
City of Tukwila

Fire Station Location Study



**Management Consulting Report
Final Report – June 26, 2017**

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Introduction

On November 8, 2016, the voters of Tukwila approved a public safety bond to fund a Public Safety Plan developed by the City of Tukwila in 2016. The City's Public Safety Plan included:

- A voter-approved **Public Safety Bond** to pay for three fire stations, guaranteed funding for fire equipment and apparatus for the life of the 20-year bond and the construction of a Justice Center to house the City's Police Department and Municipal Court.
- A **consolidated shops facility**, paid through an equal contribution of existing General and Utility funds.

The primary reason for this study is to provide the City with information and recommendations for the location for two of three new fire stations funded by the Public Safety Bond. These potential locations are determined through a geographical information system (GIS) analysis process. This GIS analysis takes into consideration response times based on national standards, historical response data, street and road access and speed limits, topography, and barriers to response, i.e. bridges, railroad tracks, etc. To determine where the new fire stations should be located, FACETS Consulting was selected to conduct this study.

In addition to the fire station locations, FACETS was asked to provide input on the size of the fire stations and the appropriate location for fire headquarters.

The importance of this study is that it identifies locations that Tukwila Fire Department (TFD) can respond from to continue be a successful public safety organization. Safety is what drives TFD's needs: the safety of its customers and, equally as important, the safety of its employees. Fire and medical emergencies can quickly become worse in a matter of minutes, so it is vitally important to locate fire stations properly for rapid response. Equally important is the need to have up-to-date equipment and apparatus in these stations. But most important is the responsibility to have trained firefighters in the proper numbers to respond from stations with the equipment they need to deal with the emergencies they face.

The City of Tukwila contracted with FACETS Consulting to identify the proper sites for the relocation of Fire Stations 51, 52 and 54; to study deployment of fire apparatus for appropriate and effective response to emergencies; and to identify other opportunities based on best practices.

Executive Summary

Fire stations are visible and potent symbols of a community's investment in the wellbeing of its residents. They are strategically placed where anyone in need can access assistance and from which firefighters respond to emergencies at all times of the day, every day of the year. As such, fire stations must have space to perform many functions: office, dormitory, garage, equipment storage, decontamination, kitchen, living and dining, training, physical fitness, and public access. The community expects much of its firefighters and functional workplaces are needed to enable them to effectively respond.

If unabated, fires and medical emergencies tend to worsen and can become deadly in minutes. Thus, appropriate station locations are essential to the ability of firefighters to respond quickly and meet their primary goal of mitigating emergencies within survivable time frames.

Fire stations are long-term investments in the community and are expensive to staff and operate. Their staffing and correct placement in the community is most important for customer service and for efficiency.

Tukwila Fire Department is an all-hazards department, providing fire suppression, hazardous materials mitigation, technical rescue, and basic life support services (EMS). TFD does not provide emergency medical transport (ambulance) services. Ambulance service is provided by Medic-One or private ambulance service providers in the region.

TFD and the surrounding fire departments operate an automatic aid system for response to fire and medical emergencies. Most of the automatic aid is provided by, and given to, the

Renton Fire Authority (RFA) and the Puget Sound Fire Authority (PSFA). There are other fire agencies that also provide and receive automatic aid. Seattle Fire Department does not currently participate in the automatic aid system, but does participate in mutual aid agreements with the surrounding fire departments.

The Insurance Services Office (ISO) is a national agency that rates fire departments on scale ranging from one to ten based on their training, and fire suppression and prevention capabilities. ISO evaluates fire departments throughout the country. However, in the state of Washington, fire departments are evaluated by the Washington State Surveying and Rating Bureau (WSRB). The WSRB uses the same methodology as ISO, so from a practical standpoint a WSRB Protection Class rating is the same as an ISO Protection Class rating. The Tukwila Fire Department has an ISO 3 classification which is excellent and is higher than most of the fire departments in the US. Based on a November 13, 2014 article in The Suburban Times, of the more than 600 fire departments in the state of Washington, only 35 have a Class 3 rating. Seattle, Bellevue and Federal Way are the only Class 2 fire departments and there are none with a Class 1 rating. The number of fire stations and their locations have an impact on the City's ISO rating and may result in a decrease or increase in fire insurance premiums for home or business owners.

The City of Tukwila's passage of the Public Safety Bond obligates the City to build three new fire stations. Three of the four current fire stations will be replaced. The stations that are being replaced are:

- Station 51 – 444 Andover Park East
- Station 52 – 5900 South 147th Street
- Station 54 – 4237 South 144th Street

Station 51 is also the headquarters for fire administration and one of the new stations will serve as the new location for headquarters in conjunction with an operational fire station. The location for Station 51 has been secured through a development agreement with Segale Properties LLC. That location is west of 180th St and intersects with Southcenter Pkwy. and includes approximately six acres; approximately 2.5 – 3 acres of the property is buildable.

This study was conducted to determine the most appropriate locations for two new fire stations based on an objective analysis of GIS data and five years of CAD data. Based on this analysis, maps were developed illustrating apparatus travel times of four-minutes for engines and eight-minutes for ladder trucks. Additional maps were developed to illustrate the deployment of an effective firefighting force based on current and potential fire station locations. Several scenarios were developed and maps were created for each scenario. Many of them are included in this report.

Based on this GIS analysis the locations with the best coverage related to equitable response times and effective firefighting forces citywide are:

- Fire Station 51 – 180th St. and Southcenter Pkwy.
- Fire Station 52 – 65th Ave. S., N. of Southcenter Blvd.
- Fire Station 53 – 4202 South 115th Street (Current site)
- Fire Station 54 – 4237 South 144th Street (Current site)

The question of the appropriate location for fire department headquarters is a policy question for the City. The consultants believe that headquarters should be near City Hall at the new Station 52 location.

In addition to the GIS analysis over 70 individual stakeholders were interviewed and over 20 documents or reports were reviewed. The interviews are summarized in this report. Some of the same questions were asked by many individuals and they are also addressed in this report.

Also addressed in this report are concerns related to the size of the new fire stations, not including the fire administration offices, and potential ladder truck locations.

Methodology

The methodology for this study included interviews with stakeholders in Tukwila, benchmarking with national standards, and a detailed geographical information system (GIS) analysis to determine new fire station locations in Tukwila.

Members of the FACETS team travelled to Tukwila four times to gather data, interview stakeholders, visit fire stations, observe operations and participate with the City's Open House meeting at Fire Station 54. The first visit was on January 20 and 21, 2017 for the initial kick-off meeting with the Fire Chief, Mayor and City Administrator. The purpose of this meeting was to review and confirm a detailed understanding of the project scope and gain an understanding of the community's need for emergency services, current fire station locations, automatic and mutual aid arrangements with surrounding fire departments, and other pertinent information. Other fire department staff members and firefighters were also interviewed during this visit including on-duty rank and file firefighters (B and C Shift) at each fire station.

Before this visit FACETS had received copies of several documents and previous reports and studies regarding TFD. The significance of these documents was discussed, as was the need for additional documents to be reviewed. The list of documents provided to FACETS is included in Appendix I.

The second visit to Tukwila was on February 6 and 7, 2017. During this visit, FACETS met with all but one of the City Council members, and a representative of the TFD fire station design committee. Interviews were also conducted with the Renton Fire Authority Fire Chief and Deputy Fire Chief. In addition, a site visit to Valley Communications Center, the 911 Public Safety Access Point (PSAP) and dispatch organization for the City of Tukwila was completed. The Valley Communications Center's Deputy Director was also interviewed and provided additional data to FACETS. Two meetings on February 6th where FACETS was scheduled to provide an overview of this study were cancelled because of snow – the Public Safety Committee and City Council meetings.

The Executive Board for the International Association of Fire Fighters (IAFF) Local 2088 met on February 7th and FACETS met with the Board members, listened to their concerns and answered questions regarding this study.

The FACETS team returned to Tukwila on February 16 and 17, 2017. During this visit interviews were conducted with the Assistant Fire Chief, City Public Works and Community Development Directors, TFD Fire Marshal, City Emergency Manager, and the City's Communications/Government Relations Manager. On-duty rank and file firefighters (A Shift) at each fire station were also interviewed. The team met with developer

Mark Segale at his location, toured the development and the designated site for Fire Station 51.

The consultants returned to Tukwila on March 18, 2017 to attend the public open house at fire station 54. During the open house, the consultant was available to answer questions regarding this study as well as general fire operations questions.

TFD shared relevant documents and emergency response data throughout the process. For mapping, FACETS contracted with EF Geographic to produce the requested

maps with Tukwila's response data and best fire station locations. Significant delays to this project occurred because of the GIS information provided by multiple sources and issues with the data that required time consuming work on the part of the FACETS GIS Analyst. In addition, our GIS Analyst worked closely with the fire department GIS contact person on several other issues specific to the Tukwila GIS data and street network.

Applicable National Standards and Benchmarking Guidelines

An essential part of analyzing a fire department's fire station performance is comparing its response experience and protocols against established national response standards. There are several ways to make such comparisons to identify a fire department's strengths and weaknesses.

- For evaluating service performance, a fire department may use the National Fire Protection Association's Standard 1710, *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public for Career Fire Departments*. NFPA 1710 clearly defines the standard level of resources required and time frames for initial and full responses for successful mitigation of emergencies, including fires, emergency medical calls, and other emergencies. For establishing response readiness and safety, a fire chief may use NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*. This standard identifies the minimum requirements for training, equipment, apparatus, physical fitness, and other factors that are required to ensure that firefighters can safely respond and mitigate emergencies. NFPA establishes and periodically revises consensus standards on all aspects of fire department operations. In addition to these two, there are standards on fire prevention, fire protection systems, personal protective equipment, apparatus, training, building construction, and others.

NFPA 1710 sets out criteria for effective response to all types of emergencies. Response time is defined as the sum of:

1. **Call processing time**, the time needed for a 911 call to be received and the information processed and dispatched to the closest available fire companies. Sixty seconds are allowed for standard call processing.
2. **Turnout time**, the time required by the firefighters to receive the call information, get on the truck, and start to move. Eighty seconds are allowed for standard turnout time.
3. **Travel time**, the time the required to respond from the fire station to the emergency location. Four minutes are allowed for travel time.

Thus, the first responding fire company is allowed up to six minutes to respond to an emergency, regardless of the type of call. Many emergencies require only one fire company for mitigation; most medical emergencies fall in this category. However, structure fires and other emergencies require response of more than one fire company. These emergencies require response from an effective firefighting force (EFF).

NFPA 1710 defines an effective firefighting force (EFF) as the number of firefighters and fire apparatus with equipment required to mitigate a fire or another emergency within a survivable time frame. Flashover is the point where a fire engulfs a room and generally occurs six to eight minutes after ignition. After flashover, survivability drops

steeply. Therefore, NFPA 1710 requires that the effective firefighting force be assembled within eight minutes after receipt of the alarm. See Figure 1 in this report that illustrates the significance of responding within eight minutes.

An effective firefighting force consists of fifteen to seventeen firefighters and officers, plus their equipment. If an aerial is needed, seventeen firefighters are required, otherwise, fifteen. Long experience has shown that these numbers are needed to accomplish the tasks required for successful fire suppression in a survivable time frame. If the fire companies are staffed at four (one officer and three firefighters), three engines, a ladder, and a command officer comprise the effective firefighting force. If the fire companies are staffed at three (one officer and two firefighters), the EFF will be comprised of four engines, a ladder, and a command officer.

Successful emergency response requires not only firefighters but appropriate equipment. Today, eighty to ninety percent of the calls for service American firefighters respond to are medical emergencies. However, they must be trained and prepared to respond to one hundred percent of emergencies, not just the majority. And that requires having all the tools and equipment necessary when they arrive on a scene, regardless of what they may have been told to expect. For example, a fire company may respond to a wreck on an interstate, having been told there are injuries. But when they arrive, one of the vehicles may be on fire. Not having the ability to extinguish the fire in addition to rendering medical aid would be a terrible – and embarrassing - service delivery failure. In addition, a fire company may be required to go from one emergency to another; having to return to the

station for the necessary equipment would cause a delayed response, another service delivery failure. For these reasons, fire departments equip, staff, and dispatch fire engines on all types of calls.

- The Public Protection Classification (PPC) program administered by the Insurance Services Office (ISO) is the oldest and perhaps the most familiar to city managers and administrators. Using the PPC measures, ISO evaluates a community's public fire protection capability and assigns a protection class rating from 1 to 10. Class 1 represents exemplary fire protection; a Class 10 rating indicates that a community's fire suppression program does not meet ISO's minimum criteria. ISO evaluates all resources required for fire suppression to establish a rating, including available water supply, call taking and dispatching resources and protocols, response unit staffing, firefighter training, response capacity and coverage, and other factors. A key element of coverage evaluation is the location of engine and ladder apparatus in relation to the development within the jurisdiction. The PPC was developed by the insurance industry and is used to set fire insurance premiums. It does not evaluate EMS capabilities or other emergency services a modern American fire department routinely provides.

For full credit in the PPC program, a fire department must provide an engine within 1.5 miles and a ladder within 2.5 miles of each property in the jurisdiction. Staffing for this level of service delivery is prohibitively expensive and, outside dense urban cores of large cities, probably unnecessary. An astute fire chief will not base performance

standards on ISO alone but will use more direct methods of evaluating community risks and resources.

In the state of Washington, fire departments are evaluated by the Washington State Surveying and Rating Bureau (WSRB). The WSRB uses the same methodology as ISO, so from a practical standpoint a WSRB Protection Class rating is the same as an ISO Class rating. The WSRB re-evaluates fire departments every 5 years or so, while ISO re-evaluates every 10 years or so.

Fire departments are evaluated in about 75 different areas that fall into four general categories, weighted accordingly; fire department (40%), water supply (35%), fire safety control (16%) and emergency communications (9%). Fire department includes things such as the number of stations, number, type and age of apparatus, staffing levels, training, hose and equipment, vehicle maintenance, etc. Water supply evaluates water flow, hydrant locations and condition, operation and maintenance of the water systems. Fire safety control encompasses prevention programs such as code enforcement, plan review, business inspections and public education programs. The final category, emergency communications, evaluates the department's dispatchers and dispatch center operations.

- The Commission on Fire Accreditation International (CFAI) provides a self-assessment and evaluation model that

enables a fire department to evaluate past, current, and potential future service levels and performance and compare them to fire industry best practices so that a department may:

- ◆ Determine community risk and safety needs and develop community-specific standards of cover.
- ◆ Evaluate the performance of the department in relation to the standard of cover.
- ◆ Establish a methodology for achieving continuous organizational improvement in relation to the standard of cover.

CFAI provides the tools for a fire department to assess its performance against national standards or locally adopted performance goals. The program is voluntary and does not set standards. A successful process leads to accreditation; compliance reports must be made annually and the assessment process is repeated every five years.

A progressive fire department will be familiar with these and use them to establish response goals and performance measures appropriate for the community and the fire department in a standards of cover document.

City Background Information

With an area of 9.8 square miles and a resident population of approximately 19,000, Tukwila would initially appear to be a small community with few fire and emergency needs. That first glance is misleading. Tukwila is a thriving small city faced with several complicating challenges that significantly increase its fire and life safety protection needs.

First is its geography. Tukwila lies in the upper Duwamish/Green River valley just south of Seattle; the river flows along the city's eastern side. A large portion of central Tukwila is in the river's flood plain. On the west side, the topography rises in a series of steep hills that require careful driving to navigate safely. The Puget Sound area is seismically active. The Cascadia fault is the shallow point of contact where the Juan de Fuca crustal plate is compressed as it slides under the North American crustal plate, in western Washington. Geologists have determined that the fault ruptures and releases this compression in 8 to 9 magnitude earthquakes once every 500 to 600 years. The last earthquake with a magnitude of 8 or greater occurred on January 26, 1700. The effects of earthquakes include surface rupture, ground shaking, liquefaction, and landslides on steep slopes. (US Geological Survey, Pacific Northwest geologic mapping and urban hazards)

The second challenge is the road network. Interstate 5 bisects Tukwila north to south, with interchanges at Interstate 405/Highway 518 and at Highway 599. There are only three interchanges where fire apparatus can

access the interstates to reach emergencies along them. The major streets that cross I-5 include Macadam Road, South 133rd Street, and South 144th Street in the north, Southcenter Boulevard and Klickitat Drive in the central area, and South 176th Street in the south.

As noted above, Tukwila is a thriving city. The third challenge is the daytime population, which swells to 150,000 as people arrive to work and shop. Westfield Southcenter is the Puget Sound area's largest retail mall, with more than three hundred fifty stores and restaurants as well as a multiplex movie theater. There is additional retail surrounding the mall. And there is room for significant growth; Segale Properties owns approximately 250 acres of buildable property in south Tukwila. The company plans to construct based on market indications of what is needed over the next several years.

Industry is the fourth challenge. Boeing Corporation has the most employees, with 7,572 in four major divisions located in the northern end of Tukwila, including a manufacturing center and airport. Many of these manufacturing facilities use hazardous materials in their processes. In addition, there are several internet and corporate datacenters located near Boeing Field. Costco Warehouse #2, with 703 employees, is in central Tukwila. There is not a hospital located in Tukwila.

Finally, transportation of goods, especially hazardous materials, is a challenge in Tukwila. A sixteen-inch diameter pipe carrying

jet fuel crosses the city on its way to Sea-Tac International Airport. There are three high pressure natural gas lines ranging from twelve to sixteen inches that also run through the City. Rail lines along the eastern border of the city carry Amtrak passenger trains as well as freight, including tank cars with crude oil. In addition to these hazards, commercial, military and private aircraft take off and land at Sea-Tac airport, less than five miles away from Tukwila. Tukwila Fire Department routinely provides automatic aid to the Sea-Tac airport.

These challenges require fire protection and emergency services resources beyond what would be typical for a city of Tukwila's size and population. Tukwila Fire Department must be prepared to effectively respond to and mitigate "all-hazards" that may be encountered. The potential for disasters in Tukwila range from natural disasters (earthquake/flood), man-made (fire/medical), transportation related (ground/rail/air), hazardous materials incidents, and terrorism.

Future Growth in Tukwila

In addition to the unique challenges Tukwila currently faces, additional growth in the form of new construction, increased population and new jobs will impact the delivery of fire services in Tukwila. Several new construction projects are underway and several more are being planned for both commercial and residential uses. Commercial projects create additional jobs.

A short summary of some of the development that is expected in Tukwila was provided by the City Administrator. The information provided is listed below:

- Central Business District Buildout – impacting all the area south of the new Station 51 (up to 8 million square feet of commercial space and approximately 2,000 housing units).
- Southcenter Area – near the current 19-story building, there will be more housing. Specifically, 500 residential units planned in just the 19-story and a five-story building in front of it. There will also be more growth in hotel rooms, probably at least another 500 to 1,000 units. This would impact the service area for a newly

located Station 52 and the north service of station 51.

- Tukwila International Boulevard (TIB) – near station 54, there will be more multi-family units, probably another 1,000 units, including Tukwila Village and other possible developments centered around S. 144th and TIB.

In a May 2012 traffic study report, *City of Tukwila: Background Report for the Transportation Element of the Comprehensive Plan Update Transportation Analysis and 2030 Improvements Recommendations*, prepared by the firm Fehr & Peers, Chapter 3 describes assumed changes in land patterns and in the transportation network that are expected between 2012 and 2030. In the report, land use forecasts for 2030 are provided by the Puget Sound Regional Council (PSRC) and are based on regional population and employment growth forecasts. Page 65 of the report includes a table that compares the 2010 and 2030 land use in terms of total households and workers. The table has been recreated below.

Table 1

2010 and 2030 Land Use Summary for City of Tukwila			
	2010	2030	Percent Growth
Total Households	7,440	12,300	65%
Employment (workers)	47,540	75,210	58%

Source: City of Tukwila, 2011

In addition, this report states that:

“substantial development is expected in the Tukwila South area, between S. 180th and S. 200th Streets. In that area, approximately 400 new households and 13,000 new jobs are expected to be added by 2030. Other major growth areas include:

- Southcenter – 1,400 new households and 4,200 new jobs
- North West Valley Highway Corridor – 1,400 new households and 300 new jobs
- Boeing Field Area – 1,800 new jobs”

This additional growth and development will impact the delivery of fire and emergency medical services, especially in Tukwila South, with increased requests for 911 services and delays in response times due to increased traffic. A list and description of additional private development projects can be found in Appendix II.

Fire Department Background Information

Tukwila Fire Department protects an area of 9.8 square miles, a resident population of 19,765 from four strategically located fire stations with a total of 67 Full-Time Equivalent (FTE) positions for career uniformed personnel and 5 FTE civilian staff members. Daily minimum emergency response staffing is 14 firefighters.

Emergency response vehicles on-shift consist of three Engines, one Ladder (Quint), one Battalion Commander, and one Aid Car. Staffing for Engines consists of three firefighters and three or four on the Ladder depending on on-duty strength after vacation and sick leave is factored. The Aid Car, when in service, is staffed with two firefighter/Emergency Medical Technicians (EMTs) that respond to medical emergencies. Currently the Aid Car is only in service approximately sixty-percent of the time.

The Tukwila Fire Department provides services to 150,000 people who daily work, shop, and drive through the city. Outside of Tukwila, fire department services are provided to the surrounding cities covered under an automatic mutual aid agreement with the Puget Sound Regional Fire Authority, Renton Regional Fire Authority as well as other neighboring fire agencies. These same fire departments also provide services to the City of Tukwila. As with most fire departments in North America, the majority of TFD's responses are to medical emergencies. TFD also provides personnel for special rescue teams including hazardous materials mitigation, heavy rescue, and swift water rescue services in addition to fire suppression and Emergency Medical Services (EMS).

