1371:45:46	1576:38:30	1501:43:10	1483:54:58	1445:04:05	7225:20:26
E19	616:34:39	601:26:44	658:04:30	634:29:11	647:15:19	631:34:05	3157:50:23
Q70	537:13:03	555:23:57	324:47:34	487:44:34	620:13:42	505:04:34	2525:22:50
E107	529:49:23	535:33:36	563:16:31	587:36:37	596:16:37	562:30:33	2812:32:44
R84	845:11:27	902:38:46	972:38:51	952:44:25	1098:03:58	954:15:29	4771:17:27
R100	807:30:54	866:46:55	863:05:26	851:09:49	817:12:35	841:09:08	4205:45:39
E100	242:05:21	240:56:05	245:51:59	252:05:17	251:05:41	246:24:53	1232:04:23
E84	146:18:39	198:19:22	170:35:13	270:14:07	342:06:51	225:30:50	1127:34:12
Q84	176:44:22	162:31:15	179:14:21	125:48:43	50:19:31	138:55:38	694:38:12
E70	36:57:14	78:49:13	329:55:45	145:43:25	34:07:41	125:06:40	625:33:18
BC19	103:03:16	110:24:54	130:05:15	141:27:37	162:24:18	129:29:04	647:25:20
BC84	114:52:54	109:32:36	129:34:31	150:30:47	151:33:28	131:12:51	656:04:16
TOTAL	**8846:50:10**	**9165:07:28**	**10108:26:05**	**10020:27:42**	**10286:54:37**	**9685:33:12**	**48427:46:02**

The highest commitment burdens in 2025 were associated with Rescue 19, Rescue 70, and Rescue 107. Rescue 19 was committed for approximately 2,170 hours, equivalent to an incident-based UHU of approximately 24.8%, when measured against a single, continuously staffed unit year. Rescue 70 was committed for approximately 1,862 hours, and Rescue 107 was committed for approximately 1,483 hours. These values reflect incident commitment only and do not include training, inspections, station duties, equipment checks, public education, and other daily workload.

Figure 85 illustrates total commitment hours by unit type, and **Table 75** shows unit hour utilization percentages by unit.

Figure 85: Miramar Fire-Rescue Department Commitment Hours by Unit Type, CYs 2021–2025

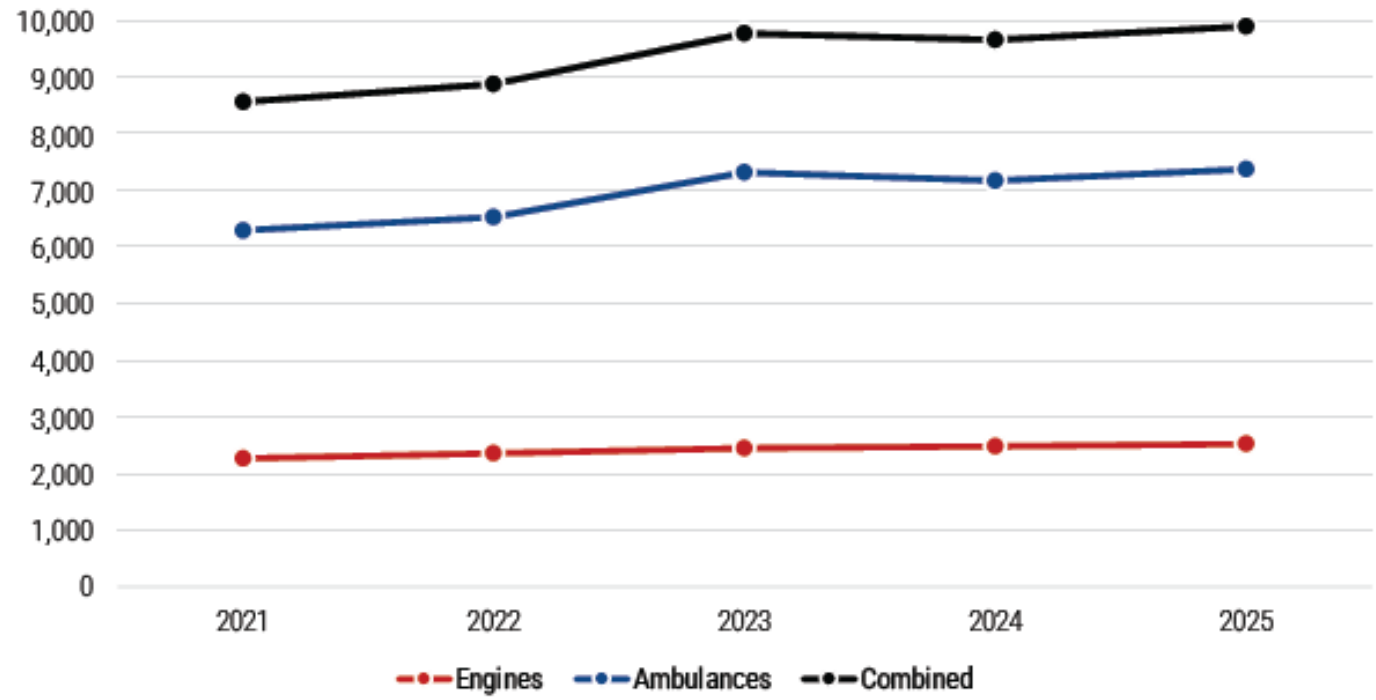


Table 75: Miramar Fire-Rescue Department Unit Hour Utilization Percentage by Unit, CYs 2021–2025

Unit	2021	2022	2023	2024	2025	TOTAL
BC19	1.2%	1.3%	1.5%	1.6%	1.9%	1.5%
BC84	1.3%	1.3%	1.5%	1.7%	1.7%	1.5%
E19	7.0%	6.9%	7.5%	7.2%	7.4%	7.2%
E70/Q70	6.6%	7.2%	7.5%	7.2%	7.5%	7.2%
E84/Q84	3.7%	4.1%	4.0%	4.5%	4.5%	4.2%
E100	2.8%	2.8%	2.8%	2.9%	2.9%	2.8%
E107	6.0%	6.1%	6.4%	6.7%	6.8%	6.4%
R19	20.7%	20.8%	22.8%	23.5%	24.8%	22.5%
R70	18.1%	18.4%	22.5%	21.1%	21.3%	20.3%
R84	9.6%	10.3%	11.1%	10.8%	12.5%	10.9%
R100	9.2%	9.9%	9.9%	9.7%	9.3%	9.6%
R107	14.7%	15.7%	18.0%	17.1%	16.9%	16.5%
Average Percentage	**8.4%**	**8.7%**	**9.6%**	**9.5%**	**9.8%**	**9.2%**

Because MFRD operates ALS transport units, rescue commitment includes not only response and scene times, but also patient transport, hospital transfer of care, and return-to-service time. The Department should continue to monitor rescue availability, hospital turnaround times, transport destination patterns, and periods of simultaneous EMS demand. Over time, these measures can help determine whether peak-demand staffing, dynamic deployment, altered transport procedures, and/or additional EMS resources should be evaluated.

Table 76 outlines the sum of duration by unit type, and **Table 77** shows the mean commitment duration by unit type.

Table 76: Miramar Fire-Rescue Department Sum of Duration by Unit Type, CYs 2021–2025

Unit Type	2021	2022	2023	2024	2025	TOTAL
Engines/Quints	2285:17:42	2373:00:12	2471:45:53	2502:42:25	2540:55:16	12173:41:28
Ambulances	6341:55:44	6572:09:46	7377:00:26	7224:06:54	7429:57:33	34945:10:23
Combined	**8627:13:26**	**8945:09:58**	**9848:46:19**	**9726:49:19**	**9970:52:49**	**47118:51:51**

Table 77: Miramar Fire-Rescue Department Mean Commitment Duration by Unit Type, CYs 2021–2025

Unit Type	2021	2022	2023	2024	2025	TOTAL
Engines/Quints	0:14:44	0:14:41	0:15:54	0:16:00	0:16:28	0:15:33
Ambulances	0:32:24	0:33:42	0:37:30	0:36:39	0:37:25	0:35:32
Combined	**0:24:35**	**0:25:05**	**0:27:58**	**0:27:30**	**0:28:15**	**0:26:41**

Rescue units accounted for the overwhelming majority of total committed time. During the five-year period, rescue units accumulated approximately 34,945 committed hours, compared with 12,173 committed hours for engines and quints. This finding confirms that EMS transport workload is the principal driver of system commitment and resource availability.

Although current unit utilization levels remain generally manageable, rescue units experience substantially greater workload than suppression apparatus. Rescue 19, Rescue 70, and Rescue 107 account for the highest commitment levels within the system and represent the most significant potential points of resource drawdown. Continued monitoring of rescue utilization, hospital turnaround times, and concurrent EMS demand will be essential to maintaining response reliability as service demand increases.

Concurrent Incidents and Unit Drawdown

One method used to evaluate system workload and resource demand is the analysis of concurrent incidents, i.e., when multiple emergencies occur simultaneously. Concurrent incidents are operationally significant because they can reduce unit availability, stretch staffing resources, and increase response distances and times for subsequent emergencies.

As the number of simultaneous incidents increases, the likelihood that first-due companies will already be committed to other calls also increases. In these cases, dispatch must assign units from neighboring stations or more distant locations, which can negatively affect travel times, response reliability, and overall system coverage. High levels of concurrent incident activity also place additional stress on personnel, apparatus, and supervisory

resources, particularly during peak demand periods and large-scale incidents.

Evaluating concurrent incident frequency provides important insight into operational workload, deployment effectiveness, and system resiliency. This analysis helps identify periods when available resources could become strained and supports future planning related to staffing, deployment models, station location analysis, and overall resource allocation.

Table 78 shows the unit drawdown by number of incidents, **Table 79** shows the unit drawdown times for engines and quints, and **Table 80** lists the drawdown times for rescue units during the study period.

Table 78: Miramar Fire-Rescue Department Unit Drawdown, CYs 2021–2025

Number of Incidents	Total Time	% of Window	Cumulative %	Run Count	Mean Run	Median Run	Max Run
0	18447:55:53	42.1%	42.1%	25,982	0:42:36	0:25:48	9:13:08
1	13299:21:55	30.3%	72.4%	55,964	0:14:16	0:09:08	3:07:55
2	6621:23:39	15.1%	87.6%	52,100	0:07:38	0:04:28	1:58:59
3	3099:28:22	7.1%	94.6%	35,531	0:05:14	0:02:41	1:35:24
4	1339:15:31	3.1%	97.7%	20,657	0:03:53	0:01:36	2:24:38
5	534:53:36	1.2%	98.9%	11,066	0:02:54	0:00:58	0:51:54
6	262:17:54	0.6%	99.5%	5,795	0:02:43	0:00:48	1:40:55
7	129:12:04	0.3%	99.8%	2,898	0:02:40	0:00:53	1:25:37
8	53:18:15	0.1%	99.9%	1,303	0:02:27	0:00:54	0:39:59
9	27:23:16	0.1%	100.0%	510	0:03:13	0:01:02	1:47:58
10	9:31:03	0.0%	100.0%	135	0:04:14	0:01:44	0:50:16
11	0:02:42	0.0%	100.0%	4	0:00:41	0:00:29	0:01:31

Table 79: Miramar Fire-Rescue Department Unit Drawdown for Engines and Quints, CYs 2021–2025

Number of Incidents	Total Time	% of Window	Run Count	Median Run
0	34904:24:35	79.6%	25,912	0:42:54
1	6559:38:57	15.0%	39,830	0:06:19
2	1753:32:17	4.0%	18,642	0:03:06
3	370:04:04	0.8%	6,613	0:00:58
4	185:18:22	0.4%	2,419	0:01:46
5	51:03:13	0.1%	535	0:02:09
6	0:02:42	0.0%	4	0:00:29

Table 80: Miramar Fire-Rescue Department Unit Drawdown for Rescue Units, CYs 2021–2025

Number of Incidents	Total Time	% of Window	Run Count	Median Run
0	20142:12:13	46.0%	24,574	0:30:00
1	15192:50:51	34.7%	45,581	0:15:13
2	6226:48:21	14.2%	30,635	0:08:32
3	1809:52:06	4.1%	12,781	0:05:13
4	392:21:28	0.9%	3,785	0:03:07
5	59:56:08	0.1%	633	0:02:20

The drawdown analysis shows that MFRD had no active incidents during approximately 42.1% of the evaluated time, and only one unit was committed during approximately 30.3% of the time. Two simultaneous incidents occurred approximately 15.1% of the time.

The finding that two or more incidents occurred simultaneously approximately 27.6% of the time demonstrates that concurrent demand is a routine operational condition, rather than an occasional occurrence. This finding requires ongoing monitoring of resource availability and response reliability, and it must be considered when evaluating first-due reliability and ERF assembly capability.

The hourly distribution of concurrent incidents demonstrates that resource drawdown increases during higher-demand periods of the day. As concurrency increases, fewer resources remain immediately available for subsequent incidents, potentially reducing first-due reliability, increasing travel times, increasing reliance on adjacent stations, and affecting the Department's ability to assemble an effective response force for structure fires and other high-risk incidents.

The frequency of multiple simultaneous incidents increases during the higher-demand portions of the day. Between approximately 10:00 and 20:00, two concurrent incidents are present during approximately 20% to 22% of each hour, while three concurrent incidents occur during approximately 9% to 11%. During several of these hours, four or more incidents are also occurring simultaneously for an additional portion of the hour. Collectively, the distribution demonstrates that periods of multiple concurrent incidents are not isolated events and are more prevalent during daytime and early evening hours.

Figure 86: Miramar Fire-Rescue Department Unit Drawdown by Hour of Day (2021–2025)

Level\Hour	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
0	53%	58%	61%	63%	65%	65%	59%	51%	42%	35%	32%	29%	29%	28%	28%	30%	30%	32%	32%	33%	33%	37%	40%	46%
1	30%	28%	27%	26%	25%	25%	27%	29%	32%	32%	31%	31%	32%	32%	32%	32%	32%	31%	32%	32%	32%	32%	34%	32%
2	11%	9%	8%	7%	7%	7%	9%	12%	15%	18%	20%	21%	20%	20%	21%	20%	20%	19%	19%	18%	18%	17%	15%	14%
3	4%	3%	2%	2%	2%	2%	3%	5%	7%	9%	10%	11%	10%	11%	11%	10%	10%	10%	10%	9%	9%	8%	6%	5%
4	1%	1%	1%	1%	1%	1%	1%	2%	2%	3%	4%	5%	5%	5%	5%	5%	4%	4%	4%	4%	4%	4%	3%	2%
5	1%	0%	0%	0%	0%	0%	0%	0%	1%	1%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	1%	1%	1%
6	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	0%
7	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%	0%	0%
8	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
9	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
10	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
11	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

GEOGRAPHICAL DISTRIBUTION AND CONCENTRATION CHARACTERISTICS

A geographic assessment was conducted using planning zones to evaluate incident concentration, travel time coverage, and the distribution of emergency resources throughout the jurisdiction. The analysis provides a spatial perspective of emergency service demand and resource deployment, allowing for the identification of geographic trends, coverage strengths, and areas that may warrant further evaluation as community conditions evolve. Drive-time modeling was used to assess the ability of existing fire stations and response units to reach incidents within established travel time objectives, with particular emphasis on high-risk areas and locations that experience concentrated service demand.

The analysis indicates that most areas within the jurisdiction can generally be reached within accepted travel time thresholds, particularly in high-density areas, areas with higher call volume, and areas with greater service demand. The assessment also identified several geographic- and infrastructure-related variables that can influence actual response performance under certain conditions, including roadway design, traffic congestion, access limitations, roadway connectivity, and the location of physical barriers.

Spatial analysis of this type provides important insights into the relationships among community risk, incident

distribution, and resource deployment. It also supports evaluation of whether current station locations and apparatus placement align with existing and projected service demand throughout the jurisdiction.

The findings from this assessment provide a foundation for future planning efforts related to station location analysis, resource allocation, deployment strategies, and overall system coverage optimization.

Travel Times

Engine company travel times were calculated from each existing fire station, factoring in existing road miles and historical data. **Figure 87** shows the area in which a first-in fire apparatus can arrive with a 4-minute travel time for the first unit. **Figure 88** demonstrates that over 95% of the city's response area can be reached in under a 10-minute travel time.

Figure 87: Four-Minute Engine Travel Times by Miramar Fire-Rescue Department Station

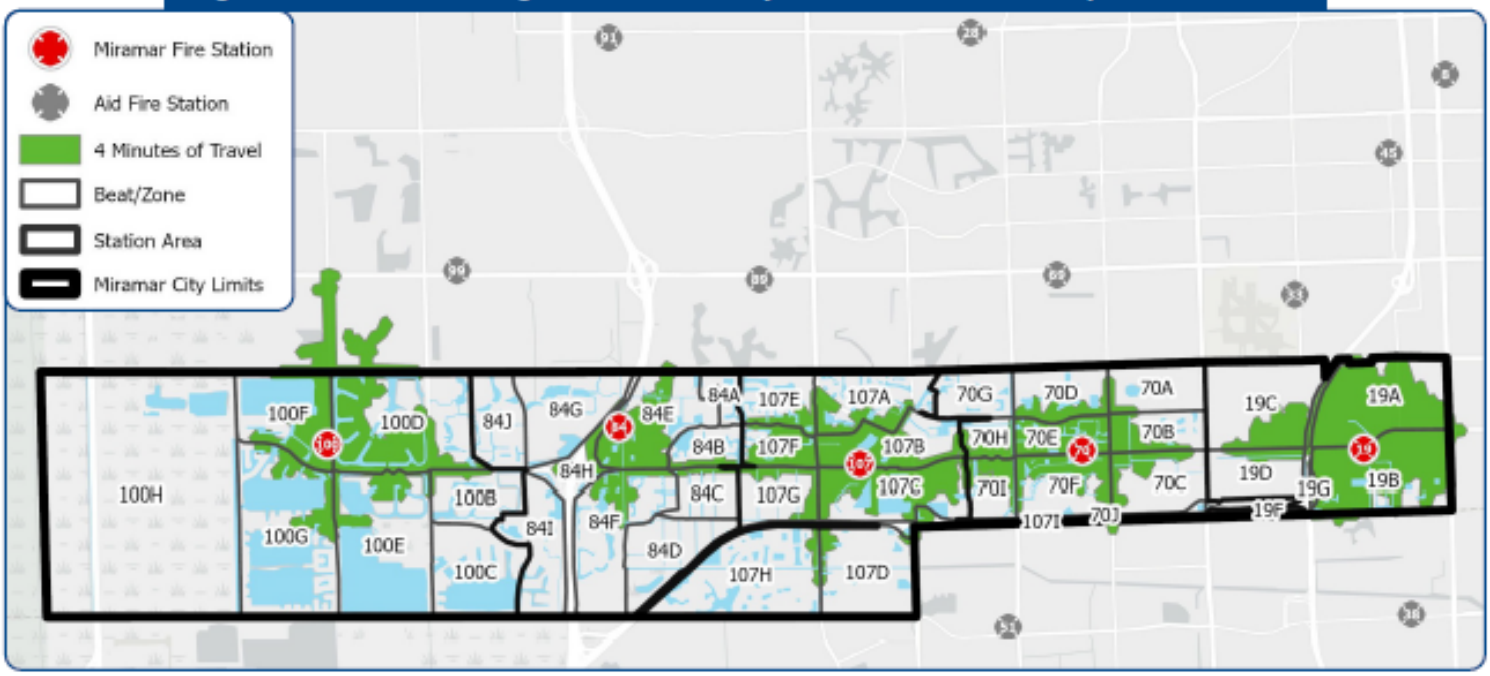
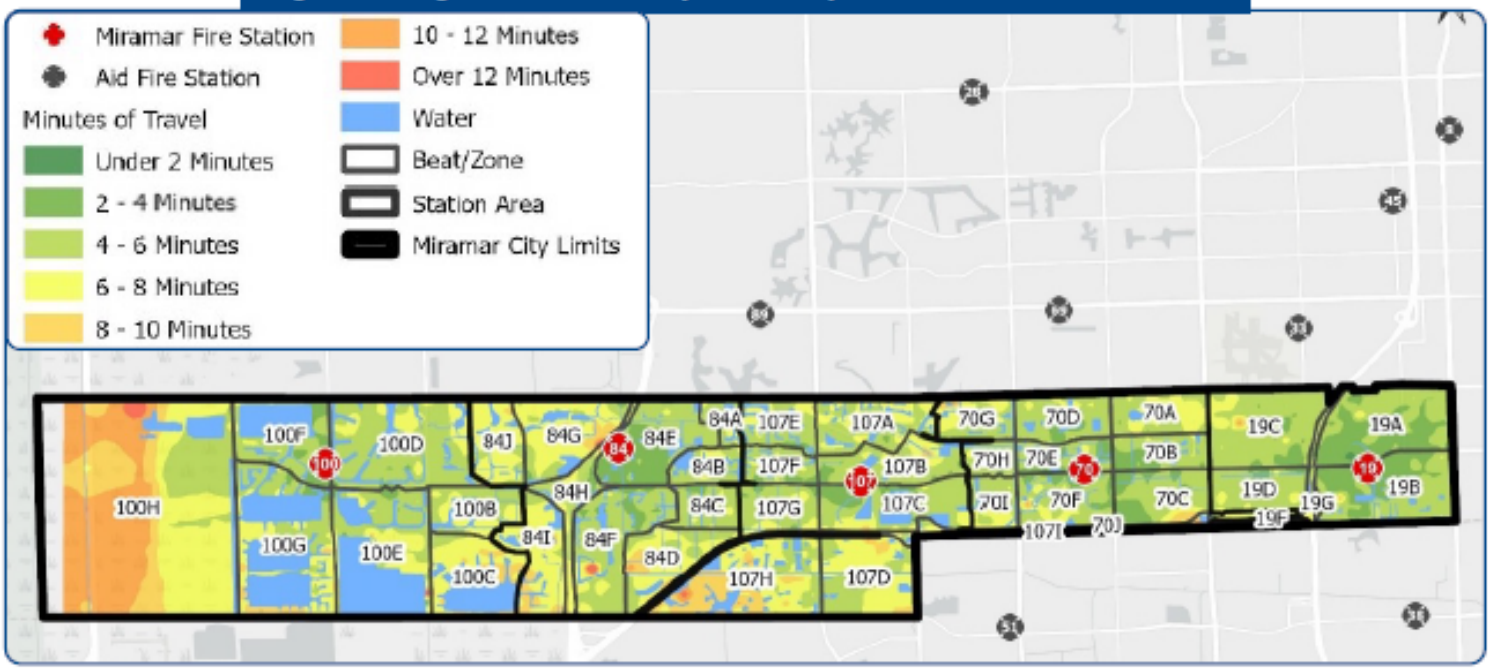


Figure 88: Engine Travel Times by Minutes by Miramar Fire-Rescue Stations



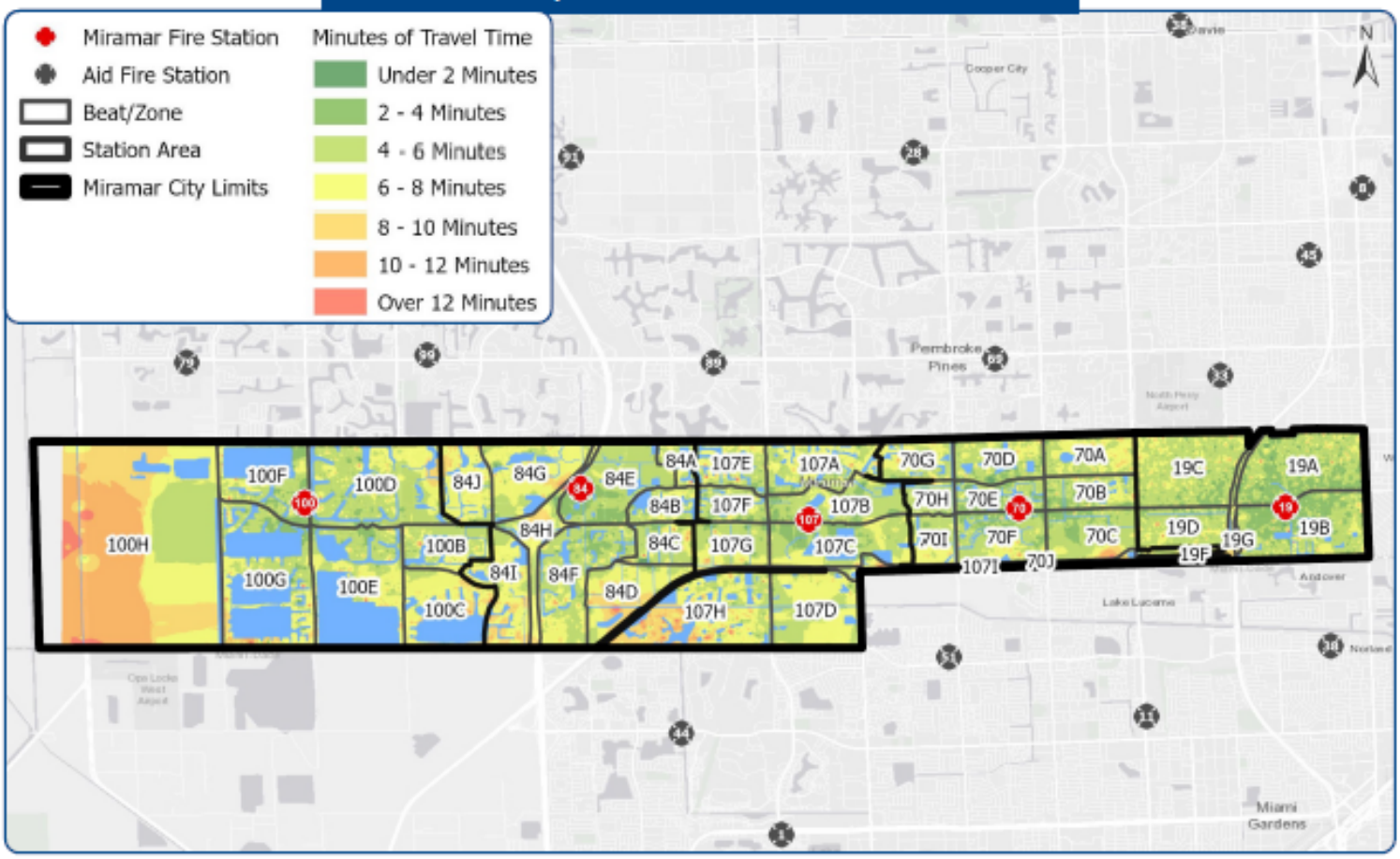
As illustrated in **Figure 88,** the analysis shows that most areas within the jurisdiction can generally be reached in an 8-minute travel time, particularly in locations with high-risk concentrations and greater service demand. This level of coverage demonstrates that the current station configuration and deployment model provide reasonable geographic access throughout most of the community.

Although geographic travel time analysis is a valuable surrogate measure for evaluating deployment effectiveness and coverage distribution, several real-world operational factors can affect actual response performance. Variables such as roadway design, traffic congestion, signalized intersections, water barriers, roadway connectivity, seasonal weather conditions, and variations in traffic patterns throughout the day can affect actual travel times during emergency responses.

Accordingly, travel time modeling should be viewed as an analytical planning tool rather than an exact predictor of response performance under all conditions. When combined with historical response performance data, workload analysis, and operational considerations, geographic analysis provides valuable insight into system coverage, deployment reliability, and future resource planning needs.

Figure 89 illustrates the historical travel time performance for first-in units throughout the City of Miramar during the five-year study period. The map displays estimated travel time ranges based on historical response data and shows that most developed areas in the city are reached within established travel time objectives. Areas shown in green represent locations with the shortest travel times and are typically situated closer to existing fire stations and major roadway networks. Areas with longer travel times are generally located near the western edge of the jurisdiction, where roadway access, lower development density, and geographic separation from existing stations affect response performance. This analysis provides valuable insight into current deployment effectiveness, geographic coverage, and areas where future growth or increased service demand could affect response reliability.

Figure 89: Historical Travel Time Performance for Miramar Fire-Rescue Department First in Units, CYs 2021–2025



OPERATIONAL PERFORMANCE STANDARDS

To evaluate MFRD's current response performance, dispatch and emergency incident response data were analyzed for the period from January 1, 2021, through December 31, 2025. The analysis included only priority emergency incidents; nonemergency and service-related calls were excluded from the performance evaluation. Response performance was evaluated using three primary components of the emergency response continuum:

- Call processing
- Turnout
- Travel

The total continuum of incident response time comprises several sequential phases, beginning with the initiation of the emergency and ending with incident mitigation. The time required for each phase varies with the type of emergency, the information available to dispatchers and responders, operational procedures, staffing levels, and environmental conditions. Several phases of the response sequence are directly affected by MFRD policies, deployment practices, and dispatch procedures. The independent evaluation of each phase enables a more detailed assessment of current performance and helps identify opportunities for operational improvement.

MFRD's response performance was compared with nationally recognized consensus standards explicated in NFPA Standard 1710: *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments, 2020 Edition.* Communications center performance was evaluated against the recommendations outlined in NFPA 1221: *Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems.*

Event Detection

Event detection is the time interval between the onset of an emergency and its recognition and reporting to the emergency response system. Examples include placing a call for assistance on a cellular phone, locating a landline telephone, contacting another individual by radio, and traveling to a location where you can notify emergency services. Event detection begins at the onset of the emergency and ends when the emergency is identified and reported.

This phase is largely outside the control of the fire department and communications center and is generally not considered a measurable component of agency response performance. Consequently, event detection time is typically not included in formal response-time performance analysis.

Notification

Notification is the phase during which the communications center receives the initial report of the emergency. Notification can occur through a 9-1-1 telephone call, radio communication, an automatic alarm system, a walk-in report, or another reporting method.

Over the past decade, emergency notification times have generally improved due to the widespread use of cellular telephones, allowing incidents to be reported more quickly from virtually any location within the community. Historically, notification delays were more common due to limited access to communication systems and fixed-location telephones.

Although cellular telephones have improved the speed at which emergencies are reported, they have introduced additional challenges for communications centers. Dispatch personnel must now spend additional time confirming the caller's exact location, particularly when callers are unfamiliar with their surroundings or when GPS data is incomplete or inaccurate. As a result, the increased accessibility of cellular communication does not always translate into significant reductions in overall call-processing times.

Call Processing

Call processing is defined as the time interval from the moment the communications center receives notification of an incident to dispatch of the recommended response units. MFRD's CAD system uses software that recommends and assigns the closest appropriate unit(s) based on incident type, location, and resource availability.

Most emergency incidents are reported through the 9-1-1 system using either landline or cellular telephones. During this phase, call takers must quickly obtain accurate information on the nature of the emergency, incident location, hazards, and other critical details necessary to dispatch the appropriate resources. Well-trained callers and bystanders who can clearly communicate information can significantly reduce call-processing times.

Once sufficient information is obtained, dispatch personnel must identify the appropriate response assignment, dispatch the necessary units, and continue gathering and relaying updated information to responding crews while units are en route.

NFPA Standard 1225 recommends that emergency call processing be completed within 60 seconds 90% of the time. However, agencies that use EMD protocols often experience longer processing times due to the structured questioning required before dispatching resources.

EMD systems are designed to improve incident prioritization, provide pre-arrival medical instructions, and ensure that the appropriate level of emergency medical response is dispatched based on the nature of the emergency. These systems require dispatchers to ask a series of standardized medical questions to determine the severity of the incident and provide caller instructions when appropriate. Although these protocols improve consistency and patient care, they can also delay the dispatch of the first responding unit.

Many accredited agencies have identified competing operational priorities when evaluating EMD performance. Although structured questioning can improve medical triage accuracy and pre-arrival care, it can also increase total call-processing time during critical emergencies. Recognizing these operational realities, NFPA extends the recommended call-processing benchmark from 60 seconds to 90 seconds for agencies using approved EMD protocols. MFRD's benchmark goal for call processing time is 2 minutes and 30 seconds or less 90% of the time.

Table 81 shows MFRD call-processing performance for priority emergency incidents during the study period.

Although MFRD demonstrated gradual improvement in call-processing performance during the study period, call-processing times remained above the NFPA-recommended benchmark.

During the study period, MFRD's call-processing times improved from 3 minutes and 41 seconds in 2021 to 2 minutes and 39 seconds in 2025. This finding represents measurable improvement; however, performance remained significantly higher than both the 60-second and 90-second NFPA benchmarks.

In addition to the use of structured EMD questioning, several operational and system-related factors can contribute to extended call-processing times, such as verification of caller location from cellular devices, high call-volume periods, staffing levels in the communications center, dispatcher workload, CAD workflow configuration, and the time required to transfer calls between agencies and dispatch positions.

Potential areas for improvement include:

- Reviewing dispatch workflows and CAD processing procedures
- Evaluating EMD questioning protocols and determinant assignment practices

Table 81: Miramar Fire-Rescue Department Call-Processing Times for Priority Calls, CYs 2021–2025

Year	90th Percentile Call-Processing Time
2021	3:41
2022	3:26
2023	3:12
2024	2:53
2025	2:39

- Analyzing staffing levels and dispatcher workload during peak-demand periods
- Improving caller location-verification technology
- Conducting regular quality-assurance reviews of dispatch performance

In addition, ongoing dispatcher training, call-review programs, and closer coordination between MFRD and the communications center can help identify any operational inefficiencies and opportunities to further reduce processing times, while maintaining appropriate medical questioning and responder safety protocols.

Turnout

Turnout time is the interval between the station or unit's notification of an emergency and the assigned unit's beginning its response. Of all phases in the emergency response continuum, fire departments have the greatest direct influence over turnout time.

MFRD stations are equipped with radio tone-alert activation systems. Turnout time at the Department is measured from completion of the dispatch alert until the assigned apparatus leaves the station or location where the fire apparatus is parked and personnel announce they are "en route" by radio or mobile data computer. During this phase, personnel must don the appropriate protective equipment, assemble on the response apparatus, and begin traveling to the incident.

Table 82: Miramar Fire-Rescue Department Unit Turnout Times for Priority Calls, CYs 2021–2025

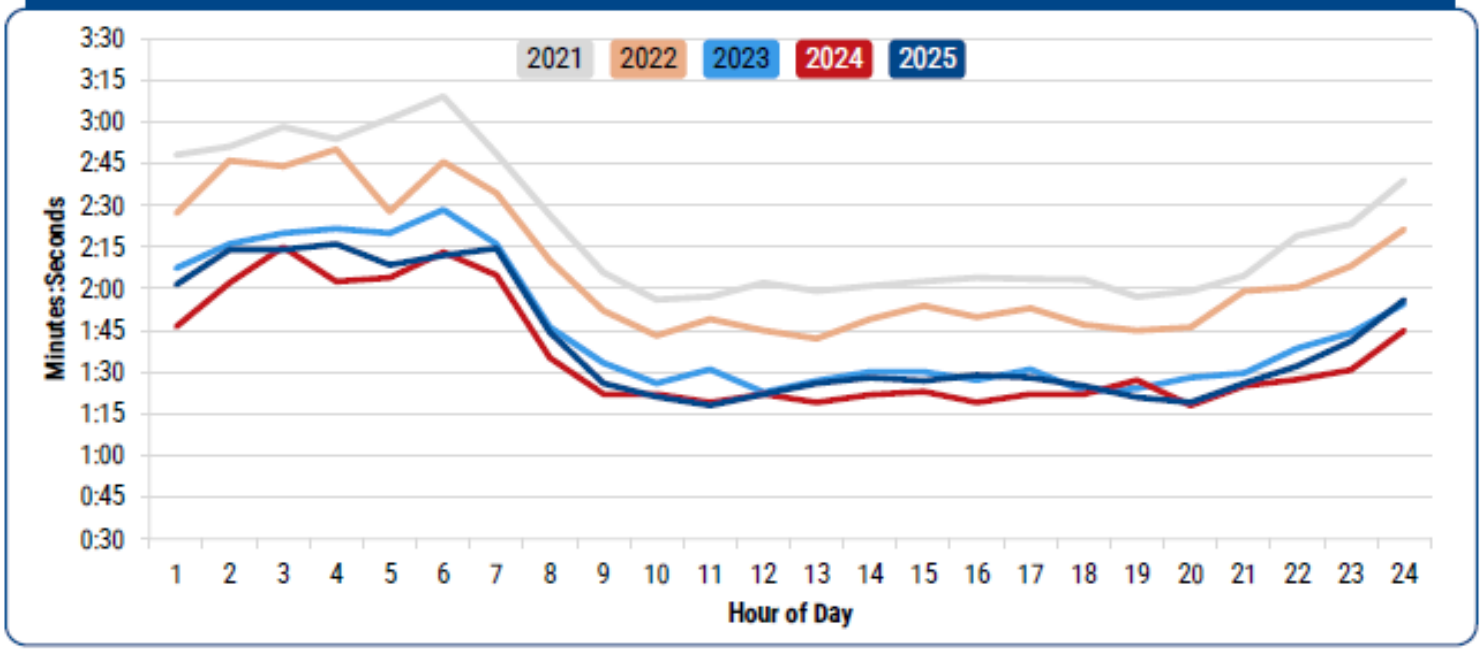
Year	90th Percentile Turnout Time
2021	2:24
2022	2:08
2023	1:45
2024	1:35
2025	1:40

Turnout performance can be influenced by several factors, including station design, apparatus bay layout, crew location within the station, time of day, incident type, required protective equipment, and personnel training. Effective station design, clear expectations, and consistent training can help minimize turnout time.

NFPA 1710 recommends a turnout time benchmark of 60 seconds for emergency medical incidents and 80 seconds for fire and special operations incidents, each measured at the 90th percentile. For priority emergency incidents, MFRD's benchmark goal for turnout time is 1 minute and 30 seconds or less, 90% of the time.

As shown in **Table 82,** MFRD's turnout times for all priority or urgent incident types exceeded both the Department's benchmark and applicable NFPA performance recommendations during the study period. The five-year 90th percentile turnout time for MFRD is 1 minute and 55 seconds. **Figure 90** illustrates unit turnout times for priority calls by hour of day.

Figure 90: Miramar Fire-Rescue Department Unit Turnout Times for Priority Calls by Hour of Day, CY 2021–2025



Data show that turnout times increase during the nighttime hours. This finding is the result of the 24-hour work cycle and the need for fire personnel to be awake, properly dressed, and able to walk safely to the fire apparatus.

Over the study period, MFRD's turnout time improved from 2 minutes and 24 seconds in 2021 to 1 minute and 40 seconds in 2025. This improvement demonstrates that turnout performance can be influenced by operational emphasis, training, supervision, and performance monitoring. MFRD should continue monitoring turnout by station, unit, incident type, hour of day, and shift.

Travel

Travel time is the interval that begins when the assigned unit reports it is "en route" to an emergency and ends when the unit arrives on scene and reports it is "on-scene." Of the major response performance components, travel time is often the longest phase within the emergency response continuum.

The distance between fire stations and emergency incident locations is the most significant factor in travel-time performance. Additional factors include roadway design and connectivity, traffic congestion, driver training, intersection density, geographic barriers, weather conditions, and overall community development patterns.

Traffic-management systems and roadway infrastructure can significantly affect travel during emergency responses. MFRD utilizes traffic signal preemption systems during emergency responses to reduce delays at signalized intersections and improve responder safety. These systems allow emergency apparatus to control traffic signals and improve roadway clearance while responding to incidents.

Conversely, certain roadway and community design features can negatively affect travel performance. Traffic-calming devices such as speed humps, narrowed roadways, landscaped medians, roundabouts, gated communities, and other access-control measures can slow emergency apparatus response times. Although these features improve neighborhood traffic safety and reduce vehicle speeds for the general public, they can create challenges for emergency response operations.

Travel-time performance is also affected by unit availability and system workload. During periods of high call volume and concurrent incidents, first-due companies might be committed to other emergencies, requiring units from more distant stations to respond. This situation can significantly increase overall travel time and reduce response reliability.

Table 83 outlines the travel times for the first-arriving engine company, rescue unit, or truck company during the five-year study period.

Table 83: Miramar Fire-Rescue Department Travel Times for First-In Engine, Rescue, or Truck, CYs 2021–2025

Year	90th Percentile Travel Time
2021	7:40
2022	7:25
2023	7:31
2024	7:40
2025	7:28

Total Response Time

Total response time reflects the cumulative performance of the emergency response system and is one of the most comprehensive measures of overall service delivery effectiveness. Total response time includes all components of the emergency response process, including call processing, turnout, and travel time. As a result, improvements and deficiencies in any individual component directly affect the total time required for emergency resources to arrive at the scene and begin mitigating the incident.

The ability to reduce total response time is particularly important because many emergency incidents are highly time-sensitive. In fire incidents, for example, response delays allow fire conditions to worsen, increase the potential for flashover, reduce occupant survivability, and increase property damage. In medical emergencies, particularly cardiac arrest, stroke, respiratory compromise, and severe trauma, early intervention is associated with improved patient outcomes and increased survivability. Consequently, total response time is a key indicator of the emergency

response system's ability to influence incident outcomes and meet community expectations.

Table 84 summarizes MFRD's 90th percentile total response time performance for emergency incidents between 2021 and 2025. During the study period, total response time improved consistently from 12 minutes and 19 seconds in 2021 to 10 minutes and 34 seconds in 2025. This finding represents an overall reduction of 1 minute and 45 seconds, or approximately 14.2%, over the five-year period.

Table 84: Miramar Fire-Rescue Department Total Response Times for First-In Engine, Rescue, or Truck, CYs 2021–2025

Year	90th Percentile Total Response Time
2021	12:19
2022	11:47
2023	11:14
2024	10:58
2025	10:34

The improvement trend in total response time suggests that system performance has improved across multiple components of the emergency response process. Improvements in turnout performance, continued refinement of dispatch operations, operational experience, deployment practices, and resource management efforts may have contributed to the observed reduction in total response times. The sustained year-over-year improvement is particularly noteworthy because it occurred while the Department continued to experience significant EMS demand, concurrent incidents, and increasing operational complexity.

Although MFRD's total response time performance remains above many commonly cited urban response objectives, the positive trend indicates measurable progress in overall system effectiveness. The reduction in total response times indicates that emergency resources are arriving sooner than in previous years, thereby increasing the opportunity to positively influence life safety outcomes, property conservation, and incident stabilization efforts.

From a deployment perspective, the improvement in total response time supports the conclusion that the current system continues to function effectively, despite increasing service demands. However, future growth, changing demographics, increasing EMS utilization, and continued development throughout the community could place additional pressure on response performance. Continued monitoring of total response time and its individual components will remain important for MFRD to evaluate deployment effectiveness, identify emerging performance gaps, and support future resource allocation decisions.

Overall, the historical trend shows a positive trajectory in emergency response performance and provides evidence that MFRD's ongoing efforts to improve operational effectiveness have led to measurable reductions in total response time across the community.



Historical Performance Summary and Strategic Implications

The historical performance analysis demonstrates that MFRD continues to provide reliable emergency services in a community with stable incident demand and increasing EMS dependence. Although overall incident growth has remained modest, EMS transport activity, rescue workload, and concurrent incident demand continue to place increasing pressure on system resources.

Over the five-year study period, MFRD experienced relatively stable incident demand, rising from 13,469 incidents in 2021 to 14,180 in 2025, an increase of approximately 5.1%. Emergency medical incidents continued to dominate system demand, accounting for approximately 70.2% of all responses and generating the majority of unit commitments and committed time.

Analysis identified several significant operational trends:

- EMS transport units experience the highest workload and commitment levels.
- Rescue 19, Rescue 70, and Rescue 107 account for the greatest system utilization.
- Incident demand remains concentrated within Stations 19 and 70 response areas.
- Concurrent incidents occur approximately 27.6% of the time.
- Call-processing performance improved during the study period, but it remains above NFPA recommendations.
- Turnout performance improved significantly and approached Department benchmarks.
- Travel-time performance remained relatively stable throughout the study period.

These findings indicate that EMS workload, rescue availability, and concurrent incident demand are the most significant factors that influence MFRD's overall system performance. These factors should be considered in future deployment planning.



Resources, Critical Tasking, and Benchmark Goals

The majority of MFRD's service area encompasses urban environments, which generally experience higher concentrations of emergency incidents, greater population density, increased traffic volume, and more complex development patterns. These characteristics result in higher call density and increased demands on personnel, apparatus, and system resources.

As actual and potential risk levels increase, the demand for personnel, apparatus, specialized equipment, and coordinated emergency response resources also increases. Different incident types and occupancy hazards require varying levels of operational capability and staffing to safely and effectively complete critical tasks. These critical tasks can include fire attack, search and rescue, ventilation, patient care, traffic control, water supply, incident command, rapid intervention, and scene stabilization activities.

Effective emergency response depends on dispatching the appropriate number and type of resources necessary to match the operational demands and risk profile of each incident. This relationship among community risk, incident characteristics, and resource deployment underpins risk-based response planning and is critical for evaluating overall response capability, deployment effectiveness, and system performance.

FIRE SUPPRESSION CAPABILITIES

The Department provides fire suppression services for a broad range of occupancy and property types throughout the community. These include single-family dwellings, multi-family residential occupancies, high-rise buildings, commercial structures, industrial facilities, and other developed properties. Fire suppression responsibilities also extend to high-risk occupancies, including institutional facilities, schools, nursing homes, assisted living facilities, and other forms of congregate housing, where occupant evacuation and life-safety challenges can be more complex. In addition to structural fires, MFRD responds to incidents involving mobile and outdoor properties, including passenger vehicles, commercial road freight, rail freight, recreational vehicles, dumpsters, rubbish fires, heavy equipment, vegetation, and similar hazards.

Firefighters routinely encounter a wide spectrum of incident conditions during suppression operations, ranging from small, incipient-stage fires that can be controlled quickly to advanced fires with significant structural involvement, rapid fire spread, entrapment potential, and/or defensive operations. Incident complexity is influenced by numerous factors, including building size and construction type, occupancy characteristics, fuel load, fire location and extent, weather conditions, time of day, water supply availability, and the number of occupants and exposures threatened. These variables create substantial differences in operational demands from one incident to another and complicate direct comparisons of fire suppression capability between agencies.

To support a meaningful and consistent evaluation of fire suppression performance, a standardized point of comparison must be established. Performance assessments should therefore focus on the Department's ability to assemble and deploy an ERF capable of completing the critical tasks associated with a representative or "typical" fire scenario within established time objectives. Using standardized incident benchmarks enables the evaluation of performance under comparable operational conditions and provides a reliable framework for assessing deployment effectiveness, resource distribution, staffing, and overall response capability.

Fire Growth, Occupant Survivability, and Response Times

The effectiveness of a fire department's deployment system is directly related to the rate at which fire conditions deteriorate and the ability of responding personnel to intervene before conditions become unsurvivable for occupants or uncontrollable for firefighters. Fire development is a dynamic process that is affected by building construction, occupancy type, fuel load, ventilation characteristics, fire-protection systems, and the time required for

emergency resources to arrive and begin suppression activities.

Modern fire research has demonstrated that fire growth in contemporary occupancies can occur significantly faster than in legacy structures due to increased quantities of synthetic furnishings and lightweight building materials. These conditions can reduce available escape time for occupants, accelerate fire extension, and increase the likelihood of flashover occurring within minutes of ignition.

Flashover represents a critical threshold in fire development in which most combustible materials within a compartment ignite nearly simultaneously. Once flashover occurs, interior temperatures increase rapidly, occupant survivability decreases significantly, and suppression operations become substantially more resource-intensive. Fire conditions that might have been controlled by an initial attack crew prior to flashover often require considerably greater staffing, fire flow, and operational coordination after flashover occurs.

The ability to intervene before flashover is influenced by the entire community's fire protection system rather than by emergency response alone. Early detection, public education, automatic fire sprinkler systems, building construction features, water supply infrastructure, alarm notification systems, citizen actions, and emergency response performance collectively influence incident outcomes.

Because fire conditions continue to deteriorate until effective suppression actions begin, response time remains one of the most important variables affecting life safety, firefighter safety, and property conservation. Delays in notification, dispatch, turnout, travel, and ERF assembly increase the probability that fire conditions will worsen before critical tasks can be completed.

For this reason, MFRD evaluates deployment effectiveness through a critical task analysis methodology. Critical tasks represent the minimum actions necessary to safely and effectively stabilize an incident. They are grouped into two broad categories: life safety tasks and fire-flow tasks.

Life safety tasks include:

- Incident command
- Primary search and rescue
- Firefighter accountability
- Rapid intervention capability
- Victim removal and treatment
- Exposure protection

Fire flow tasks include:

- Fire attack
- Water supply establishment
- Pump operations
- Backup attack line deployment
- Ventilation
- Utility control
- Salvage and overhaul

The personnel and apparatus required to complete these tasks vary based on occupancy characteristics, fire conditions, community risk, and incident complexity. Consequently, MFRD uses a risk-based deployment model that establishes distinct ERF requirements for low-, moderate-, and high-risk incidents.

CRITICAL TASK ANALYSIS

Critical tasking is the process used to determine the personnel, apparatus, equipment, and specialized capabilities necessary to safely and effectively manage emergency incidents based on their type and the severity of risk. Within the SOC process, critical tasking provides the operational foundation for establishing an ERF, the minimum number and type of resources required to complete the critical tasks necessary to stabilize an incident within an adopted performance objective.

The Department's critical tasking methodology is based on a risk-based evaluation of incident type, occupancy characteristics, life-safety conditions, fire-flow requirements, incident complexity, responder safety, and the operational functions required to bring an incident under control. The methodology ensures that response assignments are based not only on incident frequency but also on the actual tasks required to protect life, stabilize the incident, conserve property, and maintain firefighter safety.

Critical tasks were developed for each of MFRD's major service areas included in the SOC, including structure fire suppression, EMS, HazMat incidents, and technical rescue incidents. Each incident type was further evaluated using the Department's risk classifications, including low-, moderate-, and high-risk incidents, to determine the resources required to effectively manage events.

The Department identified critical tasks through a review of historical incident data, current response assignments, standard operating guidelines, training evolutions, staffing models, apparatus capabilities, and incident command requirements. The process incorporated nationally recognized fire service standards and best practices, including NFPA Standard 1710: *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments, 2020 Edition;* NFPA Standard 1550: *Standard for Emergency Responder Health and Safety, the Incident Command System (ICS),* and guidance from the CFAI accreditation model and the Center for Public Safety Excellence's Quality Improvement for the Fire and Emergency Services manual.

Critical tasks typically include incident command, scene size-up, fire attack, search and rescue, ventilation, forcible entry, water supply establishment, rapid intervention, accountability, emergency medical care, hazard control, and/or scene safety management. Depending on the incident type and risk classification, additional tasks can be required to address specialized hazards, protect exposures, support evacuation efforts, and/or coordinate regional resources.

A key consideration in a critical task analysis is that many tasks must occur simultaneously rather than sequentially. For example, during a working structure fire, incident command, fire attack, search and rescue, ventilation, water supply, and rapid intervention operations often occur concurrently. If sufficient personnel are unavailable, critical tasks can be delayed, increasing the risk to occupants, responders, and property. The ERF analysis, therefore, evaluates the Department's ability to assemble enough personnel and apparatus to perform these tasks simultaneously within the adopted performance objectives.

Department command staff and operational personnel reviewed the identified critical tasks and corresponding resource requirements to ensure they accurately reflect current operational practices, deployment models, staffing levels, and community risks. This validation process confirmed that the selected tasks and personnel requirements are consistent with accepted fire service practices and the Department's operational expectations.

The results of the critical task analysis established the minimum ERF requirements used throughout this report and provided the basis for evaluating response performance. These requirements were subsequently used to develop deployment objectives and benchmark performance measures for each risk category analyzed within the SOC. By linking community risk, critical tasks, staffing requirements, and response performance, the Department can determine whether existing deployment strategies provide the resources necessary to safely and effectively mitigate emergency incidents throughout the service area.

EFFECTIVE RESPONSE FORCE CAPABILITIES

An ERF represents the combination of personnel, apparatus, and command resources required to complete critical tasks necessary to stabilize an incident within established performance objectives. The critical task analysis identifies the resources needed to manage an incident, and the ERF analysis evaluates the Department's ability to assemble those resources within the time frames necessary to influence incident outcomes.

The ability to rapidly assemble an ERF is directly related to occupant survivability, firefighter safety, fire containment, and property conservation. As fire conditions deteriorate, the resources required to control an incident increase substantially. Delays in assembling sufficient personnel and apparatus can result in greater fire extension, increased life safety risk, and reduced operational effectiveness.

Evaluating ERF performance involves considering multiple system factors, including station distribution, staffing levels, apparatus deployment, unit availability, travel times, roadway networks, concurrent incident activity, and mutual-aid reliability. These factors collectively influence the Department's ability to concentrate resources at the scene of significant incidents.

Because ERF capability represents the intersection of community risk, deployment design, and operational performance, it serves as one of the most important measures of overall system effectiveness. The analysis that follows evaluates MFRD's ability to assemble the personnel and apparatus necessary to safely and effectively manage incidents across the community's identified risk environments.

MFRD staffs all frontline fire engines, quints, and rescue units with a minimum of three personnel. This staffing model provides operational flexibility by allowing resources to be interchanged, while maintaining consistent staffing levels and response capabilities. Based on the Department's response configurations, fire suppression incidents requiring an ERF generally rely upon the arrival of multiple water-carrying and pumping apparatus, with additional responding units providing the personnel necessary to complete critical fireground tasks.

Analysis of CAD records indicates that MFRD frequently modifies resource assignments after the initial dispatch, e.g., adding units, exchanging resources, or adjusting response configurations based upon updated incident information, unit availability, coverage considerations, or reports indicating escalating fire conditions. As additional information becomes available, dispatchers and command personnel can increase the number of responding resources to better meet anticipated incident requirements.

