CITYGATE ASSOCIATES, LLC
PUBLIC SAFETY SERVICES

STANDARDS OF COVERAGE ANALYSIS

VOLUME 1 OF 2: TECHNICAL REPORT

NOVATO FIRE PROTECTION DISTRICT

JULY 1, 2022

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EXECUTIVE SUMMARY

The Novato Fire Protection District (District) retained Citygate Associates, LLC (Citygate) to conduct a Standards of Coverage (SOC) study to provide recommendations to improve the District's ability to perform its mission within existing funding levels or with improvements requiring additional funding.

The goal of this SOC analysis is to identify current services and desired service levels and then assess the District's ability to provide them. After understanding any gaps in operations and resources, Citygate provides recommendations to improve District operations and services over time. Citygate utilized various industry-recognized best practice guidelines and criteria in the field of deployment analysis, including National Fire Protection Association (NFPA) standards, the self-assessment criteria of the Commission on Fire Accreditation International (CFAI), Insurance Services Office (ISO) schedules, and federal and state mandates relative to emergency services.

This report is presented in two volumes. **Volume 1** includes this Executive Summary and all findings and recommendations; Citygate's deployment analysis, including key elements from the separate Community Risk Assessment and Incident Statistical Analysis reports; and one appendix, including the full Community Risk Assessment. **Volume 2** contains all the maps referenced throughout this report. Overall, this assessment provides 17 findings and 4 actionable recommendations.

POLICY CHOICES FRAMEWORK

There are no federal or state regulations mandating any specific level of fire service staffing, response times, or outcomes. Thus, the level of fire protection services provided is a *local policy decision.* Communities have the level of fire services they can afford and choose to "purchase," which may not always be the level desired. However, if services are provided at all, local, state, and federal regulations relating to firefighter and citizen safety must be followed.

RISK ASSESSMENT SUMMARY

The District has made a considerable investment in and commitment to ongoing risk assessment and hazard mitigation to reduce both the frequency and severity of hazard occurrences. This is evidenced in part by being selected by the NFPA to participate in its Community Risk Assessment Pilot Project that develops customized dashboards powered by mySidewalk, a Creative Community Intelligence platform specializing in digital data visualization. These dashboards visually describe data about the community served, its social vulnerabilities and built environment, foundational risk mitigation efforts/initiatives, COVID-19 impacts, and other elements described in NFPA 1300 – Standard on Community Risk Assessment and Community Risk Reduction Plan

Development (2020 edition). Data and information from these dashboards were used in conducting this assessment.

The District was also a key agency partner in the development of the initial and updated Marin Community Wildfire Protection Plan (CWPP), which provides a science-based assessment of wildfire hazard in Marin County and provides fire agencies and other stakeholders guidance and strategies to reduce wildland fire risk and resultant impacts. In addition, the District was a key stakeholder in the creation of the Marin Wildfire Prevention Authority (MWPA), a Countywide Joint Powers Authority with 17 member agencies, including cities, towns, the County, and special districts, whose mission is to lead "the development of fire adapted communities using sound scientific, financial, programmatic, ecological practices, vegetation management, community education, evacuation and warning systems with the support of its member and partner agencies."[1]

These initiatives demonstrate the District leadership's commitment to risk assessment, mitigation, and data tracking both at the District and regional level.

RESPONSE PERFORMANCE SUMMARY

The District serves a diverse urban-to-rural population over a large geographic area. Fire service deployment, simply summarized, is about the *speed* and *weight* of response. *Speed* refers to initial (first-due) response of all-hazard intervention resources (e.g., engines, ladder trucks, squads, and ambulances) strategically deployed across a jurisdiction for response to emergencies within a travel-time interval to achieve desired outcomes. *Weight* refers to multiple-unit (Effective Response Force, or ERF) responses to more serious emergencies, such as building fires, multiple-patient medical emergencies, vehicle collisions with extrication required, or technical rescue incidents. In these situations, a sufficient number of firefighters must be assembled within a time interval to safely control the emergency and prevent it from escalating into a more serious event.

In urban population areas, if desired outcomes include limiting building fire damage to only part of the inside of an affected building, minimizing permanent impairment from a medical emergency, or both, then within *urban* population areas of the District initial units should arrive within 7:00 to 8:00 minutes from 9-1-1 notification and a multiple-unit ERF should arrive within 11:00 to 12:00 minutes of 9-1-1 notification at the Marin County Sheriff's Office Dispatch Center, all at 90 percent or better reliability. Response time to emergency incidents includes three separate components: (1) 9-1-1 call processing/dispatch time, (2) crew turnout time, and (3) travel time. Recommended best practices for these components are 1:30 minutes, 2:00 minutes, and 4:00/8:00 minutes respectively for first-due and multiple-unit ERF responses in urban areas. For rural areas, best practice travel time is 8:00 minutes for first-due units and 16:00 minutes for ERF. The

[1] Source: www.marinwildfire.org/about-us.

following table summarizes the District's 90th percentile response performance over the four-year study period.

Table 1—Response Performance Summary (2018–2021)

Response Component	Current District Policy		Best Practice		90th Percentile Performance (Minutes)	Performance vs. Current Policy	Performance vs. Best Practice
	Call Type	Minutes	Minutes	Reference			
Call Processing / Dispatch	ALL	**None**	**1:30**	Citygate	**0:47**	**N/A**	**-48%**
Crew Turnout	EMS	**1:00**	**2:00**	Citygate	**2:03**	**105%**	**3%**
	Fire	**1:45**	**2:00**	NFPA/Citygate	**2:03**	**17%**	**3%**
First Unit Travel	Novato	**None**	**4:00**	Citygate	**6:04**	**N/A**	**52%**
	Rural	**None**	**8:00**	Citygate	**8:23**	**N/A**	**5%**
Call to First Unit Arrival	Novato	**8:00**	**7:30**	Citygate	**7:47**	**-3%**	**4%**
	Rural	**8:00**	**11:30**	Citygate	**10:23**	**30%**	**-10%**
ERF Travel	All	**None**	**8:00**	NFPA/Citygate	**14:50**	**N/A**	**85%**
Call to ERF Arrival	Fire	**8:00**	**11:30**	Citygate	**18:43**	**134%**	**63%**

As the table shows, call processing and crew turnout performance are *meeting* best practice goals of 1:30 minutes and 2:00 minutes, respectively. However, first-unit travel is *significantly slower* in the City of Novato than the 4:00-minute best practice goal in urban areas, and first-unit travel is only *slightly slower* than the 8:00-minute best practice goal in the rural areas of the District. Call to first unit arrival performance, which is a fire agency's *true* customer service measure, is *nearly meeting* the recommended 7:30-minute best practice goal in the City of Novato and is *faster* than the recommended 11:30-minute best practice goal for the rural areas of the District. ERF call to arrival performance, while 41 percent *slower* than an 11:30-minute *urban* best practice goal, represents only 19 incidents (0.08 percent of total) over the four-year study period.

Overall Deployment Summary

Even where state or local fire codes require fire sprinklers in residential dwellings, it will be many decades before enough homes are replaced or remodeled with automatic fire sprinklers. If desired outcomes include limiting building fire damage to only part of the inside of an affected building or minimizing permanent impairment resulting from a medical emergency, or both, then urban

population areas of the District will need both first-due unit and multiple-unit ERF coverage in similar risk neighborhoods consistent with Citygate response performance recommendations, starting with a first-due unit arrival within 7:30 minutes from 9-1-1 dispatch notification and an ERF arrival within 11:30 minutes of 9-1-1 notification, all at 90 percent or better reliability.

Citygate finds the District's physical response resources are appropriate to protect against the hazards likely to impact its service area. The daily staffing level of 20 personnel is generally sufficient for one moderate complexity ERF incident, leaving one additional staffed engine and paramedic ambulance available for concurrent incident(s). Citygate also finds that the District has a robust EMS model, including Advanced Life Support (ALS) ground ambulance transportation and billing, and is closely monitoring evolving EMS risk and demand data to add incremental service capacity as data demonstrates the need and there are sufficient fiscal resources to support.

Overall annual service demand increased nearly 7 percent in 2021 from the previous year, nearly matching peak service demand in 2019. In addition, 85 percent of all calls for service were within the City of Novato, which is to be expected given its higher population density than the more rural areas of the District. Limited projected population growth over the next 14 years to 2035 will likely increase service demand somewhat, with EMS-related demand increasing at a higher rate than other call types due to anticipated additional senior living, continuum of care, and congregate care facilities.

In terms of emergency incident workload, no single staffed resource is approaching workload saturation; however, during peak hours of the day, more than 24 percent of incidents occurred while one or more other incidents were underway, predominantly impacting Station 61. The two staffed medic ambulances are concurrently committed on 17 percent of all EMS calls for short periods of time each, requiring Medic 62 to be staffed for any third concurrent EMS incident, which is only 5.6 percent of all EMS calls. Further, all three ambulances are concurrently committed on only 1.7 percent of all EMS calls for 15:00 minutes or less on nearly all occurrences. Given this, Citygate finds that District ambulance resources are appropriately staffed and deployed to meet current EMS demand, with minimal risk exposure during periods of concurrent commitment; however, as EMS demand increases, Citygate suggests the District consider incremental service enhancements as funding permits, as described in **Section 2.7.6**.

Citygate's analysis further finds that the District's current station locations can be expected to provide 4:00-minute first-due travel time coverage to *only 52 percent* of the District's public road network; however, 6:00-minute travel can be expected to cover 70 percent of the road miles within Novato and 86 percent of the total District road miles, which in Citygate's experience is good urban coverage and very good rural coverage. Evaluation of Station 63's location found that relocating it approximately 1.5 miles southeast to improve travel time coverage would not be cost effective for the benefit in travel time gained.

Given the diversity of its service area, Citygate recommends the District amend its current response performance policy to provide differential standards for the City of Novato and the unincorporated rural areas of the District, as described in **Section 2.8.3**, to drive future planning and monitoring of fire service performance.

FINDINGS AND RECOMMENDATIONS

Following are the findings and recommendations presented throughout this report.

Deployment Findings

Finding #1: The District's physical response unit types are appropriate to protect against the hazards likely to impact its service area.

Finding #2: The District has automatic mutual aid agreements with neighboring fire agencies to provide augmented response capacity as needed.

Finding #3: The District has adopted response performance objectives *partially compliant* with best practice recommendations as published by the Commission on Fire Accreditation International and National Fire Protection Association.

Finding #4: The District has a standard response plan that considers risk and establishes an appropriate initial response for each incident type; each type of call for service receives the combination of engines, specialty units, and command officers customarily needed to effectively control that type of incident based on District experience.

Finding #5: At least two simultaneous incidents are occurring 24 percent of the time, predominantly impacting Station 61.

Finding #6: District ambulances resources are appropriately staffed and deployed to meet current EMS demand with minimal risk exposure during periods of concurrent commitment.

Finding #7: The Marin County Sheriff's Office Communications Division 9-1-1 Dispatch Center 90th percentile call processing performance is 22 percent *faster* at 0:47 minutes than the 60-second best practice standard and 48 percent faster than the District's current 1:30-minute goal. However, this call processing performance likely does not include the earliest timestamp when a 9-1-1 call is first answered in the Dispatch Center.

Finding #8: Crew turnout performance is *meeting* the 2:00-minute best practice goal.

Finding #9: First-unit travel performance in the City of Novato, at 6:04 minutes, is *52 percent slower* than the recommended 4:00-minute best practice goal for *urban* areas, while performance outside the City of Novato, at 8:23 minutes, is only *5 percent slower* than the recommended 8:00-minute best practice goal for rural areas.

Finding #10: First-unit call-to-arrival performance in the City of Novato, at 7:47 minutes, is *3 percent faster* than the current 8:00-minute District response standard and only *4 percent slower* than the 7:30-minute best practice goal for urban areas. In addition, call to first unit arrival performance outside the City of Novato, at 10:23 minutes, is *10 percent faster* than the recommended 11:30-minute best practice goal for rural areas and *30 percent slower* than the current District response standard.

Finding #11: Overall ERF call to arrival performance, at 18:43 minutes, was *63 percent slower* than the recommended 11:30-minute best practice goal for *urban* areas and *134 percent slower* than the current 8:00-minute District response standard. However, this performance includes only 17 incidents over the four-year study period, and small data sets can be very volatile. It should also be noted that ERF call to arrival performance for the six incidents in 2021 met the 11:30-minute best practice goal.

Finding #12: The District's daily staffing level of 20 personnel is minimally adequate for one moderate complexity ERF incident, with one remaining medic unit available for a concurrent incident.

Finding #13: Annual service demand increased nearly 7 percent in 2021 from the previous year, nearly matching peak service demand in 2019, with EMS demand increasing nearly 8 percent over the same period.

Finding #14: Of all calls for service, 85 percent are within the City of Novato.

Finding #15: Projected population growth within the District over the next 14 years to 2035 can be expected to minimally impact service demand, except for EMS-related calls for service.

Finding #16: Current station locations can be expected to provide 6:00-minute first-due travel time coverage to nearly 86 percent of all public road segments within the District's service area, which is *good* suburban-level coverage.

Finding #17: Relocating Station 63 would not be cost-effective relative to any potential improvement in travel time coverage.

Deployment Recommendations

Recommendation #1: The District should modify its current Response Time Standards policy to include both first-due and First Alarm, or ERF, performance standards for all incident types, as recommended by the Commission on Fire Accreditation International and National Fire Protection Association.

Recommendation #2: To provide enhanced ambulance capacity as funding allows, establish a fourth standby, cross-staffed ambulance for surge capacity at Station 63 or 64 while maintaining adequate reserve ambulance capacity.

Recommendation #3: When the third District ambulance utilization is consistently at or above two times per day between the hours of 10:00 am and 6:00 pm, or sooner if revenues permit, consider staffing a Basic Life Support (BLS) ambulance 10 to 12 hours per day during peak activity hours for low-acuity EMS calls and non-emergency transfers, while retaining immediate cross-staffing capacity of a fourth paramedic ambulance as needed for surge capacity. Alternately, consider adding a third staffed 12-hour Advanced Life Support (ALS) ambulance during peak hours.

Recommendation #4: **Adopt Updated Deployment Policies:** The District should adopt *updated*, complete performance measures to aid deployment planning and to monitor performance. Measures should be established for urban and rural areas. The measures of time should be designed to deliver outcomes that will save patients where possible upon arrival and keep small and expanding fires from becoming more serious. With this is mind, Citygate recommends the following response performance measures:

4.1 **Fire Station Distribution:** To treat pre-hospital medical emergencies and control small fires, the first-due unit should arrive within 8:00 minutes, 90 percent of the time, from the receipt of the 9-1-1 call at the Marin County Sheriff's Office 9-1-1 Dispatch Center within the City of Novato and within 11:00 minutes in the rural District response areas; this equates to a 90-second dispatch, 2:00-minute crew turnout, and 4:30-minute travel (City of Novato) or 7:30-minute travel time (rural response areas).

4.2 **Fire Station Concentration – Multiple-Unit Effective Response Force (ERF) for Serious Emergencies:** To confine building fires near the room of origin, keep vegetation fires under one acre in size, and treat multiple medical patients at a single incident, a multiple-unit ERF of at least 15 personnel, including at least one chief officer, should arrive within 12:00 minutes in the City of Novato from the time of 9-1-1 call receipt at the Marin County Sheriff's Office 9-1-1 Dispatch Center, 90 percent of the time; this equates to 90-second dispatch, 2:00-minute crew turnout, and 8:30-minute travel. This same ERF should arrive within 19:30 minutes in the rural unincorporated areas of the District from the time of 9-1-1 call receipt at the Marin County Sheriff's Office 9-1-1 Dispatch Center, 90 percent of the time; this equates to 90-second dispatch time, 2:00-minute crew turnout time, and 16:00-minute travel time.

4.3 **Hazardous Materials Incidents:** To protect the District's service area from the hazards associated with uncontrolled release of hazardous and toxic materials, the first-due unit should arrive to assess the situation, isolate and deny entry, and determine the need for a Hazardous Materials Response Team within 8:00 minutes, 90 percent of the time, from the receipt of the 9-1-1 call at the Marin County Sheriff's Office 9-1-1 Dispatch Center within the City of Novato and within 11:00 minutes in the rural District response areas; this equates to a 90-second dispatch, 2:00-minute crew turnout, and 4:00-minute travel (City of Novato) or 7:30-minute travel time (rural response areas).

4.4 **Technical Rescue Incidents:** To provide technical rescue services as needed, the first-due unit should arrive within 8:00 minutes, 90 percent of the time, from the receipt of the 9-1-1 call at the Marin County Sheriff's Office 9-1-1 Dispatch Center within the City of Novato and within 11:00 minutes in the rural District response areas; this equates to a 90-second dispatch, 2:00-minute crew turnout, and 4:30-minute travel (City of Novato) or 7:30-minute travel time (rural response areas).

Additional resources as needed should arrive within 12:00 minutes within the City of Novato and within 19:30 minutes in the rural District areas to facilitate safe rescue/extrication and delivery of the victim to the appropriate emergency medical care facility.

NEXT STEPS

Near Term

- Review and absorb the content, findings, and recommendations of this report.
- Adopt revised response performance goals as recommended.

Longer Term

- Monitor response time performance and unit workload at least annually.
- As EMS demand increases and funding allows, consider adding a 12-hour ALS or BLS ambulance during peak demand hours.

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SECTION 1—INTRODUCTION AND BACKGROUND

The Novato Fire Protection District (District) retained Citygate Associates, LLC (Citygate) to conduct a Standards of Coverage (SOC) study to provide recommendations to improve the District's ability to perform its mission within existing funding levels or with improvements requiring additional funding. Citygate evaluated and made recommendations relative to the organization and deployment of fire suppression and EMS operations, with the results then able to serve as a foundation for future fiscal and operational planning. This assessment identifies both current services and desired service levels and then reviews the District's ability to provide them in light of projected changes to its service area.

Citygate's scope of work and corresponding Work Plan were developed consistent with Citygate's Project Team members' experience in fire administration and deployment. Citygate utilized various industry-recognized best practice guidelines and criteria in the field of deployment analysis, including National Fire Protection Association (NFPA) standards, the self-assessment criteria of the Commission on Fire Accreditation International (CFAI), Insurance Services Office (ISO) schedules, and federal and state mandates relative to emergency services.

1.1 REPORT ORGANIZATION

This report is organized into the following sections. **Volume 2—Map Atlas** is separately bound.

Executive Summary	Summarizes fire service policy choices and all findings and recommendations that can be used to strategically guide the District's efforts over the near future.
Section 1	**Introduction and Background**—Describes Citygate's project approach, methodology, and scope of work, as well as an overview of the District and its service area.
Section 2	**Standards of Coverage Analysis**—Describes Citygate's detailed analysis, findings, and recommendations for each of the eight Standards of Coverage assessment elements.
Appendix A	**Community Risk Assessment**—Provides a comprehensive analysis of the fire and non-fire hazards likely to impact the County.

1.1.1 Goals of the Report

Citygate cites findings and makes recommendations as appropriate relative to each finding. Findings and recommendations throughout this report are sequentially numbered. A complete list of these same findings and recommendations is provided in the Executive Summary.

This document provides technical information about how fire services are provided and legally regulated and how the District currently operates. This information is presented in the form of recommendations and policy choices for consideration by District leadership.

The result is a strong technical foundation upon which to understand the advantages and disadvantages of the choices facing the District regarding the best way to provide fire services and, more specifically, at what level of desired outcome and expense.

1.1.2 Limitations of Report

In the United States, there are no federal or state regulations requiring a specific minimum level of fire services. Each community, through the public policy process, is expected to understand the local fire and non-fire risks and its ability to pay and then choose its level of fire services. *If* fire services are provided at all, federal and state regulations specify how to safely provide them for the public and for the personnel providing the services.

While this report and technical explanation can provide a framework for the discussion of District services, neither this report nor the Citygate team can make the final decisions, nor can they cost out every possible alternative in detail. Once recommendation implementations receive policy approval, District staff can conduct any final costing and fiscal analyses as typically completed in its normal operating and capital budget preparation cycle.

1.2 Project Approach and Scope of Work

1.2.1 Project Approach and Methodology

Citygate utilized multiple sources to gather, understand, and model information about the District. Citygate requested and reviewed relevant background data and information to better understand current costs, service levels, and the history of service level decisions, including prior studies.

Citygate subsequently reviewed demographic information about the District's service area and the potential for future growth and development. Citygate also obtained map and response data from which to model current and projected fire service deployment, with the goal to identify the location(s) of stations and crew quantities required to best serve the District's service area as it currently exists and to facilitate future deployment.

Once Citygate understood the District's service area and its fire and non-fire risks, the Citygate team tested deployment model revisions against the travel time mapping and response data to ensure an appropriate fit. Citygate also evaluated future District service area growth and service demand by risk type. This resulted in Citygate proposing an approach to address current and long-range needs with effective and efficient use of resources. The result is a framework for enhancing District services while meeting reasonable community expectations and fiscal realities.

1.2.2 Project Scope of Work

Citygate's approach to this operational enhancement update involved:

- Requesting and reviewing relevant City, County, and District data and information.
- Interviewing District study team members and stakeholders.
- Utilizing FireView™, a geographic mapping software program, to model fire station travel time coverage.
- Using StatsFD™, an incident response time analysis program, to review and analyze prior incident data and plot the results on graphs and geographic mapping exhibits.
- Identifying and evaluating future District service area populations and related development growth.
- Reviewing service demand by risk type.
- Recommending appropriate risk-specific response performance goals.

1.3 DISTRICT OVERVIEW

Located in east-central Marin County approximately 29 miles north of San Francisco, the Novato Fire Protection District encompasses 71 square miles, including the City of Novato, with a population of nearly 60,000 residents.[2] Formed in 1894 as the Novato Volunteer Fire Department and subsequently established as a fire district in 1926, it is governed by a five-member Board of Directors elected at large to staggered four-year terms.

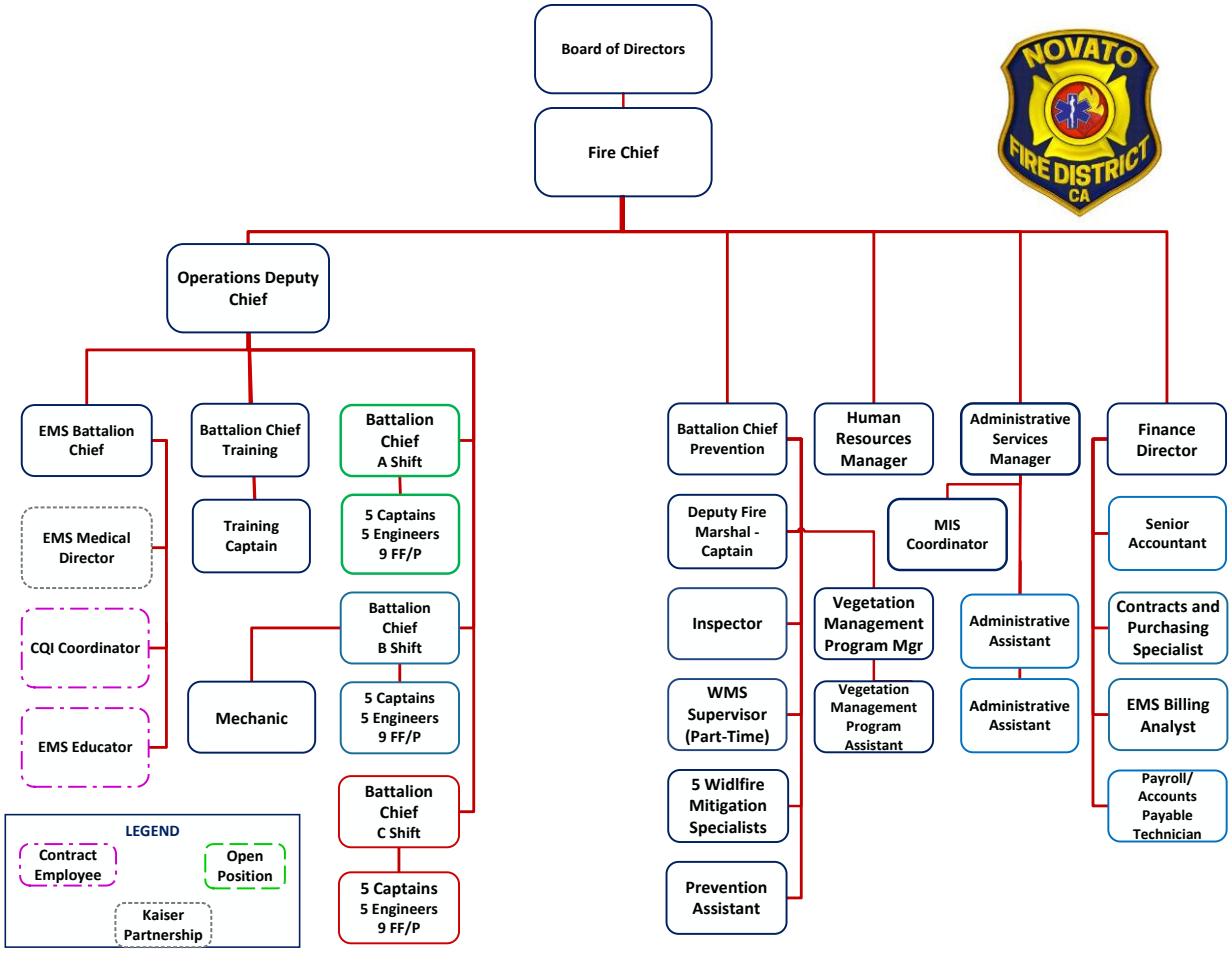
The District provides fire suppression, rescue, basic and advanced pre-hospital emergency medical services and ground ambulance transportation, and related services from five fire stations and an administration building with a staff of 78 personnel. The District also has an aerial ladder truck, two Type-3 wildland fire engines, and one water tender that are cross-staffed as needed by on-duty or call-back personnel.

1.3.1 Organization

The District is organized as shown in the following figure.

[2] Source: Esri Community Profile (2020).

Figure 1—Fire District Organization



1.3.2 Facilities and Resources

The District provides response services from five fire stations with a daily staffing of 20 personnel, as summarized in the following table.

Table 2—District Facilities, Response Resources, and Daily Operational Staffing

Station	Address	Assigned Apparatus	Minimum Daily Staffing
Station 61	7025 Redwood Boulevard	**Engine-61** **Medic 61** *Water Tender-61* **Battalion Chief**	**3** **2** ** **1**
Station 62	450 Atherton Avenue	**Engine-62** *Medic 62*	**3** **
Station 63	65 San Ramon Way	**Engine-63** *Engine-663*	**3** **
Station 64	319 Enfrente Road	**Engine-64** *Truck-64*	**3** **
Station 65	5 Bolling Circle	**Engine-65** **Medic 65** *Engine-665*	**3** **2** **
		Total	**20**

** Cross-staffed as needed based on type of call.

1.3.3 Service Capacity

All response personnel are trained to either the Emergency Medical Technician (EMT) level, capable of providing Basic Life Support (BLS) pre-hospital emergency medical care, or EMT-paramedic (paramedic) level, capable of providing Advanced Life Support (ALS) pre-hospital emergency medical care. Engine staffing includes at least one EMT-paramedic at all times. The District also provides ALS ground ambulance service. Air ambulance services, when needed, are provided by REACH Air Medical Services from Santa Rosa or Napa or by Life Flight from Palo Alto. Three hospitals provide emergency medical services within the region, including Novato Community Hospital, Kaiser Permanente San Rafael Medical Center, and MarinHealth Medical Center (Kentfield). MarinHealth Medical Center is also a Level III Trauma Center.

