GEOGRAPHIC INFORMATION SYSTEM EMERGENCY SERVICES RESPONSE CAPABILITIES ANALYSIS

Maps

International Association of Fire Fighters
1750 New York Avenue, N.W.
Washington, DC 20006

Scio Township Fire Department

Scio Township, Michigan

July 2021

Mapping Analysis of the Scio Township Fire Department

In creating this document, it was important to ascertain where stations were located and if they were located to provide fair and equitable coverage to the citizens. In order to make this assessment, the IAFF created maps of the department's response area and plotted the fire stations.

Computer modeling was then used to determine the distance apparatus could travel in four, eight, and ten minutes ten seconds. The following table specifies the current locations of the department's fire stations.

Travel times were modeled using ESRI StreetMap Premium Custom Roads version 2020.3. This dataset is derived from an average of the last two years of traffic data. Traffic volume decreased in 2020 compared to previous years due to the COVID-19 pandemic. Thus, when restrictions lift and traffic increases, the coverages shown may be reduced and travel times shown in the following maps may increase.

Fire stations were identified on Geographic Information System (GIS) maps as starting points with vehicles traveling at posted road speeds. GIS software from ESRI ArcGIS Pro version 2.7.3 was used for the analysis.

When generating the maps, several assumptions needed to be addressed prior to drawing conclusions from the analysis. These assumptions are as follows:

- Modeled travel speeds are based on reasonable and prudent historical traffic speeds using Wednesdays at 5:00 pm. Actual response speeds may be slower, and the associated travel times greater, with any unpredictable impedances including, but not limited to:
    - Traffic Incidents: Collisions and vehicle breakdowns causing lane blockages and driver distractions.
    - Work Zones: Construction and maintenance activity that can cause added travel time in locations and times where congestion is not normally present.
    - Weather: Reduced visibility--road surface problems and uncertain waiting conditions result in extra travel time and altered trip patterns.
    - Special Events: Demand may change due to identifiable and predictable causes.
    - Traffic Control Devices: Poorly timed or inoperable traffic signals, railroad grade crossings, speed control systems, and traveler information signs contribute to irregularities in travel time.

- Inadequate Road or Transit Capacity: The interaction of capacity problems with the aforementioned sources causes travel time to expand much faster than demand.[1]

In addition, it is reasonable to suggest that because larger emergency vehicles are generally more cumbersome and require greater skill to maneuver, their response may be more negatively affected by their weight, size, and in some cases, inability to travel narrow surface streets.

As discussed, computer modeling only considers travel time of apparatus. Decision makers should understand that once apparatus and personnel arrive on the incident scene there are other essential tasks that must be completed which require additional time before access, rescue, and suppression can take place. Tasks such as establishing a water supply, forcible entry (access), and deployment of an attack line are not considered in the computer modeling. Other additional factors also include:

- The time from arrival of the apparatus to the onset of interior fire operations (access interval) must be considered when analyzing response system capabilities.
  - The access interval is dependent upon factors such as distance from the apparatus to the task location and the elevation of the incident and locked doors or security bars which must be breached.
  - Impediments like these may add to the delay between discovery of a fire and the initiation of an actual fire attack.
- The reliability of a community's hydrant system to supply water to fire apparatus.

- Weather conditions

[1] David Shrank and Tim Lomax, The 2003 Urban Mobility Report, (Illinois Transportation Institute, Illinois A&M University: September 2003).

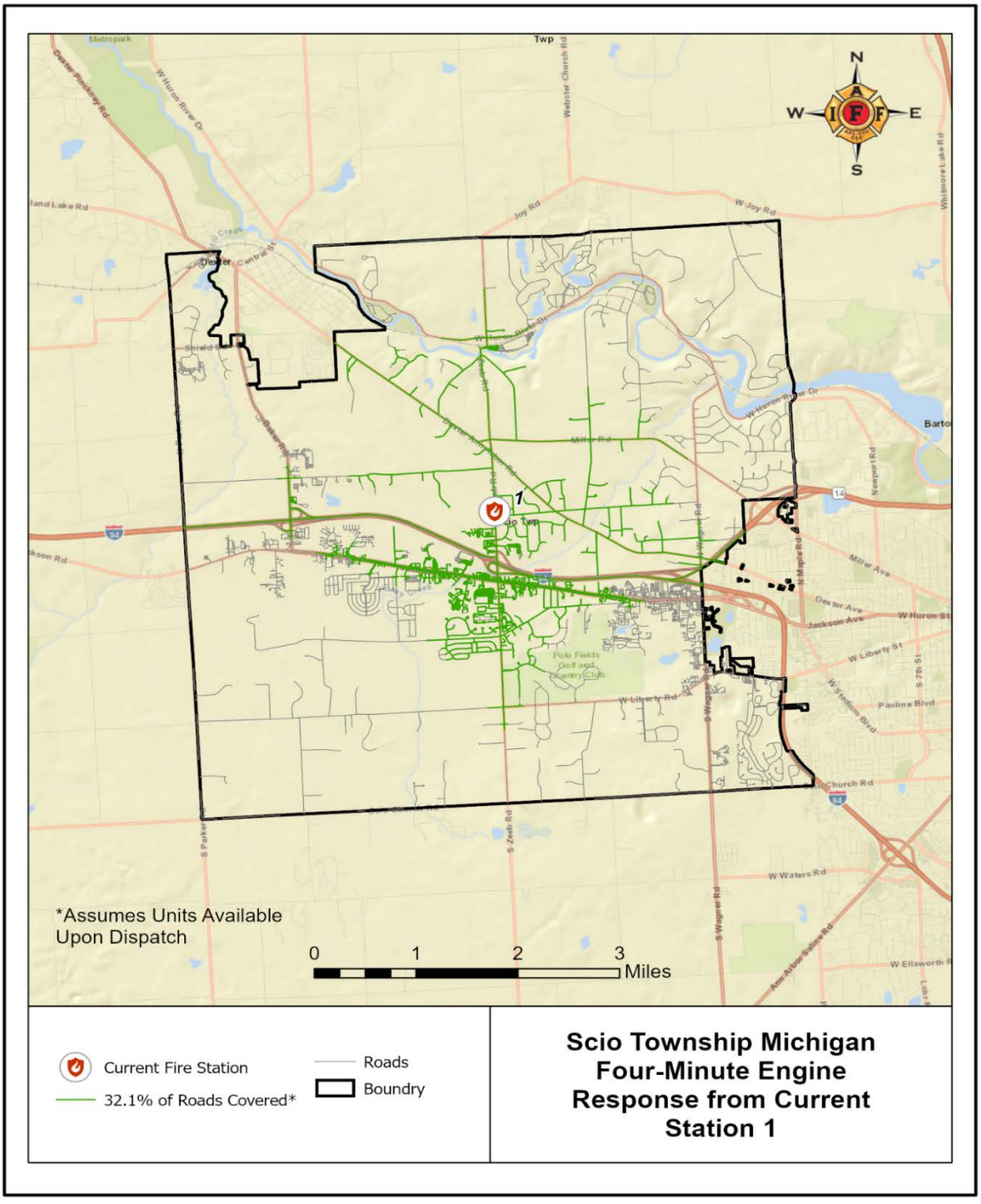
Current Emergency Response Capabilities – Scio Township Fire Department

The table below lists the department's current fire station, apparatus, and minimum staffing on each apparatus.

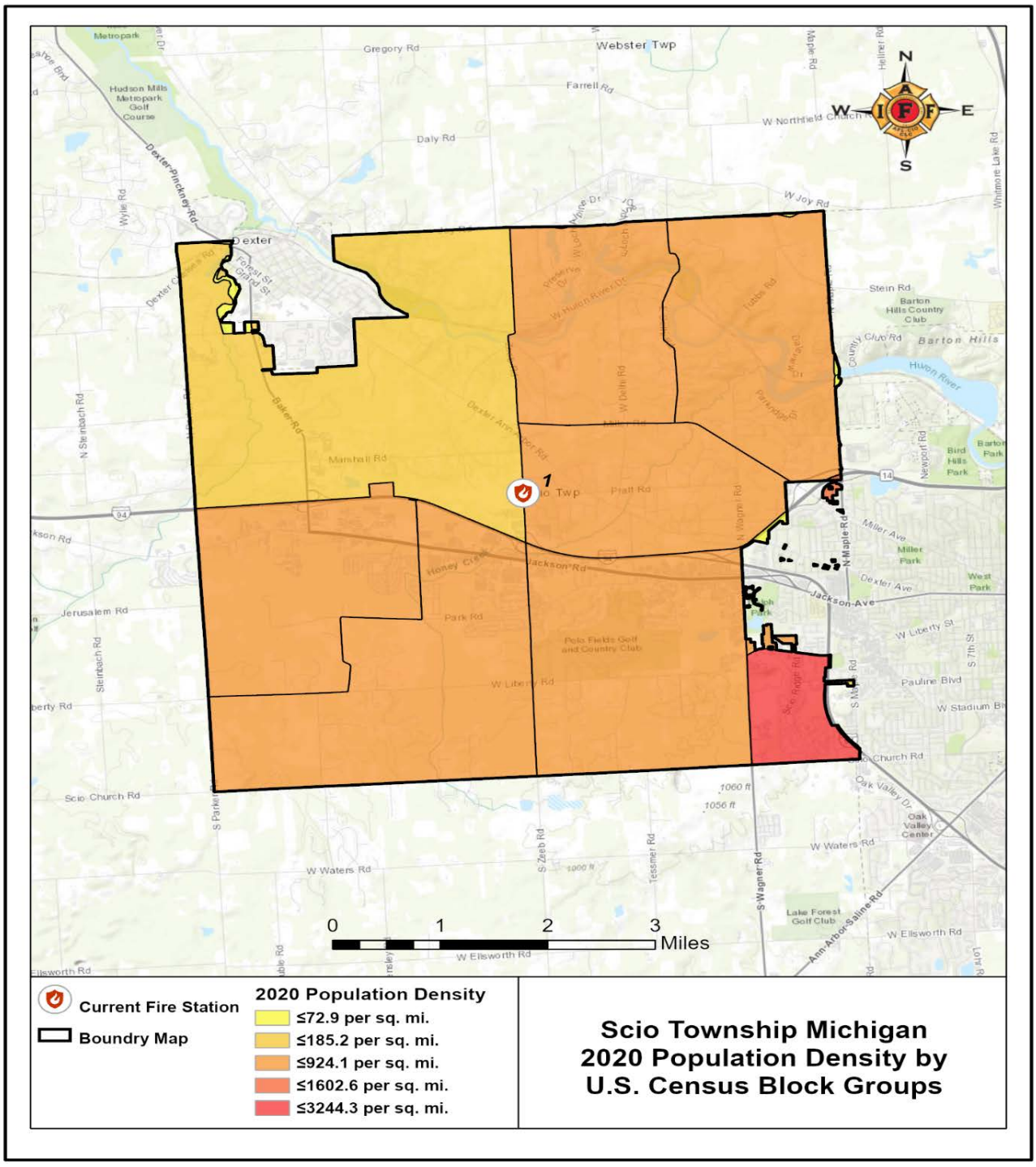
Fire Station	Address	Apparatus	Staffing
Station 1	1055 N Zeeb	Engine 1	3/4