This dynamic deployment approach differs from traditional ERF measurement methodologies that rely solely upon the initial assignment dispatched at the time of call processing. Because additional units are often assigned after the initial dispatch sequence, some responding resources receive notification later than the first-dispatched units. As a result, the measured assembly time for the complete ERF can be affected by operational decisions made after the incident has begun.

The practice of modifying assignments provides potential operational benefits by maintaining system coverage and aligning resources with actual incident conditions. However, it can also influence the Department's ability to assemble a complete ERF within established performance objectives. Consequently, traditional ERF calculations might not fully capture the real-world operating conditions associated with MFRD's deployment practices.

The ability to concentrate resources at significant incidents represents one of the most important measures of deployment effectiveness. Although maintaining geographic coverage remains essential for community protection, the Department must also ensure that resource-management practices do not unintentionally delay the assembly of personnel and apparatus needed to safely and effectively complete critical fireground tasks.

Further evaluation of resource additions, unit exchanges, and dynamic dispatching practices is recommended to determine their effect on response reliability, ERF assembly, station coverage, and overall incident outcomes. Understanding these relationships will assist the Department in balancing community coverage objectives with the timely concentration of resources necessary to manage high-risk incidents.

Relationship Between Community Risk and ERF Requirements

ERF requirements are directly linked to the CRA. As consequence and complexity increase, additional personnel and apparatus are necessary to safely complete critical tasks and achieve desired incident outcomes.

Low-risk incidents typically require fewer resources due to reduced life-safety concerns, smaller fire-flow requirements, and less complex operational objectives. Conversely, moderate- and high-risk incidents require larger ERFs due to increased occupant loads, larger structures, greater fire-flow demands, and the need to complete multiple critical tasks simultaneously.

Accordingly, MFRD establishes different ERF objectives based upon incident risk classification, ensuring that deployment expectations remain aligned with the community's identified risks and service expectations.

FIRE SUPPRESSION CRITICAL TASKS

For fire suppression incidents, critical tasks generally involve incident command, initial size-up, water supply, pump operations, fire attack, backup line deployment, primary search and rescue, ventilation, forcible entry, exposure protection, rapid intervention, utilities control, medical support, salvage, overhaul, accountability, and safety. The number of personnel assigned to each task varies based on the risk level, occupancy type, building size, construction features, fire conditions, life hazards, and the presence or absence of built-in fire-protection systems.

Examples of low-risk fire suppression incidents include passenger vehicle fires, dumpster fires, and other small fires with no threat of exposure. The ERF for low-risk incidents consists of two water-carrying apparatus capable of pumping water and at least six personnel. The first-in unit must be capable of establishing command, completing an initial size-up, establishing a water supply, and initiating fire attack and/or rescue.

Table 85 defines the NFIRS codes for low-risk fire suppression, and **Table 86** lists the critical tasks required for such incidents.

Table 85: Low-Risk Fire Suppression NFIRS Codes

NFIRS Code	Description	NFIRS Incident Type
113	Cooking fire, confined to a container	Structure fire
118	Trash or rubbish fire, contained	Structure fire
130	Mobile property (vehicle) fire, other	Non-structure fire
131	Passenger vehicle fire	Non-structure fire
132	Road freight or transport vehicle fire	Non-structure fire
138	Off-road vehicle or heavy equipment fire	Non-structure fire
150	Outside rubbish fire, other	Non-structure fire
151	Outside rubbish, trash, or waste fire	Non-structure fire
154	Dumpster or other outside trash receptacle fire	Non-structure fire
155	Outside compactor or compacted trash fire	Non-structure fire

Table 86: Low-Risk Fire Suppression Critical Tasks

Critical Tasks	No. Personnel	Company
Command, pump, and attack line	6	1st and 2nd engines
TOTAL	**6**	**Two engines or one engine and a truck**

A common example of a moderate-risk fire suppression incident is a single-family residence in which the fire is confined to the room of origin. The ERF for moderate-risk incidents includes four fire engines and/or ladder trucks, one rescue ambulance unit, and one chief officer, for a minimum of 16 personnel.

The ERF must be capable of establishing command, providing a water supply, advancing an attack line and a backup line for fire control, complying with the two-in/two-out requirement, and conducting search-and-rescue operations for at-risk victims.

Table 87 defines the NFIRS codes for moderate-risk fire suppression, and **Table 88** lists the critical tasks required for such incidents.

Table 87: Moderate-Risk Fire Suppression NFIRS Codes

NFIRS Code	Description	NFIRS Incident Type
111	Building fire	Structure fire
112	Fires in structures other than in a building	Structure fire
114	Chimney or flue fire, confined to the chimney or flue	Structure fire
116	Fuel burner/boiler malfunction, fire confined	Structure fire
118	Trash or rubbish fire, contained	Structure fire
121	Fire in a mobile home used as a fixed residence	Non-structure fire
122	Fire in motor home, camper, or recreational vehicle	Non-structure fire
123	Fire in portable building, fixed location	Non-structure fire
132	Road freight or transport vehicle fire	Non-structure fire
137	Camper or recreational vehicle fire	Non-structure fire
138	Off-road vehicle or heavy equipment fire	Non-structure fire
153	Construction or demolition landfill fire	Non-structure fire

Table 88: Moderate-Risk Fire Suppression Critical Tasks

Critical Tasks	No. Personnel	Company
Command	1	1st Battalion Chief
Attack line	2	1st engine
Pump operator/water supply	1	1st engine
Primary search and rescue	3	3rd engine
Two-out/backup attack line	3	2nd engine
Forcible entry, utilities, and ventilation	3	1st truck
Incident support	3	1st rescue units
TOTALS	**16**	**4 engines and/or trucks, 1 rescue unit, and 1 Battalion Chief**

A common example of a high-risk fire suppression incident is a multi-family residence in which the fire extends beyond the room of origin. The ERF for high-risk incidents has five fire engines and/or ladder trucks, two rescue ambulance units, and at least 23 personnel, including two chief officers.

The ERF must be capable of establishing command, ensuring safety, providing an uninterrupted water supply, advancing an attack line and a backup line for fire control, complying with the two-in/two-out requirement, achieving forcible entry, conducting search and rescue for at-risk victims, providing ventilation and exposure protection, controlling utilities, and performing salvage and overhaul.

Table 89 defines the NFIRS codes for high-risk fire suppression, and **Table 90** lists the critical tasks required for such incidents.

Table 89: High-Risk Fire Suppression NFIRS Codes

NFIRS Code	Description	NFIRS Incident Type
111	Building fire	Structure fire
112	Fires in structures other than in a building	Structure fire
121	Fire in a mobile home used as a fixed residence	Non-structure fire
123	Fire in a portable building, fixed location	Non-structure fire

Table 90: High-Risk Fire Suppression Critical Tasks

Critical Tasks	No. Personnel	Company
Command	1	1st Battalion Chief
Safety	1	2nd Battalion Chief
Attack lines (2)	5	1st and 2nd engines
Pump operator	1	1st engine
Primary search and rescue	6	1st and 2nd rescue units
Backup attack line	3	3rd engine
Forced entry, utilities	3	1st truck
Ventilation	3	2nd truck
TOTAL	**23**	**5 engines and/or trucks, 2 rescue units, 2 Battalion Chiefs**

FIRE SUPPRESSION BENCHMARK GOALS

For 90% of all fire suppression incidents, the total response time for the arrival of the first-due unit, staffed with a minimum of one officer, one engineer, and one firefighter, shall be within 9 minutes (9:00) in urban response zones. The first-arriving unit shall carry a minimum of 500 gallons of water and have a pumping capacity of 1,500 gallons per minute.

The first-due unit shall establish command, declare scene priorities, perform lifesaving and property-saving interventions, and provide scene safety and accountability for MFRD members and citizenry.

For 90% of low-risk fires, the minimum ERF staffing shall be six personnel who arrive within 9 minutes (9:00) in urban response zones. The ERF staffing shall be capable of safely controlling the incident in accordance with the adopted MFRD standard operating guidelines. ERF members shall be authorized to request additional resources to enhance safety and control an escalating incident.

Table 91 compares MFRD's 90th percentile response-time baseline performance for low-risk fire suppression calls, from alarm through on-scene distribution, with established benchmarks for January 2021 through December 2025.

Table 91: Five-Year Benchmark Versus Baseline Performance, 90th Percentile Response Times for Low-Risk Fire Suppression Incidents, CYs 2021–2025

Fire Suppression – Low-Risk Incidents		TOTAL	2025	2024	2023	2022	2021
Alarm Handling	Pick-up to Dispatch	**00:02:59**	00:02:42	00:02:46	00:02:41	00:03:21	00:03:11
Turnout Time	Turnout Time 1st Unit	**00:02:12**	00:01:35	00:01:36	00:01:48	00:02:33	00:02:37
Travel Time	Travel Time 1st Unit – **Distribution**	**00:08:11**	00:08:08	00:08:40	00:08:07	00:07:50	00:08:02
	Travel Time ERF **Concentration**	**00:08:16**	00:08:08	00:08:40	00:08:11	00:07:38	00:08:03
Total Response Time	Total Response Time 1st Unit on Scene – **Distribution**	**00:09:21**	00:09:33	00:09:59	00:09:06	00:09:19	00:09:02
		515	87	108	103	97	120
	Total Response Time ERF **Concentration**	**00:09:23**	00:09:33	00:09:48	00:09:09	00:09:09	00:09:04
		508	87	105	103	95	118

For 90% of moderate-risk fires, the minimum ERF staffing shall be 16 personnel who arrive within 13 minutes (13:00) in urban response zones.

Table 92 compares MFRD's 90th percentile response-time baseline performance for moderate-risk fire suppression calls, from alarm through on-scene distribution, against established benchmarks for January 2021 through December 2025.

Table 92: Five-Year Benchmark Versus Baseline Performance, 90th Percentile Response Times for Moderate-Risk Fire Suppression Incidents, CYs 2021–2025

Fire Suppression – Moderate-Risk Incidents		TOTAL	2025	2024	2023	2022	2021
Alarm Handling	Pick-up to Dispatch	**00:02:29**	00:02:15	00:02:31	00:02:19	00:02:18	00:02:48
Turnout Time	Turnout Time 1st Unit	**00:02:14**	00:02:57	00:01:59	00:01:51	00:02:08	00:02:34
Travel Time	Travel Time 1st Unit – **Distribution**	**00:06:25**	00:05:42	00:06:13	00:06:46	00:05:50	00:06:54
	Travel Time ERF **Concentration**	**00:12:27**	00:11:50	00:11:21	00:12:10	00:12:39	00:11:25
Total Response Time	Total Response Time 1st Unit on Scene – **Distribution**	**00:07:27**	00:06:20	00:06:59	00:07:40	00:06:43	00:08:20
		77	10	16	25	13	13
	Total Response Time ERF **Concentration**	**00:13:17**	00:17:27	00:11:54	00:13:11	00:13:18	00:12:23
		58	7	10	20	10	11

For 90% of high-risk fires in urban response zones, the minimum ERF staffing shall be 23 firefighters who arrive within 15 minutes (15:00).

Table 93 compares MFRD's 90th percentile response-time baseline performance for high-risk fire suppression calls, from alarm through on-scene distribution, with established benchmarks for January 2021 through December 2025.

Table 93: Five-Year Benchmark Versus Baseline Performance, 90th Percentile Response Times for High-Risk Fire Suppression Incidents, CYs 2021–2025

Fire Suppression – High-Risk Incidents		TOTAL	2025	2024	2023	2022	2021
Alarm Handling	Pick-up to Dispatch	**00:02:35**	00:02:07	00:01:51	00:02:58	00:02:19	00:02:23
Turnout Time	Turnout Time 1st Unit	**00:01:47**	00:01:34	00:01:35	00:02:09	00:01:34	00:01:56
Travel Time	Travel Time 1st Unit – **Distribution**	**00:07:40**	00:06:29	00:07:07	00:07:42	00:07:51	00:06:55
	Travel Time ERF **Concentration**	**00:17:29**	00:14:44	00:19:07	00:12:56	00:17:41	00:16:57
Total Response Time	Total Response Time 1st Unit on Scene – **Distribution**	**00:08:36**	00:07:11	00:07:47	00:08:37	00:08:35	00:07:55
		41	11	10	10	5	5
	Total Response Time ERF **Concentration**	**00:18:37**	00:15:27	00:19:25	00:14:08	00:18:21	00:18:22
		19	5	3	5	4	2



EMS CRITICAL TASKS

Emergency medical incidents vary significantly in complexity, patient acuity, and resource requirements. Accordingly, MFRD developed separate critical task analyses for low-, moderate-, and high-risk EMS incidents. These critical tasks identify the minimum personnel and apparatus necessary to safely assess, treat, package, and transport patients, while providing appropriate command, scene management, and responder safety.

For emergency medical incidents, critical tasks generally include scene safety, patient access, patient assessment, BLS care, ALS care when indicated, airway management, cardiac monitoring, medication administration, CPR, defibrillation, patient packaging, documentation, and transport. High-risk EMS incidents, including cardiac arrest, multiple-patient incidents, entrapment, and incidents requiring complex patient movement, require additional personnel to simultaneously address patient care, scene management, and transport-related tasks.

As part of the dispatch process, all medical calls are triaged according to EMD protocols. Calls triaged as Alpha responses are low-risk incidents, in which case MFRD units are dispatched Code 2 (nonurgent). Because these calls are dispatched as a low-priority, non-emergency response, the Department monitors overall call performance but does not have established call-processing, turnout, or travel benchmarks.

The ERF for low-risk EMS incidents is one rescue unit with three personnel. **Table 94** defines the NFIRS codes for all EMS calls, and **Table 95** displays the critical tasks required for low-risk EMS calls.

Table 94: EMS NFIRS Codes

NFIRS Code	Description	NFIRS Incident Type
311	Medical assist, assist EMS crew	EMS
320	EMS incident, other	EMS
321	EMS call, excluding vehicle accident with injury	EMS

Table 95: Low-Risk EMS Critical Tasks

Critical Tasks	No. Personnel	Company
Patient assessment and treatment	2	1st rescue unit
Patient transport	1	1st rescue unit
TOTAL	**3**	**1 rescue unit**

Moderate-risk medical responses are EMS calls that EMD triages as Bravo to Echo. Examples of moderate-risk EMS incidents include falls, traumatic injuries, allergic reactions, respiratory distress, altered mental status, and chest pain. These emergency calls often require ALS services. Units respond Code 3 (urgent), and the ERF is one rescue ambulance unit and one engine or truck with a minimum of six personnel.

Table 96 displays the critical tasks for moderate-risk EMS calls.

Table 96: Moderate-Risk EMS Critical Tasks

Critical Tasks	No. Personnel	Company
Command	1	1st engine
Patient assessment and treatment	2	1st engine
Patient transport	3	1st rescue unit
TOTAL	**6**	**1 engine and 1 rescue unit**

Examples of high-risk medical incidents include traumatic injury and a motor vehicle accident on a highway or freeway that requires additional units to safely block traffic. The ERF has two engines, four rescue ambulances, one chief officer, and a minimum of 19 personnel. **Table 97** displays the critical tasks for high-risk EMS calls.

Table 97: High-Risk EMS Critical Tasks

Critical Tasks	No. Personnel	Company
Command	1	1st Battalion Chief
Division/Group supervisor	1	1st engine
Safety officer	1	2nd engine
Patient assessment and treatment	8	1st and 2nd rescue units and 1st engine
Transport	6	3rd and 4th rescue units
Incident support	2	2nd engine
TOTAL	**19**	**2 engines, 4 rescue units, and 1 Battalion Chief**

EMS BENCHMARK GOALS

The MFRD's risks and critical tasks related to EMS are based on urban population density. In the Department's service area, urban areas have a population density of at least 1,000 people per square mile, and surrounding areas have an overall density of at least 500 people per square mile. These areas are characterized by concentrated development, interconnected transportation systems, and a mix of residential, commercial, industrial, and institutional occupancies that generate a sustained demand for fire and emergency services. The targeted service-level benchmark statements are based on industry standards, best practices, and historical response data.

For 90% of low-risk EMS calls, the minimum ERF staffing shall be three personnel on a fire engine, truck, or rescue unit that is requested Code 2 without lights and sirens. The first-due unit for all risk levels shall be capable of assessing scene safety, conducting an initial patient assessment, obtaining vital signs and the patient's medical history, initiating mitigation efforts, and transporting the patient to the hospital.

For 90% of moderate-risk EMS calls, the minimum ERF staffing shall be six personnel who arrive within 8 minutes (8:00) in urban response zones. The ERF shall be capable of establishing command, conducting initial patient assessment, obtaining vital signs and the patient's medical history, performing cardiopulmonary resuscitation (CPR), utilizing an EKG/defibrillator, administering medication, communicating with medical control, applying standing and physician orders, and packaging patients for transport.

Table 98 compares MFRD's 90th percentile response-time baseline performance for moderate-risk EMS calls, from alarm through on-scene distribution, against established benchmarks for January 2021 through December 2025.

Table 98: Five-Year Benchmark Versus Baseline Performance, 90th Percentile Response Times for Moderate-Risk EMS Incidents, CYs 2021–2025

EMS – Moderate-Risk Incidents		TOTAL	2025	2024	2023	2022	2021
Alarm Handling	Pick-up to Dispatch	**00:03:15**	00:02:34	00:02:44	00:03:10	00:03:28	00:03:38
Turnout Time	Turnout Time 1st Unit	**00:01:58**	00:01:38	00:01:28	00:01:39	00:02:07	00:02:23
Travel Time	Travel Time 1st Unit – **Distribution**	**00:07:40**	00:07:31	00:07:52	00:07:46	00:07:29	00:07:38
	Travel Time ERF **Concentration**	**00:07:40**	00:07:32	00:07:52	00:07:46	00:07:29	00:07:38
Total Response Time	Total Response Time 1st Unit on Scene – **Distribution**	**00:08:56**	00:08:35	00:08:51	00:08:52	00:08:55	00:09:18
		31,861	6,234	6,208	6,416	6,349	6,654
	Total Response Time ERF **Concentration**	**00:08:56**	00:08:35	00:08:52	00:08:52	00:08:55	00:09:18
		31,874	6,237	6,207	6,424	6,352	6,654

For 90% of high-risk EMS calls, the minimum ERF staffing shall be 19 personnel who arrive within 13 minutes (13:00) in urban response zones. The ERF shall be capable of establishing command, conducting primary and secondary patient assessments, triaging patients, interpreting electrocardiograms, administering medication, communicating with medical control, applying standing and physician orders, and packaging patients for transport.

Table 99 compares MFRD's 90th percentile response-time baseline performance for high-risk EMS calls, from alarm through on-scene distribution, with established benchmarks for January 2021 through December 2025.

Table 99: Five-Year Benchmark Versus Baseline Performance, 90th Percentile Response Times for High-Risk EMS Incidents, CYs 2021–2025

EMS – High-Risk Incidents		TOTAL	2025	2024	2023	2022	2021
Alarm Handling	Pick-up to Dispatch	**00:01:39**	00:01:08	00:01:35		00:01:41	
Turnout Time	Turnout Time 1st Unit	**00:01:30**	00:00:44	00:01:34		00:01:12	
Travel Time	Travel Time 1st Unit – **Distribution**	**00:06:49**	00:06:37	00:06:36		00:02:47	
	Travel Time ERF **Concentration**	**00:12:21**		00:13:25		00:02:47	
Total Response Time	Total Response Time 1st Unit on Scene – **Distribution**	**00:07:46**	00:07:08	00:07:56		00:03:59	
		4	2	1		1	
	Total Response Time ERF **Concentration**	**00:13:40**		00:14:45		00:03:59	
		2		1		1	

HAZMAT RESPONSE CRITICAL TASKS

For HazMat incidents, critical tasks generally include incident command, hazard identification, isolation, denied entry or evacuation, protective actions, medical monitoring, decontamination, defensive control measures, technical reference, resource coordination, and safety. High-risk HazMat incidents can require specialized regional resources and technical personnel that exceed the capabilities of the initial assignment.

Examples of low-risk HazMat incidents include carbon monoxide detector alarms, automotive fluids released at traffic accidents, abandoned chemicals found in their original containers, and spills of less than 1 gallon of gasoline outside. These incidents can typically be mitigated with a single water-carrying apparatus and three personnel trained at the HazMat First Responder Operations level. The ERF for low-risk HazMat incidents consists of a water-pumping apparatus and at least three personnel.

Table 100 defines NFIRS codes for low-risk HazMat incidents, and **Table 101** displays the critical tasks for low-risk HazMat incident response.

Table 100: Low-Risk HazMat Response NFIRS Codes

NFIRS Code	Description	NFIRS Incident Type
410	Combustible/flammable gas/liquid condition, other	HazMat
411	Gasoline or other flammable liquid spill	HazMat
412	Gas leak (natural gas or liquefied petroleum gas [LPG])	HazMat
413	Oil or other combustible liquid spill	HazMat
420	Toxic condition, other	HazMat
421	Chemical hazard (no spill or leak)	HazMat
422	Chemical spill or leak	HazMat
423	Refrigeration leak	HazMat
424	Carbon monoxide incident	HazMat
463	Vehicle accident, general cleanup	HazMat

Table 101: Low-Risk HazMat Response Critical Tasks

Critical Tasks	No. Personnel	Company
Command	1	1st engine or truck
Isolate and identify	2	1st engine or truck
TOTAL	**3**	**1 engine or truck**

Typical moderate-risk HazMat incidents include gas leaks within a structure, larger fuel spills, and unknown conditions. The ERF has three engines and/or trucks, and a chief officer, for a minimum of 10 personnel. **Table 102** defines NFIRS codes for moderate-risk and high-risk HazMat incidents, and **Table 103** lists the critical tasks for moderate-risk HazMat incident response.

Table 102: Moderate-Risk and High-Risk HazMat Response NFIRS Codes

NFIRS Code	Description	NFIRS Incident Type
410	Combustible/flammable gas/liquid condition, other	HazMat
411	Gasoline or other flammable liquid spill	HazMat
412	Gas leak (natural gas or LPG)	HazMat
413	Oil or other combustible liquid spill	HazMat
420	Toxic condition, other	HazMat
421	Chemical hazard (no spill or leak)	HazMat
422	Chemical spill or leak	HazMat
423	Refrigeration leak	HazMat
451	Biological hazard, confirmed or suspected	HazMat

Table 103: Moderate-Risk HazMat Response Critical Tasks

Critical Tasks	No. Personnel	Company
Command	1	1st Battalion Chief
Safety	1	1st engine
Isolate/deny entry	2	1st engine
Assess and identify	3	2nd engine
Contain and control	3	1st truck
TOTAL	**10**	**3 engines and/or trucks and 1 Battalion Chief**

High-risk HazMat incidents typically involve unknown items that require testing, large leaks, and/or investigations. The ERF for high-risk HazMat incidents includes four fire engines and/or one truck, two rescue ambulance units, two battalion chiefs, and a HazMat unit, for a minimum of 23 personnel. **Table 104** displays the critical tasks for high-risk HazMat incident response.

Table 104: High-Risk HazMat Response Critical Tasks

Critical Tasks	No. Personnel	Company
Command	2	1st and 2nd Battalion Chiefs
Safety	1	2nd engine
Identify/deny entry	3	1st engine
Assess	2	2nd engine
Containment and control	6	3rd engine, 2nd rescue unit, and HazMat unit
Decontamination	3	1st truck
Medical Unit	6	1st & 2nd rescue units
TOTAL	**23**	**5 engines and/or trucks, 2 rescue units, and 2 Battalion Chiefs. HazMat unit via automatic aid.**

HAZMAT RESPONSE BENCHMARK GOALS

For 90% of low-risk HazMat incidents, the minimum ERF staffing shall be three personnel trained to the HazMat First Responder Operations level who arrive within 9 minutes (9:00) in urban response zones. The first-due unit shall be capable of establishing command, conducting an initial scene assessment, performing air-quality analysis, assisting with evacuation, ventilating structures, and requesting additional resources. These operations should be conducted in accordance with the Department's standard operating guidelines, while ensuring the safety of responders and the general public.

Table 105 compares MFRD's 90th percentile response times baseline performance for low-risk HazMat responses, from alarm through on-scene distribution, against established benchmarks for January 2021 through December 2025.

Table 105: Five-Year Benchmark Versus Baseline Performance, 90th Percentile Response Times for Low-Risk HazMat Incidents, CYs 2021–2025

HazMat – Low-Risk Incidents		TOTAL	2025	2024	2023	2022	2021
Alarm Handling	Pick-up to Dispatch	**00:03:33**	00:02:33	00:02:57	00:03:52	00:03:31	00:03:39
Turnout Time	Turnout Time 1st Unit	**00:01:57**	00:01:30	00:01:30	00:01:49	00:02:09	00:02:20
Travel Time	Travel Time 1st Unit – **Distribution**	**00:07:53**	00:07:53	00:08:24	00:09:15	00:07:29	00:07:42
	Travel Time ERF **Concentration**	**00:08:01**	00:07:53	00:08:24	00:09:34	00:07:29	00:07:50
Total Response Time	Total Response Time 1st Unit on Scene – **Distribution**	**00:09:07**	00:08:54	00:09:18	00:10:06	00:08:54	00:09:02
		509	86	98	101	120	104
	Total Response Time ERF **Concentration**	**00:09:07**	00:08:54	00:09:19	00:10:21	00:08:54	00:09:07
		507	86	97	101	120	103

For 90% of moderate-risk HazMat incidents, the minimum ERF staffing shall be 10 personnel trained to the HazMat First Responder Operations level who arrive within 11 minutes (11:00) in urban response zones. The ERF for moderate-risk HazMat responses shall be capable of establishing command, performing an initial scene assessment, performing air quality analysis, assisting with evacuations, ventilating structures, performing gross decontamination, providing a hose line for protection, and providing ALS medical care.

Table 106 compares MFRD's 90th percentile response-time baseline performance for moderate-risk HazMat responses, from alarm through on-scene distribution, against established benchmarks for January 2021 through December 2025.

Table 106: Five-Year Benchmark Versus Baseline Performance, 90th Percentile Response Times for Moderate-Risk HazMat Incidents, CYs 2021–2025

HazMat – Moderate-Risk Incidents		TOTAL	2025	2024	2023	2022	2021
Alarm Handling	Pick-up to Dispatch	**00:03:43**	00:02:08	00:04:25	00:02:42	00:02:48	00:03:50
Turnout Time	Turnout Time 1st Unit	**00:02:40**	00:01:14	00:01:38	00:02:16	00:02:03	00:02:58
Travel Time	Travel Time 1st Unit – **Distribution**	**00:07:27**	00:07:20	00:08:16	00:07:20	00:05:59	00:06:36
	Travel Time ERF **Concentration**	**00:10:04**	00:08:05	00:12:22	00:08:07	00:10:20	00:08:47
Total Response Time	Total Response Time 1st Unit on Scene – **Distribution**	**00:08:31**	00:07:51	00:08:59	00:07:58	00:07:17	00:08:00
		40	2	14	7	10	7
	Total Response Time ERF **Concentration**	**00:11:08**	00:08:35	00:13:04	00:08:43	00:11:25	00:10:15
		33	1	13	5	8	6

For 90% of high-risk HazMat incidents, the minimum ERF staffing shall be 23 personnel, with some members trained to the HazMat technician or specialist level, who arrive within 15 minutes (15:00) in urban response zones. The ERF for high-risk HazMat responses shall be capable of providing incident command, administering ALS, isolating the area, denying entry, and identifying the type and hazard of materials involved.

Table 107 compares MFRD's 90th percentile response-time baseline performance for high-risk HazMat responses, from alarm through on-scene distribution, against established benchmarks for January 2021 through December 2025.

Table 107: Five-Year Benchmark Versus Baseline Performance, 90th Percentile Response Times for High-Risk HazMat Incidents, CYs 2021–2025

HazMat – High-Risk Incidents		TOTAL	2025	2024	2023	2022	2021
Alarm Handling	Pick-up to Dispatch	**00:03:28**	00:04:02	00:02:33	00:03:09	00:02:57	00:03:19
Turnout Time	Turnout Time 1st Unit	**00:01:43**	00:01:43	00:01:10	00:03:01	00:01:56	00:01:27
Travel Time	Travel Time 1st Unit – **Distribution**	**00:06:33**	00:06:33	00:06:49	00:05:58	00:05:33	00:04:43
	Travel Time ERF **Concentration**	**00:14:02**	00:11:05	00:14:44	00:13:56	00:13:11	00:06:18
Total Response Time	Total Response Time 1st Unit on Scene – **Distribution**	**00:07:17**	00:07:29	00:07:28	00:06:45	00:06:24	00:06:10
		31	10	6	5	8	2
	Total Response Time ERF **Concentration**	**00:16:00**	00:16:02	00:15:32	00:14:44	00:14:20	00:07:04
		17	7	3	3	3	1

TECHNICAL RESCUE CRITICAL TASKS

For technical rescue incidents, critical tasks generally include incident command, hazard assessment, scene stabilization, patient access, rescue group supervision, equipment deployment, technical rescue operations, patient care, packaging, extrication, safety, and resource coordination. Because technical rescue incidents are typically low-frequency but high-consequence events, the Department evaluates these responses based on the ability to assemble properly trained personnel and specialized equipment within a reasonable time frame.

Examples of low-risk technical rescue incidents include elevator lock-ins, motor vehicle accidents, and animal rescues. These incidents can typically be controlled with a single water-carrying apparatus with a pump (engine, truck, or rescue unit). The ERF is an apparatus capable of pumping water and a minimum of three personnel.

Table 108 defines NFIRS codes for low-risk technical rescue incidents, and **Table 109** displays the critical tasks for low-risk technical rescue.

Table 108: Low-Risk Technical Rescue NFIRS Codes

NFIRS Code	Description	NFIRS Incident Type
322	Motor vehicle accident with injuries	Technical Rescue
323	Motor vehicle/pedestrian accident	Technical Rescue
324	Motor vehicle accident with no injuries	Technical Rescue
331	Lock-in	Technical Rescue
341	Search for a person on land	Technical Rescue
353	Removal of victim(s) from a stalled elevator	Technical Rescue
361	Swimming/recreational water areas rescue	Technical Rescue
371	Electrocution or potential electrocution	Technical Rescue
372	Trapped by power lines	Technical Rescue
542	Animal rescue	Technical Rescue

Table 109: Low-Risk Technical Rescue Critical Tasks

Critical Tasks	No. Personnel	Company
Command	1	1st engine, truck, or rescue unit
Rescue operations	2	1st engine, truck, or rescue unit
TOTAL	**3**	**1 fire engine or truck**

Moderate-risk technical rescue incidents often involve vehicle extrications, low-angle rescues, and water rescues. The ERF for moderate-risk technical rescue incidents consists of two fire engines or trucks, two rescue units, and a battalion chief, for a minimum of 13 personnel.

Table 110 defines NFIRS codes for moderate-risk technical rescue incidents, and **Table 111** displays the critical tasks for moderate-risk technical rescue.

Table 110: Moderate-Risk Technical Rescue NFIRS Codes

NFIRS Code	Description	NFIRS Incident Type
350	Extrication, rescue, other	Technical Rescue
352	Extrication of victim(s) from vehicle	Technical Rescue
357	Extrication of victim(s) from machinery	Technical Rescue
361	Swimming/recreational water areas rescue	Technical Rescue
371	Electrocution or potential electrocution	Technical Rescue
372	Trapped by power lines	Technical Rescue
542	Animal rescue	Technical Rescue

Table 111: Moderate-Risk Technical Rescue Critical Tasks

Critical Tasks	No. Personnel	Company
Command	1	1st Battalion Chief
Fire or rescue operations	6	1st and 2nd engines
Rescue operations	3	1st rescue unit
Patient care	3	2nd rescue unit
TOTAL	**13**	**2 engines or trucks, 2 rescue units, and 1 Battalion Chief**

High-risk technical rescue incidents typically involve a vehicle striking a structure, vehicle extrication, confined-space incidents, and rescues both above and below grade. The ERF for high-risk technical rescue has three fire engines or trucks, two rescue units, one chief officer, and a minimum of 16 personnel. **Table 112** defines the NFIRS codes for high-risk technical rescue incidents, and **Table 113** shows the critical tasks for high-risk technical rescue.

Table 112: High-Risk Technical Rescue NFIRS Codes

NFIRS Code	Description	NFIRS Incident Type
350	Extrication, rescue, other	Technical Rescue
351	Extrication of victim(s) from building/structure	Technical Rescue
352	Extrication of victim(s) from vehicle	Technical Rescue
354	Trench/below-grade rescue	Technical Rescue
355	Confined space rescue	Technical Rescue
356	High-angle rescue	Technical Rescue
357	Extrication of victim(s) from machinery	Technical Rescue
363	Swift water rescue	Technical Rescue
461	A building or structure weakened or collapsed	Technical Rescue
542	Animal rescue	Technical Rescue

Table 113: High-Risk Technical Rescue Critical Tasks

Critical Tasks	No. Personnel	Company
Command	1	1st Battalion Chief
Safety	1	1st engine
Fire or rescue operations	5	1st and 2nd fire engines
Patient care	6	1st and 2nd rescue units
Rescue operations	3	1st truck and technical rescue team
TOTAL	**16**	**3 engines or trucks, 2 rescue ambulance units, and 1 Battalion Chief. Technical Rescue Team via automatic aid.**

TECHNICAL RESCUE BENCHMARK GOALS

For 90% of low-risk technical rescue incidents, the minimum ERF staffing shall be three personnel who arrive within 9 minutes (9:00) in urban response zones. The first-due unit shall be capable of establishing command, assessing scene safety, performing a scene assessment, and requesting additional resources. These operations should be conducted in accordance with the Department's standard operating guidelines, while ensuring the safety of responders and the general public.

Table 114 compares MFRD's 90th percentile response-time baseline performance for low-risk technical rescue incidents, from alarm through on-scene distribution, with established benchmarks for January 2021 through December 2025.

Table 114: Five-Year Benchmark Versus Baseline Performance, 90th Percentile Response Times for Low-Risk Technical Rescue Incidents, CYs 2021–2025

Technical Rescue – Low-Risk Incidents		TOTAL	2025	2024	2023	2022	2021
Alarm Handling	Pick-up to Dispatch	**00:03:28**	00:03:07	00:03:30	00:03:28	00:03:24	00:03:44
Turnout Time	Turnout Time 1st Unit	**00:01:55**	00:01:29	00:01:27	00:01:39	00:02:09	00:02:17
Travel Time	Travel Time 1st Unit – **Distribution**	**00:08:30**	00:08:24	00:08:40	00:08:21	00:08:23	00:08:48
	Travel Time ERF **Concentration**	**00:08:29**	00:08:28	00:08:37	00:08:21	00:08:23	00:08:44
Total Response Time	Total Response Time 1st Unit on Scene – **Distribution**	**00:09:33**	00:09:22	00:09:21	00:09:21	00:09:40	00:10:06
		5,007	892	964	1,009	1,145	997
	Total Response Time ERF **Concentration**	**00:09:32**	00:09:25	00:09:19	00:09:21	00:09:42	00:10:06
		4,996	892	961	1,006	1,141	996

For 90% of moderate-risk technical rescue incidents, the minimum ERF staffing shall be six personnel who arrive within 12 minutes (12:00) in urban response zones. The ERF for moderate-risk technical rescue shall be capable of establishing command, assessing scene safety, performing a scene assessment, requesting additional resources, mitigating hazards, performing mechanical extrication, and providing patient care.

Table 115 compares MFRD's 90th percentile response times baseline performance for moderate-risk technical rescue incidents, from alarm through on-scene distribution, with established benchmarks for January 2021 through December 2025.

Table 115: Five-Year Benchmark Versus Baseline Performance, 90th Percentile Response Times for Moderate-Risk Technical Rescue Incidents, CYs 2021–2025

Technical Rescue – Moderate-Risk Incidents		TOTAL	2025	2024	2023	2022	2021
Alarm Handling	Pick-up to Dispatch	00:03:08	00:02:58	00:04:06	00:03:36	00:02:44	00:02:51
Turnout Time	Turnout Time 1st Unit	00:02:03	00:01:22	00:01:26	00:01:51	00:02:43	00:02:47
Travel Time	Travel Time 1st Unit – **Distribution**	00:08:46	00:07:47	00:11:26	00:06:56	00:07:06	00:07:31
	Travel Time ERF **Concentration**	00:11:42	00:13:15	00:10:32	00:09:11	00:13:54	00:09:35
Total Response Time	Total Response Time 1st Unit on Scene – **Distribution**	00:09:47	00:08:54	00:12:08	00:08:28	00:07:51	00:08:32
		103	22	23	13	23	22
	Total Response Time ERF **Concentration**	00:13:05	00:14:09	00:13:12	00:09:56	00:15:04	00:10:55
		78	21	17	8	16	16

For 90% of high-risk technical rescue incidents in urban response zones, the minimum ERF staffing shall be 10 personnel who arrive within 15 minutes and 30 seconds (15:30). The ERF for high-risk technical rescues shall be capable of establishing command, assessing scene safety, performing a scene assessment, requesting additional resources, mitigating hazards, performing mechanical extrication, and providing patient care.

Between January 1, 2021, and December 31, 2025, fewer than three incidents met the criteria for inclusion in the high-risk technical rescue ERF analysis.

Performance Gap Analysis and Future Opportunities

The purpose of performance analysis is not only to measure historical performance, but also to identify opportunities for continuous improvement. MFRD's historical performance data indicate that the Department generally provides reliable emergency response services throughout the community; however, several performance gaps were identified that could affect the effectiveness of future deployments, resource availability, and service delivery outcomes.

CALL-PROCESSING PERFORMANCE

Call-processing performance measurably improved during the five-year study period, from 3 minutes and 41 seconds in 2021 to 2 minutes and 39 seconds in 2025. However, performance remains above both NFPA 1225 recommendations and the Department's adopted benchmark objective of 2 minutes and 30 seconds. Because call processing is the first measurable component of the response continuum, delays in this phase directly affect overall response performance, regardless of improvements in turnout and travel times.

The Department should continue to collaborate with Broward County Regional Communications to evaluate EMD protocols, call-transfer procedures, dispatcher workload, quality-assurance processes, and opportunities for earlier unit notification, when appropriate.

TURNOUT PERFORMANCE

Turnout performance significantly improved during the study period, decreasing from 2 minutes and 24 seconds in 2021 to 1 minute and 40 seconds in 2025. This finding represents an improvement of approximately 44 seconds, or 30%, over the five-year period. Although current performance remains slightly above the Department's adopted benchmark of 1 minute and 30 seconds, the trend shows meaningful progress and suggests that focused operational emphasis, accountability, and performance monitoring can improve turnout times.

Continued improvement in turnout performance can significantly impact overall response effectiveness, as turnout time is one of the few components of total response time that can be directly influenced by organizational policy, training, station practices, and performance management. Faster turnout times improve overall response performance without requiring additional resources or infrastructure investments.

MFRD should continue monitoring turnout performance by station, shift, incident type, and time of day to identify trends, best practices, and opportunities for further improvement. Regular review of turnout performance metrics through the Department's continuous quality improvement (CQI) process will help ensure that the gains achieved during the study period are maintained and, where practical, expanded.

RESCUE UNIT UTILIZATION

Analysis of unit commitment times and UHU identified Rescue 19, Rescue 70, and Rescue 107 as the busiest operational resources within the EMS system. In 2025, Rescue 19 recorded an incident-based UHU of approximately 24.8%, Rescue 70 exceeded 21%, and Rescue 107 exceeded 16%.

These utilization levels indicate that the Department's busiest transport units are experiencing moderate to high workload demands. According to guidance published by the International Association of Fire Fighters (IAFF), ambulance utilization is generally considered optimal when maintained below 24%. Utilization levels between 25%

and 29% warrant close evaluation, and utilization approaching or exceeding 30% can affect unit availability, response reliability, crew workload, and overall system performance.

None of the Department's rescue units currently exceeds the recommended maximum threshold, but Rescue 19 is operating near the high end of the preferred utilization range. Continued growth in EMS demand, longer transport times, longer hospital turnaround delays, and higher levels of simultaneous incidents could place additional pressure on ambulance availability and increase the likelihood of first-due coverage gaps.

As a result, MFRD should continue to monitor unit utilization trends, rescue unit availability, hospital turnaround times, transport destination patterns, mutual-aid dependence, and periods of high concurrent EMS demand. Ongoing evaluation of these performance indicators will assist the Department in identifying emerging system capacity issues and support future decision-making regarding deployment strategies, staffing, and EMS resource allocation.

EFFECTIVE RESPONSE FORCE ASSEMBLY

First-arriving unit performance generally met or approached MFRD’s adopted benchmark objectives; however, ERF assembly times exceeded benchmark objectives for several moderate- and high-risk incident categories. Analysis indicates that dynamic resource assignment practices and post-dispatch unit additions contribute to delayed ERF concentration on scene.

Future evaluation should focus on balancing geographic coverage objectives with the timely concentration of resources necessary to safely manage moderate- and high-risk incidents.

CONCURRENT INCIDENT ACTIVITY

The Department experienced two or more simultaneous incidents approximately 27.6% of the time, indicating that concurrent incident demand is a routine operational condition rather than an infrequent occurrence. Future deployment planning should continue to emphasize system reliability, resource availability, and reserve response capacity rather than relying solely on single-incident response models.

STRATEGIC IMPROVEMENT PRIORITIES

Future planning efforts should focus on maintaining response reliability, improving dispatch performance, monitoring EMS workload growth, evaluating hospital turnaround times, and ensuring that deployment strategies remain aligned with community risk and service demand.

Based on the historical performance analysis, MFRD should consider the following strategic priorities:

- Continue improving emergency call-processing performance through coordination with Broward County Regional Communications.
- Monitor growth in EMS demand and rescue unit utilization.
- Evaluate ERF assembly performance and dynamic dispatch practices.
- Expand outcome-based performance measures.
- Formalize and implement a department-wide CQI process.
- Continue monitoring annual performance to identify emerging trends before they significantly affect service delivery.

Focusing on these priorities will further strengthen MFRD’s operational reliability, improve community outcomes, and support future accreditation efforts. The performance gaps and improvement opportunities identified throughout this historical performance analysis provide the foundation for the Department's future CQI efforts.

Continuous Quality Improvement

CQI is a systematic management approach that promotes ongoing evaluation, measurement, analysis, and improvement of organizational performance. Within the fire and emergency services profession, CQI provides a structured framework for assessing service delivery, identifying opportunities for improvement, implementing corrective actions, and evaluating the effectiveness of those actions over time. CFAI identifies CQI as a fundamental component of organizational excellence and accreditation readiness.

MFRD currently utilizes a variety of processes that support organizational evaluation and performance improvement. These activities include annual budgeting, strategic planning, performance measurement, EMS quality assurance, training evaluations, after-action reviews, policy development, supervisory oversight, and monthly assessments of operational performance. The CRA/SOC provides an opportunity to more formally integrate these activities into a Department-wide CQI framework.

As part of its ongoing organizational development efforts, MFRD should continue implementing a formal CQI framework that integrates performance measurement, CRA, SOC evaluation, strategic planning, operational review, and outcome-based performance monitoring into a single, continuous improvement process.

The CRA/SOC should serve as a recurring management document rather than a one-time accreditation product. Identified risks, performance gaps, workload trends, and improvement priorities should be reviewed during preparation of the annual operating budget, capital improvement program, apparatus and equipment replacement plans, staffing evaluations, training plans, community risk-reduction priorities, and updates to the Department's strategic plan. When a proposed expenditure or operational change is intended to address an identified CRA/SOC finding, the applicable risk, performance measure, expected result, and method of evaluation should be documented as part of the decision-making process.



A formal CQI process would allow the Department to systematically evaluate performance, identify operational deficiencies, implement corrective actions, and measure the effectiveness of improvements over time. This process would support data-informed decision-making and provide a mechanism for ensuring that organizational resources, deployment strategies, staffing models, and community risk-reduction programs remain aligned with community needs and service expectations.

RECOMMENDED CONTINUOUS IMPROVEMENT PROCESS

The recommended CQI framework for MFRD consists of six primary components: identify, measure, analyze, improve, evaluate, and repeat.

Identify

Identify community risks, service demands, stakeholder expectations, organizational objectives, and operational challenges through CRA-SOC strategic planning efforts, operational reviews, and stakeholder engagement activities.

Measure

Collect and evaluate performance data related to emergency response, deployment effectiveness, EMS outcomes, firefighter safety, community risk-reduction activities, training programs, inspections, and other organizational functions. Establish measurable performance indicators and benchmark objectives that can be measured and tracked over time. Performance measures should include both operational metrics and outcome-based indicators.

Analyze

Evaluate collected data to identify trends, strengths, deficiencies, emerging risks, and opportunities for improvement. Analysis should include response performance, unit reliability, ERF assembly, workload distribution, firefighter safety outcomes, and community outcomes.

Improve

Develop and implement corrective actions designed to address identified performance gaps. Improvement initiatives can include policy revisions, training enhancements, deployment modifications, staffing adjustments, technology improvements, additional or modified community risk-reduction initiatives, and strategic planning updates.

Evaluate

Measure the effectiveness of implemented improvements to determine whether their desired outcomes were achieved. Evaluation should assess whether changes resulted in measurable improvements in performance, operational effectiveness, firefighter safety, or community outcomes.

Repeat

Continuous improvement is an ongoing process rather than a one-time activity. Performance should be reassessed regularly to ensure that organizational practices remain aligned with changing community risks, service demands, operational needs, and strategic objectives.

At least annually, MFRD should complete a documented review of the CRA/SOC findings and determine whether changes in service demand, risk distribution, development, staffing, deployment, unit availability, response performance, outcomes, or stakeholder expectations require modification of an existing program or objective.

Material findings should be communicated to executive leadership and the authority having jurisdiction and incorporated, as appropriate, into budget requests, capital plans, strategic initiatives, policy revisions, and future CRA/SOC updates.

OUTCOME-BASED PERFORMANCE EVALUATION

MFRD has begun incorporating outcome-based performance measures into its CQI efforts. As additional data become available, the Department should continue expanding outcome evaluation to include firefighter injuries, room-and-contents confinement, EMS clinical performance indicators, community risk reduction effectiveness, and community resilience measures.

CONTINUOUS IMPROVEMENT RECOMMENDATION

Although MFRD currently performs many activities consistent with CQI principles, the Department has not yet implemented a fully integrated CQI framework. Developing a more formalized and integrated CQI framework should remain a strategic organizational priority to support future accreditation efforts, improved performance measurement, enhanced organizational accountability, and continued service improvement.



Community Outcomes and System Effectiveness

Historically, fire department performance evaluations focused primarily on operational measures, such as response times, staffing levels, and deployment capability. Although these metrics remain important indicators of system performance, the 11th edition of the CFAI's *Fire and Emergency Services Self-Assessment Model* places greater emphasis on outcome-based performance measures that evaluate the effectiveness of the entire community fire-protection system. Outcome measures provide insight into how well emergency response, prevention programs, public education efforts, emergency communications, and community partnerships collectively contribute to positive community outcomes.

To evaluate overall system effectiveness, MFRD analyzed available data related to civilian casualties, cardiac arrest outcomes, and property loss. These measures assess the effectiveness of both life safety and property conservation activities and establish a baseline for future performance monitoring.

CIVILIAN FIRE CASUALTIES

Civilian injuries and fatalities resulting from fire incidents are among the most significant outcome measures for evaluating the effectiveness of a community's fire-protection system. Factors influencing civilian casualty rates include public education, smoke alarm presence, early-notification systems, building construction, fire-protection systems, occupant behavior, emergency communications, and fire department response capability.

During the study period, MFRD experienced very few civilian fire casualties. Available records identified six civilian fire casualties associated with fire incidents between 2021 and 2025, including one fatality, one life-threatening injury, one moderate injury, one minor injury, and two severe injuries **(Table 116)**. Most casualties occurred within residential occupancies and involved exposure to fire products, hazardous conditions, or secondary injury mechanisms such as slips and falls.

Given the more than 69,000 incidents handled by MFRD during the study period, the occurrence of only six documented civilian fire casualties indicates that serious civilian injuries from fire events are relatively infrequent within the community. Any fire-related injury or fatality is significant; however, the relatively low frequency of documented civilian fire casualties during the study period is consistent with favorable community fire-life-safety outcomes and provides an important baseline for evaluating future prevention, public education, built-environment, and emergency response performance.

Table 116: Miramar Fire-Rescue Department Civilian Injury or Casualties, CYs 2021–2025

Severity of Casualty	No. Injury or Casualties
Civilian fatality	1
Life-threatening injury	1
Severe injury	2
Moderate injury	1
Minor injury	1
TOTAL	**6**

CARDIAC ARREST OUTCOMES

Out-of-hospital cardiac arrest remains one of the most time-sensitive medical emergencies encountered by fire-based EMS systems. Survival outcomes are influenced by multiple components of the community's emergency

medical system, including rapid recognition of cardiac arrest, activation of 9-1-1, dispatcher-assisted CPR, bystander CPR, early defibrillation, emergency response performance, ALS interventions, and hospital post-resuscitation care.

Between 2021 and 2025, MFRD responded to 466 cardiac arrest incidents in which resuscitation efforts were initiated. Of these patients, 113 achieved Return Of Spontaneous Circulation (ROSC) at some point during treatment, representing an overall ROSC rate of approximately 24.2% **(Table 117).** 71 patients achieved ROSC prior to arrival at the emergency department (ED), and 29 patients maintained ROSC through arrival at the hospital. 13 patients sustained ROSC for at least 20 consecutive minutes, representing the most significant indicator of successful field resuscitation.

Table 117: Miramar Fire-Rescue Department Cardiac Arrest Outcomes, CYs 2021–2025

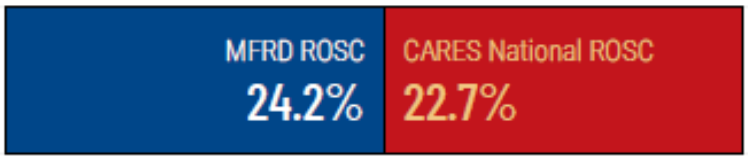
Outcome	No. Patients	Percentage
No conversion to ROSC	240	51.6%
ROSC achieved	113	24.2%
ROSC prior to ED arrival	71	15.2%
ROSC at ED arrival	29	6.2%
Sustained ROSC >20 minutes	13	2.8%
TOTAL PATIENTS IN CARDIAC ARREST	**466**	**100.0%**

The overall ROSC rate achieved by MFRD compares favorably with national performance reported through the Cardiac Arrest Registry to Enhance Survival (CARES). The 2025 CARES National Survival Report identified a sustained ROSC rate of 22.7% among more than 140,000 out-of-hospital cardiac arrest patients nationwide **(Figure 91).**

National CARES data indicate that patients who receive bystander CPR experience significantly higher survival rates than those who do not receive immediate intervention. Recent research utilizing CARES data found that survival benefits remain measurable when bystander CPR is initiated within 8 to 9 minutes of collapse, with the greatest benefit occurring when CPR is started immediately.

These outcomes indicate that MFRD's cardiac arrest performance is generally consistent with or slightly above the national comparison presented and reflects the combined contributions of the Department's ALS response system, emergency communications process, bystander intervention, and broader continuum of cardiac arrest care.

Figure 91: Miramar Fire-Rescue Department vs CARES National ROSC Comparison



EMS SYSTEM OUTCOME MEASURES

A significant characteristic of MFRD's service delivery model is that approximately 70% of all incidents are EMS-related. Because EMS represents the Department's primary workload, outcome-based performance measures should evaluate not only response times but also patient outcomes and system effectiveness.

Between 2021 and 2025, MFRD responded to more than 48,000 emergency medical incidents, representing approximately 70.2% of all emergency responses. EMS is the Department's primary service delivery function and the area in which community outcomes can be most directly influenced.

Nationally, EMS agencies are increasingly evaluated using outcome-based performance indicators rather than response times alone. These indicators include cardiac arrest survival, bystander CPR rates, pain management effectiveness, airway management success, stroke recognition, ST-segment Elevation Myocardial Infarction (STEMI) recognition, and patient satisfaction.

MFRD currently tracks cardiac arrest outcomes and should continue expanding its EMS quality improvement process to include additional outcome measures such as:

- STEMI recognition and hospital notification rates
- Stroke identification accuracy
- Advanced airway success rates
- Pain management effectiveness
- Patient satisfaction
- Hospital destination appropriateness
- Return-of-service times following patient transfer

The Department's existing cardiac arrest outcomes provide a strong foundation for future EMS outcome measurement and demonstrate a commitment to evidence-based patient care.

PROPERTY CONSERVATION EFFECTIVENESS

Property conservation is a key outcome measure for evaluating the effectiveness of fire suppression operations, fire prevention activities, public education programs, and built-in fire-protection systems. Although fire loss statistics provide one measure of system effectiveness, they must be interpreted in the context of community development patterns, occupancy types, fire severity, and incident frequency. **Table 118** shows MFRD's fire loss and property conservation data for the study period.

Table 118: Miramar Fire-Rescue Department Fire Loss and Property Conservation, in Millions, CYs 2021–2025

Year	No. Fire Incidents	Estimated Value at Risk	Estimated Loss
2021	20	$2.46 M	$1.73 M
2022	15	$0.50 M	$0.37 M
2023	28	$4.82 M	$3.89 M
2024	21	$50.68 M	$0.55 M
2025	20	$4.77 M	$1.71 M
TOTAL	**104**	**$63.23 M**	**$8.25 M**

Analysis of fire loss data provides additional insight into the effectiveness of the community's fire-protection system and the Department's ability to limit fire spread and conserve property. Between 2021 and 2025, MFRD documented 104 fire incidents with reported property loss information. During this period, the estimated value of property and contents exposed to fire exceeded $63 million, and the total reported property and content loss was approximately $8.25 million.

Although fire loss data can be skewed by a small number of high-value properties and the accuracy of loss estimates reported at the scene, the findings indicate that a substantial portion of property value exposed to fire was ultimately preserved. This outcome reflects the combined effectiveness of early fire detection, automatic fire-protection systems, public education efforts, emergency communications, fire prevention activities, and fire suppression operations.