The current locations of Tukwila Fire Stations are listed below. (See Map 1)

- Station 51 – 444 Andover Park East
- Station 52 – 5900 South 147th Street
- Station 53** – 4202 South 115th Street
- Station 54 – 4237 South 144th Street

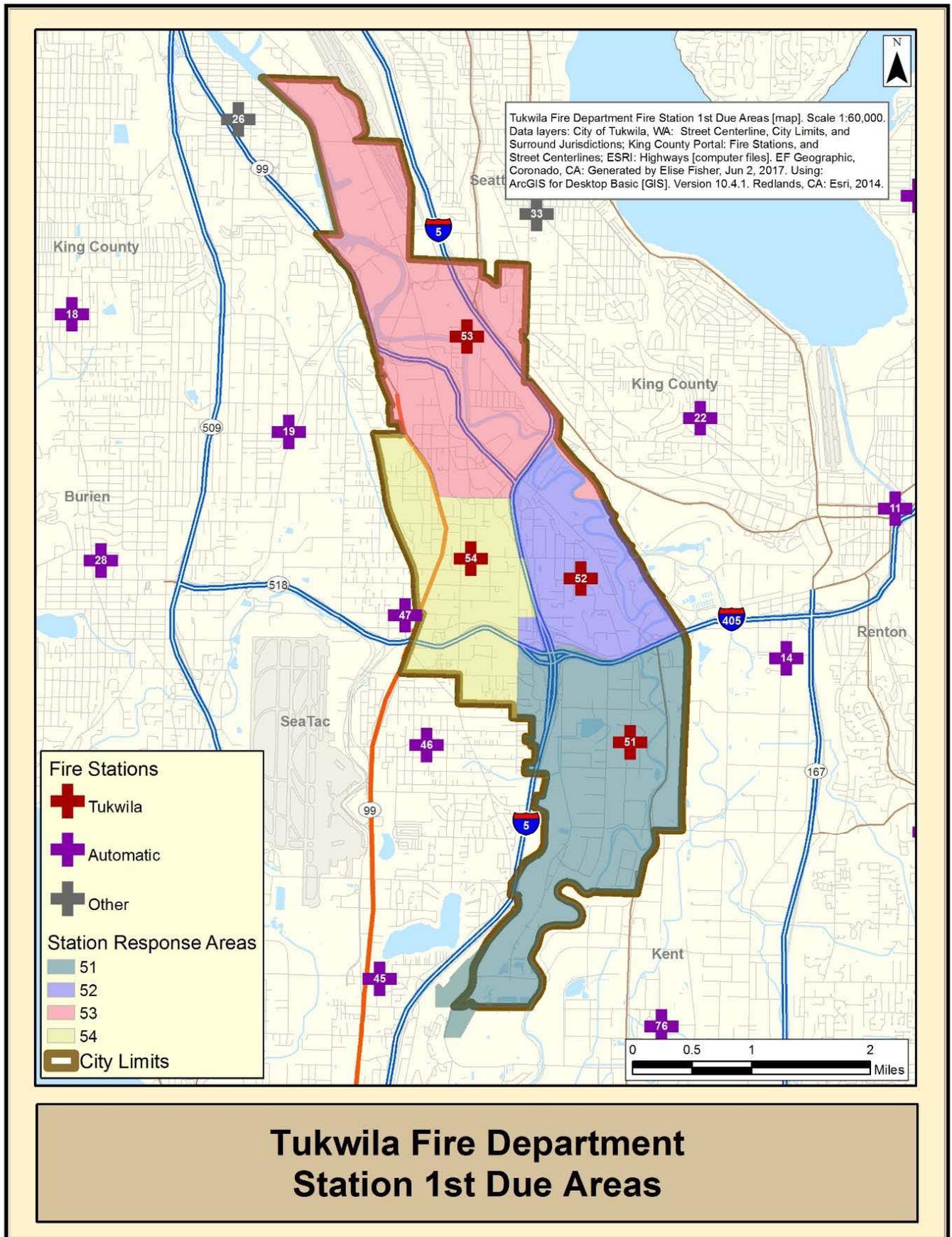
** Not being replaced.

FACETS toured all the fire stations several times during the onsite visits. Besides the seismic risks, Station 51, 52 and 54 are not adequate for the current level of services provided by the TFD. These stations are too small for both the equipment stationed there and for the firefighters assigned to them. There are not appropriate facilities for female firefighters including restrooms and sleeping areas. Firefighter safety is not adequately addressed because of current fire station configurations, many times contaminated materials are located too close to items used in the living quarters. It was noted in one station that contaminated backboards are cleaned in the same area as the refrigerators where personnel food is kept.

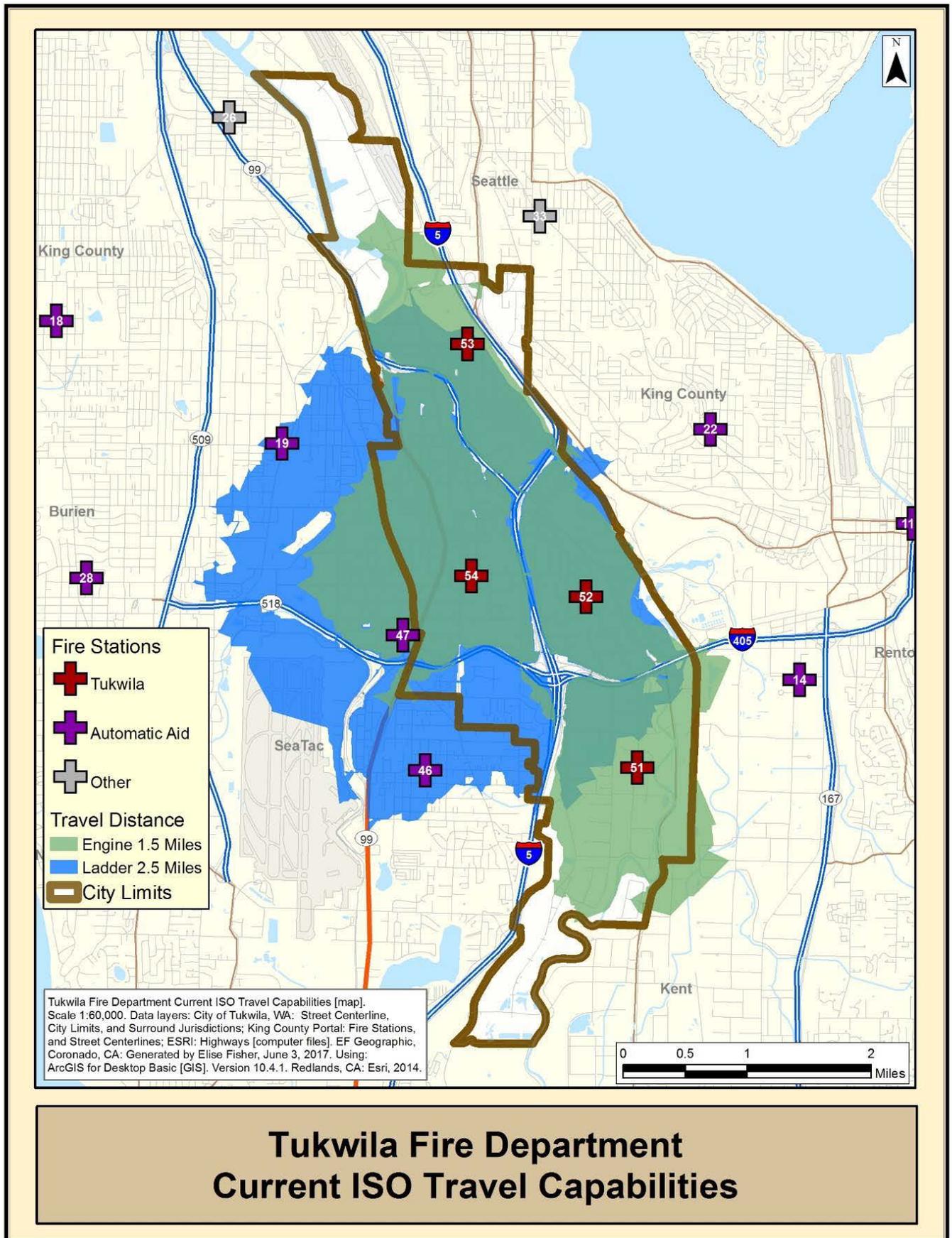
Tukwila Fire Department is an all-hazards department, providing fire suppression, hazardous materials mitigation, technical rescue, and advanced basic support services. TFD does not provide emergency medical transport (ambulance) services. Ambulance service is provided by Medic-One or private ambulance service providers.

The current Insurance Services Office (ISO) rating is a Class 3 for Tukwila Fire Department. Using the ISO criteria from the PPC program, Map 2 shows the current coverage for an engine every 1.5 miles and a ladder truck every 2.5 miles.

Map 1 – Tukwila Fire Department Current Station Locations and First-Due Areas



Map 2 – Tukwila Fire Department Current Station Locations and ISO Coverage



Over the past five years, Tukwila Fire Department's emergency workload has increased, as shown in the following table:

Year	HazMat	False	Good Int	EMS	Other	Fire	Pub Asst	Rupt/Exp	Wthr	Total
2012	101	551	340	3386	56	288	118	5	1	4846
2013	73	610	393	3267	51	270	132	3	0	4799
2014	101	609	398	3491	24	380	147	5	1	5156
2015	97	605	542	3747	31	380	138	6	3	5549
2016	118	631	472	4060	28	319	123	0	3	5754

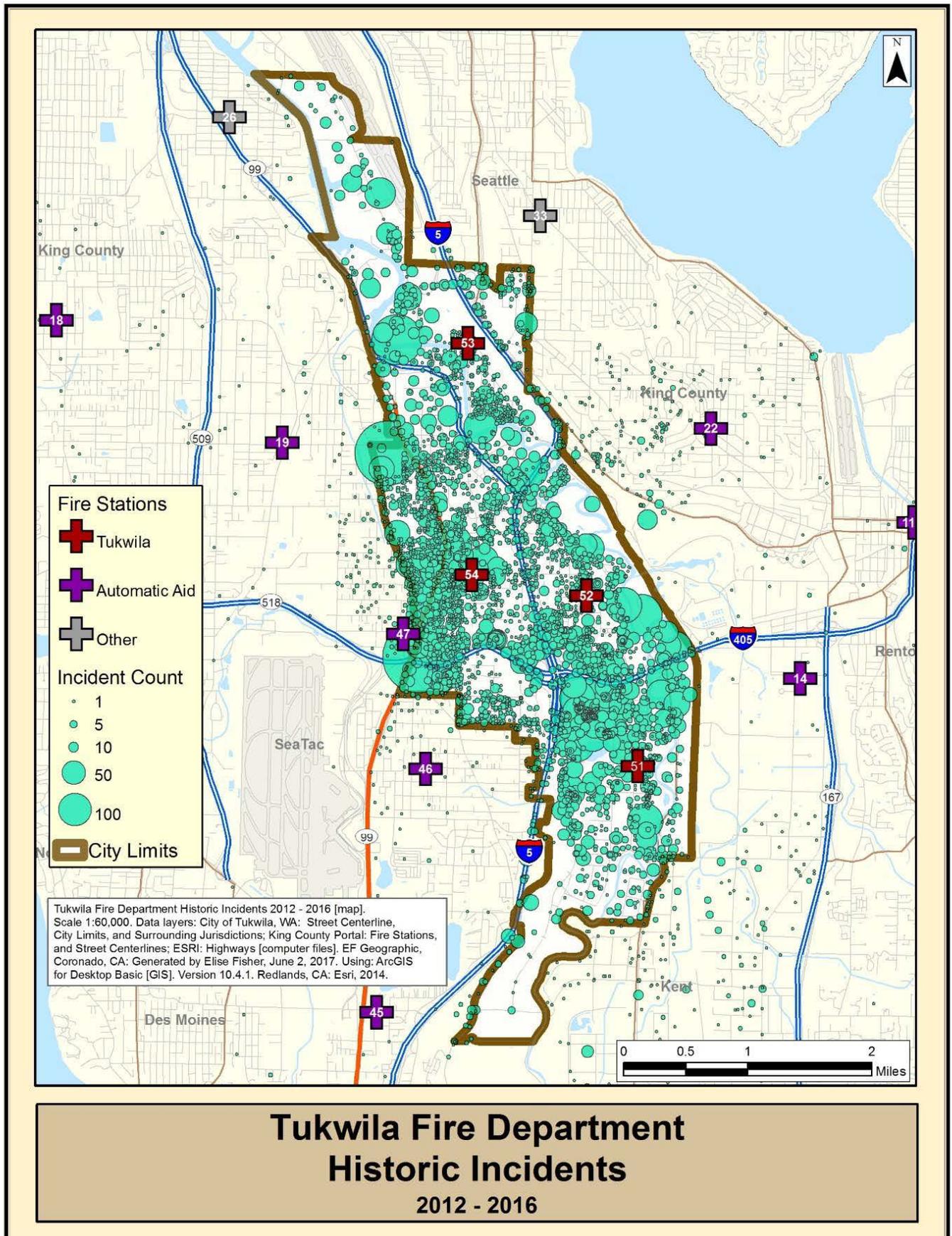
Total TFD emergency responses in 2016 were 18.7 percent higher than in 2012. Most fire departments in growing areas such as Tukwila will see increases in activity, but increases at this level will have an impact on the ability of emergency responders to respond effectively. The increase is primarily driven by the growing number of medical emergencies, which have increased 19.9 percent from 2012 to 2016. EMS incidents account for 68.7 percent of all calls over the past five-years. The number of fires has increased by 10.8 percent from 2012 to 2016. The number of false alarms has grown 14.5 percent, the hazardous materials responses have grown by 16.8 percent, and the good intent calls have risen 38.8 percent over the five-year period. Map 3 below shows the location of all incidents over the past five years.

Using the NFPA 1710 Standard for emergency response travel time of four-minutes 90% of the time for fire engines, the current station locations provide adequate response travel time to all emergency incidents within Tukwila. Map 4 below provides an overview of four-minute response travel times from the current fire stations for fire engines. NFPA 1710 also specifies an eight-minute travel time for ladder companies, Map 5 shows the current ladder company response within eight-minutes 90% of the time.

In addition to the four-minute travel time, NFPA 1710 also includes metrics for an *effective response force* (EFR), also referred to as an *effective firefighting force* (EFF), of 17 firefighters arriving within an eight-minute time frame 90% of the time for 2000 square foot single family dwelling fires. TFD and the neighboring fire departments would not be able to meet this portion of the standard without the automatic aid provided by the surrounding fire departments and TFD. The total on-duty strength for TFD is usually 14 firefighters. Map 6 illustrates the eight-minute response for an ERF of 17 firefighters with automatic aid provided by surrounding fire agencies and TFD. Maps were also developed for fire scenarios for a minimum of 15 firefighters and for high-rise fires, requiring 26 firefighters within eight-minutes 90% of the time.

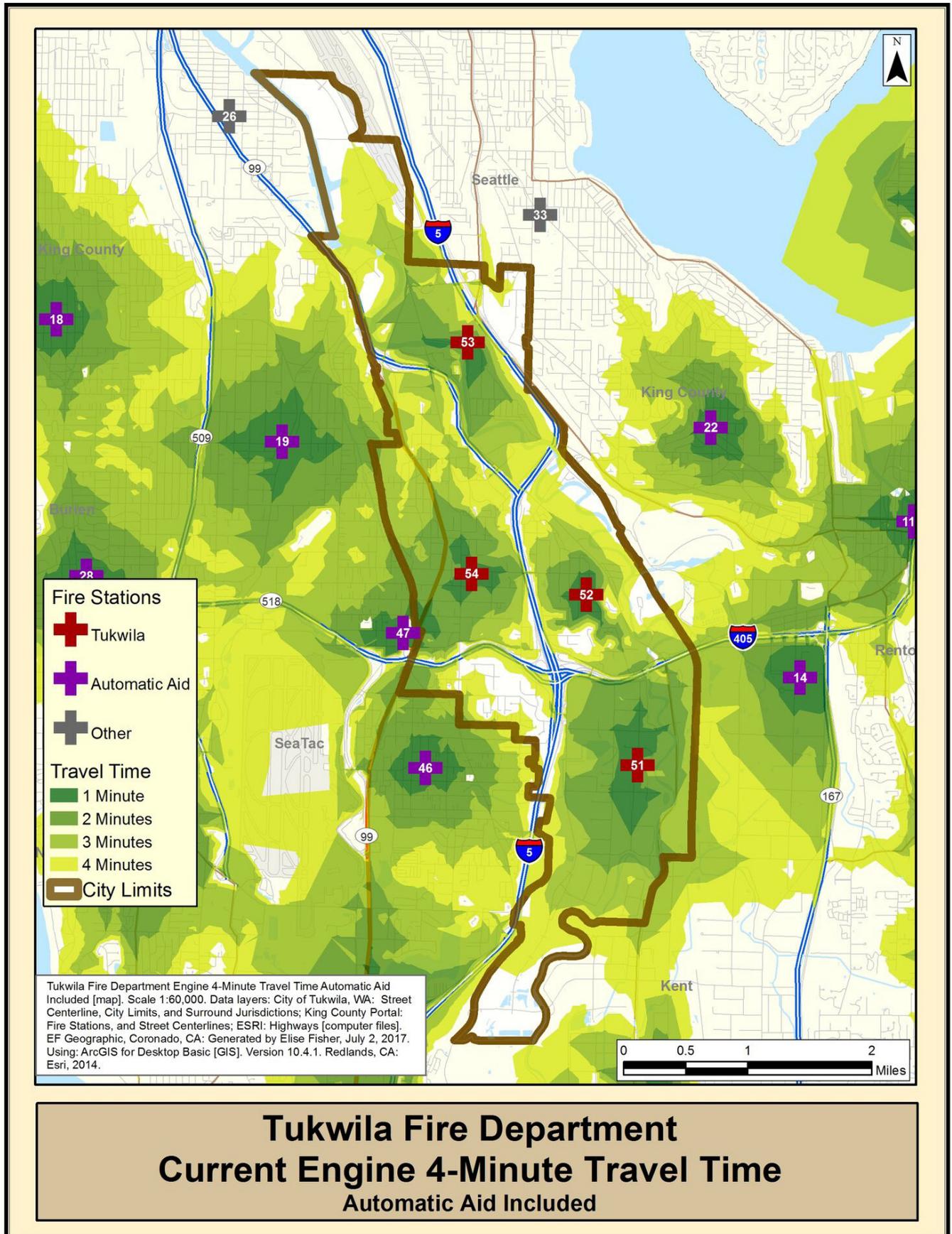
In analyzing the GIS data for Tukwila over 200 maps were created to illustrate several scenarios for this study, as well as maps requested by the City during the study. Many of the maps are included in this report to support the recommendations for fire station locations. Appendix IV includes additional GIS maps of interest. All the maps developed are not included in this report. These maps are available to the City to use as needed.