Table 1: Current Fire Station Location and Staffing. The above table displays where apparatus are housed and how units are typically staffed.[2]

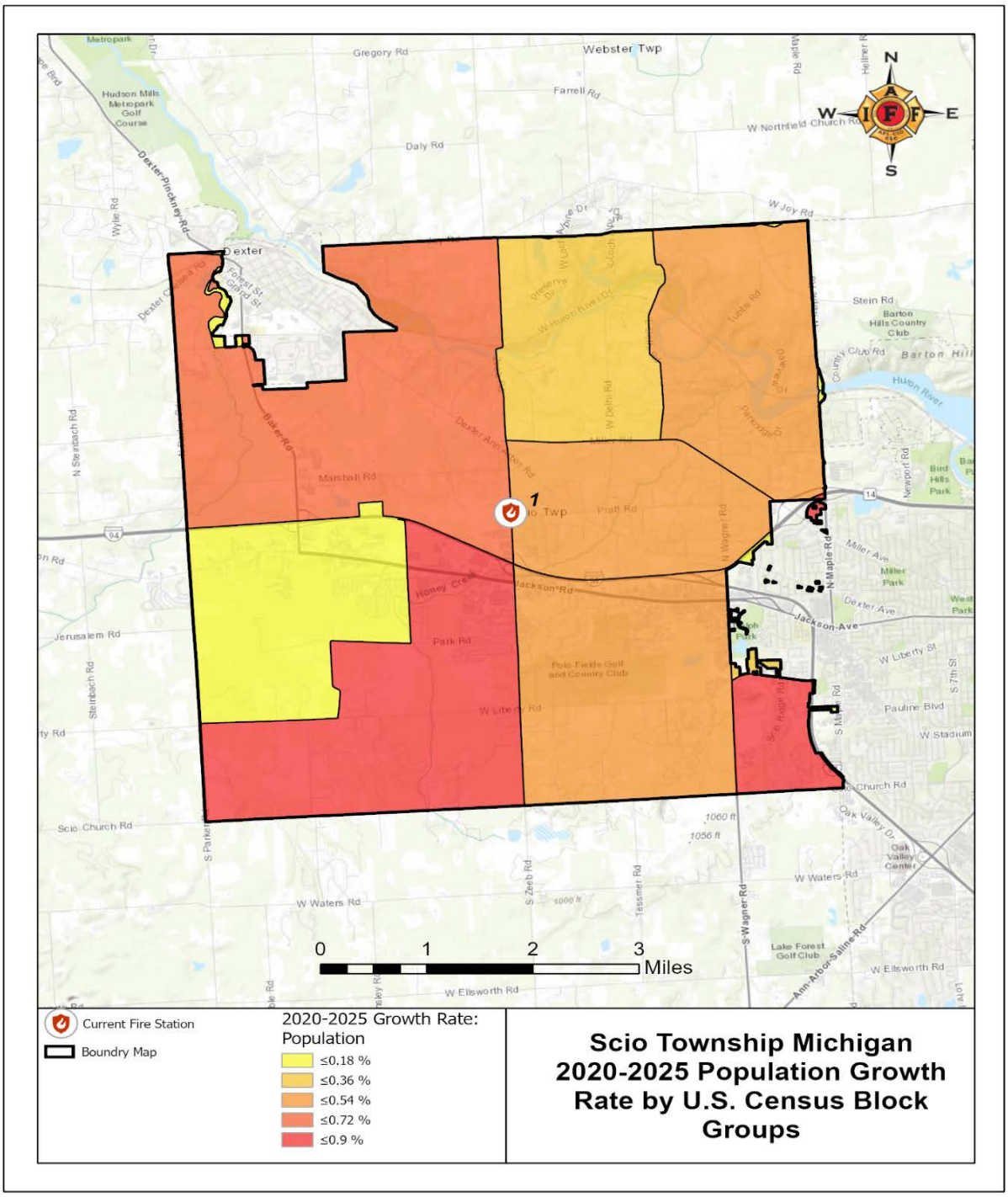
[2] Data provided by Local 4891



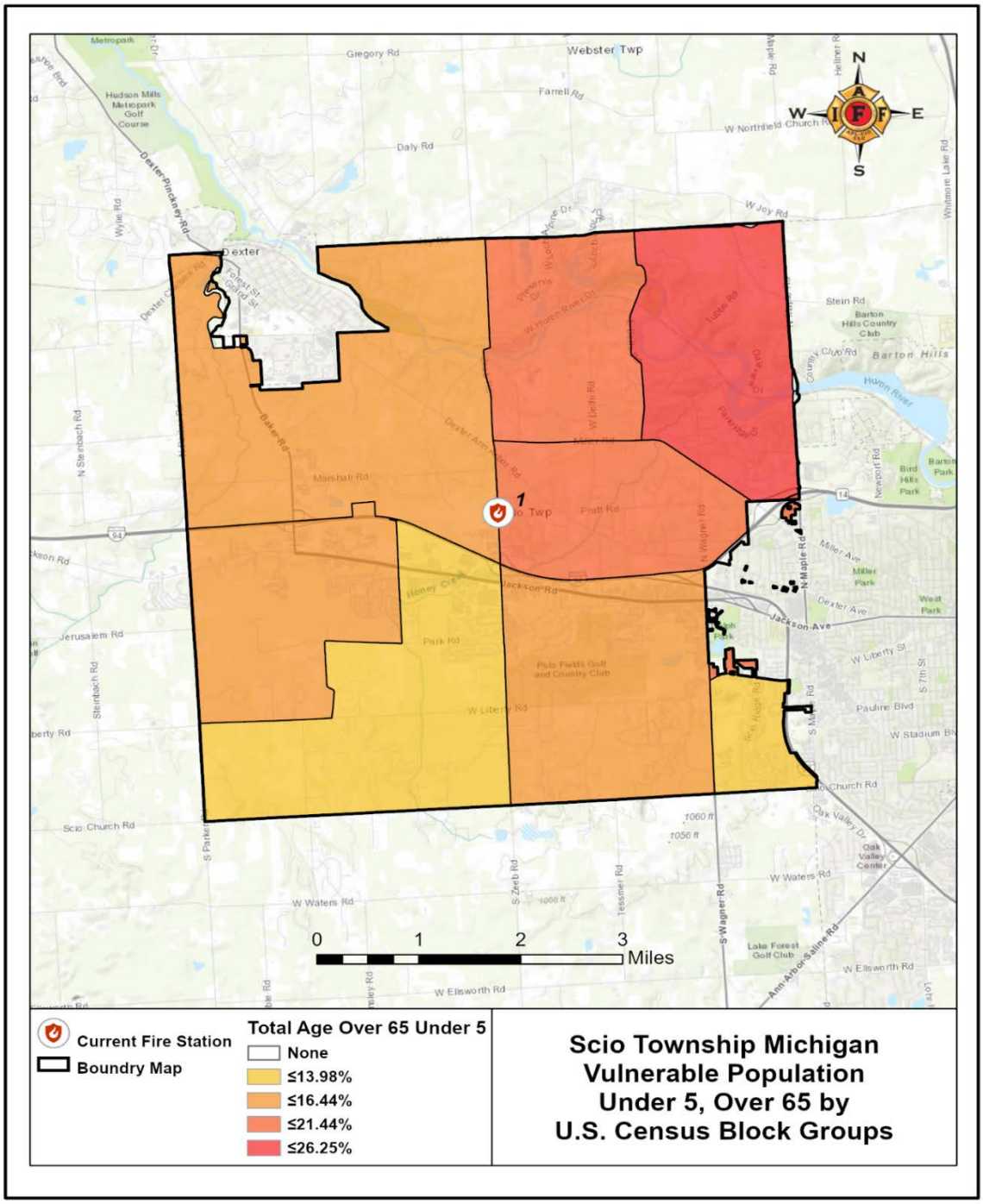
Map 1: Four-Minute Engine Response from Current Station 1. Currently, Scio Township Fire Department can cover 32.1% of all roads within four minutes. When staffed with 3 fire fighters, Scio Township can not assemble four fire fighters within four minutes to meet industry standard or OSHA regulations.



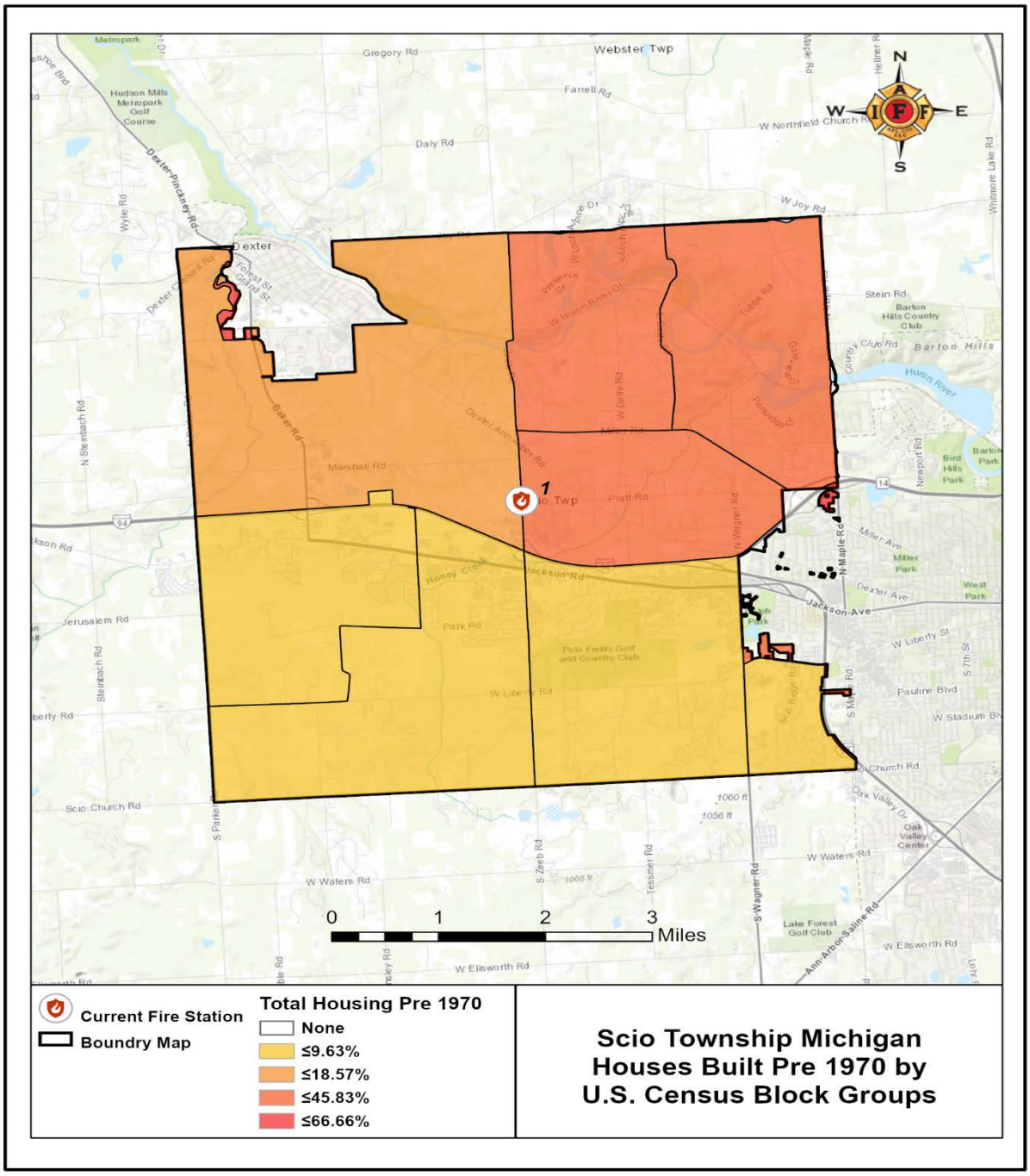
Map 2: 2020 Population Density by U.S. Census Block Groups. Map 2 depicts Scio Townships population density in 2020. Areas with high population density are likely to have a high volume of emergency incidents, resulting in a larger demand placed on the department in these areas.