Fire incidents represented only a small percentage of MFRD's overall service demand during the study period. Yet, they remain among the most resource-intensive and high-consequence incidents encountered by the Department. The relatively limited property loss experienced across the community suggests that fires are generally being controlled before resulting in catastrophic loss. These findings are consistent with the Department's overall response performance and indicate that the community's fire-protection system is producing favorable property-conservation outcomes.

As part of its CQI process, MFRD should continue monitoring annual fire loss trends, property conservation rates, room-and-contents confinement rates, and losses by occupancy type. Tracking these measures over time will provide additional insight into the effectiveness of fire suppression, prevention, and community risk-reduction efforts and will support future outcome-based performance evaluation.

Room-and-Contents Confinement

Nationally, one of the most commonly used fire outcome measures is the percentage of fires confined to the room or object of origin, a measure that generally indicates early detection, rapid notification, effective fire-protection systems, favorable response performance, and successful initial suppression operations.

Although detailed room-and-contents confinement data were not available for this study, MFRD should consider incorporating NFIRS confinement statistics into future outcome evaluations. Tracking data on fires confined to the room, floor, and structure of origin would provide additional insight into the effectiveness of the Department's suppression operations and overall fire-protection system.

As part of future CQI efforts, MFRD should establish annual reporting metrics related to confinement effectiveness and property conservation outcomes.

FIREFIGHTER SAFETY OUTCOMES

A modern fire and emergency medical response agency performance evaluation should also examine firefighter safety outcomes. Firefighter injuries and occupational exposures are important indicators of organizational effectiveness because they directly affect workforce readiness, overtime costs, workers' compensation expenses, and long-term employee health.

Nationally, the fire service has shifted toward measuring firefighter safety outcomes using data related to injuries, near-miss events, cancer-prevention initiatives, behavioral health support, and training compliance.

MFRD should continue monitoring and reporting:

- Fireground injuries
- EMS-related injuries
- Emergency response vehicle accidents
- Lost-time injuries
- Occupational exposure incidents
- Participation in cancer screening initiatives
- Participation in physical fitness programs
- Utilization of behavioral health services

Tracking these measures over time will provide valuable insight into the effectiveness of the Department's health and safety programs, as well as support accreditation and CQI initiatives.

COMMUNITY RISK-REDUCTION OUTCOMES

Community risk-reduction strategies are intended to reduce the frequency and severity of emergencies by preventing their occurrence. Although emergency response performance measures assess operational effectiveness after an event, community risk-reduction measures evaluate the effectiveness of prevention, education, inspections, code enforcement, and public outreach programs.

During the study period, fire incidents accounted for approximately 1% of all emergency responses within the MFRD service area. This low percentage reflects a combination of modern building codes, automatic fire-protection systems, public education programs, inspection activities, and proactive fire prevention efforts.

National research conducted by the U.S. Fire Administration (USFA) and NFPA consistently demonstrates that communities with strong prevention programs experience fewer fire fatalities, lower property losses, and higher rates of early fire detection.

MFRD should continue developing outcome measures related to community risk-reduction activities, including:

- Smoke alarm installations
- Public education contacts
- Fire code compliance rates
- Reinspection success rates
- Youth fire-setter interventions
- Participation in community CPR training
- Fall-prevention and senior outreach programs

Tracking these measures will help demonstrate how prevention activities influence long-term community outcomes.

COMMUNITY RESILIENCE AND RECOVERY

The Federal Emergency Management Agency (FEMA) defines community resilience as the ability of a community to prepare for, withstand, adapt to, and recover from disruptive events. Community resilience is increasingly recognized as a key outcome measure because it reflects the combined effectiveness of emergency response, mitigation, preparedness, public education, and recovery activities.

FEMA’s National Risk Index identifies community resilience indicators to evaluate the ability of residents and businesses to recover from disasters and major emergencies. Communities with higher resilience scores generally experience reduced long-term impacts from disasters and recover more rapidly following disruptive events.

MFRD supports community resilience through:

- Emergency preparedness education
- Hazard mitigation planning
- Disaster response capability
- Mutual-aid participation
- Public information programs
- Continuity of operations planning

Future evaluations should consider incorporating FEMA's Resilience Analysis and Planning Tool (RAPT) as part of the Department's continuous performance evaluation process. Monitoring changes in community resilience indicators over time will help assess the effectiveness of the Department's community risk reduction, emergency preparedness, emergency response, and recovery initiatives while providing valuable insight into the community's capacity to prepare for, withstand, and recover from natural and human-caused hazards.

OUTCOME DASHBOARD

Outcome measures provide an overall assessment of the effectiveness of the Miramar Fire-Rescue Department in achieving its mission of protecting life, property, and the environment. Unlike traditional operational metrics that measure workload or response performance, outcome measures evaluate the results of emergency services and community risk reduction efforts. Collectively, these indicators provide insight into the Department's impact on community safety and establish a baseline for continuous quality improvement. **Table 119** summarizes selected outcome measures for calendar years 2021 through 2025.

Table 119: Miramar Fire-Rescue Department Outcome Dashboard, CYs 2021–2025

Outcome Measure	Result
Total incidents	69,448
EMS Incidents	48,745 (70.2%)
Fire Incidents	702 (1.0%)
Civilian fire fatalities	1
Civilian injuries	5
Cardiac arrest patients	466
ROSC achieved	24.2%
Sustained ROSC >20 minutes	2.8%
Concurrent incidents (2+)	27.6%
Rescue 19 UHU	24.8%
Average annual incidents	13,890

OUTCOME AND OUTPUT SUMMARY

Overall, available outcome measures indicate that MFRD is producing favorable community outcomes. Civilian fire casualties remain rare, cardiac arrest resuscitation outcomes compare favorably with national benchmarks, and fire suppression activities continue to limit property loss within the community. Although additional outcome measures should be developed in future years, the current results suggest that the combined efforts of emergency communications, community risk reduction, prevention, public education, and emergency response programs are contributing to positive life safety and property conservation outcomes. Continued expansion of outcome-based performance measures will further strengthen the Department's ability to evaluate service effectiveness and support future accreditation efforts.



Key Findings and Recommendations

The historical performance analysis yielded several significant findings regarding emergency service demand, resource utilization, response performance, and future deployment considerations. Collectively, these findings provide valuable insight into the Department's current operational capabilities and areas requiring continued monitoring and improvement.

KEY FINDING 1
EMERGENCY MEDICAL SERVICES DRIVE SYSTEM DEMAND

Emergency medical incidents accounted for approximately 70% of all incidents and generated the majority of unit commitments and commitment hours during the study period. Rescue ambulances accumulated nearly three times the committed time of suppression apparatus, confirming that EMS response and transport activities are the primary driver of workload and unit availability throughout the system.

Recommendation: Continue monitoring EMS demand, hospital turnaround times, transport destination patterns, and rescue unit utilization. Future increases in EMS demand could warrant evaluation of deployment alternatives, peak-demand staffing models, and additional EMS transport resources.

KEY FINDING 2
RESCUE UNIT WORKLOAD CONTINUES TO INCREASE

Rescue 19, Rescue 70, and Rescue 107 had the highest commitment times and UHU levels within the Department. Rescue 19 approached 25% UHU during 2025, indicating an increased workload concentration within portions of the system.

Recommendation: Conduct annual workload and reliability evaluations of rescue units to determine whether current deployment models continue to support desired response reliability and service levels.

KEY FINDING 3
ESTABLISH EMS-SPECIFIC KEY PERFORMANCE INDICATORS

The Department’s written quality management policy framework does not formally incorporate specific key performance indicators (KPIs) or measurable clinical benchmarking metrics. Although the Department conducts ongoing reviews and quality improvement activities, the absence of formally established KPIs limits its ability to consistently measure long-term clinical trends, benchmark performance against regional and national standards, and quantitatively evaluate system improvement initiatives over time.

Recommendation: Develop a formal EMS performance dashboard that includes clinical, operational, and patient outcome measures. At a minimum, consider monitoring ROSC rates, bystander CPR rates, advanced airway success rates, pain management effectiveness, STEMI and stroke care performance, response reliability, and hospital turnaround times. Compare results annually against state and national benchmarks.

KEY FINDING 4
EVALUATE IF TRAINING NEEDS ARE MET BY PEMBROKE PINES TRAINING FACILITY

Access to the Pembroke Pines Fire Rescue Training Facility provides significant operational and instructional benefits; however, the distance between Miramar and the facility can pose logistical challenges, particularly when scheduling training for on-duty companies. The travel time required to transport personnel and apparatus to and from the regional training center reduces unit availability, increases out-of-service time, complicates scheduling, and potentially affects system coverage during training activities.

Recommendation: Conduct a formal assessment of the operational, financial, and training impacts associated with using an off-site training facility. The assessment should evaluate travel time impacts, unit availability, training frequency, future growth needs, and the feasibility of developing a phased training facility within the City of Miramar.

KEY FINDING 5
LACK OF FORMAL EMS FIELD TRAINING AND EVALUATION PROGRAM

Although MFRD maintains structured EMS training and CME programs, the Department does not currently utilize a formal EMS field training and evaluation program (FTEP) or designated EMS field training officers (FTOs). Formalized FTEPs are common within fire and EMS organizations to standardize the onboarding, evaluation, mentorship, and competency verification processes for newly hired and newly certified personnel. The absence of a formal EMS FTEP and assigned EMS FTO personnel could limit the Department's ability to consistently standardize clinical evaluation, field performance documentation, and mentorship processes for probationary personnel.

Recommendation: Evaluate the need to establish a formalized EMS FTEP, which could enhance operational consistency, improve documentation of competency progression, strengthen quality assurance efforts, and support long-term clinical performance and workforce development objectives.

KEY FINDING 6
LACK OF ADMINISTRATIVE SUPPORT FOR TRAINING DIVISION

The Department maintains a structured training program, but there is currently no clerical or administrative staff assigned specifically to the Training Division. Administrative responsibilities, such as scheduling, records management, documentation, reporting, and course coordination, are handled by existing training personnel alongside their operational and instructional duties.

Recommendation: Conduct a workload analysis of Training Division administrative functions, including records management, compliance reporting, scheduling, certification tracking, and course coordination. Based on the findings, determine whether additional clerical or administrative support is necessary to maintain training effectiveness and regulatory compliance.

KEY FINDING 7
NEED FOR REPLACEMENT PLANNING FOR SEVERAL FIRE APPARATUS

Inventory of the Department's frontline fleet indicates that multiple apparatus and transport units are approaching or exceeding recommended frontline service life expectations and should be considered for replacement planning.

Recommendation: Develop and maintain a comprehensive apparatus replacement plan that incorporates vehicle condition assessments, maintenance costs, life cycle expectations, reserve fleet requirements, and long-term capital funding strategies. The plan should be reviewed and updated annually.

KEY FINDING 8
CALL PROCESSING REMAINS THE LARGEST COMPONENT OF RESPONSE DELAY

Although call-processing performance improved significantly during the study period, the 2025 performance level of 2 minutes and 39 seconds remains substantially above NFPA recommendations.

Recommendation: Collaborate with Broward County Regional Communications to evaluate call-processing workflows, EMD determinant assignment practices, staffing levels, and quality assurance programs to identify opportunities for continued improvement.

KEY FINDING 9
TURNOUT PERFORMANCE DEMONSTRATED SIGNIFICANT IMPROVEMENT

Turnout performance improved by approximately 44 seconds between 2021 and 2025, approaching the Department's adopted benchmark.

Recommendation: Continue existing turnout time monitoring and performance management initiatives. Future evaluation should identify station-specific and time-of-day factors that could influence turnout performance.

KEY FINDING 10
TRAVEL TIME PERFORMANCE HAS REMAINED STABLE

Travel times remained relatively consistent throughout the study period and, when considered with the geographic coverage modeling, indicate that the current station configuration generally provides effective geographic coverage across the community.

Recommendation: Continue evaluating travel time performance in conjunction with future development patterns, roadway changes, population growth, and community risk distribution.

KEY FINDING 11
INCIDENT DEMAND REMAINS CONCENTRATED IN STATIONS 19 AND 70

More than one-half of all incidents and unit commitments occur within the Station 19 and Station 70 response areas. These stations represent the highest concentration of workload and service demand within the Department.

Recommendation: Continue evaluating workload concentration, response reliability, UHU, and station workload balance within these response areas. Future analyses should determine whether changes in deployment, staffing, and/or resource allocation are necessary to maintain service levels.

KEY FINDING 12
COMMUNITY RISK IS CONCENTRATED WITHIN SPECIFIC GEOGRAPHIC AREAS

The CRA identified that incident activity and community risk are not evenly distributed throughout the city. Several areas, particularly within the Station 19 and Station 70 response areas, consistently demonstrate higher concentrations of emergency incidents, EMS demand, and community risk factors.

Recommendation: Review the CRA annually and comprehensively update when material changes occur. Monitor changes in population density, development patterns, occupancy hazards, and incident concentrations to ensure deployment strategies remain aligned with community risk.

KEY FINDING 13
OVERALL SYSTEM PERFORMANCE CONTINUES TO IMPROVE

Total response times improved from 12 minutes and 19 seconds in 2021 to 10 minutes and 34 seconds in 2025. Improvements were observed across multiple performance components, including call processing and turnout.

Recommendation: Continue to monitor performance trends annually and incorporate performance measures into the Department's CQI process to ensure improvements are sustained as service demands evolve.

Appendix

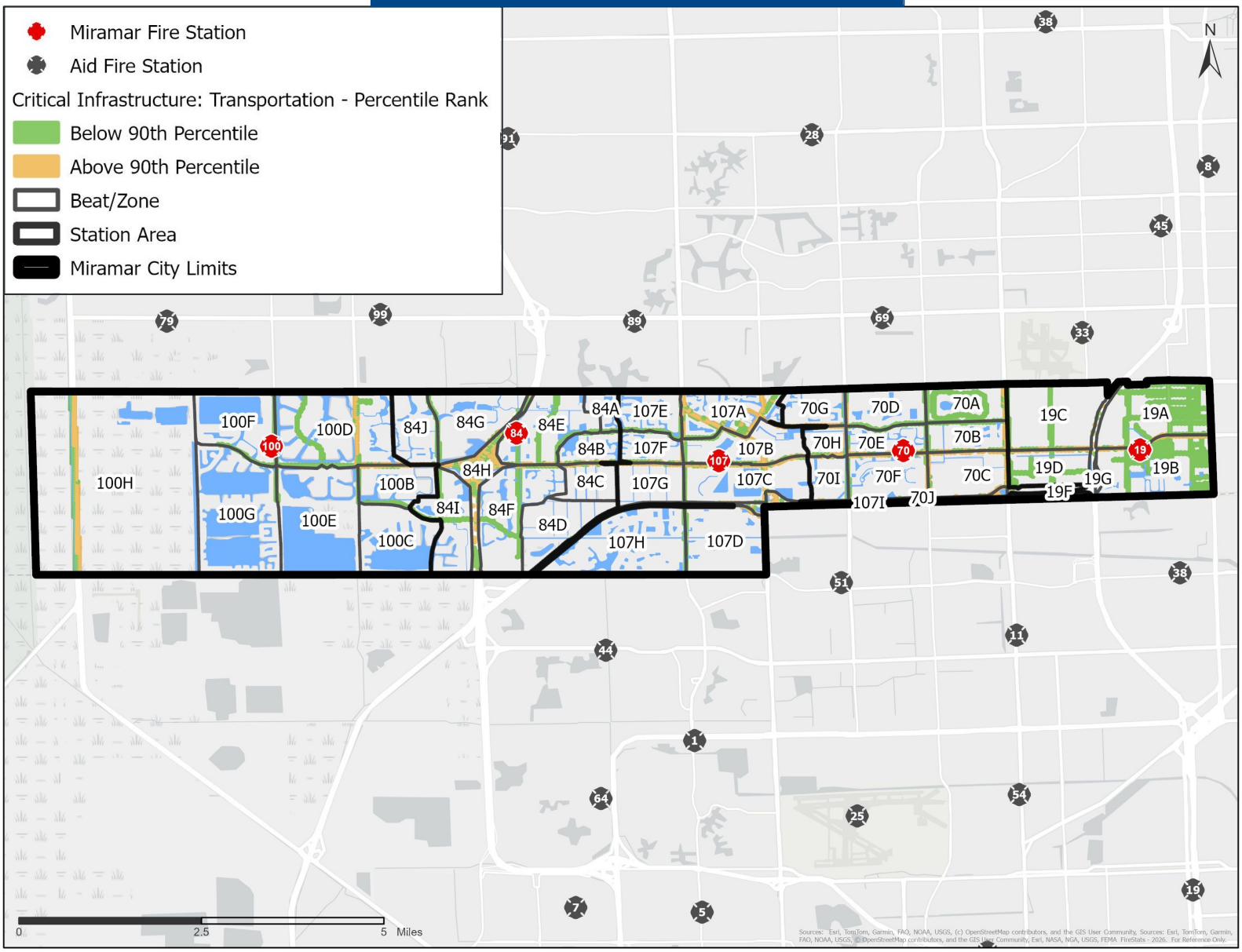
Table 120: Commitment Times Calculated, Ranked, and Scored by Station Area and Risk Type

Station Areas	Structure Fires	Non-Structure Fires	EMS	Technical Rescue	Hazardous Materials	Wildland Fires	Natural and Human-Made Disasters
19	8.3	6.7	3.3	8.3	5.0	5.0	1.7
70	6.7	5.0	5.0	1.7	1.7	8.3	6.7
84	3.3	3.3	1.7	3.3	8.3	3.3	5.0
100	1.7	1.7	8.3	6.7	6.7	6.7	8.3
107	5.0	8.3	6.7	5.0	3.3	1.7	3.3

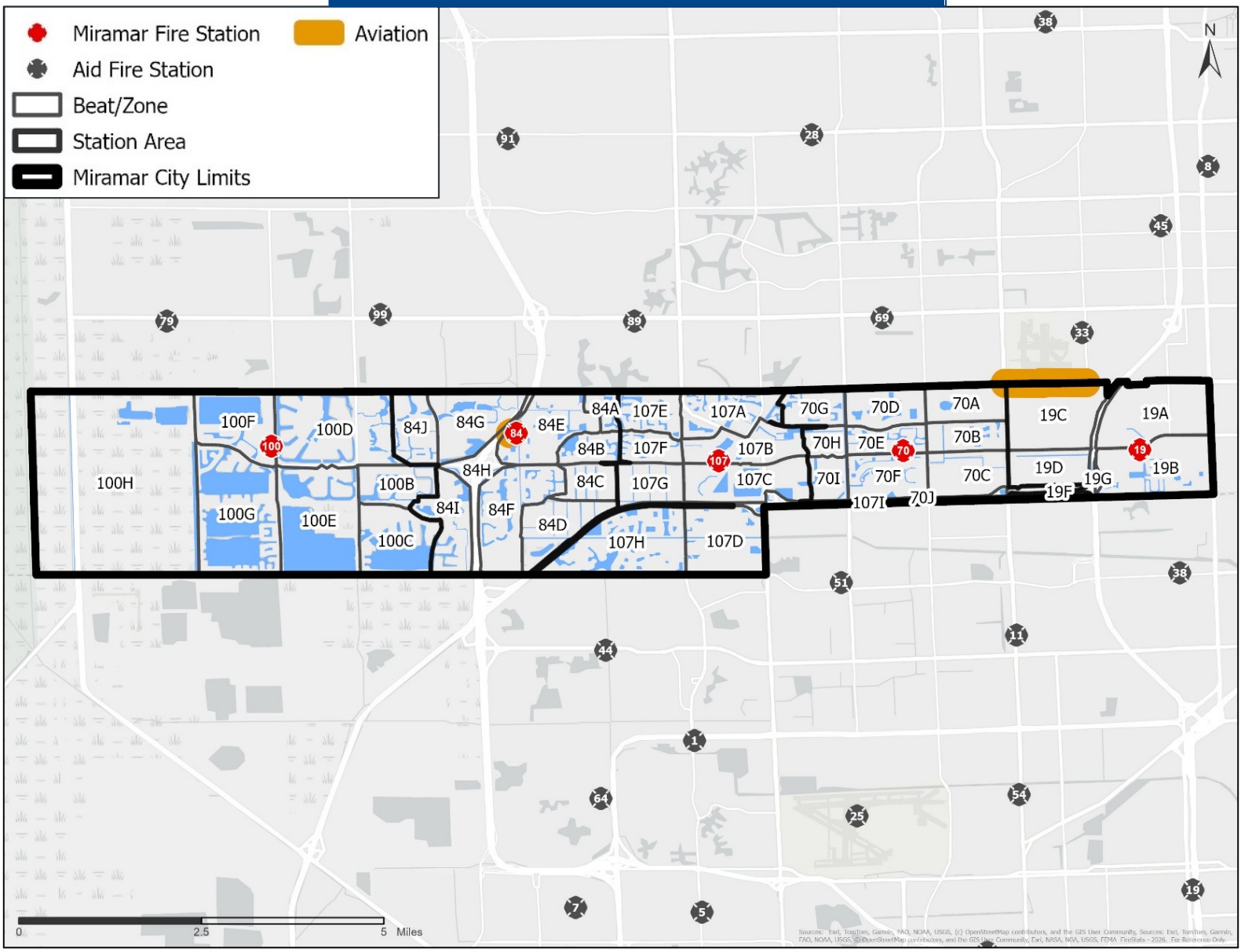
Table 121: Deployment Scores by Fire Station Area and Risk Type

Station	Structure Fires	Non-Structure Fires	EMS	Technical Rescues	Hazardous Materials	Wildland Fires	Natural and Human-Made Disasters
19	6.7	8.3	8.3	3.3	8.3	8.3	3.3
70	5.0	5.0	6.7	8.3	6.7	3.3	6.7
84	8.3	6.7	3.3	6.7	5.0	6.7	8.3
100	1.7	1.7	1.7	1.7	1.7	1.7	5.0
107	3.3	3.3	5.0	5.0	3.3	5.0	1.7

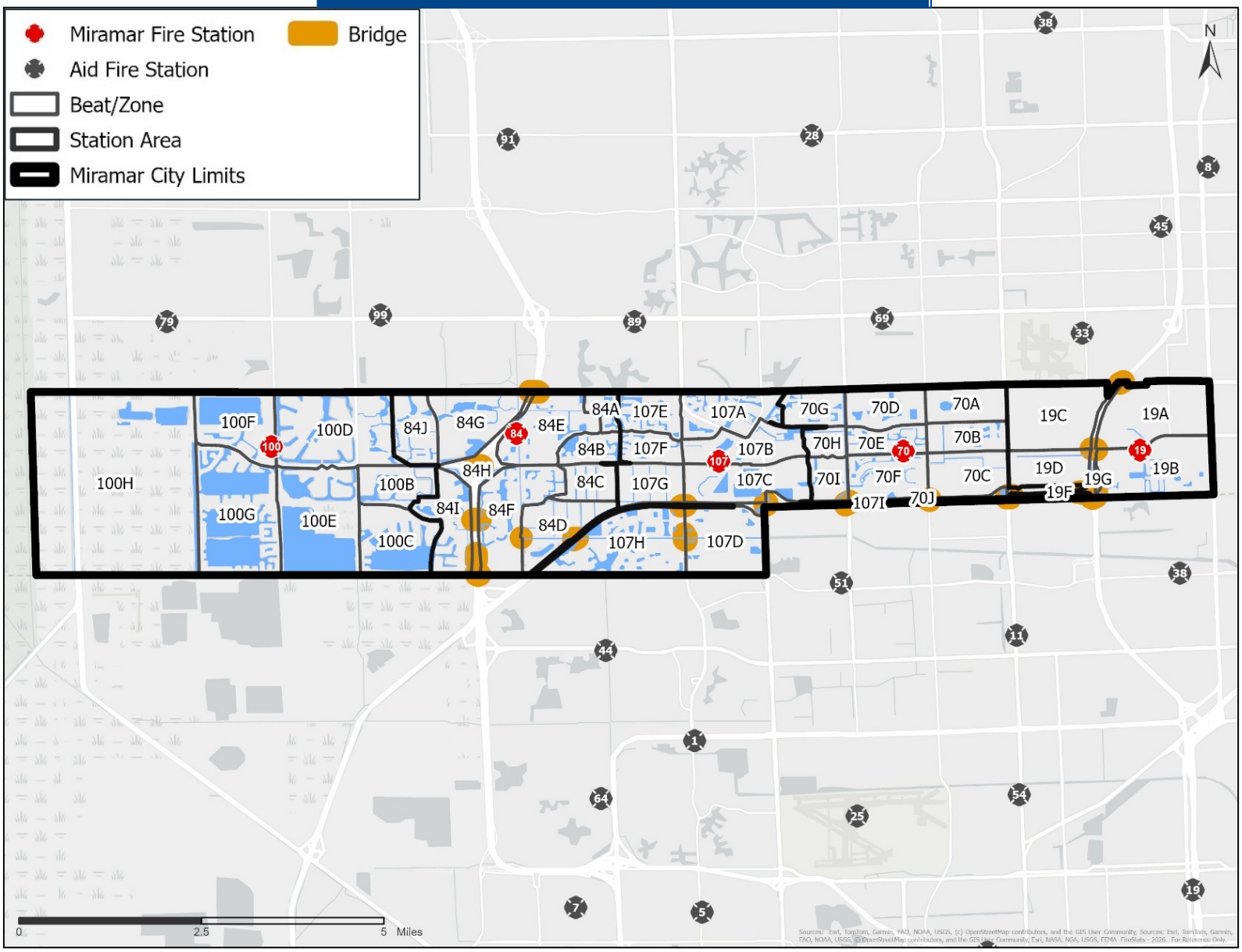
Critical Infrastructure: Transports Percentile Rank



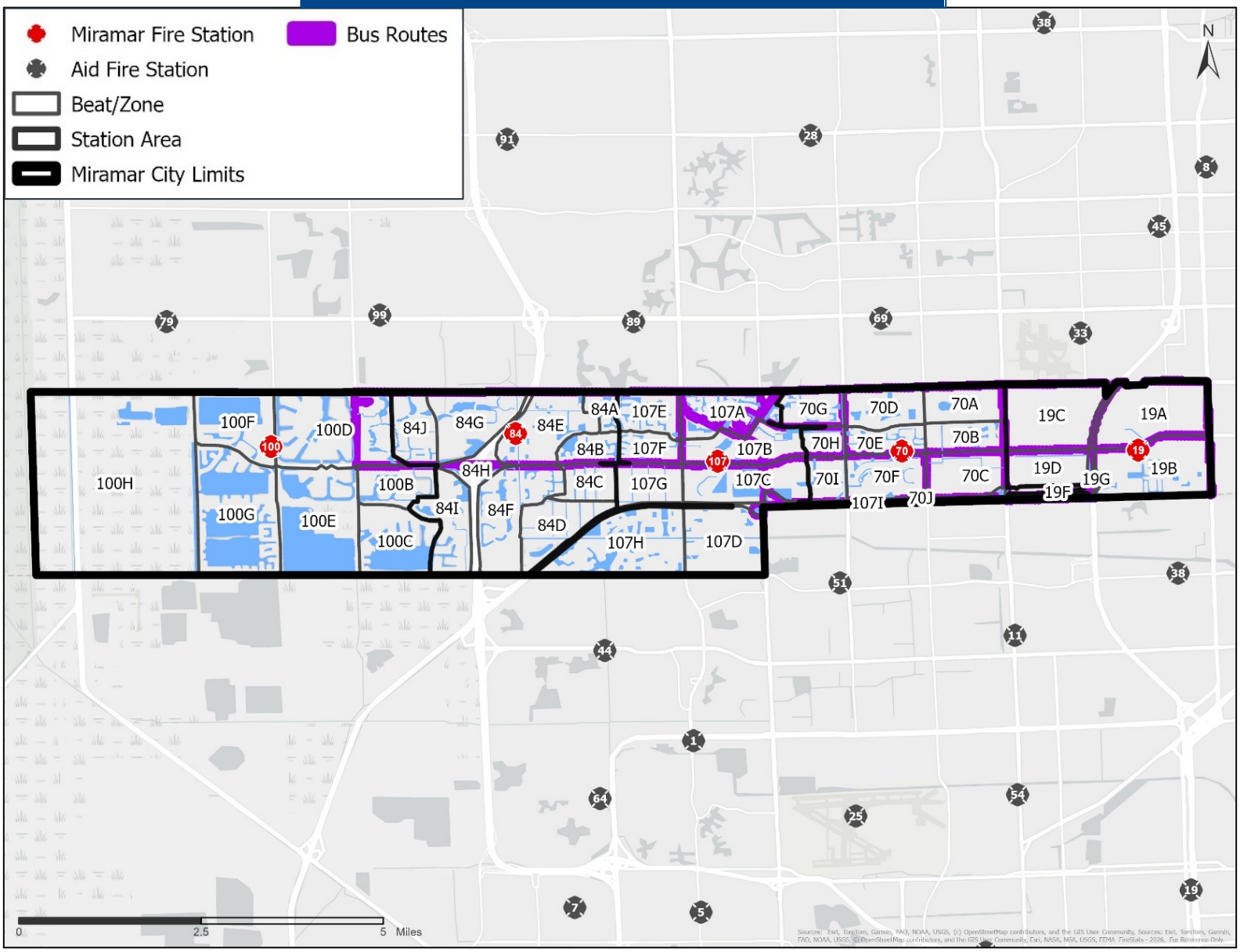
Critical Infrastructure: Transportation Systems — Aviation



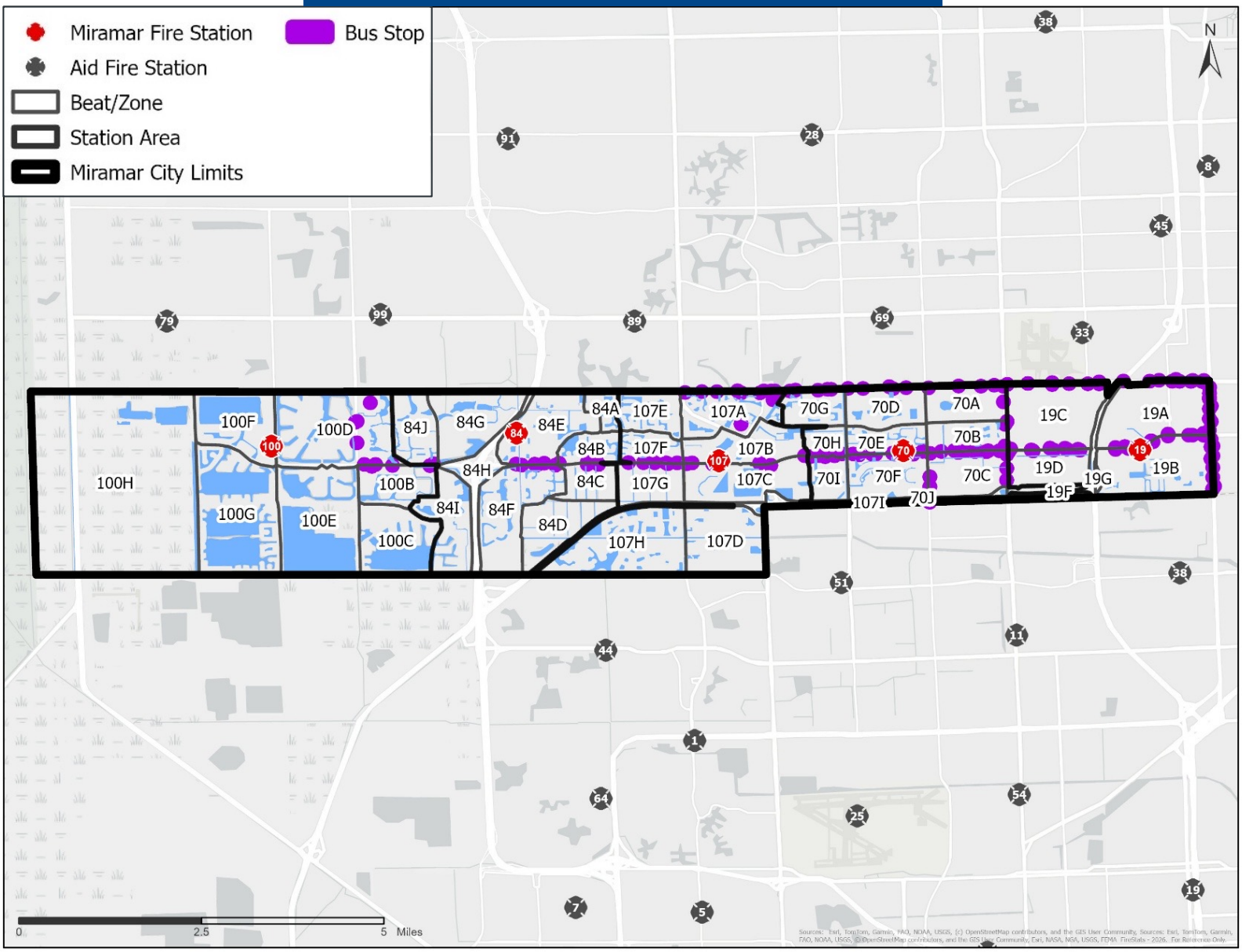
Critical Infrastructure: Transportation Systems — Bridge



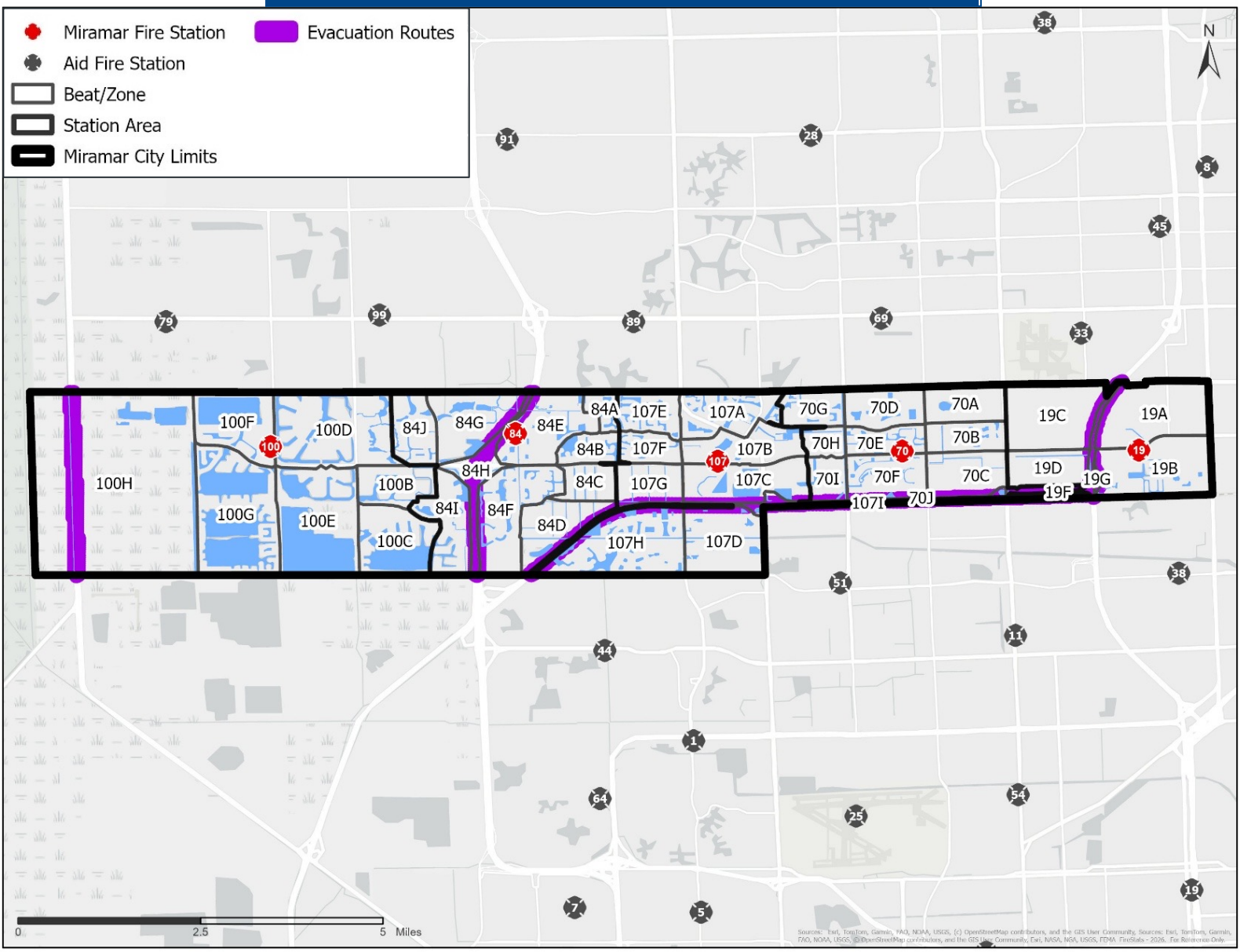
Critical Infrastructure: Transportation Systems — Bus Routes



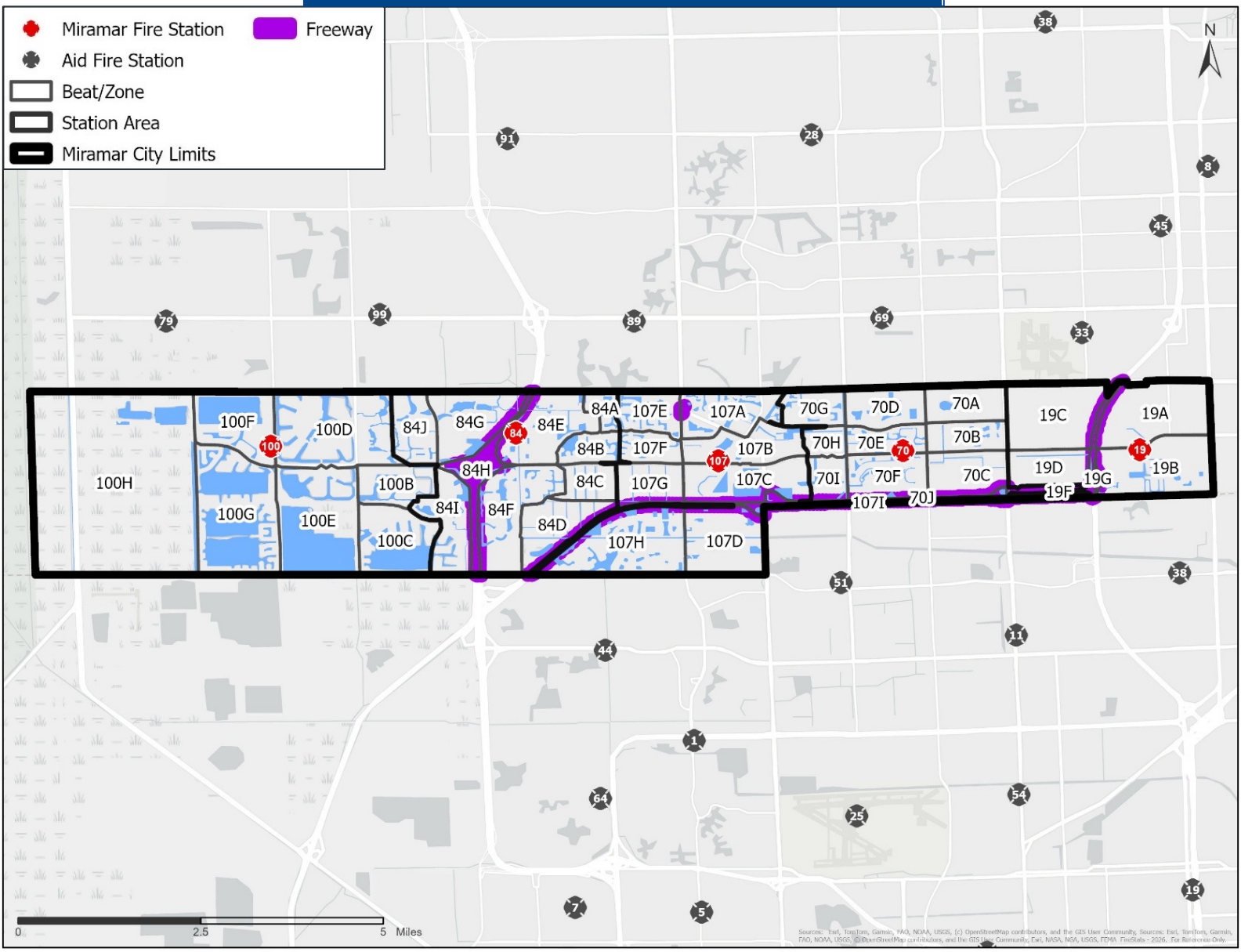
Critical Infrastructure: Transportation Systems — Bus Stops



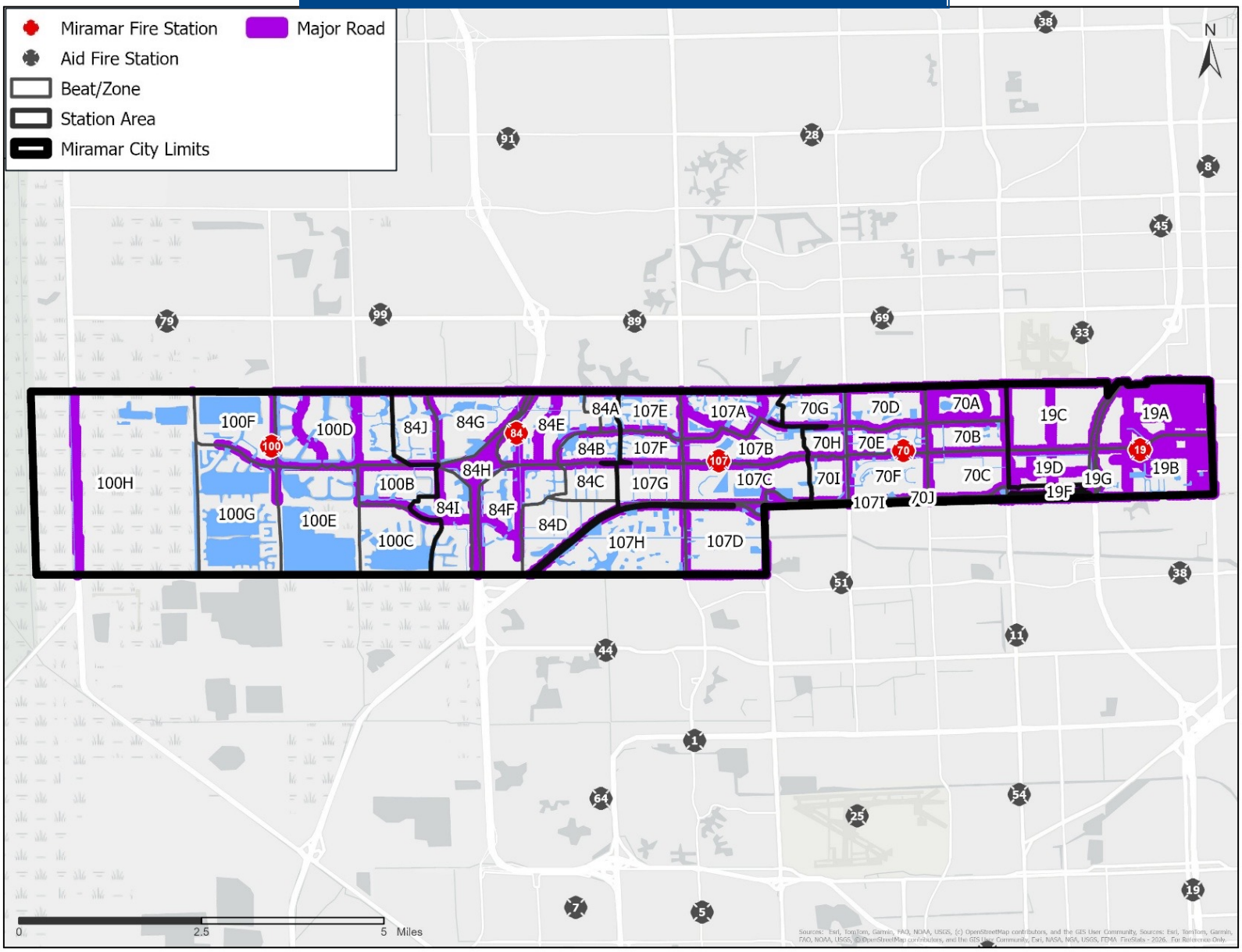
Critical Infrastructure: Transportation Systems — Evacuation Routes



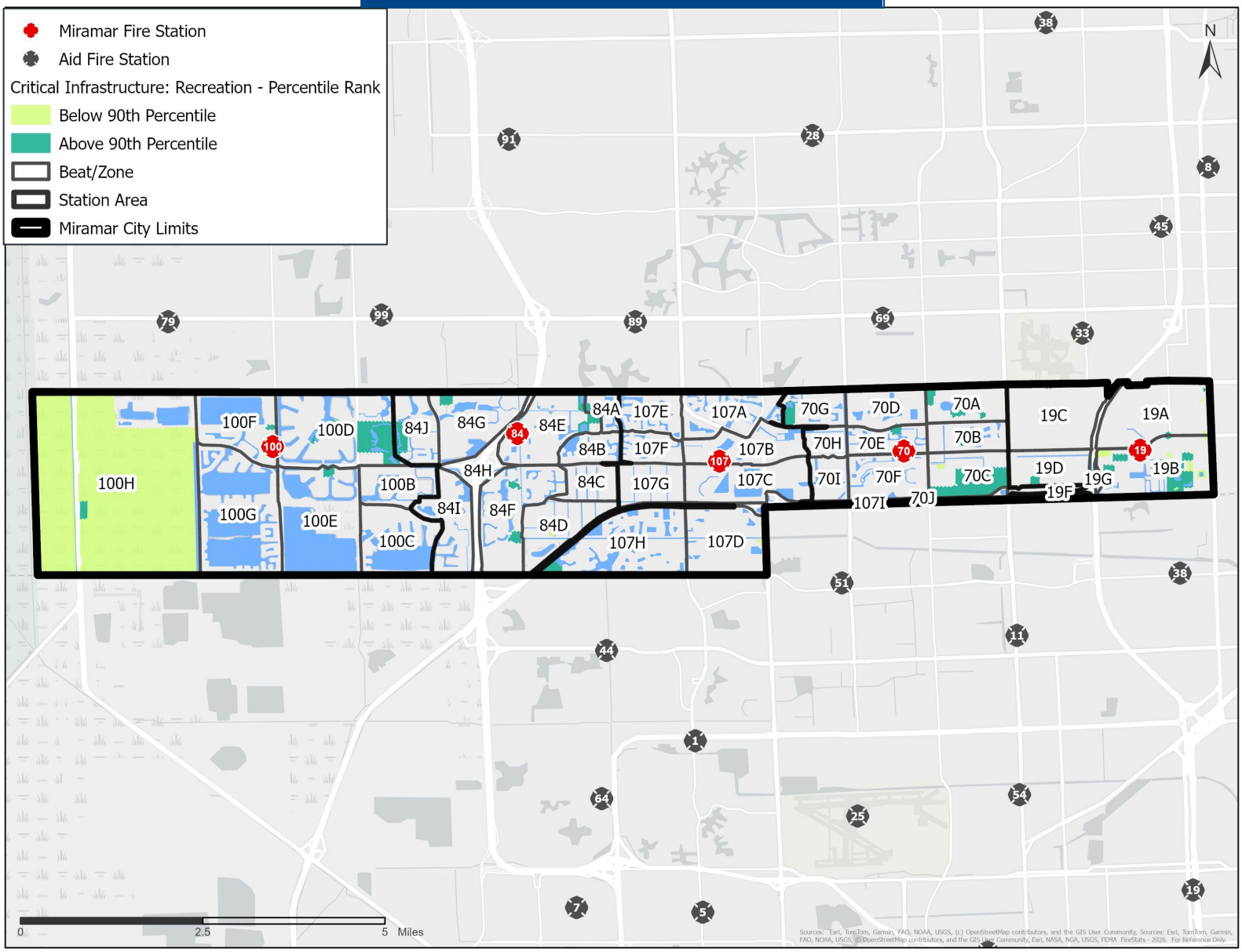
Critical Infrastructure: Transportation Systems — Freeways



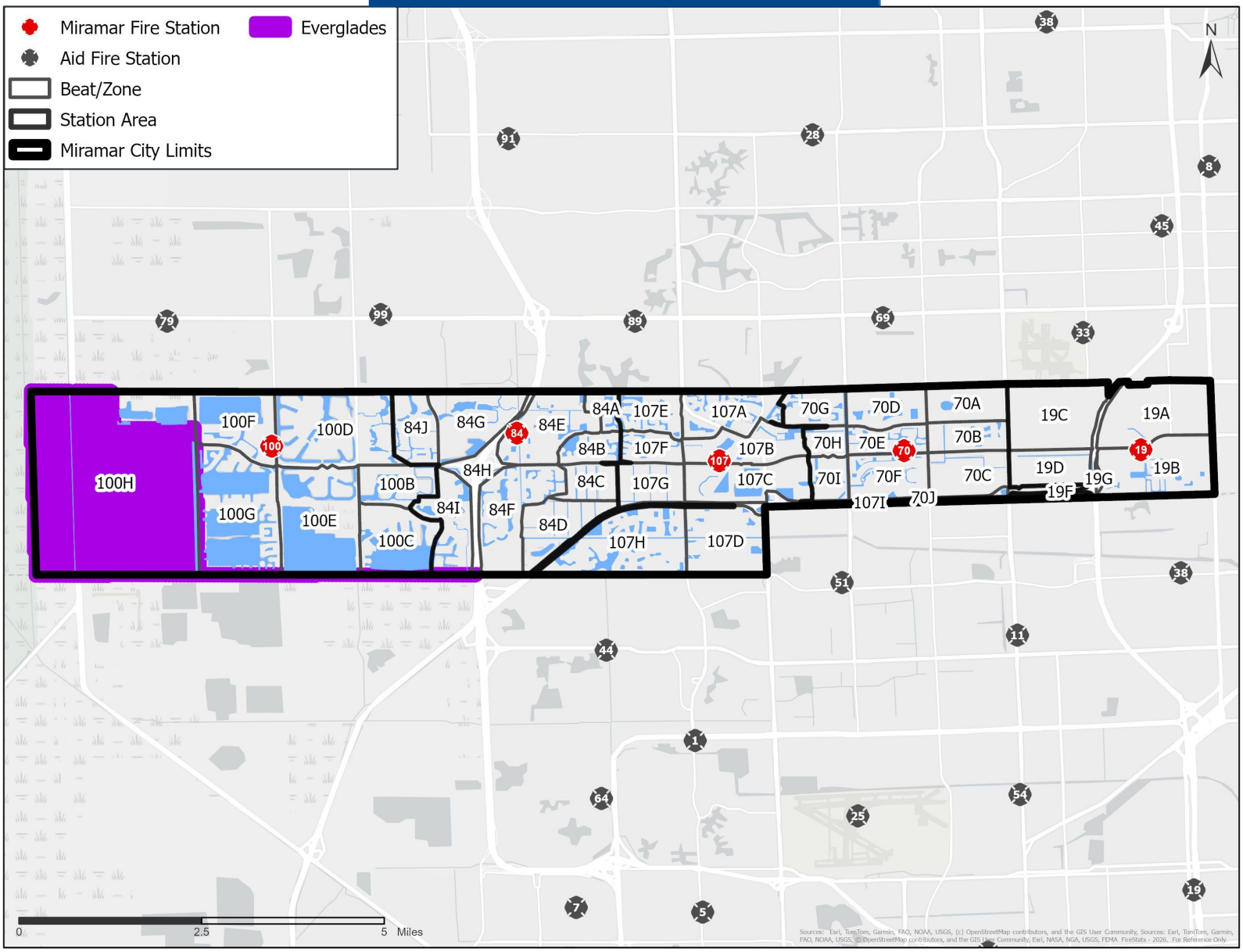
Critical Infrastructure: Transportation Systems — Major Roads



