GIS Analysis
Brooklyn Park, MN

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ESTABLISHING BASELINE PERFORMANCE

The first step in completing GIS planning analyses is to establish the desired performance parameters. Measures of total response time can be significantly influenced by both internal and external influences. For example, the dispatch time, defined as the time from call creation at the 911-center to the dispatching of units, contributes to the customer’s overall response time experience. Another element in the total response time continuum is the turnout time, defined as the time from when the units are notified of the incident until they are actually responding. Turnout time can have a significant impact on the overall response time for the customer and is generally considered under management’s control. However, the travel time, defined as the period from when the units are actually responding until arrival at the incident is a factor of the number of fire stations, the ability to travel unimpeded on the road network, the existing road network’s ability to navigate the community, and the availability of the units. Largely, travel time is the most stable variable to utilize in system design regarding response time performance.

Therefore, these GIS planning analyses will focus on travel time capability as the unit of measure. The 2018 reporting period (i.e., January 1, 2018 to December 31, 2018) performance for travel time across programs is provided below. Overall, the travel time was 6.6 minutes or less for 90% of the incidents. However, fire related incidents had a travel time performance of 6.4 minutes or less for 90% of the incidents.

<table>
<thead>
<tr>
<th>Program</th>
<th>Dispatch Time</th>
<th>Turnout Time</th>
<th>Travel Time</th>
<th>Response Time</th>
<th>Sample Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMS</td>
<td>1.6</td>
<td>2.1</td>
<td>6.6</td>
<td>9.0</td>
<td>5,789</td>
</tr>
<tr>
<td>Fire</td>
<td>2.1</td>
<td>2.5</td>
<td>6.4</td>
<td>9.2</td>
<td>1,036</td>
</tr>
<tr>
<td>Rescue</td>
<td>1.8</td>
<td>2.3</td>
<td>7.3</td>
<td>10.0</td>
<td>140</td>
</tr>
<tr>
<td>Hazmat</td>
<td>2.9</td>
<td>2.8</td>
<td>9.0</td>
<td>10.8</td>
<td>31</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1.7</strong></td>
<td><strong>2.2</strong></td>
<td><strong>6.6</strong></td>
<td><strong>9.1</strong></td>
<td><strong>6,996</strong></td>
</tr>
</tbody>
</table>

*Sample sizes reflect the number of responses made by first arriving primary front-line units to emergency calls; due to missing or excluded time data, sample sizes corresponding to individual table metrics may be smaller.
Comparison to National References

There are two notable references for travel time available to the fire service in National Fire Protection Association (NFPA) 1710¹ and the Commission on Fire Accreditation International (CFAI)². NFPA 1710 suggests a 4-minute travel time at the 90th percentile for first due arrival of Basic Life Support (BLS) and fire incidents, and the CFAI recommends a 5 minute and 12 seconds travel time for first due arrival in an urban/suburban population density. The arrival of an Advanced Life Support (ALS) unit is recommended at 8 minutes travel time by NFPA 1710. It is important to note that the latest edition (9th edition) of the CFAI guidelines have de-emphasized response time and only reference the legacy standards with a separately provided companion document³.

The CFAI recommendations are more closely aligned with the department’s historical performance as the aggregate performance is 6.6 minutes at the 90th percentile. However, the department is not currently capable of meeting the more restrictive recommendation of 4 minutes travel time or less at the 90th percentile. Considering that the department is currently at 6.6 minutes, a 6-minute travel time was used as a surrogate measure for the more restrictive 4-minute or 5:12 thresholds identified. With the current configuration of stations, the department could achieve approximately 94.22% coverage within 6 minutes.

When referring to the marginal utility analysis provided on the following pages, the ascending rank order is the station’s capability to cover risk (incidents) in relation to the total historical call volume of the sample period (calendar year 2018). The station is the current Brooklyn Park Fire Department (BPFD) fire station identifier. The station capture is the number of calls the station would capture within a 6-minute travel time. The total capture is the cumulative number of calls captured with the addition of each fire station. The percent capture is the total cumulative percentage of risk covered by each station. The goal would be to achieve at least 90% capture.