Response personnel are also trained to the US Department of Transportation Hazardous Material First Responder Operational level to provide initial hazardous material incident assessment, hazard isolation, and support for the Marin County Hazardous Materials Response Team from Ross Valley.

Response personnel are further trained to the confined space awareness level, and technical rescue services are available as needed by the Marin County Urban Search and Rescue Team.

The District has automatic mutual aid agreements with the Marinwood Community Services District, the Marin County Fire Department, the City of San Rafael Fire Department, and the City of Petaluma Fire Department.

Finding #1:	The District's physical response unit types are appropriate to protect against the hazards likely to impact its service area.
Finding #2:	The District has automatic mutual aid agreements with neighboring fire agencies to provide augmented response capacity as needed.

SECTION 2—STANDARDS OF COVERAGE ANALYSIS

This section provides a detailed analysis of the District's current ability to deploy and mitigate hazards within its service areas. The response analysis uses prior response statistics and geographic mapping to help the District and the community visualize what the current response system can and cannot deliver.

2.1 STANDARDS OF COVERAGE PROCESS OVERVIEW

The core methodology used by Citygate in the scope of this deployment analysis work is *Standards of Response Cover*, fifth and sixth editions, which is a systems-based approach to fire department deployment published by the CFAI. This approach uses local risk and demographics to determine the level of protection best fitting a community's needs.

The Standards of Coverage (SOC) method evaluates deployment as part of a fire agency's self-assessment process. This approach uses risk and community expectations regarding outcomes to help elected officials make informed decisions regarding fire and EMS deployment levels. Citygate has adopted this multiple-part systems approach as a comprehensive tool to evaluate fire station locations. Depending on the needs of the study, the depth of the components may vary.

In contrast to a one-size-fits-all prescriptive formula, such a systems approach to deployment allows for local determination. In this comprehensive approach, each agency can match local needs (risks and expectations) with the costs of various levels of service. In an informed public policy debate, a governing board "purchases" the fire and emergency medical service levels the community needs and can afford.

While working with multiple components to conduct a deployment analysis is admittedly more work, it yields a much better result than using only a singular component. For instance, if only travel time is considered and frequency of multiple calls is not, the analysis could miss over-worked companies. If a risk assessment for deployment is not considered and deployment is based only on travel time, a community could under-deploy to incidents.

The following table describes the eight elements of the SOC process.

Table 3—Standards of Coverage Process Elements

SOC Element		Description
1	Existing Deployment System	Overview of the community served, authority to provide services, and current deployment model and performance metrics
2	Community Outcome Expectations	Review of the community's expectations relative to response services provided by the agency
3	Community Risk Assessment	Description of the values to be protected within the service area, and analysis of the fire and non-fire risks likely to impact the community served
4	Critical Task Analysis	Review of the essential tasks that must be performed and the personnel required to deliver a stated outcome for an Effective Response Force (ERF)
5	Distribution Analysis	Review of the spacing of initial response (first-due) resources (typically engines) to control routine emergencies to achieve desired outcomes
6	Concentration Analysis	Review of the spacing of fire stations so that larger or more complex emergencies receive sufficient resources in a timely manner (ERF) to achieve desired outcomes
7	Reliability and Historical Response Effectiveness Analysis	Using recent prior response statistics, determination of the percentage of conformance to established response performance goals the existing deployment system delivers
8	Overall Evaluation	Proposing Standards of Coverage statements by risk type as appropriate

Source: CFAI, *Standards of Response Cover*, fifth edition.

Fire service deployment, simply summarized, is about the *speed* and *weight* of response. *Speed* refers to initial (first-due) response of all-hazard intervention resources (engines, ladder trucks, squads, and ambulances) strategically deployed across a jurisdiction for response to emergencies within a travel-time interval sufficient to control routine to moderate emergencies without the incident escalating to greater size or severity. *Weight* refers to multiple-unit responses for more serious emergencies, such as building fires, multiple-patient medical emergencies, vehicle collisions with extrication required, or technical rescue incidents, where enough firefighters must be assembled within a time interval to safely control the emergency and prevent it from escalating into an even more serious event. The following table illustrates this deployment paradigm.

Table 4—Fire Service Deployment Paradigm

Element	Description	Purpose
***Speed** of Response*	Response time of initial all-hazard intervention units strategically located across a jurisdiction	Controlling routine to moderate emergencies without the incident escalating in size or complexity
***Weight** of Response*	Number of firefighters in a multiple-unit response for serious emergencies	Assembling enough firefighters within a reasonable time frame to safely control a more complex emergency without escalation

Smaller fires and less complex emergencies require a single- or two-unit response (engine or specialty resource) within a relatively short response time. Larger or more complex incidents require more units and personnel to control. In either case, if the crews arrive too late or the total number of personnel is too few for the emergency, they are drawn into an escalating and more dangerous situation. The science of fire crew deployment is to spread crews out across a community or jurisdiction for quick response to keep emergencies small with positive outcomes without spreading resources so far apart that they cannot assemble quickly enough to effectively control more serious emergencies.

2.2 CURRENT DEPLOYMENT

SOC ELEMENT 1 OF 8
EXISTING DEPLOYMENT POLICIES

Nationally recognized standards and best practices suggest using several incremental measurements to define response time. Ideally, the clock start time is when the 9-1-1 dispatcher answers the emergency call. In some cases, the call must then be transferred to a separate fire dispatch center. In this setting, the response time clock starts when the fire dispatch center receives the 9-1-1 call into its computer-aided dispatch (CAD) system. Response time increments include dispatch center call processing, crew alerting and response unit boarding (commonly called turnout), and actual driving (travel) time.

The District has adopted the following response performance standards.[3]

[3] Source: Novato Fire Protection District Policy 303.

Table 5—Current District Emergency Services Response Performance Standards

Resource	Response Performance Standard (Minutes)[1]	Percent Reliability
First-Due Engine	**8:00**	90%
First Arriving District ALS Unit	**10:00**	90%
Full First-Alarm Fire Assignment	**8:00**	90%

[1] Includes call processing/dispatch, crew turnout, and travel time,

NFPA Standard 1710, a recommended deployment standard for career fire departments in urban/suburban areas, recommends initial (first-due) intervention units arrive within 4:00 minutes *travel* time and recommends arrival of all the resources comprising the multiple-unit First Alarm within 8:00 minutes, at 90 percent or better reliability.

The most recent published NFPA best practices have decreased the dispatch processing time to 1:00 minute;[4] however, Citygate continues to recommend the prior editions' 1:30-minute standard as an achievable best practice goal. Further, for crew turnout time, 60 to 80 seconds is nationally recommended. However, in Citygate's experience this is too short due to the protective clothing that must be donned, fire station floorplan design, or both. Current District policy for crew turnout (reflex) time is 1:00 minute for medical emergencies and 1:45 minutes for fire incidents.

If the travel time measures recommended by Citygate and the NFPA are added to dispatch processing and crew turnout times recommended by Citygate and NFPA best practices, then, *for an urban* area, a realistic 90 percent first-due unit response performance goal is 7:30 minutes from the time of the fire dispatch center receiving the call. This includes 1:30-minute call processing/dispatch, 2:00-minute crew turnout, and 4:00-minute travel.

Current District policy establishes first engine company response performance standards for all incident types and First Alarm response performance standards for fire incidents only. Current best practice recommendations include a response performance standard for both first unit as well as First Alarm or ERF for all incident types.

[4] NFPA 1221 – Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems (2019 edition).

Finding #3:	The District has adopted response performance objectives *partially compliant* with best practice recommendations as published by the Commission on Fire Accreditation International and National Fire Protection Association.
Recommendation #1:	The District should modify its current Response Time Standards policy to include both first-due and First Alarm, or ERF, performance standards for all incident types, as recommended by the Commission on Fire Accreditation International and National Fire Protection Association.

2.2.1 Current Deployment Model

Resources and Staffing

The District's current deployment model includes five all-risk fire engines staffed with three personnel, including at least one EMT-paramedic, two ALS ambulances staffed with two firefighter/paramedics each, and one Battalion Chief, for a total daily minimum year-round continuous staffing of 20 personnel operating from five fire stations. The District also has an aerial ladder truck, two wildland fire engines, one water tender, and one ALS ambulance that are cross-staffed as needed by on-duty or call-back personnel.

Response Plan

The District utilizes a tiered response plan calling for different types and numbers of resources depending on incident/risk type. The Marin County Sheriff's Office Communications Division CAD system selects and dispatches the closest and most appropriate resource(s) pursuant to the District's response plan, including automatic and mutual aid resources as summarized in the following table.

Table 6—Response Plan by Type of Emergency

Incident Type	Response	Total Staffing
Structure Fire	3 Engines, 1 Truck or Fourth Engine, 1 Medic Ambulance, BC	**15**
Medical Emergency	1 Engine, 1 Medic Ambulance	**5**
Vegetation/Wildland Fire	4 Engines, 1 Medic Ambulance, BC	**15**
Vehicle Fire	1 Engine	**3**
Commercial Vehicle Fire	2 Engines, 1 Water Tender	**7**
Vehicle Collision	1 Engine, 1 Medic Ambulance	**5**
Hazardous Materials	3 Engines, 1 Medic Ambulance, 1 Truck, BC	**15**

Source: Novato FPD Policies 312, 313, 315.

Finding #4: The District has a standard response plan that considers risk and establishes an appropriate initial response for each incident type; each type of call for service receives the combination of engines, specialty units, and command officers customarily needed to effectively control that type of incident based on District experience.

2.3 Outcome Expectations

SOC Element 2 of 8
Community Outcome Expectations

The SOC process begins by reviewing existing emergency services outcome expectations. This includes determining the purpose of the response system and whether the governing body has adopted any response performance measures. If it has, the time measures used must be understood and reliable data must be available.

Current national best practice is to measure percent completion of a goal (e.g., 90 percent of responses) instead of an average measure. Mathematically, this is called a fractile measure.[5] Measuring the average only identifies the central or middle point of response time performance for all calls for service in the data set. This makes it impossible to know how many incidents had response times that were far above or just above the average.

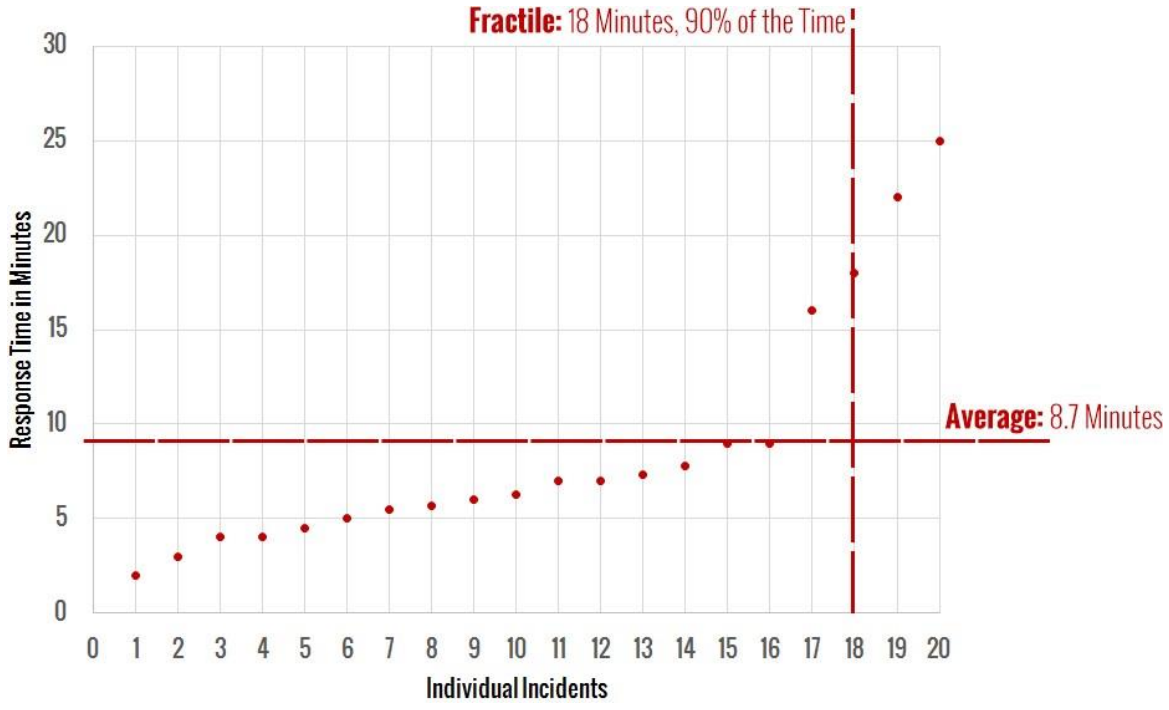
[5] A *fractile* is that point below which a stated fraction of the values lie. The fraction is often given in percent; the term percentile may then be used.

For example, the following figure shows response times for a hypothetical small fire department that receives 20 calls for service each month. Each response time has been plotted on the graph from shortest to longest.

This figure shows that the average response time is 8.7 minutes. However, the average response time fails to properly account for four calls for service with response times far exceeding a threshold in which positive outcomes could be expected. In fact, it is evident in the following figure that 20 percent of responses are far too slow and that this hypothetical jurisdiction has a potential life-threatening service delivery problem. Average response time as a fire service delivery measurement is simply not sufficient. This is a significant issue in larger cities if hundreds or thousands of calls are answered far beyond the average response time.

By using the fractile measurement with 90 percent of responses in mind, this small jurisdiction has a response time of 18:00 minutes, 90 percent of the time. Stated another way, 90 percent of all responses are 18:00 minutes or less. This fractile measurement is far more accurate at reflecting the service delivery situation of this small agency.

Figure 2—Fractile versus Average Response Time Measurements



More importantly, within the SOC process, the goal is positive outcomes. From that, crew size and response time can be calculated to provide appropriate fire station spacing (distribution and concentration) to achieve the desired goal. Emergency medical incidents include situations with the most severe time constraints. The brain can only survive 4:00 to 6:00 minutes without oxygen.

Cardiac arrests make up a small percentage, along with drowning, choking, trauma constrictions, or other similar events that can cause oxygen deprivation to the brain. In a building fire, a small incipient fire can grow to involve the entire room in a 6:00- to 8:00-minute time frame. If fire service response is to achieve positive outcomes in severe emergency medical situations and incipient fire situations, *all* responding crews must arrive, assess the situation, and deploy effective measures before brain death occurs or before the fire spreads beyond the room of origin.

Therefore, from the time of 9-1-1 receiving a call, an effective deployment system is *beginning* to manage the problem within a 7:00- to 8:00-minute total response time. This is right at the point when brain death is becoming irreversible and a building fire has grown to the point of leaving the room of origin and becoming very serious. Consequently, the District needs a first-due response goal that is within a range to give people in the situation hope for a positive outcome. It is important to note that the fire or medical emergency continues to deteriorate from the time of inception, not from the time the fire engine starts to drive the response route. Ideally, the emergency is noticed immediately and the 9-1-1 system is activated promptly. This step of awareness—calling 9-1-1 and giving the dispatcher accurate information—takes at least 1:00 minute in the best circumstances. Crew notification and travel time take additional minutes. Upon arrival, the crew must approach the patient or emergency, assess the situation, and appropriately deploy its skills and tools. Even in easy-to-access situations, this step can take 2:00 minutes or more. This time frame may be increased considerably due to long driveways, apartment buildings with limited access, multiple-story buildings, rural highways, or wildland and recreation areas.

Unfortunately, there are times when the emergency has become too severe, even before the 9-1-1 notification or fire department response, for the responding crew to reverse; however, when an appropriate response time policy is combined with a well-designed deployment system, only anomalies like bad weather, poor traffic conditions, or multiple emergencies slow down the response system. As a result, a properly designed system gives residents the hope of a positive outcome for their tax-dollar expenditure.

For this report, total response time is the sum of the Marin County Sheriff's Office Communications Center call processing time, crew turnout time, and travel time increments, which is also consistent with NFPA and CFAI best practice recommendations.

2.4 COMMUNITY RISK ASSESSMENT

SOC ELEMENT 3 OF 8
COMMUNITY RISK ASSESSMENT

The third element of the SOC process is a community risk assessment. Within the context of an SOC study, the objectives of a community risk assessment are to:

- Identify and quantify the values at risk to be protected within the community or service area.

- Identify the specific hazards with the potential to adversely impact the community or service area.
- Quantify the overall risk associated with each hazard.
- Establish a foundation for current/future deployment decisions and risk-reduction/hazard mitigation planning and evaluation.

A *hazard* is broadly defined as a situation or condition that can cause or contribute to harm. Examples include fire, medical emergency, vehicle collision, earthquake, flood, etc. *Risk* is broadly defined as the *probability of hazard occurrence* in combination with the *likely severity of resultant impacts* to people, property, and the community as a whole.

2.4.1 Risk Assessment Methodology

The methodology employed by Citygate to assess community risks as an integral element of an SOC study incorporates the following elements:

- Identification of geographic planning sub-zones (risk zones) appropriate to the community or jurisdiction.
- Identification and quantification (to the extent data is available) of the specific values at risk to various hazards within the community or service area.
- Identification of the fire and non-fire hazards to be evaluated.
- Determination of the probability of occurrence for each hazard.
- Determination of *probable* impact severity of a hazard occurrence by planning zone.
- Quantification of overall risk for each hazard based on probability of occurrence in combination with probable impact severity according to the following table.

Table 7—Overall Risk

Probability	Impact				
	Insignificant	Minor	Moderate	Major	Catastrophic
Rare	Low	Low	Low	Moderate	High
Unlikely	Low	Low	Low	Moderate	High
Possible	Low	Low	Moderate	High	Extreme
Probable	Low	Low	Moderate	High	Extreme
Frequent	Low	Moderate	High	Extreme	Extreme

2.4.2 Values to Be Protected

Broadly defined, *values at risk* are those tangibles of significant importance or value to the community or jurisdiction that are potentially at risk of harm or damage from a hazard occurrence. Values at risk typically include people, critical facilities/infrastructure, buildings, and key economic, cultural, historic, or natural resources.

People

Residents, employees, visitors, and travelers in a community or jurisdiction are vulnerable to harm from a hazard occurrence. Particularly vulnerable are specific at-risk populations, including those unable to care for themselves or self-evacuate in the event of an emergency. At-risk populations typically include children younger than 10 years of age, the elderly, and people housed in institutional settings. Key demographic data for the District service area includes the following:[6]

- Slightly more than 32 percent of the population is under 10 years or over 65 years of age.
- The District's population is predominantly Caucasian (75 percent), including Hispanic/Latino (23 percent and also counted as Caucasian), followed by other ethnicities (15 percent), Asian (8 percent), and Black/African American (2 percent).
- Of the population over 24 years of age, more than 94 percent has completed high school or equivalency.
- Of the population over 24 years of age, 68 percent has an undergraduate, graduate, or professional degree.

[6] Source: Esri Community Profile (2020).

- More than 86 percent of the population 15 years of age or older is in the workforce; of those, nearly 14 percent are unemployed.
- Median household income is nearly $111,000.
- Approximately 7 percent of the service area population is below the federal poverty level.
- Only 3.5 percent of the service area population does not have health insurance coverage.

The City of Novato General Plan projects the City population will increase by about 5.5 percent to approximately 55,500 by 2035.[7] In addition, the unincorporated area of the District is expected to experience very minimal population growth of less than 1 percent over the next 14 years to 2035; however, current and future planned senior living, continuum of care, and congregate care facilities can be expected to impact EMS-related demand more than other risk types.

Buildings

The District's service area includes more than 24,100 housing units, as well as nearly 3,000 businesses, including manufacturing, research, technology, office, professional services, retail sales, restaurants/bars, motels, churches, schools, government facilities, healthcare facilities, and other business types as described in **Appendix A**.[8]

Critical Facilities

The US Department of Homeland Security defines critical infrastructure and key resources as those physical assets essential to the public health and safety, economic vitality, and resilience of a community, such as lifeline utilities infrastructure, telecommunications infrastructure, essential government services facilities, public safety facilities, schools, hospitals, airports, etc. The District identified 385 critical facilities and infrastructure within its service area as described in **Appendix A**. A hazard occurrence with significant impact severity affecting one or more of these facilities would likely adversely impact critical public or community services.

Cultural, Economic, Historic, Natural, and Special/Unique Resources

The District has numerous cultural, economic, historic, natural, and special/unique resources to protect within its service area as identified in **Appendix A**.

[7] Source: City of Novato General Plan 2035 – Public Review Draft, August 2016, Section 2.3.
[8] Source: Esri Community Analyst Business Summary (2020).

2.4.3 Hazard Identification

Citygate utilizes prior risk studies where available, fire and non-fire hazards as identified by the CFAI, and data and information specific to the agency/jurisdiction to identify the hazards to be evaluated for this report.

The 2018 Marin County Multi-Jurisdiction Local Hazard Mitigation Plan identifies the following nine hazards:

1. Earthquake/liquefaction
2. Dam failure
3. Severe storm
4. Debris flow (landslides)
5. Flooding
6. Wind
7. Tsunami
8. Wildfire
9. Post-fire debris flow

Although the District has no legal authority or responsibility to mitigate any of these hazards other than possibly for wildfire, it does provide services related to each hazard, including fire suppression, emergency medical services, technical rescue, and hazardous materials response.

Subsequent to review and evaluation of the hazards identified in the 2018 Marin County Multi-Jurisdiction Local Hazard Mitigation Plan and the fire and non-fire hazards as identified by the CFAI as they relate to services provided by the District, Citygate evaluated the following five hazards for this risk assessment:

1. Building fire
2. Vegetation/wildland fire
3. Medical emergency
4. Hazardous material release/spill
5. Technical rescue

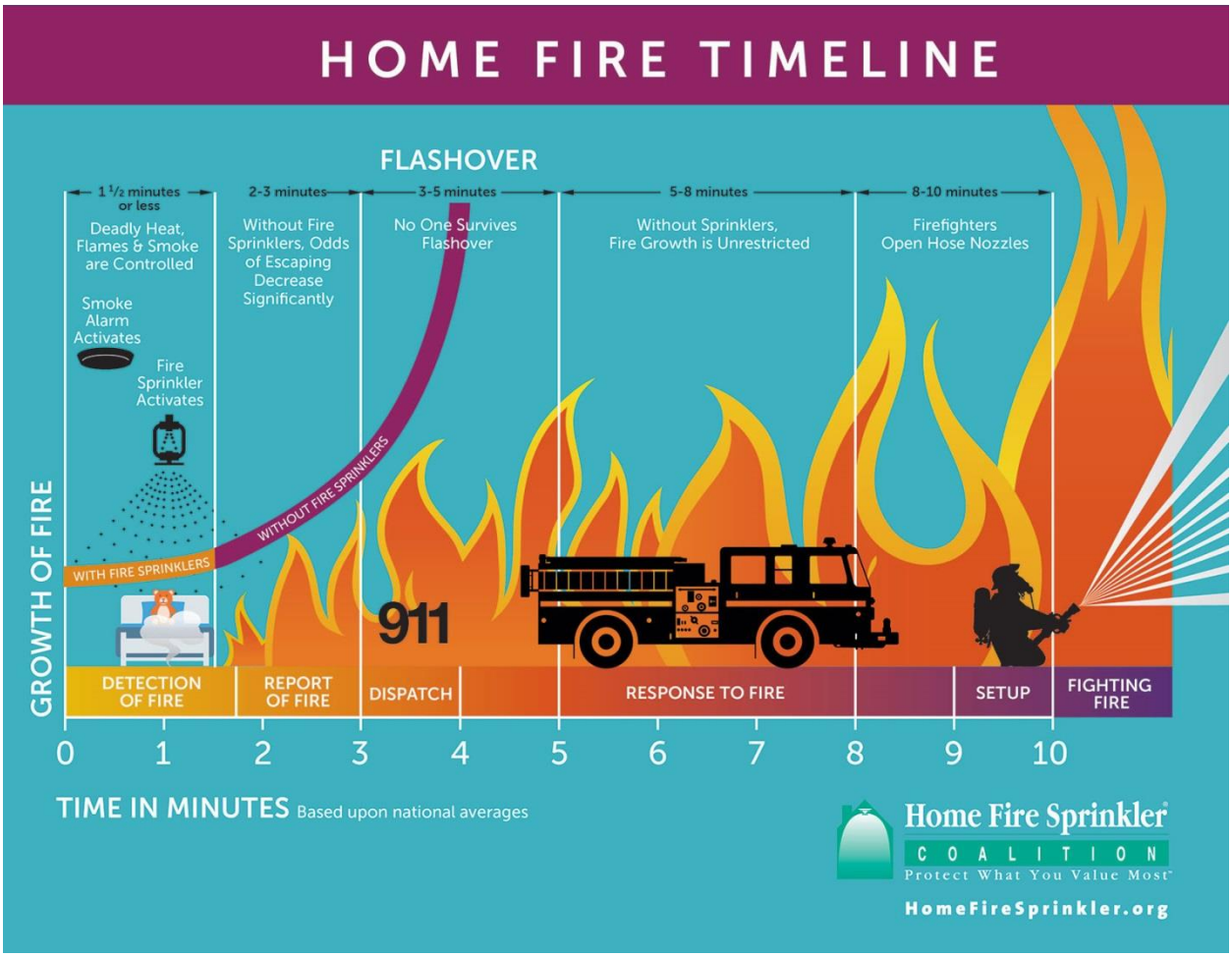
Because building fires and medical emergencies have the most severe time constraints if positive outcomes are to be achieved, the following is a brief overview of the District's building fire and medical emergency risk. **Appendix A** contains the full risk assessment for all five hazards.

Building Fire Risk

One of the primary hazards in any community is building fire. Building fire risk factors include building size, age, construction type, density, occupancy, number of stories above ground level, required fire flow, proximity to other buildings, built-in fire protection/alarm systems, available fire suppression water supply, building fire service capacity, fire suppression resource deployment (distribution/concentration), staffing, and response time.

The following figure illustrates the building fire progression timeline and shows that flashover, which is the point at which the entire room erupts into fire after all the combustible objects in that room reach their ignition temperature, can occur as early as 3:00 to 5:00 minutes from the initial ignition. Human survival in a room after flashover is extremely improbable.