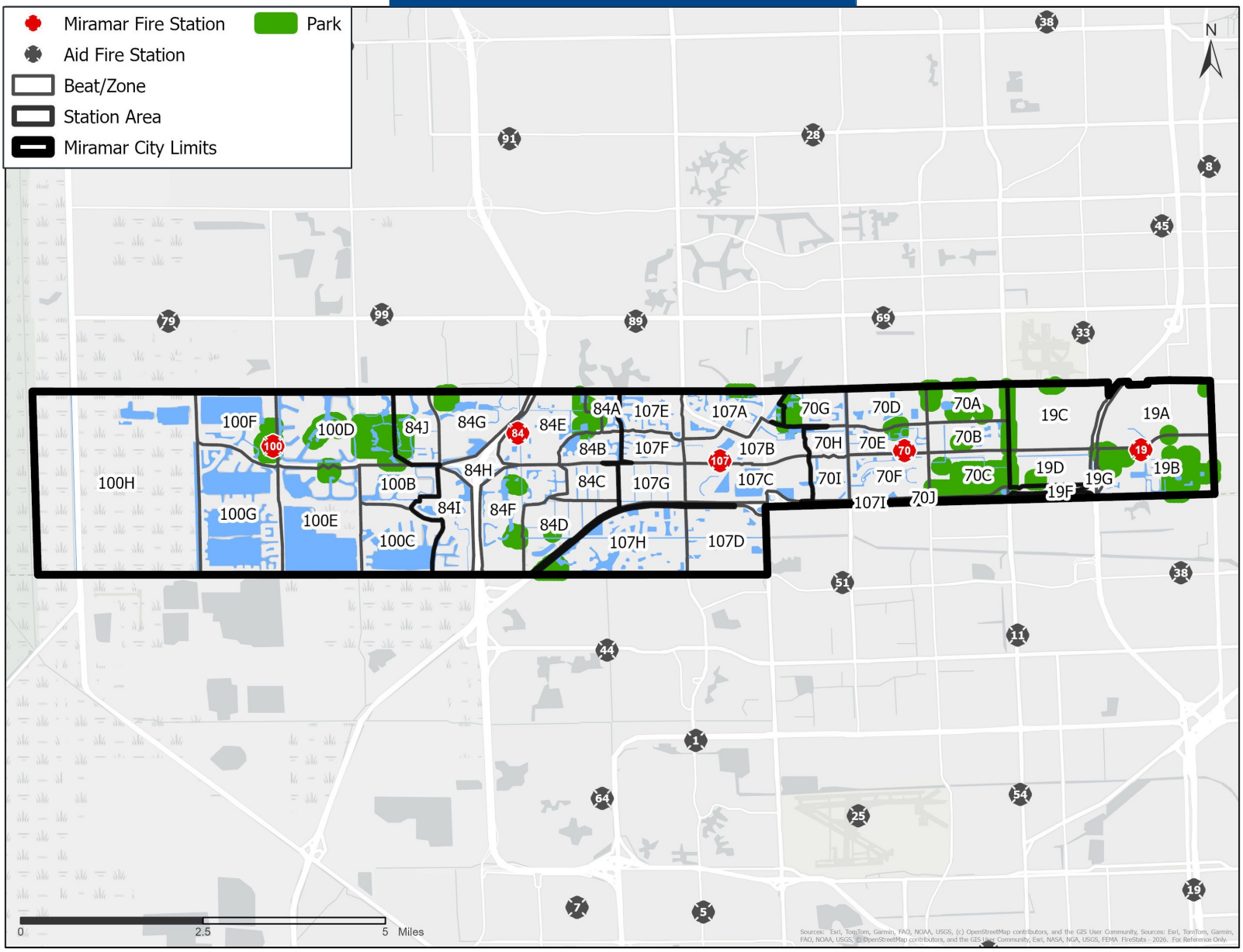
Critical Infrastructure: Recreation Percentile Rank



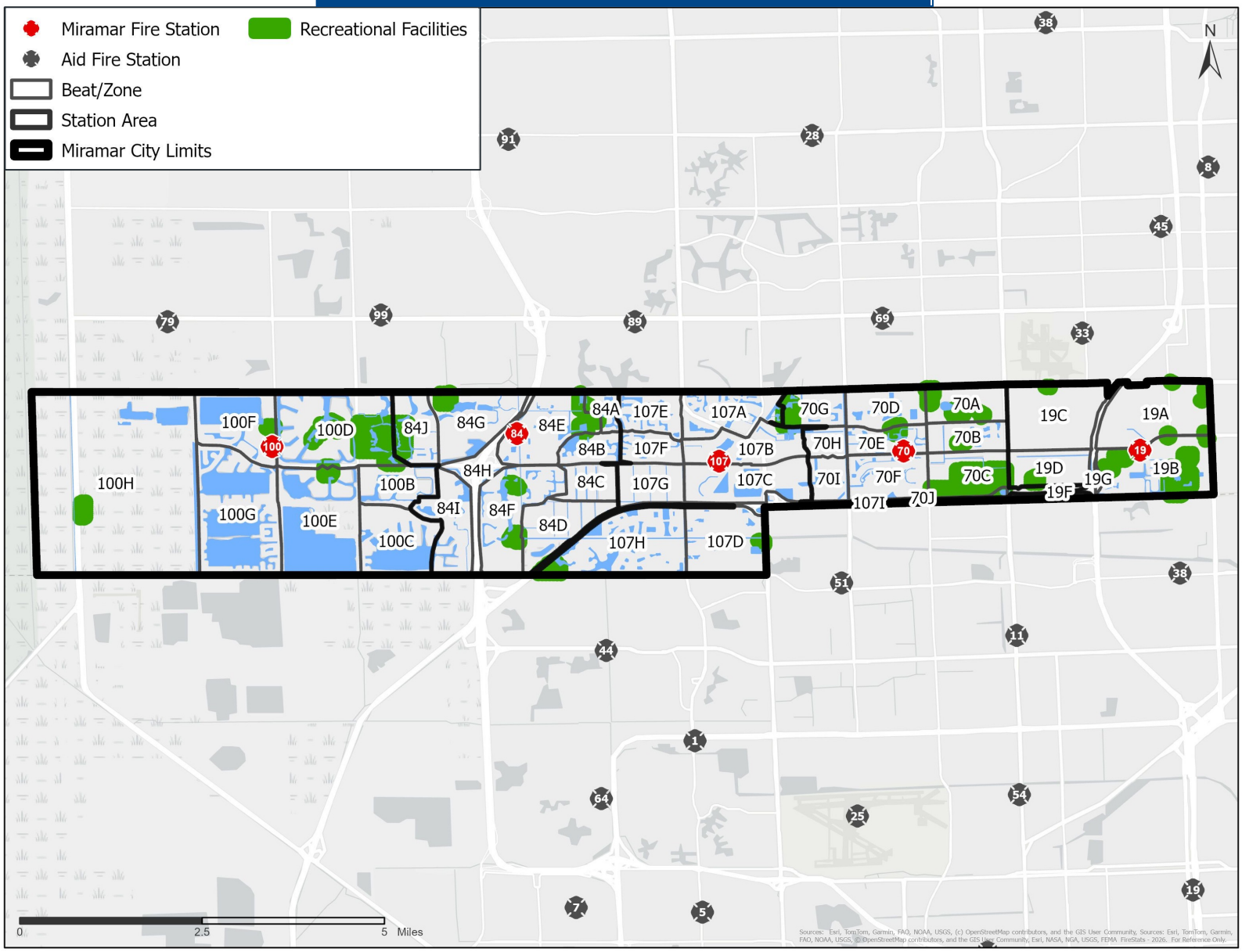
Critical Infrastructure: Recreation — Everglades



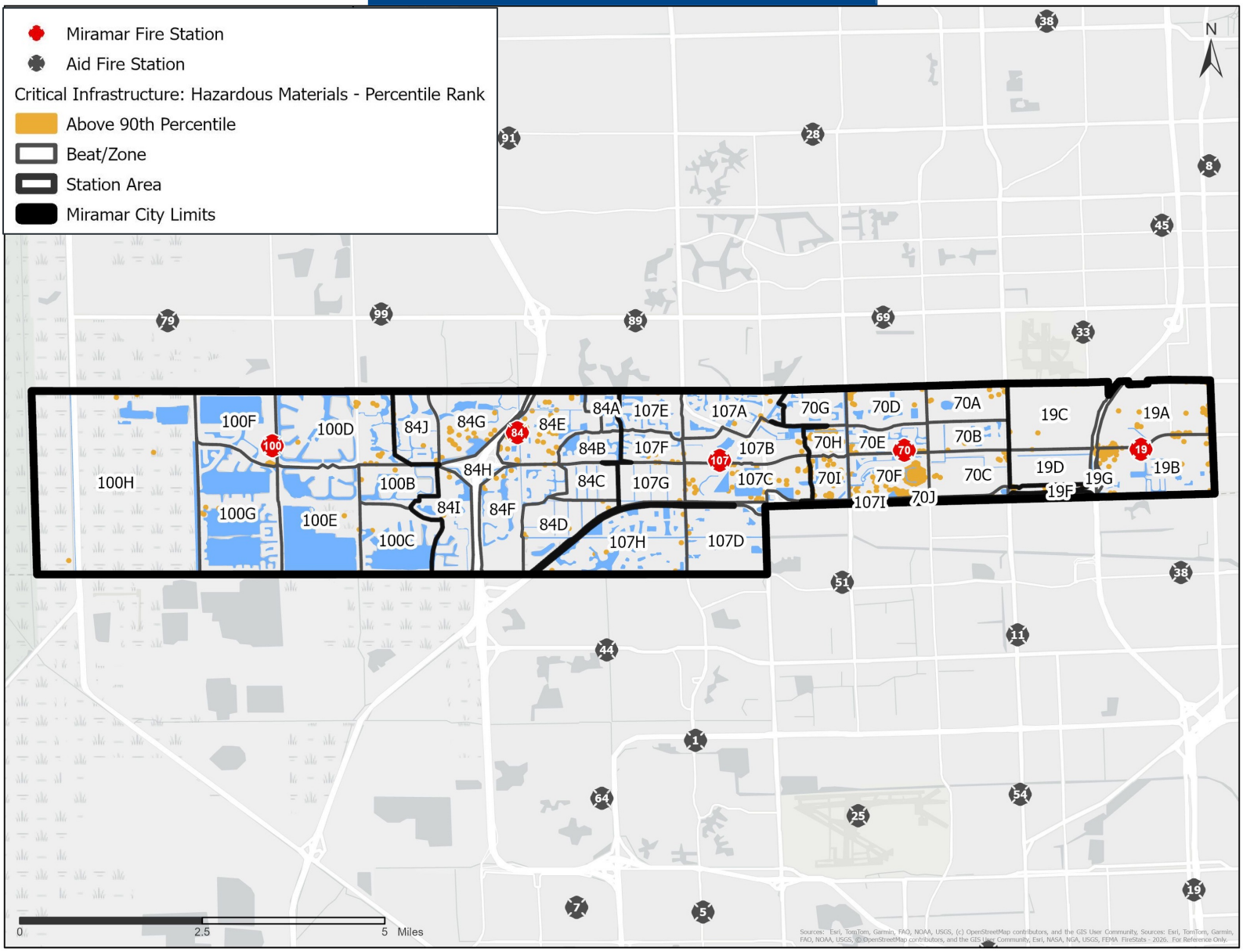
Critical Infrastructure: Recreation – Parks



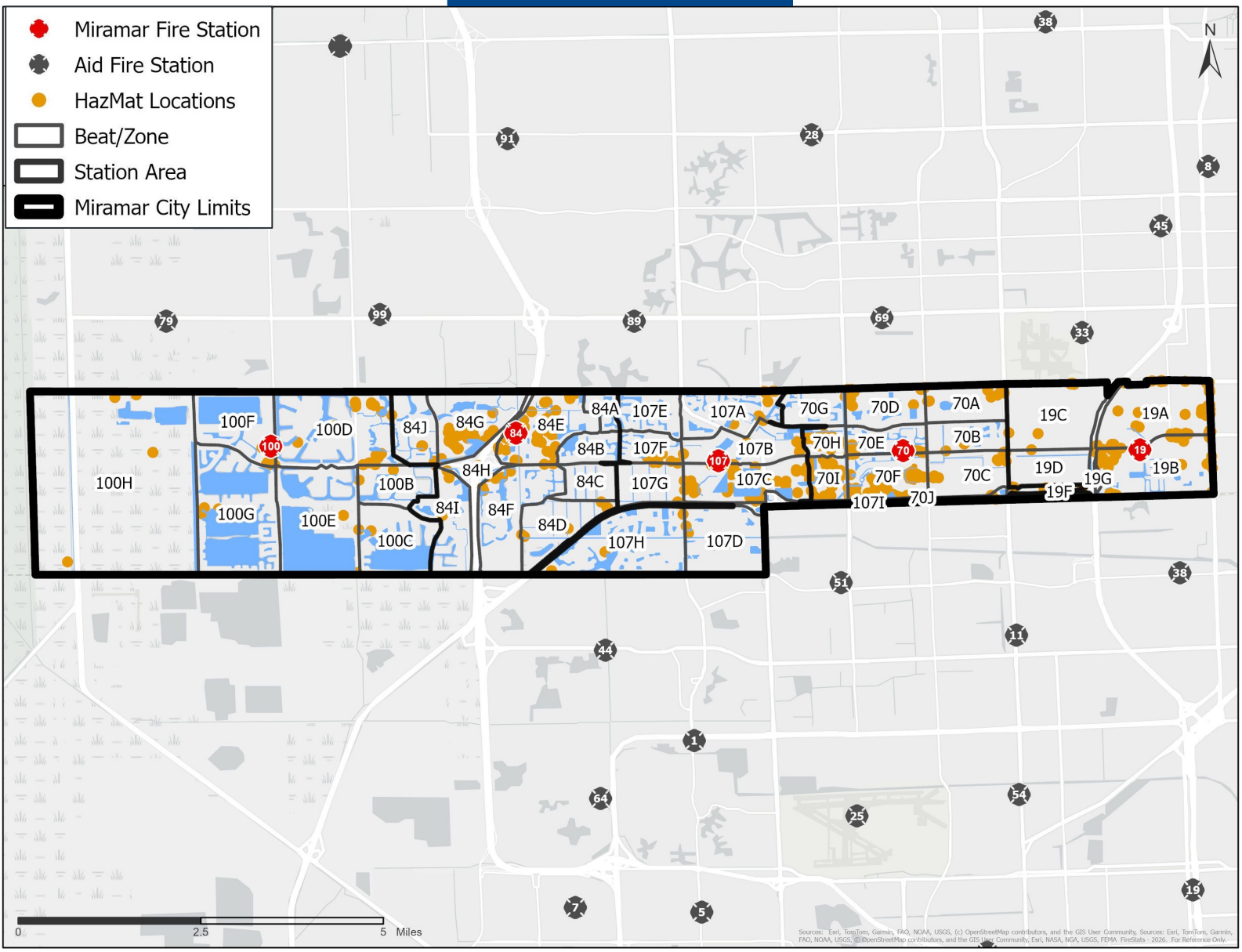
Critical Infrastructure: Recreation — Recreational Facilities



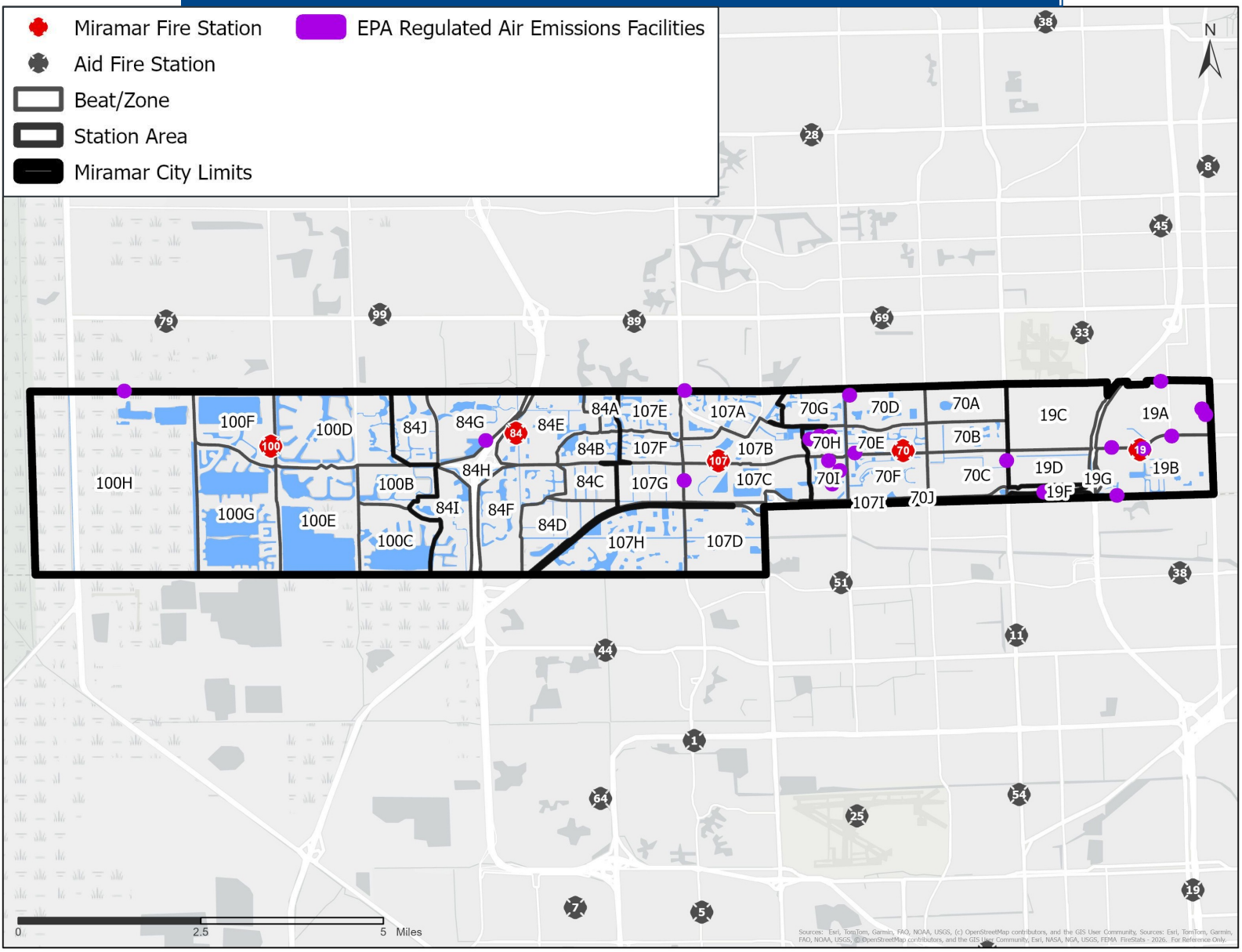
Critical Infrastructure: HazMat Percentile Rank



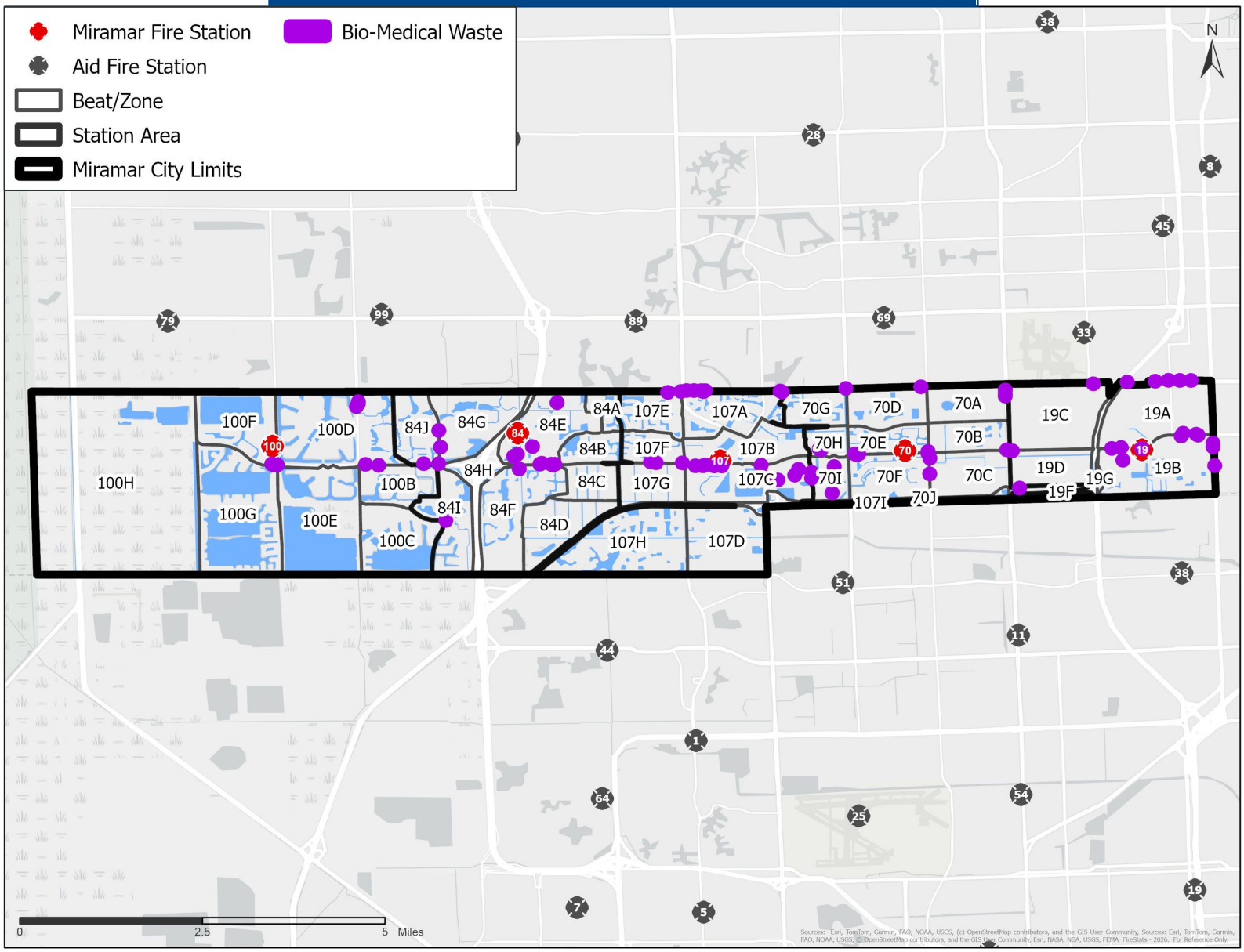
Hazardous Materials Locations



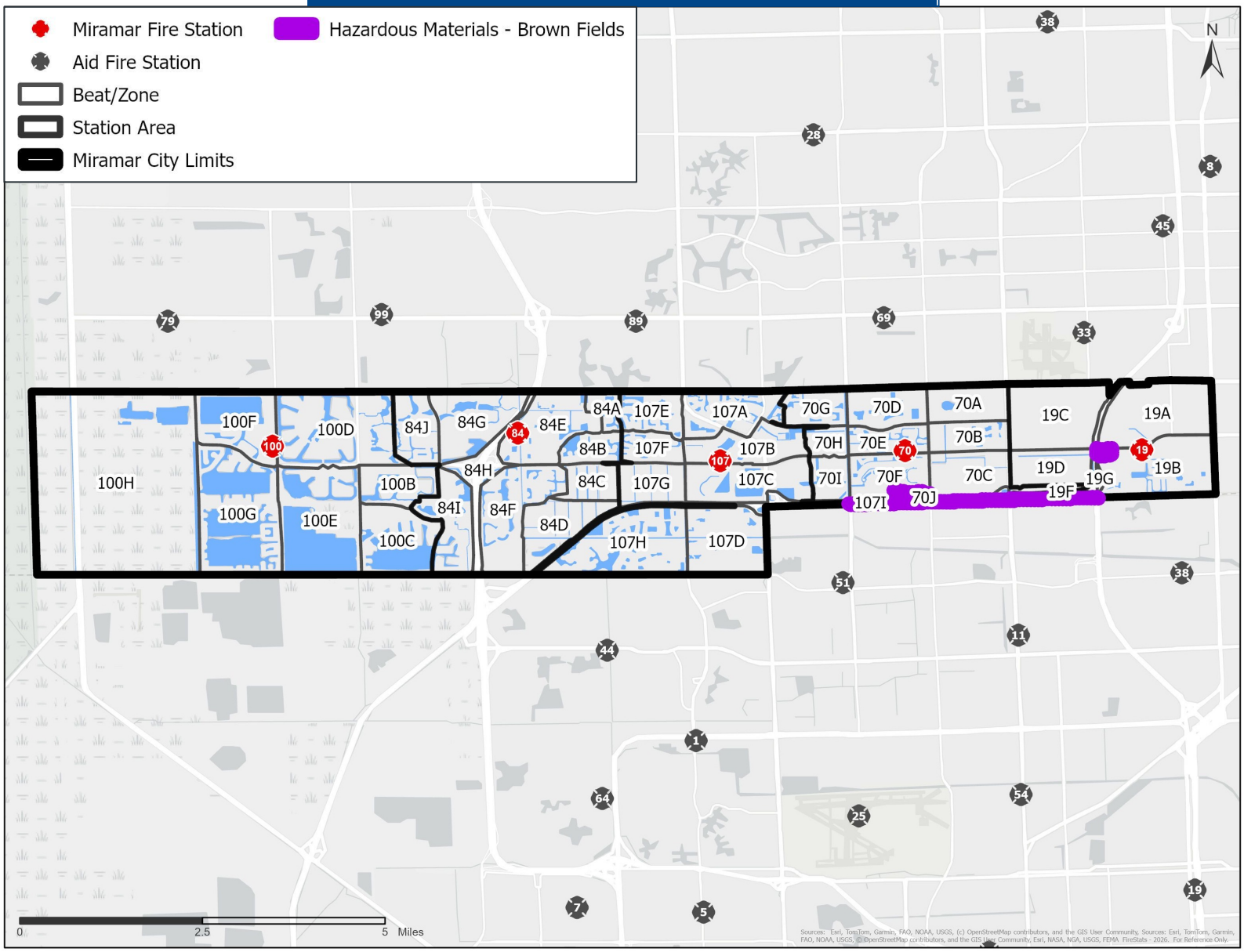
Critical Infrastructure: Hazardous Materials – EPA Regulated Air Emissions Facilities



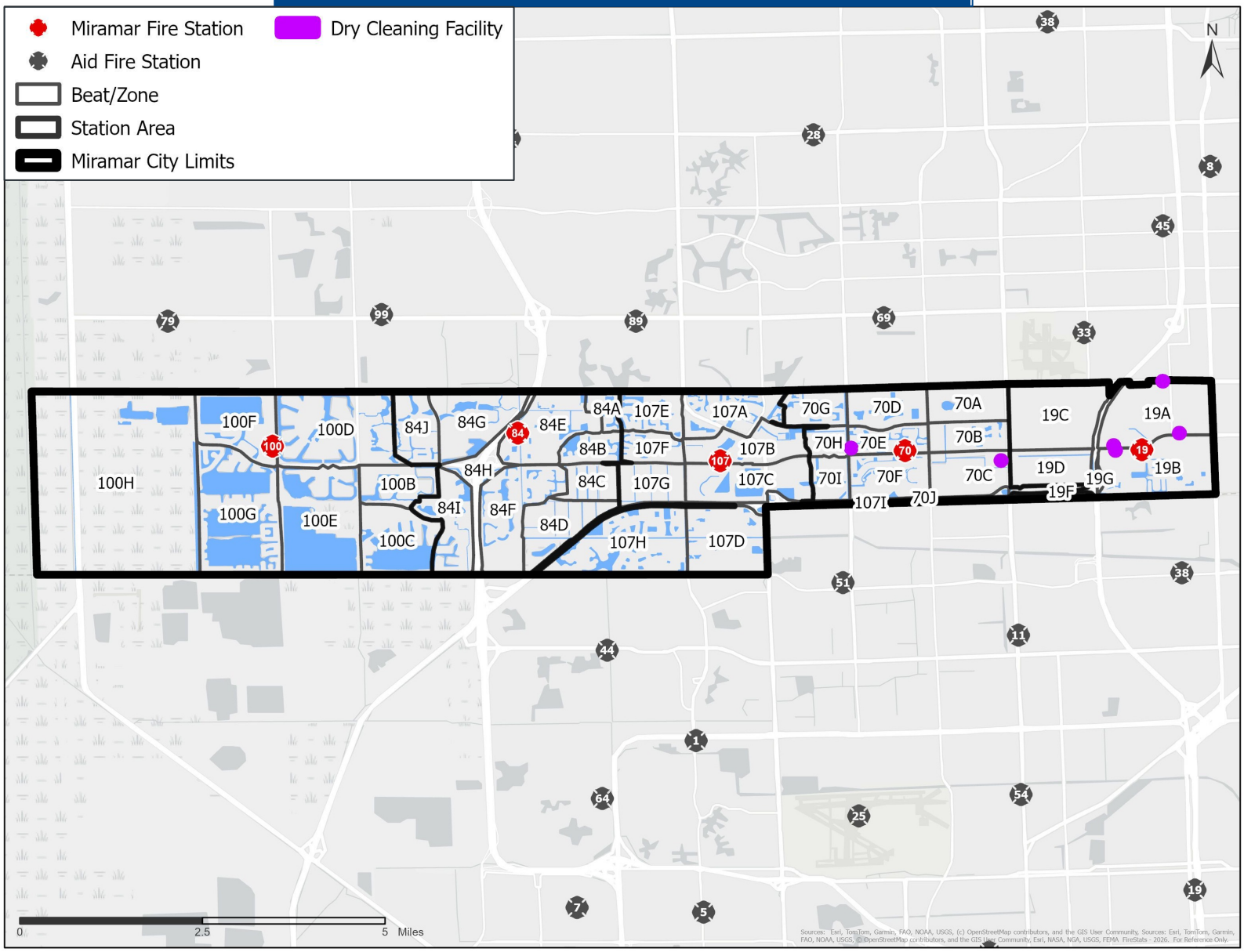
Critical Infrastructure: Hazardous Materials — Bio—Medical Waste



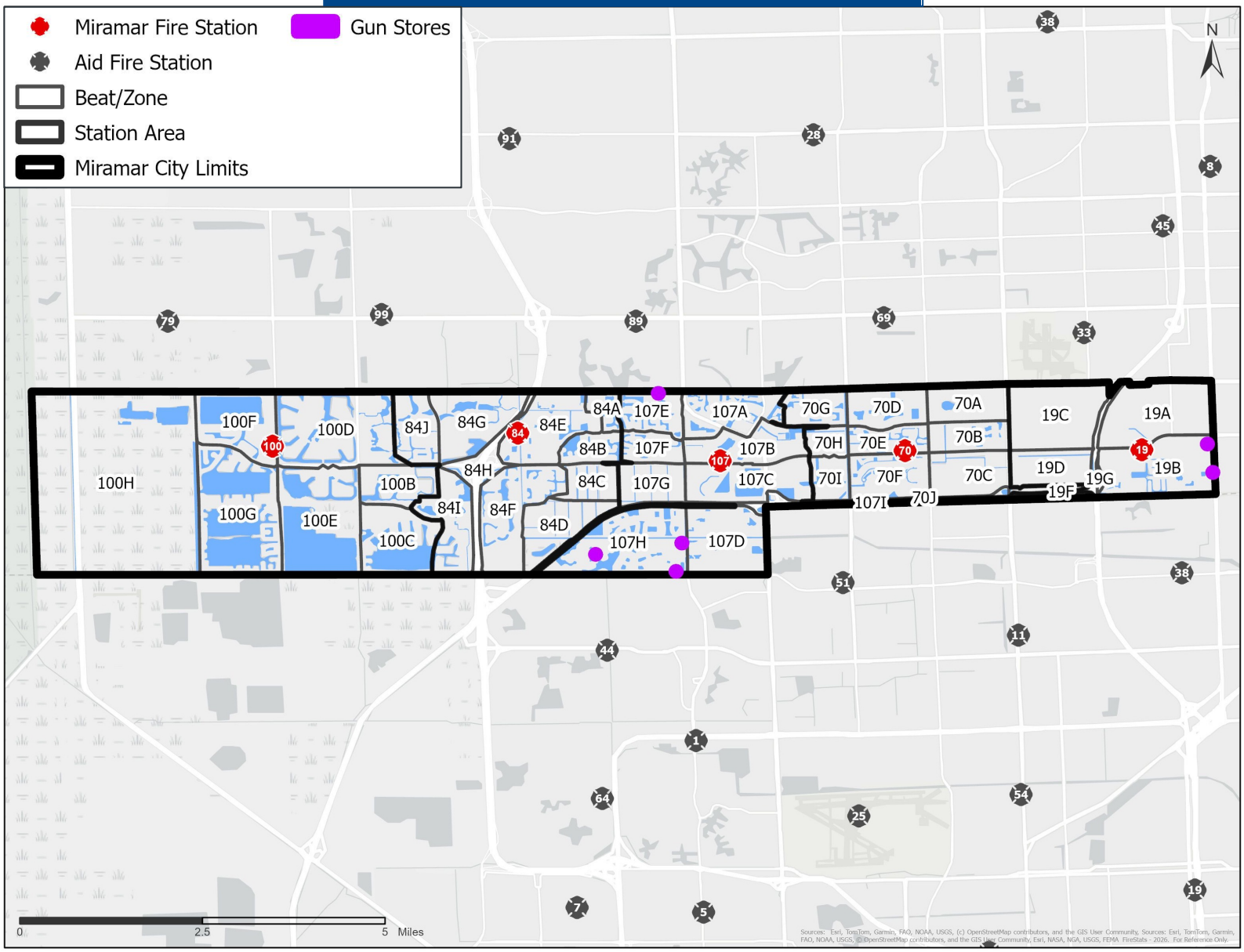
Critical Infrastructure: Hazardous Materials — Brown Fields



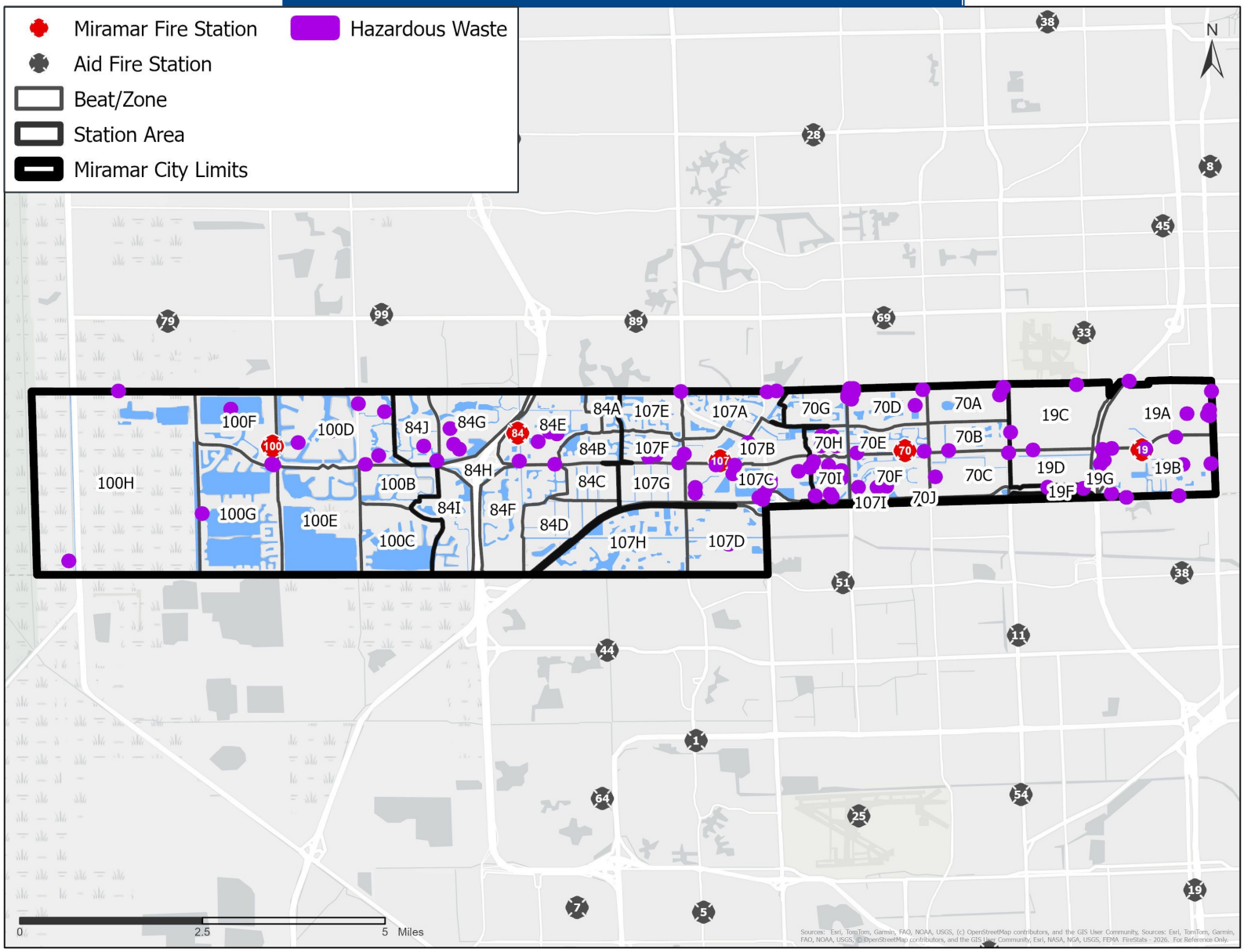
Critical Infrastructure: Hazardous Materials – Dry Cleaning Facility



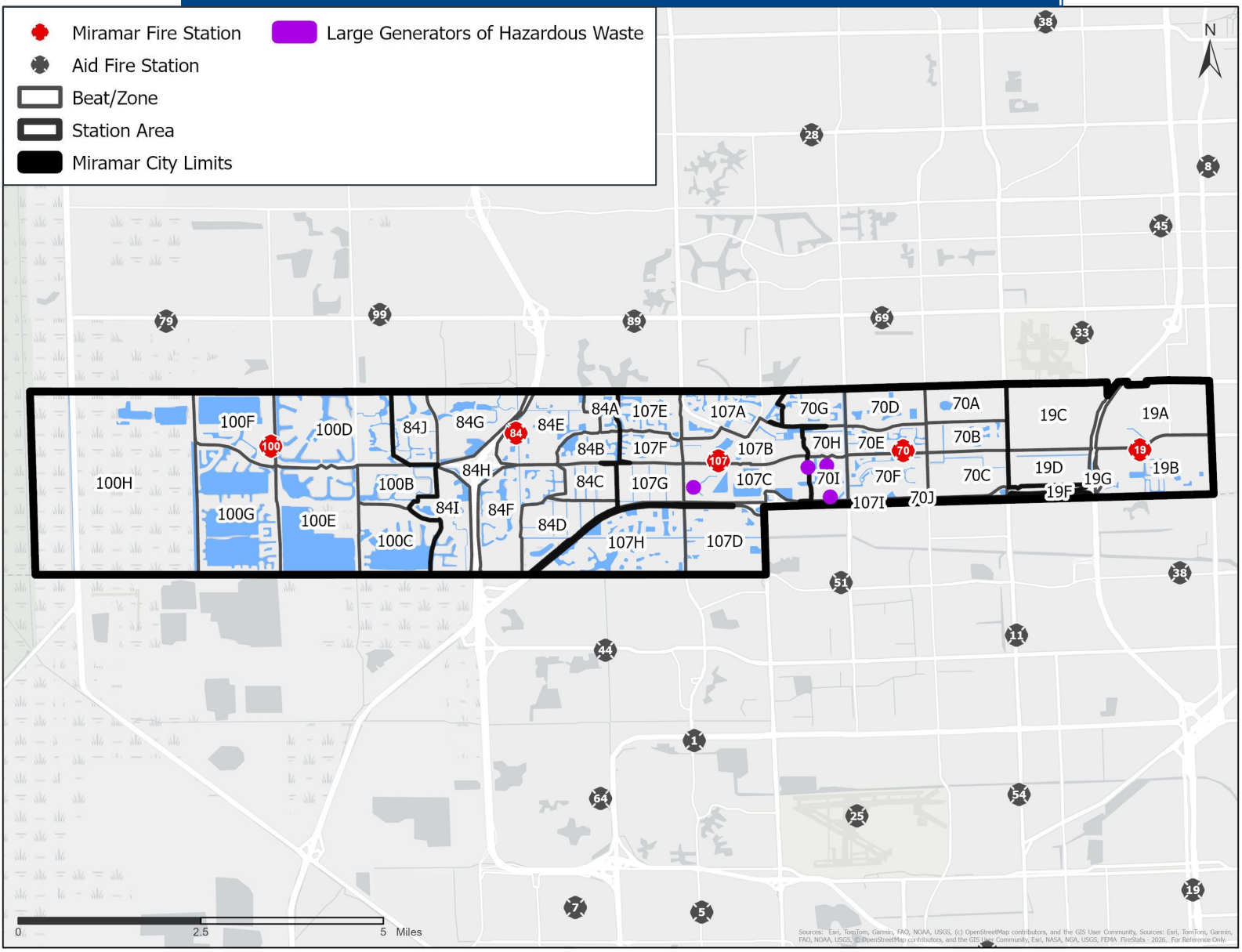
Critical Infrastructure: Hazardous Materials — Gun Stores



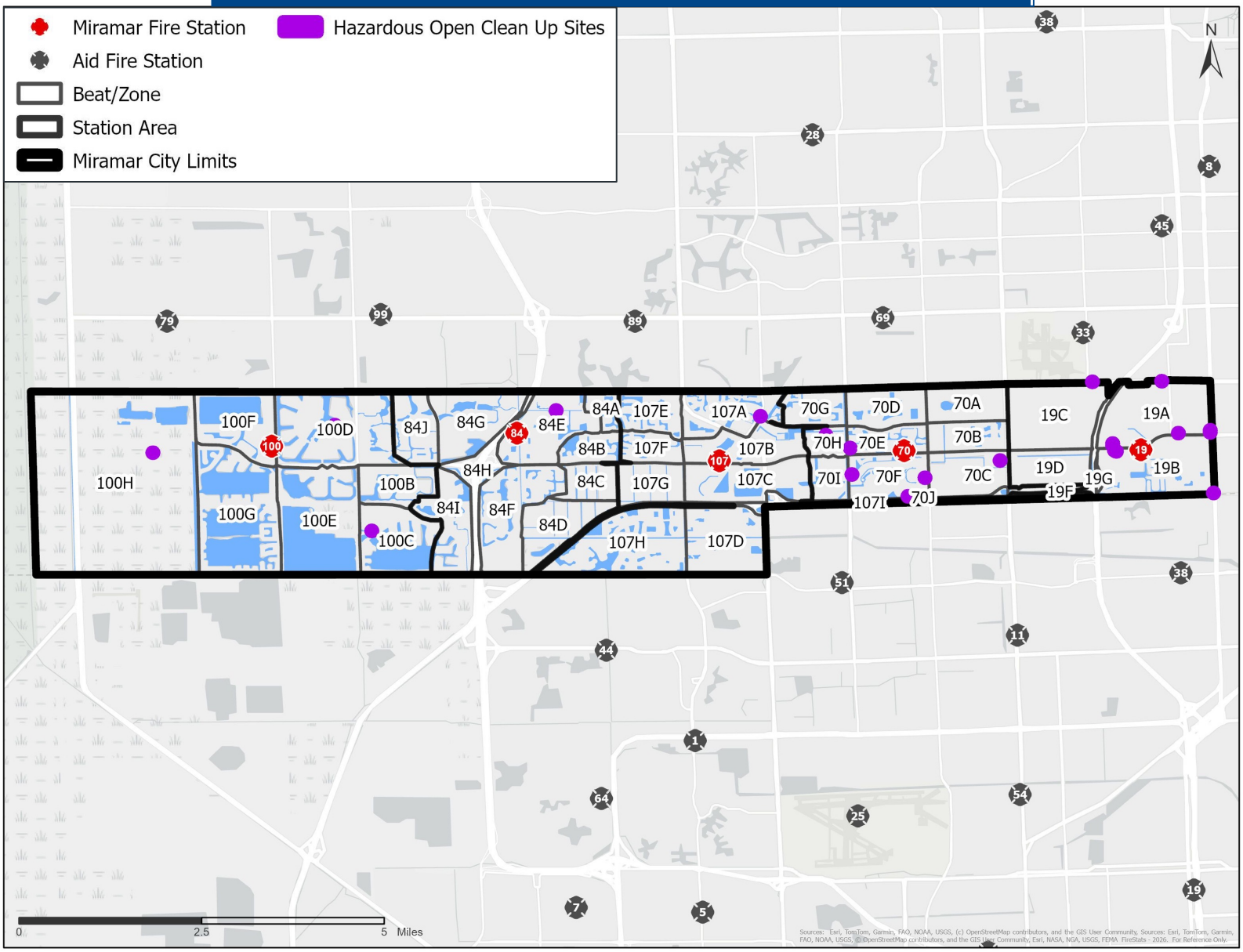
Critical Infrastructure: Hazardous Materials – Hazardous Waste



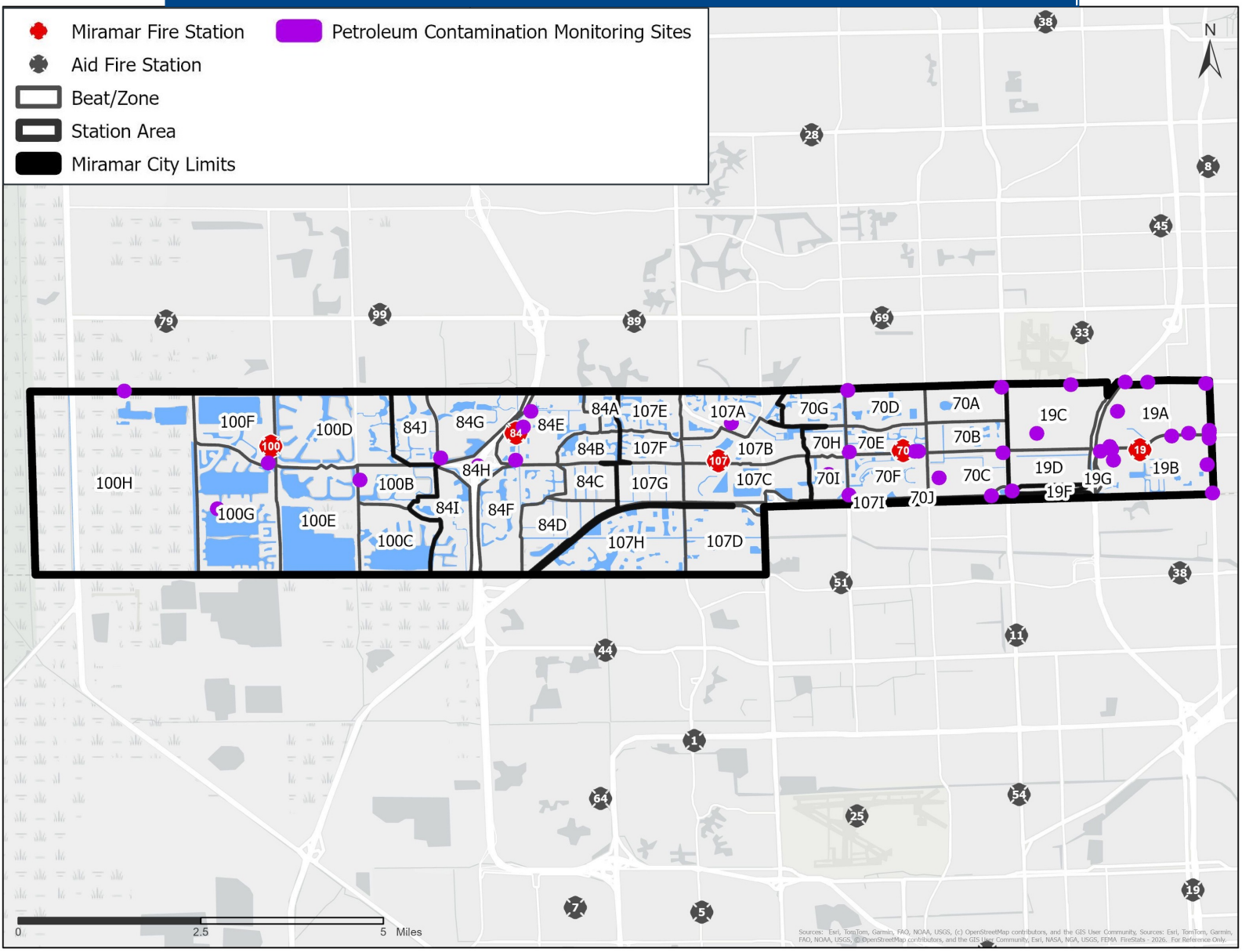
Critical Infrastructure: Hazardous Materials — Large Generators of Hazardous Waste



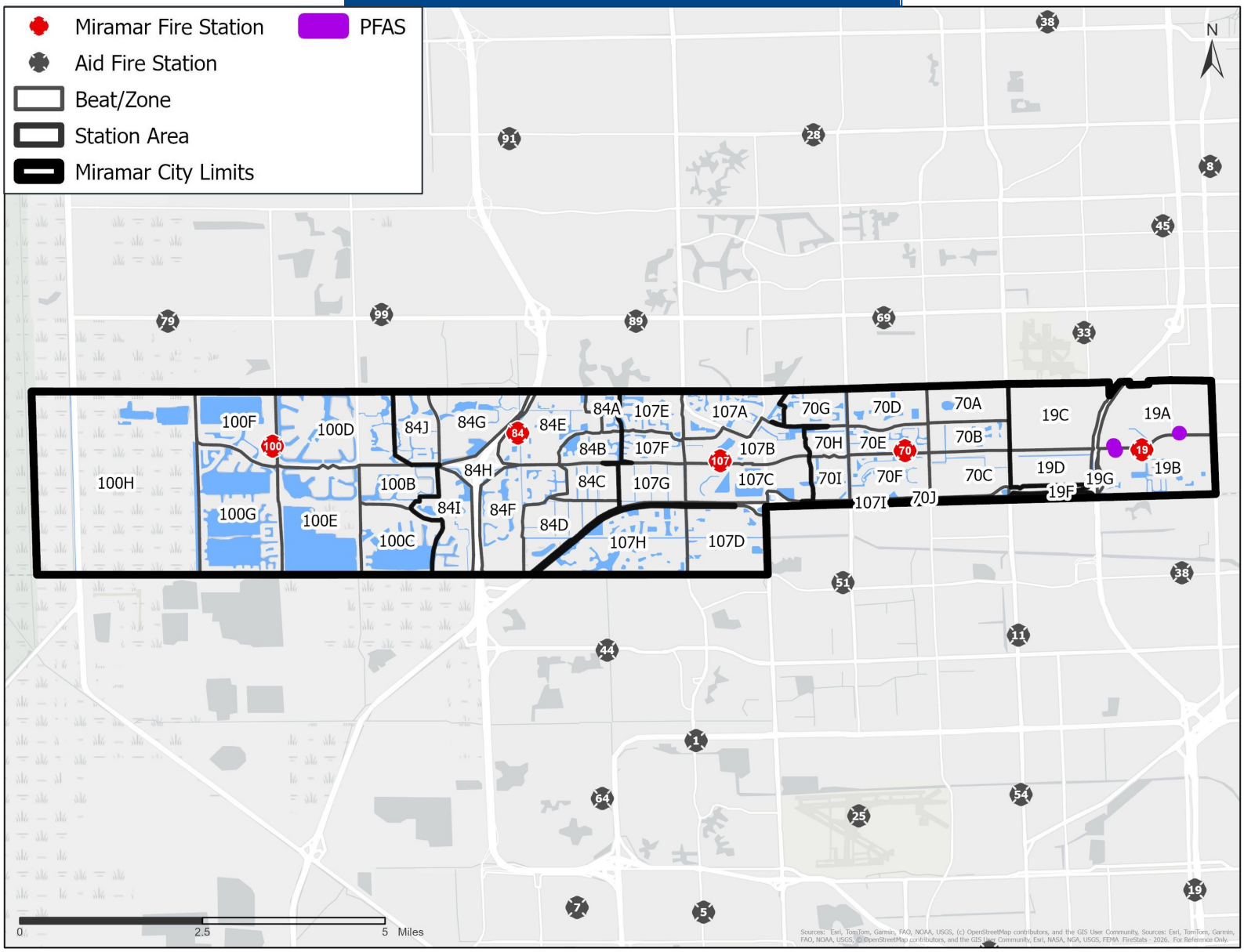
Critical Infrastructure: Hazardous Materials – Hazardous Open Clean Up Sites



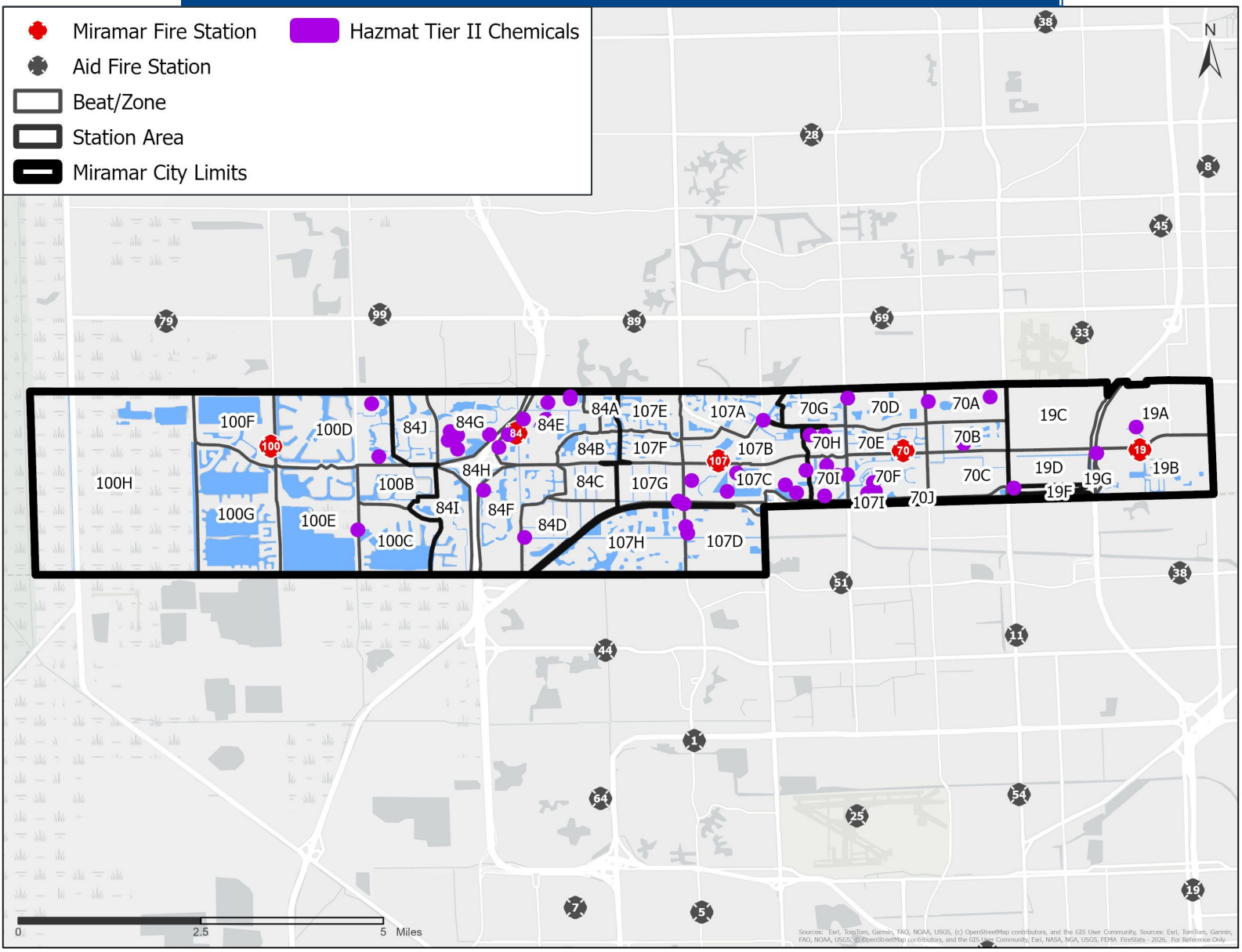
Critical Infrastructure: Hazardous Materials – Petroleum Containment Monitoring Sites