Map 3 – All Emergency Response Incident Locations: 2012 - 2016

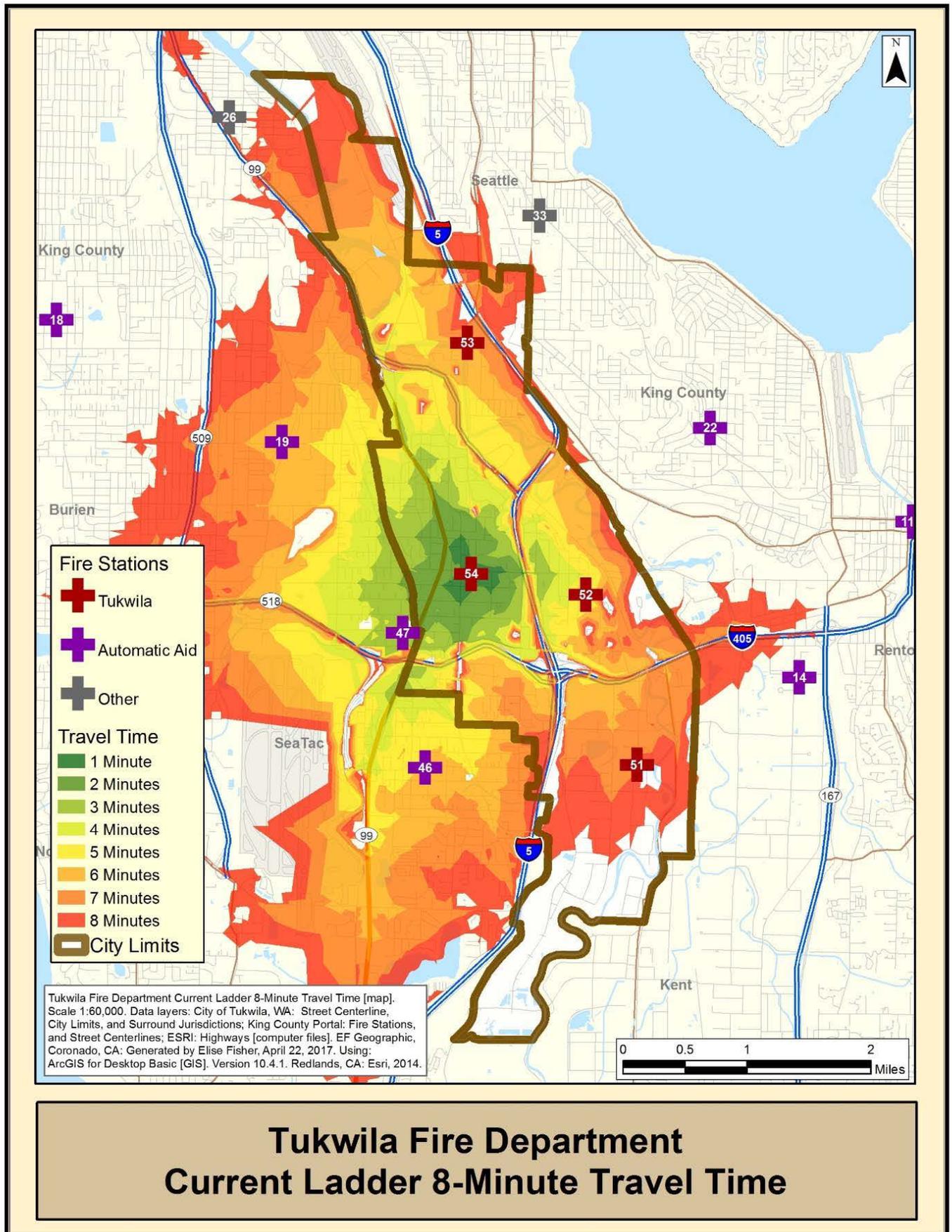


**Tukwila Fire Department
 Historic Incidents
 2012 - 2016**

Map 4 – Current Four-Minute Travel Time from Existing Fire Stations for Engines

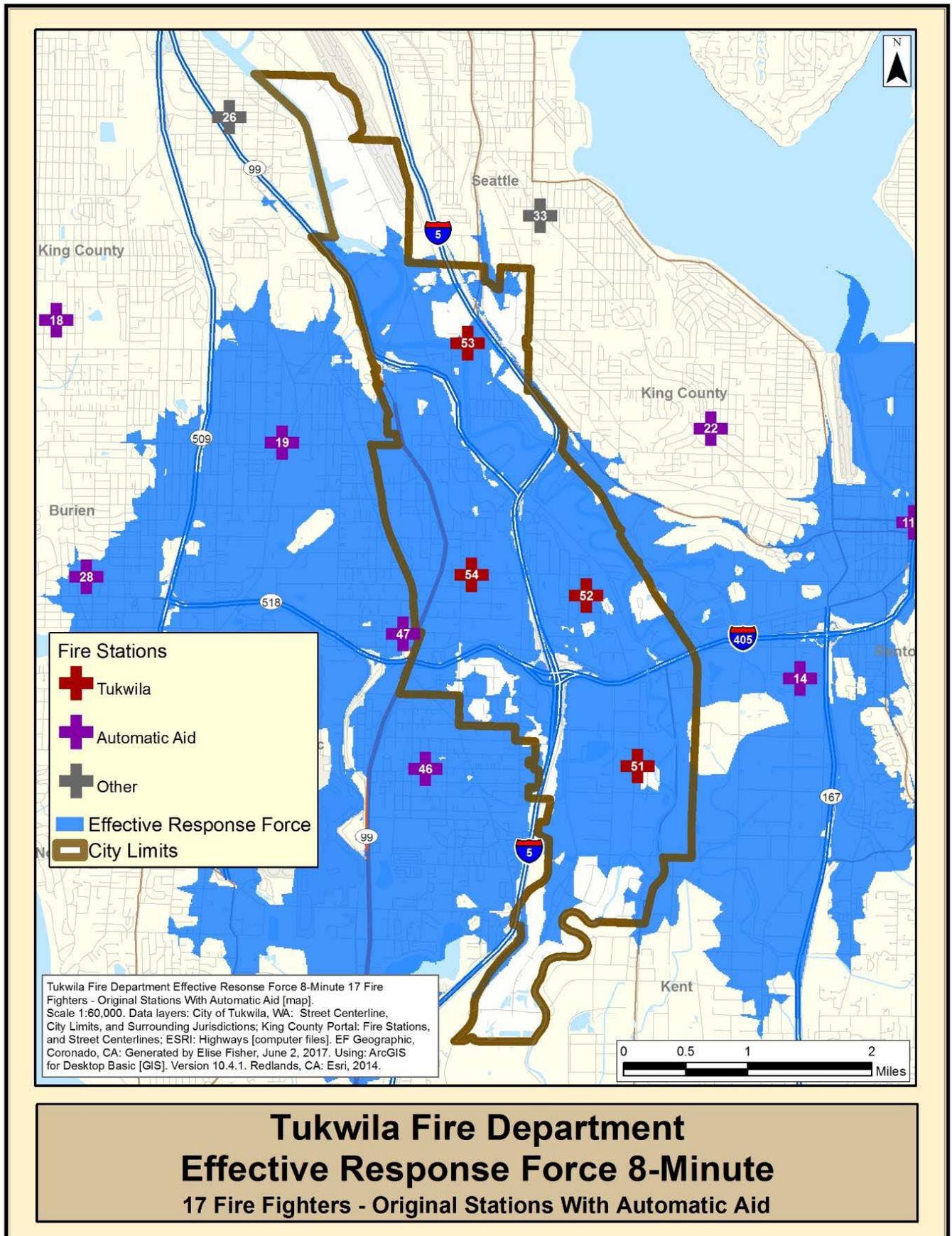


Map 5 – Current Eight-Minute Travel Time for Ladder 54



Tukwila Fire Department Current Ladder 8-Minute Travel Time

Map 6 – Effective Response Force (ERF) for Residential Fire Response: Eight-Minutes



Fire Station Location Considerations

As previously noted, appropriate fire station locations are necessary to ensure that firefighters can respond rapidly and mitigate emergencies within survivable time frames (See Figure 1 below). As the city has grown, Tukwila's fire stations have generally provided an acceptable level of service. TFD's automatic aid agreements with Renton Fire Authority and Puget Sound Fire Authority as well as Fire District 22, Burien and Skyway have benefitted all organizations by providing essential resources to assemble effective fire fighting forces, provide emergency medical services and special rescue operations.

The key to the ability for firefighters to mitigate a fire or medical emergency is response time. Response time is the interval of time that is broken down into three components.

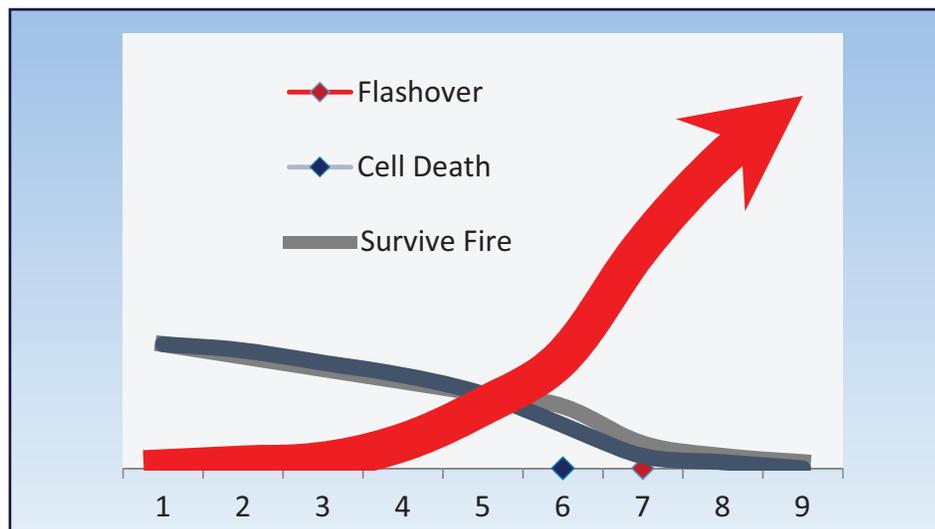
First is call receiving/dispatching time. This segment includes the time from when the telephone rings in the 911 center until dispatchers have gotten the information they need and notified the appropriate resources to respond. NFPA 1710 specifies that calls should be answered within 15 seconds 95

percent of the time and processed within 60 seconds for 90 percent of alarms.

Second is turnout time. This is the elapsed time between when firefighters are notified of an alarm, don their gear, and are on their truck moving out of the station. NFPA 1710 specifies that turnout time should be no more than 80 seconds for fires and special operations and no more than 60 seconds for medical emergencies.

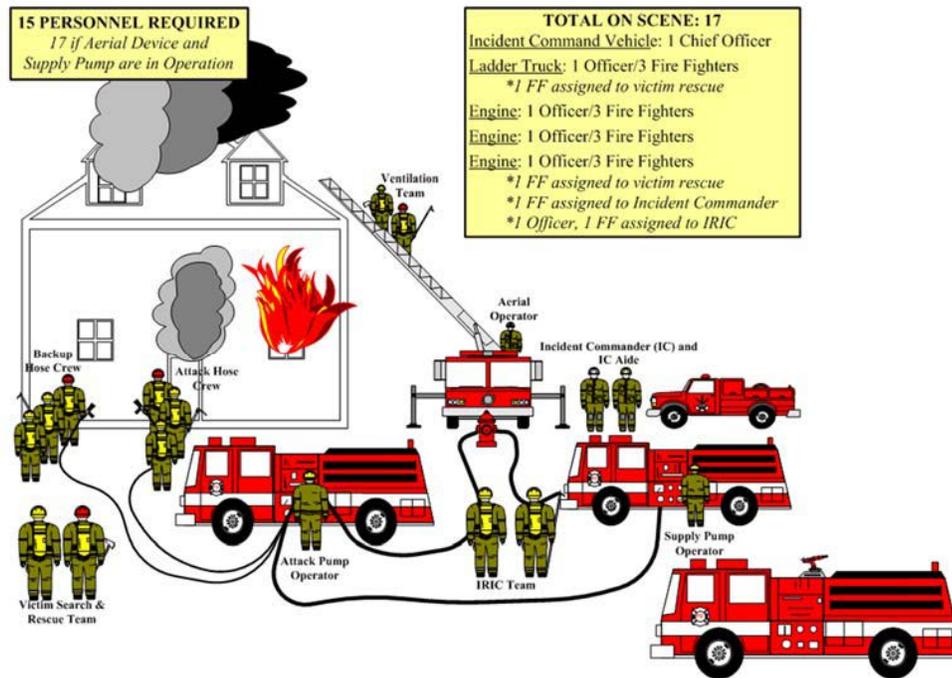
Third is travel time. NFPA 1710 sets out a requirement that the first responding fire company should travel no more than 240 seconds to an emergency. This four-minute travel time for the first responding fire company is significant for two reasons. First, a person in cardiac arrest will suffer brain damage without intervention within four to six minutes after the heart stops. Second, a fire will reach flashover – when a room and its contents erupt into flames – within six to eight minutes after ignition. Firefighters must arrive quickly and be ready to act, to save lives. The chart in Figure 1 below highlights response time with cardiac survival and fire development.

Figure 1 – Fire Development and Survival vs. Time



Likewise, NFPA 1710 defines an effective fire fighting force as the firefighters needed on-scene in a reasonable timeframe to safely and successfully mitigate emergencies that cannot be handled by one fire company alone. Research on fire operations conducted by the National Institute of Standards and Technology (NIST), in partnership with several fire service organizations, determined that seventeen firefighters arriving within eight minutes of travel are the optimal force to effectively fight a structure fire in a 2000 square foot residential structure without exposures. Figure 2 below illustrates one scenario of an effective firefighting force.

Figure 2 – Fireground Staffing Requirements of NFPA 1710 – Effective Fire Fighting Force



Source: NFPA 1710 Implementation Guide – International Association of Fire Chiefs/
International Association of Fire Fighters, 2002

A fire company consists of a piece of fire apparatus (heavy-duty vehicle) and the firefighters assigned to it, with the equipment they need to provide services. For effective services, there should be one officer, a driver/operator, and two firefighters. All or several may be certified as emergency medical technicians or paramedics, if their department provides EMS. An effective fire fighting force for a fire in a 2000 square foot single family dwelling consists of four fire companies, each staffed with four fire personnel, and a command officer, for a total of seventeen firefighters and officers. Several studies, including those conducted by the National Institute of Standards and Technology (NIST), have demonstrated that this is the number of personnel to effectively mitigate these types of fire incidents. Since all fire departments in South King County staff fire apparatus with an officer, driver and one firefighter, additional apparatus would need to respond to assemble the firefighting force of seventeen firefighters listed in the Standard.

Fire departments send the closest available resource (engine, tower, quint, squad) to an emergency. If the closest resource is not available, the next closest resource is automatically selected by the dispatching system and sent. This creates a cascading effect in the community where busy areas of the community draw resources from slower parts of the community. Response times in a local area and in the entire community can be negatively impacted if adequate resources are not in place.

Fire stations are expensive to build and operate and their locations should be selected for long-term service. Spacing is important and should vary by population density. At a maximum, fire companies from two adjacent stations should travel four minutes before meeting. In a suburban setting, that might be four to five miles. In a more developed area, it might be as little as

a mile. Travel time is also impacted by other factors such as traffic, natural and man-made barriers, and the street network. These considerations need to be addressed when assessing fire station locations.

The primary issue for TFD is the department's ability to provide commensurate services and equitable response times throughout the city. TFD needs to be able to respond with the same number of fire companies in the same time frame to similar areas. In other words, an effective fire fighting force should be identical for a single-family house in northwest Tukwila as in the southwest or downtown, or anywhere.

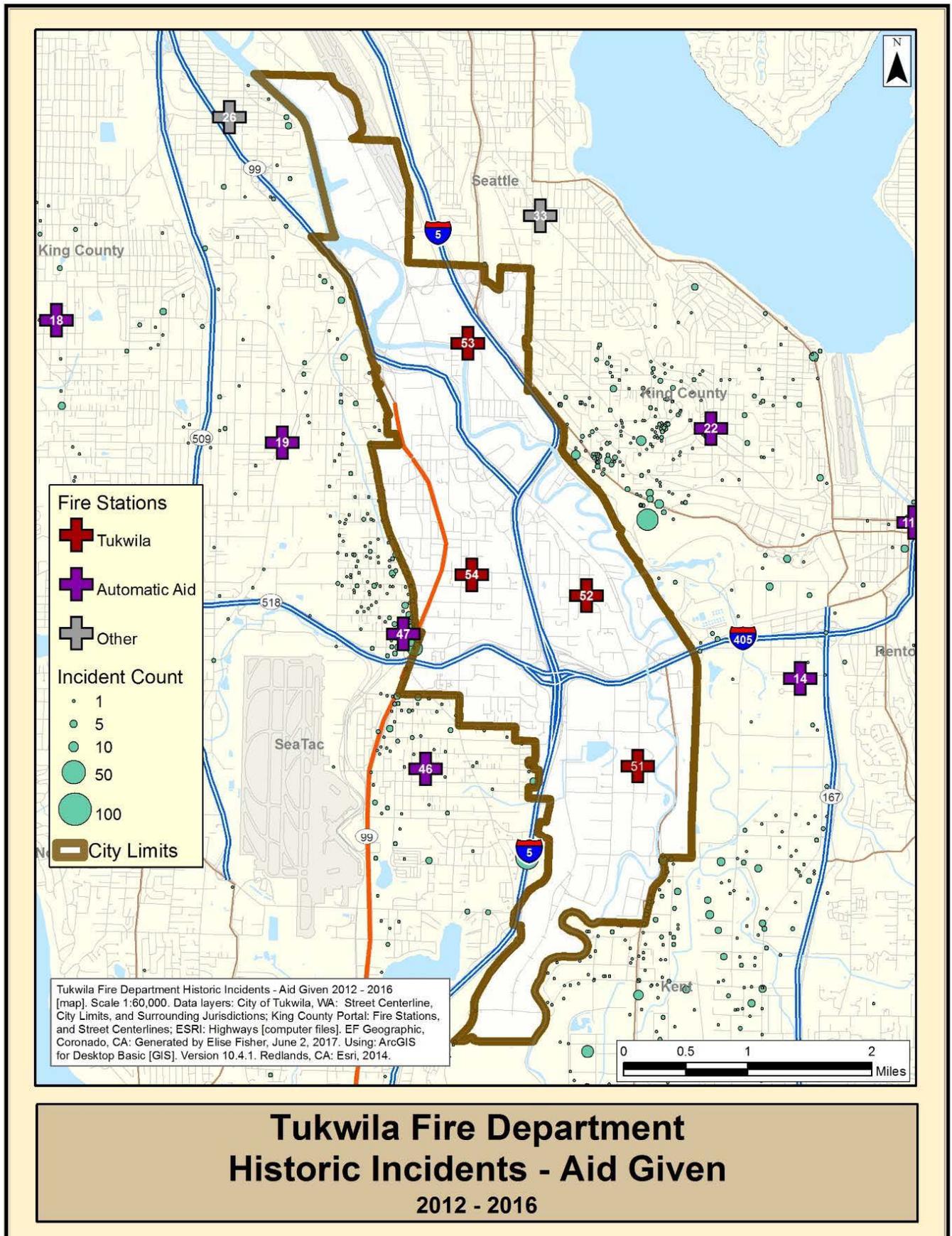
Automatic and Mutual Aid in Tukwila

The fire departments in South King County all participate in some form of mutual aid or automatic aid to respond to emergency incidents in a timely manner with the resources needed to mitigate an emergency. Automatic aid is given and received by TFD by the surrounding fire departments, primarily the RFA and the PSRFA. Under the automatic aid concept, the closest fire apparatus responds to the emergency regardless of geopolitical boundaries. The response is automatic and included in the Valley Com dispatch or response plan. Under the mutual

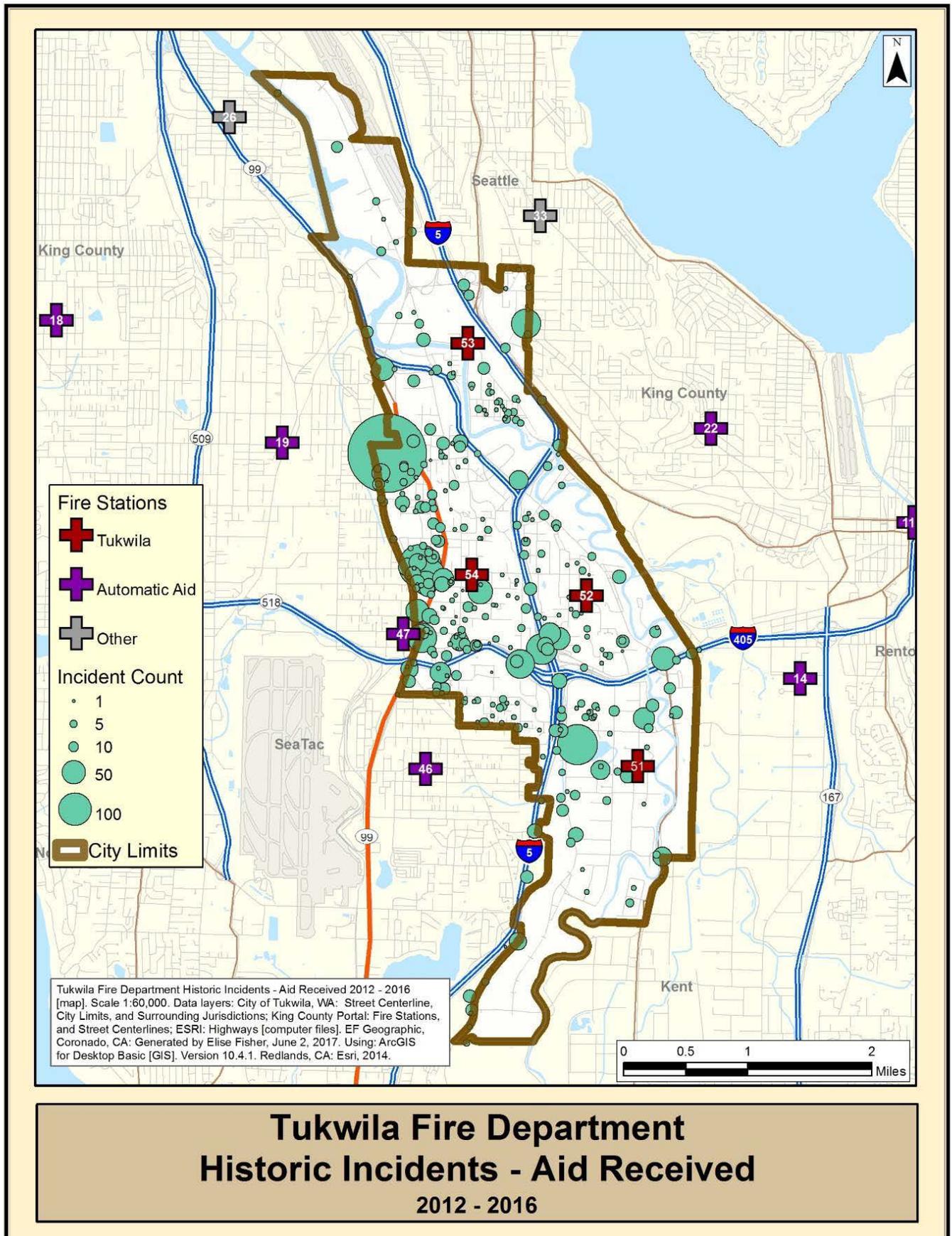
aid concept, response by an agency to another jurisdiction must be approved by someone at the time of the request. This response is not automatic and may be delayed.

Maps 7 and 8 below illustrates the locations of responses where automatic aid was given or automatic aid was received by the City of Tukwila for all incidents.

Map 7 – Automatic Aid Given by Tukwila Fire Department: 2012 - 2016



Map 8 – Automatic Aid Received by Tukwila Fire Department: 2012 - 2016



Tukwila Stakeholder Interviews

Although identifying potential locations for fire stations is determined through an objective analysis process using data from the City's and other jurisdictions geographical information systems, at least 78 face-to-face interviews or phone interviews were completed by the consultants. The purpose of the interviews was to allow all interested stakeholders to have input and voice their concerns.

The first interviews were conducted on January 20, 2017 and continued through the completion of this project. In addition to these interviews, approximately 10 residents provided input or had questions regarding this project at the Open House on March 18, 2017 at Fire Station 54.