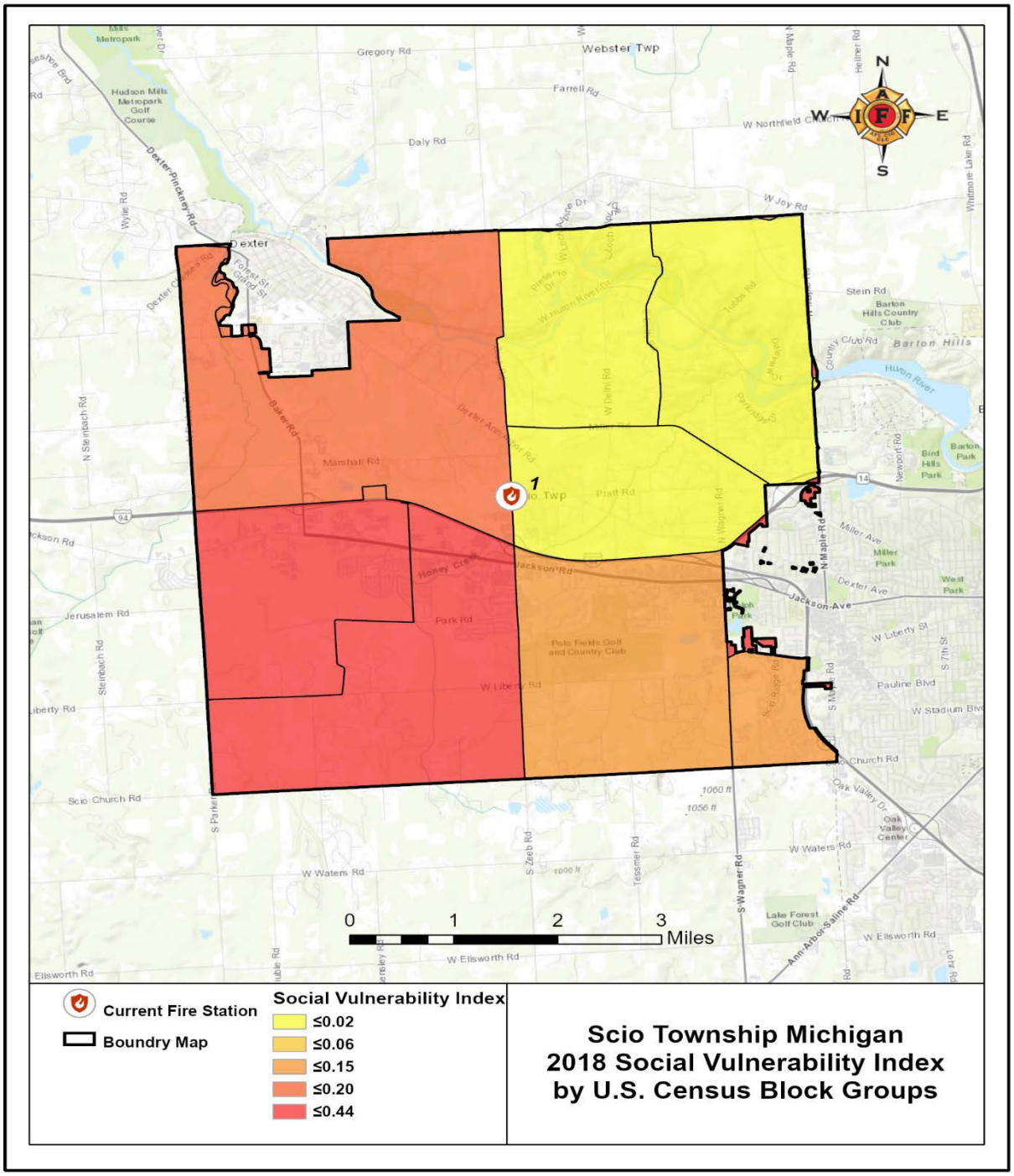
Map 3: 2020-2025 Population Growth Rate by U.S. Census Block Groups. Map 3 depicts the estimated annual population growth rate from 2020-2025. Areas that have a positive estimated population growth rate will likely experience an increase in emergency services requests. Typically, as population increases, so does demand.



Map 4: Vulnerable Population Under 5, Over 65 by U.S. Census Block Groups. Map 4 depicts the percentage of the population under 5 and over 65 years of age. Typically, these populatons are at a higher risk for injury or death because of their inability or reduced ability to evacuate in an emergency.



Map 5: Houses Built Pre 1970 by U.S. Census Block Groups. Map 5 depicts the percentage o fhousing units built before 1970. Tpically, when there are high numbers of older buildings constructed before many current fire codes were developed and poorly maintained properties, there is an increased demand on emergency services.



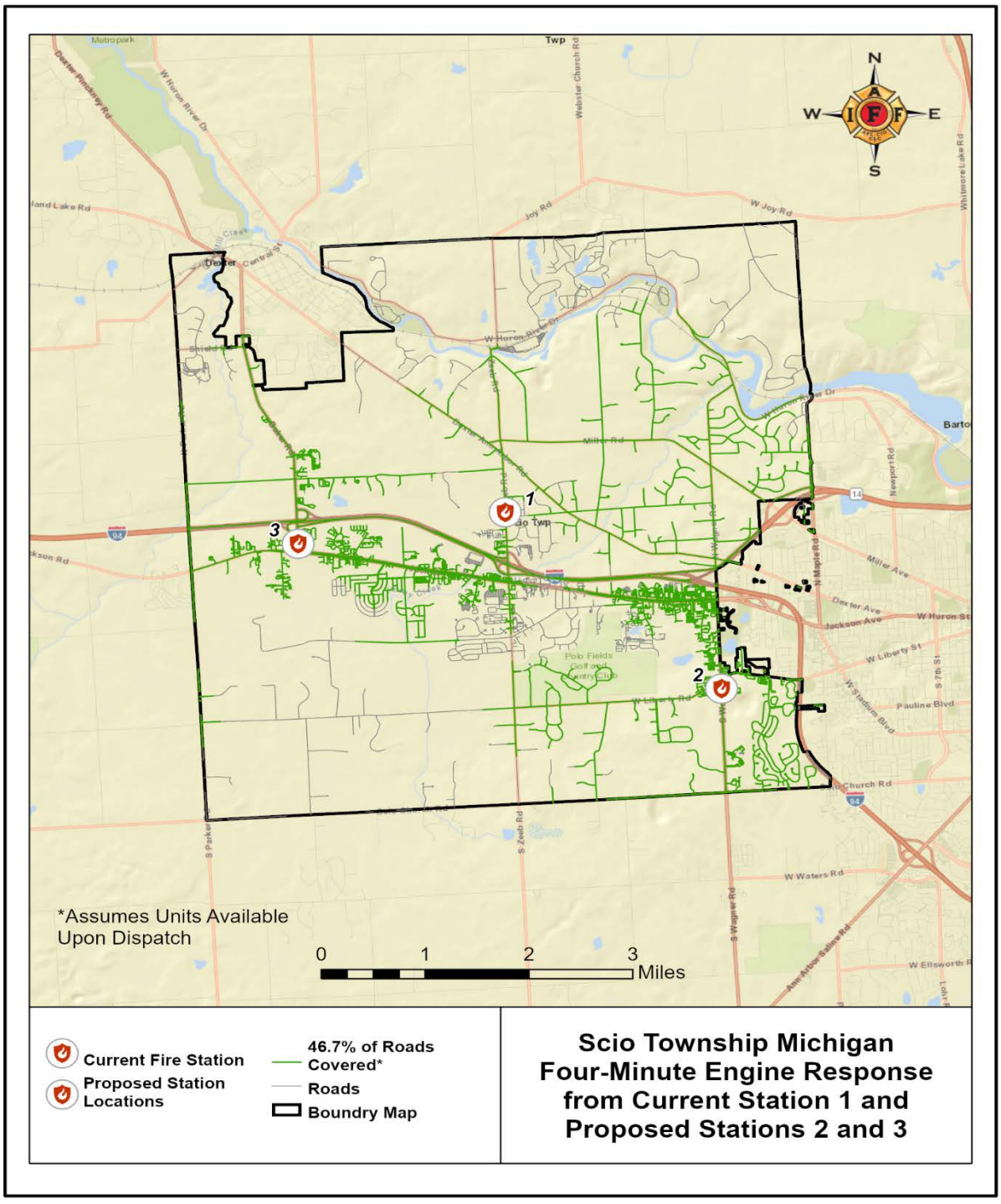
Map 6: 2018 Social Vulnerability Index by U.S. Census Block Groups. Map 6 identifies the percentage of the 2018 population living in social vulnerability broken down by census block groups for Scio Township. Social vulnerability combined census data categories of persons living with a disability, persons without health insurance, persons without the use of a vehicle, and where English is not the primary language spoken in households. The social vulnerability categories can increase the demand on emergency services and medical transportation

Table 2 below lists current station and proposed stations 2 and 3, apparatus, and minimum staffing on each apparatus.