Therefore, the station that contributed the most to the overall system’s performance was Station 3 (W) in the first row and would capture 61.04% of the risks within 6 minutes. Station 2 (C) would cover an additional 20.92% of the risk bringing the cumulative total to 81.96% between Stations 2 and 3. In total, with all four fixed fire stations, 94.22% of the incidents could be responded to within 6 minutes travel time. Results are provided below.

---

Table 2: Marginal Fire Station Contribution for 6-Minute Travel Time – With Station 1 (E)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Station</th>
<th>Station Capture</th>
<th>Total Capture</th>
<th>Percent Capture</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3 (W)</td>
<td>5,706</td>
<td>5,706</td>
<td>61.04%</td>
</tr>
<tr>
<td>2</td>
<td>2 (C)</td>
<td>1,956</td>
<td>7,662</td>
<td>81.96%</td>
</tr>
<tr>
<td>3</td>
<td>1 (E)</td>
<td>625</td>
<td>8,287</td>
<td>88.65%</td>
</tr>
<tr>
<td>4</td>
<td>4 (N)</td>
<td>521</td>
<td>8,808</td>
<td>94.22%</td>
</tr>
</tbody>
</table>

Figure 1: Current Fire Station Bleed Map for 6-Minute Travel Time – With Station 1 (E)
### Table 3: Marginal Fire Station Contribution for 6-Minute Travel Time – Without Station 1 (E)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Station</th>
<th>Station Capture</th>
<th>Total Capture</th>
<th>Percent Capture</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3 (W)</td>
<td>5,706</td>
<td>5,706</td>
<td>61.04%</td>
</tr>
<tr>
<td>2</td>
<td>2 (C)</td>
<td>1,956</td>
<td>7,662</td>
<td>81.96%</td>
</tr>
<tr>
<td>3</td>
<td>4 (N)</td>
<td>524</td>
<td>8,186</td>
<td>87.57%</td>
</tr>
</tbody>
</table>

### Figure 2: Current Fire Station Bleed Map for 6-Minute Travel Time – Without Station 1 (E)
Validation of Planning Analysis

The first step in this validation analysis is to utilize the historical performance to validate the planning analyses utilized by the GIS system. The historical performance demonstrated a 6.6-minute overall department travel time performance and a 6.4-minute travel time capability to fire related calls from the existing fire stations at the 90th percentile. The planning assessments estimated greater than 98.80% at 7 minutes. The GIS planning efforts utilize average road speeds and impedance and it is not uncommon for the fire department responses to outperform the average road speed. Therefore, there is high degree of agreement between the planning tools and the actual historical performance.

Table 4: Marginal Fire Station Contribution for 7-Minute Travel Time – With Station 1 (E)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Station</th>
<th>Station Capture</th>
<th>Total Capture</th>
<th>Percent Capture</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2 (C)</td>
<td>7,157</td>
<td>7,157</td>
<td>76.56%</td>
</tr>
<tr>
<td>2</td>
<td>3 (W)</td>
<td>1,101</td>
<td>8,258</td>
<td>88.34%</td>
</tr>
<tr>
<td>3</td>
<td>1 (E)</td>
<td>706</td>
<td>8,964</td>
<td>95.89%</td>
</tr>
<tr>
<td>4</td>
<td>4 (N)</td>
<td>272</td>
<td>9,236</td>
<td>98.80%</td>
</tr>
</tbody>
</table>
Figure 3: Current Fire Station Bleed Maps for 7-Minute Travel Time – With Station 1 (E)
Table 5: Marginal Fire Station Contribution for 7-Minute Travel Time – Without Station 1 (E)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Station</th>
<th>Station Capture</th>
<th>Total Capture</th>
<th>Percent Capture</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2 (C)</td>
<td>7,157</td>
<td>7,157</td>
<td>76.56%</td>
</tr>
<tr>
<td>2</td>
<td>3 (W)</td>
<td>1,101</td>
<td>8,258</td>
<td>88.34%</td>
</tr>
<tr>
<td>3</td>
<td>4 (N)</td>
<td>299</td>
<td>8,557</td>
<td>91.54%</td>
</tr>
</tbody>
</table>