The interviews are categorized by the following groups of stakeholders:

- Elected Officials - 7
- City Administrators – 3
- Fire Department Administration – 5
- Fire Department Rank and File Members – 41
- International Association Fire Fighters Local 2088 Executive Board – 6
- Neighboring Fire Department Officials - 3
- Valley Communications Representative – 1
- Segale Properties Owner – 1
- Shiels Oblatz Johnsen, Inc. (SOJ) Representative – 1
- Open House Attendees – 10

On January 20, 2017, the initial kick-off meeting was conducted with the fire chief to review and confirm a detailed understanding of the scope of work to be performed for this project. Several documents related to the fire

department, including previous consulting studies and reports, were provided prior to this meeting. The consultants confirmed whether there were additional documents that needed to be provided as well as the significance of these documents in relation to this study. A list of documents provided to the consultants are in Appendix I. In addition, a list of stakeholders who were to be interviewed for this project was reviewed and additional stakeholders were identified by City representatives.

After the meeting with the fire chief, Mayor Ekberg and City Administrator David Cline met with the consultants. During this meeting additional background information, including the previous consideration of a regional fire authority (RFA) annexation in 2015 and 2106, history regarding the fire department and the Public Safety Bond was provided. An overview of potential future growth in the City of Tukwila was provided. Because Tukwila is essentially land locked and largely built out (except for the Tukwila South area) most of the growth will occur in the following ways:

- Development of a major corporate campus, associated housing and support retail in the Tukwila South area
- Mixed use mid-rise projects in the Southcenter area and along Tukwila International Boulevard
- A few dozen single family infill houses per year in neighborhoods throughout the City
- Development of higher intensity industrial uses in the Manufacturing Industrial Center area

Additional information regarding potential growth in Tukwila and the impact on emergency services is addressed later in this report.

The Mayor and City Administrator reiterated the importance of this project since once built, a fire station may be used for 50 years in addition to the potential impact on the regional response to emergency incidents. Because of a previous developer agreement, the location for one fire station in the Tukwila South area has been secured. Some in the community, including fire department members, have voiced concern regarding the proposed station location at 180th Street and Southcenter Parkway. During this meeting, it was mentioned that significant public involvement and input, through the City's Community Connectors Program and other means, is extremely important to the City. Additional questions were asked of the consultants including the number of fire stations needed in Tukwila, Engines versus Ladders and Aid Cars assigned to fire stations, and the appropriate location for fire department headquarters.

On January 20 and 21, 2017 the consultants met with the on-duty fire department staff members at all four fire stations to explain the scope of this project, answer any questions and listen to their concerns. A variety of concerns were expressed by these firefighters including not locating fire stations in earthquake or flood areas, the hill and gas pipeline on the new Station 51 site, station security, traffic issues related to medians and other traffic calming remedies, and the impact on the regional response system currently in place. In addition to voicing concerns, several potential locations for new fire stations were presented based on their knowledge of available land to build on.

The consultants returned to Tukwila on February 5, 2017 and conducted interviews on the 6th and 7th at several locations. In the morning of February 6th, the consultants met with members of the fire administration team to better understand the needs of the department. During these interviews

several issues were mentioned, including the following:

- The department has developed a list of priority items to be addressed in new fire stations with input from rank and file firefighters
- Current facility maintenance issues at fire stations
- Concerns with overall daytime traffic and the addition of traffic calming devices/ methods
- Extreme variance between daytime (approximately 150,000) and night time population (approximately 19,000) affecting emergency response times and availability
- Redundancy of major equipment in each station, i.e. SCBA air compressor
- Topography concerns and weather conditions
- Opticom system does not pre-empt crosswalks; department policy on driving over the speed limit
- Fire stations located in residential areas versus location on major thoroughfares
- Future growth areas in Tukwila
- Location of training area/function on the new Station 51 site – may result in savings from training consortium
- Station size, number of dorms, number of bays, storage space, etc.
- Headquarters location issues
- Potential station sites available

In the afternoon of February 6th and morning of the 7th the consultants were able to meet with six of the City Council Members in separate meetings. The Council Members provided additional background regarding the current fire stations and concerns that residents have voiced regarding

fire department services and fire station locations. Some of the Council Members mentioned potential sites available for new fire stations. The Council Members raised the following issues and concerns:

- Moving Station 52 will be concerning to the residents in this area
- Concerned about the potential growth in the south part of the City
- Need a fire station in the south part of the City
- The location of the fire department headquarters
- Co-locating additional City services in new fire stations, i.e. police substation, community meeting rooms, etc.
- Co-locating non-obtrusive revenue generating opportunities in new fire stations, i.e. radio and cell towers
- Shared fire stations with surrounding fire agencies
- Energy savings technology (LEED/Green) included to some extent in the new fire stations
- Concerned about increase in high-rise construction and impact to the fire department
- Size of new fire stations, number of bays, and one story versus two stories
- Concerned about construction and land acquisition costs – SOJ contracted for oversight
- City’s contractual commitment to development agreement with Segale Properties for fire station 51 site

The afternoon of February 7th the consultants met with the fire chief and deputy fire chief of the Renton Fire Authority (RFA), one of the fire departments that provides

emergency automatic-aid response services to the City of Tukwila. The meeting was held at the RFA headquarters that is located on the top floor of the Renton City Hall building, the same floor where the city administrators and elected officials are located. The chiefs provided an overview of RFA, including the number of apparatus, on-duty personnel totals, and incident volume. The area fire departments in South King County respond as a single response system with the fire departments responding into each other’s jurisdictions based on a predetermined emergency response plan coordinated by the Valley Communications Center and any change to the location of Tukwila fire stations affects that response plan. Fire apparatus and personnel from Tukwila respond to Renton and RFA responds to Tukwila on a frequent basis providing emergency services based on the closest fire apparatus, regardless of geopolitical boundaries.

Also on February 7th the consultants visited the Valley Communications Center, the regional 9-1-1 center that provides emergency communications services to communities of South King County, including Tukwila. The Valley Communications Operations Manager was interviewed, provided an overview and tour of the facility and provided response data for this study. The center known as “Valley Com” is a state of the art facility utilizing a sophisticated computer aided dispatch (CAD) system with highly trained personnel. Valley Com is a model consolidated emergency 9-1-1 communications center serving the public and first-responders, police, fire and EMS, in several South King County communities. Additional information regarding the organization and services provided by Valley Com can be obtained from their public website: <http://www.valleycom.org>.

On February 15, 2017, the consulting team returned and conducted interviews and information gathering on February 16th and 17th with several of the stakeholders including city officials and staff, fire personnel, the developer for Segale Properties LLC.

The morning of February 16th the consultants met with fire administrative staff, including the Assistant Fire Chief and on-duty Battalion Chief. The following information was provided:

- Proposed Station 51 site was narrowed down from 3 – 4 alternative sites
- Concerned about the lack of fire department maintenance services provided by the City, provided example for request to paint fire station 51 not completed – new stations need to be low-maintenance
- A single architect and construction company will be selected to design and build the new fire stations
- Consideration for shared fire station with Puget Sound Fire Authority Station 47 and Tukwila Station 54
- Mentioned multiple utility providers for water and energy in Tukwila
- Concern with natural gas and jet fuel pipelines running through Tukwila
- Critical infrastructure related to data centers and military operations in and around Tukwila, including the Jorgensen Forge facility and others unique to Tukwila

The afternoon of February 16th included interviews with the Directors of Community Development, Public Works, the Fire Marshal and Deputy Fire Marshal and the deputy fire chief for Puget Sound Regional Fire Authority (PSRFA).

Several maps outlining the zoning and development efforts in Tukwila were reviewed. Extensive infrastructure information and development concerns was provided by both Community Development and Public Works representatives, including the following information:

- Major topographical issues in Tukwila
- Major utilities running through Tukwila including fiber optics, water lines, gas lines, sewer lines
- Thirty years ago, Tukwila was 3 square miles with approximately 8,000 residents and today Tukwila consists of 9.8 square miles with approximately 19,000-night time residents and 150,000 daytime population
- Approximately 43,000 jobs in Tukwila
- Nine million square feet at Boeing, including the flight museum
- 1.7 million square feet at Westfield Southcenter Mall with expansion planned for complexity of uses
- Approximately 2,000 permits issued per year for tenant improvements and new construction generating approximately 90 million dollars a year
- Tukwila South consists of approximately 250 acres with 8 – 10 million square feet of potential commercial and residential use; site built out over 3 – 4 years; developer agreement expires in 2023
- Explained “streamline sales tax” and fire impact fees
- Described areas of growth including north industrial area tenant improvements, Southcenter/Urban center, north area near mall, and Tukwila International Blvd. (TIB)

- Need for new east to west corridors
- In-fill of approximately 30 single-family dwellings per year; multi-family residential near TIB and Southcenter
- Ryan Hill – lack of utilities; 640 dwelling in past 30 years, 600 new in the past 3 years
- Consideration of exceeding building codes and standards for public safety facilities, police and fire
- Major employer is Boeing with 12 – 14,000 employees; approximately 354 City employees; 3 – 4% growth in job market potential in Tukwila
- Approximately 2,800 existing businesses
- Location of tech companies like Amazon and Microsoft in Tukwila and world-wide impact if operations interrupted
- Tukwila is one of the 10 most diverse cities in the US – over 80 languages spoken
- Approximately 20% of population is considered lower income
- Ongoing upgrades to water and sewer near Washington Place
- Extension project on Strander Blvd. east and west
- “Super blocks” to breakup areas
- Additional items related to growth and development in Tukwila

The consultants then met with the Fire Marshal and fire prevention Captain who provided an overview of the fire prevention efforts within Tukwila. Fire inspections are conducted on a two-year cycle or sooner if needed. Several documents related to development in Tukwila, including future traffic calming features to the street network, were provided. Discussed the need for functioning fire stations over the design components. Expressed concerns over adequate funding to construct new fire

stations. Additional concerns regarding the components and functional issues of new fire stations was discussed and they prioritized the following:

- Enhanced response times
- Health and Safety of firefighters, minimize exposures
- Security
- Low maintenance facilities

On February 17th, the consultants met with the City’s Emergency Manager and Communications/Government Relations Manager who both provided additional information regarding Tukwila and the recently passed Public Safety Bond. The City’s Emergency Operations Center (EOC) will be located at the new Justice Center, not at fire department headquarters. Storage of specialty fire apparatus, including boats and trailers will possibly be located at the new Public Works facility. Concerns were voiced regarding the potential noise level at fire stations located in residential neighborhoods and the need for firefighters to be good neighbors.

The City’s Communications Manager described the activities and events planned to engage the community in the process and provide necessary education related to the siting of new fire stations. Both an online open house and a live open house at Station 54 are planned. One of the primary goals is to explain what the fire department does and need for “equitable response times” to emergency incidents city-wide. Additional information regarding this study was provided including:

- Approximately 250,000 vehicles a day travel through Tukwila resulting in several freeway incidents
- Fluctuation between daytime (150,000) and night time (19,000) population and impact on fire department responses

- Recovery aspects in the aftermath of emergency incidents

Also on February 16th the consulting team met with Mark Segale, developer and owner of Segale Properties LLC. Mr. Segale provided the property for fire station 51 to the City of Tukwila through a development agreement. Mr. Segale provided an overview of the Tukwila South plan including the following:

- Approximately 250 acres of development property
- Approximately 8 million square feet of development including office campus, retail and residential
- 125 feet height restriction on construction
- Creating an urban environment, live-work-play
- Build-out timing depends on market demand
- Several flat graded pads for commercial and civil construction ready to go
- Infrastructure phase has been completed
- Station 51 property consists of approximately 3 acres of buildable land
- Significant preparation of station 51 site including grading to reinforce slope and relocation of underground gas line

The next meeting on February 17th was with the Mayor and City Administrator at City Hall. During this meeting, the consultants provided an overview of the National Fire Protection 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 that is being used for the response time and effective response force analysis for this study. The Mayor requested that the analysis include more than the two-years of GIS response data, the consultants used five years of data for

the GIS analysis. Several questions were addressed at this meeting including the following:

- Best ladder truck location
- Aid car response versus engine or truck response
- Effect of combining stations 47 (PSRFA) and station 54 on response
- The right number of fire station in Tukwila – 3, 4 or 5

The consultants were also informed that the City's current fire code requires residential fire sprinkler systems in new construction. Additional information regarding future growth was also provided and discussed.

The consultant attended the public open house event on March 18, 2017 at fire station 54. The open house was well planned and well attended. Several Community Connector representatives were in attendance. Poster boards with information and data for the Public Safety Bond was highlighted as well as the opportunity for residents to provide written comments or suggestions. The consultant's role at the open house was to answer any inquiries related to this study, its methodology and answer any general fire service related questions. Approximately 10 residents interacted with the consultant during the open house. The consultant also had conversations with city staff members, elected officials and SOJ representatives.

On April 4, 2017, a telephone interview with a representative of SOJ was conducted. The role of SOJ was explained to the consultant and the impact of this study regarding the actual locations deemed best based on the GIS analysis. Several questions regarding fire services in general and specific fire department operational questions were answered by the consultant.

Burning Questions from Interviews

During the interviews conducted in support of this study, there were a lot of questions asked regarding this study and how potential locations are determined as well as a lot of general fire department operations questions. Some of the questions were asked on multiple occasions from different people. The section of the report will attempt to answer the most common questions raised.

- ***Why does the City need four fire stations, three should be adequate?***

The number of fire stations needed in a community is determined by several factors starting with a community risk assessment from an all-hazards perspective and developing a community risk reduction (CRR) plan. This process includes a risk assessment, prioritization of risks, developing strategies to mitigate risks, implementing a CRR plan, monitoring the plan, and evaluating the plan. One way of developing a CRR plan is to develop a comprehensive standards of coverage plan using the guidelines established by the Center for Public Safety Excellence (CPSE) through its CFAI program (see page 8). Additional information is available at: <http://publicsafetyexcellence.org>.

In addition to the CRR plan, other considerations include the City's and TFD's ISO rating. The ISO establishes the cost for fire insurance premiums based on its PPC program (see page 8). A reduction from four fire stations to three fire stations may affect the City's ISO rating potentially impacting fire insurance premiums, mainly for commercial occupancies.

In addition, the community's expectation regarding the delivery of fire services, the City budget, mutual and automatic aid resources and other factors need to be considered.

- ***Why doesn't the fire department replace an engine with an aid car?***

Fire departments in the United States are all-hazards organizations and must be capable of responding with the appropriate apparatus and number of firefighters. In Tukwila EMS incidents account for 68% of all incidents and EMS incidents have increased 19% in the past five years. Although the number of fire incidents only account for 6.27% of all calls, fire incidents have increased by 10.8% since 2012. TFD must maintain appropriate fire apparatus and firefighters to effectively respond to these fires.

It is a common practice in the U.S. fire service to use the closest fire apparatus for EMS incidents. Fire apparatus usually consists of engines and ladder trucks. As described in the section on CRR plans, the type and number of apparatus is based on the community's standards of coverage. There may be more EMS incidents responded to than fire incidents, but the overall risk to the community is greater from fire incidents than the risk from multiple single EMS incidents. By responding to EMS incidents in smaller vehicles with less personnel, the risk of having a fire engine or ladder truck not available for a fire incident is greater.

There have been debates regarding wear and tear of a larger apparatus versus a smaller response vehicle. The consultants have reviewed relevant documents and studies and the increase in the per mile cost is minimal compared to the risk of not having the appropriate fire apparatus and firefighters available for fire incidents.

- ***Why is this study needed to determine fire station locations?***

The primary purpose of this study is to objectively determine potential fire station sites for the City of Tukwila. The methodology for determining the locations is described elsewhere in this report.

Building and staffing a fire station are costly. Fire stations are usually operational for more than 30 years. The goal in locating these fire station sites is to provide equitable services and response times to all parts of the City. During the interviews for this study, several locations were suggested based on the individual's opinion and knowledge of available land to build on. The locations suggested by this study are based on objective data analysis.

- ***How big should new fire stations be?***

This question was asked frequently. The size of the new fire stations in Tukwila should be determined by evaluating several factors including services to be delivered, the impact of future growth and development, the number of anticipated firefighters assigned to each station over the next 30 years, the anticipated fire apparatus assigned to each station, the functions needed at each station, co-locating additional services or functions at stations, and several other factors. The ultimate decision on size will be based on the needs of the community and the funding available to construct the new fire stations.

Summary of Interviews

Information collected during the interviews and answers to some of the questions, included in this report, provided the consultants with the history and background information in Tukwila to understand the critical nature of this report and effect on the City of Tukwila in the near future and well beyond. Fire stations can be operational for more than thirty-years and must be located in a strategic manner for current incident response as well as future incident response predictions. Almost everyone interviewed mentioned growth and increased daytime populations and its impact on traffic in general as well as the impact on emergency responses. The

uniqueness of the City was also mentioned by most participants interviewed including topography, transportation barriers, multiple critical infrastructure, especially utilities, data centers, military projects, and the work at Boeing. Several of those interviewed provided locations for potential fire station sites based either on their knowledge of available property or their interpretation of response volume and access to emergency incidents. The questions raised in the interviews are addressed in this report.

Geographical Information System (GIS) Analysis

Key to this study is the analysis of current and historical data collected by the City of Tukwila, King County and the Tukwila Fire Department. This data analysis is conducted using a computer software program called ArcGIS for Desktop. The Network extension of the software contains the Location-Allocation tool, which is utilized to solve fire station location problems by choosing locations that includes all or the greatest amount of demand within a specified impedance cutoff. The impedance cutoff is travel time, 4-minutes for engine analysis and 8-minutes for ladder analysis. Included in this analysis is the Tukwila street network. The Tukwila street network is built by combing street segment, intersection characteristics and special accommodations.

Existing attributes and street segment attributes in the GIS data, such as length, speed, direction of travel, and calculated slope. Intersection attributes are also incorporated such as elevation (for over/under passes) and turn delay (left-4 seconds, right-2-seconds, and straight-0.5 seconds). Special accommodations include speed bumps, street closures, and school zone modifications (20 MPH), and apparatus restrictions.

This is the same software used by the International Association of Firefighters conducting GIS related analysis studies for communities.

Data Issues and Delays

This report was delayed approximately 60 days related to the data analysis portion of this study. The reasons for the delay are listed below.

- CAD Data
 - Last CAD data component received on: 04/20/2017
 - CAD Data Analysis Delays:
 - ◆ Duplicate apparatus deletion
 - ◆ Invalid XY Coordinates
 - ◆ Aid Given Data merging
 - CAD Data General Issues:
 - ◆ No AVL
 - ◆ Invalid XY Coordinates
 - ◆ Truncated data (between systems)
 - ◆ Send to wrong call type
 - ◆ Direct export from CAD unreliable
 - ◆ Original data received from Tami contained invalid XY coordinates

- Routing
 - Last street modifications received on: 04/20/2017
 - ◆ Routing Delays
 - Street network modifications
 - Addition of speed bumps, delays, and closures
 - Street network customizations
 - Two network versions for separate engine and ladder routing.

With the assistance of TFD members with GIS experience, the FACETS GIS Analyst corrected all five years (2012 – 2016) of the incident response (CAD) data as well as the street network data. The clean data is available to the City of Tukwila to use as needed. Steps should be taken to eliminate the data inaccuracies/errors from the data bases for future GIS related studies.

Fire Station Location Recommendations

Several scenarios for fire station locations were calculated and over 200 maps were created. Maps were developed for daytime, night time and combined day and night times. The optimal locations for fire stations shift between day and night because of incident volume and traffic considerations. Recommendations for fire stations for this study are based on the combined day and night call volume and traffic.

The consultants developed maps with locations for three, four or five fire stations if Tukwila was an island to itself without any fixed fire stations or automatic aid. Maps 9 – 11 are based on combined day and night factors. These maps were included to illustrate the current fire station locations and to forecast future potential sites in the event the neighboring fire departments or fire districts were to relocate fire stations further away from Tukwila.