Fire Station	Address	Apparatus	Staffing
Station 1	1055 N Zeeb	Engine 1	3
Proposed 2	Next to 857 S Wagner	Engine 2	3
Proposed 3	Next to 98 Baker Rd	Engine 3	3

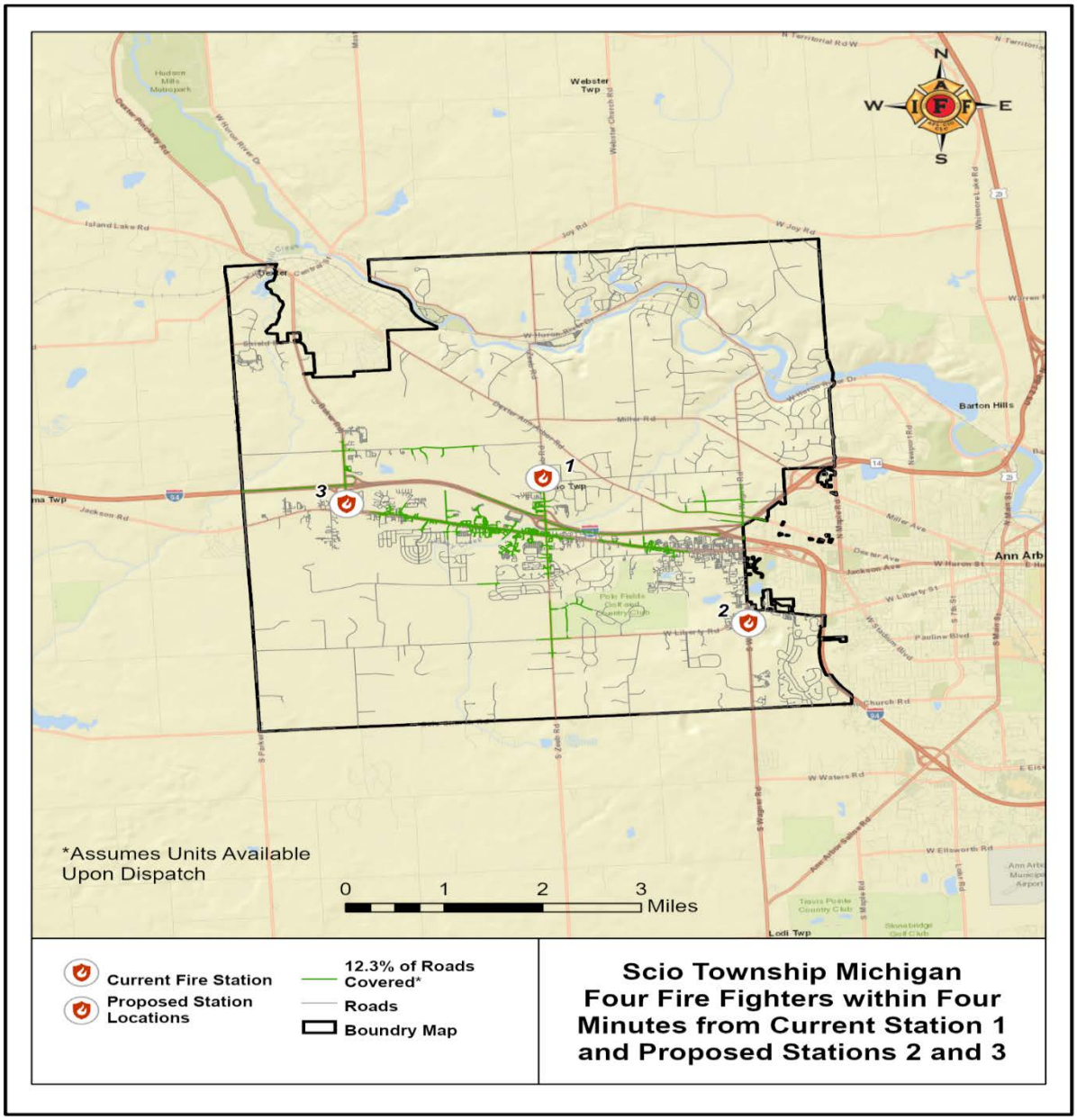
Table 2: Current and Proposed Staffed Fire Station Locations and Staffing. The above table displays where apparatus would be housed and how units would be staffed.[3]

[3] Data provided by Local 4891



Map 7: Four-Minute Engine Response from Current Station 1 and Proposed Stations 2 and 3. Map 7 identifies the roads Scio Township Fire Department could reach within four minutes of travel. NFPA 1710 requires that the first unit be on scen within four minutes of travel to 90% of incidents.[4] Units would be capable of responding on 46.7% of roads within the response area, assuming they are available to respond immediately upon dispatch.

[4] NFPA 1710 §4.1.2.1.3 and §4.1.2.1.7



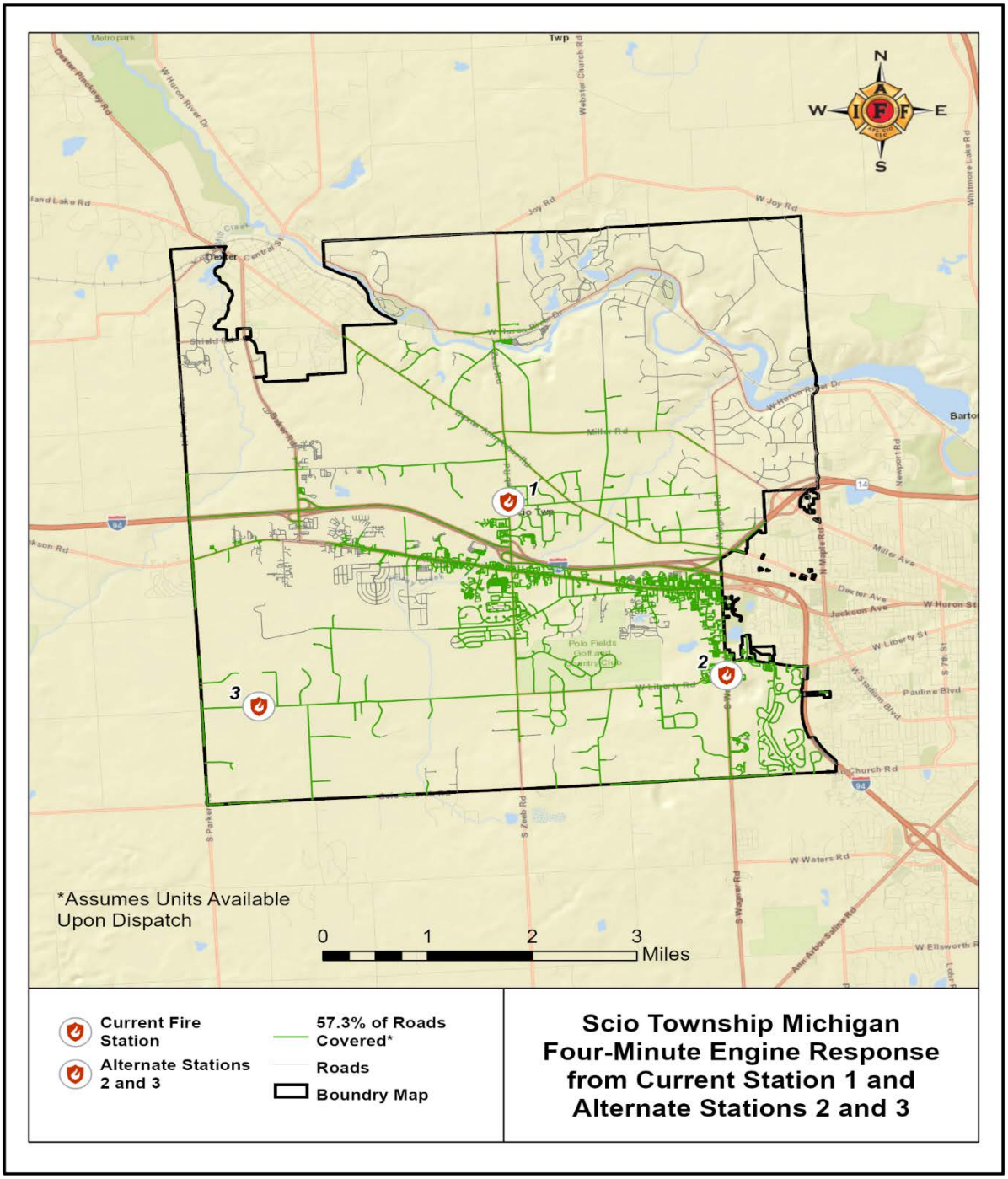
Map 8: Four Fire Fighters within Four Minutes from Current Station 1 and Proposed Stations 2 and 3. Map 8 identifies those roads where a minimum of four fire fighters can assemble on scene within four minutes of travel. The department would be capable of assembling a minimum of four fire fighters on 12.3% of the roads within four minutes. Since it is the intent to staff each station with three fire fighters, fire fighters must rely on supplemental personnel arriving later before making entry into environment that areimmediately dangerous to life and health, such as structure fires, in order to meet objectives outlined in industry standards and OSHA rules and regulations.[5]

[5] 29 CFR 1910.134(g)(4).

Table 3 below lists current station, proposed station 2, and alternate station 3, apparatus, and minimum staffing on each apparatus.

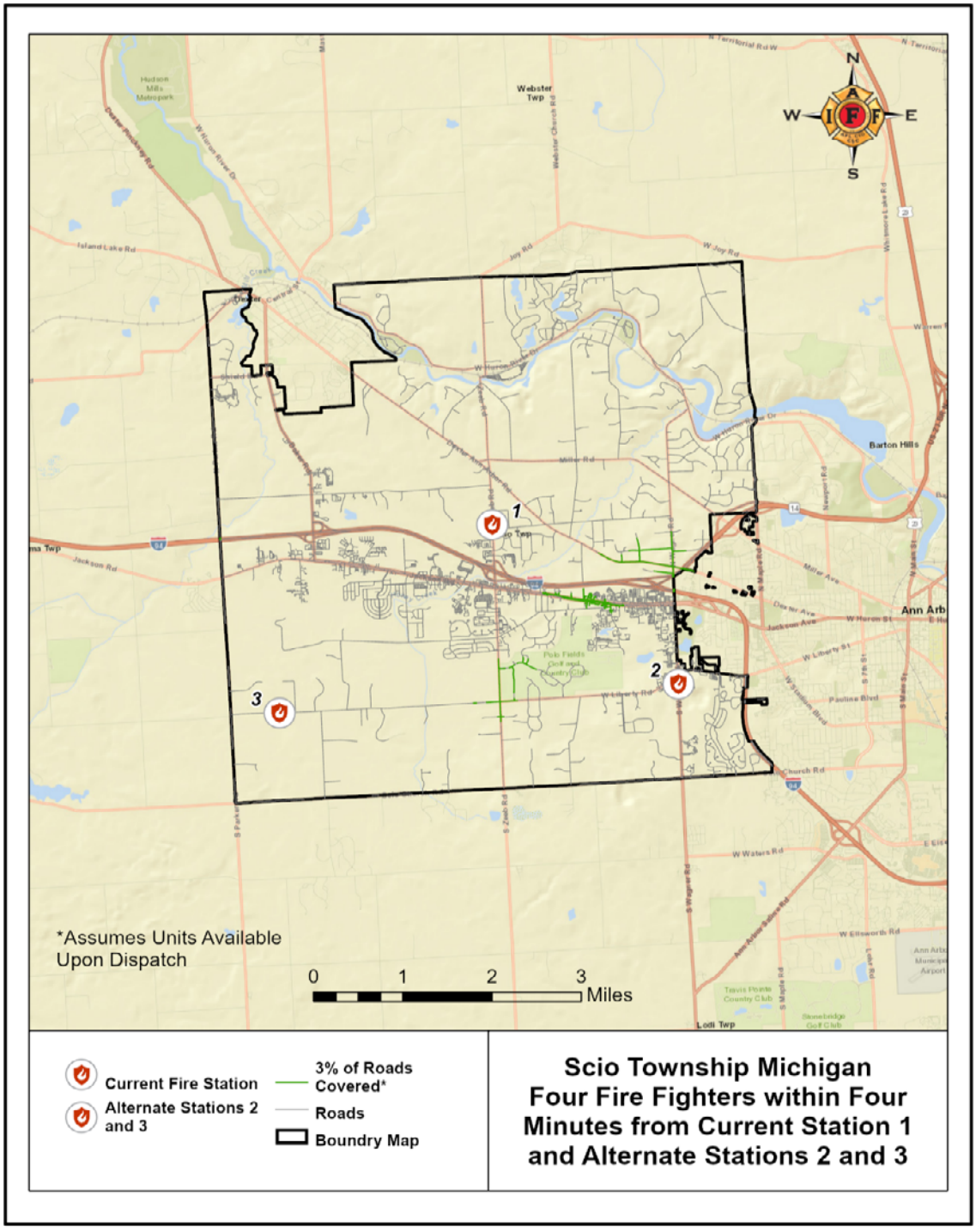
Fire Station	Address	Apparatus	Staffing
Station 1	1055 N Zeeb	Engine 1	3
Proposed 2	Next to 857 S Wagner	Engine 2	3
Alternate 3	Next to 7970 Liberty	Engine 3	3