Figure 4: Current Fire Station Bleed Maps for 7-Minute Travel Time – Without Station 1 (E)
Internal Performance Objectives

The Brooklyn Park Fire Department does not currently utilize a system of internal performance objectives to assist in performance management and community transparency in service delivery. However, the city and department are contemplating adoption of a system of measures as part of this planning process.
EVALUATION OF VARIOUS DISTRIBUTION MODELS

As previously discussed, these analyses utilized 2018 historical performance as the desired performance for system designs. Various configurations of 4-, 6-, 7-, and 8-minute travel times were completed to consider alternatives compared to the current performance of 6.6 minutes. The following analyses are utilized to compare and contrast the various potential distribution models.

Current Stations

4-Minute Travel Time

Analyses of 6- and 7-minute travel times were previously presented. However, a 4-minute travel time analysis was created to evaluate the department’s capabilities with the current station configuration. Results suggest that with all four fire stations, 50.30% of the incidents could be responded to within 4 minutes or less travel time.

Table 6: Marginal Fire Station Contribution for 4-Minute Travel Time

<table>
<thead>
<tr>
<th>Rank</th>
<th>Station</th>
<th>Station Capture</th>
<th>Total Capture</th>
<th>Percent Capture</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2 (C)</td>
<td>2,284</td>
<td>2,284</td>
<td>24.43%</td>
</tr>
<tr>
<td>2</td>
<td>3 (W)</td>
<td>1,434</td>
<td>3,718</td>
<td>39.77%</td>
</tr>
<tr>
<td>3</td>
<td>4 (N)</td>
<td>721</td>
<td>4,439</td>
<td>47.49%</td>
</tr>
<tr>
<td>4</td>
<td>1 (E)</td>
<td>263</td>
<td>4,702</td>
<td>50.30%</td>
</tr>
</tbody>
</table>
Figure 5: Current Fire Station Bleed Maps for 4-Minute Travel Time
**8-Minute Travel Time**

The analysis demonstrates that the current station configuration could respond to over 99% of incidents within 8 minutes travel time with the utilization of all current fire stations.

**Table 7: Marginal Fire Station Contribution for 8-Minute Travel Time – With Station 1 (E)**

<table>
<thead>
<tr>
<th>Rank</th>
<th>Station</th>
<th>Station Capture</th>
<th>Total Capture</th>
<th>Percent Capture</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2 (C)</td>
<td>8,227</td>
<td>8,227</td>
<td>88.01%</td>
</tr>
<tr>
<td>2</td>
<td>1 (E)</td>
<td>571</td>
<td>8,798</td>
<td>94.12%</td>
</tr>
<tr>
<td>3</td>
<td>3 (W)</td>
<td>438</td>
<td>9,236</td>
<td>98.80%</td>
</tr>
<tr>
<td>4</td>
<td>4 (N)</td>
<td>42</td>
<td>9,278</td>
<td>99.25%</td>
</tr>
</tbody>
</table>

**Figure 6: Current Fire Station Bleed Maps for 8-Minute Travel Time – With Station 1 (E)**
### Table 8: Marginal Fire Station Contribution for 8-Minute Travel Time – Without Station 1 (E)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Station</th>
<th>Station Capture</th>
<th>Total Capture</th>
<th>Percent Capture</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2 (C)</td>
<td>8,227</td>
<td>8,227</td>
<td>88.01%</td>
</tr>
<tr>
<td>2</td>
<td>3 (W)</td>
<td>440</td>
<td>8,667</td>
<td>92.72%</td>
</tr>
<tr>
<td>3</td>
<td>4 (N)</td>
<td>177</td>
<td>8,844</td>
<td>94.61%</td>
</tr>
</tbody>
</table>