Figure 3—Building Fire Progression Timeline

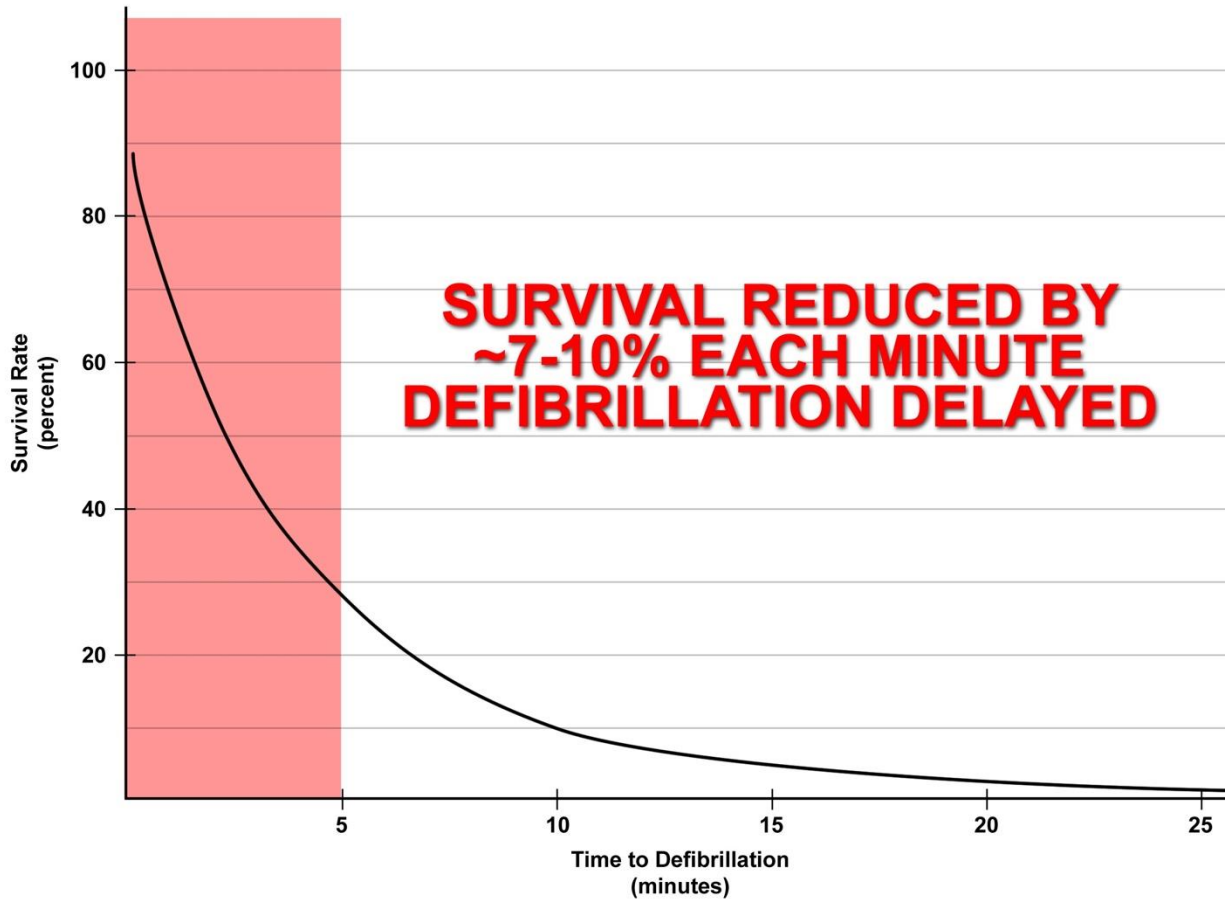


Source: http://www.firesprinklerassoc.org.

Medical Emergency Risk

Fire agency service demand in most jurisdictions is predominantly for medical emergencies. The following figure illustrates the reduced survivability of a cardiac arrest victim as time to defibrillation increases.

Figure 4—Survival Rate versus Time of Defibrillation



Source: www.suddencardiacarrest.org.

The District provides both BLS and ALS pre-hospital emergency medical services, including ground ambulance transportation, with operational personnel trained to the EMT or EMT-paramedic level.

2.4.4 Risk Assessment Summary

The District has made a considerable investment in and commitment to ongoing risk assessment and hazard mitigation to reduce both the frequency and severity of hazard occurrences. This is evidenced in part by being selected by the NFPA to participate in its Community Risk Assessment Pilot Project that develops customized dashboards powered by mySidewalk, a Creative

Community Intelligence platform specializing in digital data visualization. These dashboards visually describe data about the community served, its social vulnerabilities and built environment, foundational risk mitigation efforts/initiatives, COVID-19 impacts, and other elements described in NFPA 1300 – Standard on Community Risk Assessment and Community Risk Reduction Plan Development (2020 edition). Data and information from these dashboards were used in conducting this assessment.

The District was also a key agency partner in the development of the initial and updated Marin Community Wildfire Protection Plan (CWPP) that provides a science-based assessment of wildfire hazard in Marin County and provides fire agencies and other stakeholders guidance and strategies to reduce wildland fire risk and resultant impacts. In addition, the District was a key stakeholder in the creation of the Marin Wildfire Prevention Authority (MWPA), a Countywide Joint Powers Authority with 17 member agencies, including cities, towns, the County, and special districts, whose mission is to lead "the development of fire adapted communities using sound scientific, financial, programmatic, ecological practices, vegetation management, community education, evacuation and warning systems with the support of its member and partner agencies."[9]

These initiatives demonstrate the District leadership's commitment to risk assessment, mitigation, and data tracking both at the District and regional level.

Citygate's assessment of the values at risk and hazards likely to impact the District's service area yields the following. See **Appendix A** for the full risk assessment.

- The District serves a diverse urban/suburban/rural population, with densities ranging from less than 1,500 to more than 5,000 people per square mile, over a widely varied land use pattern.
- The City of Novato's population is projected to increase modestly over the next 14 years to approximately 55,500 by 2035. In addition, the unincorporated area of the District is expected to experience very minimal population growth over the same period.
- The District's service area includes a large inventory of residential and non-residential buildings to protect.
- The District has significant economic and other resource values to be protected, as identified in this assessment.
- The County has a mass emergency notification system to effectively communicate emergency information to the public in a timely manner.

[9] Source: www.marinwildfire.org/about-us.

- The District's overall risk for five hazards related to emergency services range from **Low** to **High**, as summarized in the following table.

Table 8—Overall Risk by Hazard

Hazard		Planning Zone				
		Station 61	Station 62	Station 63	Station 64	Station 65
1	Building Fire	*Moderate*	*Moderate*	*Moderate*	*Moderate*	*Moderate*
2	Vegetation/Wildland Fire	*Moderate*	*High*	*High*	*High*	*High*
3	Medical Emergency	*High*	*High*	*High*	*High*	*High*
4	Hazardous Materials	*Moderate*	*Low*	*Low*	*Moderate*	*Low*
5	Technical Rescue	*Moderate*	*Moderate*	*Moderate*	*Moderate*	*Moderate*

2.5 Critical Task Time Measures—What Must Be Done over What Time Frame to Achieve the Stated Outcome Expectation?

SOC Element 4 of 8
Critical Task Time Study

SOC studies use critical task information to determine the number of firefighters needed within a time frame to achieve desired objectives on fire and emergency medical incidents. The following two tables illustrate critical tasks typical of building fire and medical emergency incidents, including the minimum number of personnel required to complete each task. These tables are composites from Citygate client agencies similar to the District, with units staffed with three personnel per engine or ladder truck. It is important to understand the following relative to these tables:

- It can take considerable time after a task is ordered by command to complete the task and achieve the desired outcome.
- Task completion time is usually a function of the number of personnel that are *simultaneously* available. The fewer firefighters available, the longer some tasks will take to complete. Conversely, with more firefighters available, some tasks are completed concurrently.
- Some tasks must be conducted by a minimum of two firefighters to comply with safety regulations. For example, two firefighters are required to search a smoke-filled room for a victim.

2.5.1 Critical Firefighting Tasks

The following table illustrates the critical tasks required to control a typical single-family dwelling fire with a total Effective Response Force (ERF) of three engines, one ladder truck or fourth engine, one ALS medic unit, and one Battalion Chief, totaling 15 personnel. It should be noted that the District's response plan for a working structure fire includes one additional engine for a total of 18 personnel. These tasks are taken from similarly staffed career fire departments' operational procedures, which are consistent with the customary findings of other agencies using the SOC process. No conditions exist to override the Occupational Safety and Health Administration (OSHA) two-in/two-out safety policy, which requires firefighters enter atmospheres that are immediately dangerous to life and health, such as building fires, in teams of two while two more firefighters are outside, immediately ready to rescue them should trouble arise.

Scenario: *Simulated approximately 2,000-square-foot, two-story, residential fire with unknown rescue situation. Responding companies receive dispatch information typical for a witnessed fire. Upon arrival, they find approximately 50 percent of the second floor involved in fire.*

Table 9—First Alarm Residential Fire Critical Tasks – 15 Personnel

Critical Task Description		Personnel Required
First-Due Engine		
1	Conditions report	1
2	Establish supply line to hydrant	2
3	Deploy initial fire attack line to point of building access	1–2
4	Operate pump and charge attack line	1
5	Or skip the previous and establish incident command	1
6	Conduct primary search within OSHA regulations	2
Second-Due Engine		
1	If necessary, establish supply line to hydrant	1–2
2	Deploy an attack or backup attack line	1–2
3	Establish initial Rapid Intervention Crew	2
Truck / Third-Due Engine		
1	Conduct initial search and rescue, if not already completed	2
2	Deploy ground ladders to roof	1–2
3	Establish horizontal or vertical building ventilation	1–2
4	Open concealed spaces as required	2
Battalion Chief		
1	Transfer of incident command from first- or second-in Captain	1
2	Establish incident command and safety	1
Medic/Aid Unit		
1	Establish incident rehab	2–3
2	Support incident operations as assigned	3
3	Treat/transport suppression personnel/civilians as needed	2–3
Fourth-Due Engine		
1	Establish full Rapid Intervention Crew	3
2	Secure utilities	1
3	Deploy second attack line(s) as needed	2
4	Conduct secondary search	2

Grouped together, the duties in the previous table form an ERF, or First Alarm Assignment. These distinct tasks must be performed to effectively achieve the desired outcome; arriving on scene does

not stop the emergency from escalating. While firefighters accomplish these tasks, the incident progression clock keeps running.

Fire in a building can double in size during its free-burn period before fire suppression is initiated. Many studies have shown that a small fire can spread to engulf an entire room in fewer than 4:00 to 5:00 minutes after free burning has started. Once the room is completely superheated and involved in fire (known as flashover), the fire will spread quickly throughout the structure and into the attic and walls. For this reason, it is imperative that fire suppression and search/rescue operations commence before the flashover point occurs if the outcome goal is to keep the fire damage in or near the room of origin. In addition, flashover presents a life-threatening situation to both firefighters and any occupants of the building.

2.5.2 Critical Medical Emergency Tasks

The District responded to more than 4,000 EMS incidents in 2020, including vehicle accidents, strokes, heart attacks, difficulty breathing, falls, childbirths, and other medical emergencies. For comparison, the following table summarizes the critical tasks required for a cardiac arrest patient.

Table 10—Cardiac Arrest Critical Tasks – 1 Engine +1 ALS Medic Unit (5 Personnel)

Critical Task		Personnel Required	Critical Task Description
1	Chest compressions	1–2	Compression of chest to circulate blood
2	Ventilate/oxygenate	1–2	Mouth-to-mouth, bag-valve-mask, apply O_2
3	Airway control	1–2	Manual techniques/intubation/cricothyroidotomy
4	Defibrillate	1–2	Electrical defibrillation of dysrhythmia
5	Establish I.V.	1–2	Peripheral or central intravenous access
6	Control hemorrhage	1–2	Direct pressure, pressure bandage, tourniquet
7	Splint fractures	2–3	Manual, board splint, HARE traction, spine
8	Interpret ECG	2	Identify type and treat dysrhythmia
9	Administer drugs	2	Administer appropriate pharmacological agents
10	Spinal immobilization	2–5	Prevent or limit paralysis to extremities
11	Extricate patient	3–4	Remove patient from vehicle, entrapment
12	Patient charting	1–2	Record vitals, treatments administered, etc.
13	Hospital communication	1–2	Receive treatment orders from physician
14	Treat en route to hospital	2–3	Continue to treat/monitor/transport patient

2.5.3 Critical Task Analysis and Effective Response Force Size

The time required to complete the critical tasks necessary to stop the escalation of an emergency (as shown in the two previous tables) must be compared to outcomes. As shown in nationally published fire service time-versus-temperature tables, after approximately 4:00 to 5:00 minutes of free burning in an enclosed room, a building fire will escalate to the point of flashover. At this point, the entire room is engulfed in fire, the fire extends rapidly both horizontally and vertically, and human survival near or in the room of fire origin becomes impossible. Additionally, brain death begins to occur within 4:00 to 6:00 minutes of the heart stopping. The ERF must arrive in time to prevent these emergency events from worsening.

The District's daily staffing provides an ERF of 15 firefighters to a building fire—if they can arrive in time, which the statistical analysis of this report will discuss in depth. Mitigating an emergency event is a team effort once the units have arrived. This refers to the *weight* of response analogy; if too few personnel arrive too slowly, the emergency will escalate instead of improve. The outcome times, of course, will be longer and yield less-desirable results if the arriving force is smaller or arrives later.

The quantity of staffing and the arrival time frame can be critical in a serious fire. Fires in older or multiple-story buildings could require the initial firefighters to rescue trapped or immobile

occupants. If the ERF is too small, rescue and firefighting operations *cannot* be conducted simultaneously.

Fires and complex medical incidents require that additional units arrive in time to complete an effective intervention. Time is one factor that comes from *proper station placement*. Good performance also comes from *adequate staffing* and training. However, where fire stations are spaced too far apart, and one unit must cover another unit's area or multiple units are needed, these units can be too far away, and the emergency will escalate, result in a less-than-desirable outcome, or both.

Previous critical task studies conducted by Citygate and NFPA Standard 1710 (2020 edition) find that all units need to arrive with 17+ firefighters within 11:30 minutes (from the time of 9-1-1 call) at a building fire to be able to *simultaneously and effectively* perform the tasks of rescue, fire suppression, and ventilation.

A question one might ask is, "If fewer firefighters arrive, *what* from the list of tasks mentioned would not be completed?" Most likely, the search team would be delayed, as would ventilation. The attack lines would only consist of two firefighters, which does not allow for rapid movement of the hose line above the first floor in a multiple-story building. Rescue is conducted with at least two-person teams; thus, when rescue is essential, other tasks are not completed in a simultaneous, timely manner. Effective deployment is about the **speed** *(travel time)* and the **weight** *(number of firefighters)* of the response.

While an ERF of 15 personnel can handle a moderate risk confined building fire, it will be seriously slowed if the fire is above the first floor in a low-rise apartment building or commercial/industrial building. This is where the capability to add additional personnel and resources to the standard response becomes critical.

The District's ERF plan that delivers 15 personnel to a building fire reflects a goal to confine serious building fires to or near the room of origin and to prevent the spread of fire to adjoining buildings. This is a typical desired outcome in urban/suburban areas and requires more firefighters more quickly than the typical rural outcome of keeping the fire contained to the building, not room, of origin.

The District's current physical response to building fires is, in effect, its de facto deployment measure—*if those areas are within a reasonable travel time from the needed number of fire stations*. Therefore, this becomes the baseline policy for the deployment of firefighters.

2.6 Distribution and Concentration Studies—How the Location of First-Due and First Alarm Resources Affects Emergency Incident Outcomes

SOC Element 5 of 8
Distribution Study

SOC Element 6 of 8
Concentration Study

The District provides services from five fire stations deploying the resources and staffing identified in Table 2. It is appropriate to understand, using geographic mapping tools, what the existing stations do and do not cover within travel time goals, if there are any coverage gaps needing one or more stations, and what, if anything, to do about them.

In brief, there are two geographic perspectives to fire station deployment:

- **Distribution** – the spacing of first-due fire units to control routine emergencies before they escalate and require additional resources.
- **Concentration** – the spacing of fire stations sufficiently close to each other so that more complex emergency incidents can quickly receive sufficient resources from multiple fire stations. As indicated, this is known as the **Effective Response Force** (ERF), or, more commonly, the First Alarm Assignment—the collection of a sufficient number of firefighters on scene, delivered within the concentration time goal to stop the escalation of the problem.

To analyze first-due fire unit travel time coverage, Citygate used FireView™, a geographic software mapping tool that can measure theoretical travel time over a road network. Using this tool, Citygate ran several deployment tests and measured their impact on various parts of the District's service area, including 4:00-minute, 6:00-minute, and 10:30-minute first-due travel and 8:00-minute, 11:30-minute, and 20:00-minute ERF travel.

2.6.1 Deployment Baselines

All maps referenced can be found in **Volume 2—Map Atlas**.

Map 1—General District Geography, Station Locations, and Response Resource Types

Map 1 shows the District and City of Novato boundaries, District and automatic aid fire station locations and staffed response resource types, and fire station first-due response areas. This is a reference map for the other maps that follow.

Map 2—Risk: Population Density

This map shows the resident population density across the District's service area. People drive EMS incident demand, and the highest population density areas are typically the locations with

the highest EMS demand. As Map 2 shows, the District's population density ranges from fewer than 1,500 to more than 5,000 people per square mile.

Map 3—Distribution: 4:00-Minute First-Due Travel

Map 3 shows 4:00-minute first-due travel time coverage from the District's existing fire station locations, with green indicating the current road network that a fire engine should be expected to reach within 4:00 minutes' travel time *without traffic congestion*, assuming the response is within the station's assigned first-due service area.

Ideally, there should be some overlap between station areas so that a second-due unit can have a chance of an acceptable response time when it responds to a call in a different station's first-due response area. As this map shows, and as further explained in the table to follow at the end of this section, only 52 percent of the District's 210 public road miles can be expected to be covered in 4:00 minutes or less travel time.

Map 3a—Distribution: 4:00-Minute First-Due Travel with Auto Aid

This map shows 4:00-minute first-due travel time coverage from the District's existing fire station locations with automatic mutual aid from the Marinwood Community Services District fire station. As the map illustrates, automatic aid *does not* increase 4:00-minute first-due travel coverage.

Map 3b—Distribution: 6:00-Minute First-Due Travel

Map 3b shows 6:00-minute first-due travel time coverage from the District's existing fire station locations, encompassing 86 percent of the District's total road miles, including 79 percent of the road miles within the City of Novato.

Map 3c—Distribution: 10:30-Minute First-Due Travel

Map 3c shows 10:30-minute first-due travel time coverage from the District's existing fire station locations, increasing the coverage to 97 percent of the District's total road miles. This is very good rural-level coverage.

Map 4—Insurance Services Office 1.5-Mile Coverage Areas

Map 4 displays the ISO recommendation that urban stations cover a 1.5-mile *distance* response area. Depending on a jurisdiction's road network, the 1.5-mile measure usually equates to a 3:30- to 4:00-minute travel time. However, a 1.5-mile measure is a reasonable indicator of station spacing and overlap.

Map 5—Concentration: 8:00-Minute Effective Response Force Travel

Map 5 shows the road segments where the District's current response plan should deliver a minimum initial ERF of three engines, one ladder truck or fourth engine, one medic unit, and one Battalion Chief within 8:00 minutes' travel time. As the map illustrates, an ERF should reach 60

percent of the District's public road miles within the 8:00-minute travel time, nearly all of which is within the City of Novato.

Map 5a—Concentration: 11:30-Minute Effective Response Force Travel

By extending ERF travel time to 11:30 minutes, coverage is increased to 81 percent of the District's public road miles, nearly all within the City of Novato.

Map 5b—Concentration: 20:00-Minute Effective Response Force Travel

Map 5b shows that 99 percent of the District's public road miles should be reached by an ERF within 20:00 minutes' travel time.

Map 6—8:00-Minute Ladder Truck Travel

This map shows the areas of the District that the ladder truck should be expected to reach from Station 64 within 8:00 minutes' travel time.

Map 7—8:00-Minute Battalion Chief Travel

Map 7 displays 8:00-minute travel time coverage for a Battalion Chief from Station 61. It is apparent that the Battalion Chief cannot reach most of the District outside of the City of Novato within 8:00 minutes' travel time.

Map 8—All Incident Locations

Map 8 shows the locations of all incidents over the three-year study period, which occur on virtually every road segment of the District's service area, as well as outside of the District. The urban area in and around the City of Novato naturally has the highest demand, but all the major roads, rural roads, and recreation areas also have demand.

Map 9—Emergency Medical Services and Rescue Incident Locations

This map illustrates only the emergency medical and rescue incident locations over the three-year study period. With most of the calls for service being EMS-related, virtually all the District's service area needs pre-hospital EMS response. This data is consistent with the population density from Map 2 since humans and their activities, such as driving or recreation, drive EMS demand.

Map 10—All Fire Locations

Map 10 identifies the location of all fires within the District's service area over the three-year study period. All fires include any type of fire call, from vehicle, to dumpster, to building fire. There are obviously fewer fires than medical or rescue calls; however, fires occur in all areas of the District.

Map 11—Building Fire Locations

This map displays the location of all building fire incidents. While the number of building fires is a smaller subset of total fires, there are two meaningful findings from this map. First, nearly all the building fires occurred in the City of Novato, and second, there are a relatively small number of building fires overall, which in Citygate's experience is consistent with other similar communities in the western United States.

Map 12—Emergency Medical Services and Rescue Incident Location Densities

Map 12 shows by mathematical density where clusters of EMS and rescue incident activity occurred over the three-year study period. In this set, the darker density color plots the highest concentration of EMS and rescue incidents. This type of map makes the location of frequent workload more meaningful than simply mapping the locations of all EMS and rescue incidents, as shown in Map 9.

This perspective is important because the deployment system needs an overlap of units to ensure the delivery of multiple units when needed for more serious incidents or to handle simultaneous calls for service, as is evident for the higher medical incident density areas of the District's service area. This measure of deployment also shows that the fire stations are located in or very near all the main hot spot areas.

Map 13—All Fire Location Densities

This map shows the hot spots of activity for all types of fires as shown in Map 10. Fire density is greater in the higher building/population density neighborhoods.

Map 14—All Building Fire Location Densities

Map 14 shows the hot spots for building fire activity as shown in Map 11. Map 5a shows that travel time for an ERF of three engines, one ladder truck or a fourth engine, one medic unit, and one Battalion Chief to the majority of these hot spots is 11:30 minutes or less.

2.6.2 Road Mile Coverage Measures

In addition to the visual displays of coverage the previous maps provide, the following table summarizes expected travel time coverage for map series 3 and 5.

Table 11—Travel Time Coverage Summary

Map Number	Travel Time Measure	Total Public Road Miles	Miles Covered	Percent of Total Miles Covered
3	**4:00-Minute First-Due**	403	**210**	**52.11%**
3a	**4:00-Minute First-Due with Auto Aid**	403	**210**	**52.11%**
3b	**6:00-Minute First-Due – City of Novato**	380	**300**	**78.95%**
3b	**6:00-Minute First-Due – District**	403	**345**	**85.61%**
3c	**10:30-Minute First-Due – District**	403	**392**	**97.27%**
5	**8:00-Minute ERF – District**	403	**241**	**59.80%**
5a	**11:30-Minute ERF – City of Novato**	380	**307**	**80.79%**
5a	**11:30-Minute ERF –District**	403	**353**	**87.59%**
5b	**20:00-Minute ERF – District**	403	**397**	**98.51%**

2.7 STATISTICAL ANALYSIS

SOC ELEMENT 7 OF 8
RELIABILITY & HISTORICAL RESPONSE EFFECTIVENESS STUDIES

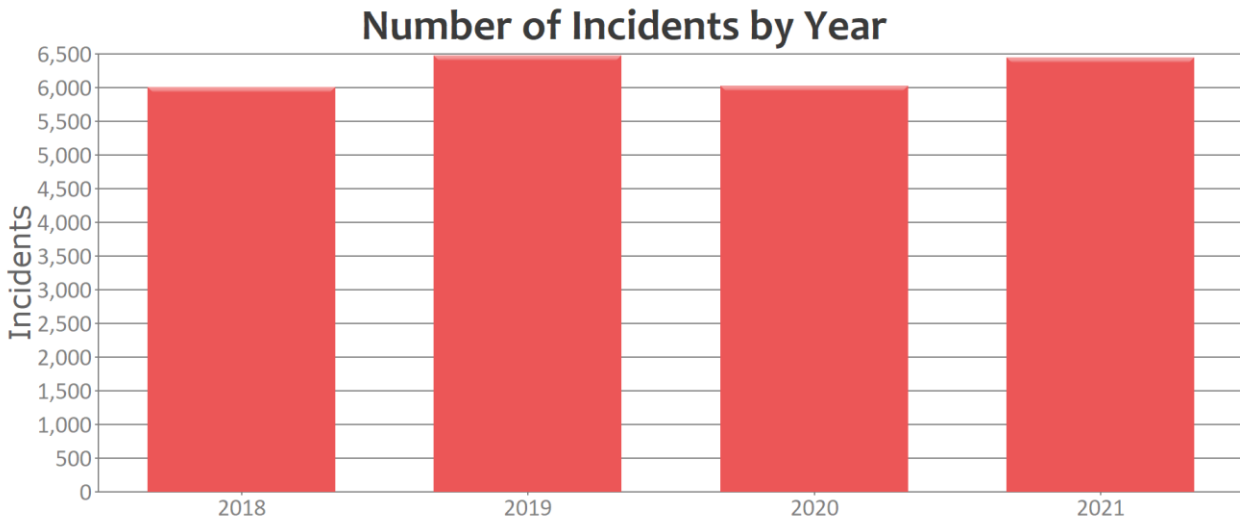
The maps described in **Section 2.6** and presented in **Volume 2—Map Atlas** show the ideal situation for response times and the response effectiveness given no competing calls, units out of place, or simultaneous calls for service. Examination of the response time data provides a picture of actual response performance with simultaneous calls, rush hour traffic congestion, units out of position, and delayed travel time for events such as periods of severe weather.

The following subsections provide summary statistical information and analysis regarding the District, its services, and performance.

2.7.1 Demand for Service

The District provided four years of incident data covering the period from January 1, 2018, through December 31, 2021, including 24,976 incidents, as summarized in the following figure.