Table 3: Current, Proposed Station 2, and Alternate Station 3 Fire Station Locations and Staffing. The above table displays where apparatus would be housed and how units would be staffed.



Map 9: Four-Minute Engine Response from Current Station 1 and Alternate Stations 2 and 3. Map 9 identifies the roads Scio Township Fire Department could reach within four minutes of travel. NFPA 1710 requires that the first unit be on scen within four minutes of travel to 90% of incidents.[6] Under this scenario, units would be capable of responding on 57.3% of roads within the response area, assuming they are available to respond immediately upon dispatch.

[6] NFPA 1710 §4.1.2.1.3 and §4.1.2.1.7

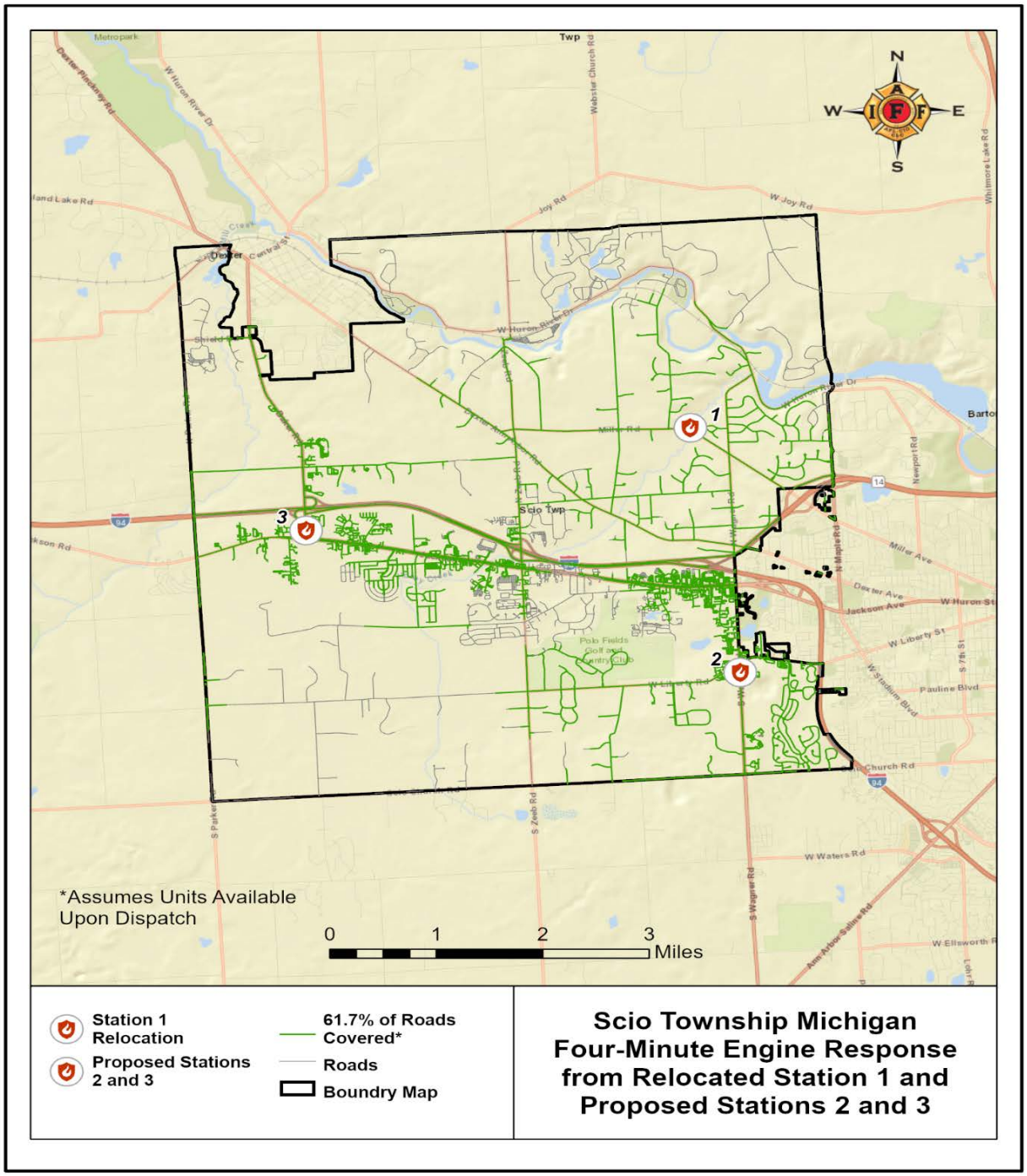


Map 10: Four Fire Fighters within Four Minutes from Current Station 1 and Alternate Stations 2 and 3. Map 10 identifies those roads within the department's response area where a minimum of four fire fighters can assemble on scene within four minutes of travel from alternate fire stations. The fire department would be capable of assembling at least four fire fighters on 3 % of roads within the response area within four minutes, assuming all apparatus are staffed, in the station, and available to respond immediately upon dispatch.

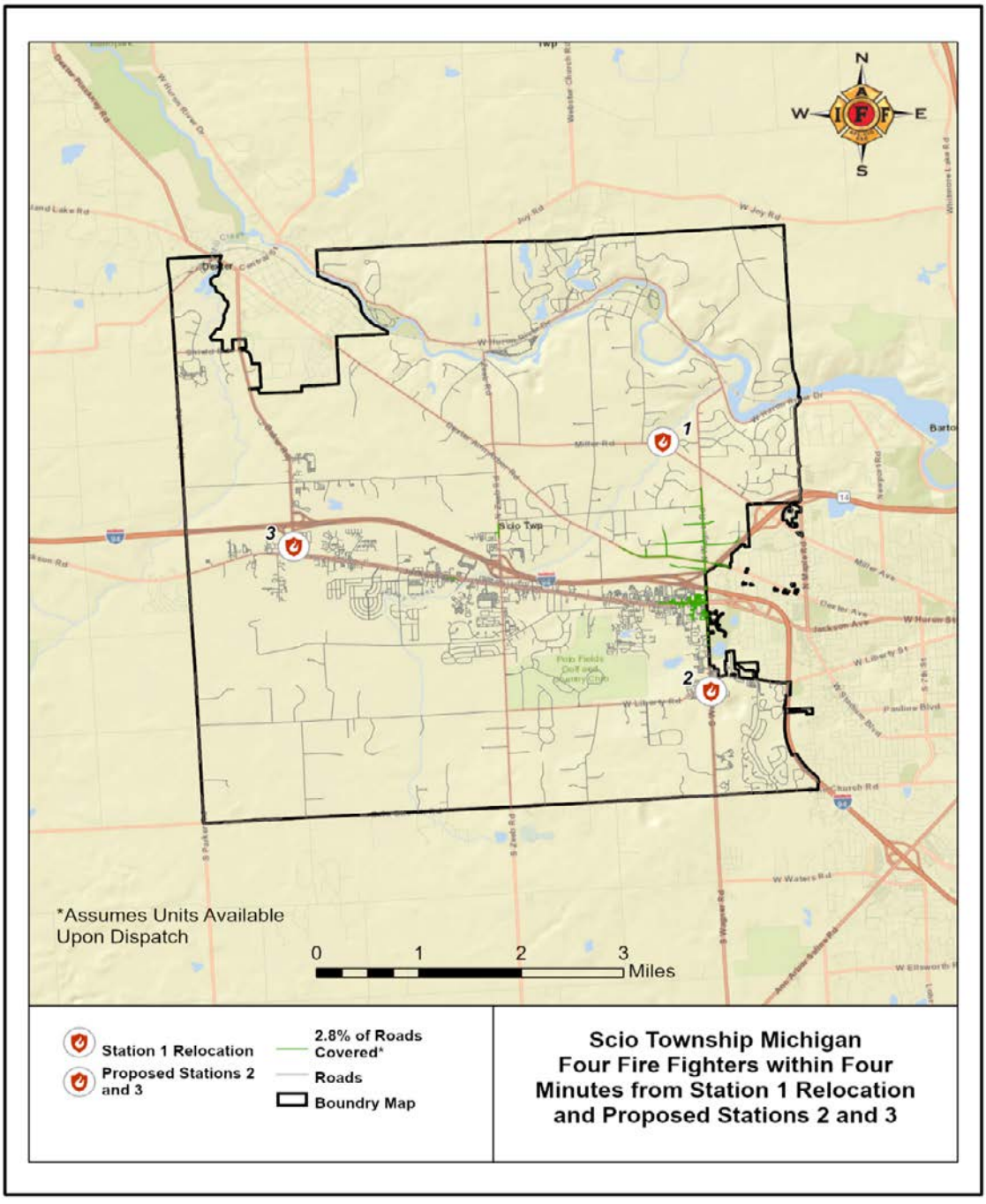
Table 4 below lists relocated station 1 and proposed stations 2 and 3, apparatus, and minimum staffing on each apparatus.

Fire Station	Address	Apparatus	Staffing
Relocated Station 1	42.309796, -83.820708	Engine 1	3
Proposed 2	Next to 857 S Wagner	Engine 2	3
Proposed 3	Next to 98 Baker Rd	Engine 3	3

Table 4: Relocated Station 1, Proposed Stations 2 and 3 Fire Station Locations and Staffing. The above table displays where apparatus would be housed and how units would be staffed.



Map 11: Four-Minute Engine Response from Relocated Station 1 and Proposed Stations 2 and 3. Map 11 identifies the roads Scio Township Fire Department could reach within four minutes of travel with this station configuration. NFPA 1710 requires that the first unit be on scen within four minutes of travel to 90% of incidents.[7] Under this scenario, units would be capable of responding on 61.7% of roads within the response area, assuming they are available to respond immediately upon dispatch.