### Figure 7: Current Fire Station Bleed Maps for 8-Minute Travel Time – Without Station 1 (E)
Optimized Station Distribution Plans

Optimized locations were created for the department’s consideration. Optimized plans utilize a “white board” approach where all existing locations are disregarded, and we allow the data to indicate the best station locations. It is understood that stations are placed for a variety of reasons and that few agencies would have the flexibility in land availability, purchase price, capital investment, and political considerations to build a brand-new deployment model.

However, these analyses are beneficial for validating existing stations where applicable and identifying potential areas of future need for either new stations or station relocations.
**Optimized 4-Minute Travel Time**

Analyses were completed to develop an optimized station distribution model for a 4-minute travel time. This evaluation suggests that an optimized 9-station model can provide for greater than 92% effectiveness covering all incidents within 4 minutes or less travel time.

A graphic illustration is presented below.

*Figure 8: Optimized Station Deployment Plan - 4-Minute Travel Time*
**Optimized 6-Minute Travel Time**

Analyses were completed to develop an optimized station distribution model for a 6-minute travel time. This evaluation suggests that an optimized 3-station model can provide for nearly 92% effectiveness covering all incidents within 6 minutes or less travel time 90% of the time.

A graphic illustration is presented below.

*Figure 9: Optimized Station Deployment Plan - 6-Minute Travel Time*
**Optimized 7-Minute Travel Time**

Analyses were completed to develop an optimized station distribution model for a 7-minute travel time. This evaluation suggests that an optimized 2-station model can provide for greater than 93% effectiveness covering all incidents within 7 minutes or less travel time 90% of the time.

A graphic illustration is presented below.

*Figure 10: Optimized Station Deployment Plan - 7-Minute Travel Time*
**Optimized 8-Minute Travel Time**

Analyses were completed to develop an optimized station distribution model for an 8-minute travel time. This evaluation suggests that an optimized 2-station model can provide for greater than 95% effectiveness covering all incidents within 8 minutes or less travel time 90% of the time.

A graphic illustration is presented below.

*Figure 11: Optimized Station Deployment Plan - 8-Minute Travel Time*
Geographic Coverage without Consideration for Call Distribution

While there are multiple deployment strategies that may be adopted, two clear policy positions emerge in communities. First, position stations that are best prepared to meet the community’s historical distribution of calls or demand for services. The advantage to this approach is that it is a more efficient model to address meeting 90% of the risk within the desired performance. This is a very stable outlook for communities that are established and are growing in density or in-fill rather than through significant annexations or urban growth.

A second strategy is to provide station response coverage purely on a geographic lens without any consideration for how calls are distributed throughout the community. In addition, this analysis utilized distance without consideration of the relative impedance and/or the robustness of the road network. For example, when time is the unit of measure, a station could travel a farther distance on a highway than through a school zone, but this approach caps the coverage area at 1.5 miles regardless of available travel speeds. This strategy more closely follows the recommendations of insurance rating services. Therefore, the following analyses examine current and hypothetical coverage areas by utilizing 1.5-mile engine and 2.5-mile ladder/tower truck polygons. All stations were within 5-miles, respectively.

Engine Coverage

All analyses utilize the existing road network and average travel impedance for the jurisdiction. When examining the 1.5-mile polygons for engine coverage, it is evident that the core of the city has the best coverage.

In addition, the road networks in the core of the city are more robust in that each of the polygons has a more symmetrical polygon shape. This allows for the Department to have much greater flexibility in station placement and for a more efficient distribution model, as fewer barriers exist. However, where the road networks are not as robust, a less efficient drive time capability emerges.
Figure 12: 1.5-Mile Engine Polygons - Stations 2, 3 and 4
Figure 13: 1.5-Mile Engine Polygons - Stations 1, 2, 3, and 4
**Tower Unit Coverage**

When examining the 2.5-mile polygons for tower unit coverage, the Department maintains considerable coverage based on the geographic coverage only and without consideration for the distribution of risk. However, when considering the distribution of risks, the Department’s deployment strategy is aligned with the risks.