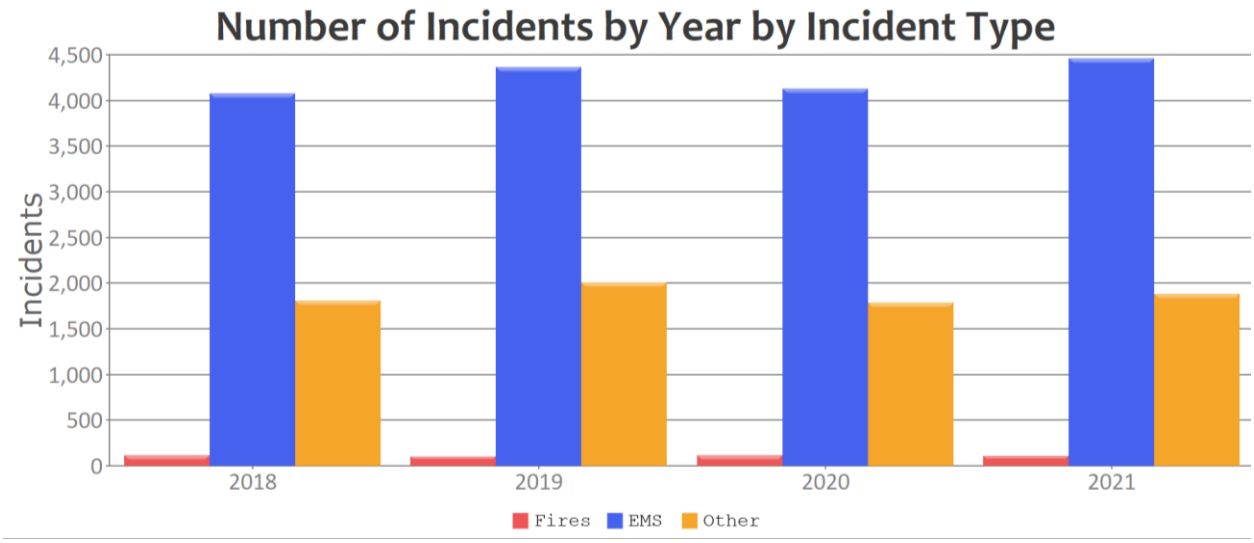
Figure 5—Total Service Demand by Year



In 2021, the District responded to 6,453 incidents for an average daily service demand of 17.68 incidents. Of these, 1.69 percent were fire incidents, 69.12 percent were EMS incidents, and 29.19 percent were other incident types. As the previous figure illustrates, overall annual service demand increased nearly 7 percent in 2021 from the previous year, nearly matching peak service demand in 2019. Also of note is 85 percent of total service demand over the four-year study period was in the City of Novato.

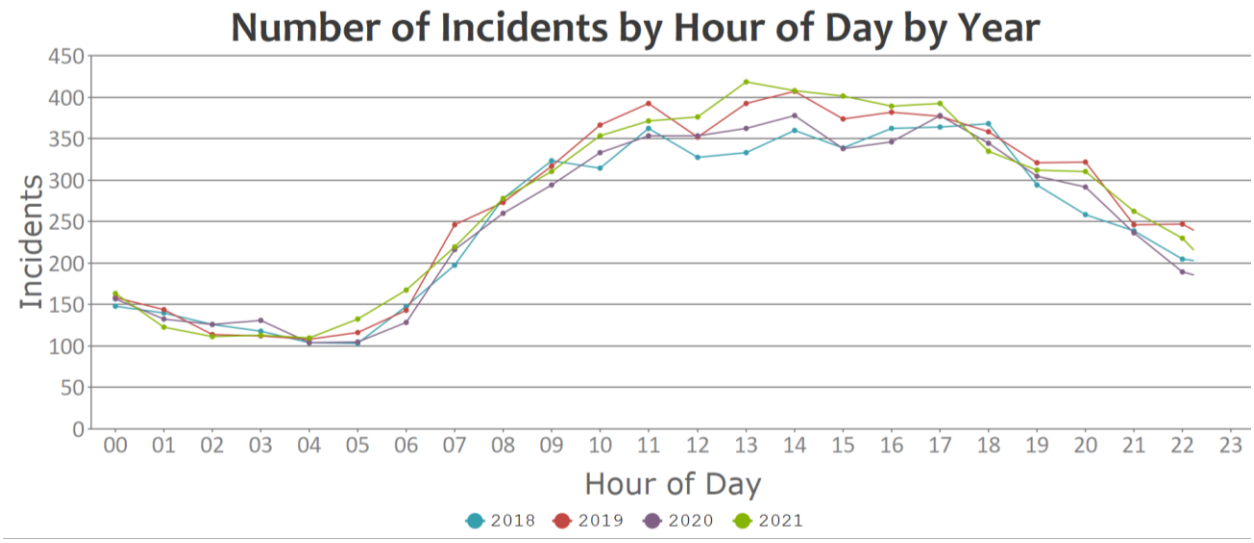
The following figure shows the annual number of incidents by incident type. Although fire incidents remained relatively constant over the four-year study period, EMS incidents peaked in 2021 while other incident types peaked in 2019.

Figure 6—Annual Service Demand by Incident Type



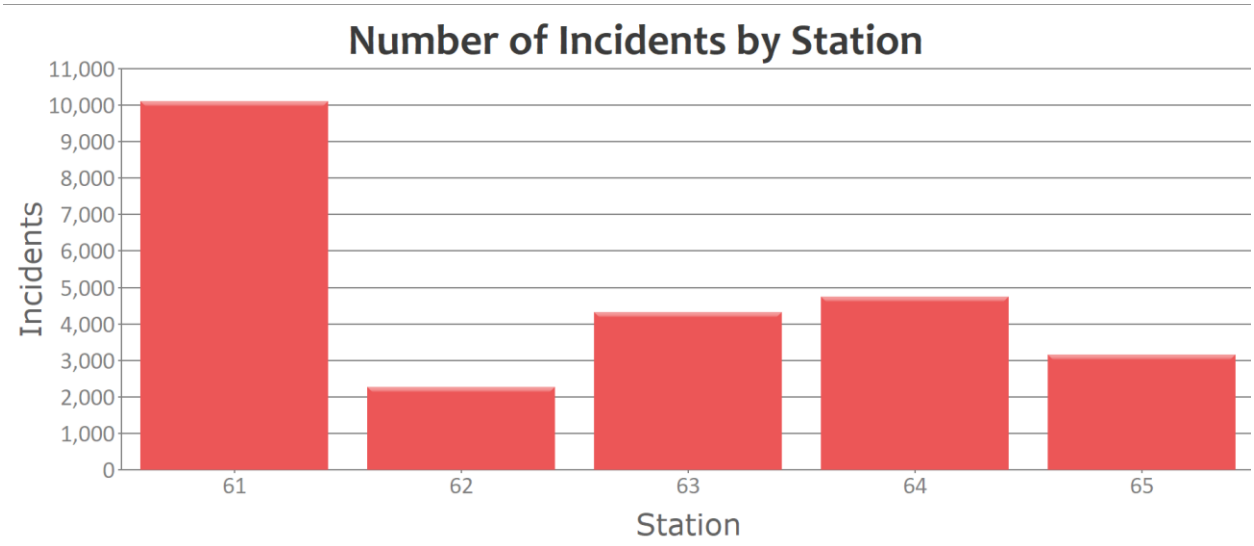
The following figure shows that service demand by hour of day varies only slightly from year to year.

Figure 7—Service Demand by Hour of Day and Year



The following figure shows that Station 61 had the highest service demand over the four-year study and Station 62 had the lowest.

Figure 8—Service Demand by Station Area by Year



The following table lists service demand by incident type for the four-year study. Only incident types with more than 100 calls for service over the study period are shown. EMS-related incidents rank highly, as well as incidents where the responding unit(s) were cancelled prior to arrival. Building fires ranked 30th by volume.

Table 12—Service Demand by Incident Type (2018–2021)

Incident Type	2018	2019	2020	2021	Total
321 EMS call, excluding vehicle accident with injury	3,751	4,047	3,900	4,140	**15,838**
611 Dispatched and canceled en route	373	424	305	395	**1,497**
554 Assist invalid	284	325	357	380	**1,346**
322 Vehicle accident with injuries	203	214	148	183	**748**
651 Smoke scare, odor of smoke	132	146	138	133	**549**
622 No incident found on arrival of incident address	124	113	88	106	**431**
553 Public service	59	113	71	60	**303**
324 Motor vehicle accident no injuries	71	66	59	96	**292**
735 Alarm system sounded due to malfunction	40	72	54	52	**218**
733 Smoke detector activation due to malfunction	51	57	50	54	**212**
745 Alarm system sounded, no fire – unintentional	50	40	69	43	**202**
700 False alarm or false call, other	90	45	34	24	**193**
743 Smoke detector activation, no fire – unintentional	45	35	43	44	**167**
600 Good intent call, other	36	56	32	40	**164**
550 Public service assistance, other	48	52	27	31	**158**
736 CO detector activation due to malfunction	38	45	42	11	**136**
500 Service call, other	62	33	21	18	**134**
740 Unintentional transmission of alarm, other	27	27	33	46	**133**
571 Cover assignment, standby, move-up	14	34	37	29	**114**
510 Person in distress, other	27	26	7	41	**101**

The following table shows incident volume by property use and year, with residential dwellings ranking highest, followed by residential streets. Only those property uses with at least 100 incident responses in the last three years are shown.

Table 13—Service Demand by Property Use (2018–2021)

Property Use	2018	2019	2020	2021	Total
419 1 or 2 family dwelling	2,628	2,773	2,686	2,998	**11,085**
429 Multi-family dwellings	875	840	1,048	883	**3,646**
311 24-hour care nursing homes, 4 or more persons	217	356	206	341	**1,120**
962 Residential street, road, or residential driveway	269	274	252	241	**1,036**
961 Highway or divided highway	281	288	190	232	**991**
963 Street or road in commercial area	201	250	187	227	**865**
965 Vehicle parking area	207	163	118	183	**671**
519 Food and beverage sales, grocery store	77	99	96	60	**332**
459 Residential board and care	66	80	82	94	**322**
960 Street, other	78	75	43	96	**292**
340 Clinics, doctors' offices, hemodialysis centers	91	103	58	36	**288**
931 Open land or field	60	48	65	76	**249**
449 Hotel/motel, commercial	43	47	89	54	**233**
888 Fire station	44	66	57	44	**211**
400 Residential, other	26	32	20	125	**203**
460 Dormitory-type residence, other	22	83	77	20	**202**
439 Boarding/rooming house, residential hotels	61	66	20	38	**185**
BLANK	42	34	48	55	**179**
215 High school/junior high school/middle school	37	73	32	31	**173**
900 Outside or special property, other	33	31	50	51	**165**
331 Hospital – medical or psychiatric	39	42	34	40	**155**
213 Elementary school, including kindergarten	45	35	27	47	**154**
599 Business office	36	49	32	23	**140**
500 Mercantile, business, other	34	39	21	40	**134**
161 Restaurant or cafeteria	35	45	24	24	**128**
322 Alcohol or substance abuse recovery center	27	37	23	31	**118**

2.7.2 Simultaneous Incident Activity

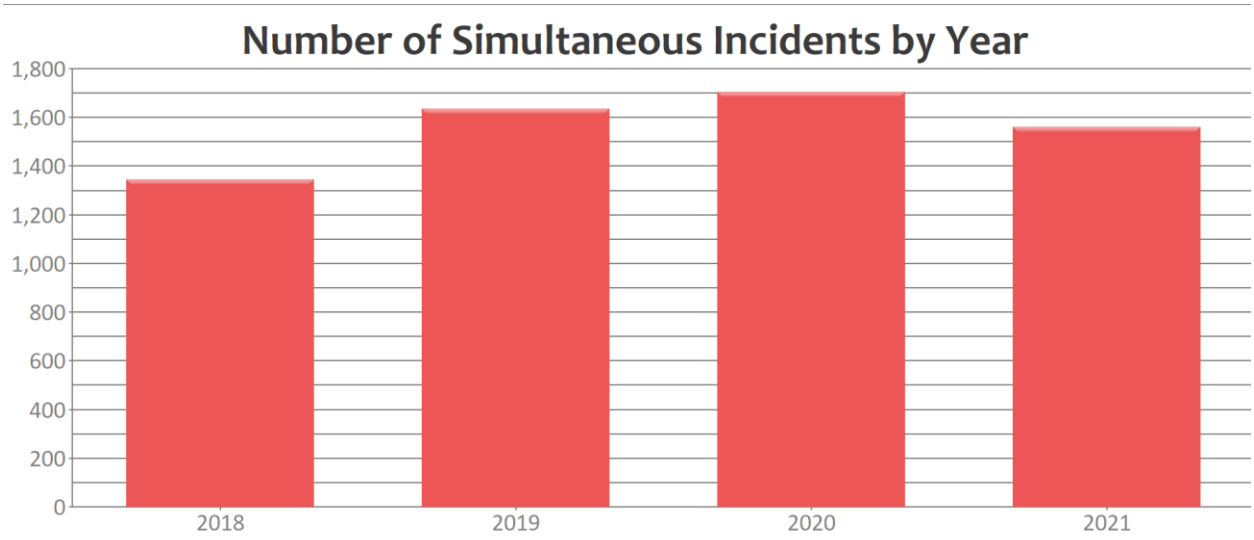
Simultaneous incidents occur when an incident is underway at the time a new incident occurs. In 2021, 24.22 percent of District incidents occurred while one or more other incidents were underway, as shown in the following table.

Table 14—Simultaneous Incident Activity – 2021

Number of Simultaneous Incidents	Percentage
2 or more	**24.22%**
3 or more	**3.95%**
4 or more	**0.50%**

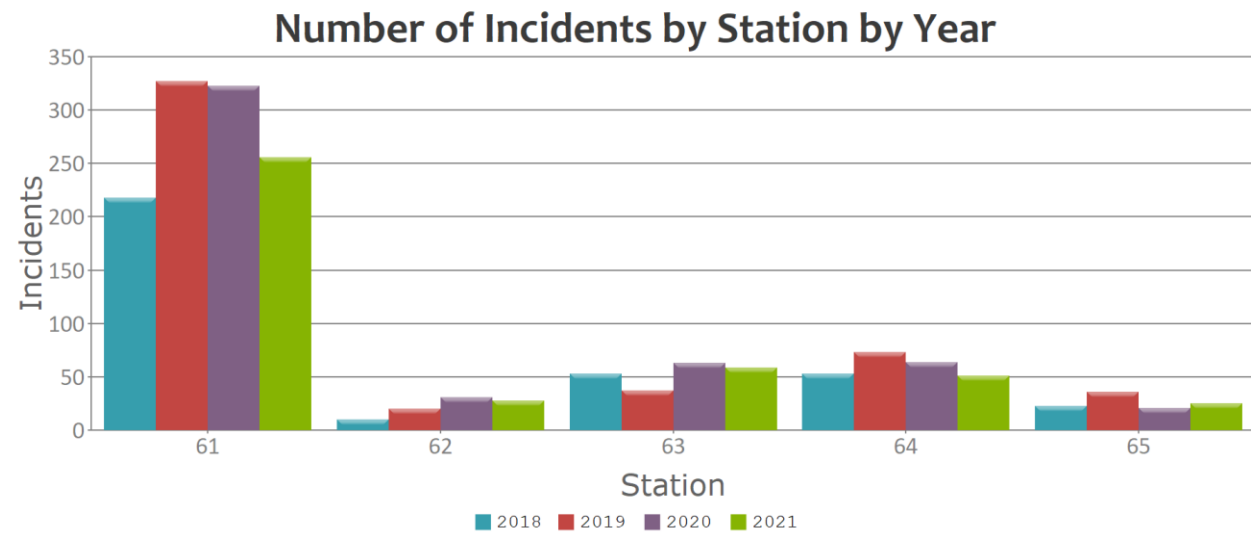
The following figure illustrates that simultaneous incidents decreased nearly 9 percent in 2021 from the previous year.

Figure 9—Number of Simultaneous Incidents by Year



In larger jurisdictions, simultaneous incidents in different station areas have minimal operational impact. However, when simultaneous incidents occur within a single station area, there can be significant delays in response times since responding unit(s) must come from a more distant station. The following figure illustrates the number of single-station simultaneous incidents by station area by year, showing that Station 61 has by far the greatest number of single-station area simultaneous incidents over the four-year study period.

Figure 10—Number of Single-Station Simultaneous Incidents by Station by Year



Finding #5: At least two simultaneous incidents are occurring 24 percent of the time, predominantly impacting Station 61.

2.7.3 Station Demand

The following table shows 2021 activity by hour of day for each station. The percentage listed is the percent likelihood that a particular station is involved in an incident during a given hour. This percentage considers not only of the number of incidents but also the duration of incidents. The busiest stations are listed first.

Table 15—Station Demand by Hour (2021)

Hour	Station 61	Station 63	Station 64	Station 62	Station 65
00:00	6.34%	1.79%	3.00%	2.22%	1.74%
01:00	4.61%	2.37%	2.26%	1.76%	1.55%
02:00	4.35%	1.91%	1.90%	0.83%	0.87%
03:00	4.14%	1.44%	2.86%	1.04%	1.40%
04:00	3.99%	2.09%	1.94%	0.93%	1.92%
05:00	3.77%	3.37%	1.78%	2.87%	1.79%
06:00	5.91%	1.54%	2.87%	11.72%	1.85%
07:00	7.02%	3.88%	3.90%	2.41%	2.02%
08:00	9.15%	5.18%	3.49%	2.00%	2.43%
09:00	12.59%	4.94%	4.18%	2.97%	2.96%
10:00	10.69%	6.77%	6.61%	3.82%	4.87%
11:00	12.30%	6.57%	4.88%	2.72%	3.68%
12:00	11.61%	7.74%	5.35%	4.08%	2.79%
13:00	13.09%	7.36%	5.40%	4.36%	3.82%
14:00	11.66%	7.71%	6.63%	3.50%	3.91%
15:00	16.04%	5.48%	5.43%	3.57%	3.85%
16:00	11.70%	7.17%	5.84%	2.59%	3.52%
17:00	13.33%	8.26%	5.85%	3.50%	2.94%
18:00	10.74%	4.34%	5.01%	4.11%	4.01%
19:00	8.57%	5.73%	3.43%	1.83%	3.54%
20:00	9.46%	5.34%	6.90%	2.32%	2.85%
21:00	8.50%	5.35%	5.25%	2.09%	3.20%
22:00	7.75%	3.20%	2.85%	2.74%	2.87%
23:00	4.57%	2.70%	1.98%	1.38%	2.15%
Overall	**8.83%**	**4.68%**	**4.15%**	**2.97%**	**2.77%**
Incidents	**2,572**	**1,165**	**1,148**	**618**	**866**

2.7.4 Apparatus Deployment

The following table shows apparatus responses by station area for fire and EMS incidents only for 2021. The **columns** show the home station for primary apparatus resources. The **rows** identify the station area where incidents occurred. Multiple-company stations will have multiple apparatus assigned under that Station ID.

The table shows the number of resources that responded to incidents in each station response area. Highlighted cells indicate apparatus operating in their home station area. For example, in the first row, Station 64 contributed 158 apparatus responses to Station 61's response area. Similarly, in Station 64's area, Station 65 contributed 777 apparatus responses.

Table 9—Apparatus Responses by Station Area for Fire and EMS Emergencies (2021)

Station Area	Assigned Station Apparatus					Total
	Station 61	Station 62	Station 63	Station 64	Station 65	
Station 61	3,267	298	138	158	471	**4,332**
Station 62	363	397	44	78	170	**1,052**
Station 63	741	92	777	36	177	**1,823**
Station 64	148	102	18	735	777	**1,780**
Station 65	88	44	6	87	900	**1,125**
Total	**4,607**	**933**	**983**	**1,094**	**2,495**	**10,112**

2.7.5 Unit-Hour Utilization

The utilization percentage for apparatus per hour is calculated using the number and duration of responses. The following table shows the percentage of each hour that an apparatus is committed to an active incident in 2021, with the busiest engines listed first. The District's ladder company made only 20 responses in 2021 and is thus not included.

Table 16—Unit-Hour Utilization – Engines (2021)

Hour	E-61	E-63	E-64	E-62	E-65
00:00	6.80%	2.49%	3.33%	2.55%	1.96%
01:00	5.68%	3.15%	3.38%	2.62%	2.56%
02:00	4.37%	1.81%	2.62%	1.10%	1.04%
03:00	4.56%	1.44%	3.03%	1.23%	1.31%
04:00	4.00%	2.24%	2.08%	1.10%	2.13%
05:00	4.28%	3.45%	2.23%	3.11%	1.93%
06:00	7.11%	5.22%	5.05%	12.03%	2.15%
07:00	7.77%	4.21%	5.05%	3.52%	3.70%
08:00	9.07%	6.00%	5.31%	3.01%	2.56%
09:00	11.95%	8.02%	6.95%	6.37%	6.93%
10:00	11.02%	6.65%	7.02%	6.69%	5.82%
11:00	11.23%	6.70%	5.39%	4.95%	4.17%
12:00	11.62%	7.58%	7.08%	5.63%	4.78%
13:00	11.55%	7.84%	7.27%	7.30%	4.83%
14:00	11.88%	8.37%	6.50%	5.83%	4.94%
15:00	21.88%	6.79%	7.25%	5.72%	4.58%
16:00	11.76%	7.35%	7.26%	4.10%	3.85%
17:00	13.25%	8.17%	7.58%	4.70%	3.52%
18:00	10.55%	4.96%	5.93%	4.98%	4.31%
19:00	8.21%	6.12%	3.75%	2.69%	3.81%
20:00	9.33%	6.24%	8.27%	2.87%	4.06%
21:00	8.97%	5.43%	6.82%	3.09%	3.45%
22:00	8.38%	3.92%	3.63%	4.04%	3.31%
23:00	4.49%	2.89%	2.36%	1.80%	2.58%
Overall	**9.15%**	**5.29%**	**5.21%**	**4.21%**	**3.51%**

The following table shows unit-hour utilization for the District's EMS apparatus.

Table 17—Unit-Hour Utilization – EMS Apparatus (2021)

Hour	M-61	M-65	M-62
00:00	6.60%	4.02%	0.14%
01:00	5.40%	4.34%	0.45%
02:00	4.72%	3.08%	0.00%
03:00	4.83%	3.17%	0.00%
04:00	5.66%	3.33%	0.00%
05:00	5.17%	2.91%	0.00%
06:00	6.05%	4.67%	0.00%
07:00	8.32%	11.91%	0.21%
08:00	10.26%	5.84%	0.64%
09:00	12.63%	8.40%	0.40%
10:00	13.21%	10.34%	0.96%
11:00	12.77%	8.78%	1.39%
12:00	12.81%	9.06%	1.06%
13:00	14.63%	8.33%	1.71%
14:00	13.55%	9.51%	1.32%
15:00	12.65%	9.18%	1.97%
16:00	12.37%	8.79%	0.88%
17:00	13.05%	9.34%	1.42%
18:00	10.95%	7.17%	1.33%
19:00	9.81%	13.39%	0.42%
20:00	9.36%	8.93%	0.99%
21:00	10.36%	7.23%	0.44%
22:00	8.96%	4.77%	0.25%
23:00	5.83%	4.08%	0.24%
Overall	**9.58%**	**7.11%**	**0.68%**

2.7.6 Ambulance Utilization Analysis

While the previous table shows neither full-time staffed District paramedic ambulance (Medic 61 or Medic 65) as approaching Citygate's recommended maximum workload saturation rate of 30 percent unit-hour utilization over multiple consecutive hours, the following table is a deeper analysis of ambulance utilization, including Medic 62, which is cross-staffed by Engine-62 personnel as needed for a third concurrent EMS call. In situations where Engine-62 is already

committed to an incident, the third ambulance typically comes from the City of San Rafael Fire Department through mutual aid. In 2021, the District received an ambulance response from San Rafael 104 times, for a total commitment time of 21.83 hours, which equates to a monthly average of 8.66 incidents and 1.82 hours.

The following table shows that Medic 61 and Medic 65 were simultaneously committed to incidents 2,858 times over the four-year study period for a total of 423 hours, or an average of 1.96 times per day, with 95 percent of those occurrences lasting less than 20:00 minutes. This occurred in 11.44 percent of all calls for service and 16.80 percent of all EMS calls over the four-year period.

Table 18—Simultaneous Commitment Occurrence – Medics 61 and 65 (2018–2021)

Hour	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Total
00:00	8	14	7	2	11	7	11	**60**
01:00	8	4	2	7	9	11	7	**48**
02:00	2	6	3	6	4	6	3	**30**
03:00	7	5	3	1	5	3	5	**29**
04:00	4	4	2	2	5	0	1	**18**
05:00	3	2	6	3	4	2	7	**27**
06:00	6	5	8	5	6	6	4	**40**
07:00	17	11	12	12	14	14	8	**88**
08:00	13	18	20	18	11	6	15	**101**
09:00	16	29	22	19	28	16	23	**153**
10:00	22	32	27	42	37	16	26	**202**
11:00	35	19	39	24	36	31	26	**210**
12:00	34	26	35	22	26	23	18	**184**
13:00	28	25	30	25	25	28	18	**179**
14:00	32	24	29	39	30	28	27	**209**
15:00	19	26	22	36	31	30	19	**183**
16:00	15	33	26	27	28	30	21	**180**
17:00	22	25	19	29	32	31	30	**188**
18:00	18	17	16	26	23	26	30	**156**
19:00	16	25	23	25	21	18	30	**158**
20:00	20	18	21	14	17	23	19	**132**
21:00	12	24	11	16	18	20	20	**121**
22:00	6	16	13	12	14	16	11	**88**
23:00	7	7	6	15	15	13	11	**74**
Total	**370**	**415**	**402**	**427**	**450**	**404**	**390**	**2,858**

Over the same period, all *three* District ambulances were simultaneously committed 293 times, as shown in the following table, for a total of 27.15 hours, or an average of once every five days, with 95 percent of the occurrences lasting slightly more than 15:00 minutes. This occurred in only 1.2 percent of all calls for service and 1.7 percent of all EMS calls.

Table 19—Simultaneous Commitment Occurrence – Medics 61, 62, and 65 (2018–2021)

Hour	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Total
00:00	1	2	0	0	0	0	0	**3**
01:00	1	1	0	0	0	1	0	**3**
02:00	0	0	0	0	0	1	0	**1**
03:00	0	0	1	0	0	0	0	**1**
04:00	0	0	0	0	0	0	0	**0**
05:00	0	0	0	0	0	0	0	**0**
06:00	0	0	0	0	0	0	0	**0**
07:00	1	4	0	1	2	0	0	**8**
08:00	2	1	4	5	1	1	3	**17**
09:00	1	2	2	2	2	2	1	**12**
10:00	0	5	1	5	4	3	0	**18**
11:00	5	2	6	1	2	3	3	**22**
12:00	5	2	3	4	1	4	3	**22**
13:00	2	6	6	3	4	2	3	**26**
14:00	1	0	4	4	4	4	2	**19**
15:00	0	4	2	3	6	6	1	**22**
16:00	1	5	2	4	2	4	1	**19**
17:00	4	6	1	3	6	3	2	**25**
18:00	1	3	0	8	0	3	2	**17**
19:00	2	5	2	2	2	5	0	**18**
20:00	1	2	3	1	1	1	2	**11**
21:00	1	1	0	0	3	3	1	**9**
22:00	0	3	4	2	4	4	0	**17**
23:00	0	1	0	0	1	1	0	**3**
Total	**29**	**55**	**41**	**48**	**45**	**51**	**24**	**293**

Medic 62 was deployed to 936 incidents over the four-year period, as summarized in the following tables, for an average of 19.5 times per month (0.65 times per day), or 5.6 percent of all EMS calls.