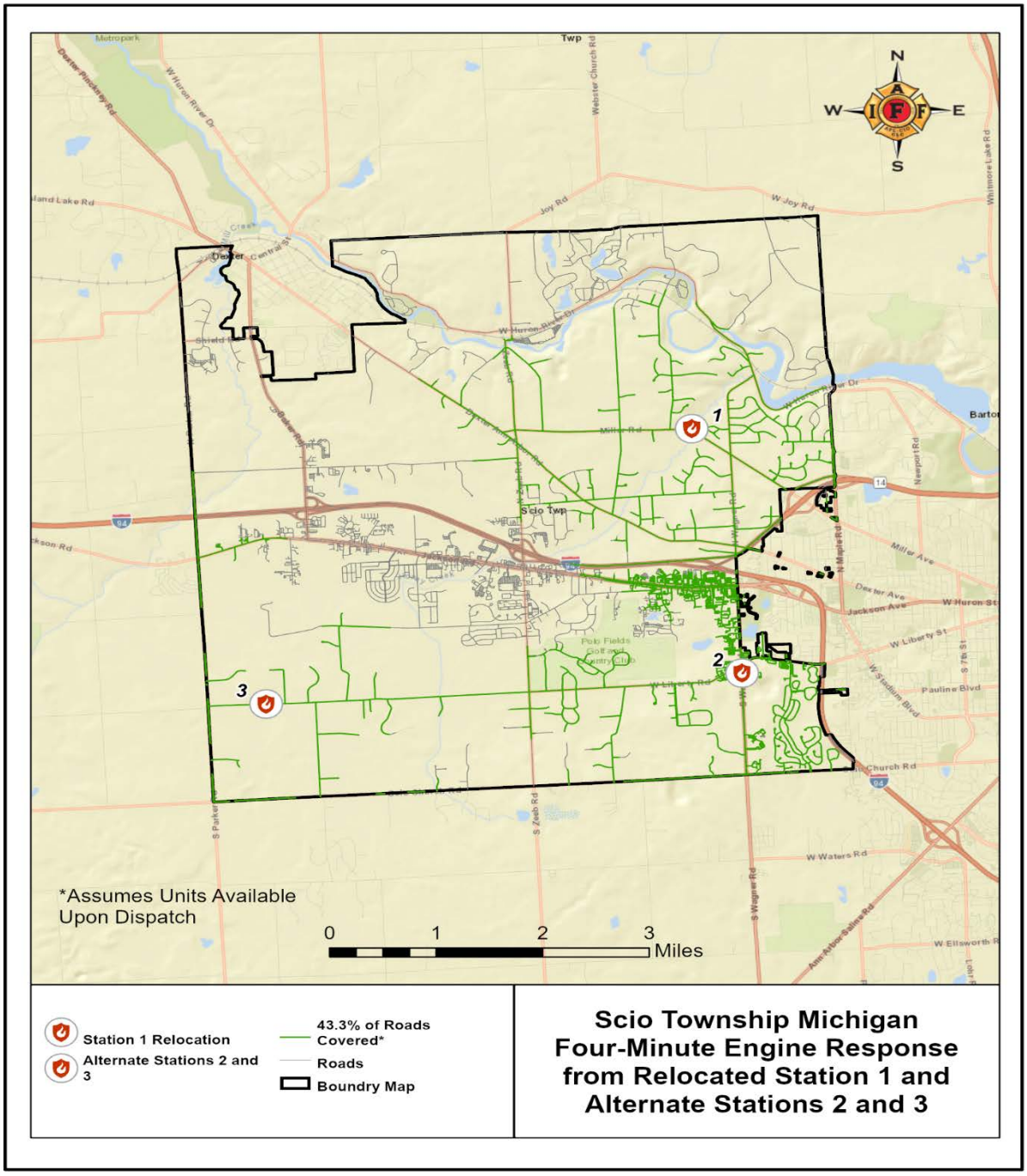
Map 12: Four Fire Fighters within Four Minutes from Station 1 Relocation and Proposed Stations 2 and 3. Map 12 identifies those roads within the department's response area where a minimum of four fire fighters could assemble on scene within four minutes of travel from relocated station 1 and proposed stations 2 and 3. The fire department would be capable of assembling at least four fire fighters on 2.8% of roads within the response area within four minutes, assuming all units are staffed, in the station, and available to respond immediately upon dispatch.

[7] NFPA 1710 §4.1.2.1.3 and §4.1.2.1.7

Table 5 below lists relocated station 1, proposed station 2, and alternate station 3, apparatus, and minimum staffing on each apparatus.

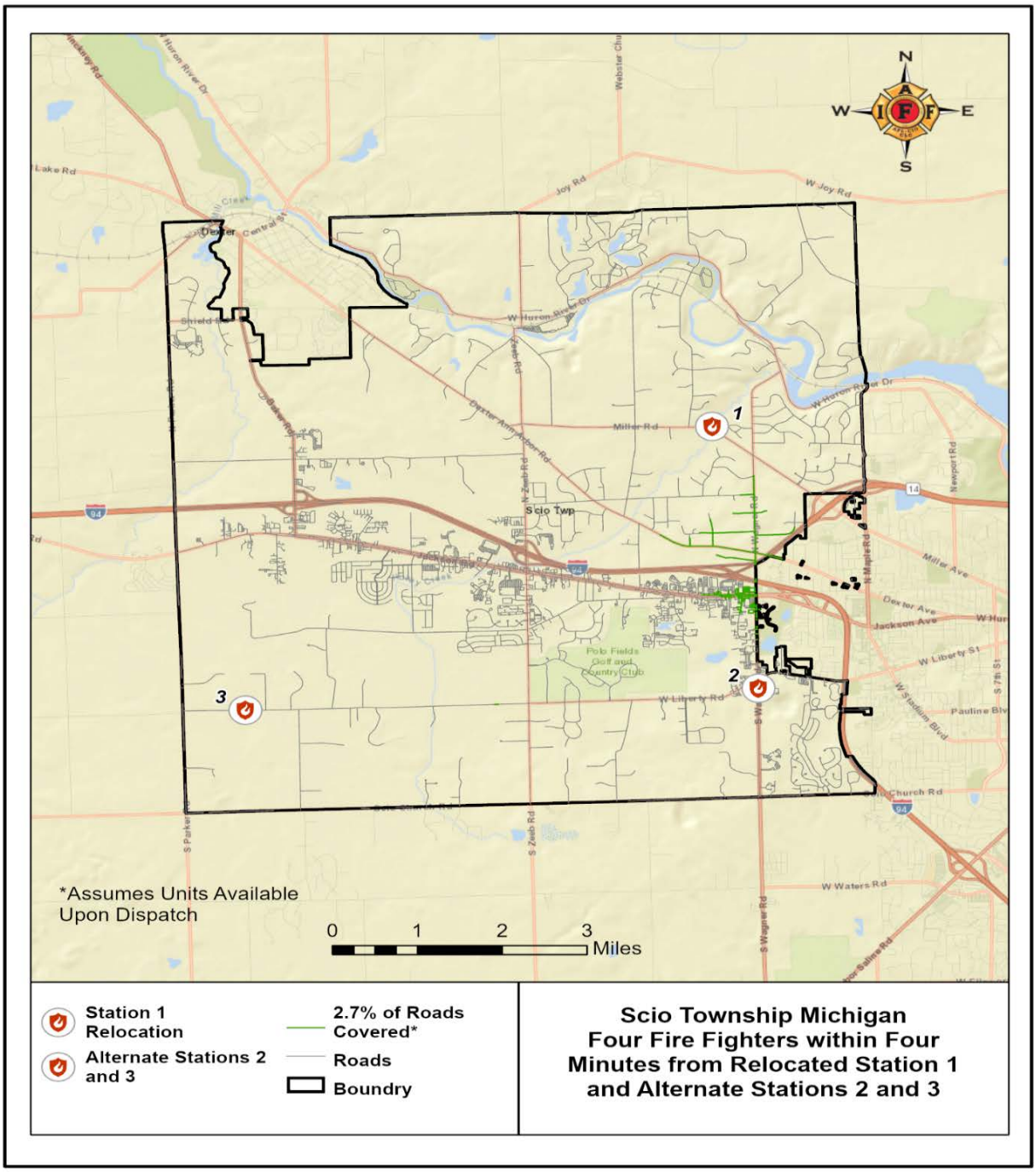
Fire Station	Address	Apparatus	Staffing
Relocated Station 1	42.309796, -83.820708	Engine 1	3
Proposed 2	Next to 857 S Wagner	Engine 2	3
Alternate 3	Next to 7970 Liberty	Engine 3	3

Table 5: Relocated Station 1, Proposed Station 2, and Alternate Station 3 Fire Station Locations and Staffing. The above table displays where apparatus would be housed and how units would be staffed.