Map 9 shows that the best locations for three fire stations that would be at or near the following locations:

- Fire Station 1 – Interurban Ave S. & Gateway Dr.
- Fire Station 2 – Tukwila Parkway, S. of the I-405 Ramp
- Fire Station 3 – Southcenter Blvd. & Western City Boundary

Map 10 shows the best locations for four fire stations that would be at or near the following locations:

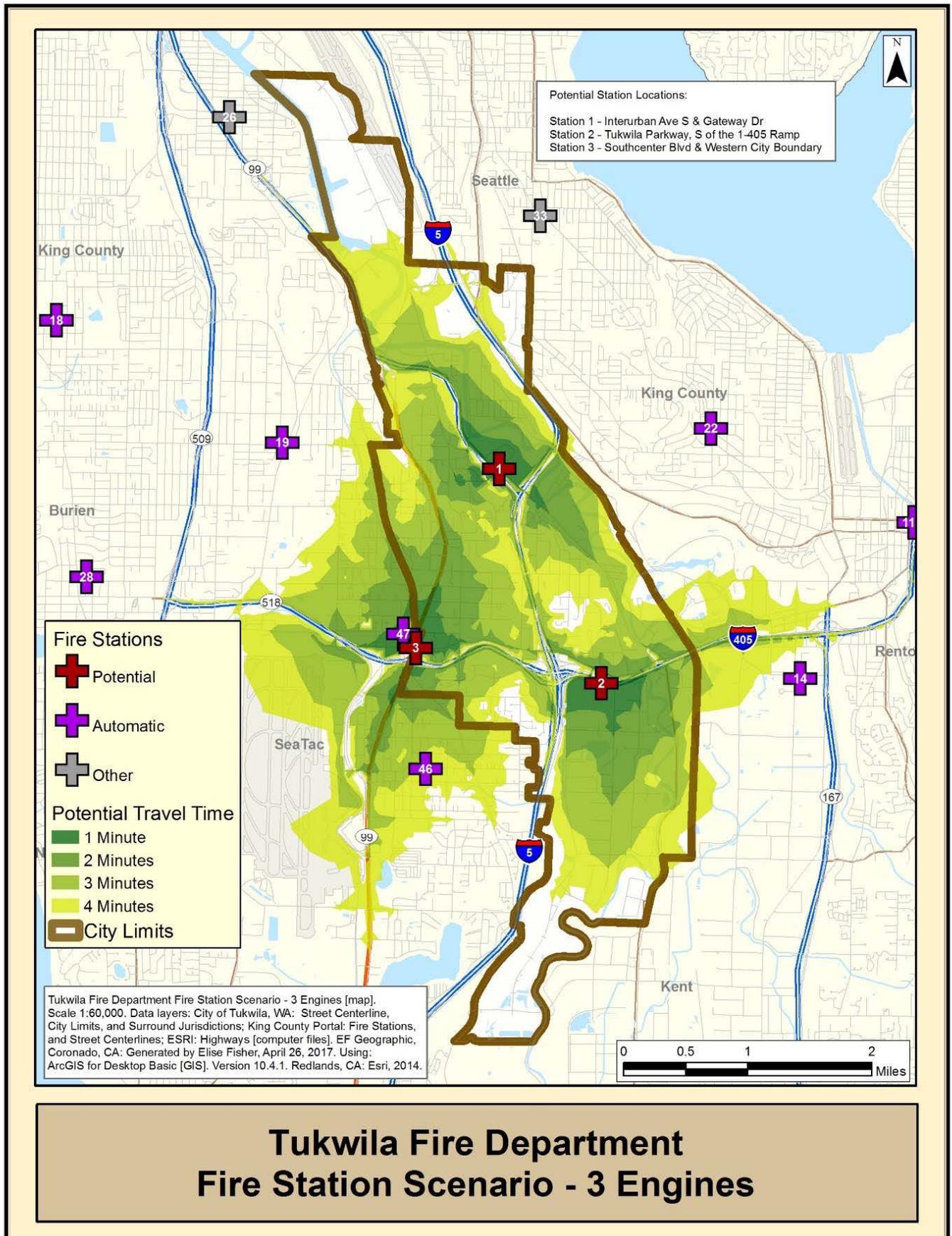
- Fire Station 1 – Boeing Access Rd., S. of Airport Way Intersection
- Fire Station 2 – S. 133rd St. & 134th Pl.
- Fire Station 3 – Southcenter Blvd. & S. 154th St.
- Fire Station 4 – Tukwila Parkway, S. of I-405 Ramp

Map 11 shows the best locations for five fire stations that would be at or near the following locations:

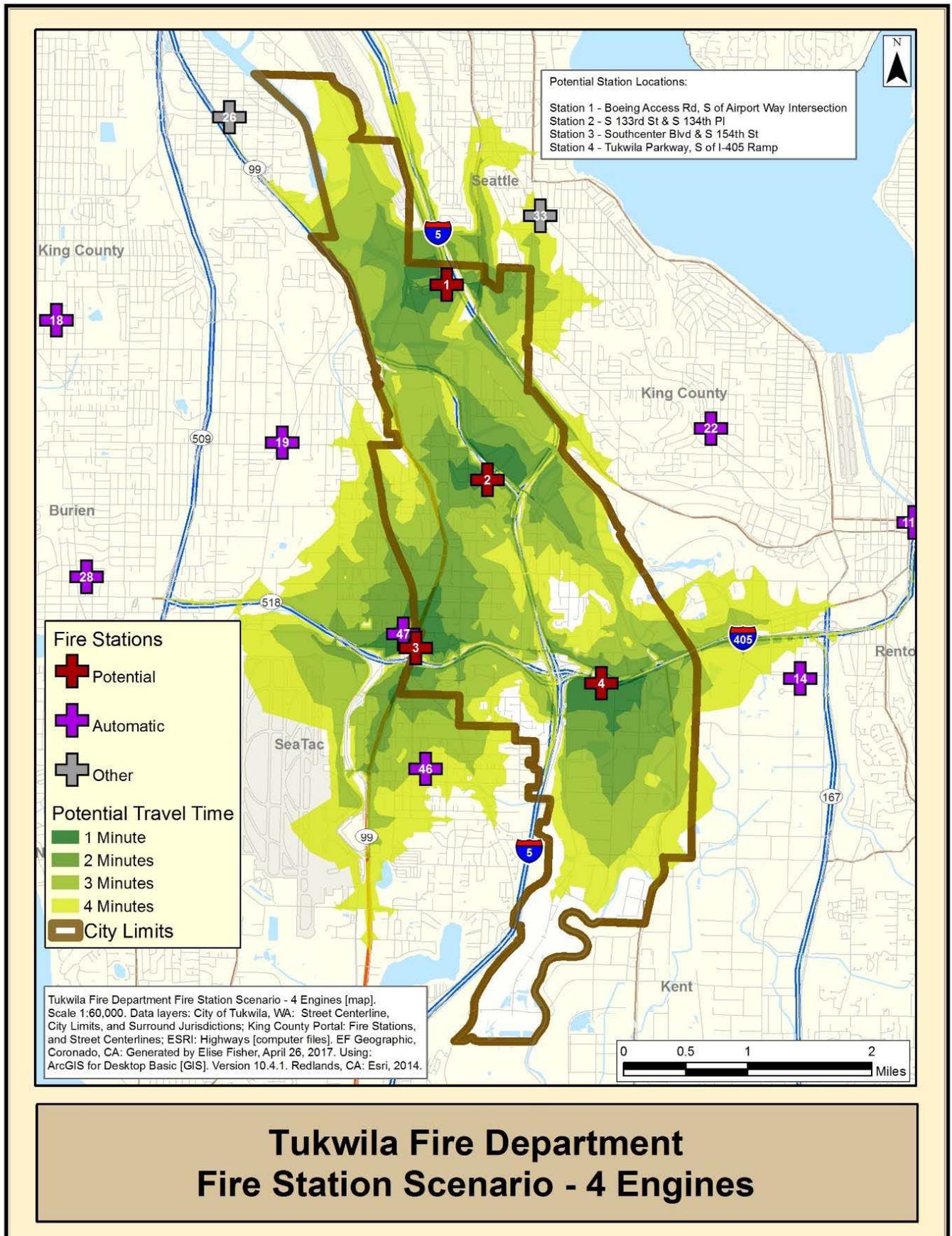
- Fire Station 1 – Boeing Access Rd., S. of I-5 Ramp
- Fire Station 2 – S. 133rd St. & 134th Pl.
- Fire Station 3 – Southcenter Blvd. & Western City Boundary
- Fire Station 4 – Southcenter Blvd. & 65th Ave S.
- Fire Station 5 – 53rd Ave. S & S. 160th St.

Based on the travel time of four-minutes and the historical incident volume a minimum of four fire stations are needed to continue to provide effective fire service delivery, five stations would be ideal if Tukwila were an island to itself.

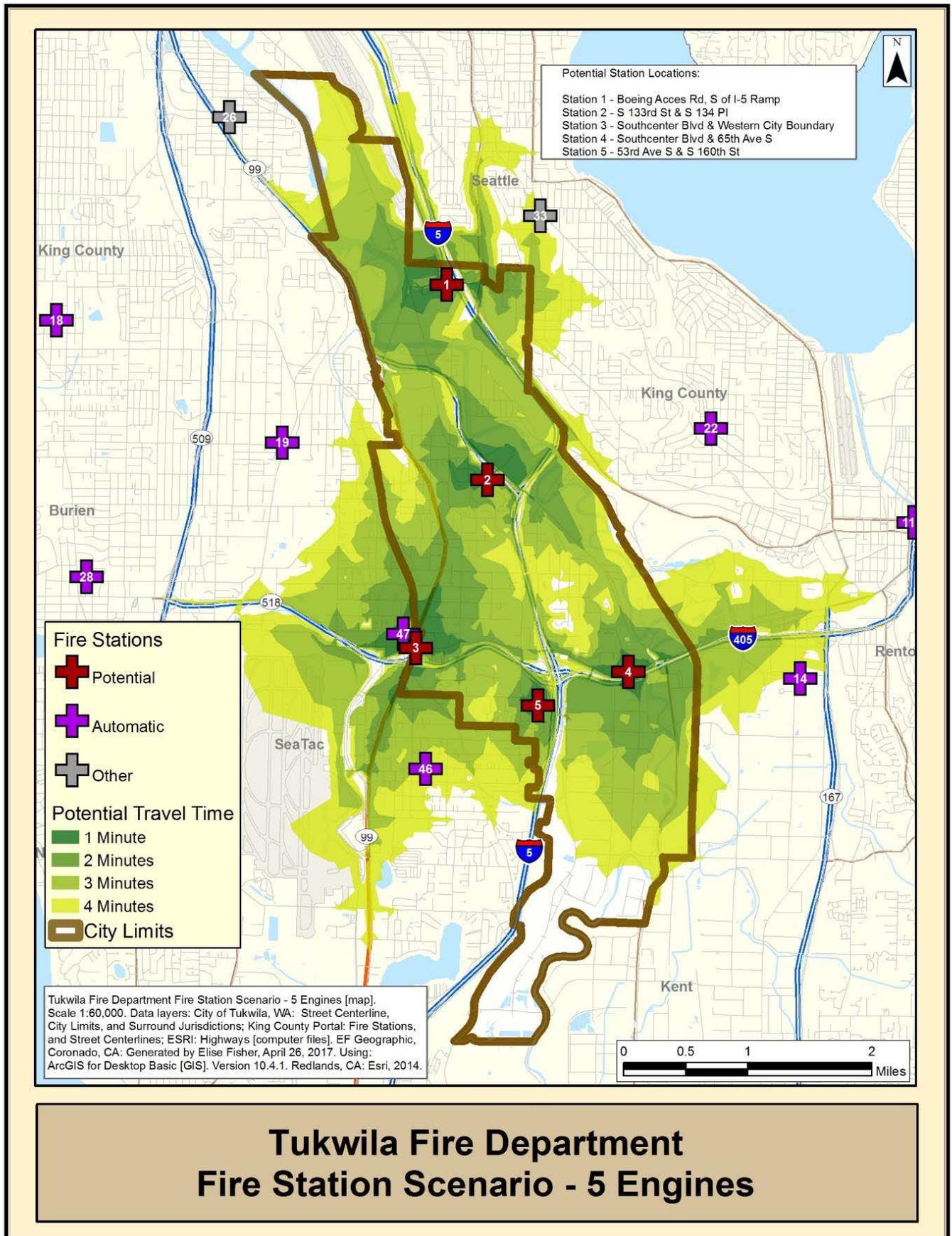
Map 9 – Tukwila as an Island with Three Fire Stations



Map 10 – Tukwila as an Island with Four Fire Stations



Map 11 – Tukwila as an Island with Five Fire Stations



The next maps were developed to determine the location of ladder trucks based on the NFPA 1710 Standard. Map 12 shows the best location for one ladder truck with automatic aid at or near S. 140th St. & 38th Ave. S.

Map 13 shows the eight-minute travel time if the ladder was located at 65th Ave. and Southcenter Blvd.

Map 14 shows the best locations for two ladder trucks located in the west at or near:

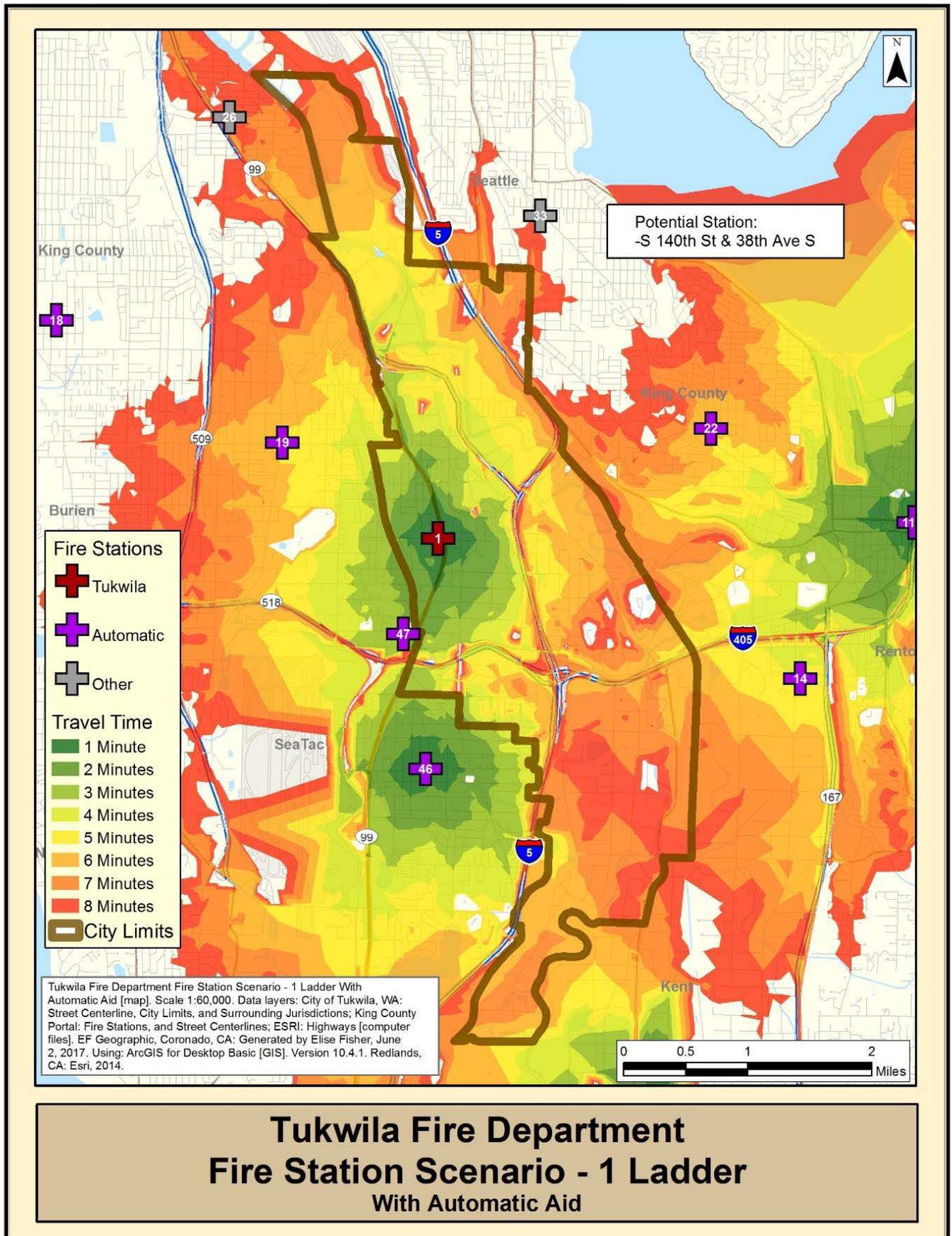
- 37th Ave. & 133rd St.
- 42nd Ave. S. & Southcenter Blvd.

Map 15 shows the best location for two ladder trucks if the west is not the determined location. These locations are at or near:

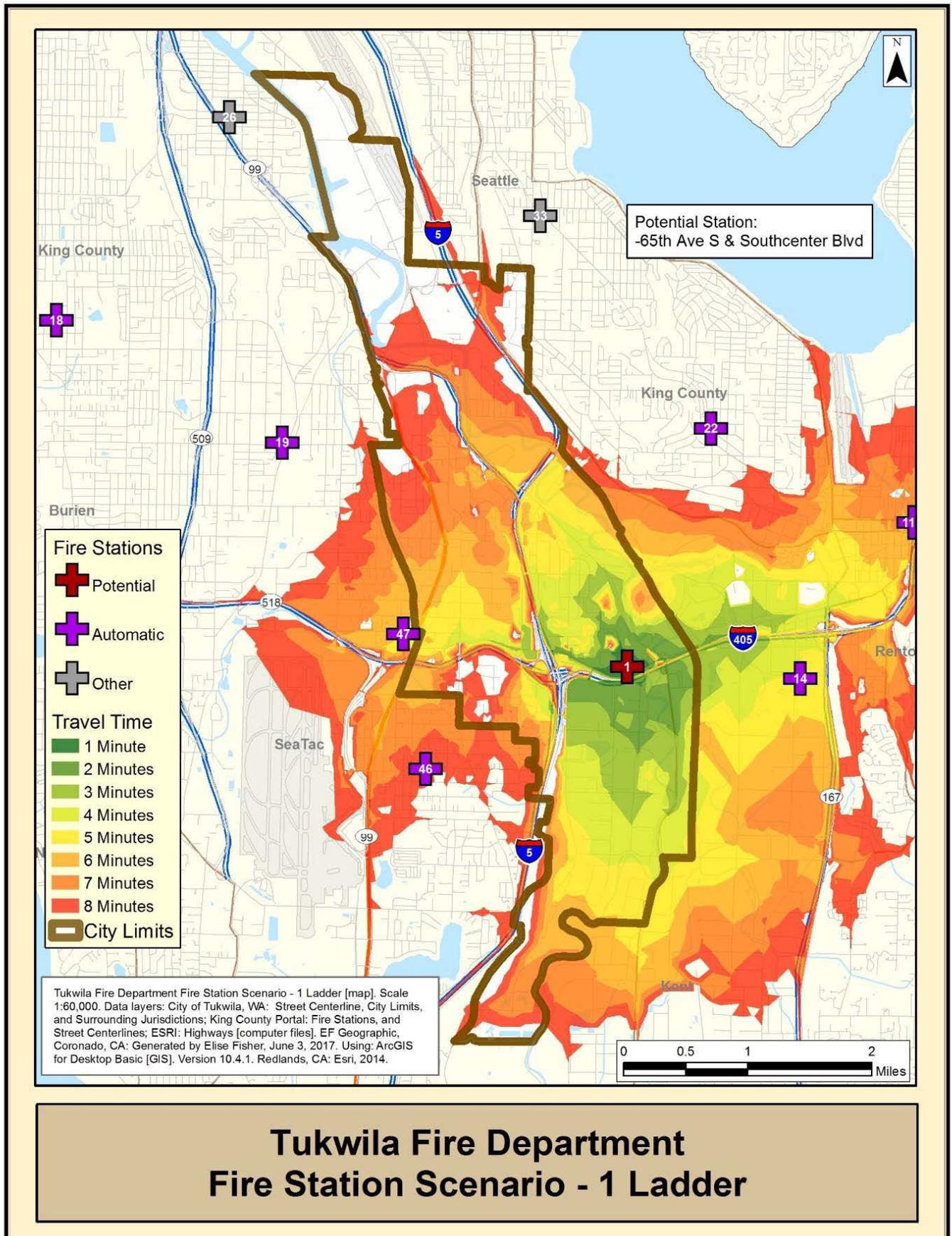
- S. Ryan St. at Eastern Border
- 42nd Ave. S. & Southcenter Blvd.

Maps were developed showing the impact of closing PSRFA fire station 47. Map 16 illustrates the impact to effective firefighting force if Station 47 was closed.

Map 12 – Best Location for 1 Ladder Truck – 8 Minute Travel Time

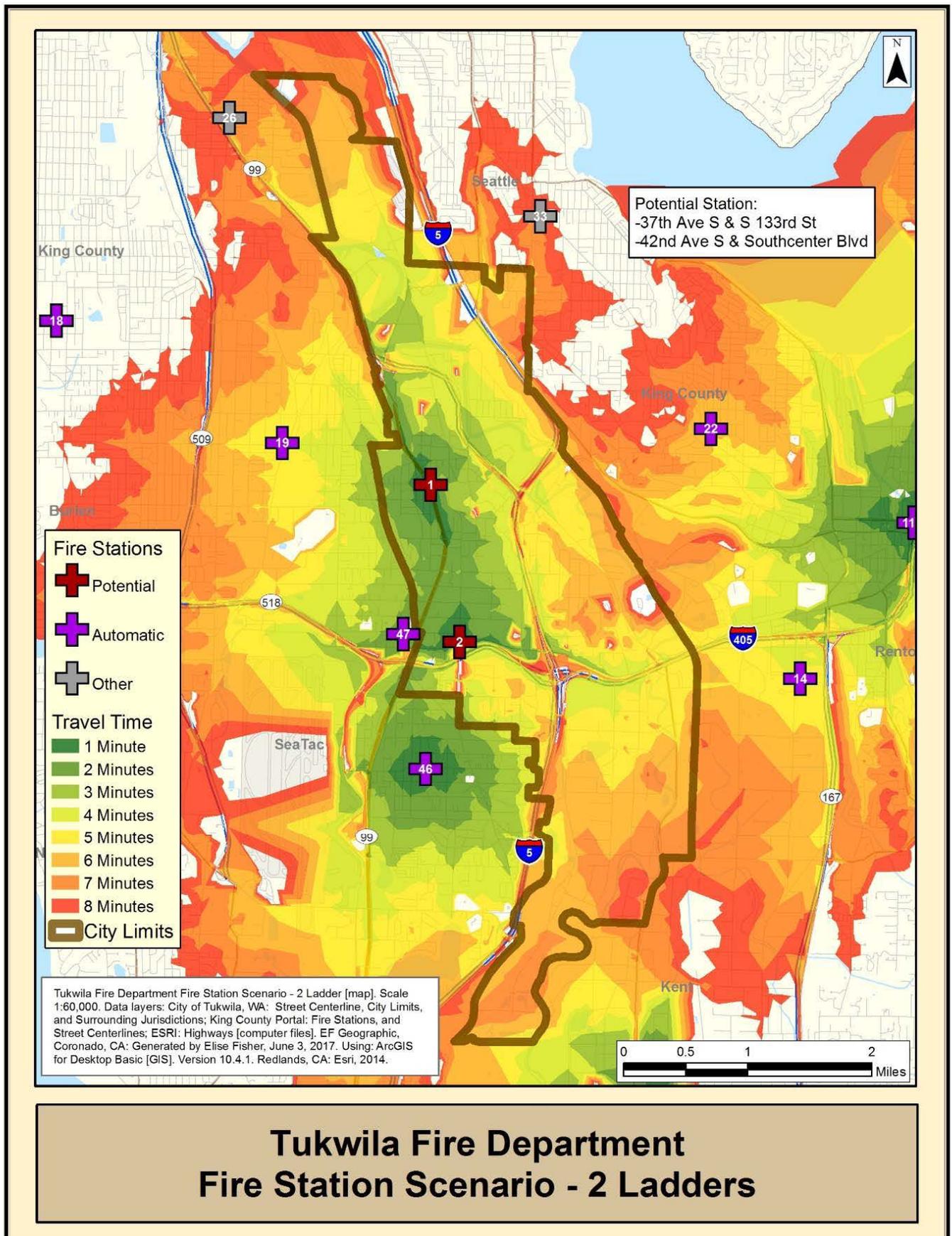


Map 13 – 8-Minute Travel Time: 1 Ladder Located at 65th Ave. & Southcenter Blvd.