Table 20—Medic 62 Utilization Summary by Month and Year

Month	2018	2019	2020	2021	Total
January	13	24	28	15	**80**
February	15	14	26	9	**64**
March	24	24	14	23	**85**
April	17	16	16	21	**70**
May	17	13	18	30	**78**
June	20	27	17	19	**83**
July	9	16	14	16	**55**
August	19	26	32	10	**87**
September	15	24	18	26	**83**
October	16	32	9	20	**77**
November	15	17	15	32	**79**
December	20	20	23	32	**95**
Total	**200**	**253**	**230**	**253**	**936**

The following table summarizes Medic 62 incidents by day of week and hour of day over the four-year study.

Table 21—Medic 62 Utilization Summary by Hour and Day (2018–2021)

Hour	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Total
00:00	1	3	1	0	5	0	0	**10**
01:00	1	1	0	1	1	1	0	**5**
02:00	1	0	0	0	0	3	1	**5**
03:00	1	0	1	0	0	1	0	**3**
04:00	1	1	0	0	0	0	0	**2**
05:00	0	0	0	1	1	0	0	**2**
06:00	0	0	0	1	0	1	0	**2**
07:00	2	2	5	3	3	0	1	**16**
08:00	6	2	9	7	6	2	4	**36**
09:00	2	7	11	5	4	6	5	**40**
10:00	8	14	11	7	7	10	2	**59**
11:00	9	13	16	8	10	7	11	**74**
12:00	16	9	12	5	11	10	6	**69**
13:00	11	9	20	11	14	7	9	**81**
14:00	7	4	7	25	16	11	10	**80**
15:00	10	15	13	16	18	12	8	**92**
16:00	9	8	9	11	9	8	6	**60**
17:00	9	16	2	10	15	12	7	**71**
18:00	7	10	7	15	8	7	10	**64**
19:00	7	7	10	3	8	10	4	**49**
20:00	4	10	8	1	6	7	8	**44**
21:00	5	4	2	1	4	7	5	**28**
22:00	1	5	3	7	4	6	0	**26**
23:00	0	6	2	4	1	3	2	**18**
Total	**118**	**146**	**149**	**142**	**151**	**131**	**99**	**936**

This analysis shows that while both staffed ambulances are simultaneously committed on a significant percentage of EMS calls, it is for a period of less than 20:00 minutes in nearly all cases. In addition, all three ambulances are concurrently committed to only 1.7 percent of all EMS calls for 15:00 minutes or less in nearly all cases. A mutual aid ambulance was utilized 104 times in 2021 for 21.8 hours, which equates to 2.4 percent of all EMS calls for that same year.

In Citygate's experience and opinion, this analysis shows that District ambulances are appropriately staffed and deployed to meet current EMS demand with minimal risk exposure during periods of simultaneous commitment. However, future planned/anticipated senior living, continuum of care, and congregate care facilities, as well as other future development, will increase EMS demand, and Citygate suggests the District consider the following incremental ambulance service enhancements as ambulance or general revenues permit:

1. Establish a fourth standby, cross-staffed ambulance for surge capacity at Station 63 or 64 while maintaining adequate reserve ambulance capacity.
2. When the third District ambulance utilization is consistently at or above two times per day between the hours of 10:00 am and 6:00 pm, or sooner if revenues permit, consider staffing a BLS ambulance 10 to 12 hours per day during peak activity hours for low-acuity EMS calls and non-emergency transfers, while retaining immediate cross-staffing capacity of a fourth paramedic ambulance as needed for surge capacity.
    - Alternately, consider adding a third staffed 12-hour ALS ambulance during peak activity hours.

Finding #6:	District ambulances resources are appropriately staffed and deployed to meet current EMS demand with minimal risk exposure during periods of concurrent commitment.

Recommendation #2:	To provide enhanced ambulance capacity as funding allows, establish a fourth standby, cross-staffed ambulance for surge capacity at Station 63 or 64 while maintaining adequate reserve ambulance capacity.

Recommendation #3:	When the third District ambulance utilization is consistently at or above two times per day between the hours of 10:00 am and 6:00 pm, or sooner if revenues permit, consider staffing a Basic Life Support (BLS) ambulance 10 to 12 hours per day during peak activity hours for low-acuity EMS calls and non-emergency transfers, while retaining immediate cross-staffing capacity of a fourth paramedic ambulance as needed for surge capacity. Alternately, consider adding a third staffed 12-hour Advanced Life Support (ALS) ambulance during peak hours.

2.7.7 Operational Performance

Measurements for the performance of the first response apparatus to arrive at emergency incidents are the number of minutes and seconds necessary for 90 percent completion of the following response components:

- Call processing/dispatch
- Crew turnout
- First unit travel
- Call to arrival

Call Processing/Dispatch

Call processing measures the time from receipt of the 9-1-1 call to completion of the dispatch notification process. Call processing performance depends on what is being measured. If the first incident timestamp takes place at the time the public safety answering point (PSAP) receives the 9-1-1 call, then call processing includes PSAP time as well as dispatch handling time. Otherwise, the performance represents only a portion of the entire call processing and dispatch operation.

Not all requests for assistance are received via 9-1-1, so there will generally be a mix of channels for receiving requests for assistance. Each channel will have a timestamp at a different point in the processing operation. This is not as much of a factor if most requests are received via a 9-1-1 PSAP.

Best practice for call processing is 60 seconds 90 percent of the time, except for the following situations where it is 90 seconds 90 percent of the time:[10]

- Calls requiring emergency medical dispatch questioning and pre-arrival medical instructions.
- Calls requiring language translation.
- Calls requiring the use of a TTY/TDD device or audio/video relay services.
- Calls of criminal activity that require information vital to emergency responder safety prior to dispatching units.
- Hazardous material incidents.
- Technical rescue incidents.
- Calls that require determining the location of the alarm due to insufficient information.
- Calls received by text message.

Considering the best practice standards cited previously and a District and Citygate goal of 90 seconds, 90th percentile call processing performance presented in the following table is exceptionally fast. While this may be due to operational efficiency, it is more likely due to PSAP call processing not being included in the timestamps provided for analysis. Likely, the time captured for the *Time of Call* in Department records represents a timestamp after "off-hook" PSAP time.

[10] NFPA 1221 – Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems (2019 edition).

Table 22—90th Percentile Call Processing Performance (2018–2021)

Station	Overall	2018	2019	2020	2021
District-Wide	0:47	0:51	0:49	0:42	0:40

Finding #7: The Marin County Sheriff's Office Communications Division 9-1-1 Dispatch Center 90th percentile call processing performance is 22 percent *faster* at 0:47 minutes than the 60-second best practice standard and 48 percent faster than the District's current 1:30-minute goal. However, this call processing performance likely does not include the earliest timestamp when a 9-1-1 call is first answered in the Dispatch Center.

Crew Turnout

Crew turnout measures the time from completion of the dispatch notification to the start of apparatus movement toward the emergency. While the NFPA recommends 60 seconds for medical emergencies and 90 seconds for fire and special service responses, in Citygate's extensive deployment study experience this goal is very rarely achieved.[11] As a result, Citygate has long recommended a 90th percentile turnout of 2:00 minutes or less as an achievable goal for most agencies, which is the standard used for this analysis. As the following table illustrates, the District's crew turnout performance *is meeting* the recommended 2:00-minute goal.

Table 23—90th Percentile Crew Turnout Performance (2018–2021)

Station	Overall	2018	2019	2020	2021
District-Wide	2:03	1:53	1:56	2:06	2:13

Finding #8: Crew turnout performance is *meeting* the 2:00-minute best practice goal.

First Unit Travel

Travel measures the time from initial apparatus movement until the apparatus arrives at the incident. Best practice for travel time is 4:00 minutes or less 90 percent of the time in *urban* areas[12]

[11] NFPA 1710 – Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments (2020 edition).
[12] NFPA 1710.

and 8:00 minutes or less 90 percent of the time in rural areas.[13] As the following table shows, 90th percentile first-unit travel performance within the City of Novato, at 6:04 minutes, is *52 percent slower* than the recommended 4:00-minute best practice goal for urban areas, while 90th percentile performance outside the City of Novato, at 8:23 minutes, is only *5 percent slower* than the recommended 8:00-minute best practice goal for rural areas.

Table 24—90th Percentile First Unit Travel Performance (2018–2021)

Response Area	Performance
District-Wide	6:34
City of Novato	6:04
Rural District	8:23

Finding #9: First-unit travel performance in the City of Novato, at 6:04 minutes, is *52 percent slower* than the recommended 4:00-minute best practice goal for *urban* areas, while performance outside the City of Novato, at 8:23 minutes, is only *5 percent slower* than the recommended 8:00-minute best practice goal for rural areas.

First Unit Call to Arrival

Call to arrival measures the interval from receipt of the 9-1-1 request for assistance until the first responding apparatus arrives at the emergency. This is a fire agency's *true* customer service performance measure. Citygate recommends a 7:30-minute call-to-arrival performance goal at 90 percent reliability to facilitate desired outcomes in *urban* areas, including 1:30 minutes for call processing/dispatch, 2:00 minutes for crew turnout, and 4:00 minutes' travel time. Citygate further recommends an 11:30-minute call-to-arrival goal at 90 percent reliability in *rural* areas.

As the following table shows, call to first unit arrival performance in the City of Novato, at 7:47 minutes, is *3 percent faster* than the current 8:00-minute District response standard and only *4 percent slower* than the 7:30-minute best practice goal for urban areas. In addition, call to first unit arrival performance outside the City of Novato, at 10:23 minutes, is *10 percent faster* than the recommended 11:30-minute best practice goal for rural areas; however, it is *30 percent slower* than the current 8:00-minute District response standard. In Citygate's experience, this is very good response performance, both in the City of Novato as well as the rural areas outside Novato.

[13] Citygate recommended.

Table 25—90th Percentile Call to First Unit Arrival Performance (2018–2021)

Response Area	Performance
District-Wide	8:18
City of Novato	7:47
Rural District	10:23

Finding #10: First-unit call-to-arrival performance in the City of Novato, at 7:47 minutes, is *3 percent faster* than the current 8:00-minute District response standard and only *4 percent slower* than the 7:30-minute best practice goal for urban areas. In addition, call to first unit arrival performance outside the City of Novato, at 10:23 minutes, is *10 percent faster* than the recommended 11:30-minute best practice goal for rural areas and *30 percent slower* than the current District response standard.

ERF Call to Arrival

ERF call to arrival measures the time from receipt of the 9-1-1 request for assistance to arrival of the *last* ERF resource. A full ERF of four engines (or three engines and one ladder truck), one medic unit, and one Battalion Chief arriving at an emergency incident occurred only 17 times over the four-year study period.

As the following table shows, 90th percentile District-wide ERF call to arrival performance, at 18:43 minutes, was *63 percent slower* than the recommended 11:30-minute best practice goal for *urban* areas and *134 percent slower* than the current 8:00-minute District response standard. However, this analysis involved a very small data set, which can be very volatile. It should also be noted that ERF call to arrival performance for the six incidents in 2021 met the 11:30-minute best practice goal.

Table 26—90th Percentile Call to ERF Arrival Performance (2018–2021)

Station	Overall	2018	2019	2020	2021
District-Wide	**18:43**	24:01	19:12	18:43	11:24

Finding #11: Overall ERF call to arrival performance, at 18:43 minutes, was *63 percent slower* than the recommended 11:30-minute best practice goal for *urban* areas and *134 percent slower* than the current 8:00-minute District response standard. However, this performance includes only 17 incidents over the four-year study period, and small data sets can be very volatile. It should also be noted that ERF call to arrival performance for the six incidents in 2021 met the 11:30-minute best practice goal.

2.8 Overall Deployment Evaluation

SOC Element 8 of 8
Overall Evaluation

The District serves a diverse urban-to-rural population over a widely varied land-use pattern, and Citygate finds that the District's physical response resources are appropriate to protect against the hazards likely to impact its service area.

Even where state or local fire codes require fire sprinklers in residential dwellings, it will be many more decades before enough homes are remodeled with automatic fire sprinklers. If desired outcomes include limiting building fire damage to only part of the inside of an affected building or minimizing permanent impairment resulting from a medical emergency, or both, then *urban* population areas of the District will need both first-due unit and multiple-unit ERF coverage in similar risk neighborhoods consistent with Citygate response performance recommendations, starting with a first-due unit arrival within 7:00 to 8:00 minutes from 9-1-1 dispatch notification and an ERF arrival within 11:00 to 12:00 minutes of 9-1-1 notification, all at 90 percent or better reliability.

The District's daily staffing level of 20 personnel is generally sufficient for one moderate complexity ERF incident, leaving one additional staffed engine and paramedic ambulance available for concurrent incident(s).

Overall annual service demand increased nearly 7 percent in 2021 from the previous year, nearly matching peak service demand in 2019. In addition, 85 percent of all calls for service were within the City of Novato, which is to be expected given its higher population density than the more rural

areas of the District. Limited projected population growth over the next 14 years to 2035 will likely increase service demand somewhat, with EMS-related demand increasing at a higher rate than other call types due to anticipated additional senior living, continuum of care, and congregate care facilities.

As described in detail in **Section 2.7.7** and summarized in the following table, call processing and crew turnout performance are *meeting* best practice goals of 1:30 minutes and 2:00 minutes, respectively. First-unit travel, however, is *significantly slower* in the City of Novato than the 4:00-minute best practice goal in urban areas, and first-unit travel is only *slightly slower* than the 8:00-minute best practice goal in the rural areas of the District. A fire agency's *true* customer service measure of 9-1-1 call to arrival performance is *nearly meeting* recommended best practice goals for first unit in the City of Novato and is *faster* than recommended best practice goals in the rural areas of the District.

Table 27—90th Percentile Response Performance Summary (2018–2021)

Response Component	Current District Policy		Best Practice		90th Percentile Performance (Minutes)	Performance vs. Current Policy	Performance vs. Best Practice
	Call Type	Minutes	Minutes	Reference			
Call Processing / Dispatch	ALL	**None**	**1:30**	Citygate	**0:47**	**N/A**	**-48%**
Crew Turnout	EMS	**1:00**	**2:00**	Citygate	**2:03**	**105%**	**3%**
	Fire	**1:45**	**2:00**	NFPA Citygate	**2:03**	**17%**	**3%**
First Unit Travel	Novato	**None**	**4:00**	Citygate	**6:04**	**N/A**	**52%**
	Rural	**None**	**8:00**	Citygate	**8:23**	**N/A**	**5%**
Call to First Unit Arrival	Novato	**8:00**	**7:30**	Citygate	**7:47**	**-3%**	**4%**
	Rural	**8:00**	**11:30**	Citygate	**10:23**	**30%**	**-10%**
ERF Travel	All	**None**	**8:00**	NFPA Citygate	**14:50**	**N/A**	**85%**
Call to ERF Arrival	Fire	**8:00**	**11:30**	Citygate	**18:43**	**134%**	**63%**

In terms of emergency incident workload, no single staffed resource is approaching workload saturation; however, during peak hours of the day, more than 24 percent of incidents occurred while one or more other incidents were underway, predominantly impacting Station 61. The two staffed medic ambulances are concurrently committed on 17 percent of all EMS calls for short periods of time each, requiring Medic 62 to be staffed for any third concurrent EMS incident,

which is only 5.6 percent of all EMS calls. Further, all three ambulances are concurrently committed on only 1.7 percent of all EMS calls for 15:00 minutes or less on nearly all occurrences. Given this, Citygate finds that District ambulances resources are appropriately staffed and deployed to meet current EMS demand with minimal risk exposure during periods of concurrent commitment; however, as EMS demand increases, Citygate suggests that the District consider incremental service enhancements as funding permits, as described in **Section 2.7.6**.

Citygate's analysis further finds that the District's current station locations can be expected to provide 4:00-minute first-due travel time coverage to *only 52 percent* of the District's public road network; however, 6:00-minute travel can be expected to cover 70 percent of the road miles within the City of Novato and 86 percent of the total District road miles, which in Citygate's experience is good urban coverage and very good rural coverage.

Given the diversity of its service area, Citygate recommends the District amend its current response performance policy to provide differential standards for the City of Novato and the unincorporated rural areas of the District, as described in **Section 2.8.3**, to drive future planning and monitoring of fire service performance.

2.8.1 Station 63 Location

As an element of this study, Citygate was tasked to evaluate the location of Station 63 and any potential service improvements to be gained from relocating this station. According to District staff, this station was originally sited at its current location in anticipation of additional future development to the west and northwest, which subsequently did not occur due to adoption of the Novato Urban Growth Boundary measure in 1997. Based on first-unit travel time coverage as shown in Map 3 and Map 3b and ERF travel time coverage in Map 5 and Map 5a, some limited travel time coverage could be gained by relocating Station 63 southeast, optimally in the general area of Novato Boulevard and Wilson Avenue/Simmons Lane. With current fire station construction costs upwards of $1,000 per square foot,[14] relocating Station 63 would cost upwards of $5.5 million for a similar-size station, exclusive of land and other project costs.[15] In Citygate's opinion, these costs significantly outweigh the minimal service gains to be achieved from such a move.

2.8.2 Service Reduction Analysis

As part of this study, Citygate was tasked to evaluate and recommend an appropriate drawdown plan and related service impacts if future District revenues are unable to support the current service delivery model. Given the proximity to Station 64 and the southern District boundary, Citygate

[14] Cost estimate is for actual construction only; does not include site acquisition, design, permits, or other ancillary costs.

[15] Source: Recent City of San Rafael fire station construction projects.

evaluated the service delivery impacts of either browning out (intermittently un-staffing) or permanently un-staffing Station 65 as having the least impact on overall service delivery, specifically relative to first-due and ERF travel time performance.

Map 3a (No Station 65)—Distribution: 4:00-Minute First-Due Travel with No Engine-65

As Map 3a (No Engine-65) illustrates, un-staffing Engine-65, whether intermittent, temporary, or permanent, would result in a 6.7 percent reduction in 4:00-minute first-due engine travel time coverage from Map 3a with Engine-65.

Map 3b (No Station 65)—Distribution: 6:00-Minute First-Due Travel with No Engine-65

Map 3b (No Engine-65) shows only a 0.75 percent reduction in 6:00-minute first-due engine travel time coverage without Engine-65 compared to Map 3b with Engine-65.

Map 5a (No Station 65)—Distribution: 6:00-Minute First-Due ERF Travel with No Engine-65

Map 5a (No Engine-65) shows an 8.43 percent reduction in 11:30-minute ERF travel time coverage without Engine-65 compared to Map 5a with Engine-65.

Service Reduction Recommendations

Depending on the fiscal target, Citygate suggests the following service reductions, ordered from least impact to greatest:

1. Reduce staffing on Medic 65 to one firefighter/paramedic and make Engine-65 and Medic 65 a two-piece company with a total of four personnel, including two paramedics.
    a. Medic 65 would respond to low-acuity EMS calls with two personnel, including at least one paramedic.
    b. Engine-65 would be available as a two-person company when Medic 65 is committed to an incident.
    c. Both units would respond to high-acuity EMS and fire incidents.
    d. Alternately, move Medic 65 to Station 64 with the same staffing model.
2. Reduce staffing on Engine-65 to three personnel to meet fiscal target.
3. Brown-out or suspend use of Engine-65 as needed to meet fiscal target. Medic 65 remains fully staffed at either Station 65 or alternately at Station 64.
4. Close Station 65; move Medic 65 to Station 64.

2.8.3 Deployment Findings and Recommendations

Citygate's evaluation of the District's current deployment and staffing yields the following findings and recommendations.

Finding #12: The District's daily staffing level of 20 personnel is minimally adequate for one moderate complexity ERF incident, with one remaining medic unit available for a concurrent incident.

Finding #13: Annual service demand increased nearly 7 percent in 2021 from the previous year, nearly matching peak service demand in 2019, with EMS demand increasing nearly 8 percent over the same period.

Finding #14: Of all calls for service, 85 percent are within the City of Novato.

Finding #15: Projected population growth within the District over the next 14 years to 2035 can be expected to minimally impact service demand, except for EMS-related calls for service.

Finding #16: Current station locations can be expected to provide 6:00-minute first-due travel time coverage to nearly 86 percent of all public road segments within the District's service area, which is *good* suburban-level coverage.

Finding #17: Relocating Station 63 would not be cost-effective relative to any potential improvement in travel time coverage.

Recommendation #4: **Adopt Updated Deployment Policies:** The District should adopt *updated*, complete performance measures to aid deployment planning and to monitor performance. Measures should be established for urban and rural areas. The measures of time should be designed to deliver outcomes that will save patients where possible upon arrival and keep small and expanding fires from becoming more serious. With this is mind, Citygate recommends the following response performance measures:

4.1 **Fire Station Distribution:** To treat pre-hospital medical emergencies and control small fires, the first-due unit should arrive within 8:00 minutes, 90 percent of the time, from the receipt of the 9-1-1 call at the Marin County Sheriff's Office 9-1-1 Dispatch Center within the City of Novato and within 11:00 minutes in the rural District response areas; this equates to a 90-second dispatch, 2:00-minute crew turnout, and 4:30-minute travel (City of Novato) or 7:30-minute travel time (rural response areas).

4.2 **Fire Station Concentration – Multiple-Unit Effective Response Force (ERF) for Serious Emergencies:** To confine building fires near the room of origin, keep vegetation fires under one acre in size, and treat multiple medical patients at a single incident, a multiple-unit ERF of at least 15 personnel, including at least one chief officer, should arrive within 12:00 minutes in the City of Novato from the time of 9-1-1 call receipt at the Marin County Sheriff's Office 9-1-1 Dispatch Center, 90 percent of the time; this equates to 90-second dispatch, 2:00-minute crew turnout, and 8:30-minute travel. This same ERF should arrive within 19:30 minutes in the rural unincorporated areas of the District from the time of 9-1-1 call receipt at the Marin County Sheriff's Office 9-1-1 Dispatch Center, 90 percent of the time; this equates to 90-second dispatch time, 2:00-minute crew turnout time, and 16:00-minute travel time.

4.3 **Hazardous Materials Incidents:** To protect the District's service area from the hazards associated with uncontrolled release of hazardous and toxic materials, the first-due unit should arrive to assess the situation, isolate and deny entry, and determine the need for a Hazardous Materials Response Team within 8:00 minutes, 90 percent of the time, from the receipt of the 9-1-1 call at the Marin County Sheriff's Office 9-1-1 Dispatch Center within the City of Novato and within 11:00 minutes in the rural District response areas; this equates to a 90-second dispatch, 2:00-minute crew turnout, and 4:00-minute travel (City of Novato) or 7:30-minute travel time (rural response areas).

4.4 **Technical Rescue Incidents:** To provide technical rescue services as needed, the first-due unit should arrive within 8:00 minutes, 90 percent of the time, from the receipt of the 9-1-1 call at the Marin County Sheriff's Office 9-1-1 Dispatch Center within the City of Novato and within 11:00 minutes in the rural District response areas; this equates to a 90-second dispatch, 2:00-minute crew turnout, and 4:30-minute travel (City of Novato) or 7:30-minute travel time (rural response areas).

Additional resources as needed should arrive within 12:00 minutes within the City of Novato and within 19:30 minutes in the rural District areas to facilitate safe rescue/extrication and delivery of the victim to the appropriate emergency medical care facility.

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APPENDIX A

RISK ASSESSMENT

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APPENDIX A—RISK ASSESSMENT

A.1 COMMUNITY RISK ASSESSMENT

SOC ELEMENT 3 OF 8
COMMUNITY RISK ASSESSMENT

The third element of the Standards of Coverage (SOC) process is a community risk assessment. Within the context of an SOC study, the objectives of a community risk assessment are to:

- Identify the values at risk to be protected within the community or service area.
- Identify the specific hazards with the potential to adversely impact the community or service area.
- Quantify the overall risk associated with each hazard.
- Establish a foundation for current/future deployment decisions and risk-reduction/hazard-mitigation planning and evaluation.

A hazard is broadly defined as a situation or condition that can cause or contribute to harm. Examples include fire, medical emergency, vehicle collision, earthquake, flood, etc. Risk is broadly defined as the *probability of hazard occurrence* in combination with the *likely severity of resultant impacts* to people, property, and the community as a whole.

A.1.1 Risk Assessment Methodology

The methodology employed by Citygate to assess community risks as an integral element of an SOC study incorporates the following elements:

- Identification of geographic planning sub-zones (risk zones) appropriate to the community or jurisdiction.
- To the extent data is available, identification and quantification of the specific values at risk to various hazards within the community or service area.
- Identification of the fire and non-fire hazards to be evaluated.
- Determination of the probability of occurrence for each hazard.
- Determination of *probable* impact severity of a hazard occurrence by planning zone.
- Determination of overall risk by hazard as outlined in the following table.

Table A28—Overall Risk

Probability	Impact				
	Insignificant	Minor	Moderate	Major	Catastrophic
Rare	*Low*	*Low*	*Low*	*Moderate*	*High*
Unlikely	*Low*	*Low*	*Low*	*Moderate*	*High*
Possible	*Low*	*Low*	*Moderate*	*High*	*Extreme*
Probable	*Low*	*Low*	*Moderate*	*High*	*Extreme*
Frequent	*Low*	*Moderate*	*High*	*Extreme*	*Extreme*

Citygate used the following data sources for this study to understand the hazards and values to be protected in the District:

- US Census Bureau population and demographic data
- City and County General Plan and Zoning information
- City and County geographic information systems data
- City and County Hazard Mitigation Plans
- NFPA Community Risk Assessment Tool
- Fire District data and information

A.1.2 Best Practice References

Citygate utilized the following industry-recognized best practice guidelines and recommendations for this assessment:

- NFPA 1300 — Standard on Community Risk Assessment and Community Risk Reduction Plan Development (2020 edition)
- Vision 20/20 — National Strategies for Fire Loss Prevention (October 2008)

A.1.3 Risk Assessment Summary

The District has made a considerable investment in and commitment to ongoing risk assessment and hazard mitigation to reduce both the frequency and severity of hazard occurrences. This is evidenced in part by being selected by the NFPA to participate in its Community Risk Assessment Pilot Project that develops customized dashboards powered by mySidewalk, a Creative Community Intelligence platform specializing in digital data visualization. These dashboards visually describe data about the community served, its social vulnerabilities and built environment, foundational risk mitigation efforts/initiatives, COVID-19 impacts, and other elements described

in NFPA 1300 – Standard on Community Risk Assessment and Community Risk Reduction Plan Development (2020 edition). Data and information from these dashboards were used in conducting this assessment.