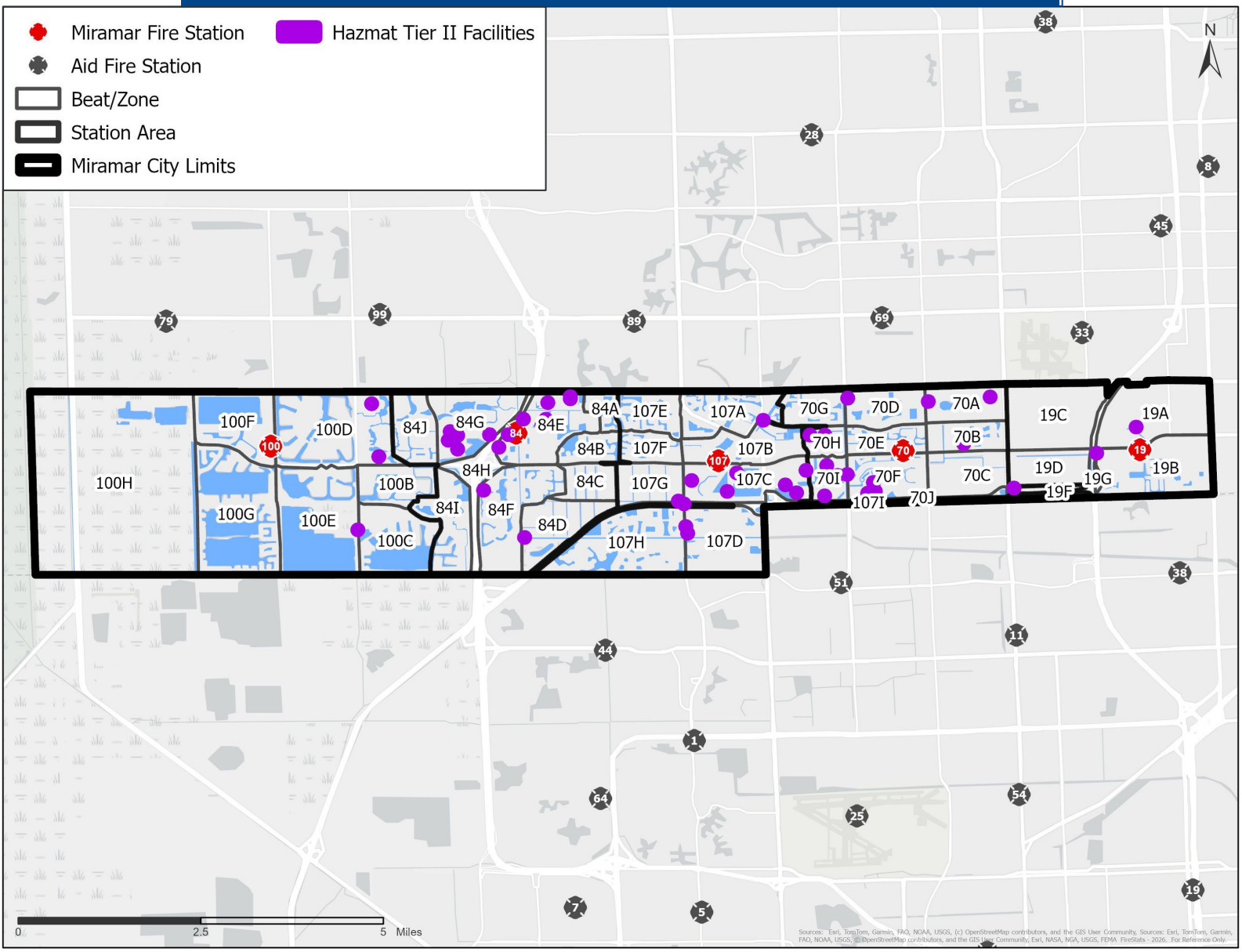
Critical Infrastructure: Hazardous Materials – PFAS



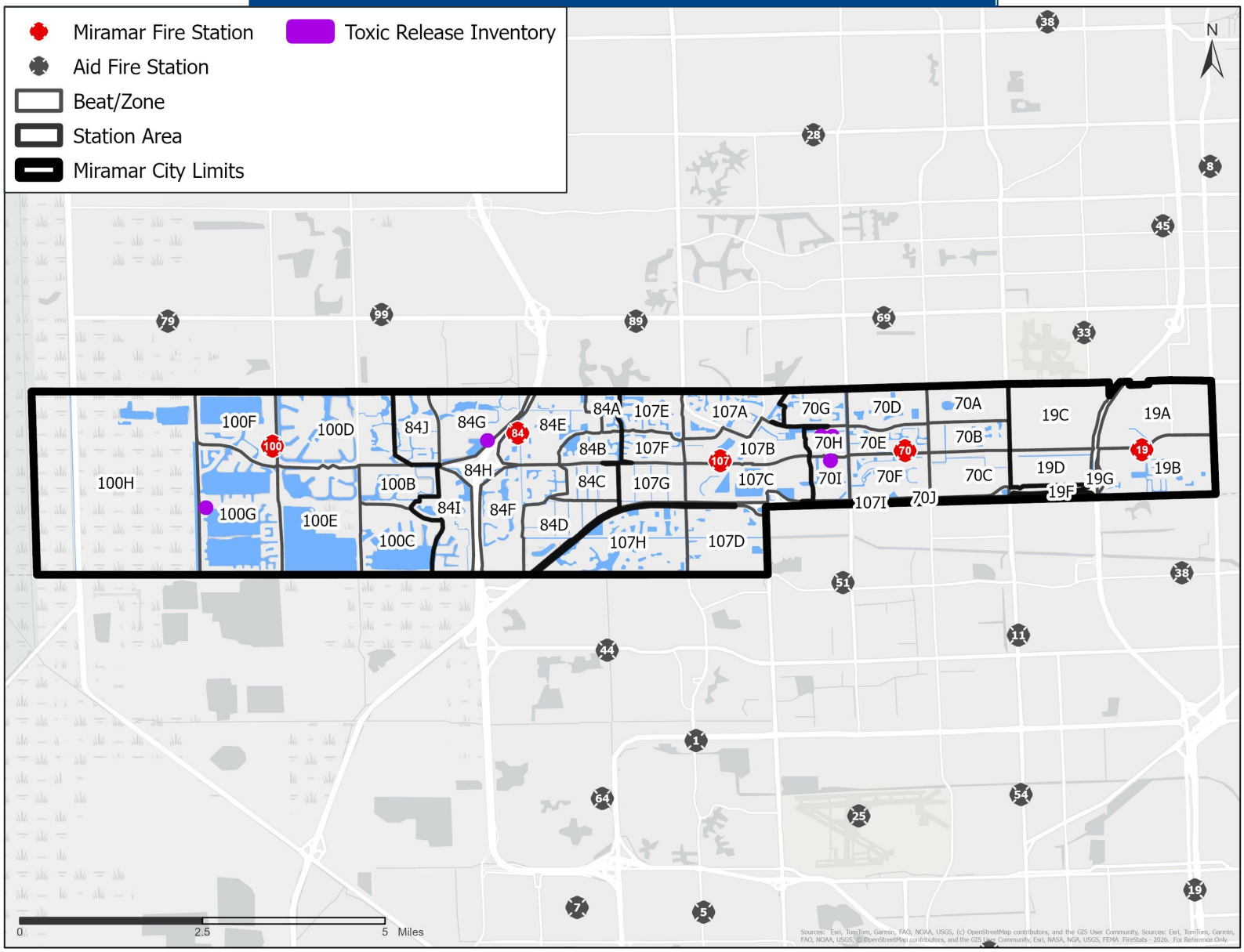
Critical Infrastructure: Hazardous Materials — Hazardous Materials Tier II Chemicals



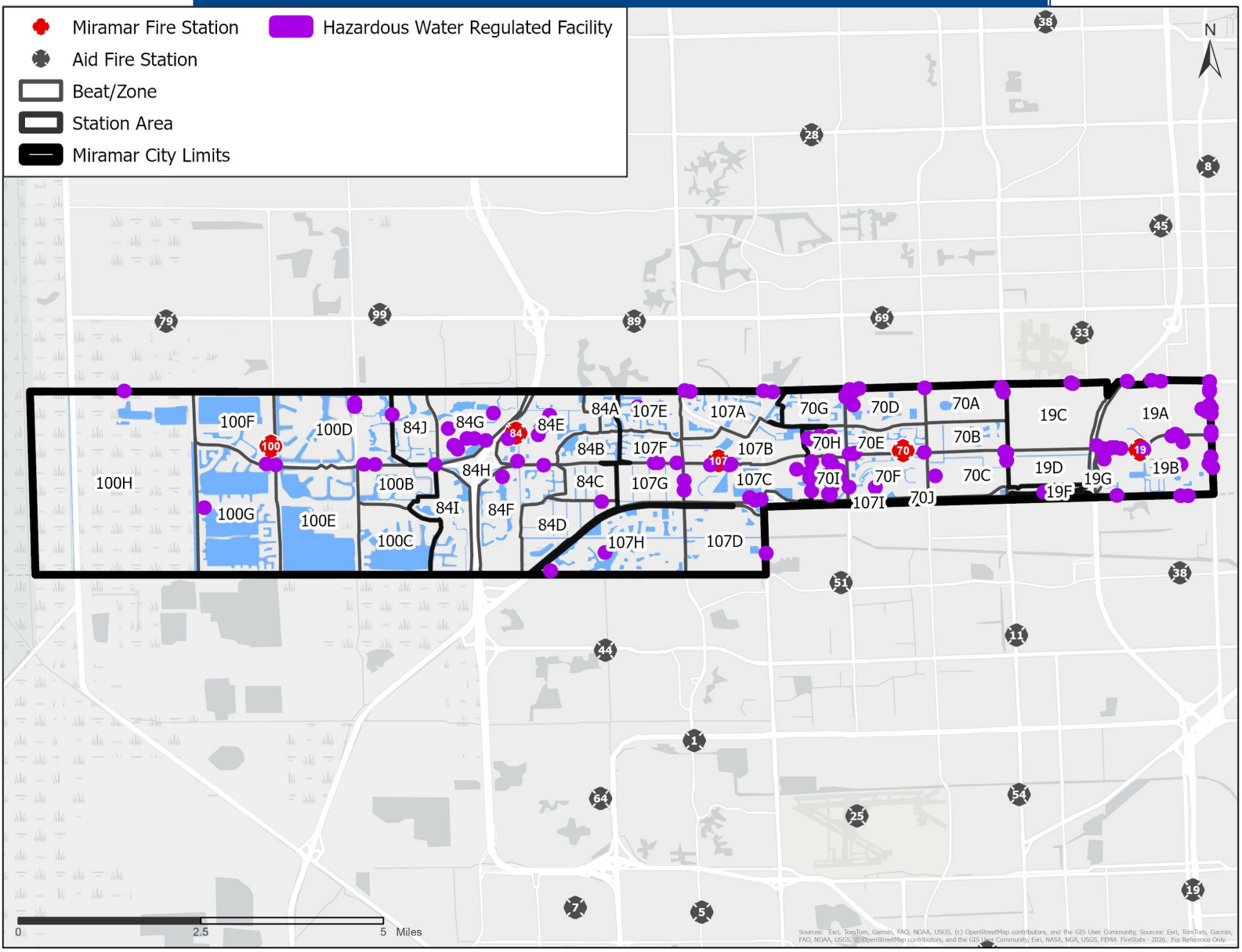
Critical Infrastructure: Hazardous Materials – Hazardous Materials Tier II Facilties



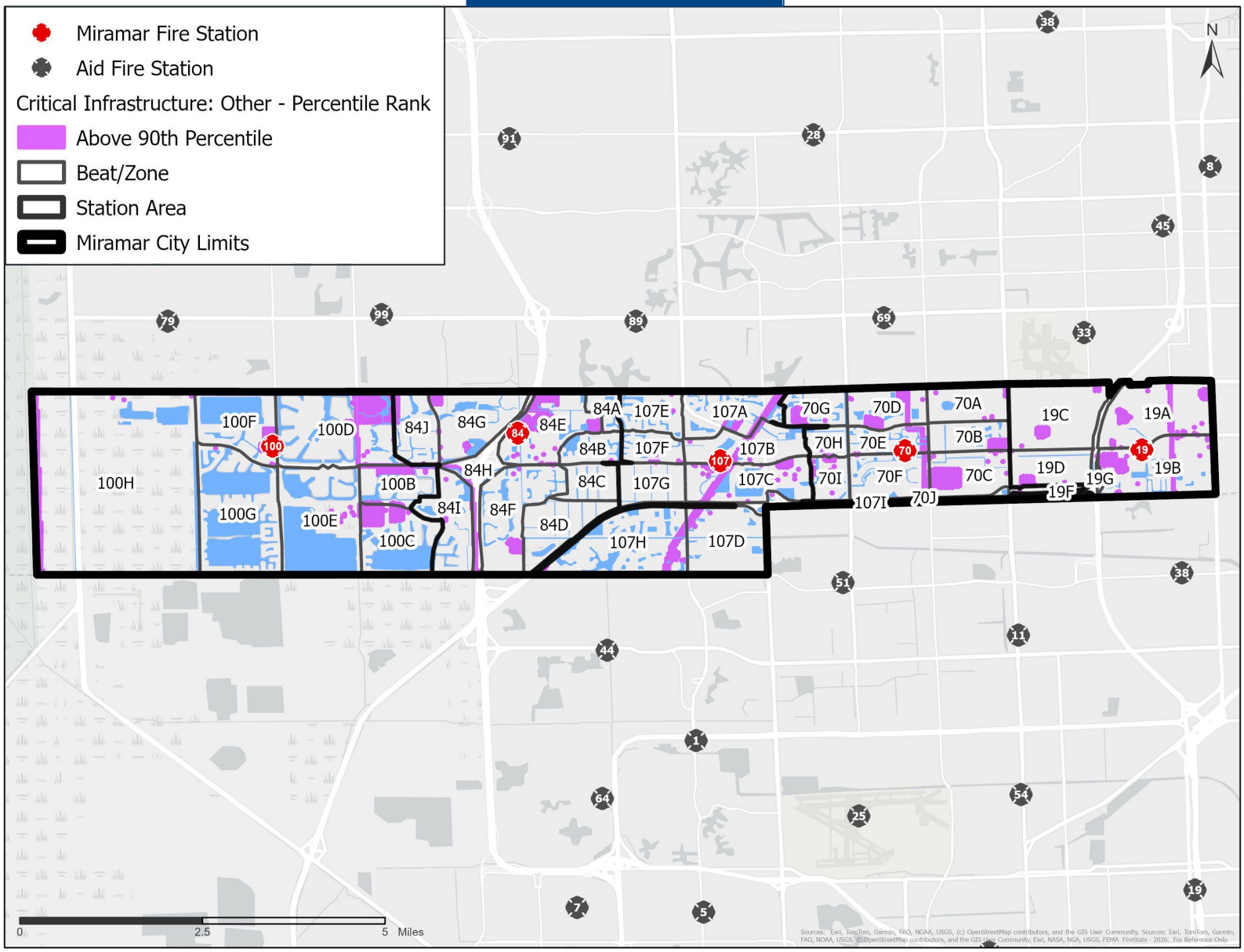
Critical Infrastructure: Hazardous Materials – Toxic Release Inventory



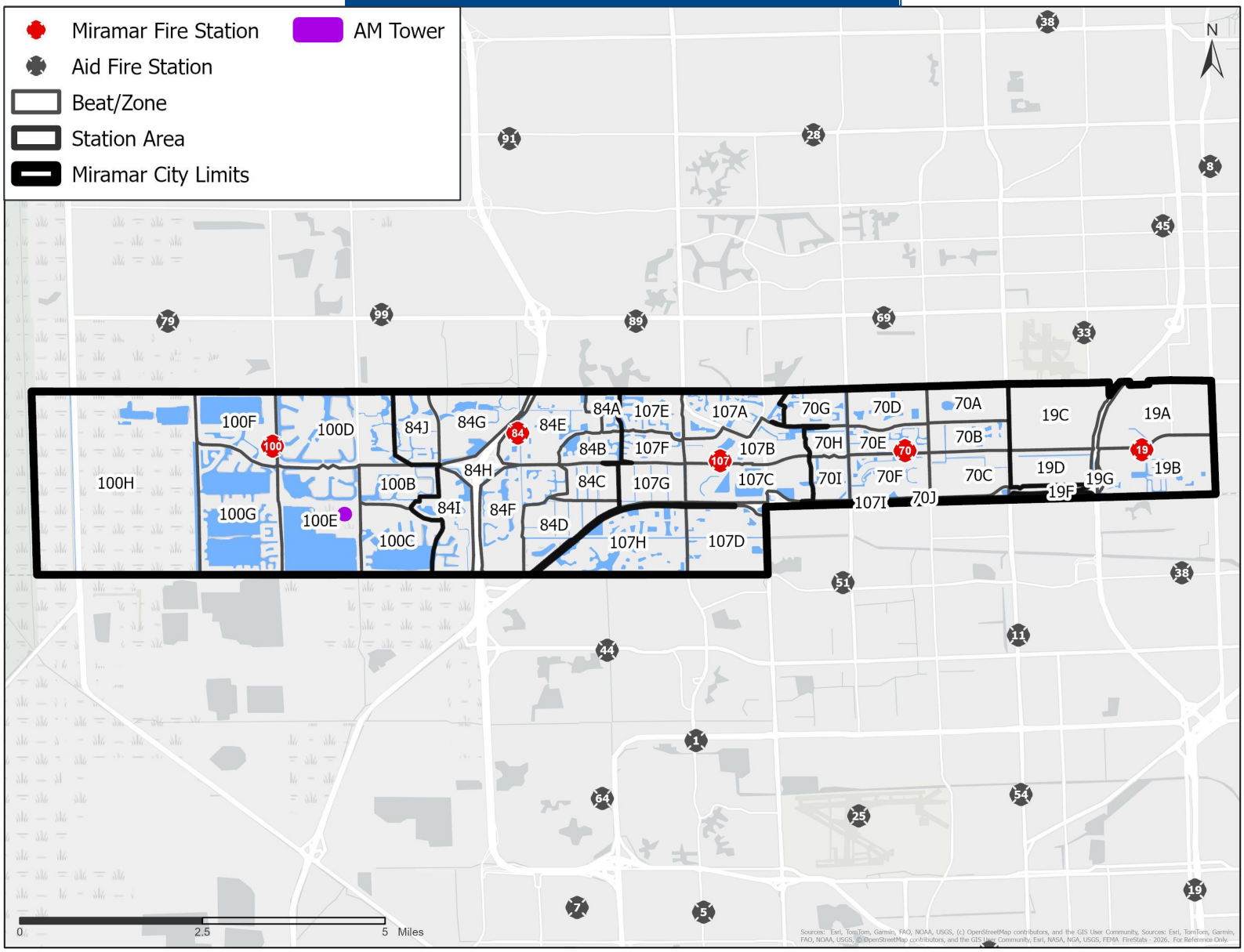
Critical Infrastructure: Hazardous Materials — Hazardous Water Regulated Facilty



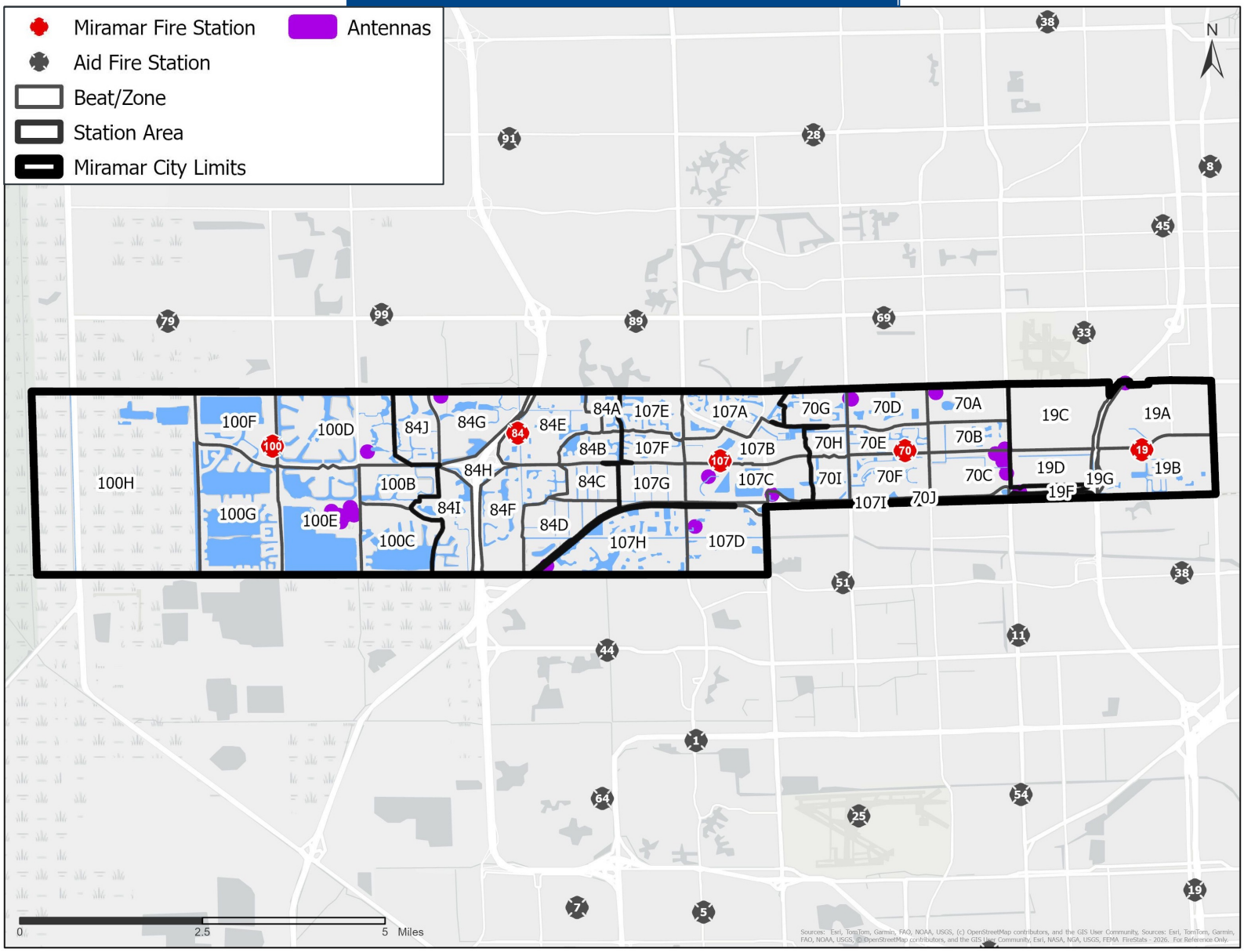
Critical Infrastructure: Other



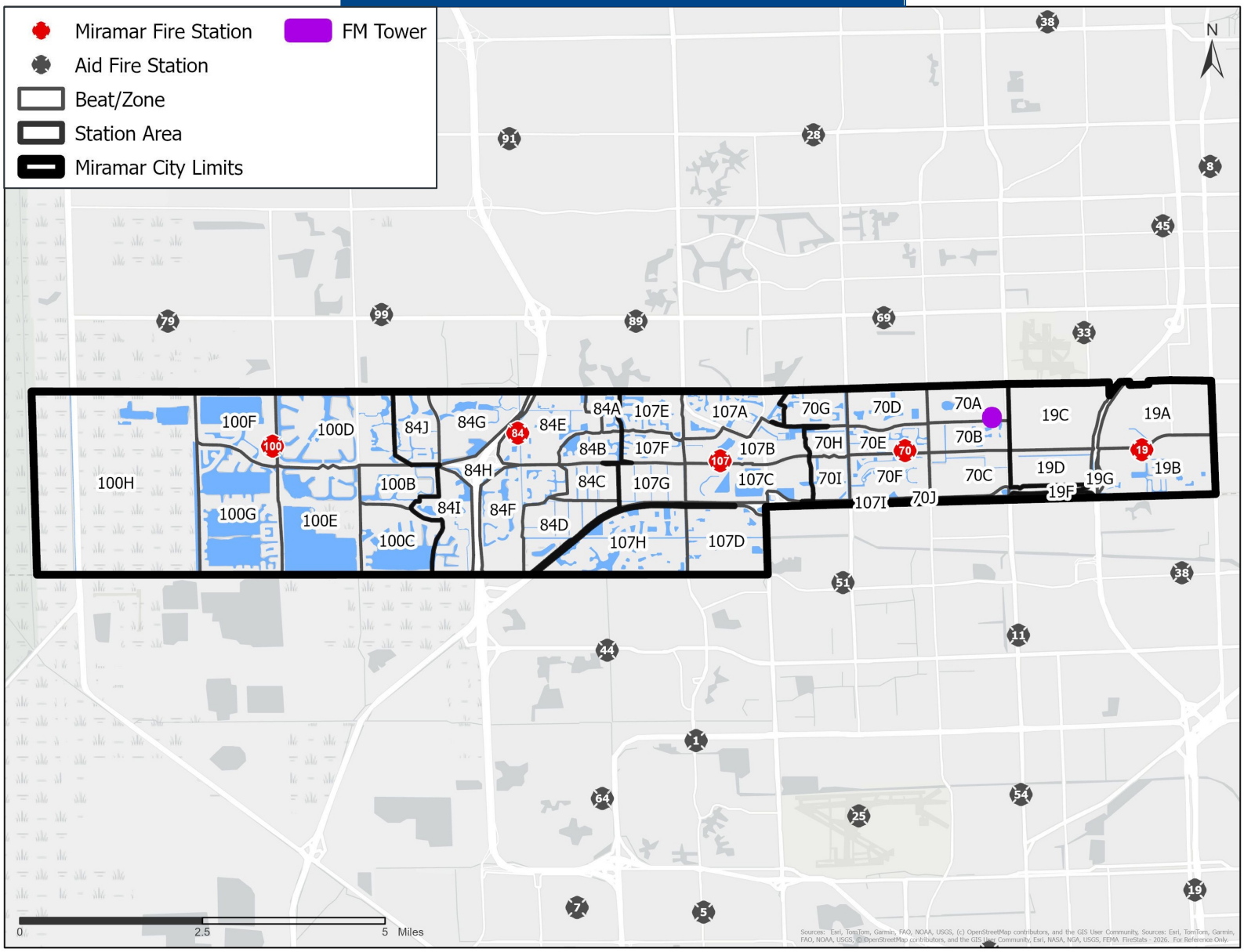
Critical Infrastructure: Communications – AM Tower



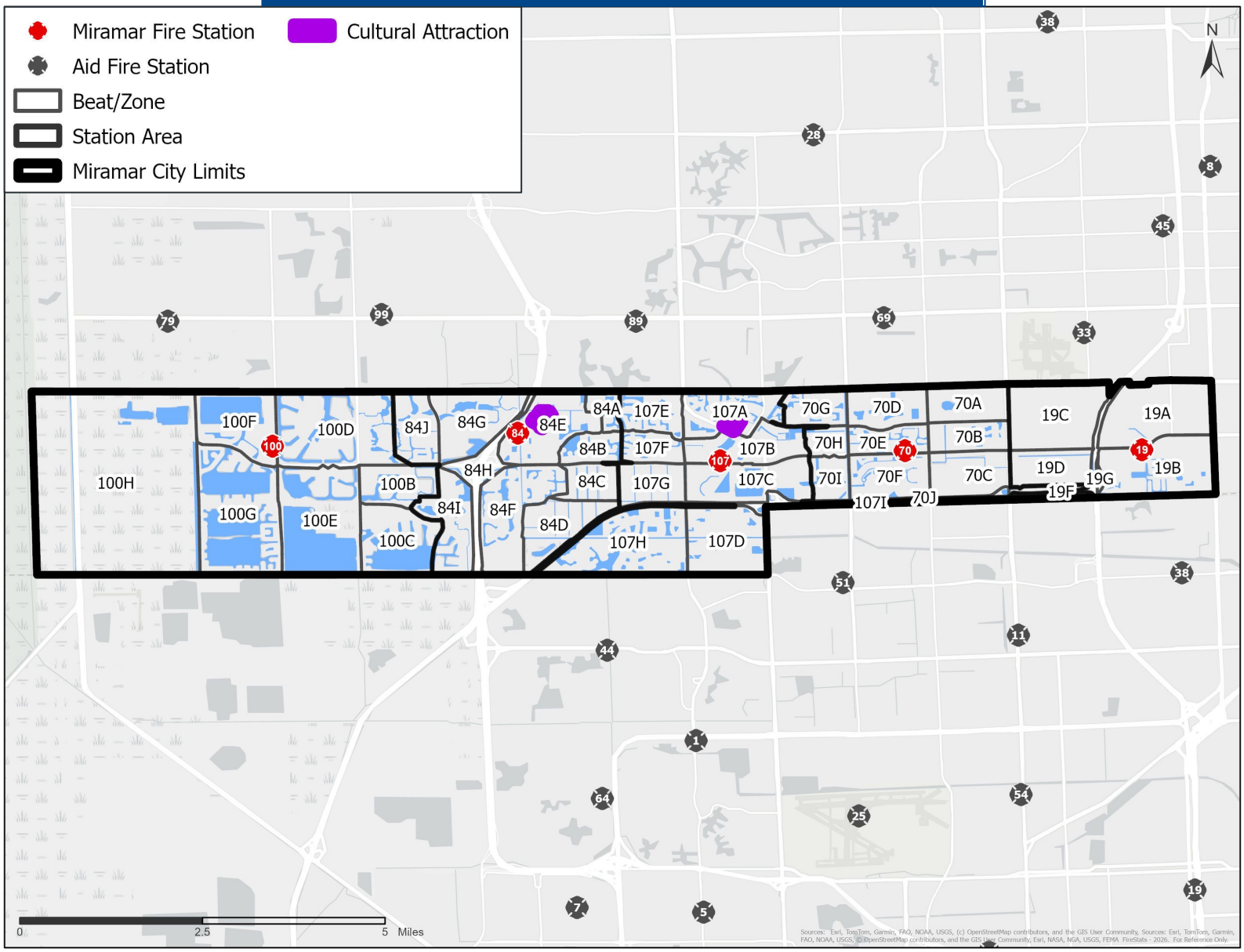
Critical Infrastructure: Communications – Antennas



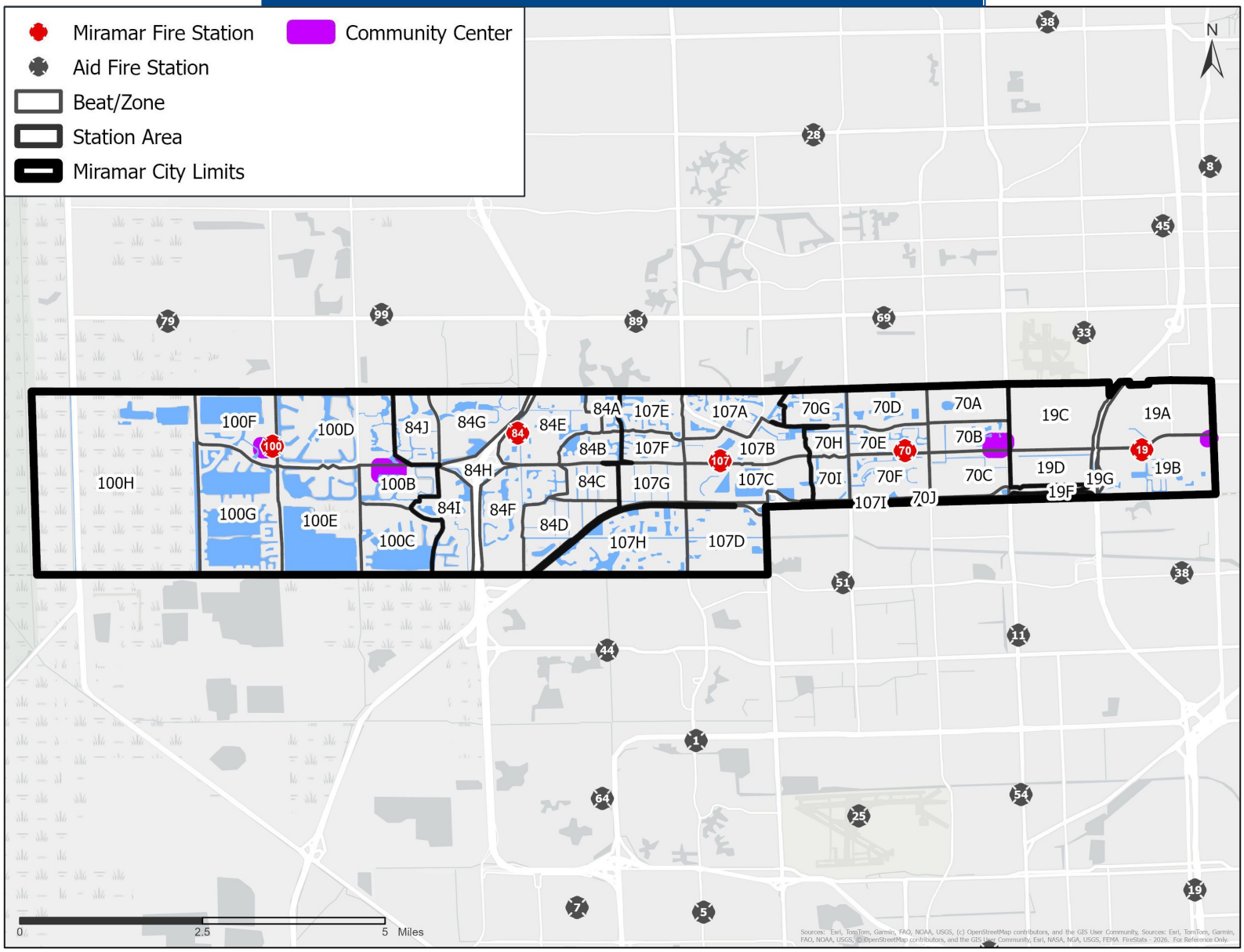
Critical Infrastructure: Communications – FM Tower



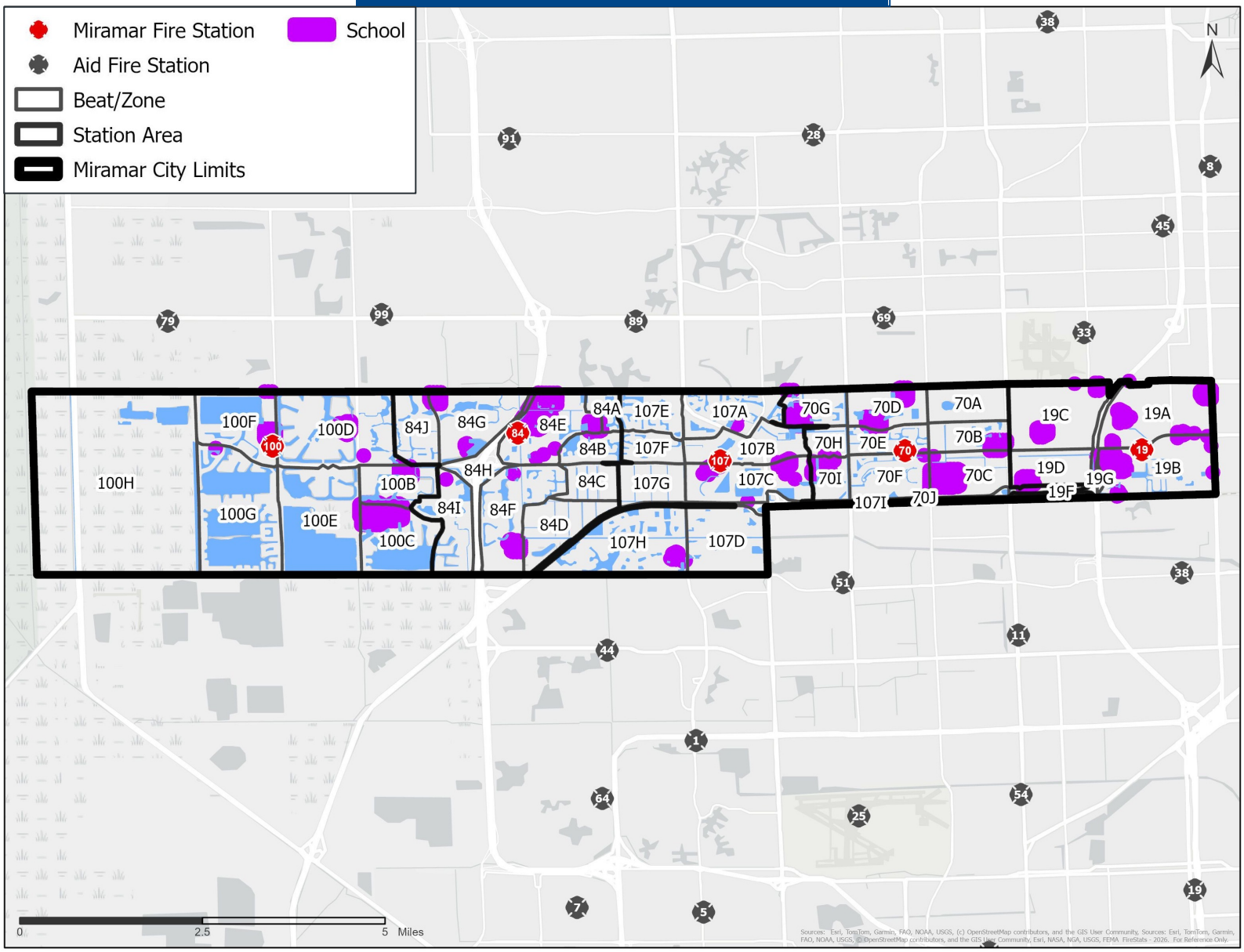
Critical Infrastructure: Other – Gathering Places – Cultural Attraction



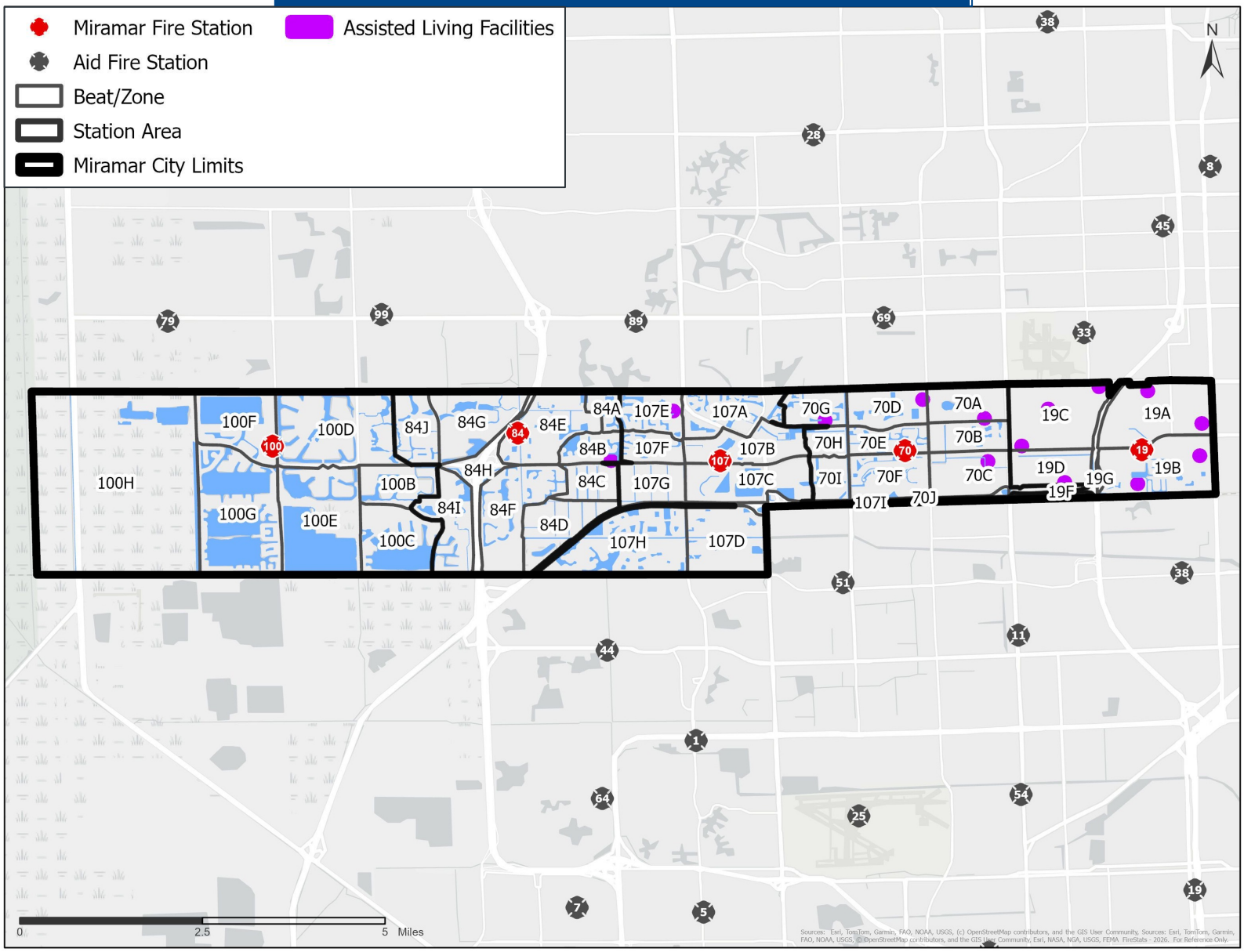
Critical Infrastructure: Other – Gathering Places – Community Center



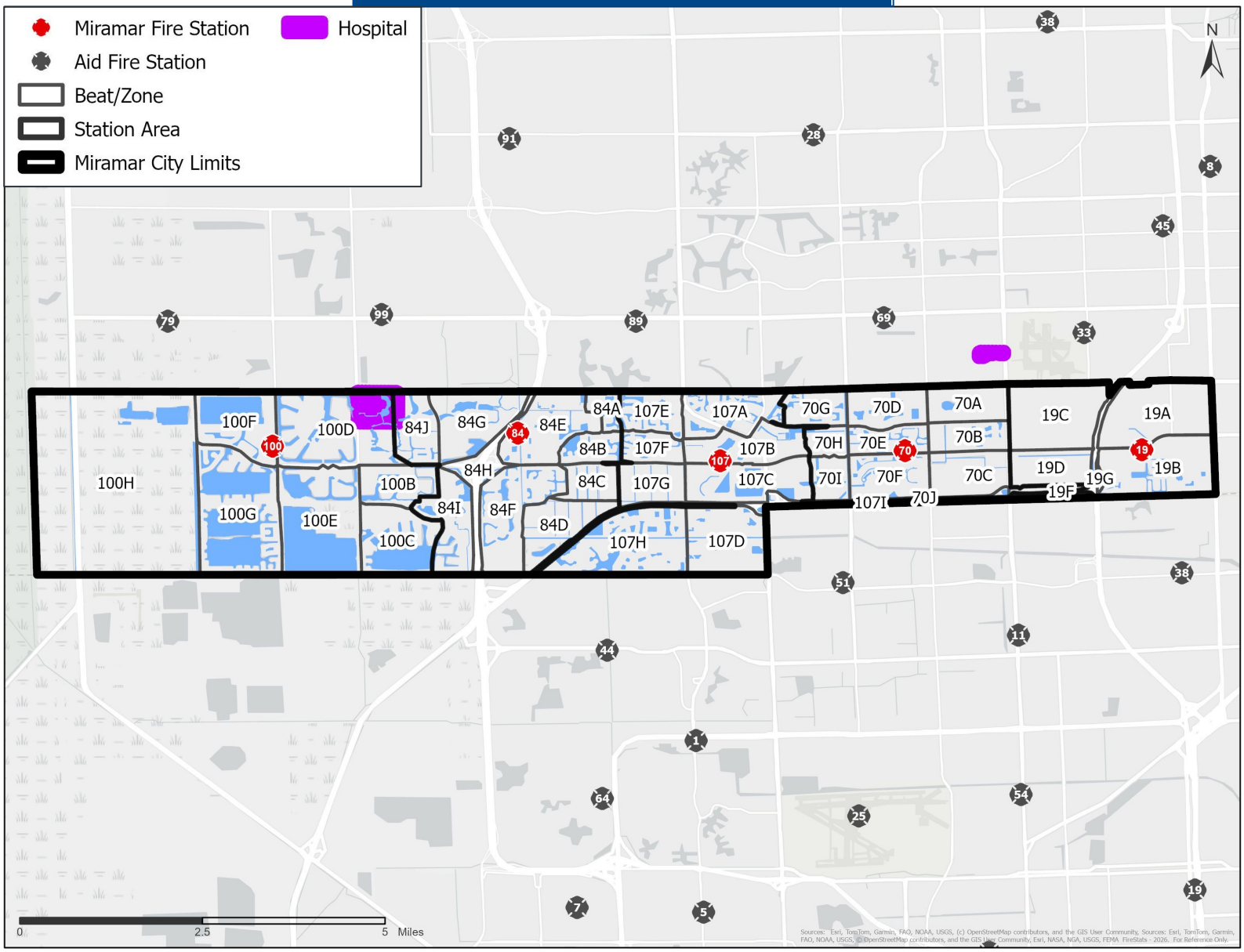
Critical Infrastructure: Other — Education — School



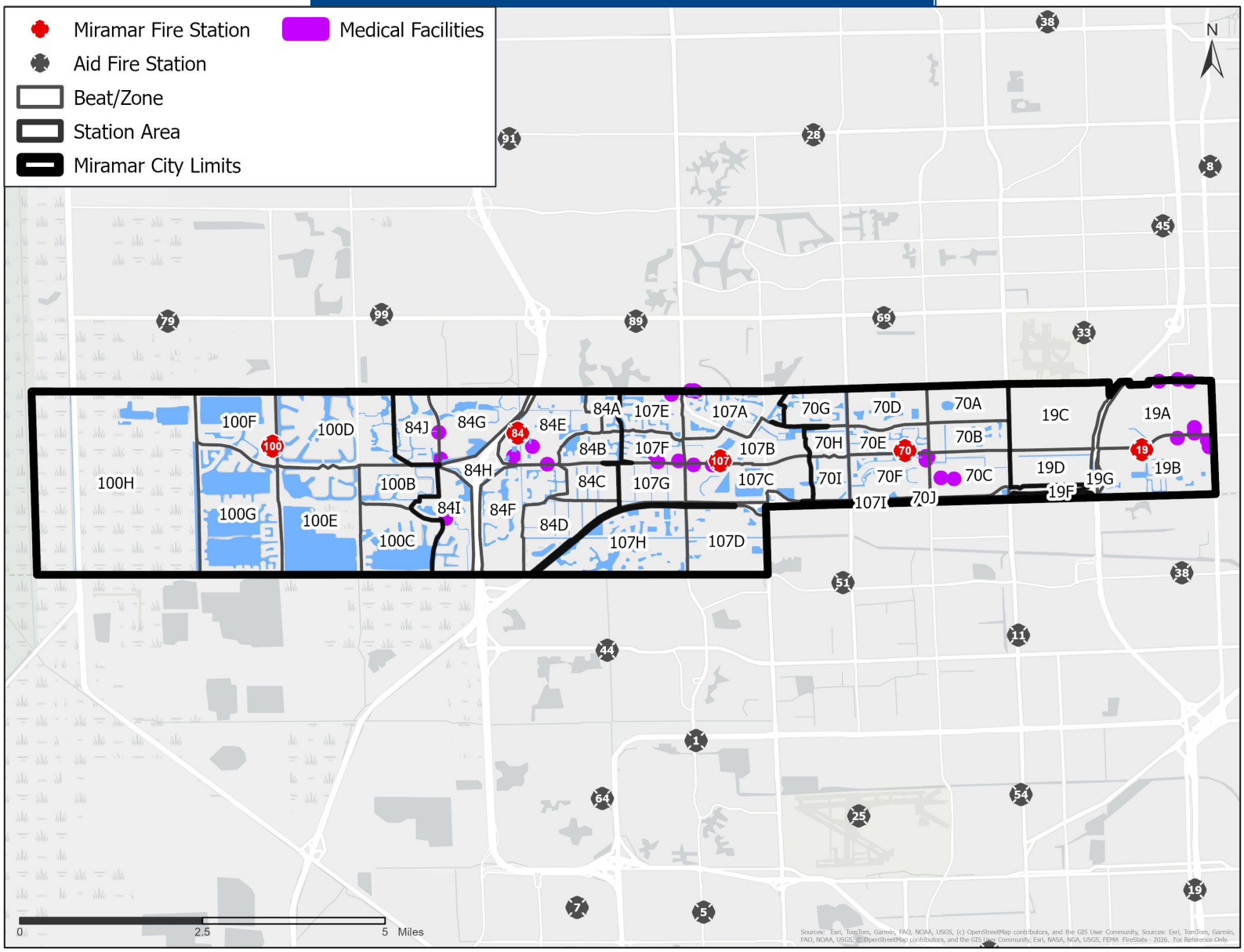
Critical Infrastructure: Other — Medical — Assisted Living Facilities



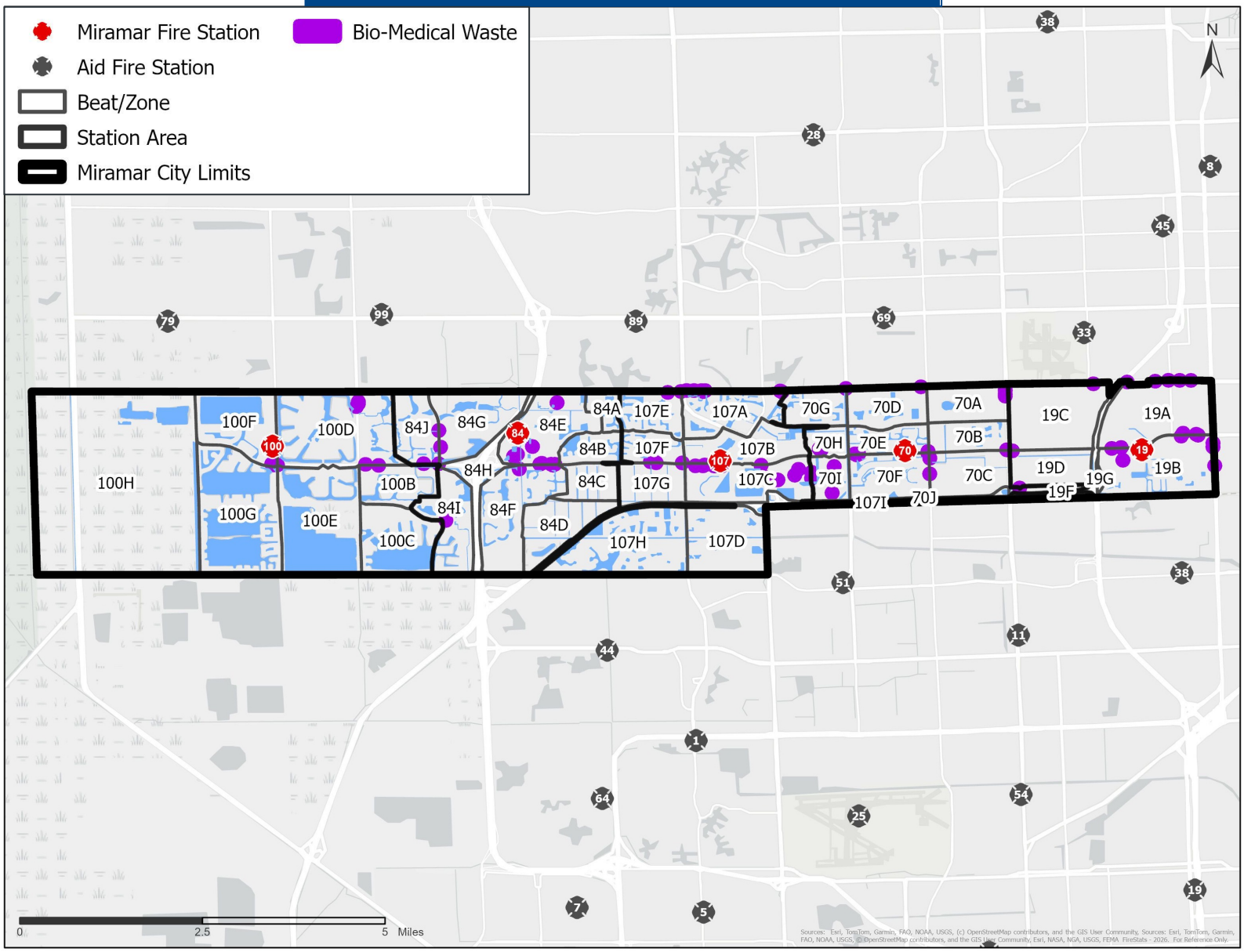
Critical Infrastructure: Other – Medical – Hospital