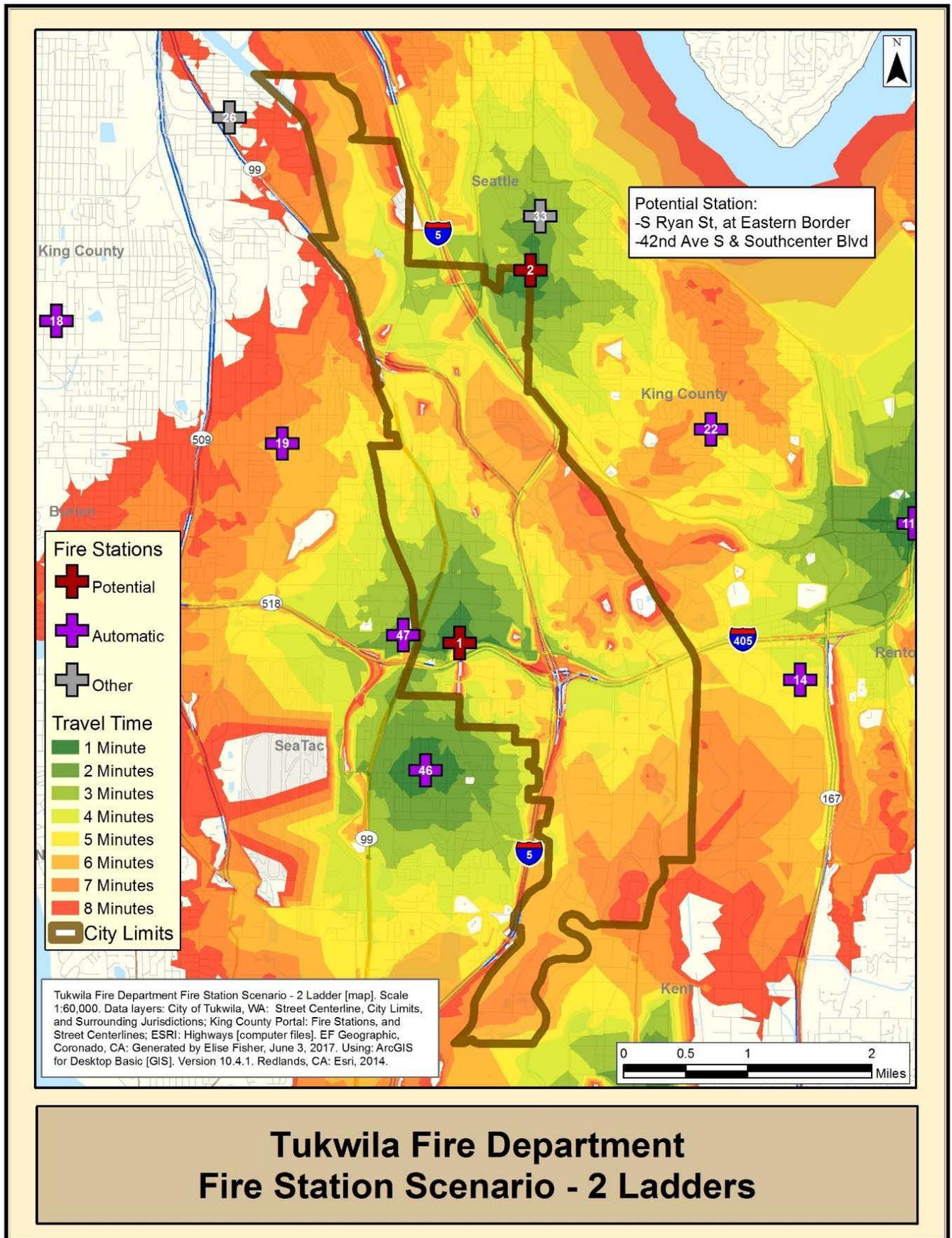
Tukwila Fire Department Fire Station Scenario - 1 Ladder

Map 14 – Best West Location for Two Ladder Trucks – 8 Minute Travel Time

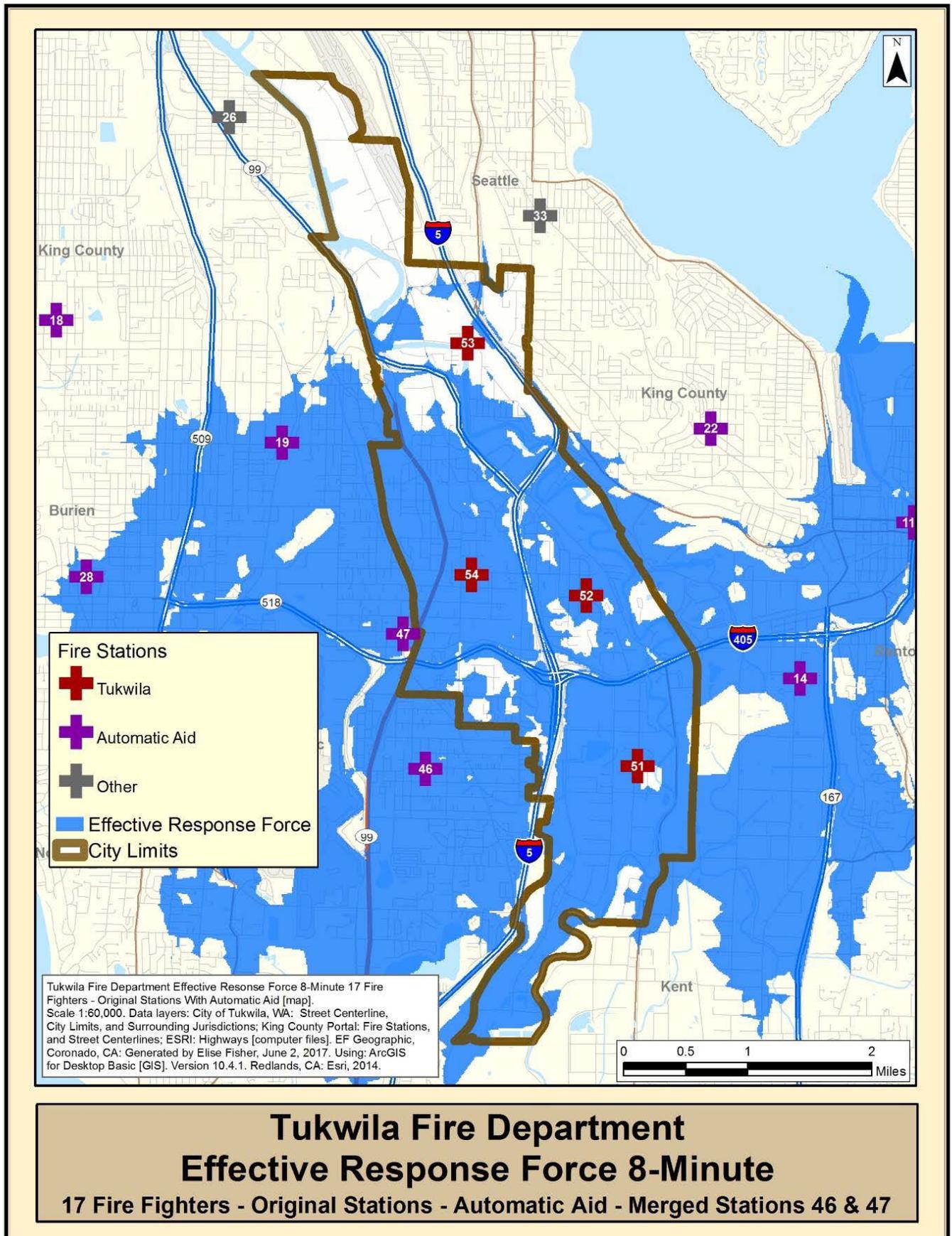


Tukwila Fire Department Fire Station Scenario - 2 Ladders

Map 15 – Best Citywide Location for Two Ladder Trucks – 8 Minute Travel Time



Map 16 – Impact of Closure of PSRFA Fire Station 47



Map 17 was developed with Station 51 located at the new location of 180th St. and Southcenter Pkwy. and Station 53 at its current location to determine the location for two new station locations for Station 52 and 54. The best coverage was determined to be at or near the following locations:

- Fire Station 52 - 65th Ave. S., North of Southcenter Blvd.
- Fire Station 54 – 51st Ave. S. across from S. 146th Pl.

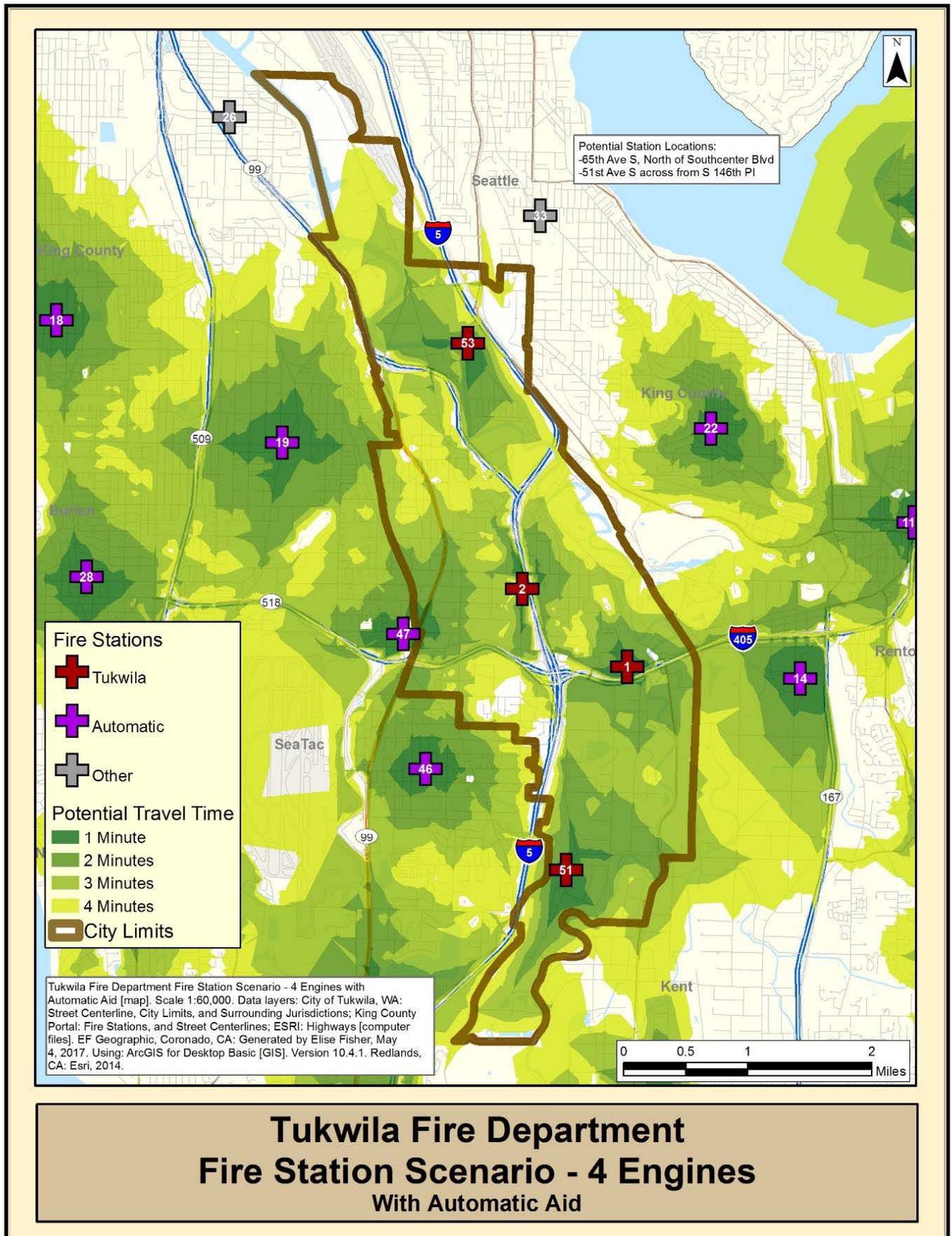
In consultation with City officials the 51st Ave. location was deemed not to be a good location because of severe uphill slopes that impact fire apparatus response times during inclement weather, especially snow and ice.

Map 18 was developed with Station 51 located at the new location of 180th St. and Southcenter Pkwy., Station 53 at its current location, and Station 54 at its current location to determine the location for one new station locations for Station 52. The map also includes the relocation of PSRFA Station 47. The best coverage was determined to be at or near the following location:

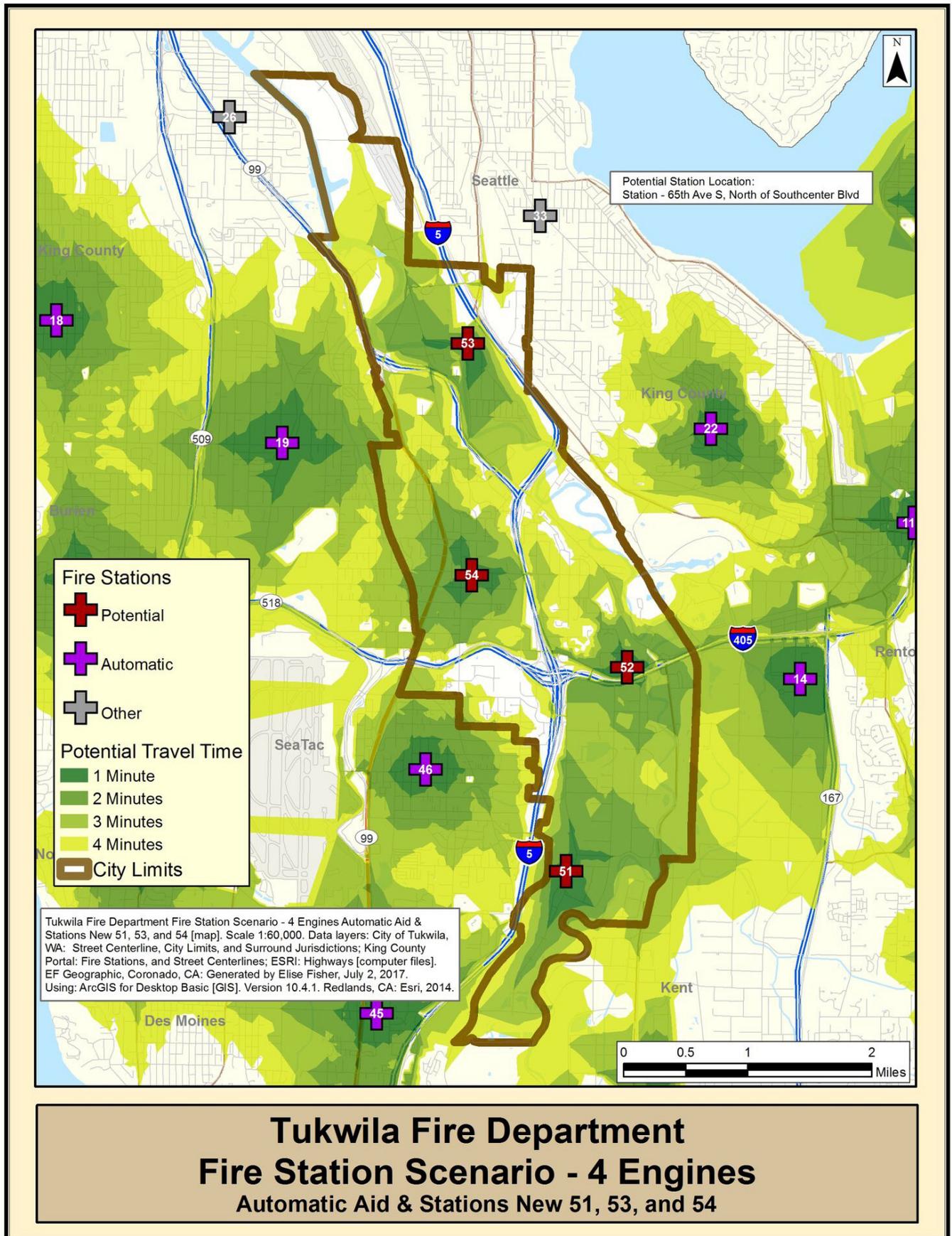
- Fire Station 52 - 65th Ave. S., North of Southcenter Blvd.

Map 19 illustrates the projected travel times based on the station locations indicated on Map 18.

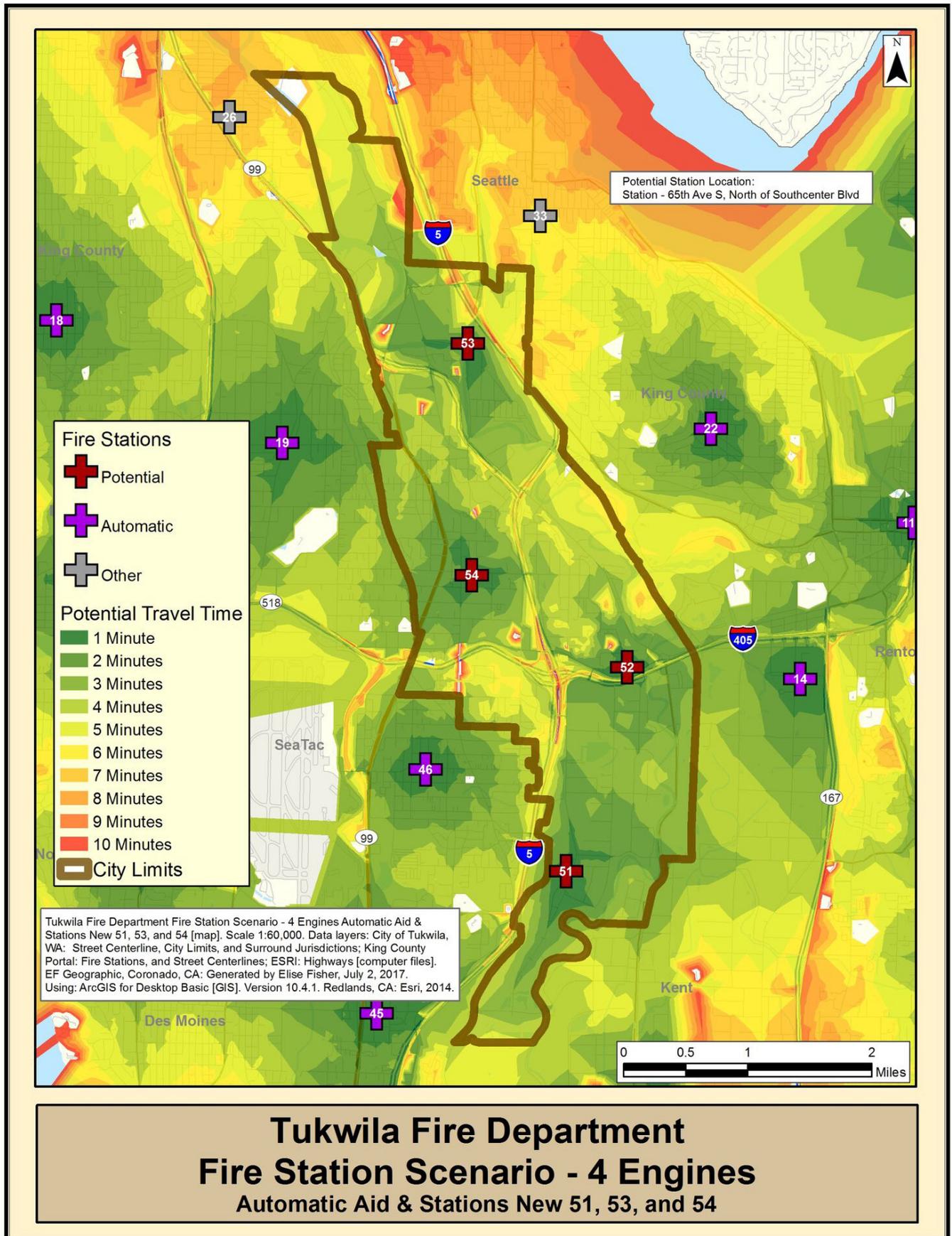
Map 17 – Existing sites: Station 51 & 53 – 2 Potential New Sites for Station 52 & 54



Map 18 – Existing sites: Station 51, 53 & 54 – Potential New Site for Station 52



Map 19 – Projected Travel Times Station 51, 53 & 54 and New Site for Station 52



Fire Station Design Considerations

The consultants were asked about recommendations related to the size and design of the new fire stations. TFD currently has an employee-management committee that has been discussing and identifying various options and functions for the City and its architects to consider including in the fire station design and construction. The committee has prioritized the following:

- Enhanced response times
- Health and Safety of firefighters, minimize exposures
- Security
- Low maintenance facilities

TFD personnel have also conducted site visits to recently constructed fire stations in King County and in other jurisdictions for ideas and best practices related to their identified priorities. The committee and its leadership have a good grasp of understanding constraints related to land acquisition and construction costs. Since the scope of this study does not include the specific design of the new fire stations, this section will provide general and standard information related to fire station construction.