The District was also a key agency partner in the development of the initial and updated Marin Community Wildfire Protection Plan (CWPP) that provides a science-based assessment of wildfire hazard in Marin County and provides fire agencies and other stakeholders guidance and strategies to reduce wildland fire risk and resultant impacts. In addition, the District was a key stakeholder in the creation of the Marin Wildfire Prevention Authority (MWPA), a Countywide Joint Powers Authority with 17 member agencies, including cities, towns, the County, and special districts, whose mission is to lead "the development of fire adapted communities using sound scientific, financial, programmatic, ecological practices, vegetation management, community education, evacuation and warning systems with the support of its member and partner agencies."[16]

Citygate's evaluation of the values at risk and hazards likely to impact the District's service area yields the following:

1. The District serves a diverse urban/suburban/rural population, with densities ranging from less than 1,500 to more than 5,000 people per square mile, over a widely varied land use pattern.

2. The City of Novato's population is projected to increase modestly over the next 14 years to approximately 55,500 by 2035. In addition, the unincorporated area of the District is expected to experience very minimal population growth over the same period.

3. The District's service area includes a large inventory of residential and non-residential buildings to protect.

4. The District has significant economic and other resource values to be protected, as identified in this assessment.

5. The County has a mass emergency notification system to effectively communicate emergency information to the public in a timely manner.

6. The District's overall risk for five hazards related to emergency services range from **Low** to **High**, as summarized in the following table.

[16] Source: www.marinwildfire.org/about-us.

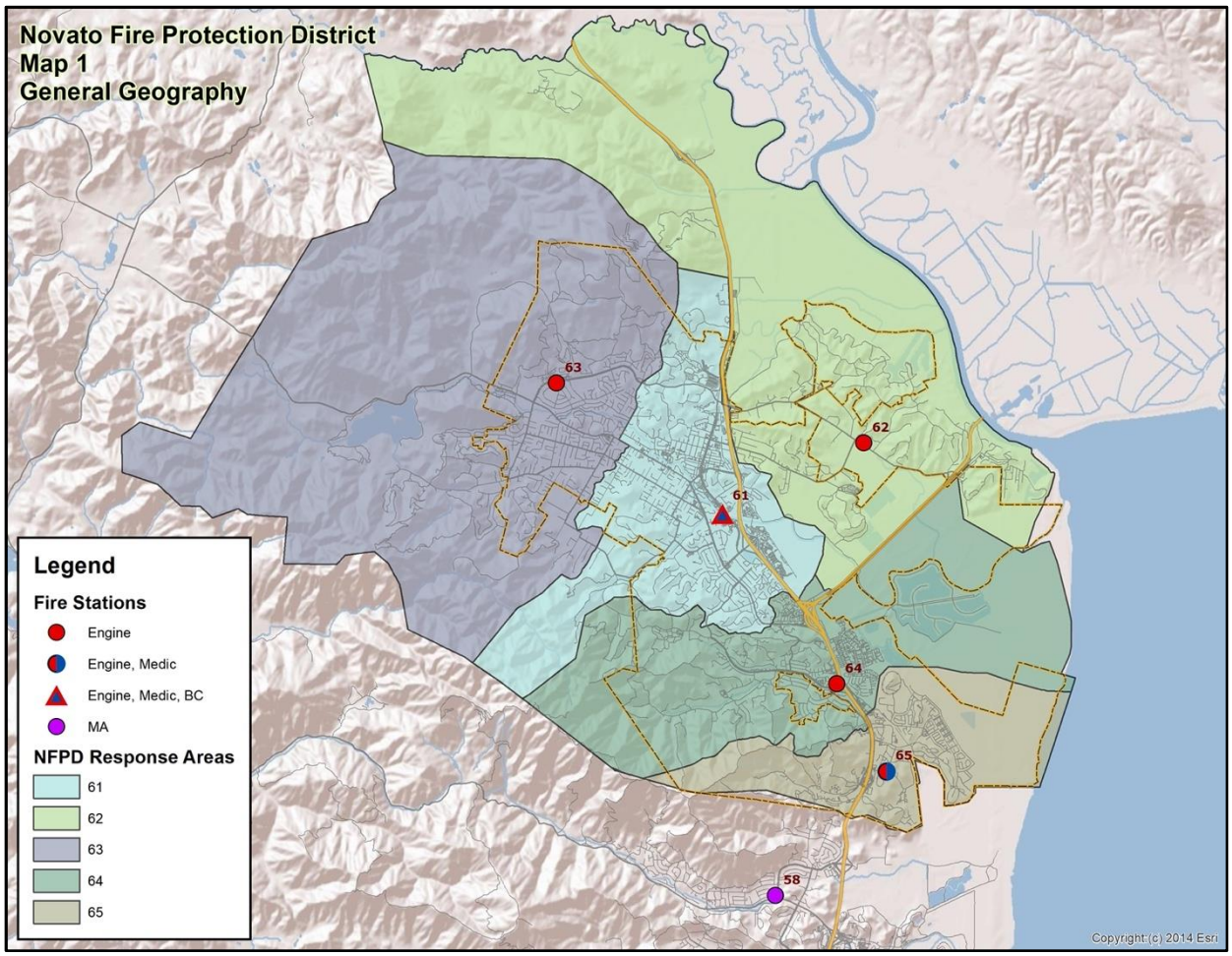
Table A29—Overall Risk by Hazard

Hazard		Planning Zone				
		Station 61	Station 62	Station 63	Station 64	Station 65
1	Building Fire	*Moderate*	*Moderate*	*Moderate*	*Moderate*	*Moderate*
2	Vegetation/Wildland Fire	*Moderate*	*High*	*High*	*High*	*High*
3	Medical Emergency	*High*	*High*	*High*	*High*	*High*
4	Hazardous Materials	*Moderate*	*Low*	*Low*	*Moderate*	*Low*
5	Technical Rescue	*Moderate*	*Moderate*	*Moderate*	*Moderate*	*Moderate*

A.1.4 Planning Zones

The Commission on Fire Accreditation International (CFAI) recommends that jurisdictions establish geographic planning zones to better understand risk at a sub-jurisdictional level. For example, portions of a jurisdiction may contain predominantly moderate risk building occupancies, such as detached single-family residences, while other areas contain high- or maximum-risk occupancies, such as commercial and industrial buildings with a high hazard fire load. If risk were to be evaluated on a jurisdiction-wide basis, the predominant moderate risk could outweigh the high or maximum risk and may not be a significant factor in an overall assessment of risk. If, however, those high- or maximum-risk occupancies are a larger percentage of the risk in a smaller planning zone, then it becomes a more significant risk factor. Another consideration in establishing planning zones is that the jurisdiction's record management system must also track the specific zone for each incident to be able to appropriately evaluate service demand and response performance relative to each specific zone. For this assessment, Citygate utilized five planning zones corresponding with each fire station's first-due response area, as shown in the following figure.

Figure A11—Risk Planning Zones



A.1.5 Values at Risk to Be Protected

Values at risk, broadly defined, are tangibles of significant importance or value to the community or jurisdiction potentially at risk of harm or damage from a hazard occurrence. Values at risk typically include people, critical facilities/infrastructure, buildings, and key economic, cultural, historic, or natural resources.

People

Residents, employees, visitors, and travelers in a community or jurisdiction are vulnerable to harm from a hazard occurrence. Particularly vulnerable are specific at-risk populations, including those unable to care for themselves or self-evacuate in the event of an emergency. At-risk populations typically include children less than 10 years of age, the elderly, and people housed in institutional settings. The following table summarizes key demographic data for the District's service area.

Table A30—Key Demographic Data – Novato FPD

Demographic	2020
Population	**59,228**
Under 10 years	10.60%
10–14 years	5.90%
15–64 years	62.00%
65–74 years	12.90%
75 years and older	8.60%
Median age	45.8
Daytime population	57,268
Housing Units	**24,166**
Owner-Occupied	67.00%
Renter-Occupied	28.70%
Vacant	4.30%
Average Household Size	2.54
Median Home Value	$891,890
Ethnicity	
Caucasian	75.30%
Hispanic/Latino (counted as Caucasian)	22.70%
Asian	7.90%
Black/African American	2.30%
Other	14.50%
Education (Population over 24 Years of Age)	**43,283**
High School Graduate	94.40%
Undergraduate Degree	49.30%
Graduate/Professional Degree	18.70%
Employment (Population over 15 Years of Age)	**32,630**
In Labor Force	86.40%
Unemployed	13.60%
Median Household Income	$110,888
Population below Poverty Level	6.90%
Population without Health Insurance Coverage	3.50%

Source: Esri Community Analyst (2020) and US Census Bureau.

Of note from the previous table is that:

- Slightly more than 32 percent of the population is under 10 years or over 65 years of age.
- The District's population is predominantly Caucasian (75 percent), including Hispanic/Latino (23 percent and also counted as Caucasian), followed by other ethnicities (15 percent), Asian (8 percent), and Black/African American (2 percent).
- Of the population over 24 years of age, more than 94 percent has completed high school or equivalency.
- Of the population over 24 years of age, 68 percent has an undergraduate, graduate, or professional degree.
- More than 86 percent of the population 15 years of age or older is in the workforce; of those, nearly 14 percent are unemployed.
- Median household income is nearly $111,000.
- Approximately 7 percent of the service area population is below the federal poverty level.
- Only 3.5 percent of the service area population does not have health insurance coverage.

The City of Novato General Plan projects the City population will increase by about 5.5 percent to approximately 55,500 by 2035.[17] In addition, the unincorporated area of the District is expected to experience very minimal population growth of less than 1 percent over the next 14 years to 2035.

Buildings

The District's service area includes more than 24,100 housing units, as well as nearly 3,000 businesses, including manufacturing, research, technology, office, professional services, retail sales, restaurants/bars, motels, churches, schools, government facilities, healthcare facilities, and other business types.[18]

Building Occupancy Risk Categories

The CFAI identifies the following four risk categories that relate to building occupancy:

[17] Source: City of Novato General Plan 2035 – Public Review Draft, August 2016, Section 2.3.
[18] Source: Esri Community Analyst Business Summary (2020).

Low Risk – includes detached garages, storage sheds, outbuildings, and similar building occupancies that pose a relatively low risk of harm to humans or the community if damaged or destroyed by fire.

Moderate Risk – includes detached single-family or two-family dwellings; mobile homes; commercial and industrial buildings less than 10,000 square feet without a high hazard fire load; aircraft; railroad facilities; and similar building occupancies where loss of life or property damage is limited to the single building.

High Risk – includes apartment/condominium buildings; commercial and industrial buildings more than 10,000 square feet without a high hazard fire load; low-occupant load buildings with high fuel loading or hazardous materials; and similar occupancies with potential for substantial loss of life or unusual property damage or financial impact.

Maximum Risk – includes buildings or facilities with unusually high risk requiring an Effective Response Force involving a significant augmentation of resources and personnel and where a fire would pose the potential for a catastrophic event involving large loss of life or significant economic impact to the community.

The District identified 365 high- and maximum-risk building occupancies, as described in the following table.

Table A31—High/Maximum Risk Building Occupancies

Building Occupancy Classification		Quantity	Risk Category[1]
A-1	Assembly	2	***High***
H	Hazardous	4	***Maximum***
I	Institutional	4	***High***
R-1	Hotel/Motel	8	***High***
R-2	Multi-Family Residential	313	***High***
R-2.1	Residential Care	34	***High***
	Total	**365**	

[1] Source: CFAI *Standards of Response Cover* (fifth edition).

Critical Facilities

The US Department of Homeland Security defines critical infrastructure and key resources as those physical assets essential to the public health and safety, economic vitality, and resilience of a community, such as lifeline utilities infrastructure, telecommunications infrastructure, essential government services facilities, public safety facilities, schools, hospitals, airports, etc. The District has identified 385 critical facilities and infrastructure, as summarized in the following table. A

hazard occurrence with significant impact severity affecting one or more of these facilities would likely adversely impact critical public or community services.

Table A32—Critical Facilities

Critical Facility Category	Number of Facilities
Care Facility	35
Communications	177
Community Services	11
Education	16
Government Services	8
Healthcare	10
Public Safety	13
Transportation	20
Utility	95
Total	**385**

Source: Novato Fire District

Economic Resources

Major employers within the service area include:

- Novato Unified School District
- BioMarin Pharmaceutical Inc.
- Visual Concepts
- Novato Community Hospital
- Costco Wholesale
- Safeway
- W. Bradley Electric Inc.
- Novato Healthcare Center
- Buck Institute for Research on Aging

Natural Resources

Natural resources within the District's service area include:

- Loma Verde Preserve

- Ignacio Valley Preserve
- Indian Valley Preserve
- Deer Island Preserve
- Rush Creek Preserve
- Hamilton Wetlands
- San Pablo Bay
- Petaluma River

Cultural/Historic Resources

Cultural and historical resources within the District include:

- Marin Museum of the American Indian
- Marin Museum of Contemporary Art
- Novato History Museum
- Hamilton Field Aviation Museum
- The Buck Center

Special/Unique Resources

- Marin County Airport (Gnoss Field)

A.1.6 Hazard Identification

Citygate utilized prior risk studies where available, fire and non-fire hazards as identified by the CFAI, and agency/jurisdiction-specific data and information to identify the hazards to be evaluated for this study. The 2018 Marin County Multi-Jurisdiction Local Hazard Mitigation Plan identifies the following nine hazards:

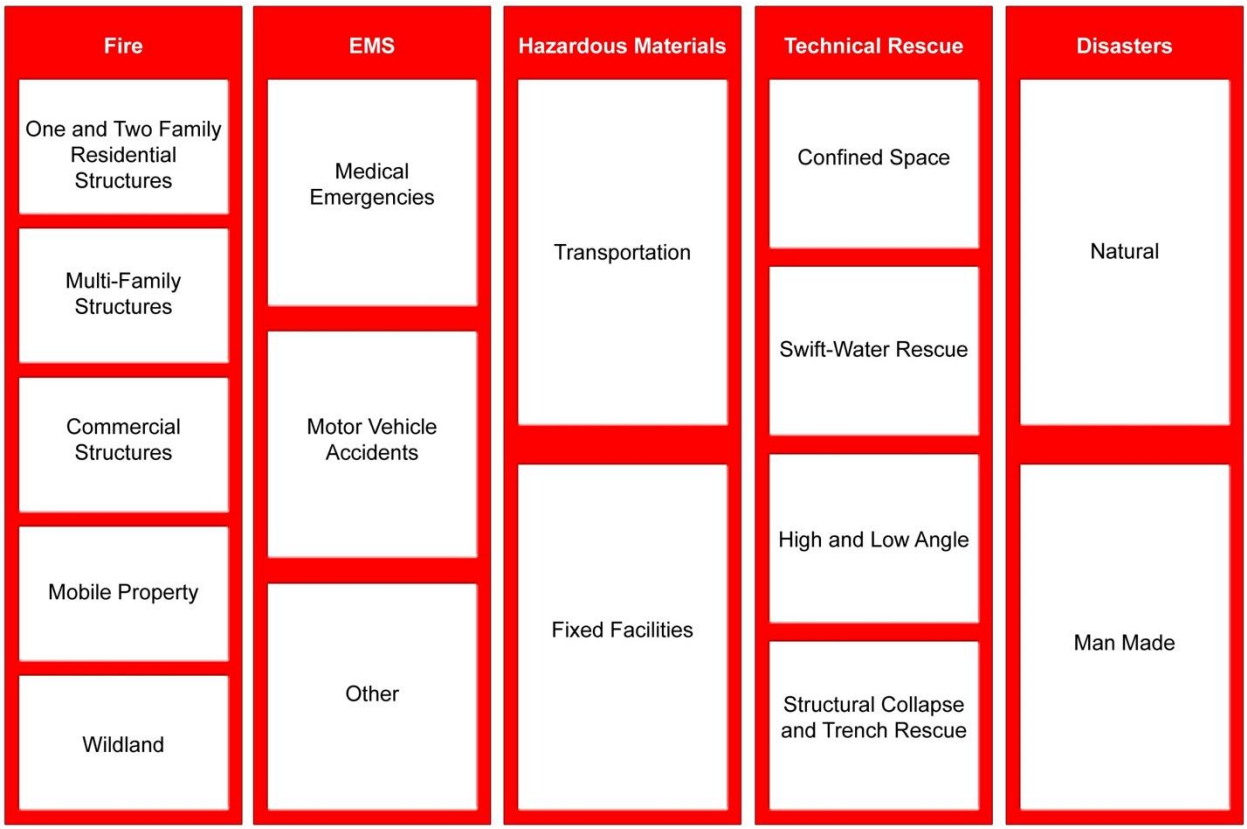
1. Earthquake/liquefaction
2. Dam failure
3. Severe storm
4. Debris flow (landslides)
5. Flooding
6. Wind
7. Tsunami

8. Wildfire
9. Post-fire debris flow

Although the District has no legal authority or responsibility to mitigate any of these hazards other than possibly for wildfire, it does provide services related to each hazard, including fire suppression, emergency medical services, technical rescue, and hazardous materials response.

The CFAI groups hazards into fire and non-fire categories, as shown in the following table. Identification, qualification, and quantification of the various fire and non-fire hazards are important factors in evaluating how resources are or can be deployed to mitigate those risks.

Figure A12—Commission on Fire Accreditation International Hazard Categories



Source: CFAI *Standards of Response Cover* (fifth edition).

Subsequent to review and evaluation of the hazards identified in the County Multi-Jurisdiction Local Hazard Mitigation Plan and the fire and non-fire hazards as identified by the CFAI as they relate to services provided by the District, Citygate evaluated the following five hazards for this risk assessment:

1. Building fire

2. Vegetation/wildland fire
3. Medical emergency
4. Hazardous material release/spill
5. Technical rescue

A.1.7 Service Capacity

Service capacity refers to the District's available response force; the size, types, and condition of its response fleet and any specialized equipment; core and specialized performance capabilities and competencies; resource distribution and concentration; availability of automatic or mutual aid; and any other agency-specific factors influencing its ability to meet current and prospective future service demand relative to the risks to be protected.

The District's service capacity for fire and non-fire risk consists of 20 personnel on duty daily, staffing five engines, two paramedic ambulances, and one Battalion Chief, all operating from the District's five fire stations. The District also has one aerial ladder truck, two wildland engines, one water tender, and one additional ambulance that are cross-staffed as needed by on-duty or call-back personnel depending on type of incident.

All response personnel are trained to either the Emergency Medical Technician (EMT) level, capable of providing Basic Life Support pre-hospital emergency medical care, or EMT-paramedic level, capable of providing Advanced Life Support pre-hospital emergency medical care. The five engines and two ambulances are staffed with at least one EMT-paramedic at all times. Ground paramedic ambulance service is provided by the District. When needed, air ambulance services are provided by REACH Air Medical Services from Santa Rosa or Napa or Life Flight from Palo Alto. Novato Community Hospital, Kaiser Permanente San Rafael Medical Center, and MarinHealth Medical Center in Kentfield provide emergency room services. MarinHealth Medical Center is also a Level III Trauma Center.

Response personnel are also trained to the US Department of Transportation Hazardous Material First Responder Operational level to provide initial hazardous material incident assessment, hazard isolation, and support for a hazardous material response team. Hazardous material emergency response is provided by the Marin County Hazardous Materials Response Team from Ross Valley.

All response personnel are further trained to the Confined Space Awareness level. Technical rescue services are provided by the Marin County Urban Search and Rescue Team, a multiple-agency/discipline team with the tools, equipment, and training to conduct confined space, low/high-angle rope rescue, breaching, shoring, excavation, trench, and water rescue operations.

In addition to the response capacity to mitigate a hazard occurrence, the District's Fire Prevention Division focuses on preventing hazard occurrences through education, engineering, and

enforcement efforts and initiatives, with one Battalion Chief / Fire Marshal, one Captain Deputy Fire Marshal, five Wildfire Mitigation Specialists, one Wildfire Mitigation Project Manager, and one Inspector.

A.1.8 Probability of Occurrence

Probability of occurrence refers to the probability of a future hazard occurrence during a specific period. Because the CFAI agency accreditation process requires annual review of an agency's risk assessment and baseline performance measures, Citygate utilizes the most recent 36 to 60 months of hazard occurrence as an appropriate measure of probability of occurrence evaluation. The following table describes the five probability of occurrence categories and related characteristics used for this analysis.

Table A33—Probability of Occurrence

Probability	General Characteristics	Expected Frequency of Occurrence
Rare	• Hazard ***may occur*** under exceptional circumstances.	25+ years
Unlikely	• Hazard ***could occur*** at some time. • No recorded or anecdotal evidence of occurrence. • Little opportunity, reason, or means for hazard to occur.	5–24 years
Possible	• Hazard ***should occur*** at some time. • Infrequent, random recorded, or anecdotal evidence of occurrence. • Some opportunity, reason, or means for hazard to occur.	1–4 years
Probable	• Hazard will ***probably occur*** occasionally. • Regular recorded or strong anecdotal evidence of occurrence. • Considerable opportunity, reason, or means for hazard to occur.	1–12 months
Frequent	• Hazard is ***expected to occur*** regularly. • High level of recorded or anecdotal evidence of regular occurrence. • Strong opportunity, reason, or means for hazard to occur. • Frequent hazard recurrence.	1–4 weeks

Citygate's SOC assessments use recent multiple-year hazard response data to determine the probability of hazard occurrence for the ensuing 12-month period.

A.1.9 Impact Severity

Impact severity refers to the extent a hazard occurrence impacts people, buildings, lifeline services, the environment, and the community as a whole. The following table describes the five impact severity categories and related general criteria used for this analysis.

Table A34—Impact Severity

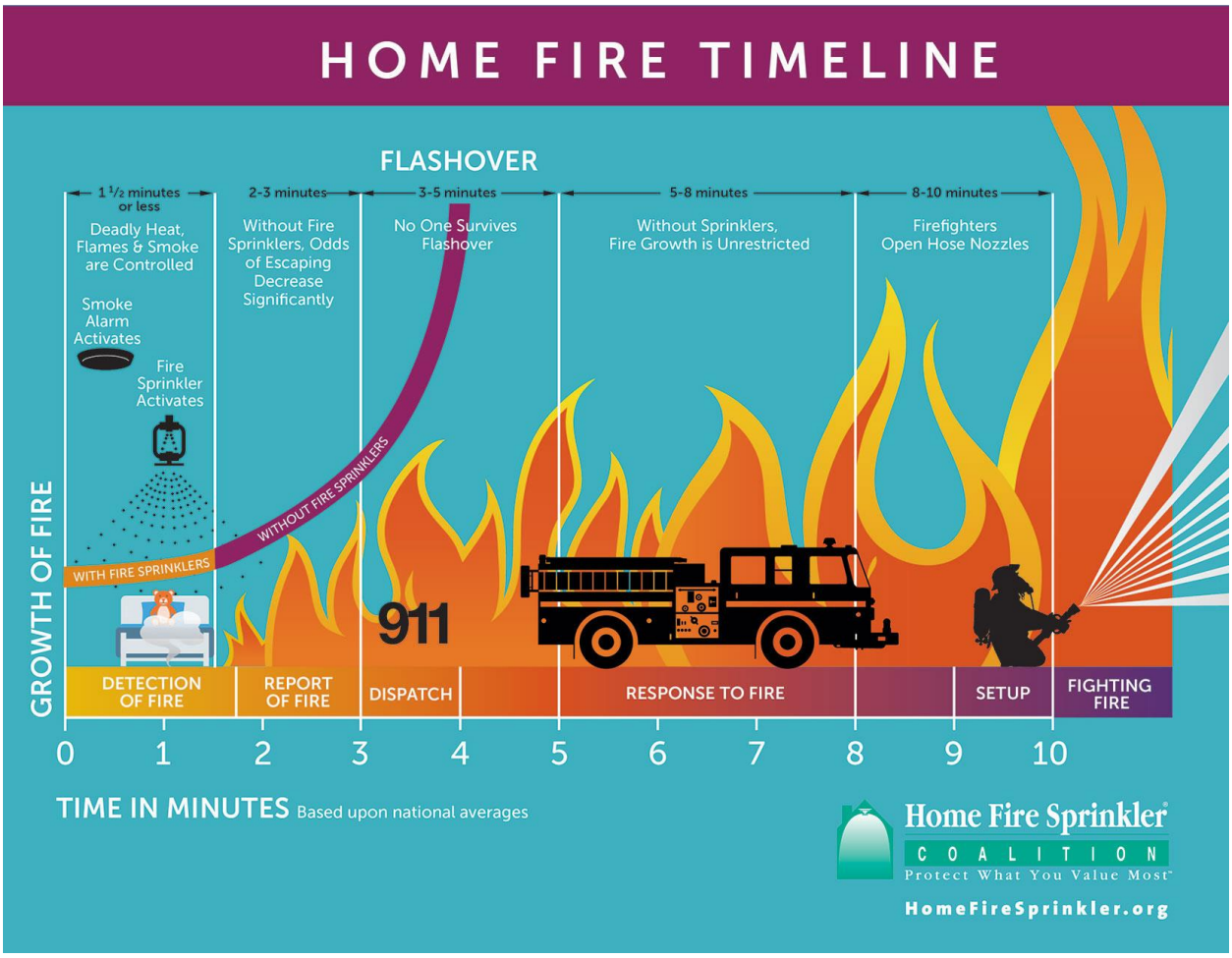
Impact Category	Characteristics
Insignificant	• No injuries or fatalities • Few to no persons displaced for short duration • Little or no personal support required • Inconsequential to no damage • Minimal to no community disruption • No measurable environmental impacts • Minimal to no financial loss • No wildland Fire Hazard Severity Zones (FHSZs)
Minor	• Few injuries; no fatalities; minor medical treatment only • Some displacement of persons for less than 24 hours • Some personal support required • Some minor damage • Minor community disruption of short duration • Small environmental impacts with no lasting effects • Minor financial loss • No wildland FHSZs
Moderate	• Medical treatment required; some hospitalizations; few fatalities • Localized displaced of persons for less than 24 hours • Personal support satisfied with local resources • Localized damage • Normal community functioning with some inconvenience • No measurable environmental impacts with no long-term effects, or small impacts with long-term effect • Moderate financial loss • Less than 25% of area in *Moderate* or *High* wildland FHSZs
Major	• Extensive injuries; significant hospitalizations; many fatalities • Large number of persons displaced for more than 24 hours • External resources required for personal support • Significant damage • Significant community disruption; some services not available • Some impact to environment with long-term effects • Major financial loss with some financial assistance required • More than 25% of area in *Moderate* or *High* wildland FHSZs; less than 25% in *Very High* wildland FHSZs
Catastrophic	• Large number of severe injuries requiring hospitalization; significant fatalities • General displacement for extended duration • Extensive personal support required • Extensive damage • Community unable to function without significant external support • Significant impact to environment and/or permanent damage • Catastrophic financial loss; unable to function without significant support • More than 50% of area in *High* wildland FHSZs; more than 25% of area in *Very High* wildland FHSZs

A.1.10 Building Fire Risk

One of the primary hazards in any community is building fire. Building fire risk factors include building size, age, construction type, density, occupancy, number of stories above ground level, required fire flow, proximity to other buildings, built-in fire protection/alarm systems, available fire suppression water supply, building fire service capacity, fire suppression resource deployment (distribution/concentration), staffing, and response time. Citygate used available data from the District and the US Census Bureau in determining building fire risk.