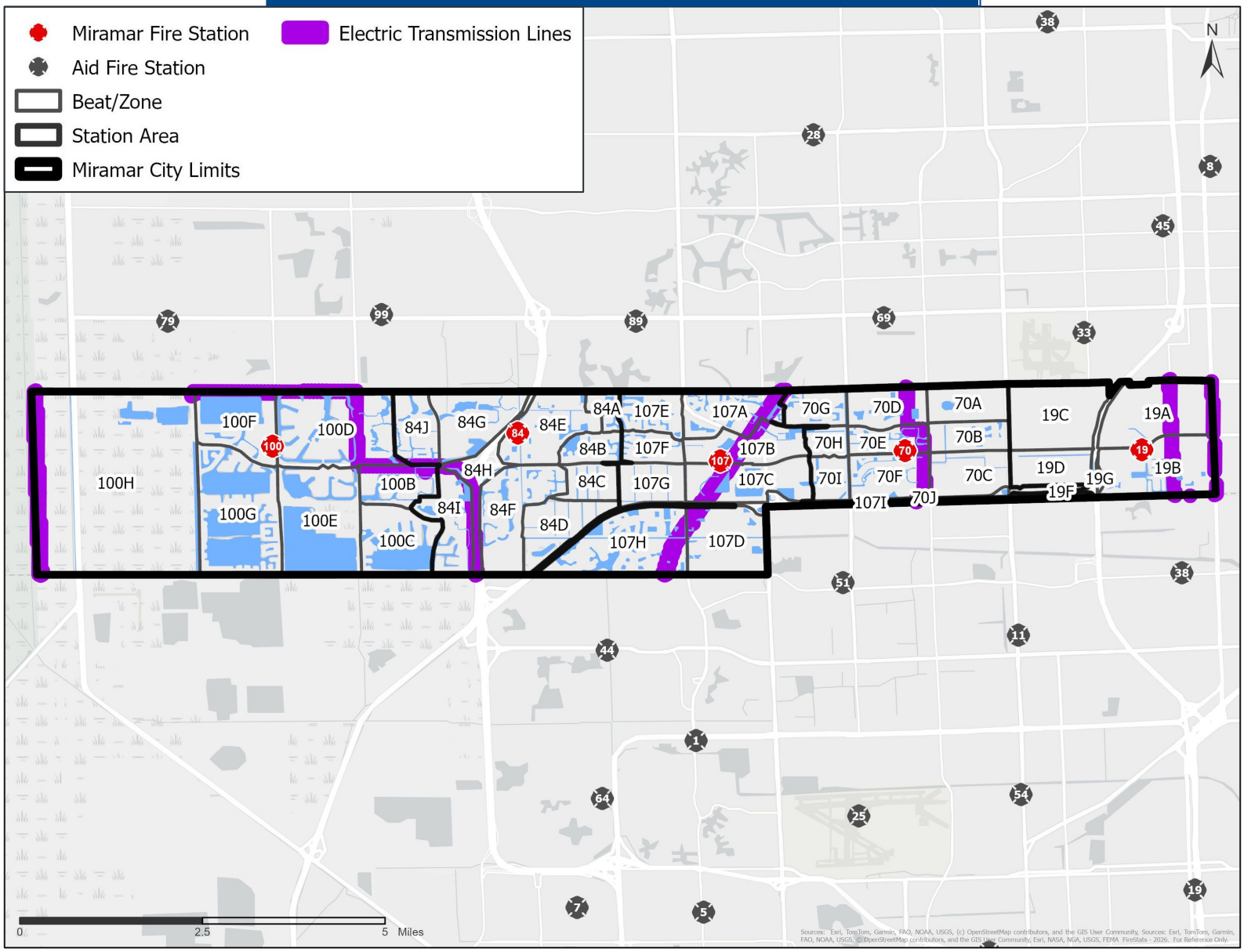
Critical Infrastructure: Other — Medical — Medical Facilities



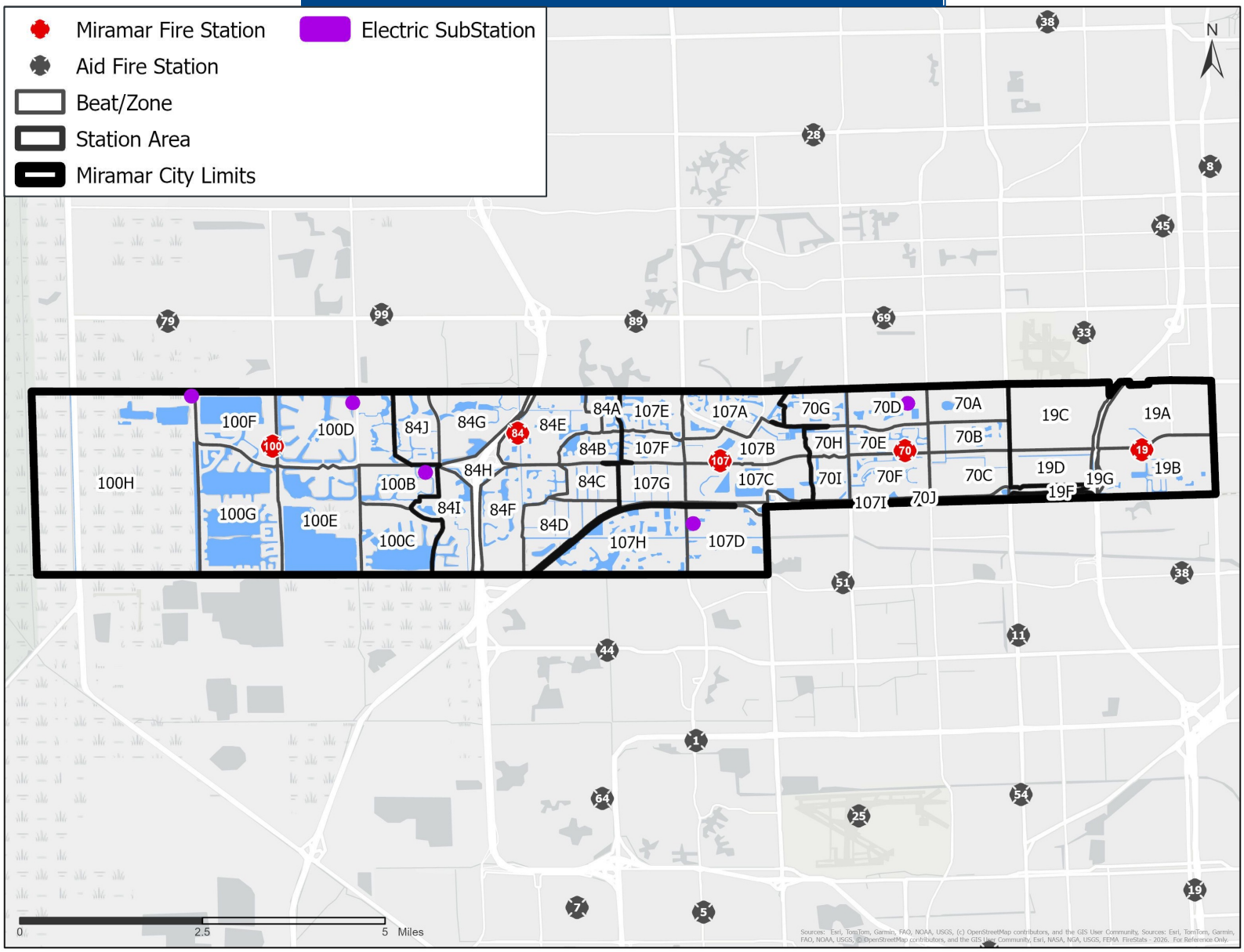
Critical Infrastructure: Other – Medical – Bio-Medical Waste



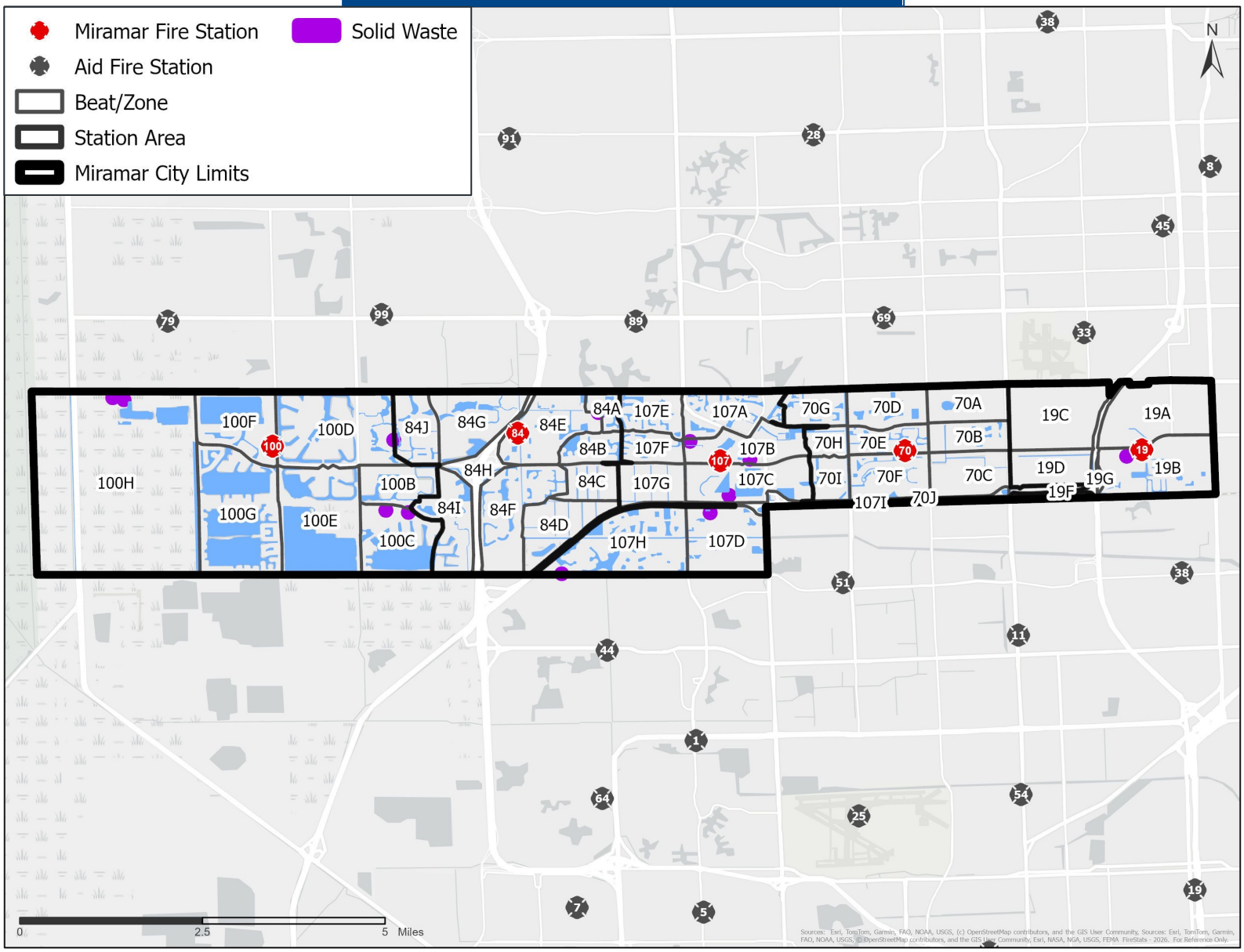
Critical Infrastructure: Other — Utilites — Electric Transmission Lines



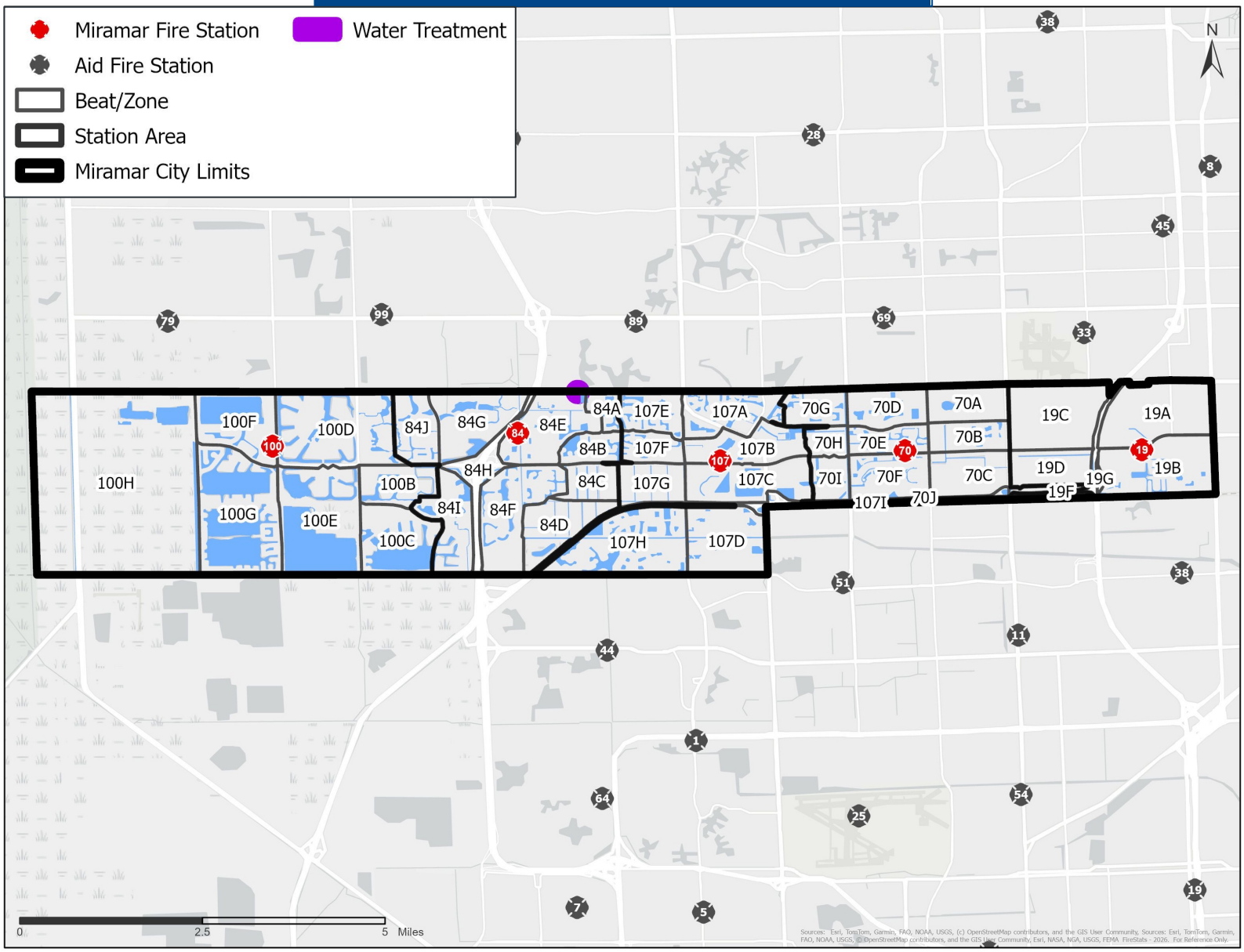
Critical Infrastructure: Other – Utilites – Electric Substations



Critical Infrastructure: Other — Utilites — Solid Waste



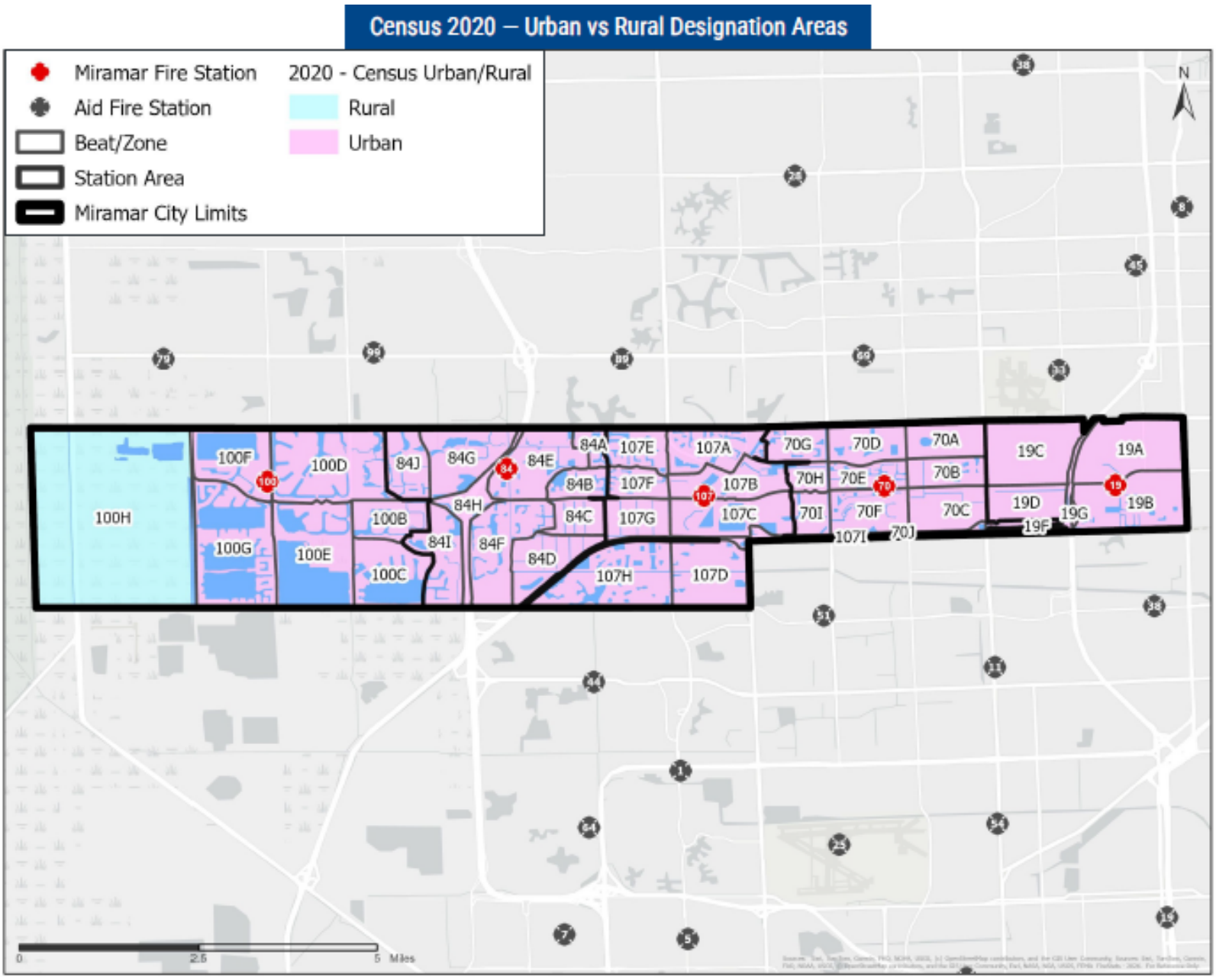
Critical Infrastructure: Other — Utilites — Water Treatment



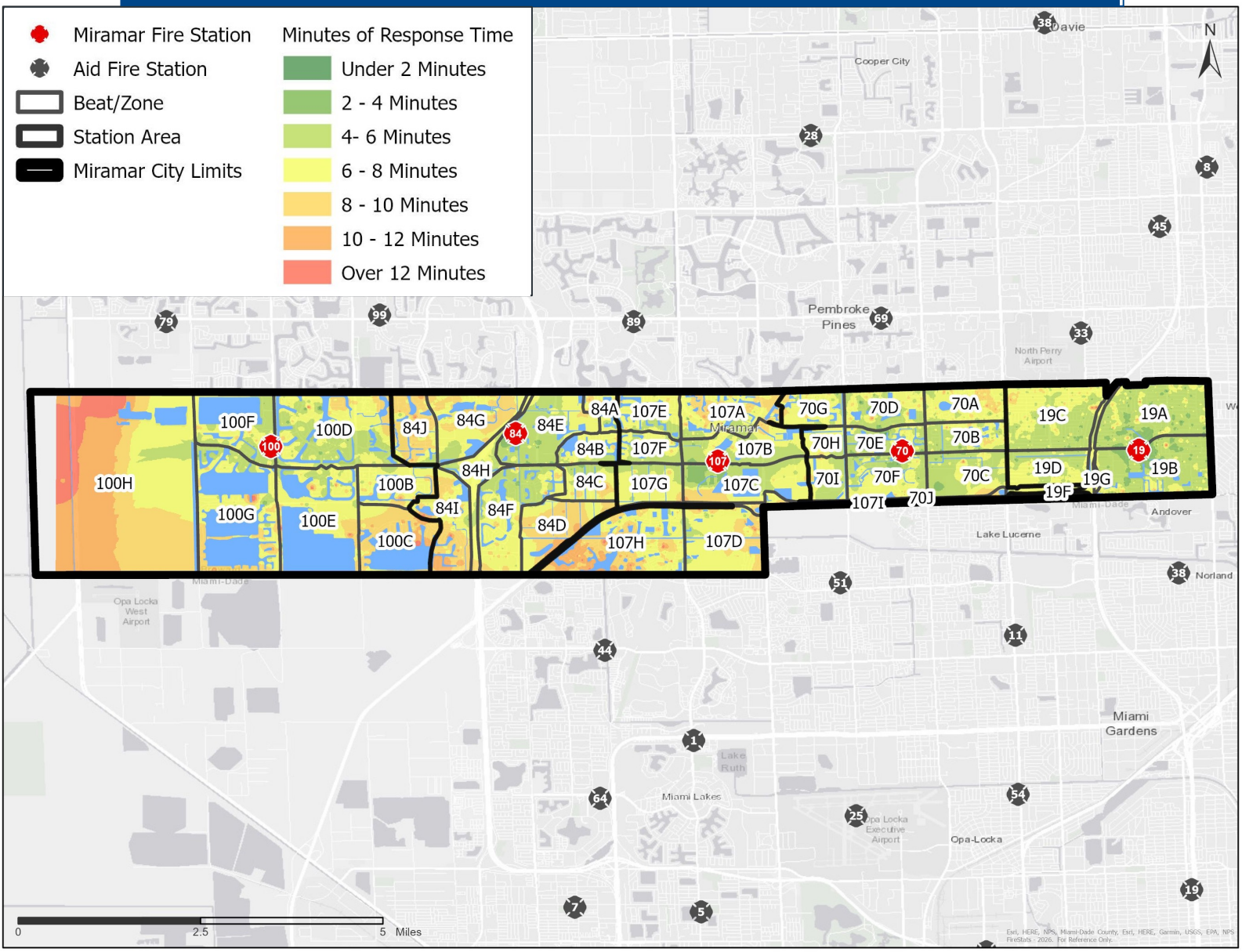
Population Density Classification for Miramar Hexbins

Population density was calculated at the census block level by dividing population by land area, consistent with the density-based approach used in both the Census Bureau's urban area delineation and NFPA 1710 demand zone classification. Rather than applying fixed thresholds as those standards use, population density was evaluated using a percent-rank approach, normalizing each hexbin's density relative to all other hexbins in the study area on a scale of 0 to 100. This relative approach adjusts automatically to the density distribution observed within Miramar's jurisdictional boundaries, rather than relying on national or generalized breakpoints that may not reflect local conditions.

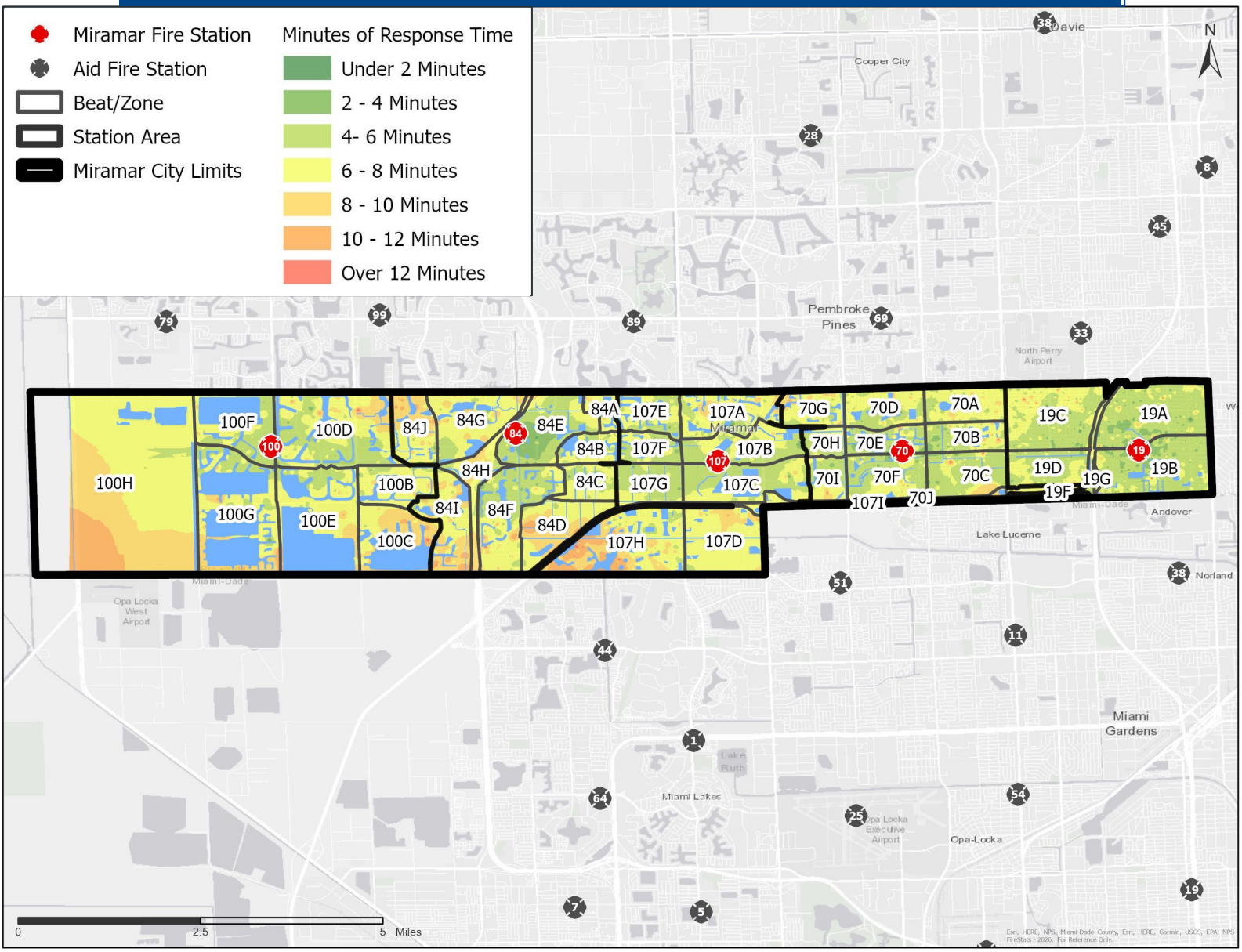
Hexbins with a higher percent rank score reflected relatively greater population density compared to other hexbins in the study area, while lower scores reflected comparatively lower density. This value was incorporated into the risk model as a demographic exposure variable, complementing incident frequency, incident persistence, and flood exposure to identify areas with an elevated likelihood of emergency service demand. Unlike the Census Bureau's or NFPA 1710's discrete classification schemes, the percent rank method preserves population density as a continuous variable scaled specifically to Miramar's local population distribution, allowing for more granular differentiation between hexbins.



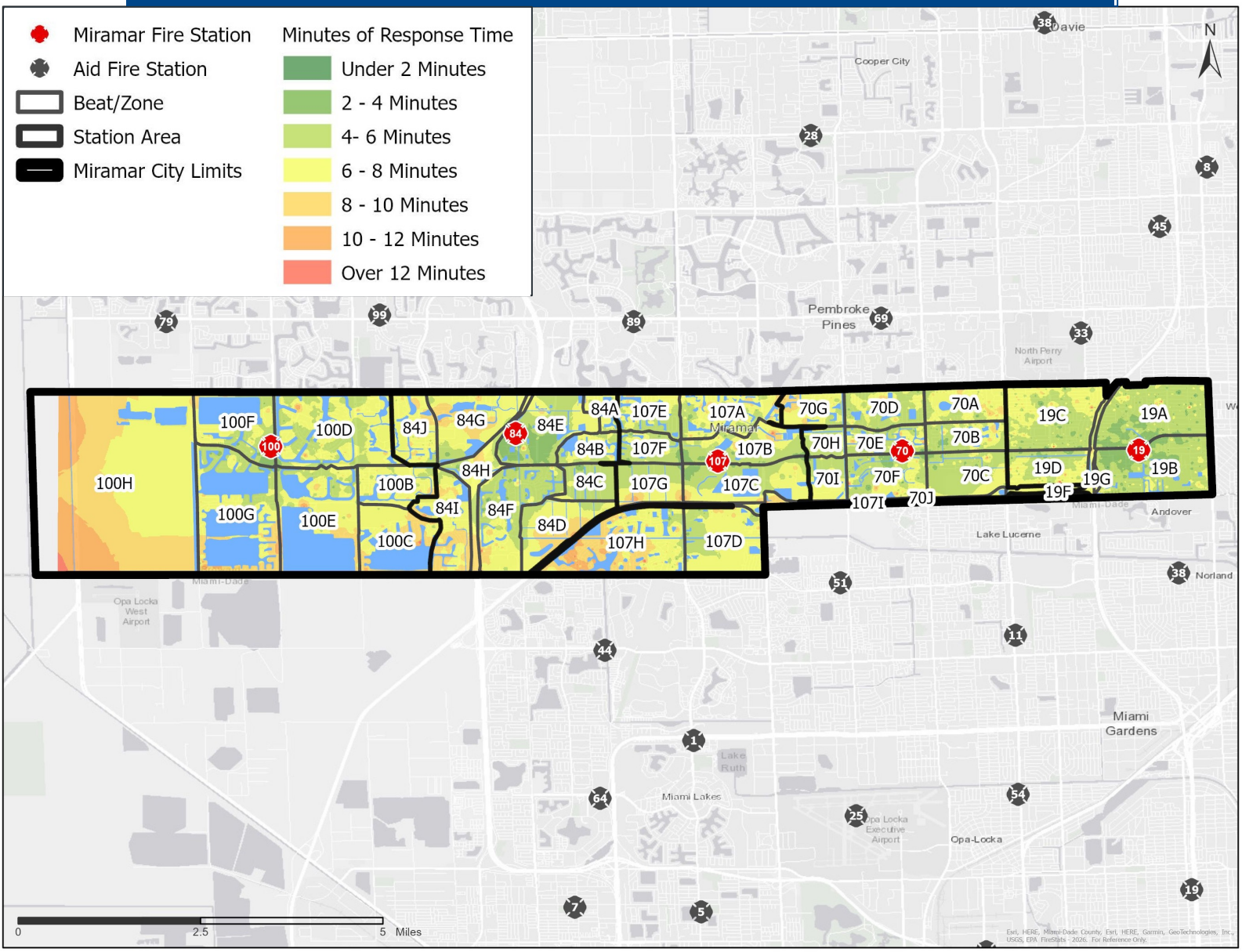
Historic Response Time Performance for Miramar Fire-Rescue Department First in Units, CY 2021



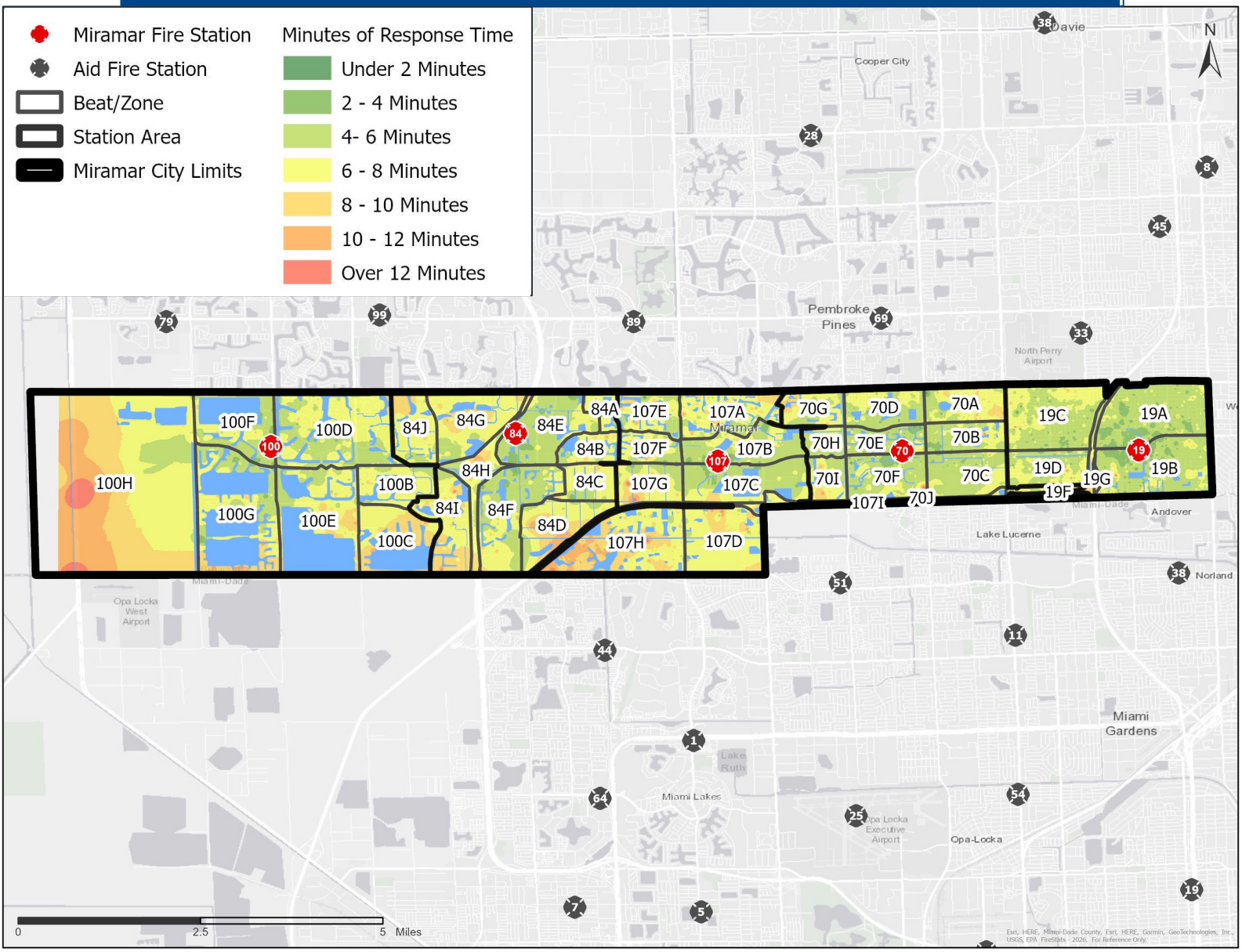
Historic Response Time Performance for Miramar Fire-Rescue Department First in Units, CY 2022



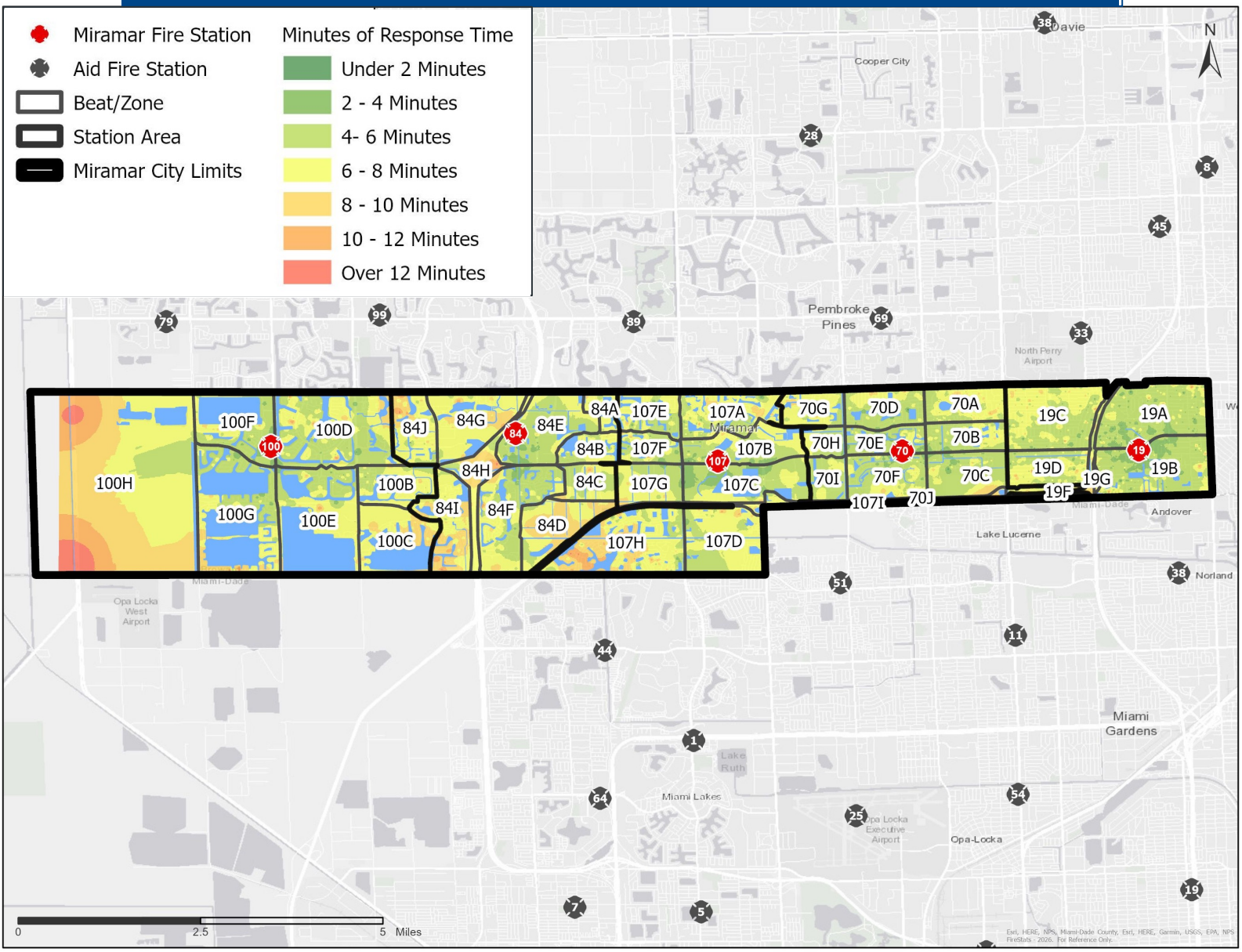
Historic Response Time Performance for Miramar Fire-Rescue Department First in Units, CY 2023



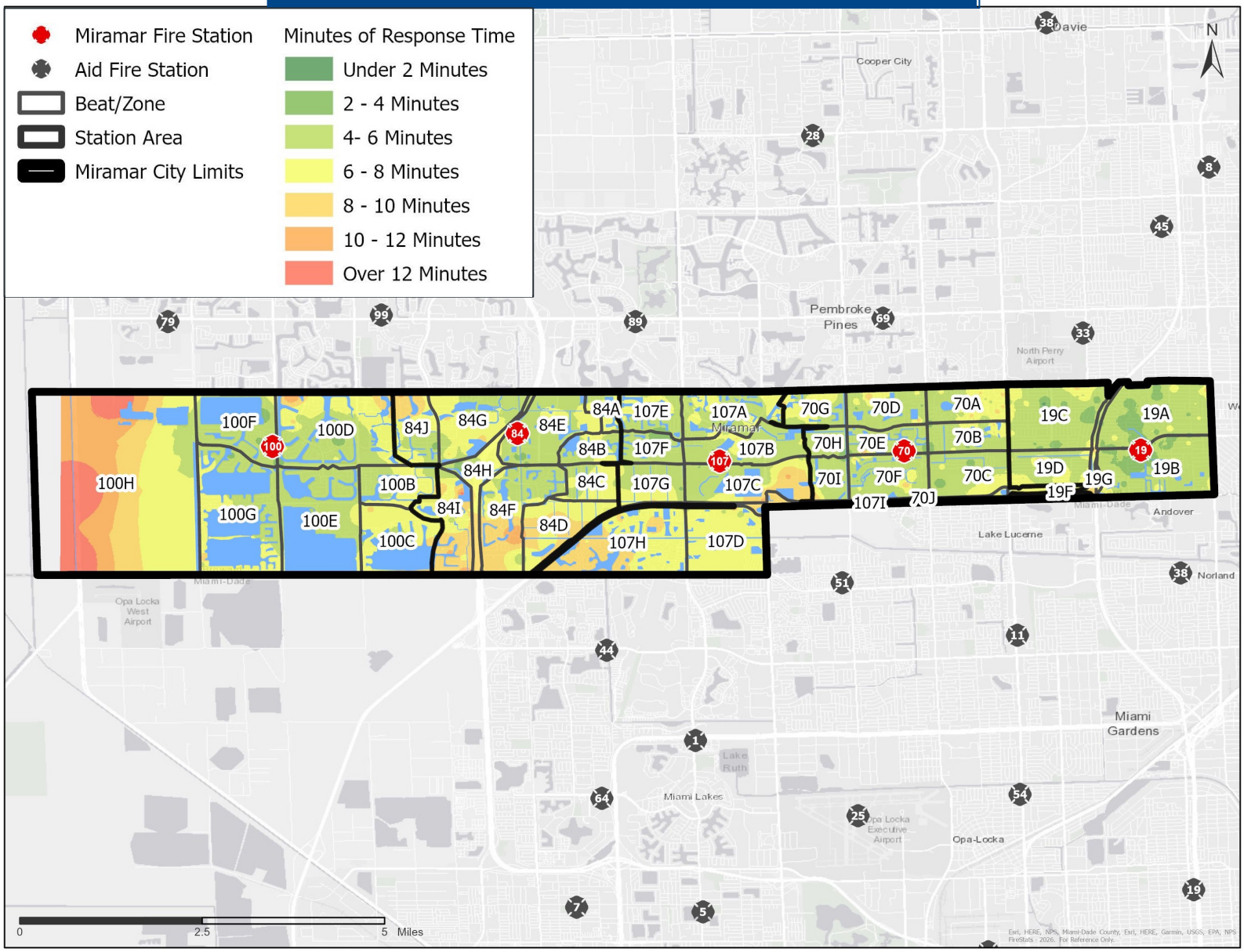
Historic Response Time Performance for Miramar Fire-Rescue Department First in Units, CY 2024



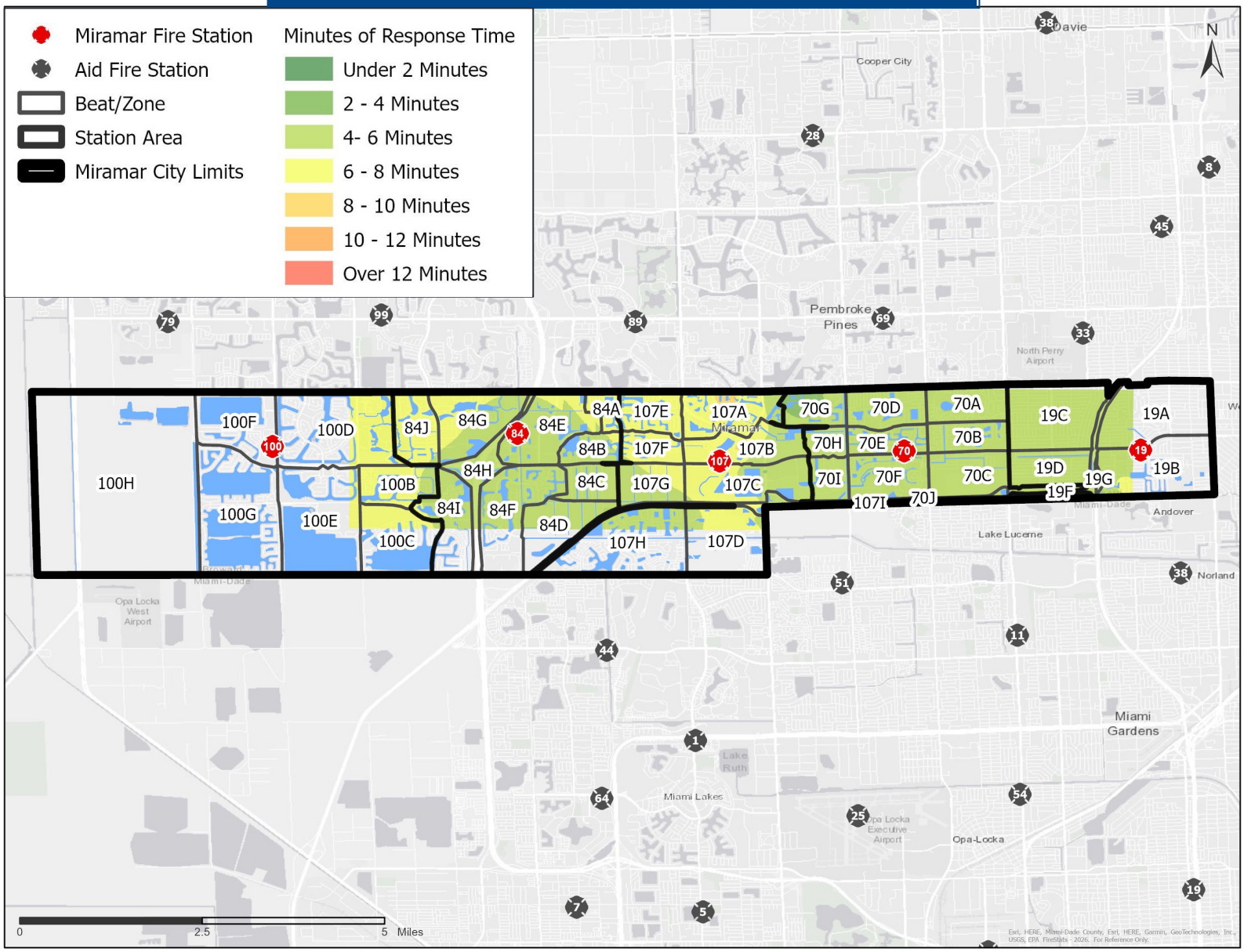
Historic Response Time Performance for Miramar Fire-Rescue Department First in Units, CY 2025



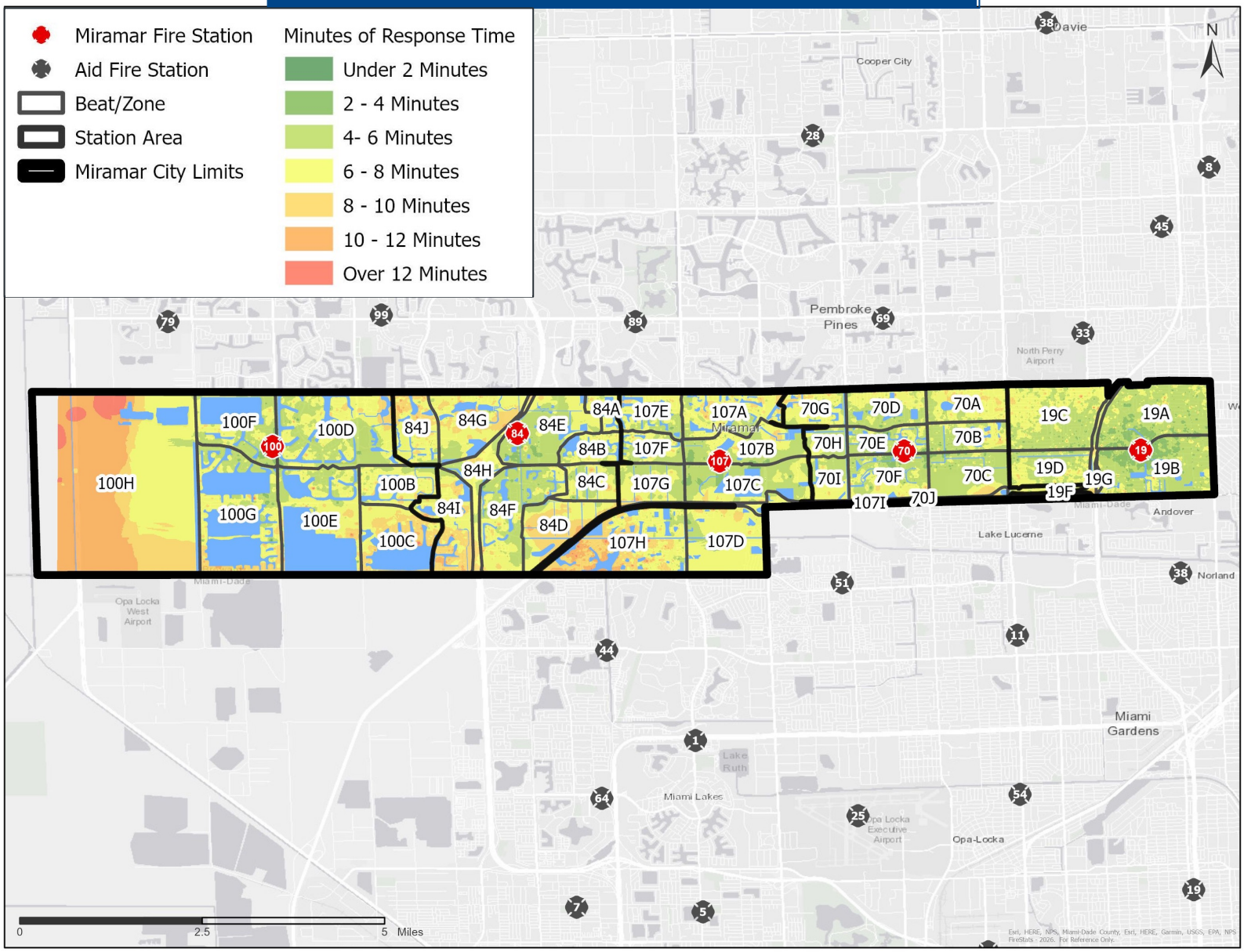
NFIRS Group Code 100 — Historic Response Time Performance for Miramar Fire-Rescue Department First in Units, CYs 2021–2025



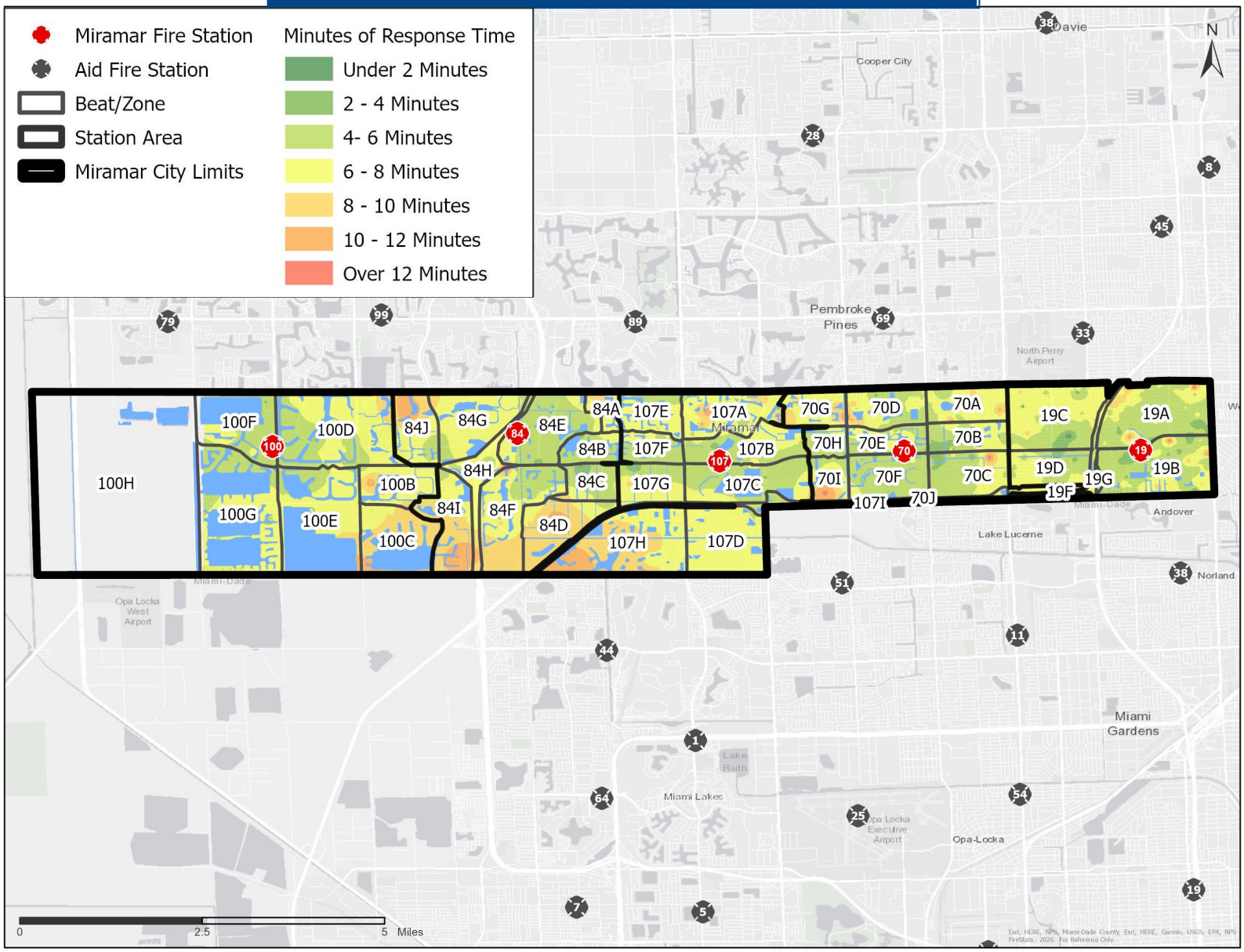
NFIRS Group Code 200 — Historic Response Time Performance for Miramar Fire-Rescue Department First in Units, CYs 2021–2025