The following map is the current tower unit coverage for 2.5 miles from Station 2.

*Figure 14: 2.5-Mile Tower Unit Polygon – Station 2*
Quint Coverage

When examining the 2.5-mile polygons for quint coverage by Stations 3 and 4, additional geographic coverage could be obtained. In these two scenarios, dedicated units may be assigned to Stations 1, 3, and 4 or Stations 3 and 4, with Quints. If at least 50% of the stations are equipped with either dedicated aerial capacity or a Quint, ISO provides additional credit for ladder services. The utilization of the Quint concept is not universal as one of the first criticisms is the additional cost of running larger apparatus to EMS calls. This analysis and discussion is only provided through the lens of considering improvement in “Coverage for Ladder Service” in the ISO process.

There are no data suggesting that the current Tower placement and configuration is not meeting the needs of the department. The mapping output is provided below.
Figure 15: 2.5-Mile Quint Polygons - Stations 3 and 4
Figure 16: 2.5-Mile Quint Polygons - Stations 1, 3, and 4
DISTRIBUTION OF RISK ACROSS THE JURISDICTION

Distribution of Demand Overall and by Program Areas

Heat maps were created to identify the concentration of the historic demand for services overall and by program area (i.e., fire and EMS). The blue areas have the lowest concentration of demand and the dark red areas have the highest concentration of demand.

For all incidents and for fire and EMS related incidents separately, the greatest relative density of service demands is generally located south of Station 2 (C) and east of Station 3 (W).

*Figure 17: Heat Map for All Incidents*
Figure 19: Heat Map for EMS Related Incidents
Finally, we calculate call density based on the relative concentration of incidents based on approximately 0.5-mile geographic areas as well as the adjacent 0.5-mile areas. The results demonstrate an urban and rural designation based on call density for services and not based on population. The red areas are designated as urban service areas and the green areas are designated as rural service areas. Any area that is not colored has less than one call every six months in the 0.5-mile area and the adjacent areas.

Figure 20: Urban and Rural Call Density Map with Current Stations
Long-Term Sustainability of the Models Presented

It is important to understand that the distribution models are restrictive to the geographic limitations of the jurisdiction and the historical demand for services. Therefore, the number of stations is descriptive of the number of fixed facilities required from which to deploy resources. These analyses do not specifically describe the concentration of resources required at each fire station facility to adequately handle the demand for services. For example, some stations may require two or more units in order to handle the demand for services.

With respect to the long-term sustainability of the deployment models presented here, the models will remain accurate for as long as the jurisdiction’s overall coverage area has not expanded. In other words, if the city’s square mileage remains, then the deployment strategy will be sustainable indefinitely with respect to the coverage area. As other variables such as population density or socioeconomic status change over time, there may be a need for a higher concentration of resources necessary to meet the growing demand for services, but not additional stations. The most prominent reason that the geographic distribution model would need to be updated is for changes in traffic impedance that significantly limit the historical average travel speed. Monitoring travel time performance, system reliability, and call concurrency will provide timely feedback for changes in the environment that could impact the distribution model.

Projected Growth

The available data set was restricted to five calendar years with an average annual growth of approximately 2.4%. The following straight-line projection should be used with caution due to the variability across years. However, in all cases, data must be reviewed annually to ensure timely updates to projections.

Figure 21: Projected Growth in Call Volume

![Figure 21: Projected Growth in Call Volume](image)
Assuming that future demands may not be reasonably distributed across the various stations in the system, the system may ultimately require a redistribution of workload and ultimately reinvestment in resources to meet the growing demand. While the system should be evaluated continuously for performance and desired outcomes, the department should specifically re-evaluate workload and performance indicators for every 1,000-call increase to ensure system stability.