Fire station sites should be at least two-acres in size or approximately 90,000 square feet. The site size can shrink or grow depending on the project program/design criteria, however two-acres or more allows room for future growth. Anything smaller than 1.5 acres should be avoided.

Appendix III, Fire Station Room Data Sheets, provides information for a common one-story fire station design commonly required to meet the operational and deployment requirements for a career fire department. The Data Sheets do not include the fire administration component that will be included in the Headquarters fire station and additional square footage is required based on the number of administrative personnel and other functions located at Fire Administration. As the City pursues property for the replacement fire stations, this data will aid in the filtering of potential sites. These calculations also assume a rectangular shaped site. Odd shaped sites and two-story stations add cost and complexity that are not depicted in the tables listed in the Appendix.

Based on the final decision on station size, potential sites should take in consideration the following:

- 75' front apron + 75' deep bay + 75' rear apron = 225' deep site
- 225' deep x 275' wide = 61,875 sq. ft. (divided by 43560) = 1.4 acres
- 225' deep x 350' wide = 78,750 sq. ft. (divided by 43560) = 1.8 acres
- Sites should be no smaller than 1.5 acres
- Sites averaging 2 acres allows for future growth

In addition to the appropriate size and location for these new fire stations, there are several opportunities to incorporate other function/services within the new stations. There are several examples across the country where fire stations are combined with other uses or functions, including public/private ventures that generate revenues. City leaders have stated they want creative, cost effective facilities that not only meets the needs of the fire department, but the public's needs at large. The following considerations are offered:

- Community rooms for public meeting and use by groups – may or may not involve fees for use

- Police report area or mini-substation
- Co-location of radio or cell towers – fee based
- Incorporation of fire station with commercial use structures

There are two national fire conferences specifically related to fire station design considerations. TFD should consider attending or having their construction team attend one or both conferences.

Fire Station

Headquarters Location

There are no national standards or practices for the location of fire department headquarters locations. The location for headquarters is a policy decision based on various factors. In general, the headquarters location should be close to City Hall so that the fire administration team can interact with City staff, City officials, and City Department Directors from various City Departments. If the headquarters location is isolated from where the City does its business, the fire department chief may not be able to participate effectively in City business that

benefits both the City, the fire department and its residents. The fire department is one of several City departments that must work together to meet the City's mission and vision. There is value to locating the fire administration headquarters within a fire station and not in a separate facility. This co-location of headquarters within an operational fire station allows fire administrators to interact with rank and file firefighters daily.

Conclusion

In government services, as in life, we do not always get what we pay for. This is not the case for the residents of Tukwila as they receive excellent service from Tukwila Fire Department at very reasonable cost. Such a high ratio of cost-benefit cannot continue indefinitely. As demand for emergency services continues to increase, TFD will need additional resources to keep the current level of services.

The point of this study is to identify the strengths and weaknesses of Tukwila Fire Department station locations and deployment and identify directions that will enable it to improve, not only in customer service, but also as a growing, learning community of firefighters dedicated to the safety of the city and its residents. Both the FACETS team and TFD command staff recognize that improvement is a continuous process. As goals are achieved, new ones are established and managed through the strategic planning process. As the community grows and changes and as technology evolves in ways that impact fire risk, such as new forms of energy for vehicles and buildings, there will always be something new to prepare for.

Based on its comprehensive review, the FACETS team perceives an organization that has intelligently examined the risks

the City faces, and, given its limitations, has deployed its available resources to the best advantage. At all levels, TFD members have cultivated good relations with the other public safety agencies with whom they work, to the betterment of not only the members themselves but also to the community they serve.

The FACETS team found the City of Tukwila and TFD to be a progressive organization open to positive change. The Mayor, elected officials and the City Administrator are extremely supportive of the TFD and committed to the public safety of Tukwila residents and visitors.

The observations of the FACETS team, both staff and facilities and of the relevant documents, lead to the conclusion that TFD provides excellent value in services but is facing increased growth resulting in additional demand for services. The City can meet the challenges related to the increased demand for services through appropriate locations for fire stations related to equitable response times and effective firefighting forces to mitigate all-hazards incidents.

Appendix I

List of City of Tukwila Documents/Reports Received

1. "Headquarters Fire Station Location Analysis – City of Tukwila" – TCA Architecture Planning: November 30, 2009
2. "Headquarters Fire Station Location Analysis Amendment – City of Tukwila" – TCA Architecture Planning: March 25, 2013
3. "Investing in Tukwila – Essential Government Services Facilities Plan 2015 – 2040 DRAFT – City of Tukwila: December 14, 2015
4. "Cities of SeaTac and Tukwila – Opportunities for Partnership Efforts" – ESCI: October 2008
5. "Tukwila Fire Department Master Plan" – Tukwila Fire Department: August 2008
6. "Kent Regional Fire Authority Annexation Review" – Tukwila City Council: December 2015
7. "Tukwila City Council Work Session Agenda: Public Safety Plan: January 10, 2017
8. "RFA Capital Planning Workbook – September 30, 2015
9. "Public Safety Plan Summary"
10. "City of Tukwila Comprehensive Plan 2015"
11. "Mayor's Fact Sheet About Tukwila's Public Safety Plan"
12. "PSP Service Level Impact" – Power point
13. "Tukwila Facilities Cost Estimates" – May 3, 2016
14. "Regional Fire Authority Annexation Review" – City of Tukwila: December 3, 2015
15. "Exhibit A to Resolution 1784: City of Tukwila Strategic Plan"
16. Response Time Maps (2 files)
17. 2016 TFD Call Data
18. Tukwila CAD Data
19. City of Tukwila: Background Report for the Transportation Element of the Comprehensive Plan Update Transportation Analysis and 2030 Improvements Recommendations – Fehr & Peers: May 2012
20. AGREEMENT BY AND BETWEEN THE CITY OF TUKWILA AND SEGALE PROPERTIES LLC, FOR THE TUKWILA SOUTH DEVELOPMENT – October 2013
21. UTILITY RELOCATION AGREEMENT BETWEEN THE CITY OF TUKWILA, SEGALE PROPERTIES LLC, AND PUGET SOUND ENERGY, INC. – April 2014
22. Additional documents not listed.

Appendix II

(Source City of Tukwila)

Private Development Projects

Tukwila Village 144th and TIB

Tukwila Village will include a branch of the nationally recognized King County Library System and the City's neighborhood police resource center in combination with other retail, office, live/work, or residential space.

Tukwila South Project

The Tukwila South agreement set the stage for the development of 512 acres of land, five minutes from SeaTac International Airport and adjacent to I-5. The boundaries are approximately S 180th Street on the north, the Green River on the east, S 204th Street on the south, and Orillia Road/I-5 on the west.

Woodspring Suites 15643 West Valley Highway

Construction of a four-story, 110-room hotel and associated site improvements to include parking, open space, pedestrian connections, shoreline and wetland buffer mitigation, public access to the shoreline, and landscaping. The James and Mary Nelsen House will remain on the front parcel and the on-site barn will be demolished.

Quail Park 13112 Military Road South

145 units of senior housing with some memory care units. Parking will be broken up into four different locations on the site, including tucked under the building, to avoid the impact of large parking lots. Plans call for significant landscaping and fencing on the south side of the project to visually buffer the project from adjacent homes. This project is currently under review.

Urban Center

Washington Place Andover Pk E between Strander and Baker

Washington Place is a 19 story apartment and hotel project currently under construction at 223 Andover Park E. It is planned to have 370 apartments as well as 189 room business hotel with meeting space and a restaurant.

Holiday Inn Express 90 Andover Park East

Construction of a 62,337 sq. ft. five-story, 92-unit Holiday Inn Express hotel. The project includes frontage improvements along Andover Park E. and Christensen Road, 98 parking spaces including a shared parking lot along Christensen Road for hotel guests and access to the Green River Trail, landscaping, and improvements to the vehicular and pedestrian circulation.

Twin Peaks Restaurant

Demolition of the existing Newport Bay restaurant and construction of a new Twin Peaks 6,929 sq. ft. restaurant and bar, with 1,399 square foot covered patio.

Olympus Spa Andover Park E and Industry Dr

24,900 square foot women-only spa, and will include a public restaurant and space for one or more retail suites. The building is intended to have modern, clean lines, with

well-designed planting and landscape treatments. Parking will be primarily located to the rear of the building. This project is currently under review.

DiagnosTechs 950 Andover Park E.
Proposed 2-3 story testing laboratory.

Broadstone Apartments 415 Baker Blvd.
Proposed 7 story, 160-unit age restricted apartment community. This proposal will have 5 stories of residential units (studio, 1-bedroom and 2-bedroom) over 2 levels of parking.

Family Fun Center: Bullwinkle's Route 66 Addition
Construction of a 12,386 sq. ft. addition for a bowling alley and 1,646 sq. ft. second floor addition off the northeast corner of the existing amusement center.

Residential

Boulevard Townhomes 3726 Southcenter Boulevard
Development of five townhomes along with associated access, parking, utilities, and landscaping.

Foster Short Plat 14418 44th Avenue South
Development of eight new single-family homes.

Osterly Park Townhomes 14401 34th Avenue South
Development of 31 townhomes in two phases, with associated parking, landscaping, and recreation space. Phase 1 includes 8 homes; Phase 2 includes 23 homes.

Macadam Short Plat 13816 Macadam Road South
Creation of seven new lots to build seven new single-family homes, along with installation of wetland and watercourse buffer plantings.

51st Avenue S Townhomes 5002 S 109th St, Tukwila
Development of eight new townhomes along with associated access road, parking, utilities, landscaping, and recreation space.

Appendix III

Fire Station Room Data Sheets – Does Not Include Fire Administration

Type	Room Name	Min. Sq. Ft.	Min. Dimensions
Private Spaces	Captains Dorm	140	10' x 14'
	Firefighters Dorm	100	10' x 10'
	Unisex Bathroom (1 per 3 FF's)	60	6' x 10'
	Men's Gang Bathroom	324	18' x 18'
	Women's Gang Bathroom	180	10' x 18'
Semi-Private Spaces	Day Room	225	15' x 15'
	Kitchen	120	10' x 12'
	Dining	225	15' x 15'
	Laundry	80	8' x 10'
	Office / Study	100	10' x 10'
	Weight Room / PT.	625	25' x 25'
Semi-Public Spaces	Apparatus Bay	1680	24' x 70'
	Turn-outs	150	10' x 15'
	Shop	100	10' x 10'
	SCBA	100	10' x 10'
	CAD Radio & Comms.	100	10' x 10'
Public Spaces	Public Entries	144	12' x 12'
	Community Room	1000	25' x 40'
	Public Rest-room	36	6' x 6'
Site Spaces	Trash Enclosure	128	8' x 16'
	Outside Storage	144	12' x 12'
	Generators / Fuel Site	120	10' x 12'

Fire Station Types

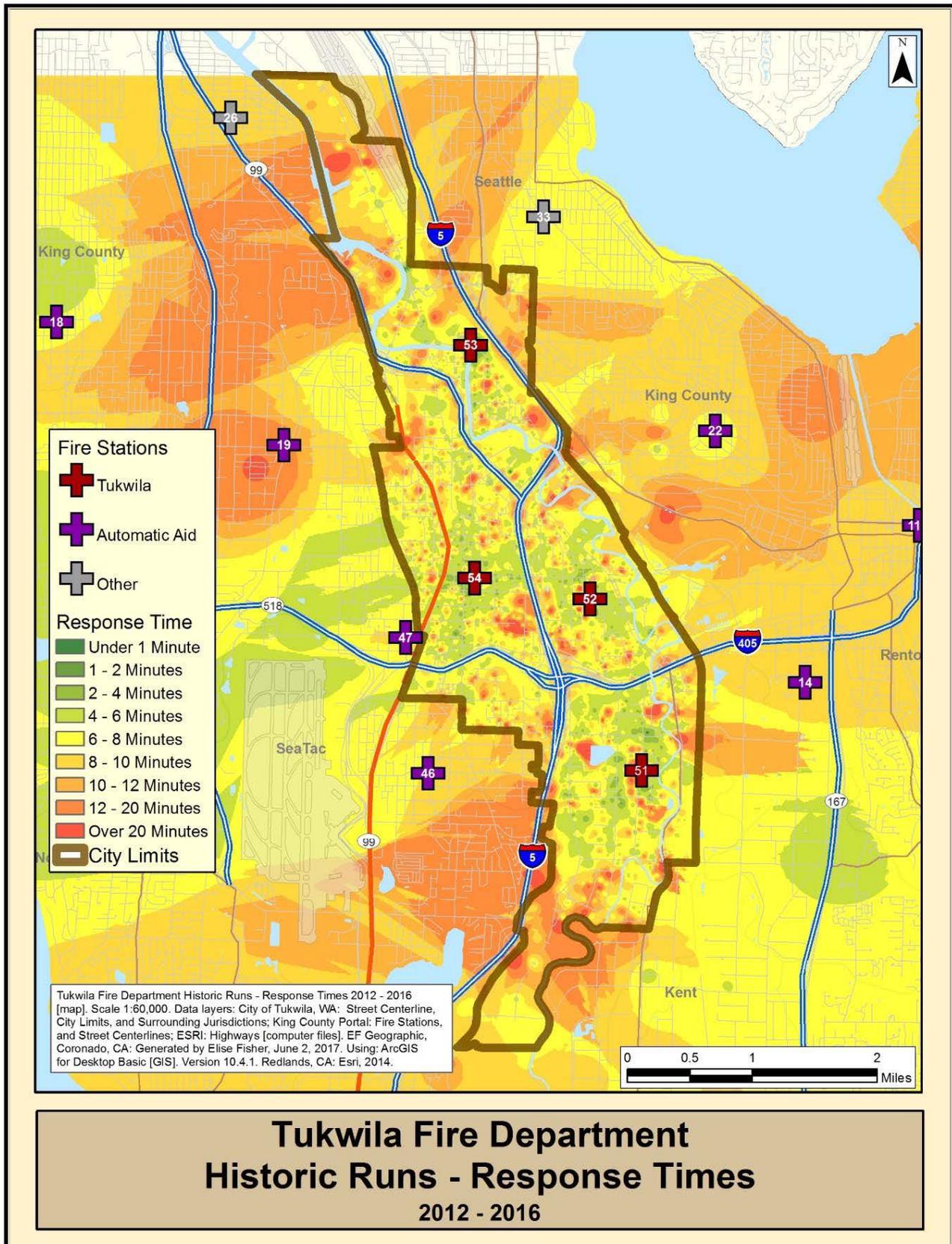
Description	Min. Spaces	Min. Sq. Ft.	Total Sq. Ft.
Infill Station - Small			
	2 Captains Dorms	140 x 2	280
	6 Firefighter Dorms	100 x 6	600
	3 Unisex Restrooms	60 x 3	180
	Day Room	225	225
	Kitchen	120	120
	Dining	225	225
	Laundry	80	80
	Office / Study	100	100
	Weight Room / PT.	625	625
	Apparatus Bay	1680 x 2	3360
	Turn-outs	150	150
	Shop	100	100
	SCBA	100	100
	CAD Radio & Comms.	100	100
	Public Entries	144	144
	Public Restroom	36	36
	Minimum Square Footage		6425
Typical Station - Medium			
	3 Captains Dorms	140 x 3	420
	9 Firefighter Dorms	100 x 9	900
	4 Unisex Restrooms	60 x 4	240
	Day Room	225 x 50%	340
	Kitchen	120 x 50%	180
	Dining	225 x 50%	340
	Laundry	80	80
	Office / Study	100	100
	Weight Room / PT.	750	750
	Apparatus Bay	1680 x 3	5040
	Turn-outs	150 x 50%	225
	Shop	100	100
	SCBA	100	100
	CAD Radio & Comms.	100	100
	Public Entries	144	144
	Public Restroom	36	36
	Minimum Square Footage		9095

Fire Station Types

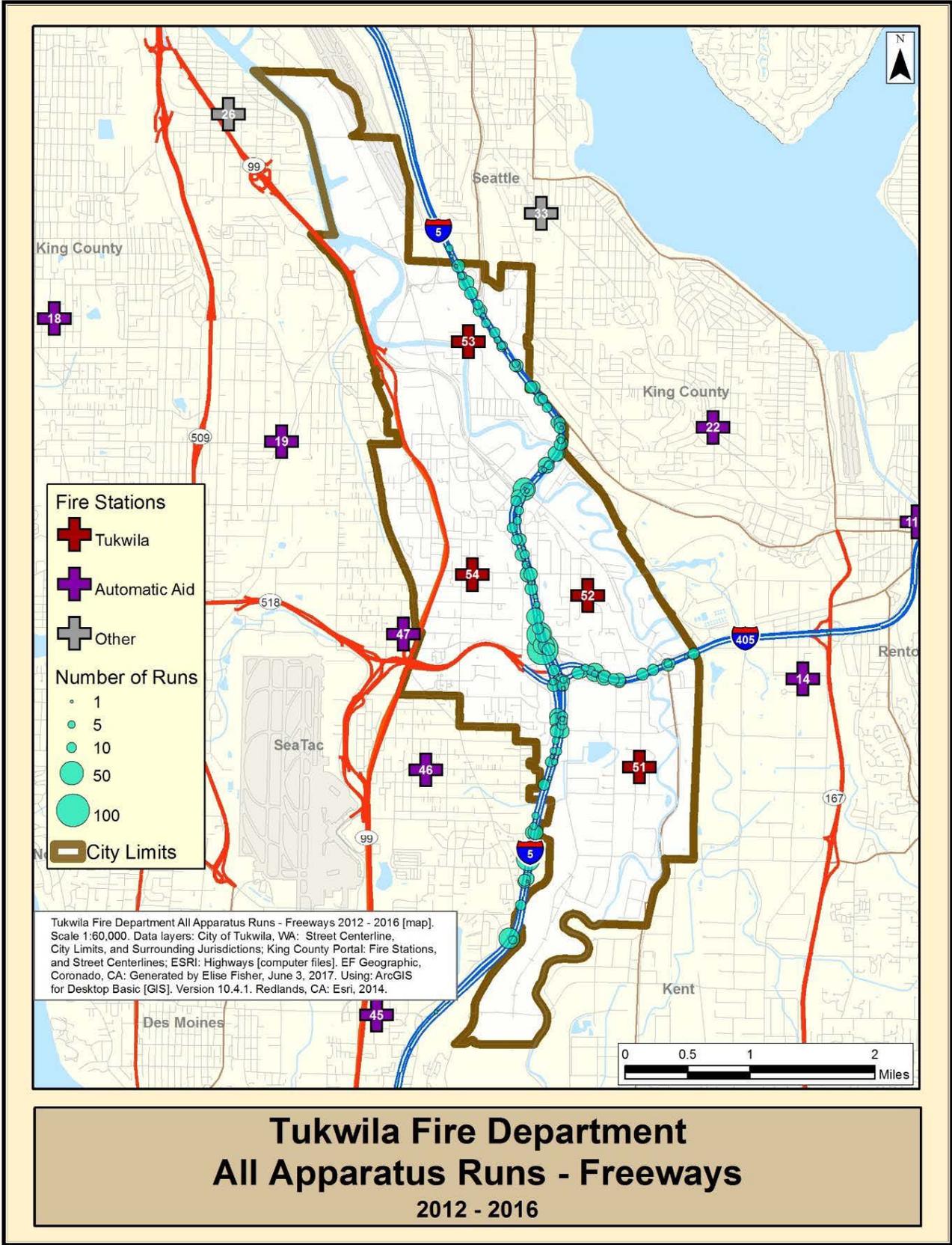
Description	Min. Spaces	Min. Sq. Ft.	Total Sq. Ft.
Multi-Company Station			
- Large			
4 Captains Dorms		140 x 4	560
11 Firefighter Dorms		100 x 11	1100
5 Unisex Restrooms		60 x 5	300
Day Room		225 x 75%	400
Kitchen		120 x 75%	210
Dining		225 x 75%	400
Laundry		100	100
Office / Study		100	100
Weight Room / PT.		1000	1000
Apparatus Bay		1680 x 4	6720
Turn-outs		150 x 75%	265
Shop		100	100
SCBA		150	150
CAD Radio & Comms.		100	100
Public Entries		144	144
Public Restroom		36	36
Minimum Square Footage			11685
Battalion Station			
- Extra Large			
4 Captains Dorms		140 x 4	560
11 Firefighter Dorms		100 x 11	1100
1 BC Dorm, 1 FIT Dorm		140 x 2	280
6 Unisex Restrooms		60 x 6	360
Day Room		225 x 100%	450
Kitchen		120 x 100%	240
Dining		225 x 100%	450
Laundry		100	100
Office / Study		100	100
Weight Room / PT.		1000	1000
Apparatus Bay		1680 x 4.5	7560
Turn-outs		150 x 100%	300
Shop		100	100
SCBA		150	150
CAD Radio & Comms.		100	100
Public Entries		144	144
Public Restroom		36	36
Minimum Square Footage			13030