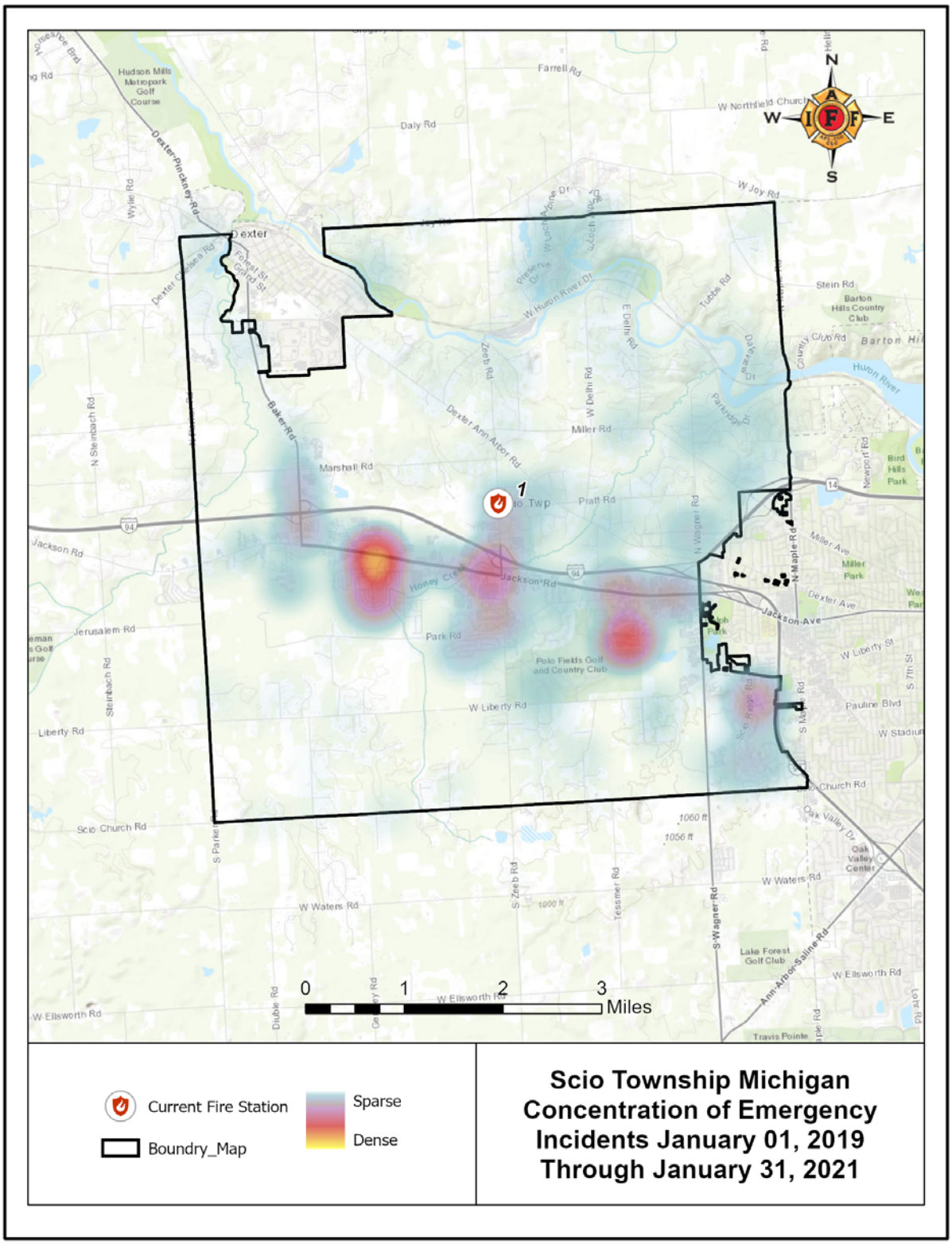


Map 13: Four-Minute Engine Response from Relocated Station 1 and Alternate Stations 2 and 3. Map 13 identifies the roads Scio Township Fire Department could reach within four minutes of travel. NFPA 1710 requires that the first unit be on scen within four minutes of travel to 90% of incidents.[8] Under this scenario, units would be capable of responding on 43.3% of roads within the response area, assuming they are available to respond immediately upon dispatch.

[8] NFPA 1710 §4.1.2.1.3 and §4.1.2.1.7



Map 14: Four Fire Fighters within Four Minutes from Station 1 Relocation and Alternate Stations 2 and 3. Map 14 identifies those roads within the department's response area where a minimum of four fire fighters could assemble on scene within four minutes of travel from relocated station 1 and alternate stations 2 and 3. The fire department would be capable of assembling at least four fire fighters on 2.7% of roads within the response area within four minutes, assuming all units are staffed, in the station, and available to respond immediately upon dispatch.



Map 15: Concentration of Emergency Incidents January 1, 2019 Through January 31, 2021. Map 15 depicts the concentration of incidents from January 01, 2019 to January 31, 2021. The highest concentration of incidents would be best covered from the current station 1 and proposed station 2 and 3.

Recommendations

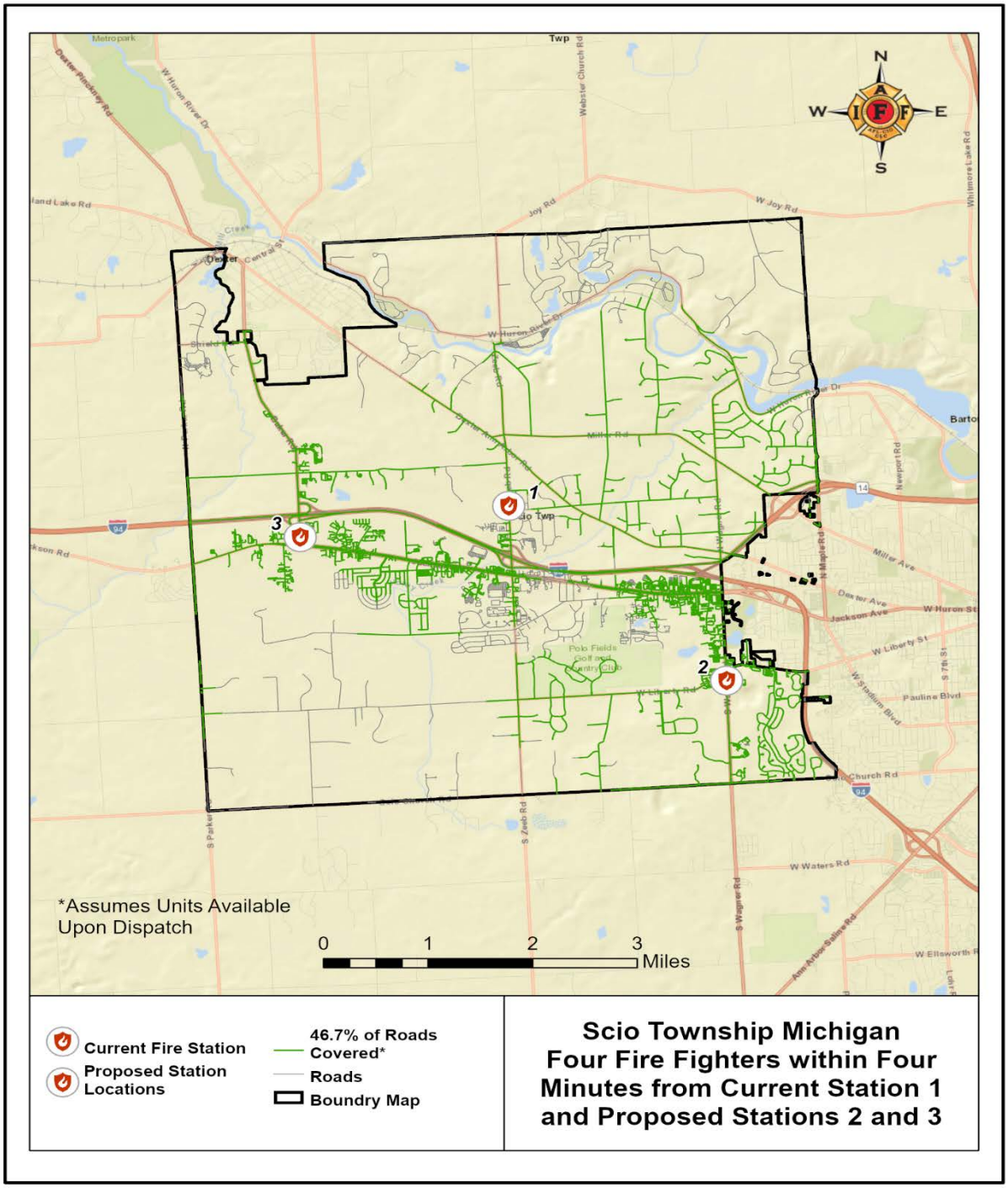
According to NFPA® 1710 engine companies shall be staffed with a minimum of four on-duty members.[9] It was expressed that the intent of Scio Township Fire Department was to staff each engine with three members, which does not meet the standard set forth by NFPA®. Therefore, the IAFF recommends staffing each engine to the standard, four fire fighters, not only to provide better response to the community, but also to ensure that fire fighters are able to mitigate emergencies safely.

By increasing staffing on each engine from three to four fire fighters, Scio Township will be able to assemble four fire fighters, and cover a greater percentage of the roads within four minutes. The current proposal of three fire fighters per engine, only allows for Scio Township assemble four fire fighters within four minutes on 2.7% to 12.3% of the roads. Increasing staffing on each engine, to four fire fighters, will allow for assembly of four fire fighters within four minutes on 43.3% to 61.7% of the roads.

[9] NFPA 1710 5.2.3.1.2

Fire Station	Address	Apparatus	Staffing
Station 1	1055 N Zeeb	Engine 1	4
Proposed 2	Next to 857 S Wagner	Engine 2	4
Proposed 3	Next to 98 Baker Rd	Engine 3	4

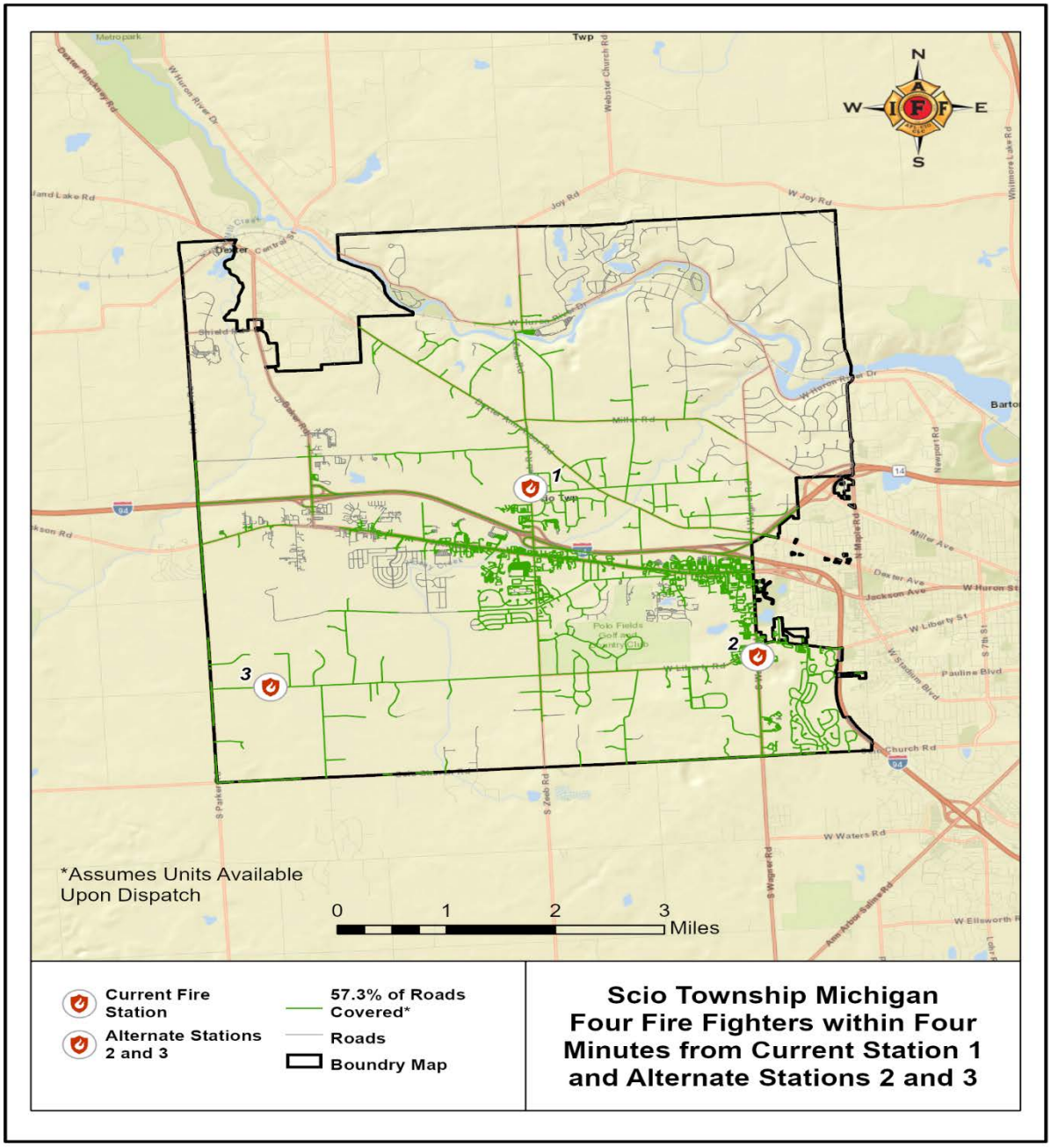
Table 6: Current Station 1, Proposed Stations 2 and 3 Fire Station Locations and Staffing. The above table displays where apparatus would be housed and recommended staffing for each unit.