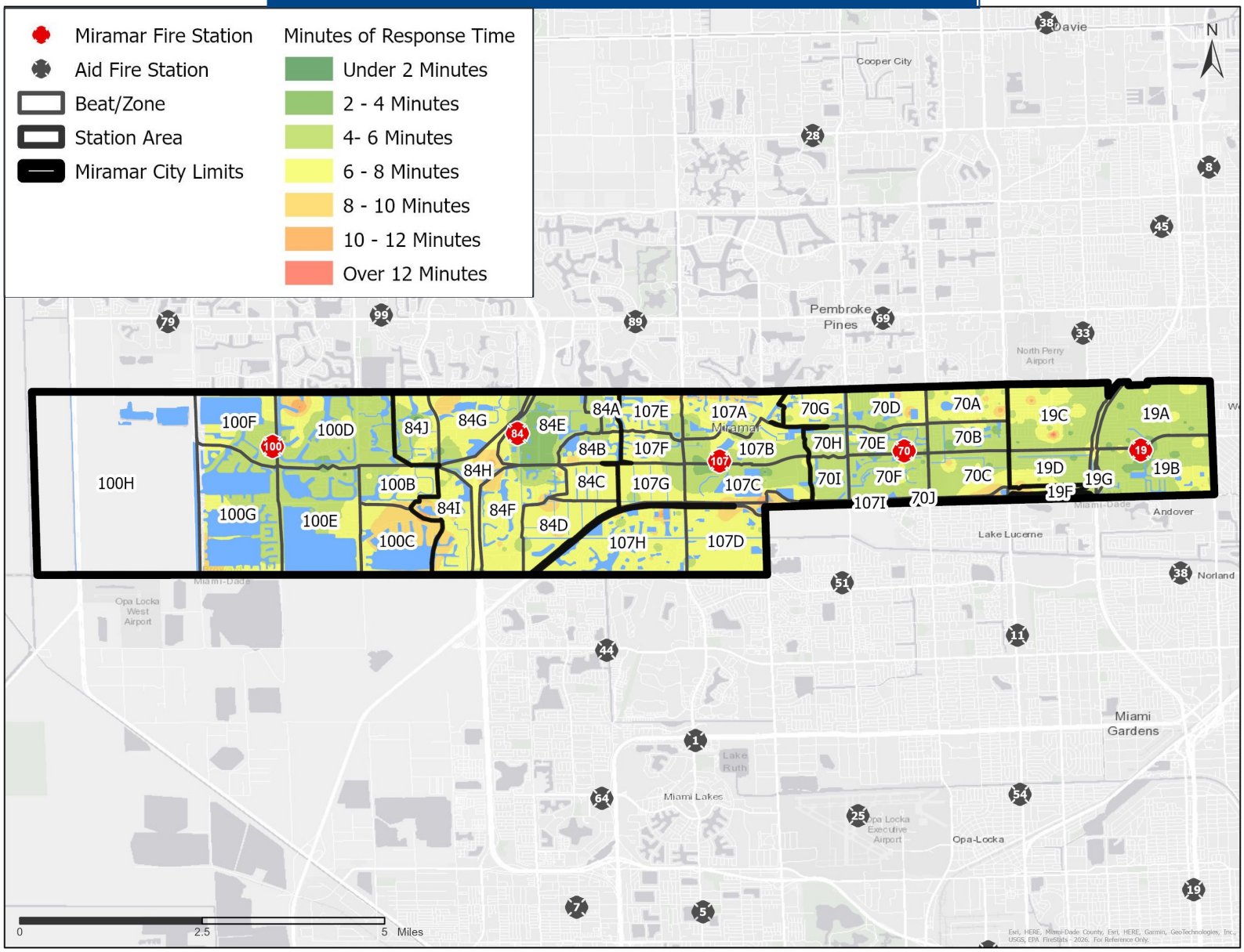
NFIRS Group Code 300 — Historic Response Time Performance for Miramar Fire-Rescue Department First in Units, CYs 2021–2025



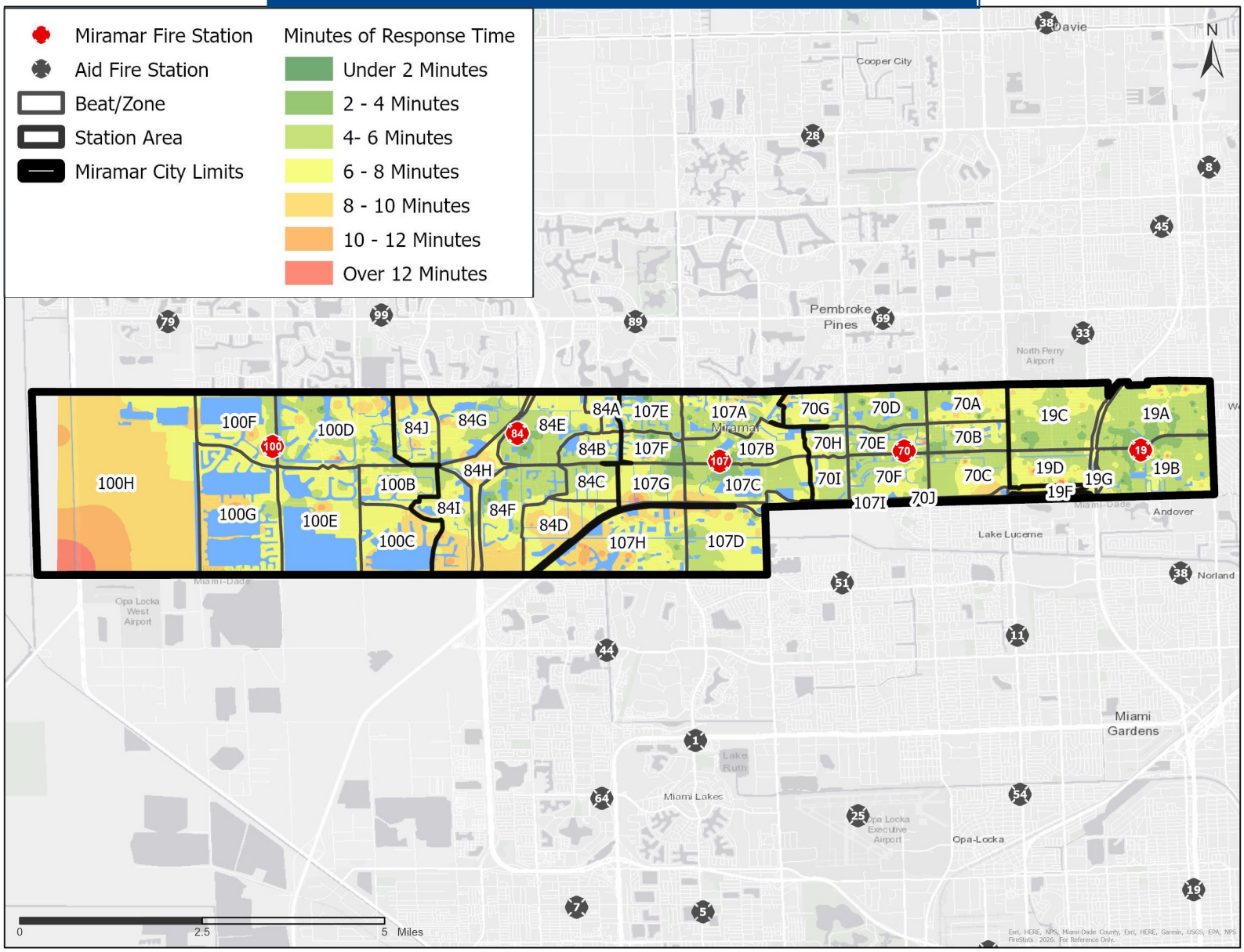
NFIRS Group Code 400 — Historic Response Time Performance for Miramar Fire-Rescue Department First in Units, CYs 2021–2025



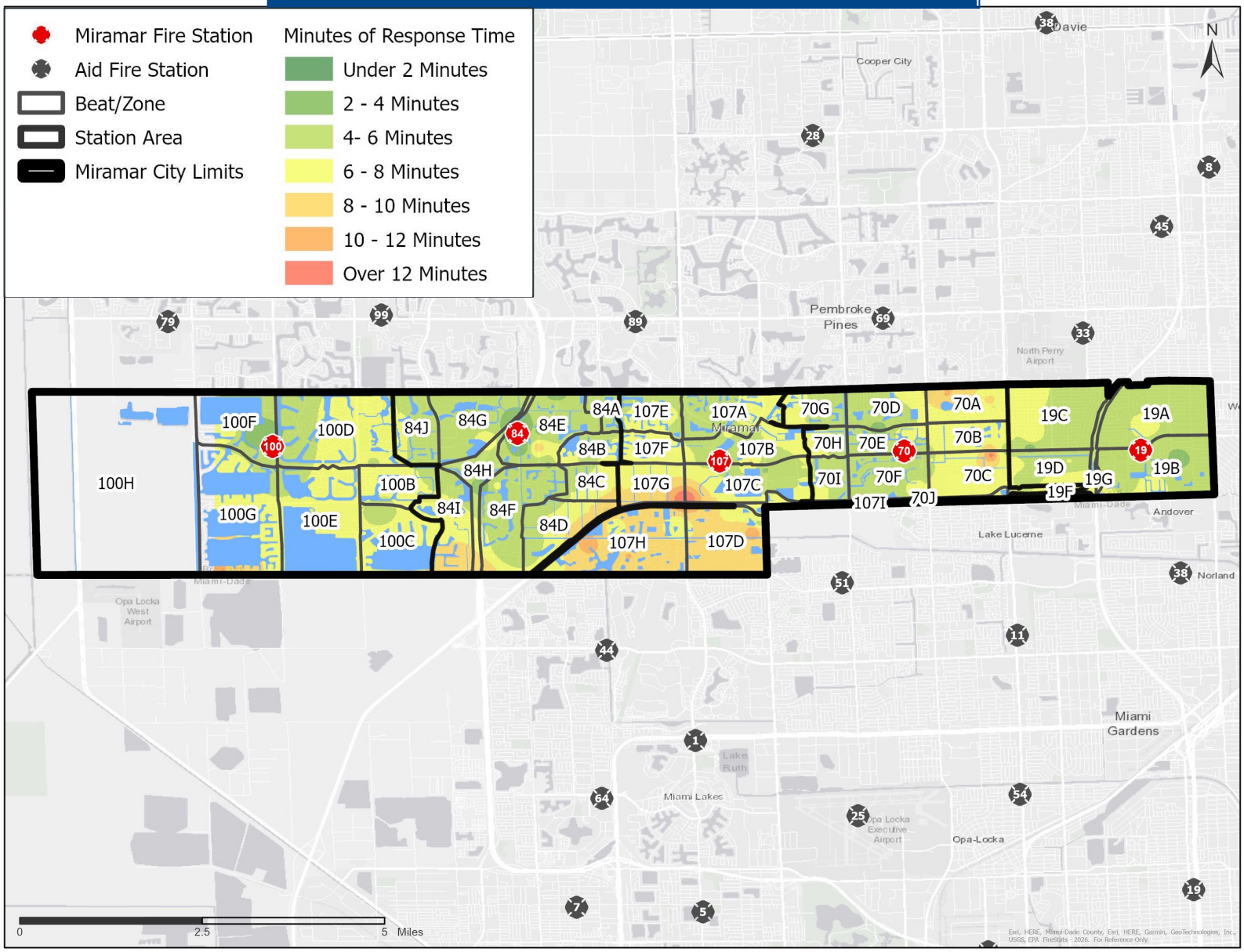
NFIRS Group Code 500 — Historic Response Time Performance for Miramar Fire-Rescue Department First in Units, CYs 2021–2025



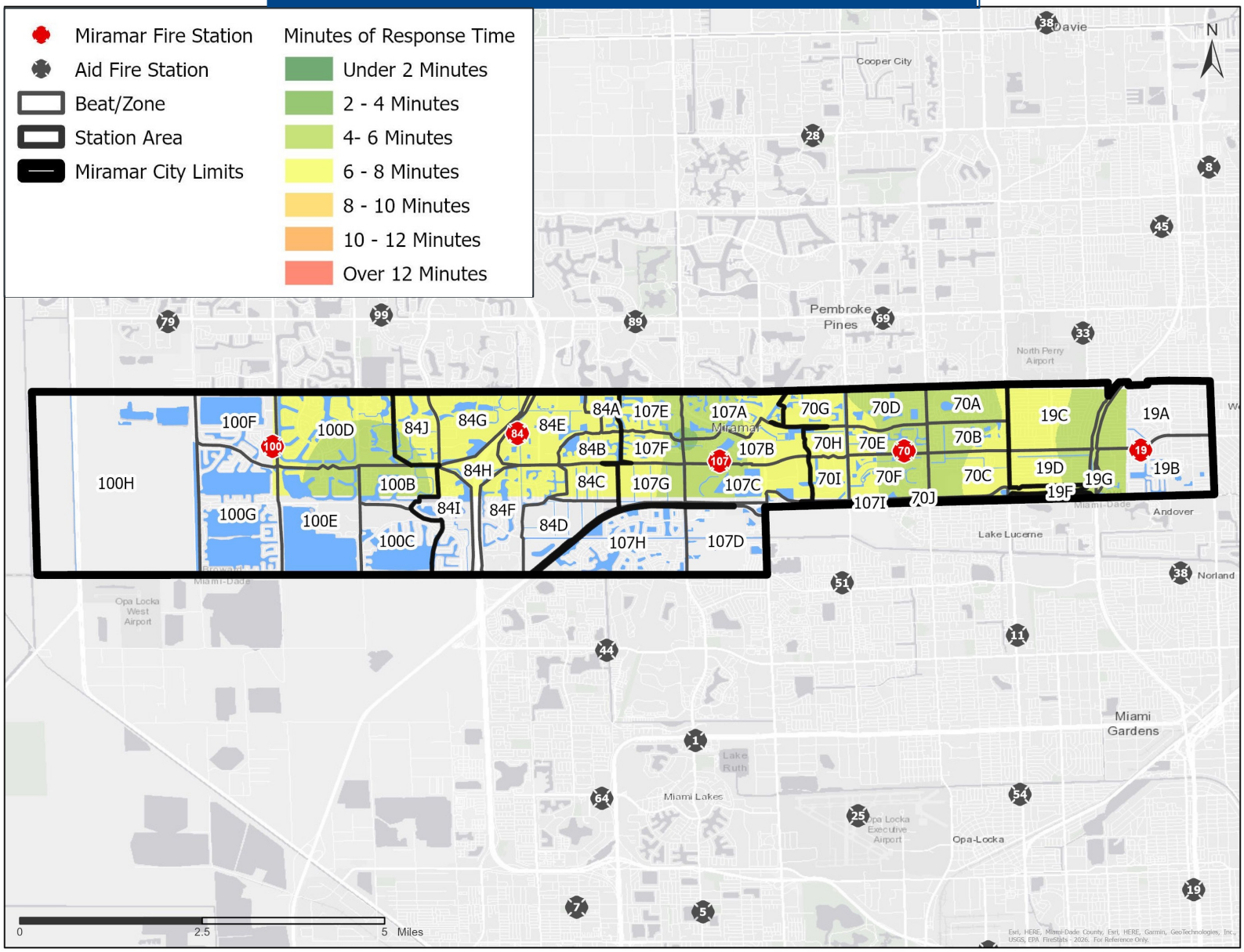
NFIRS Group Code 600 — Historic Response Time Performance for Miramar Fire-Rescue Department First in Units, CYs 2021–2025



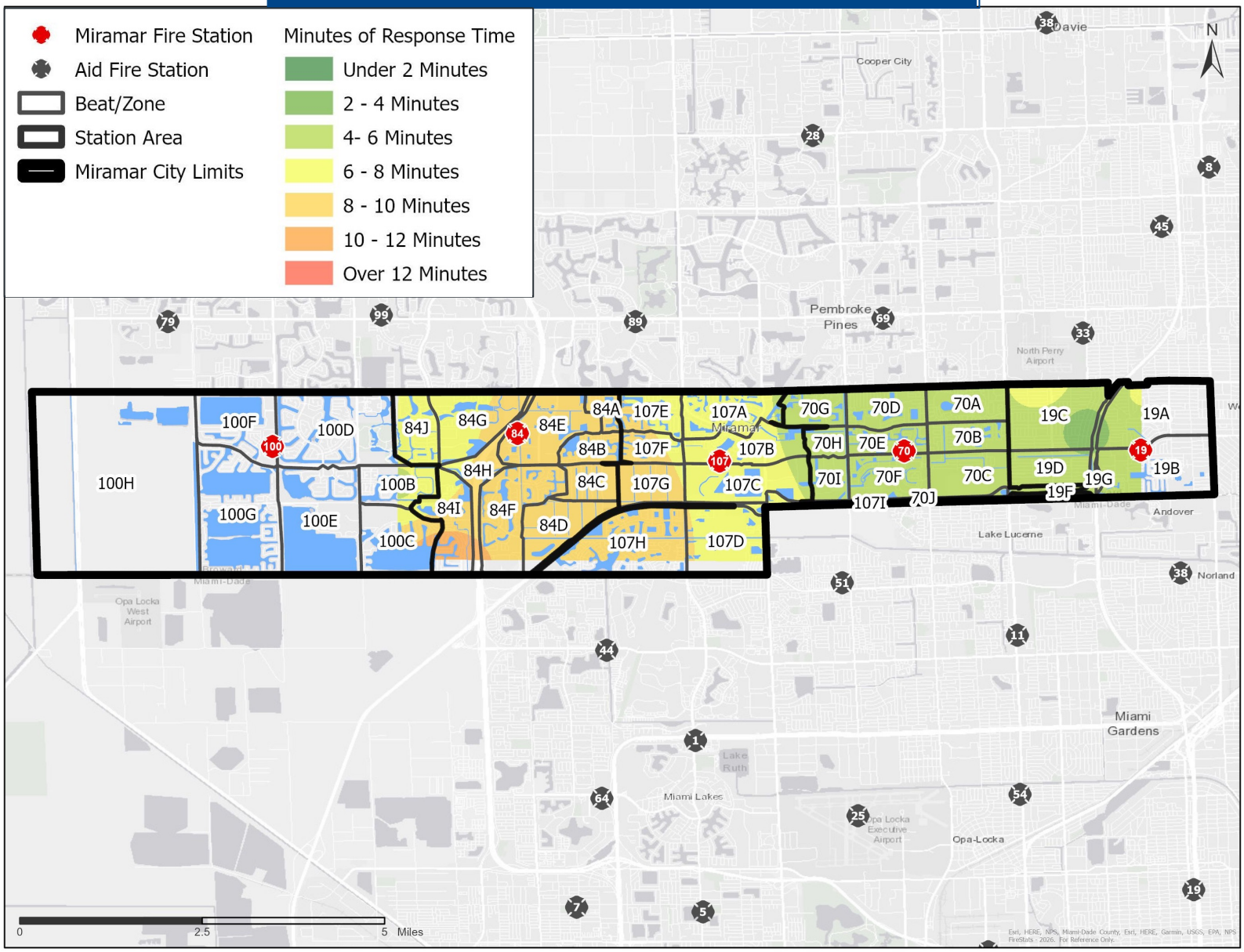
NFIRS Group Code 700 — Historic Response Time Performance for Miramar Fire-Rescue Department First in Units, CYs 2021–2025



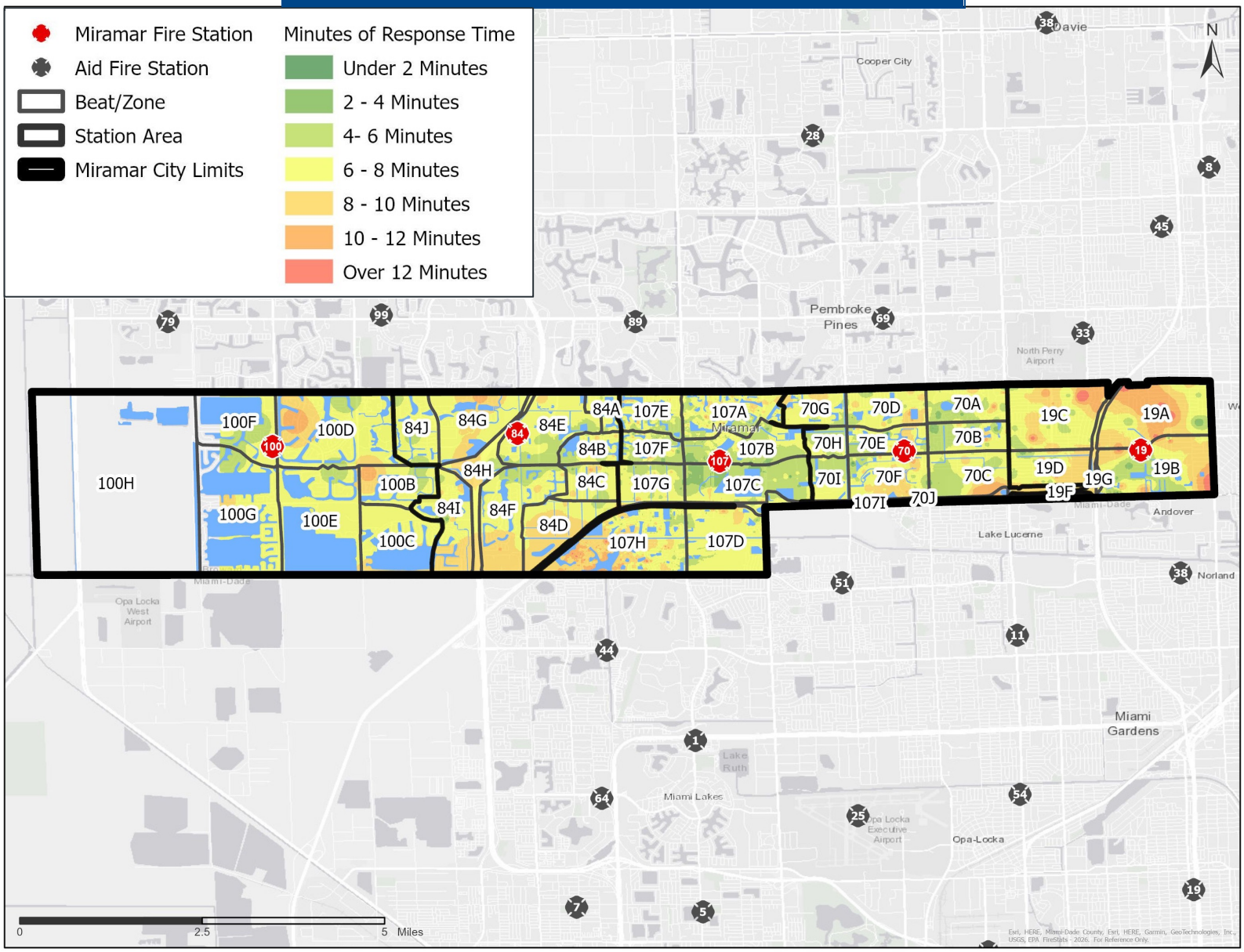
NFIRS Group Code 800 — Historic Response Time Performance for Miramar Fire-Rescue Department First in Units, CYs 2021–2025



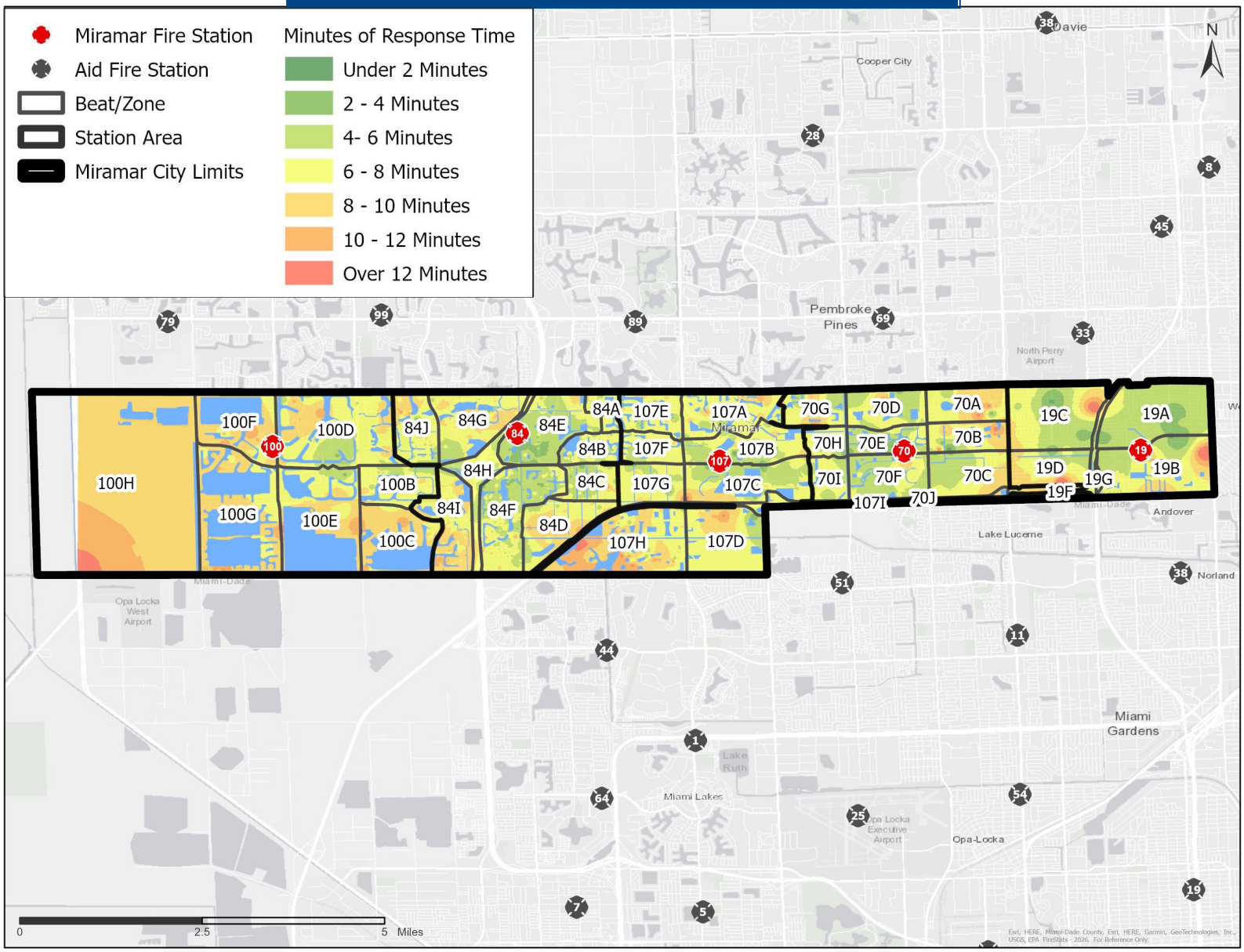
NFIRS Group Code 900 — Historic Response Time Performance for Miramar Fire-Rescue Department First in Units, CYs 2021–2025



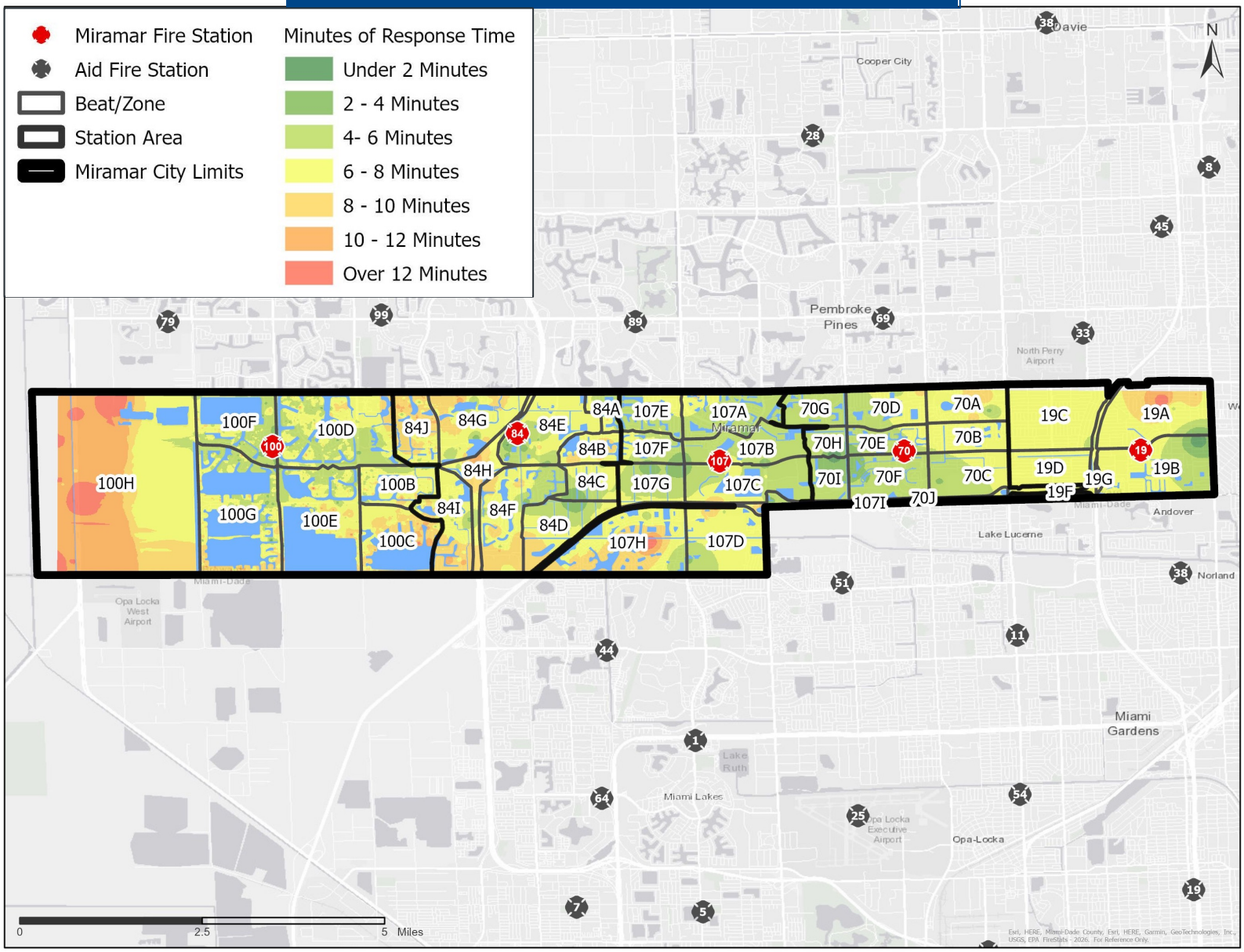
Station 100 — Historic Response Time Performance for Miramar Fire-Rescue Department First in Units, CYs 2021–2025



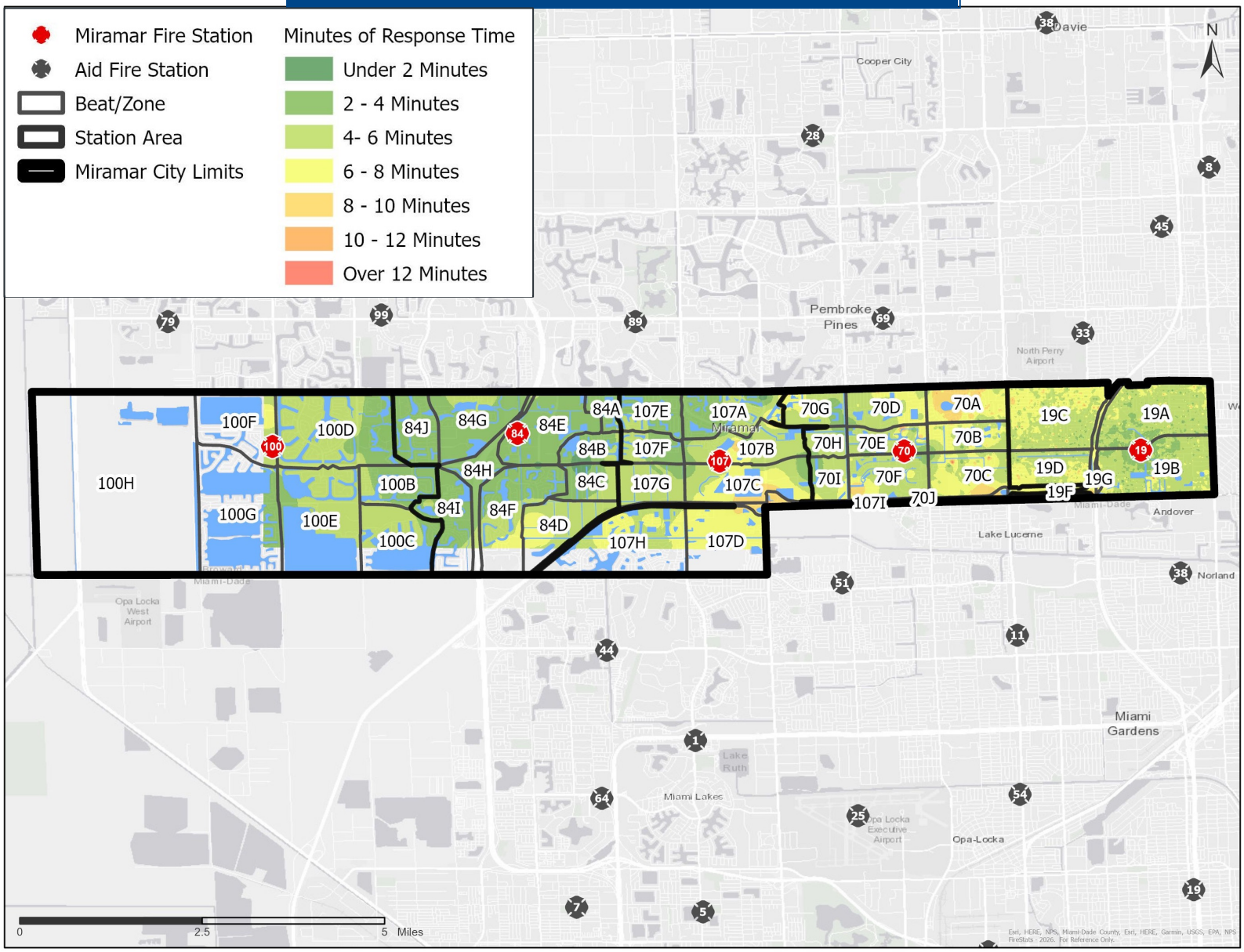
Station 84 — Historic Response Time Performance for Miramar Fire-Rescue Department First in Units, CYs 2021–2025



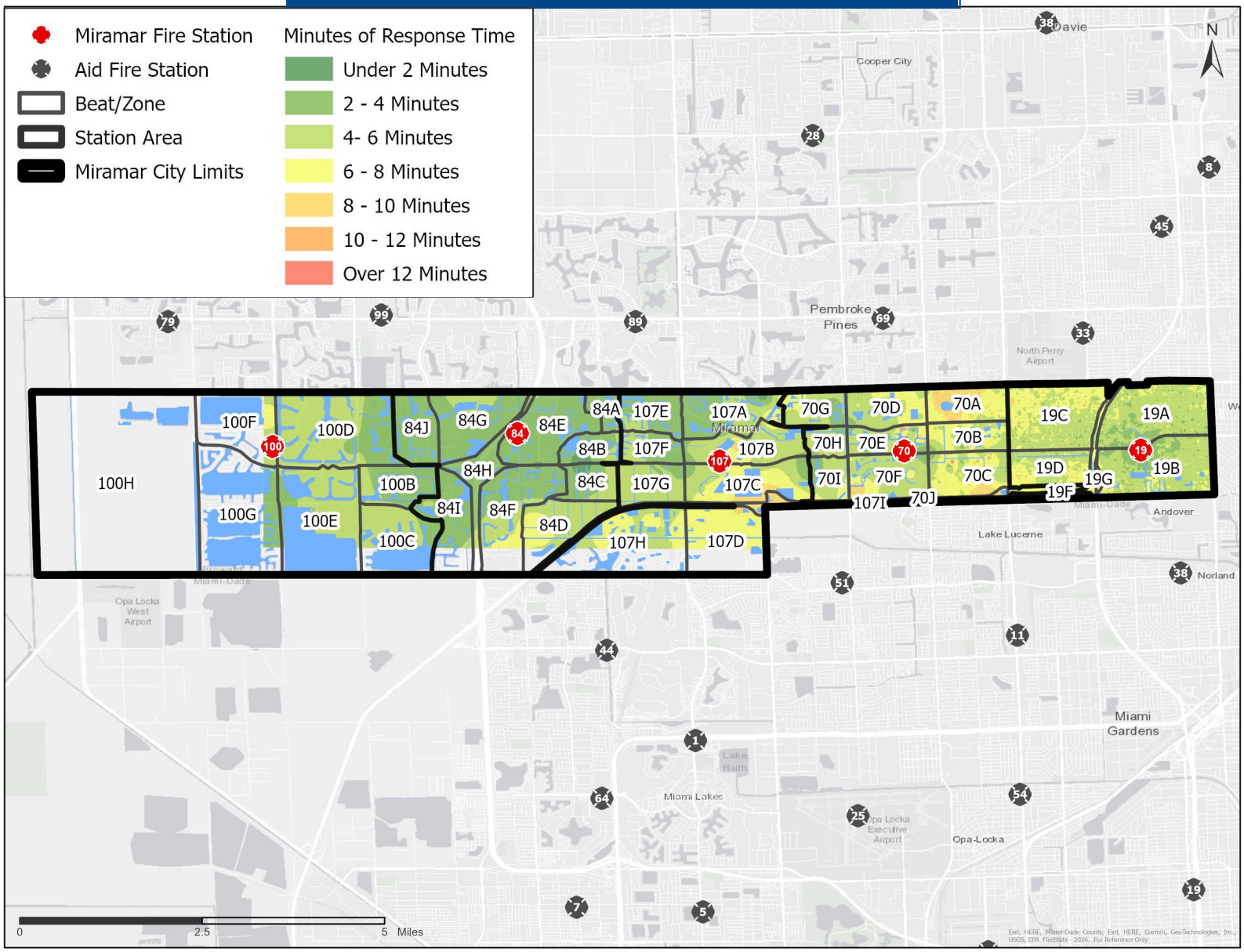
Station 107 — Historic Response Time Performance for Miramar Fire-Rescue Department First in Units, CYs 2021–2025



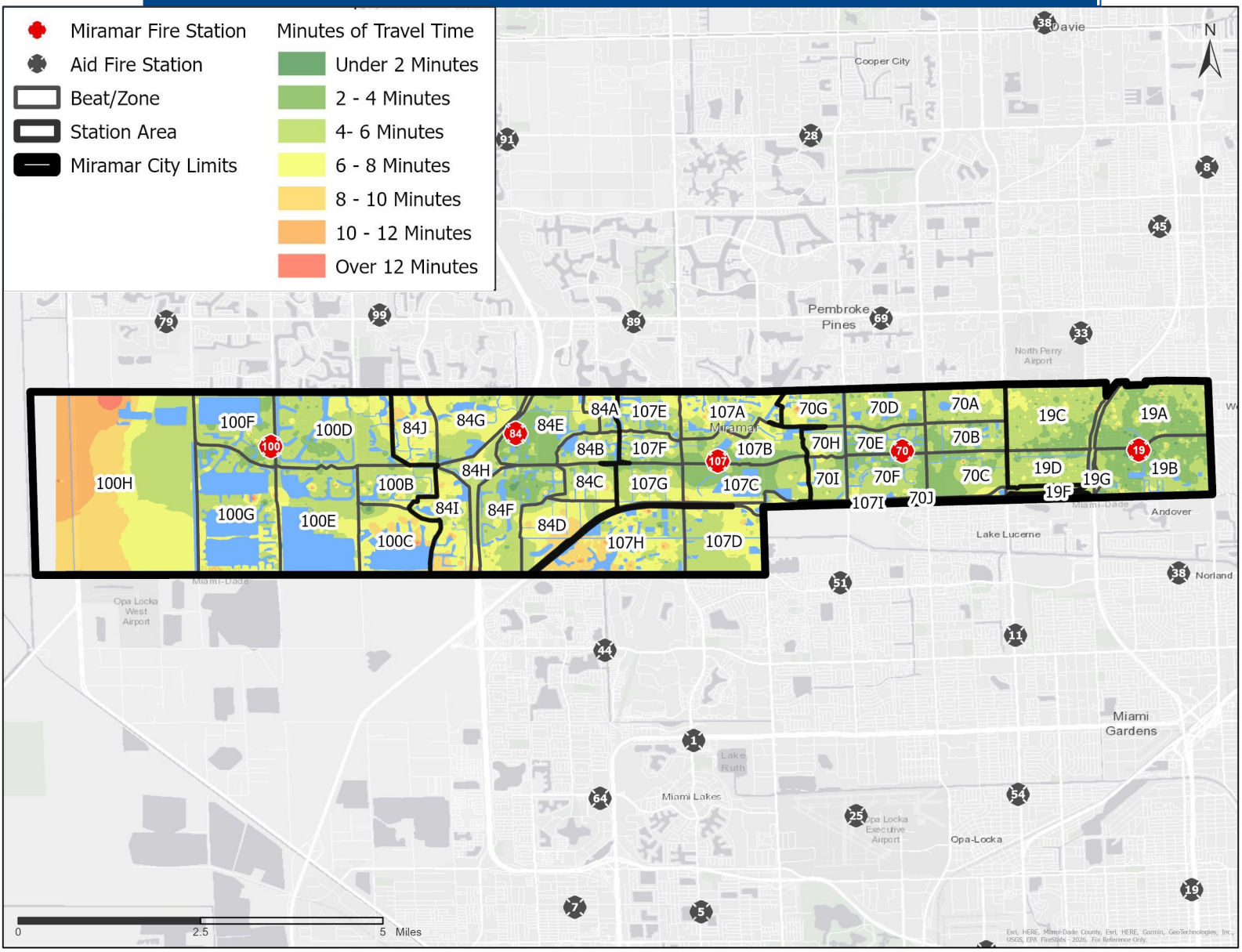
Station 70 — Historic Response Time Performance for Miramar Fire-Rescue Department First in Units, CYs 2021–2025



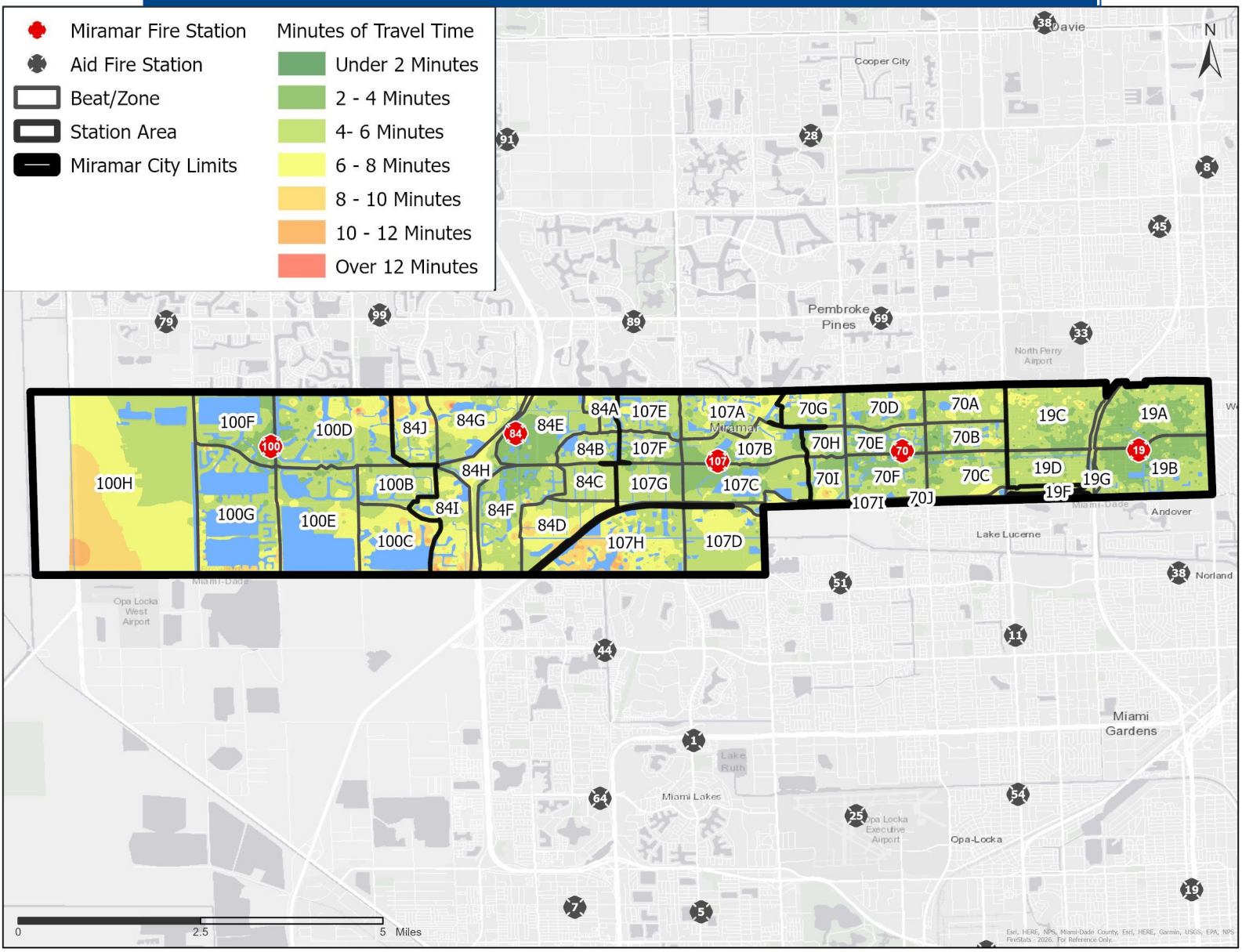
Station 19 — Historic Response Time Performance for Miramar Fire-Rescue Department First in Units, CYs 2021–2025



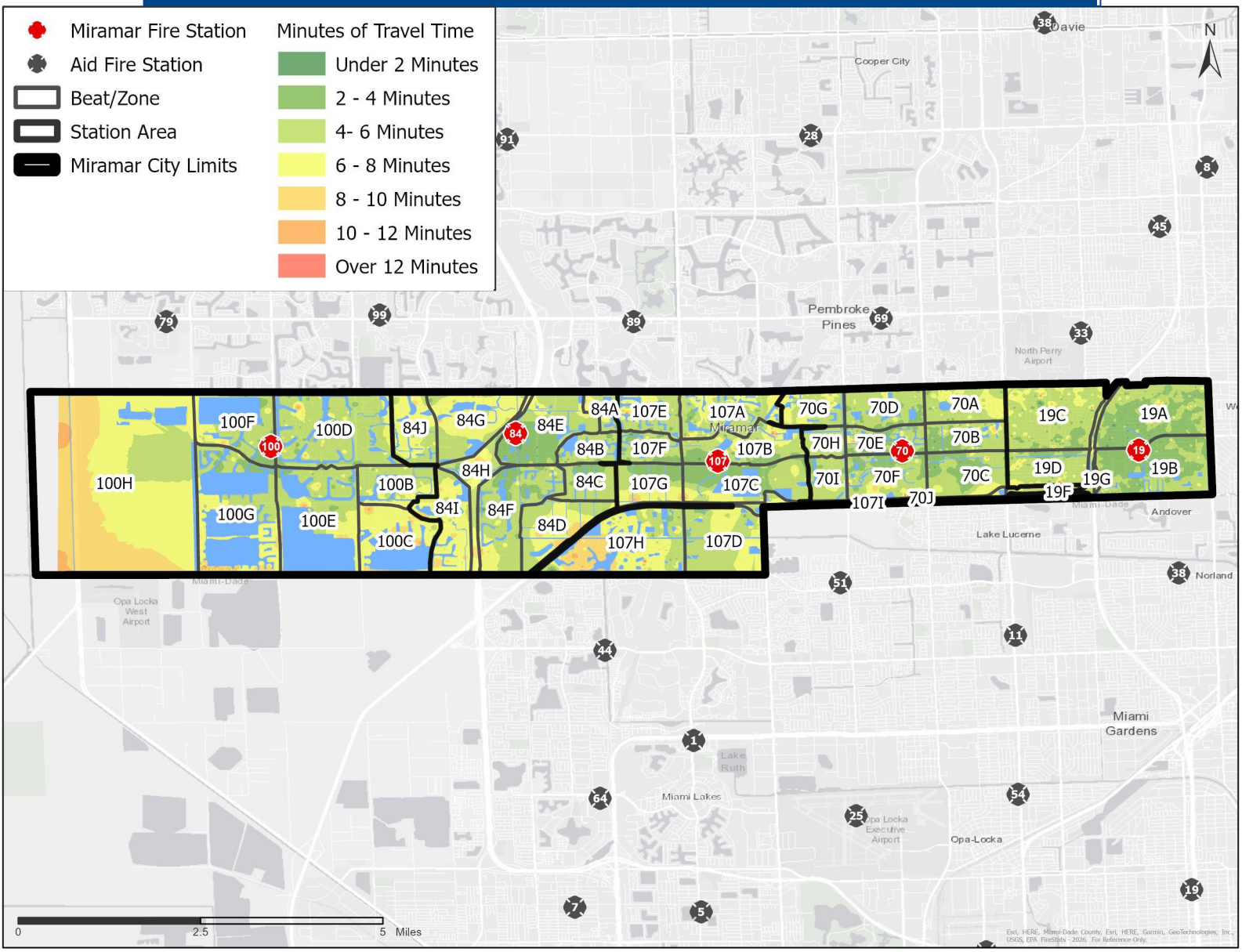
Historic Travel Time Performance for Miramar Fire-Rescue Department First in Units, CY 2021



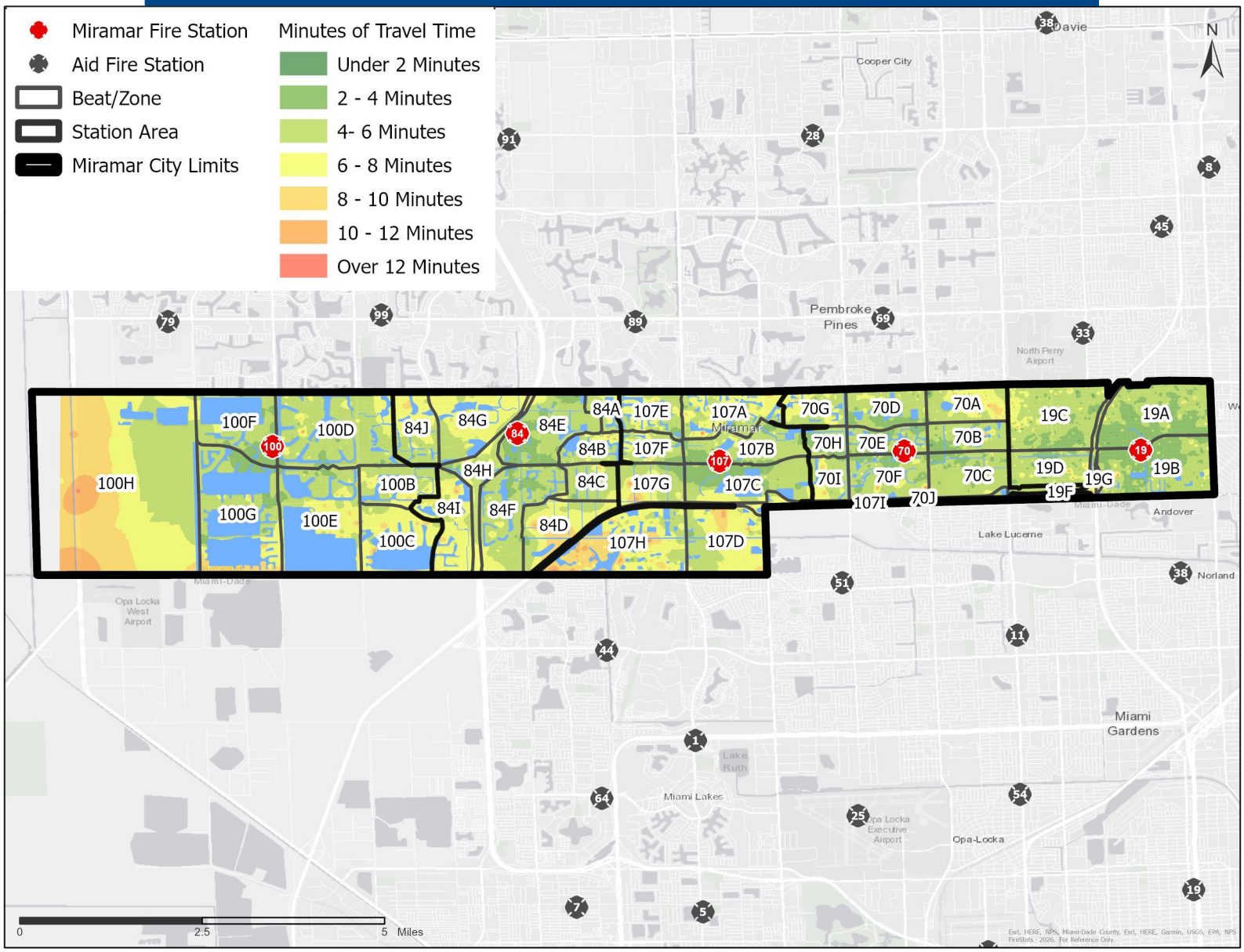
Historic Travel Time Performance for Miramar Fire-Rescue Department First in Units, CY 2022