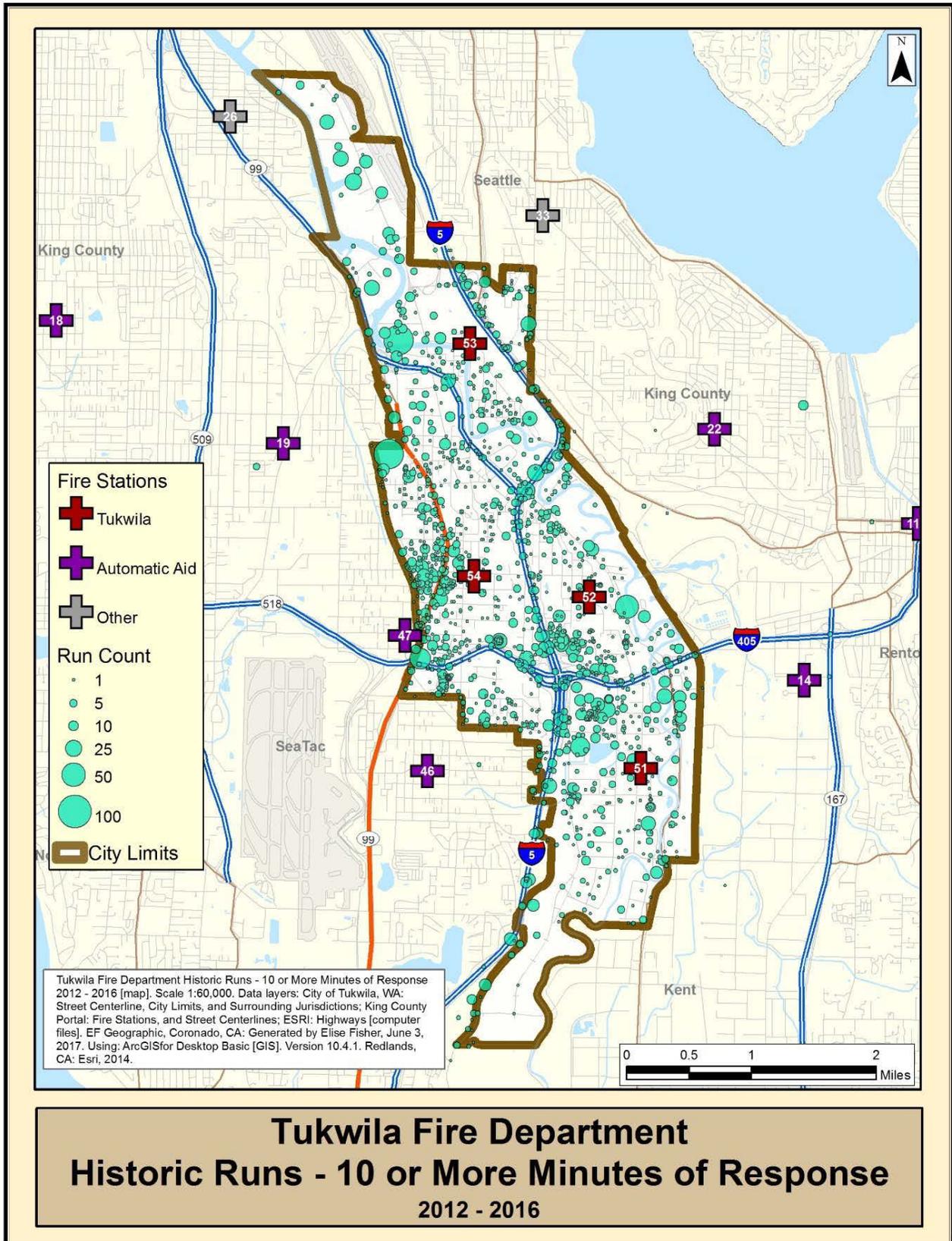
Appendix IV

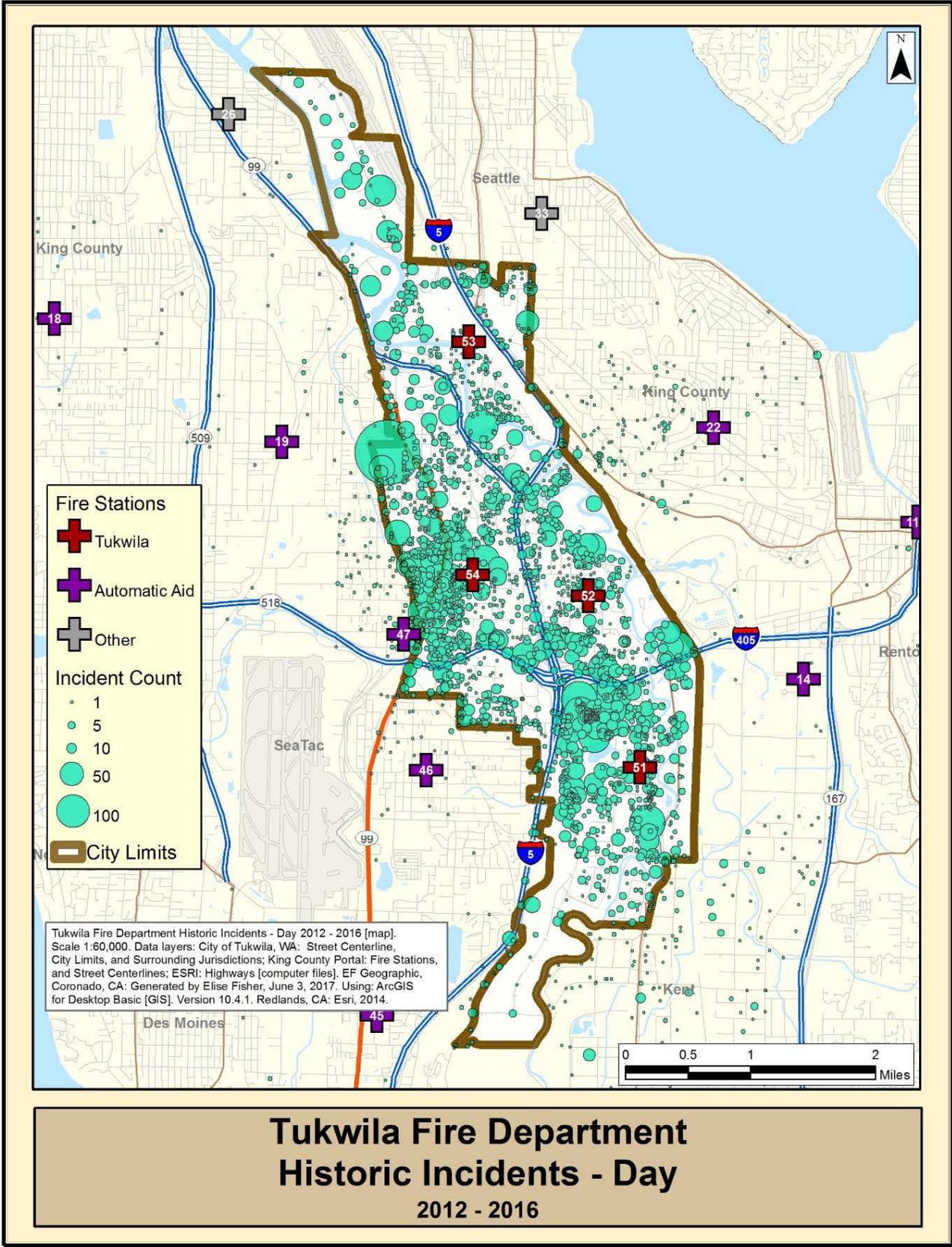
Additional GIS Maps of Interest

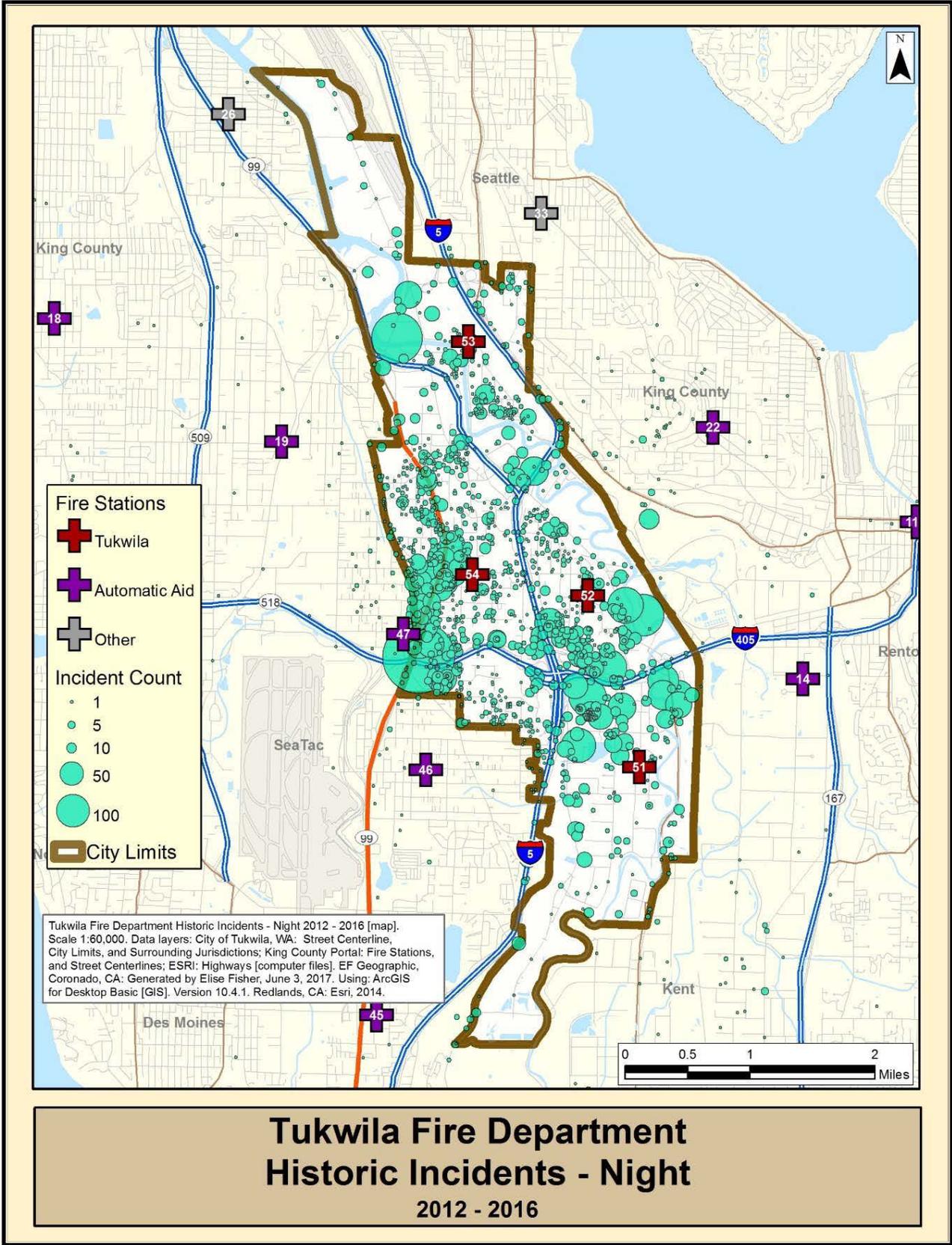


**Tukwila Fire Department
Historic Runs - Response Times
2012 - 2016**

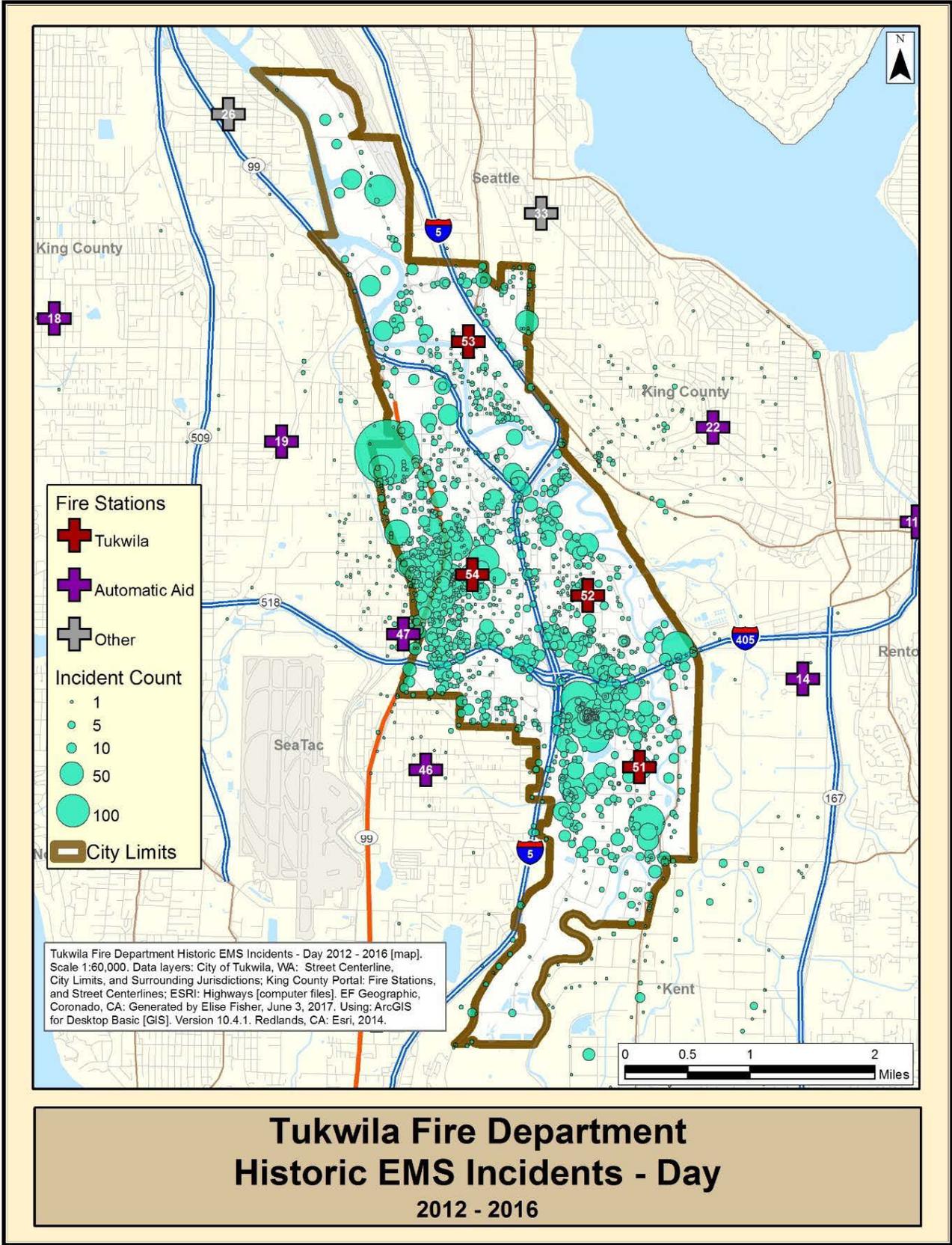


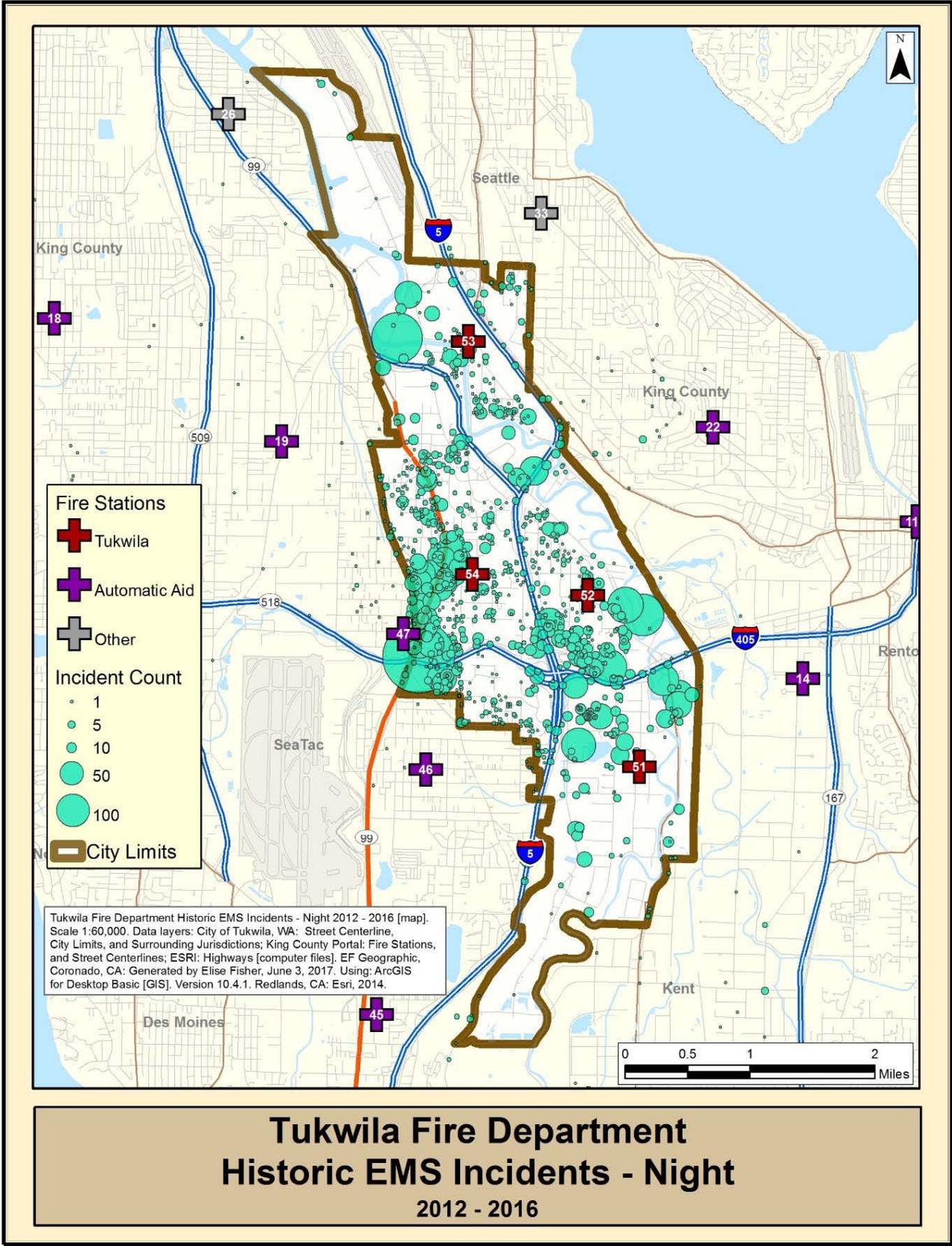


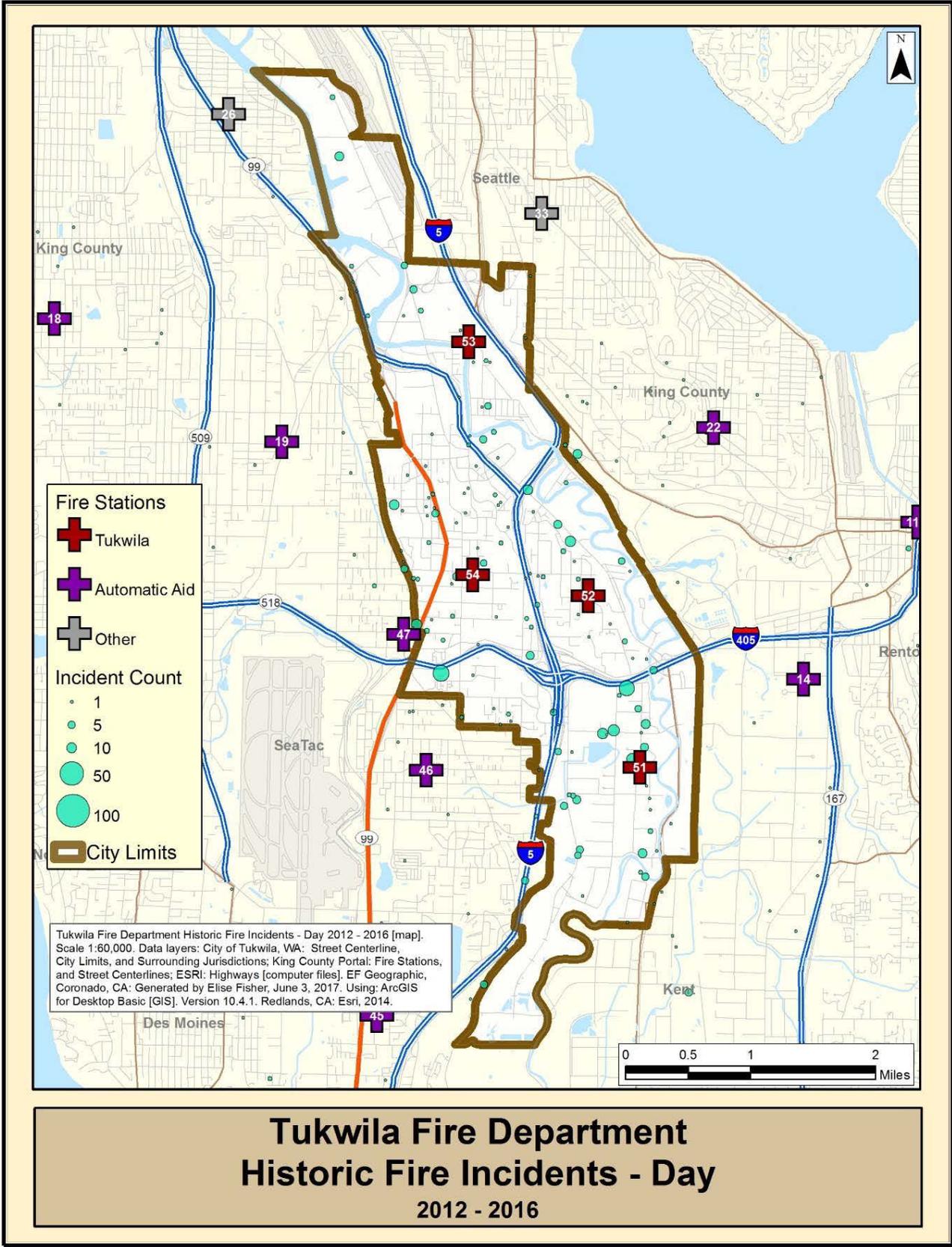




**Tukwila Fire Department
 Historic Incidents - Night
 2012 - 2016**







**Tukwila Fire Department
 Historic Fire Incidents - Day
 2012 - 2016**