The following figure illustrates the building fire progression timeline and shows that flashover, which is the point at which the entire room erupts into fire after all the combustible objects in that room reach their ignition temperature, can occur as early as 3:00 to 5:00 minutes from the initial ignition. Human survival in a room after flashover is extremely improbable.

Figure A13—Building Fire Progression Timeline



Source: www.firesprinklerassoc.org.

Population Density

Population density within the service area ranges from less than 1,500 to more than 5,000 people per square mile, as shown in Map 2 (**Volume 2—Map Atlas)**. Although risk analysis across a wide spectrum of other Citygate clients shows no direct correlation between population density and building fire *occurrence*, it is reasonable to conclude that building fire *risk* relative to potential impact on human life is greater as population density increases, particularly in areas with high density, multiple-story buildings.

Water Supply

A reliable public water system providing adequate volume, pressure, and flow duration in close proximity to all buildings is a critical factor in mitigating the potential impact severity of a community's building fire risk. Potable water within the District's service area is provided by the North Marin Water District. The Water District's distribution system consists of 31 storage tanks in four pressure zones with more that 37 million gallons of storage capacity, 26 pump stations, 321 miles of 16-inch to 30-inch transmission and 6-inch to 12-inch distribution pipeline, and 2,659 fire hydrants. Each pressure zone has storage capacity for 25 percent of maximum daily demand for one day, two to three hours of 1,500 to 3,500 gallons per minute (gpm) fire flow depending on residential versus non-residential occupancies, and 100 percent of maximum daily demand for one day as emergency reserve.[19] District fire protection standards policy requires a minimum 1,500 gpm available fire flow for one- and two-family residential dwellings.[20] According to Water District staff, available fire flow is at least 1,500 gpm in the commercial areas of the District, 1,000 gpm in urban/suburban residential areas, and 500 gpm in rural areas.[21] In addition, the District's fire hydrant spacing standard is 300 feet.

Building Fire Risk Mitigation

For more than 25 years, the District has required automatic fire sprinkler systems in all new residential and commercial buildings. Since 1998, the District has also required fire sprinklers in substantially remodeled homes and businesses, resulting in thousands of homes and hundreds of commercial businesses now having this additional fire protection. This is significant given that fire is generally extinguished more quickly with a fire sprinkler system than the time it would take a fire department to reach the home or commercial building, as noted in Figure A13.

A well-designed fire sprinkler system can provide prompt control of fire spread to minimize fire and water damage to property and lives. Sprinkler-controlled fires also tend to be less damaging

[19] Source: North Marin Water District 2018 Novato Water System Master Plan Update Final Report (September 2019).
[20] Source: Novato Fire District Ordinance 2016-1.
[21] Source: Chief Engineer Tony Williams.

than fires in non-sprinklered buildings. As an additional incentive, many insurance companies offer discounts to homeowners with approved residential fire sprinkler systems.

Building Fire Service Demand

Over the four-year study period from January 1, 2018, through December 31, 2021, the District experienced 123 building fire incidents, comprising 0.49 percent of total service demand over the same period, as summarized in the following table.

Table A35—Building Fire Service Demand

Hazard	Year	Planning Zone					Total	Percent of Total Annual Demand
		Station 61	Station 62	Station 63	Station 64	Station 65		
Building Fire	**2018**	10	2	3	10	5	**30**	0.50%
	2019	10	1	10	5	2	**28**	0.43%
	2020	10	3	13	6	3	**35**	0.58%
	2021	10	2	10	7	1	**30**	0.46%
	Total	**40**	**8**	**36**	**28**	**11**	**123**	**0.49%**
Percent of Total Station Demand		0.40%	0.35%	0.83%	0.59%	0.35%		

As the previous table illustrates, building fire service demand was consistent across the four years of the study, with the highest demand occurring at Station 61 and the lowest at Station 62. Overall, building fire service demand is low, comprising less than 1 percent of all calls for service, which is similar to other California jurisdictions of similar size and demographics.

Building Fire Risk Assessment

The following table summarizes Citygate's assessment of building fire risk by planning zone.

Table A36—Building Fire Risk Assessment

Building Fire Risk	Planning Zone				
	Station 61	Station 62	Station 63	Station 64	Station 65
Probability of Occurrence	*Probable*	*Probable*	*Probable*	*Probable*	*Probable*
Probable Impact Severity	*Moderate*	*Moderate*	*Moderate*	*Moderate*	*Moderate*
Overall Risk	***Moderate***	***Moderate***	***Moderate***	***Moderate***	***Moderate***

A.1.11 Vegetation/Wildland Fire Risk

Most areas of the District are susceptible to a vegetation/wildland fire. Vegetation/wildland fire risk factors include vegetative fuel types and configuration, weather, topography, prior service demand, water supply, mitigation measures, and vegetation fire service capacity.

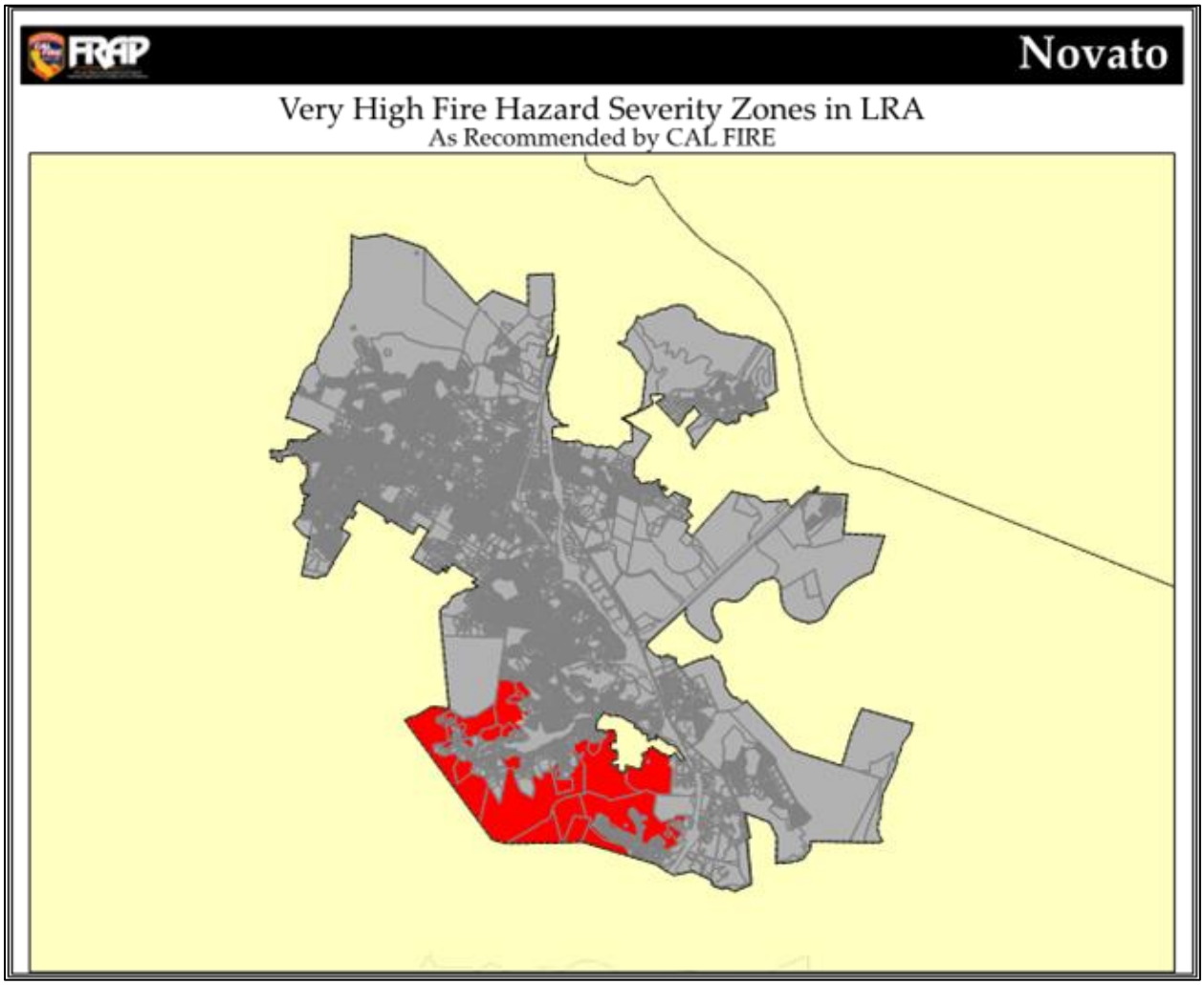
Wildland Fire Hazard Severity Zones

CAL FIRE designates wildland Fire Hazard Severity Zones (FHSZs) throughout the state based on analysis of multiple wildland fire hazard factors and modeling of potential wildland fire behavior. For State Responsibility Areas (SRAs) where CAL FIRE has fiscal responsibility for wildland fire protection, CAL FIRE designates ***Moderate***, ***High***, and ***Very High*** FHSZs by county, as shown in yellow, orange, and red respectively in the following map for Marin County. Both ***Moderate*** and ***High*** wildland FHSZs surround most of the District.

Figure A14—Marin County Wildland Fire Hazard Severity Zones – State Responsibility Areas

CAL FIRE also identifies recommended ***Very High*** FHSZs for Local Responsibility Areas, where a local jurisdiction is responsible for wildland fire protection, including incorporated cities, as shown in red in the following map for the City of Novato.

Figure A15—Wildland Fire Hazard Severity Zones – City of Novato



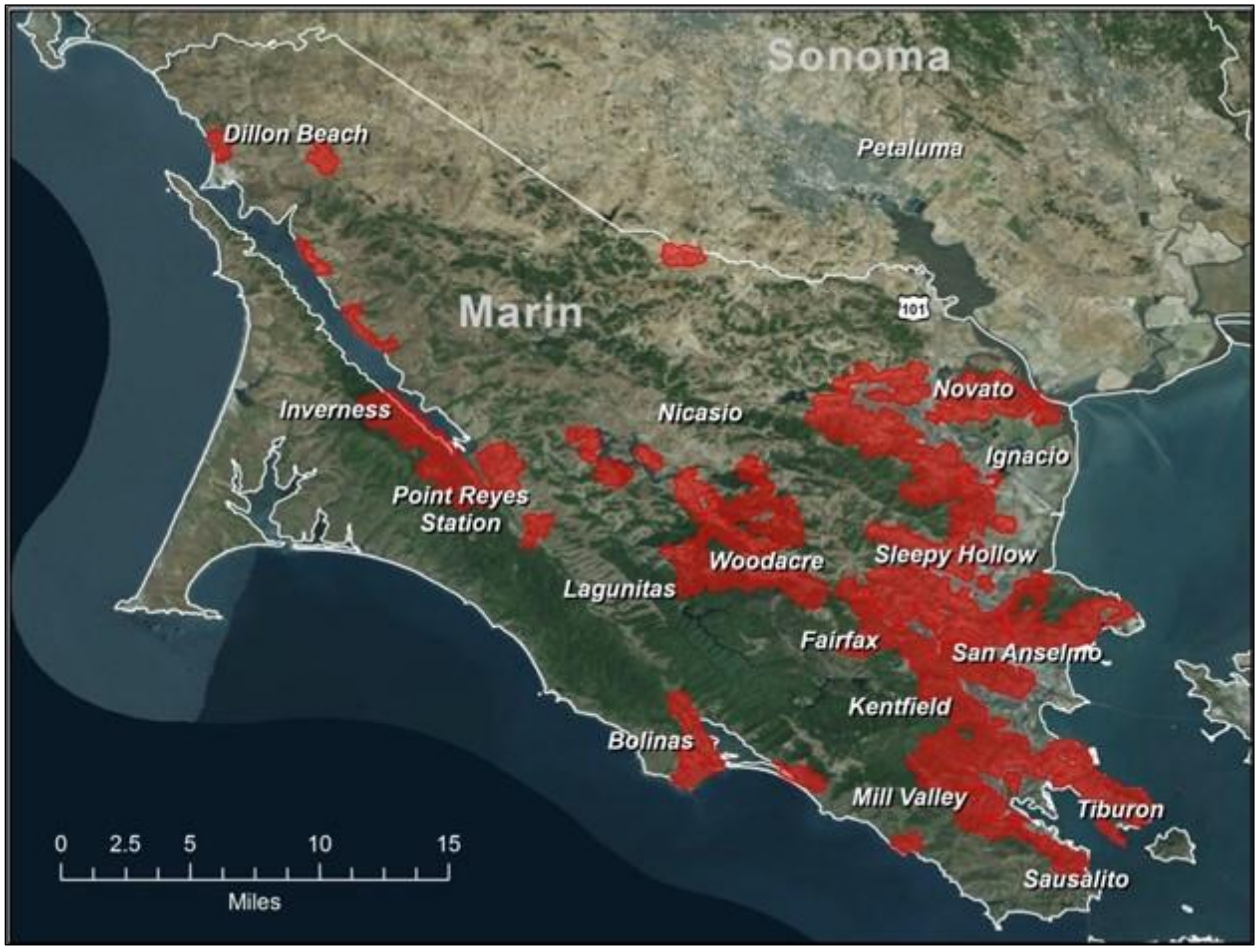
Wildland–Urban Interface Areas[22]

Wildland–Urban Interface (WUI) are areas where urban development meets undeveloped lands at risk of wildfires. These areas typically pose a significant threat due to the mix and density of structures and natural vegetative fuels combined with limited access/egress routes. In Marin

[22] Source: Marin Community Wildfire Protection Plan (December 2020).

County, approximately 18 percent of the total land area is within the WUI, as shown in the following map. Of note is the extensive WUI within the District.

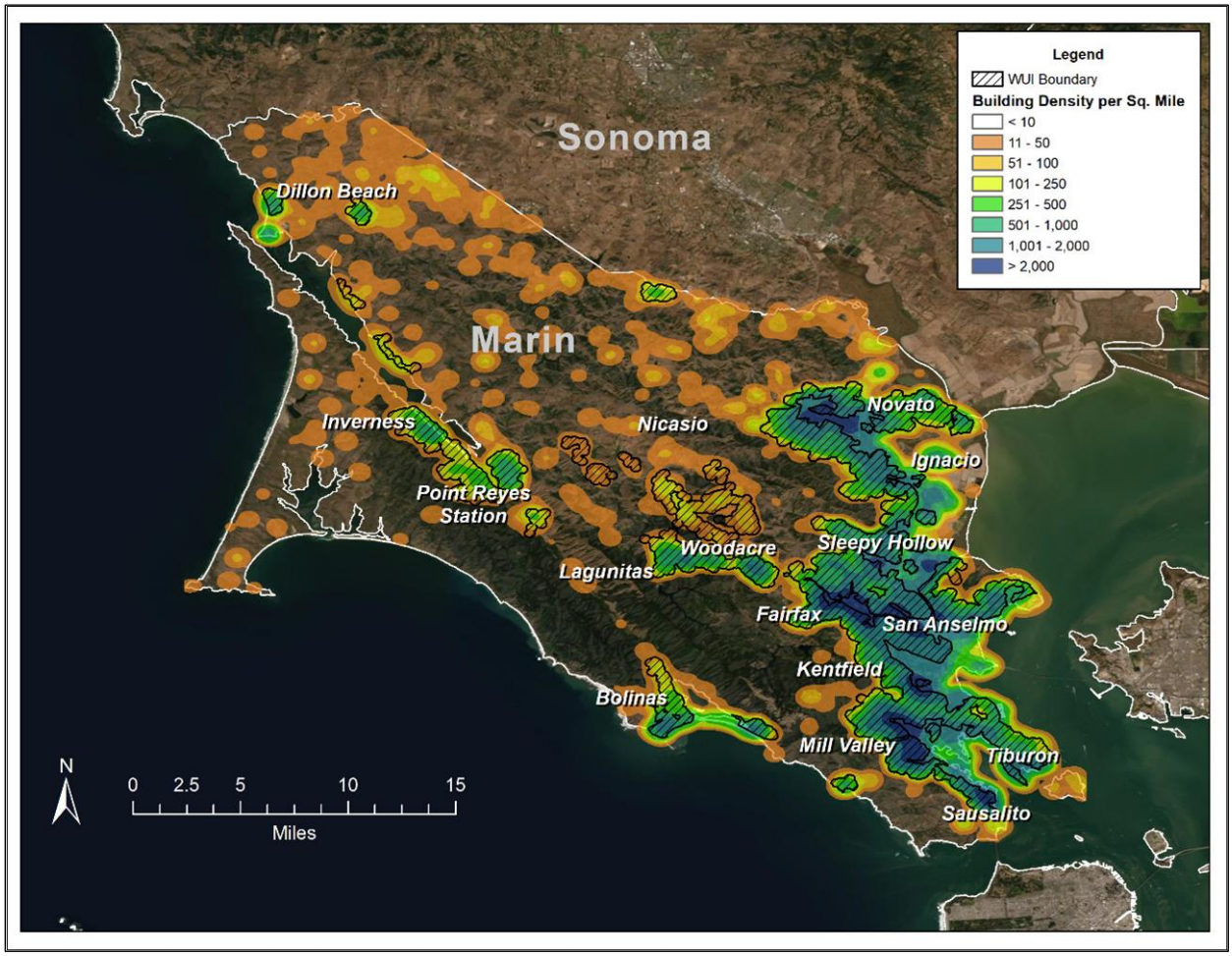
Figure A16—Wildland–Urban Interface Areas in Marin County



Source: Marin Community Wildfire Protection Plan (December 2020), Section 4.

As the following figure illustrates, the District's WUI areas include higher building densities.

Figure A17—Structure Density in WUI Areas

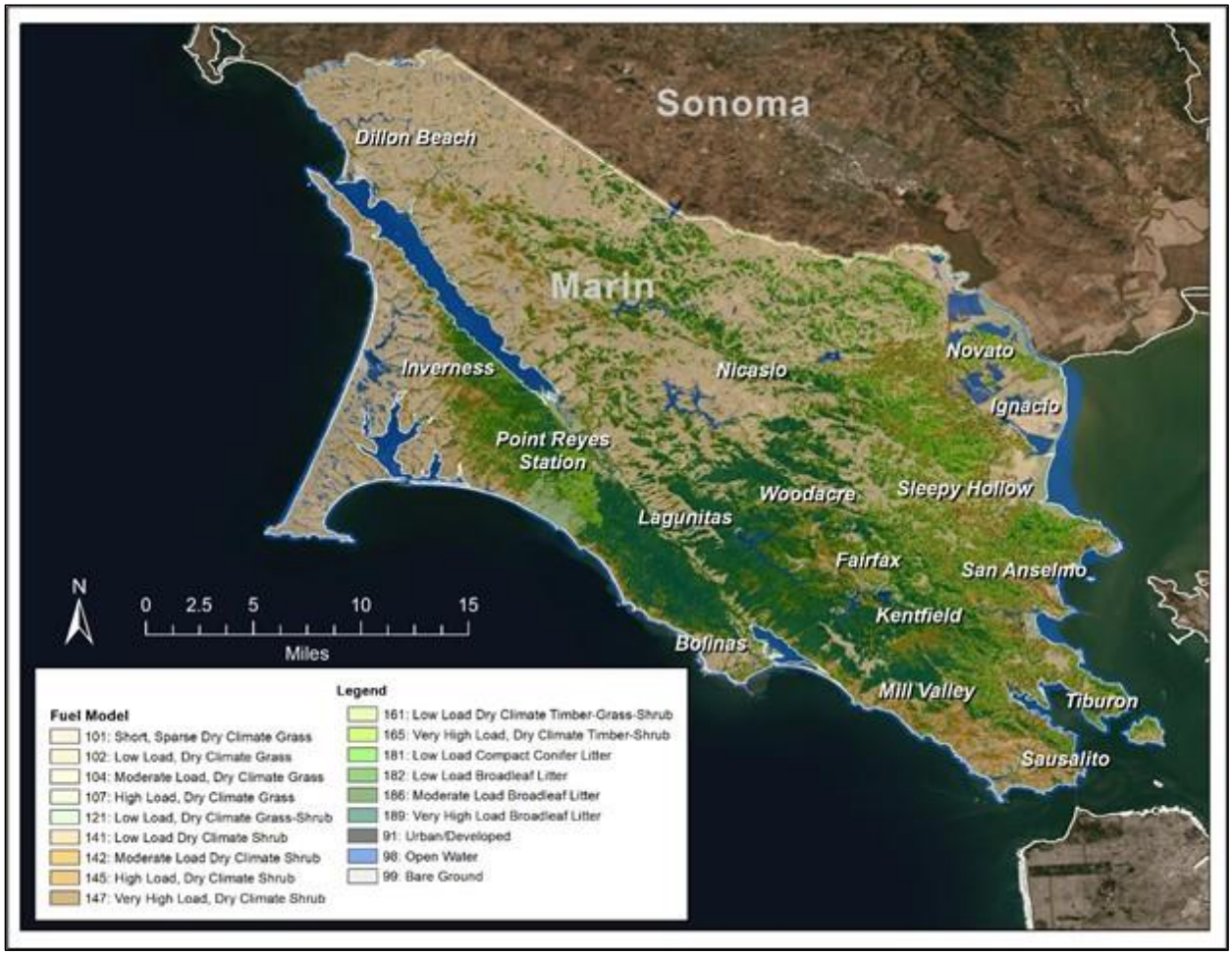


Source: Marin Community Wildfire Protection Plan (December 2020), Section 4.1.

Vegetative Fuels

Vegetative fuel factors influencing fire intensity and spread include fuel type (vegetation species), height, arrangement, density, and moisture. In addition to decorative landscape species, vegetative fuels within the District's service area vary from dense stands of mostly hardwood tress, including coastal live oak, California bay, Pacific madrone, and other oak species, to chapparal vegetation and native and non-native annual and perennial grass and plant species, as shown in the following figure. Once ignited, vegetation fires can burn intensely and contribute to rapid fire spread under the right fuel, weather, and topographic conditions.

Figure A18—Wildland Fuel Models



Source: Marin Community Wildfire Protection Plan (December 2020), Section 5.2.1.

Weather

Weather elements, including temperature, relative humidity, wind, and lightning, also affect vegetation/wildland fire potential and behavior. High temperatures and low relative humidity dry out vegetative fuels, creating a situation where fuels will more readily ignite and burn more intensely. Wind is the most significant weather factor influencing vegetation/wildland fire behavior, with higher wind speeds increasing fire spread and intensity. Wildland fire season, when vegetation fires are most likely to occur due to fuel and weather conditions, occurs from approximately June through October in Marin County. Summer weather within the service area typically includes cool mornings, warm afternoons and evenings, and west/northwest breezes that can reach 15 to 25 miles per hour. Occasional summer gradients can produce temperatures in the high 90s to low 100s, low relative humidity, and offshore winds as high as 40 miles per hour. These less frequent and transient weather patterns, as well as complex topography and annual variability of weather patterns, elevate the potential for a large, damaging wildfire.

Topography

Vegetation/wildland fires tend to burn more intensely and spread faster when burning uphill and up-canyon, except for a wind-driven downhill or down-canyon fire. Terrain within the District's service area varies from flat to steep slopes, which can contribute significantly to wildfire behavior and spread.

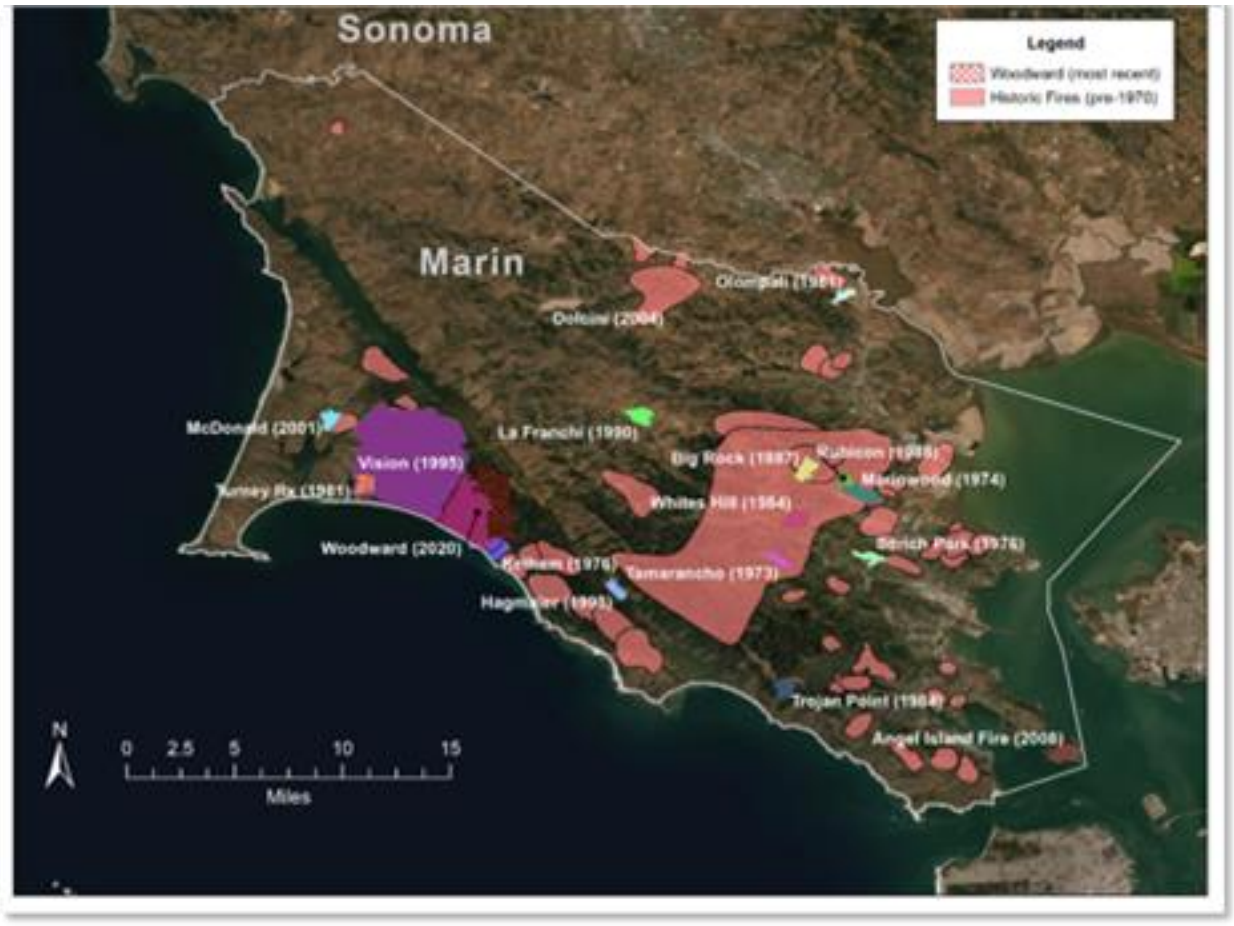
Water Supply

Another significant vegetation fire impact severity factor is water supply immediately available for fire suppression. According to North Marin Water District staff, available fire flow is at least 500 gpm in the rural areas of the District, and the District also has a water tender available to provide an augmented water supply as needed.