Map 16: Four Fire Fighters within Four Minutes from Current Station 1 and Proposed Stations 2 and 3. Map 16 identifies those roads where a minimum of four fire fighters can assemble on scene within four minutes of travel, when each engine is staffed with four fire fighters. The department would be capable of assembling a minimum of four fire fighters on 46.7% of the roads within four minutes.

Fire Station	Address	Apparatus	Staffing
Station 1	1055 N Zeeb	Engine 1	4
Proposed 2	Next to 857 S Wagner	Engine 2	4
Alternate 3	Next to 7970 Liberty	Engine 3	4

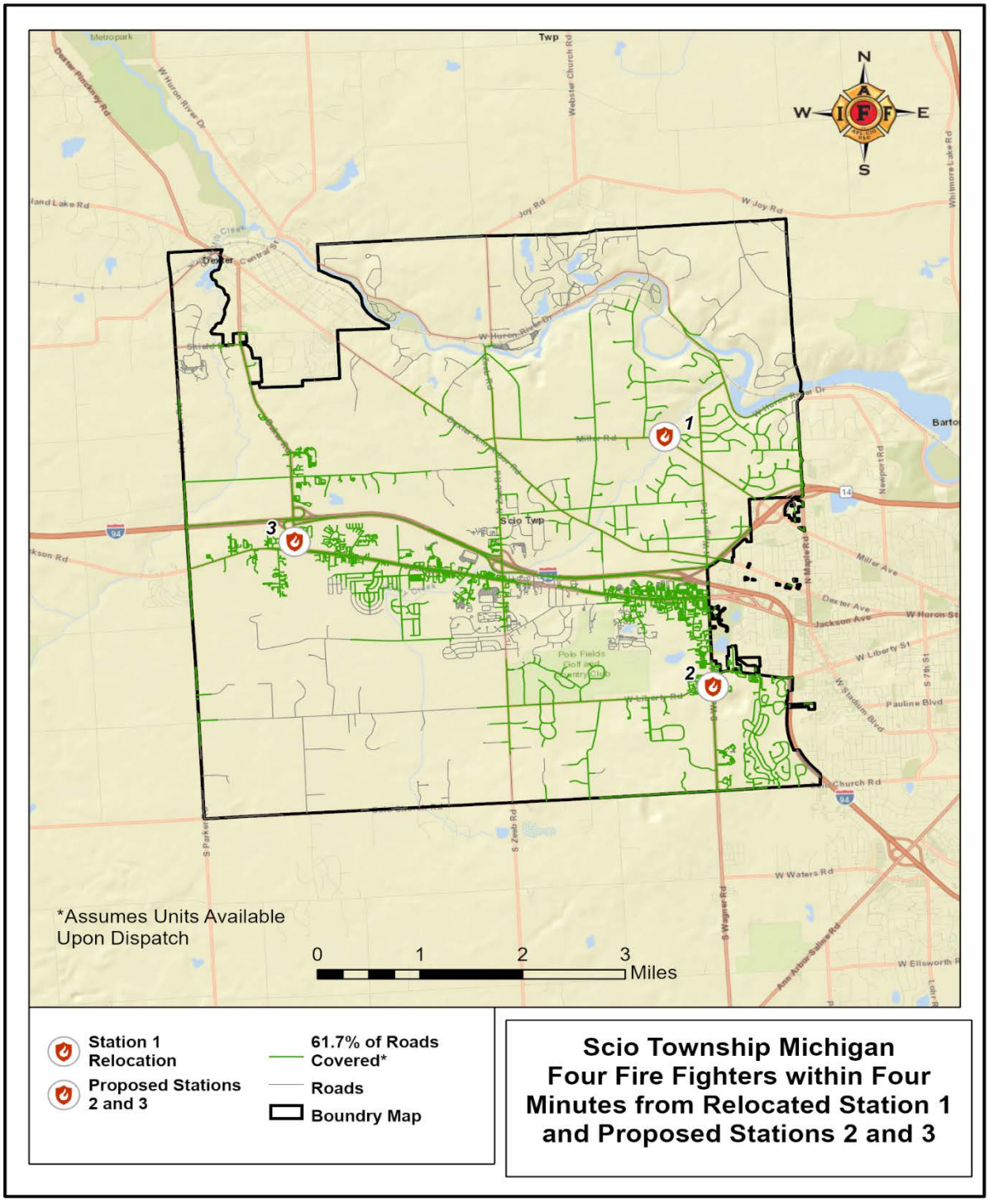
Table 7: Current Station 1, Proposed Station 2, and Alternate Station 3 Fire Station Locations and Staffing. The above table displays where apparatus would be housed and recommended staffing for each unit.



Map 17: Four Fire Fighters within Four Minutes from Current Station 1 and Proposed Stations 2 and 3. Map 17 identifies those roads where a minimum of four fire fighters can assemble on scene within four minutes of travel, when each engine is staffed with four firefighers. The department would be capable of assembling a minimum of four fire fighters on 57.3% of the roads within four minutes.

Fire Station	Address	Apparatus	Staffing
Relocated Station 1	42.309796, -83.820708	Engine 1	4
Proposed 2	Next to 857 S Wagner	Engine 2	4
Proposed 3	Next to 98 Baker Rd	Engine 3	4

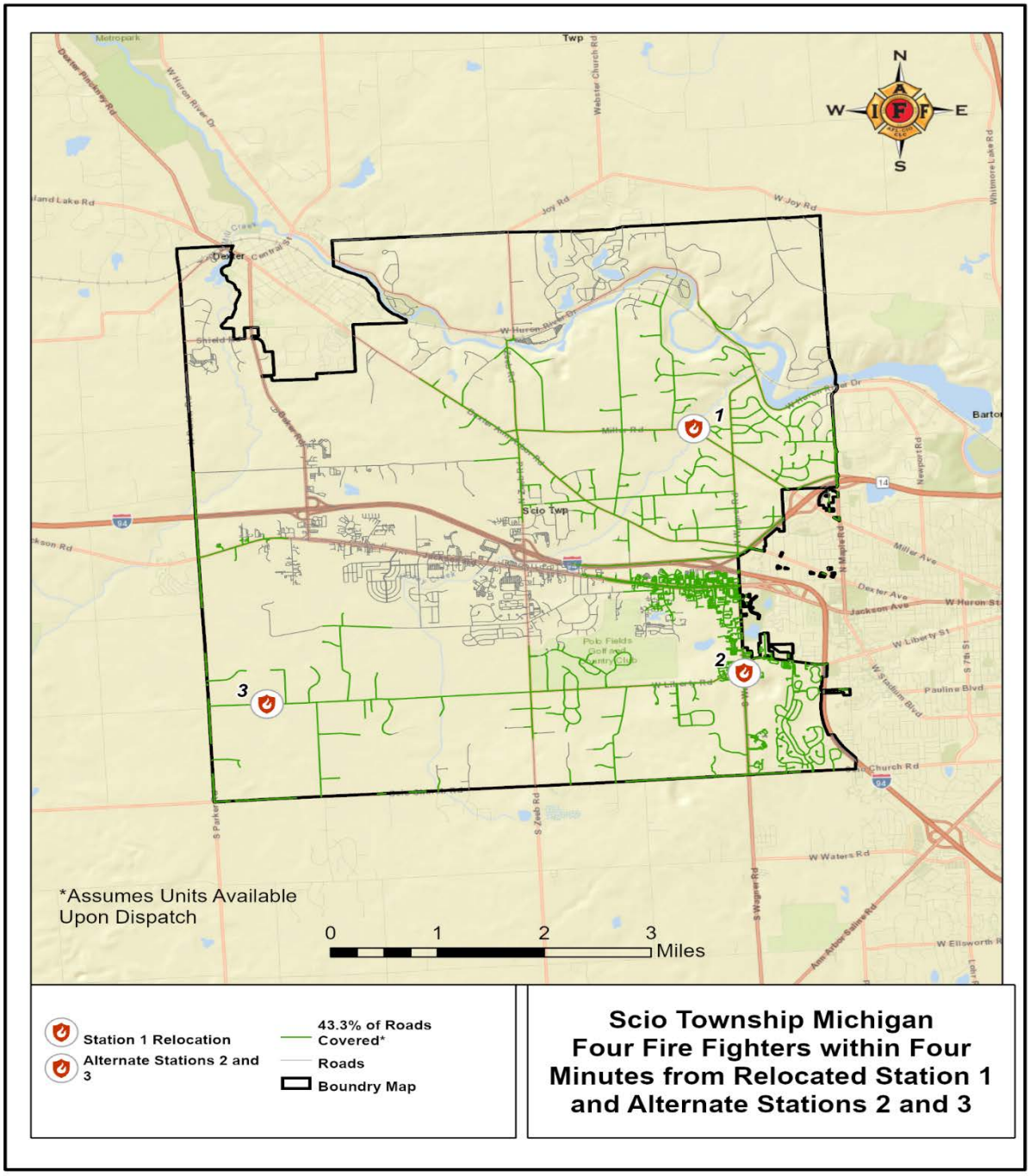
Table 8: Relocated Station 1, Proposed Stations 2 and 3 Fire Station Locations and Staffing. The above table displays where apparatus would be housed and recommended staffing for each unit.



Map 18: Four Fire Fighters within Four Minutes from Current Station 1 and Proposed Stations 2 and 3. Map 18 identifies those roads where a minimum of four fire fighters can assemble on scene within four minutes of travel, when each engine is staffed with four fire fighters. The department would be capable of assembling a minimum of four fire fighters on 61.7% of the roads within four minutes.

Fire Station	Address	Apparatus	Staffing
Relocated Station 1	42.309796, -83.820708	Engine 1	4
Proposed 2	Next to 857 S Wagner	Engine 2	4
Alternate 3	Next to 7970 Liberty	Engine 3	4

Table 9: Relocated Station 1, Proposed Station 2, and Alternate Station 3 Fire Station Locations and Staffing. The above table displays where apparatus would be housed and recommended staffing for each unit.



Map 19: Four Fire Fighters within Four Minutes from Current Station 1 and Proposed Stations 2 and 3. Map 19 identifies those roads where a minimum of four fire fighters can assemble on scene within four minutes of travel, when each engine is staffed with four fire fighters. The department would be capable of assembling a minimum of four fire fighters on 43.3% of the roads within four minutes.

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