**Population Characteristics**

Generally, older populations and very young populations are considered to be most vulnerable to the frequency and incidents of fire. In addition, older populations historically utilize EMS services with greater frequency. It is important to understand, what field crews often recognize intuitively, that the distribution of population risks are not uniform across the jurisdiction. According to these data, the majority of the jurisdiction is less than 45 years of age. The median age map is provided below.

*Figure 22: Median Age - 2018*
The population density is largely of a suburban density, with some rural densities of less than 1,000 people per square mile.

*Figure 23: Population Density by Census Block - 2018*
The population change is predicted at 0% to +1.25% for the majority of census block areas. Census block areas in the northwest quadrant of Brooklyn Park are predicted to grow at greater rates from 2018 to 2023, ranging from 1.3% to 4.1%. The areas south of Station 2 (C) and east of Station 3 (W) where the highest concentration of requests for service currently occurs, are projected to grow 1.3% to 1.9% over the next five years.

**Figure 24: Annual Population Change - 2018-2023**

![Annual Population Change - 2018-2023](image-url)
Finally, population alone is not the sole variable that influences demand for services, as socioeconomic and demographic factors have greater influence over demand. Median household income was evaluated to determine the degree to which the community had underprivileged populations. According to the US Census Bureau, the 2017 national median household income is reported at $61,372.

Figure 25: Median Household Income - 2018
Figure 27: Unemployment Rate - 2018

2018 USA Unemployment Rate
Block Group
- 13.2 - 100.0 %
- 8.0 - 13.2 %
- 2.9 - 8.0 %
- 0.0 - 2.9 %
RISK ANALYSES

Occupancy Level Risk

Occupancy risk was evaluated across the jurisdiction utilizing internal fire inspection records. Inspection records utilized the building occupancy type, square footage, building height, construction type, and needed fire flow as the risk variables. Secondly, the risk ratings were moderated if the building had an automatic sprinkler system. Ultimately, a risk-rating matrix was developed that categorized 1,577 occupancies within the jurisdiction into high, moderate, and low risks.

Due to the relatively higher demands for personnel and apparatus required for fire events that have occupancy classifications deemed high risk, these risks garnished the highest ratings. Conversely, the presence of an automatic sprinkler system elicited a moderating value. In this manner, the fact that 96% of the fires are controlled with sprinkler activation is included into the matrix for a more realistic risk factor rating. The results of the risk assessment process categorized the 1,577 occupancies into 1 high-risk structure, 575 moderate structures, and 1,002 low risk structures.

Geospatial analyses were completed to map the locations of each of the commercial occupancies included in the risk matrix process and specifically overlaid within each of the fire station locations. This analysis lends validity to the risk assessment matrix and the process utilized by the Department as the concentration of risks is correlated with the historical demand for fire related services. The results of the geospatial analyses of all, high, moderate, and low risk structures are presented in the Figures, respectively. From a broad perspective, this provides validation to the risk assessment process developed with the Department as well as the necessary deployment strategy to cover the historical demand for services.

The risk matrix developed for the occupancy level risk is provided below.
<table>
<thead>
<tr>
<th>Risk Class</th>
<th>Needed Fire Flow</th>
<th>Square Footage</th>
<th>Construction Class</th>
<th>Occupancy Type</th>
<th>Full Credit Sprinkler System</th>
<th>Total Risk Score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Value</td>
<td>Scale</td>
<td>Value</td>
<td>Scale</td>
<td>Value</td>
<td>Scale Scale</td>
</tr>
<tr>
<td>High</td>
<td>5</td>
<td>≥ 1500 gpm</td>
<td>5</td>
<td>≥ 4</td>
<td>5</td>
<td>Combustible or Frame</td>
</tr>
<tr>
<td>Moderate</td>
<td>3</td>
<td>&gt; 499 and &lt; 1500 gpm</td>
<td>3</td>
<td>&gt; 1 and &lt; 4</td>
<td>3</td>
<td>Joisted Masonry or Ordinary</td>
</tr>
<tr>
<td>Low</td>
<td>1</td>
<td>≤ 499 gpm</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>Non-Combustible Masonry, Non-Combustible, Fire Resistive</td>
</tr>
</tbody>
</table>
Figure 28: High Risk Occupancies by Station Demand Zone
Figure 30: Low Risk Occupancies by Station Demand Zone
Concentration of Risks by Station Demand Zone