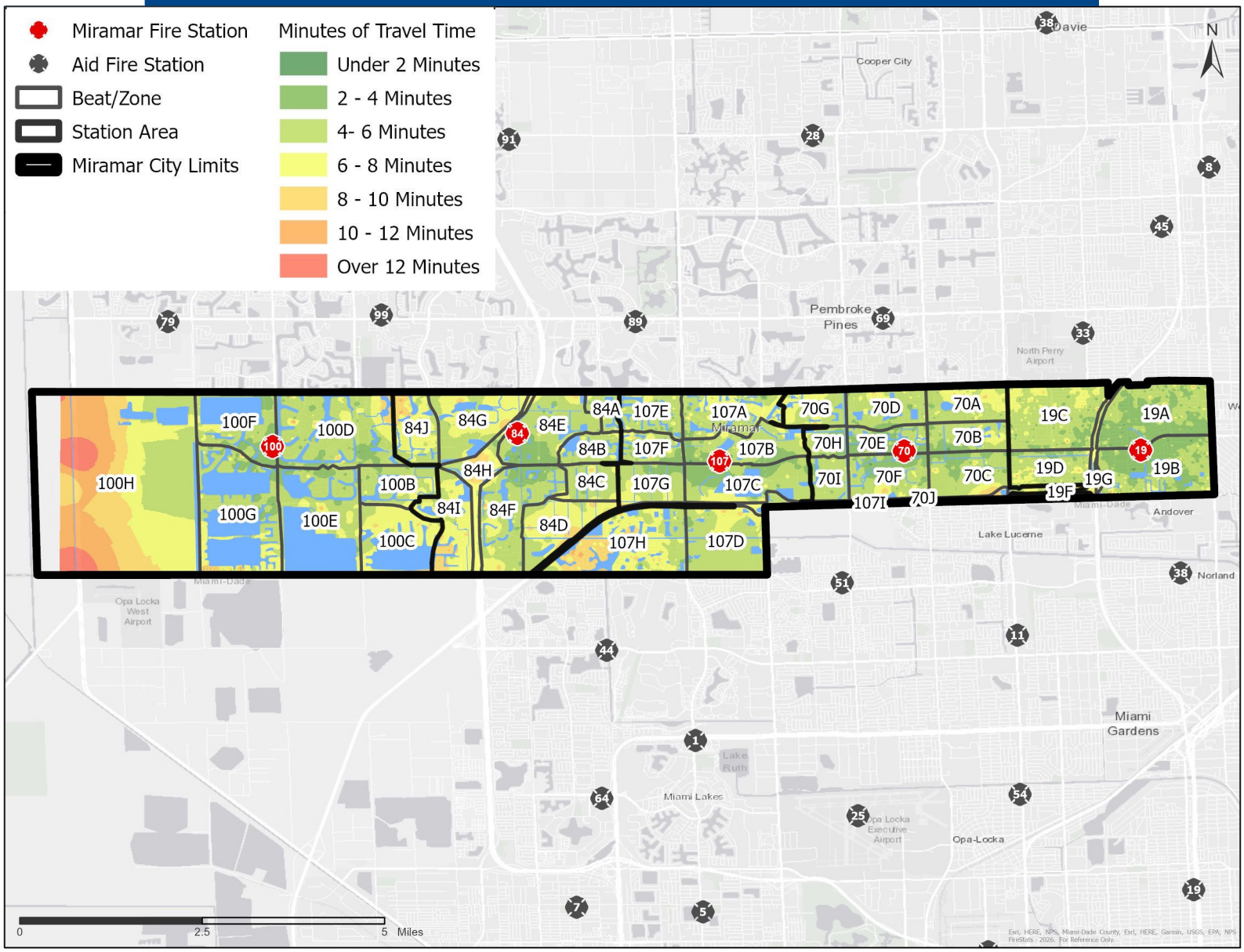
Historic Travel Time Performance for Miramar Fire-Rescue Department First in Units, CY 2023



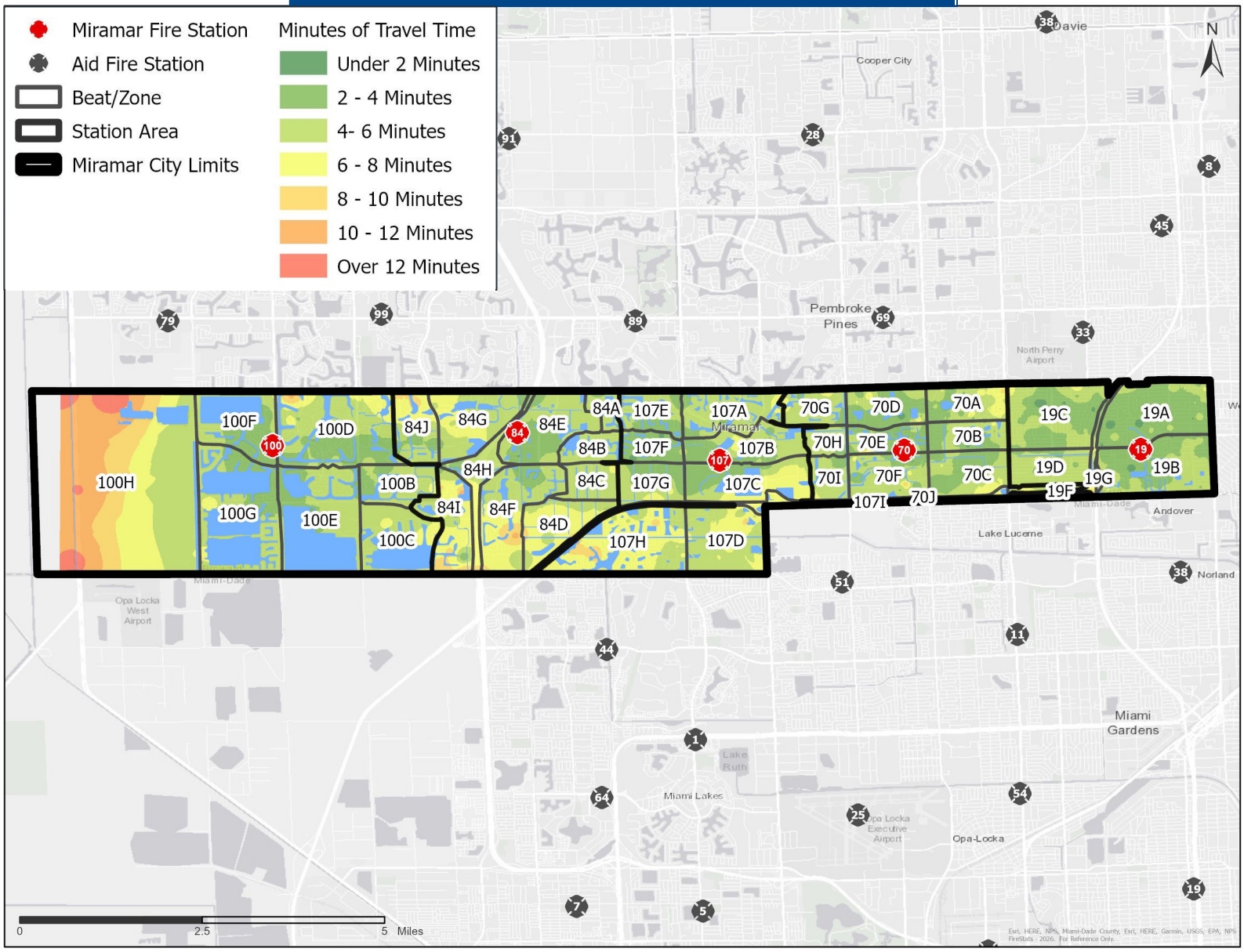
Historic Travel Time Performance for Miramar Fire-Rescue Department First in Units, CY 2024



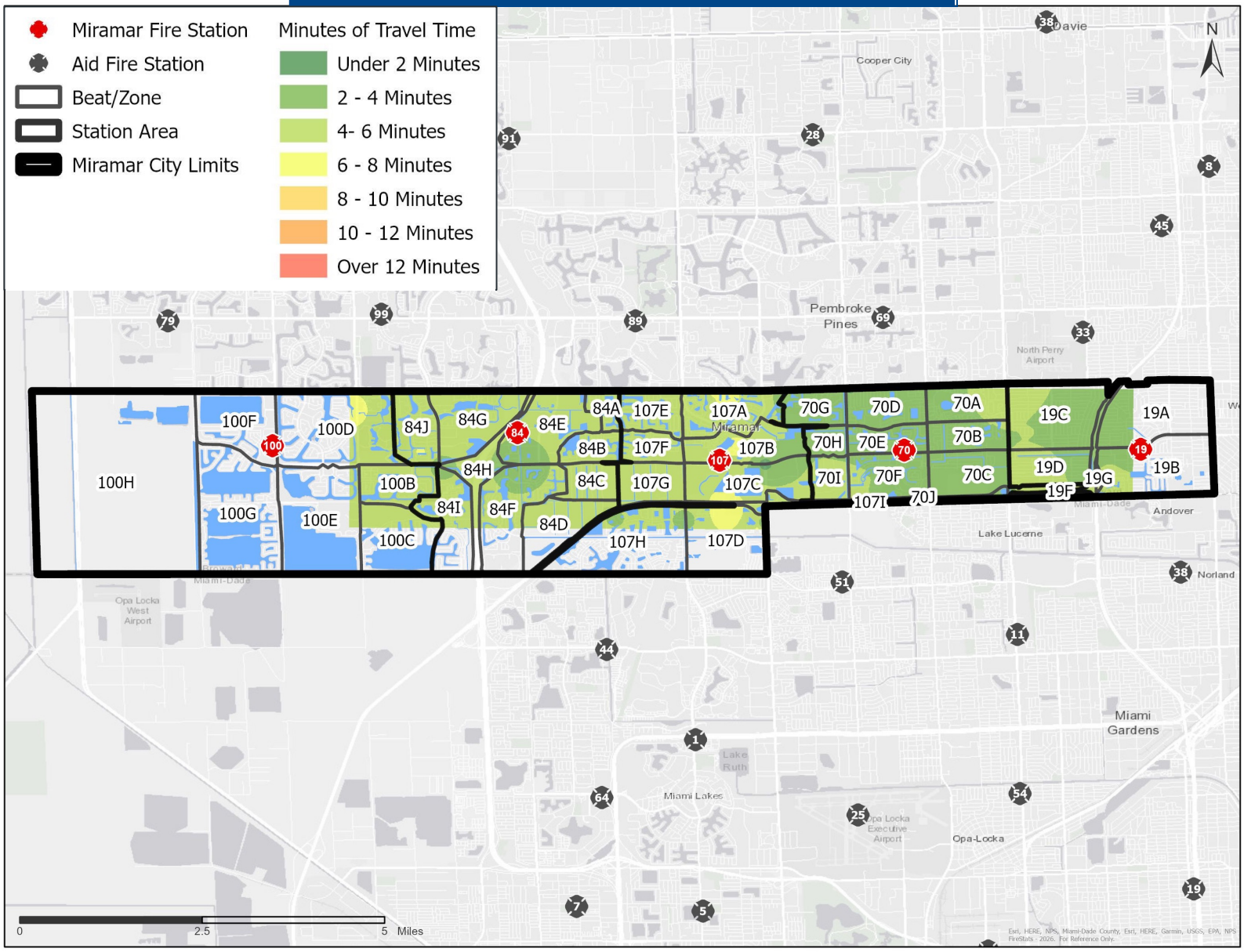
Historic Travel Time Performance for Miramar Fire-Rescue Department First in Units, CY 2025



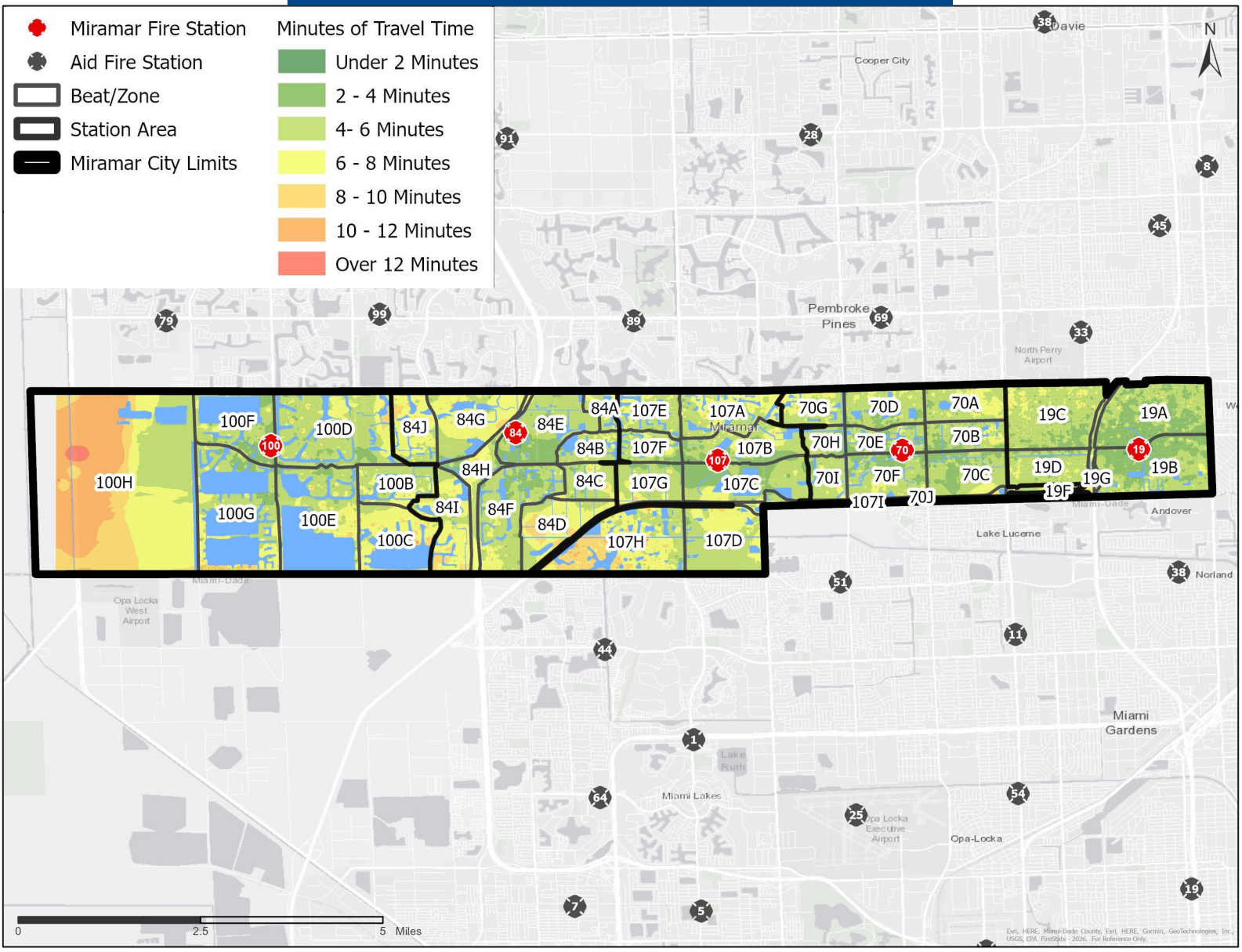
NFIRS Group Code 100 — Historic Travel Time Performance for Miramar Fire-Rescue Department First in Units, CYs 2021–2025



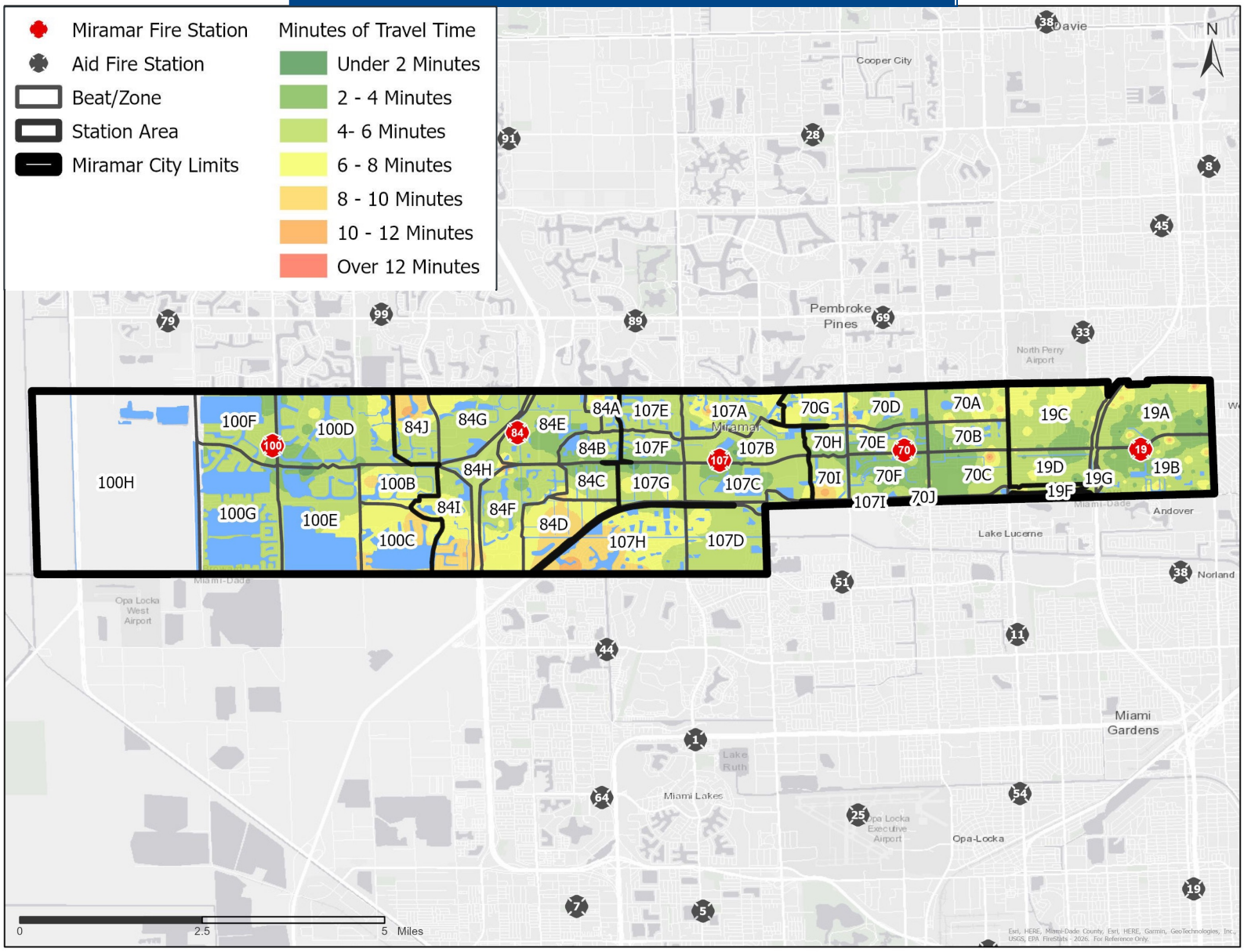
NFIRS Group Code 200 — Historic Travel Time Performance for Miramar Fire-Rescue Department First in Units, CYs 2021–2025



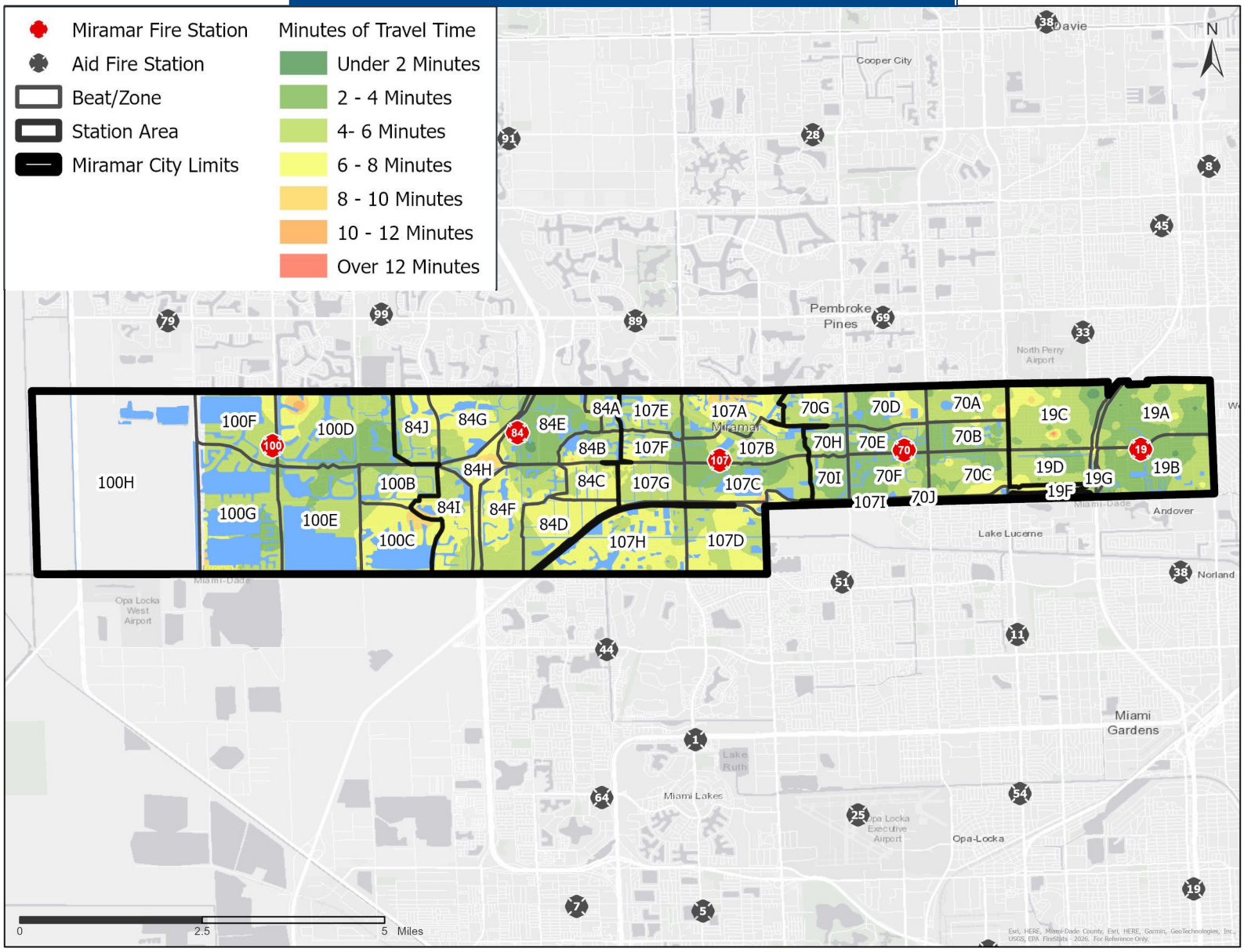
NFIRS Group Code 300 — Historic Travel Time Performance for Miramar Fire-Rescue Department First in Units, CYs 2021–2025



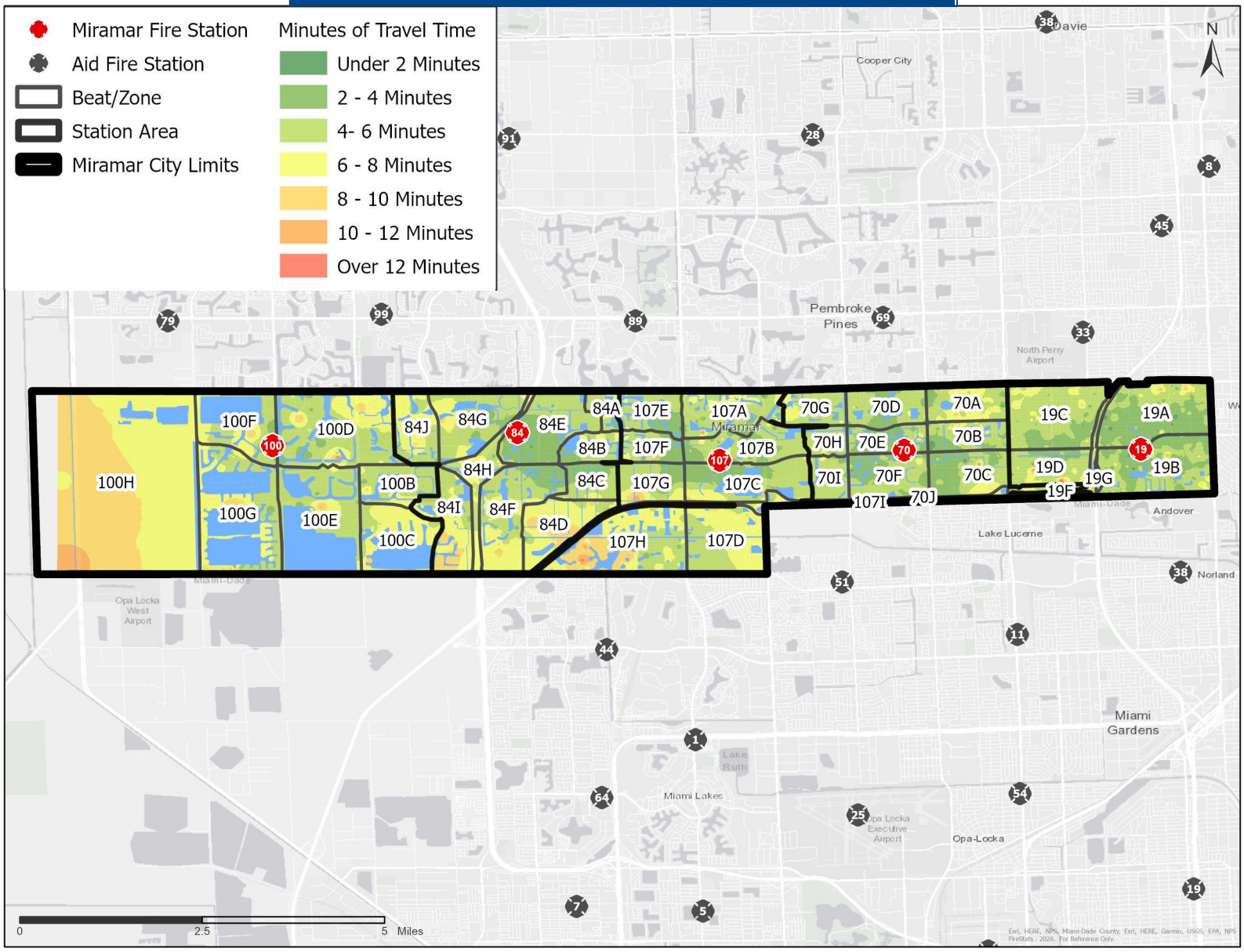
NFIRS Group Code 400 — Historic Travel Time Performance for Miramar Fire-Rescue Department First in Units, CYs 2021–2025



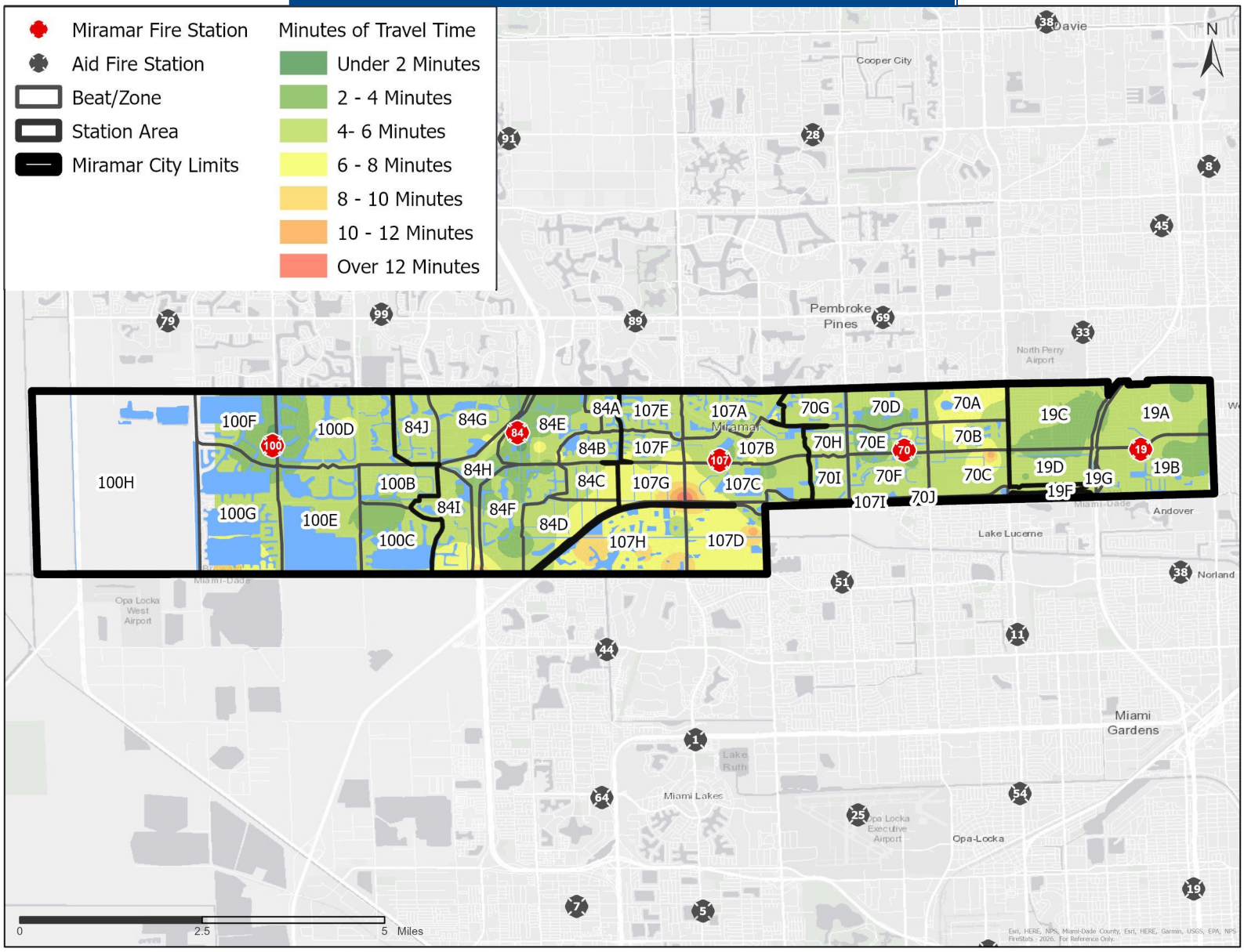
NFIRS Group Code 500 — Historic Travel Time Performance for Miramar Fire-Rescue Department First in Units, CYs 2021–2025



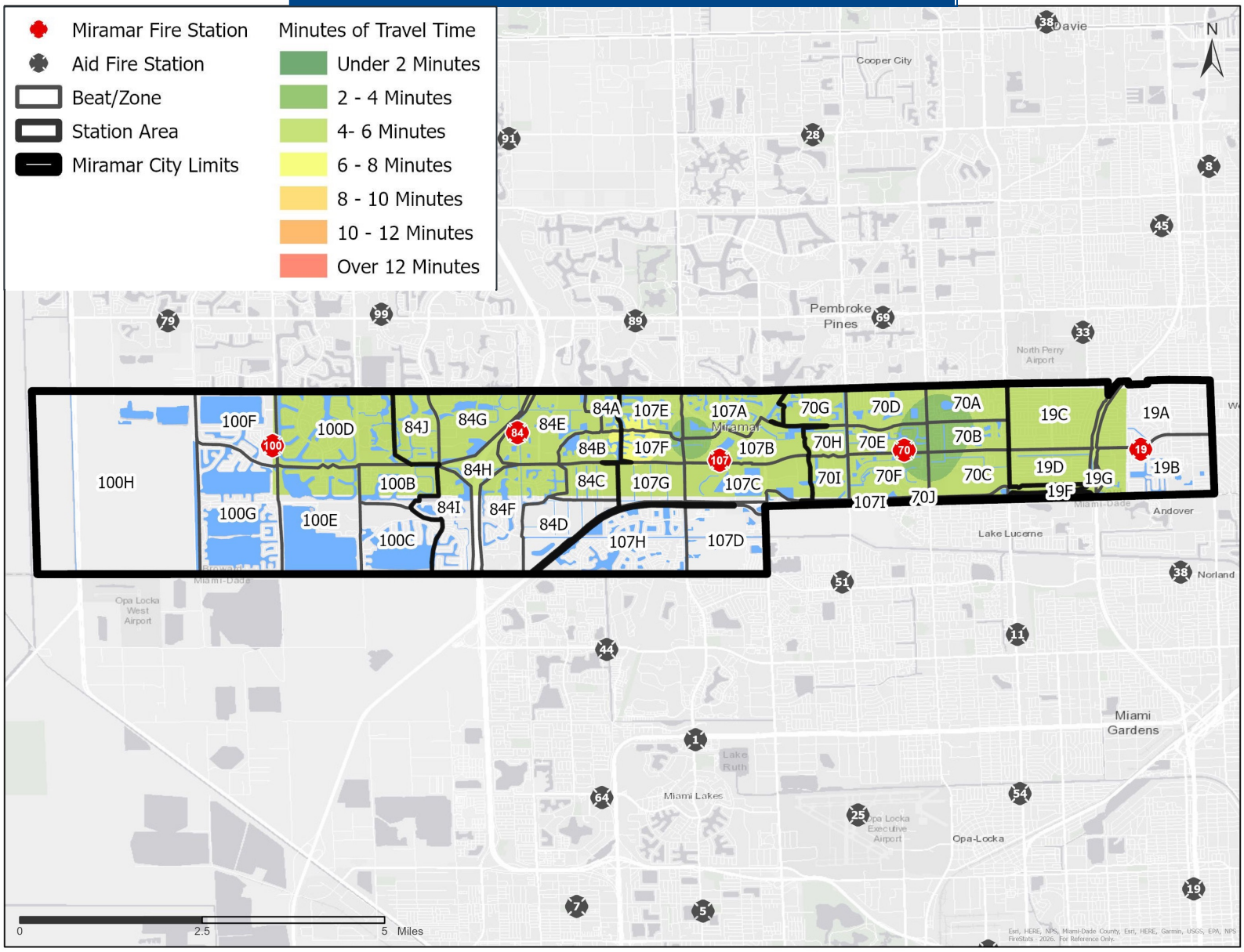
NFIRS Group Code 600 — Historic Travel Time Performance for Miramar Fire-Rescue Department First in Units, CYs 2021–2025



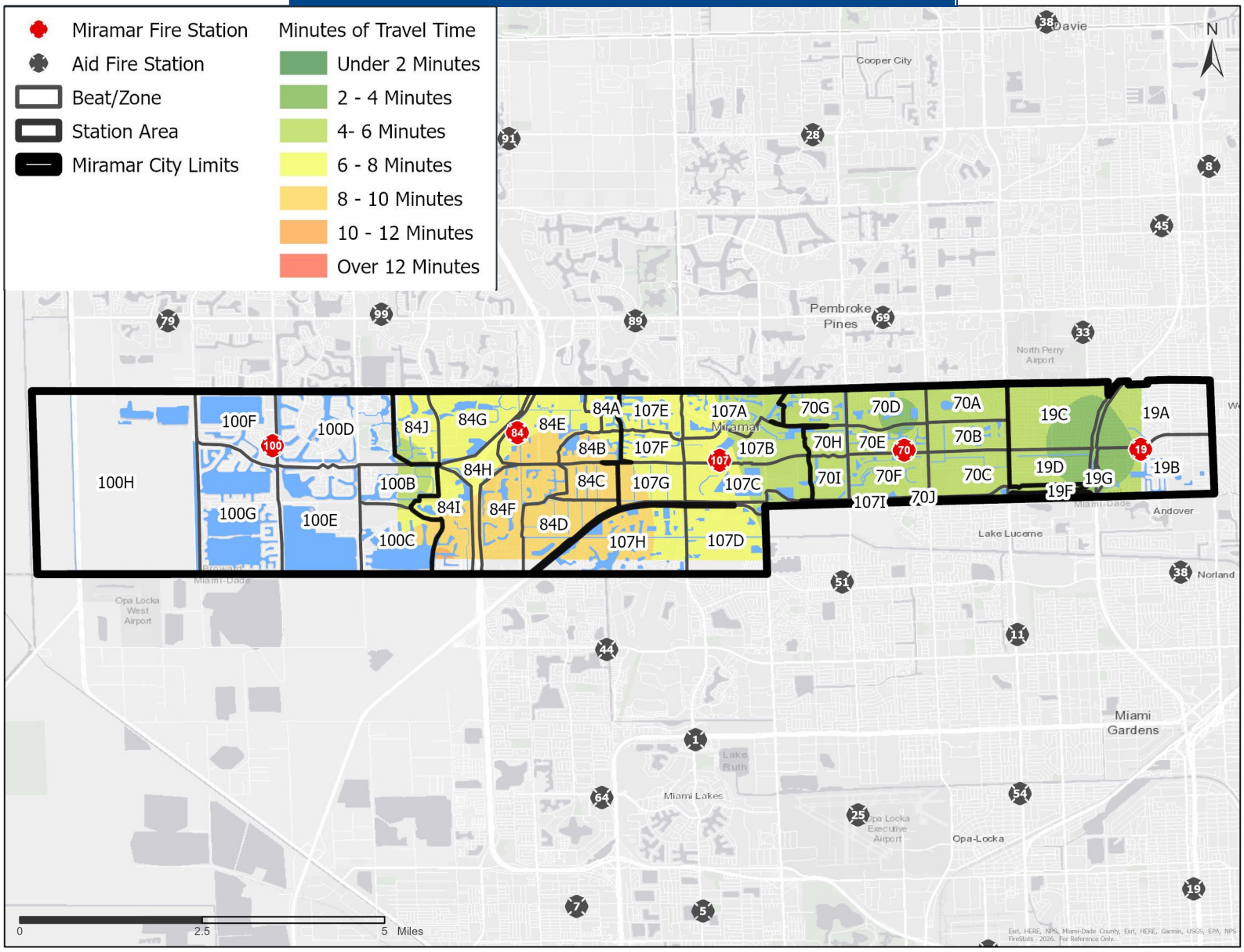
NFIRS Group Code 700 — Historic Travel Time Performance for Miramar Fire-Rescue Department First in Units, CYs 2021–2025



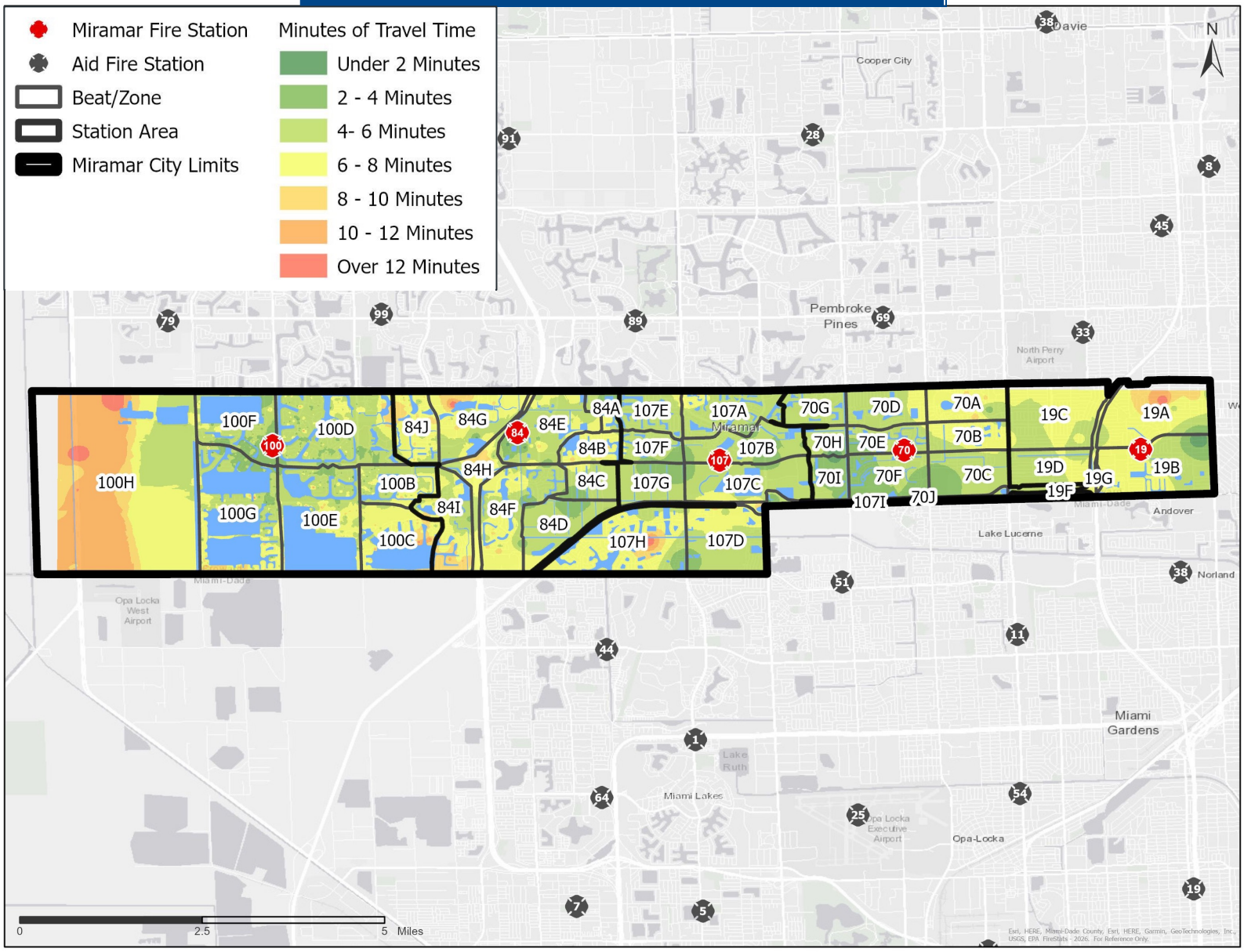
NFIRS Group Code 800 — Historic Travel Time Performance for Miramar Fire-Rescue Department First in Units, CYs 2021–2025



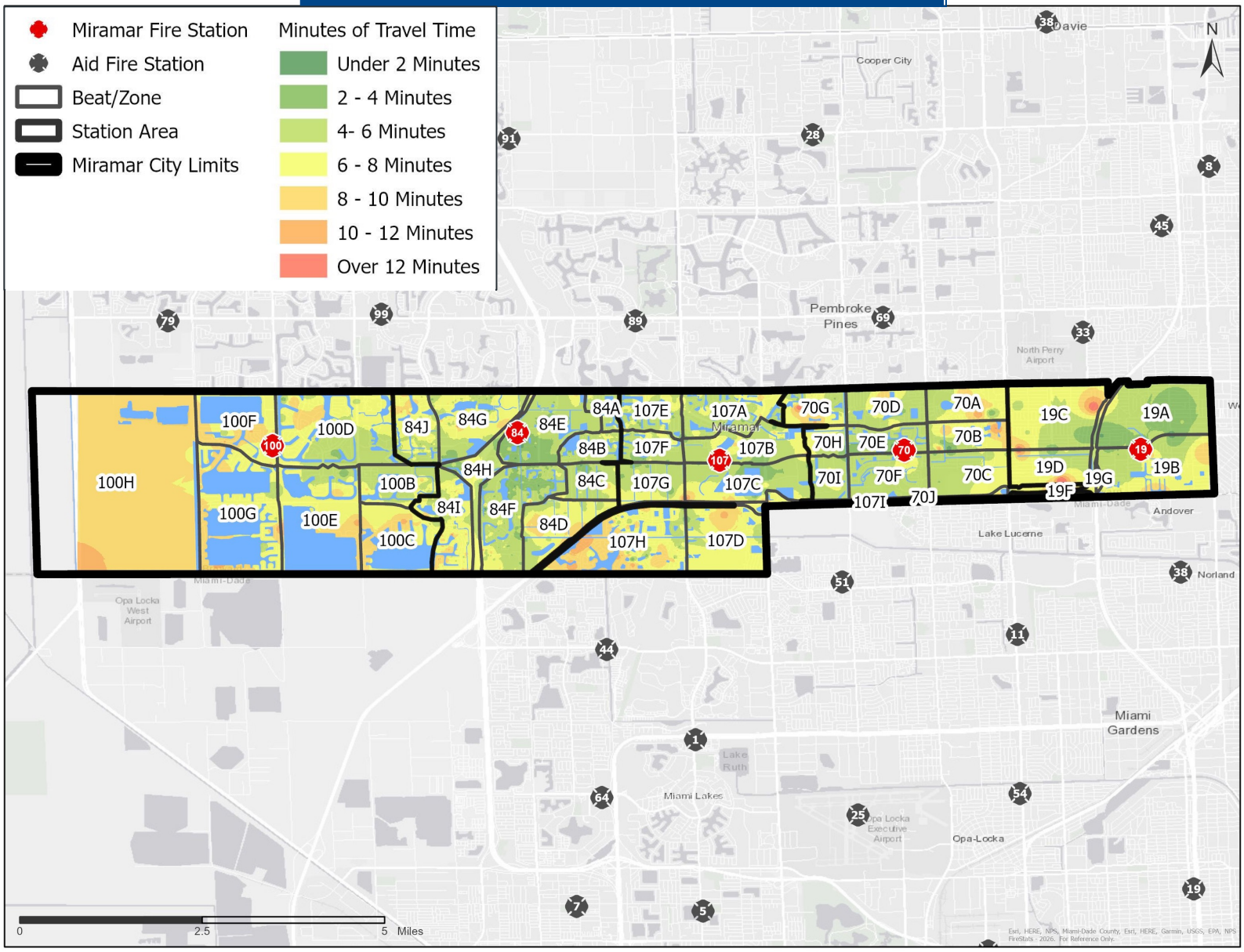
NFIRS Group Code 900 — Historic Travel Time Performance for Miramar Fire-Rescue Department First in Units, CYs 2021–2025



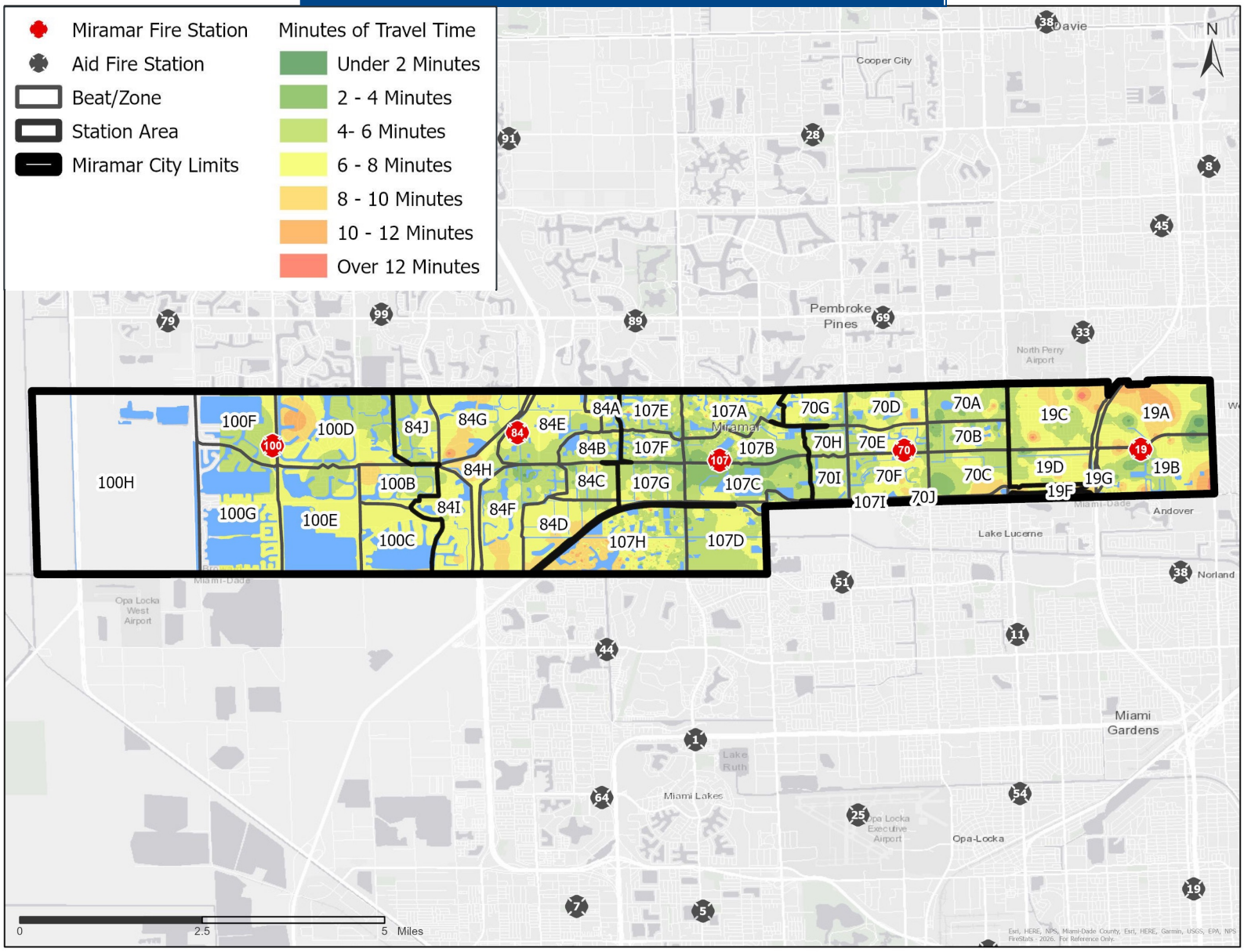
Station 100 — Historic Travel Time Performance for Miramar Fire-Rescue Department First in Units, CYs 2021–2025



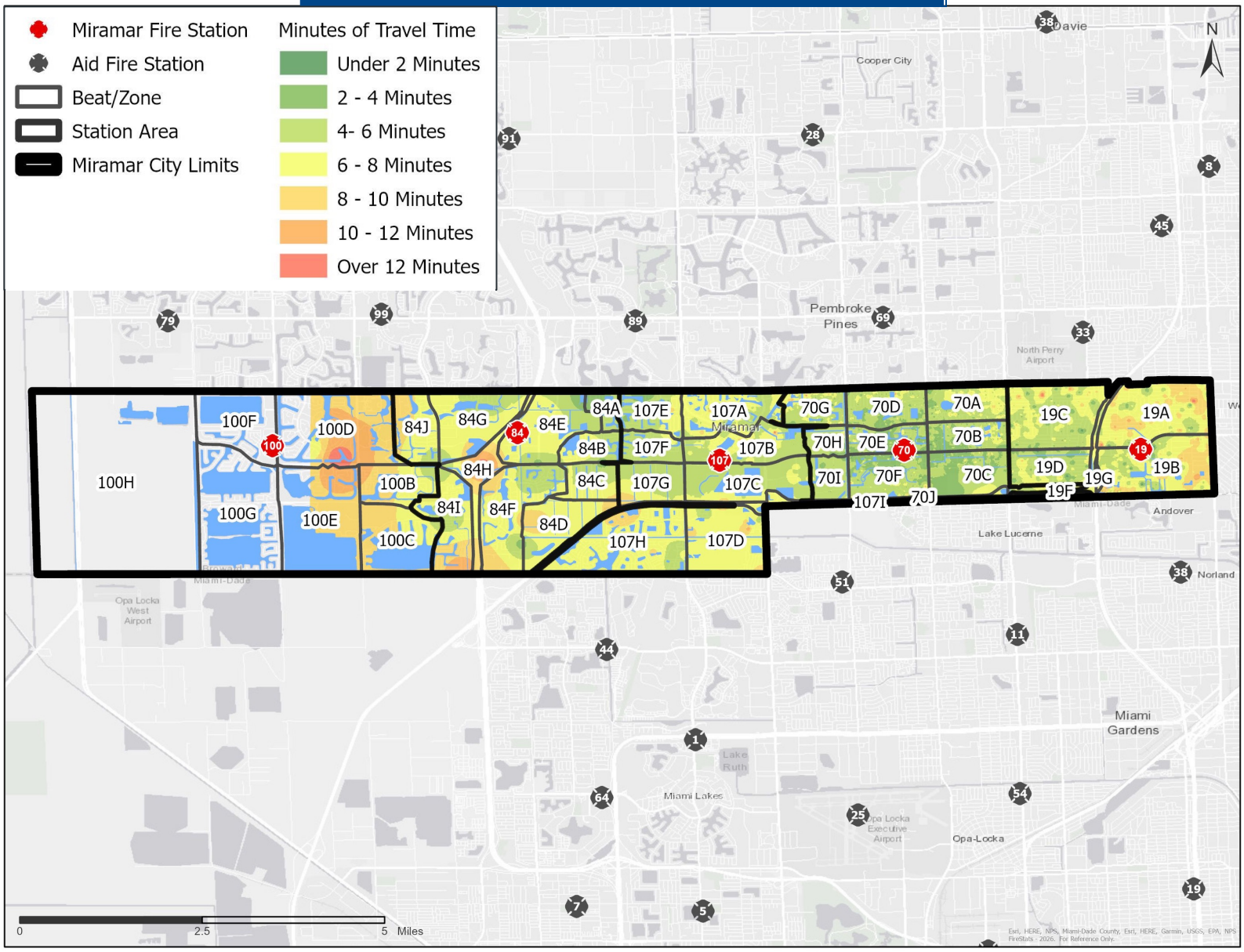
Station 84 — Historic Travel Time Performance for Miramar Fire-Rescue Department First in Units, CYs 2021–2025



Station 107 — Historic Travel Time Performance for Miramar Fire-Rescue Department First in Units, CYs 2021–2025



Station 70 — Historic Travel Time Performance for Miramar Fire-Rescue Department First in Units, CYs 2021–2025



Station 19 — Historic Travel Time Performance for Miramar Fire-Rescue Department First in Units, CYs 2021–2025