Analyses were conducted to describe and measure the relative concentration of risks in each of the fire station demand zones. Therefore, a station demand zone risk matrix was developed to quantitatively evaluate the relative risk by including measures for the frequency of moderate and high-risk occupancies in each fire demand zone that are directly correlated to the necessity of higher concentrations of resources. In addition, several measures were used that both serves the distribution aspect of the risk evaluation, but also contributes to the need for higher concentrations of resources. For example, a higher call volume may serve to drive the need for additional resources to cover the community’s demand.

The variables included in the risk matrix are the demand for services for each station demand zone, the number of high and moderate-risk occupancies, and the impact of simultaneous events in each station demand zone. All measures were weighted equally, however, two variables have surrogate relationships with historical community demands and one variable is dedicated to prospective occupancy risk. Community demands were rated more heavily in an effort to provide a realistic balance between the potential risk and historical experience. The risk tool and the scoring template are provided below.

Table 10: Station Demand Zone Risk Concentration Matrix

<table>
<thead>
<tr>
<th>Station Demand Zone</th>
<th>Community Demand</th>
<th>Call Concurrency</th>
<th>High/Moderate Risk Occupancies</th>
<th>Total Risk Score</th>
<th>Risk Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>6</td>
<td>3</td>
<td>3</td>
<td>19.09</td>
<td>Moderate</td>
</tr>
<tr>
<td>3</td>
<td>7</td>
<td>4</td>
<td>7</td>
<td>44.55</td>
<td>High</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
<td>3</td>
<td>3</td>
<td>19.09</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

Overall, the risk assessment identified that Station 3 is a High-risk station and two moderate risk stations (stations 2 and 4). Station 1 was not specifically calculated as a hypothetical area, but it is anticipated it would it be a low risk station.
<table>
<thead>
<tr>
<th>Risk Class</th>
<th>Community Demand (D)</th>
<th>Call Concurrency (C)</th>
<th>High/Moderate Risk Occupancies (R)</th>
<th>Total Risk Score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Value</td>
<td>Scale (Calls)</td>
<td>Value</td>
<td>Scale (%)</td>
</tr>
<tr>
<td>Maximum</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>7 – 9</td>
<td>≥3,600 and &lt; 5,400</td>
<td>7 – 9</td>
<td>≥21 and &lt; 31.5</td>
</tr>
<tr>
<td>Moderate</td>
<td>4 to 6</td>
<td>≥1,800 and &lt; 3,600</td>
<td>4 to 6</td>
<td>≥10.5 and &lt; 21</td>
</tr>
<tr>
<td>Low</td>
<td>1 to 3</td>
<td>&lt; 1,800</td>
<td>1 to 3</td>
<td>&lt; 10.5</td>
</tr>
</tbody>
</table>

* Definitions for Occupancy Risk Type were provided as part of the full risk assessment previously.
These analyses result in a three-dimensional model that illustrates the representativeness of each of the variables as they contribute to each station's risk profile. For example, one station may score heavily in potential risk and have moderate or low demand for services and another station may have little potential risk but have high demand and call concurrency that drives the necessity for a greater concentration of resources.

Graphic representations of the three axis risk matrices are provided below. When reviewing these radar figures, the larger the shaded area, the greater the risk. In addition, each axis is labeled so that the reader can determine the relationship between the risk drivers for each station area.

*Figure 31: Station 2 Risk Profile*
Figure 32: Station 3 Risk Profile

Figure 33: Station 4 Risk Profile