Wildland Fire History

Since the early 1900s, there have been several large wildland fires in Marin County, including the 1923 fire that burned from Ignacio to Woodacre, the 1972 Kent Woodlands Fire, the 1976 Sorich Park Wildfire, and the 1995 Vision Fire (12,354 acres). The following figure shows the location and relative size of wildland fires larger than 200 acres from 1828 to 2019.

Figure A19—Large Marin County Wildland Fires



Source: Marin Community Wildfire Protection Plan (December 2020), Section 5.4.

Vegetation/Wildland Fire Service Capacity

In addition to the fire hazard service capacity described in **Section A.1.7**, the areas of the District outside the City of Novato are within the SRA where CAL FIRE has fiscal responsibility for wildland fire protection. As such, all of CAL FIRE's wildland suppression resources, including engines, fire crews, bulldozers, and aircraft, are available for wildland fires within those areas of the District.

In addition, as a CAL FIRE contract county, the Marin County Fire Department provides initial SRA wildland fire response within the County with six Type-3 wildland engines, one bulldozer, and one 12-person fire crew from approximately June 1 through October 31.

Vegetation/Wildland Fire Hazard Mitigation

Hazard mitigation refers to specific actions or measures taken to prevent a hazard from occurring or to minimize the severity of resultant impacts. While none of the hazards subject to this study

can be entirely prevented, measures *can* be taken to minimize the impacts when those hazards do occur.

The 2020 Marin Community Wildfire Protection Plan (CWPP) identifies the following wildfire hazard mitigation strategies to minimize the risk of a catastrophic wildfire within the WUI:

- Public education and community outreach
- Wildfire preparedness and planning
- Reducing structural ignitability
- Defensible space
- Non-residential vegetation management
- Evacuation planning and preparation

The CWPP further identifies 20 priority mitigation projects for the District to focus on:

- Creating and maintaining shaded fuel breaks
- Conducting wildfire mitigation home assessments
- Improving evacuation routes
- Creating/improving defensible space
- Reducing wildland fuel loading
- Reducing structural ignitability
- Increasing public education/information

With the passing of Measure C in 2020, the Marin Wildfire Prevention Authority (MWPA) was formed and funded at $20 million per year for 10 years to develop and implement a comprehensive Countywide wildfire prevention and emergency preparedness plan, to include:

- Vegetation management
- Wildfire detection and evacuation program improvements
- Grants
- Public education
- Defensible space evaluations
- Local wildfire prevention mitigation

The MWPA is a Countywide Joint Powers Authority with 17 member agencies, including cities, towns, the County, and special districts. The MWPA's mission is to lead "the development of fire adapted communities using sound scientific, financial, programmatic, ecological practices, vegetation management, community education, evacuation and warning systems with the support of its member and partner agencies."[23]

In addition to being an MWPA member agency, the District requires fire resistive construction materials and methods in high fire hazard severity zones and WUI areas, has an annual weed abatement program, inspects and enforces defensible space requirements, and investigates all fire hazard complaints, taking appropriate actions as authorized by the City of Novato and District ordinances and regulations to eliminate or mitigate identified fire hazards.

Vegetation/Wildland Fire Service Demand

Over the four-year study period, the District responded to 101 vegetation/wildland fires, comprising 0.40 percent of total service demand over the same period, as summarized in the following table.

Table A37—Vegetation/Wildland Fire Service Demand

Hazard	Year	Planning Zone					Total	Percent of Total Annual Demand
		Station 61	Station 62	Station 63	Station 64	Station 65		
Vegetation/Wildland Fire	2018	12	5	5	6	2	**30**	0.50%
	2019	4	4	4	7	3	**22**	0.34%
	2020	8	6	4	8	6	**32**	0.53%
	2021	7	4	1	2	3	**17**	0.26%
	Total	**31**	**19**	**14**	**23**	**14**	**101**	**0.40%**
Percent of Total Station Demand		0.31%	0.83%	0.32%	0.48%	0.44%		

As the table shows, vegetation/wildland fire service demand was fairly consistent over the four-year study period, with the highest demand at Station 61 and the lowest at Station 65 and Station 63. Overall, vegetation/wildland fire service demand is low.

[23] Source: www.marinwildfire.org/about-us.

Vegetation/Wildland Fire Risk Assessment

The following table summarizes Citygate's assessment of vegetation/wildland fire risk by planning zone utilizing prior wildland fire service demand and County-level and parcel-level data from the Marin CWPP.

Table A38—Vegetation/Wildland Fire Risk Assessment

Vegetation/Wildland Fire Risk	Planning Zone				
	Station 61	Station 62	Station 63	Station 64	Station 65
Probability of Occurrence	*Probable*	*Probable*	*Probable*	*Probable*	*Probable*
Probable Impact Severity	*Moderate*	*Major*	*Major*	*Major*	*Major*
Overall Risk	***Moderate***	***High***	***High***	***High***	***High***

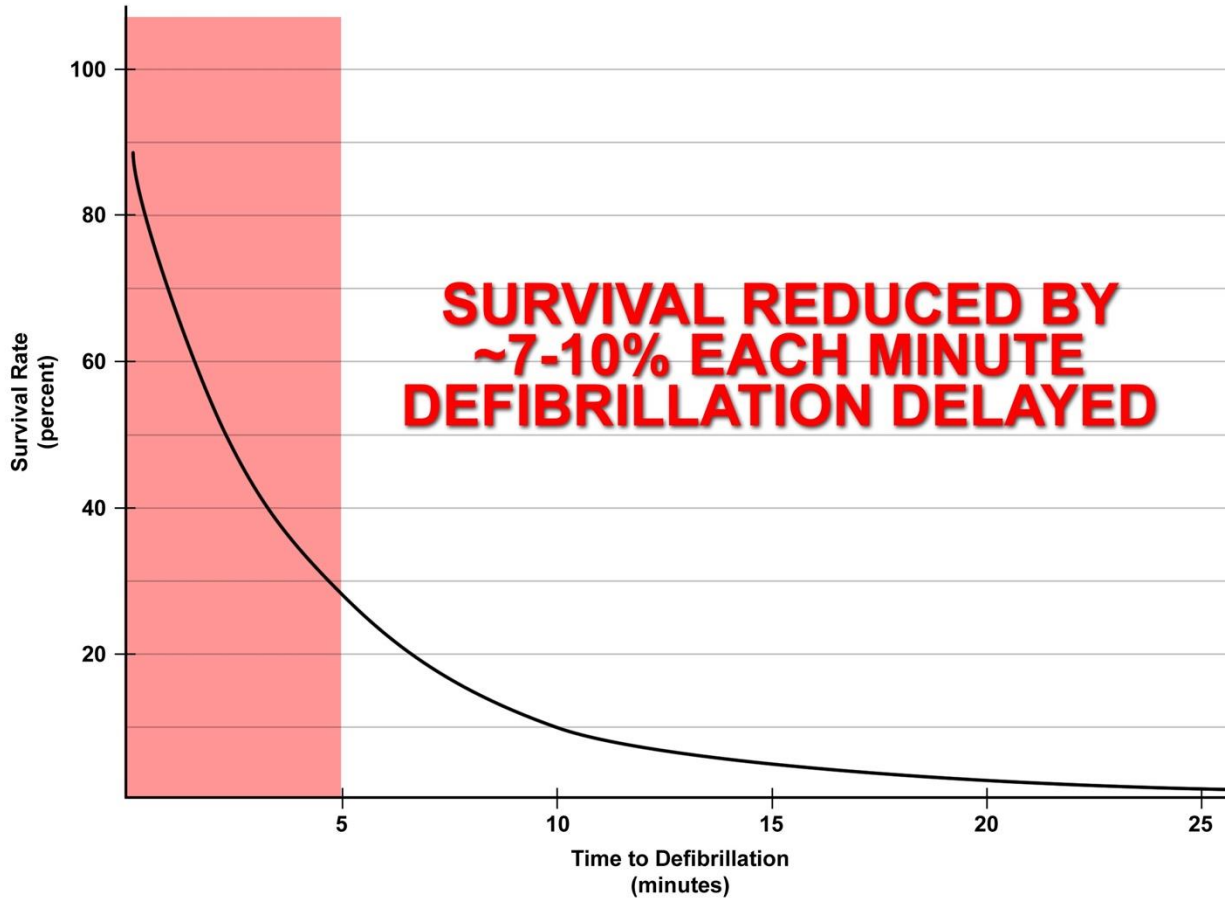
A.1.12 Medical Emergency Risk

Medical emergency risk in most communities is predominantly a function of population density, demographics, violence, health insurance coverage, and vehicle traffic.

Medical emergency risk can also be categorized as either a medical emergency resulting from a traumatic injury or a health-related condition or event. Cardiac arrest is one serious medical emergency among many where there is an interruption or blockage of oxygen to the brain.

The following figure illustrates the reduced survivability of a cardiac arrest victim as time to defibrillation increases. While early defibrillation is one factor in cardiac arrest survivability, other factors can influence survivability as well, such as early CPR and pre-hospital advanced life support interventions.

Figure A20—Survival Rate versus Time to Defibrillation



Source: www.suddencardiacarrest.org.

Population Density

Population density within the District's service area ranges from less than 1,500 to more than 5,000 people per square mile, as shown in Map 2 (**Volume 2—Map Atlas**). Risk analysis across a wide spectrum of other Citygate clients shows a direct correlation between population density and the *occurrence* of medical emergencies, particularly in high urban population density zones.

Demographics

Medical emergency risk tends to be higher among older, poorer, less educated, and uninsured populations. As shown in Table A30, nearly 22 percent of the District's population is 65 and older, nearly 6 percent of the population over 24 years of age has less than a high school education or

equivalent, nearly 7 percent of the population is at or below poverty level, and 3.5 percent of the population does not have health insurance coverage.[24]

Vehicle Traffic

Medical emergency risk tends to be higher in those areas of a community with high daily vehicle traffic volume, particularly those areas with high traffic volume traveling at high speeds. The District's transportation network includes US 101 and Highway 37, which carry an aggregate annual average daily traffic volume of nearly 200,000 vehicles, with a peak-hour load of more than 17,000 vehicles.[25] In addition, the Sonoma–Marin Area Rail Transit operates approximately 40 passenger trains through the District's service area daily.[26]

Medical Emergency Service Demand

Medical emergency service demand over the four-year study period includes nearly 17,000 calls for service, comprising slightly more than 67 percent of total service demand over the same period, as summarized in the following table.

Table A39—Medical Emergency Service Demand

Hazard	Year	Planning Zone					Total	Percent of Total Annual Demand
		Station 61	Station 62	Station 63	Station 64	Station 65		
Medical Emergency	**2018**	1,762	290	715	769	468	**4,004**	66.66%
	2019	1,969	327	693	810	522	**4,321**	66.66%
	2020	1,765	333	727	795	474	**4,094**	67.86%
	2021	1,923	381	812	782	514	**4,412**	68.38%
	Total	**7,419**	**1,331**	**2,947**	**3,156**	**1,978**	**16,831**	**67.39%**
Percent of Total Station Demand		73.40%	58.38%	68.20%	66.36%	62.63%		

As the table shows, medical emergency service demand varies significantly by planning zone and increased 7.8 percent in 2021. Overall, the District's medical emergency service demand is typical of other jurisdictions with similar demographics.

[24] Source: Esri Community Analyst and US Census Bureau.
[25] Source: California Department of Transportation (2019).
[26] Source: US Department of Transportation Federal Railroad Administration crossing data.

Medical Emergency Risk Assessment

The following table summarizes Citygate's assessment of medical emergency risk by planning zone.

Table A40—Medical Emergency Risk Assessment

Medical Emergency Risk	Planning Zone				
	Station 61	Station 62	Station 63	Station 64	Station 65
Probability of Occurrence	*Frequent*	*Frequent*	*Frequent*	*Frequent*	*Frequent*
Probable Impact Severity	*Moderate*	*Moderate*	*Moderate*	*Moderate*	*Moderate*
Overall Risk	***High***	***High***	***High***	***High***	***High***

A.1.13 Hazardous Material Risk

Hazardous material risk factors include fixed facilities that store, use, or produce hazardous chemicals or waste; underground pipelines conveying hazardous materials; aviation, railroad, maritime, and vehicle transportation of hazardous commodities into or through a jurisdiction; vulnerable populations; emergency evacuation planning and related training; and specialized hazardous material service capacity.

Fixed Hazardous Materials Facilities

The Marin County Department of Public Works, serving as the designated Certified Unified Program Agency for the County, identified 18 facilities within the District's service area requiring a state or County hazardous material operating permit or Hazardous Materials Business Plan. High-pressure natural gas transmission pipelines are also located on the west side of US 101.

Transportation-Related Hazardous Materials

The District also has transportation-related hazardous material risk as a result of its road transportation network, including US 101 and Highway 37, with heavy daily truck traffic volume, many carrying hazardous commodities, as summarized in the following table.

In addition, there are approximately six Northwest Pacific Railroad freight train movements into or through the District's service area daily, with some freight cars transporting hazardous materials.[27]

[27] Source: US Department of Transportation Federal Railroad Administration crossing data.

Table A41—Average Annual Daily Truck Traffic

Highway	Crossing	AADT[1]	Truck AADT by Axles				% Truck AADT by Axles			
			2	3	4	5+	2	3	4	5+
US-101	Jct. SR-37	6,896	3,866	917	230	1,883	56.06%	13.30%	3.34%	27.31%
SR-37	Jct. US-101	1,174	423	115	44	592	36.03%	9.80%	3.75%	50.43%
Total		**8,070**	**4,289**	**1,032**	**274**	**2,475**	**53.15%**	**12.79%**	**3.40%**	**30.67%**

[1] Average Annual Daily Trips.

Source: California Department of Transportation (2017).

Population Density

Because hazardous material emergencies have the potential to adversely impact human health, it is logical that the higher the population density, the greater the potential population exposed to a hazardous material release or spill. As shown in Map 2 (**Volume 2—Map Atlas**), population density within the District ranges from less than 1,500 people per square mile to more than 5,000 per square mile.

Vulnerable Populations

Persons vulnerable to a hazardous material release/spill include those individuals or groups unable to self-evacuate, generally including children under the age of 10, the elderly, and persons confined to an institution or other setting where they are unable to leave voluntarily. As shown in Table A30, more than 32 percent of the District's population is under age 10 or is 65 years of age and older.

Emergency Evacuation Planning, Training, Implementation, and Effectiveness

Another significant hazardous material impact severity factor is a jurisdiction's shelter-in-place / emergency evacuation planning and training. In the event of a hazardous material release or spill, time can be a critical factor in notifying potentially affected persons, particularly at-risk populations, to either shelter-in-place or evacuate to a safe location. Essential to this process is an effective emergency plan that incorporates one or more mass emergency notification capabilities, as well as pre-established evacuation procedures. It is also essential to conduct regular, periodic exercises involving these two emergency plan elements to evaluate readiness and to identify and remediate any planning or training gaps to ensure ongoing emergency incident readiness and effectiveness.

The Office of Emergency Services within the Marin County Sheriff's Office is responsible for disaster/emergency preparedness and management in the unincorporated areas of the County, including hazard information, coordination with other local/regional emergency management

organizations, emergency preparedness, and disaster response, communications, and recovery. The Office of Emergency Services also manages Alert Marin, a free, subscription-based, mass emergency notification system that can provide emergency alerts, notifications, and other emergency information to email accounts, cell phones, smartphones, tablets, and landline telephones. Alert Marin notifications can be initiated by designated fire or law enforcement agency personnel.

Hazardous Material Service Demand

The District experienced 170 hazardous material incidents over the four-year study period, comprising 0.68 percent of total service demand over the same period, as summarized in the following table.

Table A42—Hazardous Material Service Demand

Hazard	Year	Planning Zone					Total	Percent of Total Annual Demand
		Station 61	Station 62	Station 63	Station 64	Station 65		
Hazardous Material	**2018**	16	2	9	8	10	**45**	0.75%
	2019	13	4	6	6	6	**35**	0.54%
	2020	21	5	5	9	4	**44**	0.73%
	2021	21	10	3	2	10	**46**	0.71%
	Total	**71**	**21**	**23**	**25**	**30**	**170**	**0.68%**
Percent of Total Station Demand		0.70%	0.92%	0.53%	0.53%	0.95%		

As the table indicates, hazardous material service demand varies by planning zone and was overall relatively consistent over the four-year study period, with Station 61 having the highest demand and Station 62 the lowest. Overall, the District's hazardous material service demand is low.

Hazardous Material Risk Assessment

The following table summarizes Citygate's assessment of hazardous material risk by planning zone.

Table A43—Hazardous Material Risk Assessment

Hazardous Material Risk	Planning Zone				
	Station 61	Station 62	Station 63	Station 64	Station 65
Probability of Occurrence	*Frequent*	*Possible*	*Probable*	*Probable*	*Probable*
Probable Impact Severity	*Minor*	*Minor*	*Minor*	*Moderate*	*Minor*
Overall Risk	***Moderate***	***Low***	***Low***	***Moderate***	***Low***

A.1.14 Technical Rescue Risk

Technical rescue risk factors include active construction projects; structural collapse potential; confined spaces, such as tanks and underground vaults; bodies of water, including rivers and streams; industrial machinery use; transportation volume; and earthquake, flood, and landslide potential.

Construction Activity

There is ongoing residential, commercial, and infrastructure construction activity occurring within the District.

Confined Spaces

There are multiple tanks, vaults, and temporary open trenches within the District's service area.

Bodies of Water

Bodies of water within the service area include Basalt, Novato, and Rush Creeks; Hamilton Wetlands; Bel Marin Keys; Bahia Marsh; Petaluma River; San Pablo Bay; and numerous smaller tributaries and ponds.

Transportation Volume

Another technical rescue risk factor is transportation-related incidents requiring technical rescue. This risk factor is primarily a function of vehicle, railway, maritime, and aviation traffic. Vehicle traffic volume is the greatest of these factors within the District, with US 101 and Highway 37 carrying an aggregate annual average daily traffic volume of nearly 200,000 vehicles, with a peak-hour load of more than 17,000 vehicles.[28] There are also approximately 40 commuter train movements through the District daily.[29] Additionally, the Marin County Airport (Gnoss Field) just north of the City of Novato is home to approximately 300 general aviation aircraft.

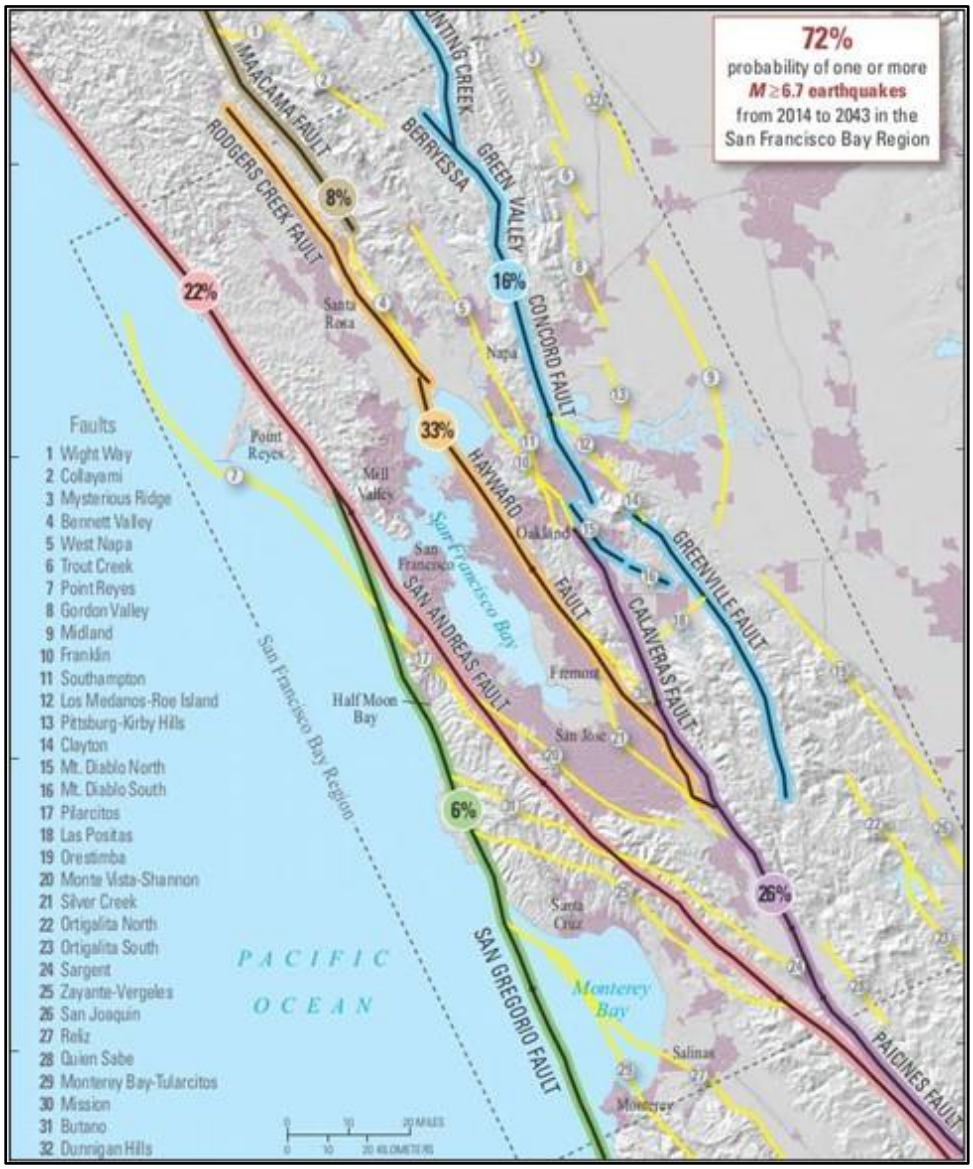
[28] Source: California Department of Transportation (2018).
[29] Source: US Department of Transportation – Federal Railroad Administration.

Earthquake Risk[30]

The potential for earthquake damage exists throughout Marin County due to the combination of the number of active faults within and near the County and the presence of soils vulnerable to liquefaction. Active faults include the Hayward, Rodgers Creek, and San Andreas, as shown in the following figure. According to the Working Group on California Earthquake Probabilities, there is a 72 percent probability of at least one earthquake of magnitude 6.7 or greater within the Bay Area before 2043. The Association of Bay Area Governments Resilience Program projects a 52 percent chance of a magnitude 6.7 or greater earthquake on one of the faults affecting Marin County by 2036.

[30] Source: 2018 Marin County Multi-Jurisdiction Local Hazard Mitigation Plan, Section 3.3.1.

Figure A21—Earthquake Faults

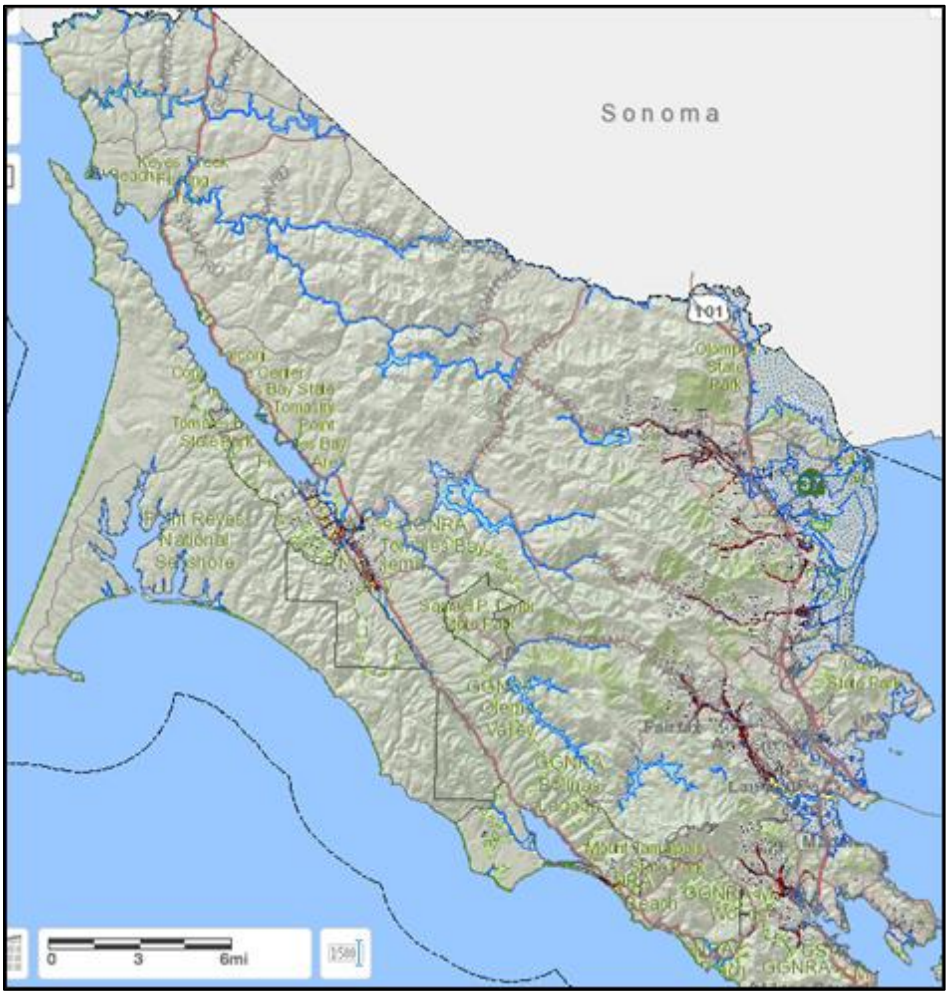


Flood Risk[31]

All incorporated cities and towns in Marin County have flood risk, and many contain Special Flood Hazard Areas with at least a 1 percent chance of a flood event in a given year. The following figure shows the flood hazard zones within the County as identified by the Federal Emergency Management Agency. There are a number of Special Flood Hazard Areas within the District's service area.

[31] Source: 2018 Marin County Multi-Jurisdiction Local Hazard Mitigation Plan, Section 3.3.5.

Figure A22—Flood Hazard Areas



Technical Rescue Service Demand

Over the four-year study period, there were 15 technical rescue incidents, comprising only 0.06 percent of total service demand for the same period, as summarized in the following table.

Table A44—Technical Rescue Service Demand

Hazard	Year	Planning Zone					Total	Percent of Total Annual Demand
		Station 61	Station 62	Station 63	Station 64	Station 65		
Technical Rescue	2018	2	0	0	2	2	**6**	0.10%
	2019	2	0	0	0	0	**2**	0.03%
	2020	0	1	0	0	1	**2**	0.03%
	2021	3	1	0	0	1	**5**	0.08%
	Total	**7**	**2**	**0**	**2**	**4**	**15**	**0.06%**
Percent of Total Station Demand		0.07%	0.09%	0.00%	0.04%	0.13%		

As the table shows, technical rescue service demand is very low, with Station 61 experiencing the highest demand.

Technical Rescue Risk Assessment

The following table summarizes Citygate's assessment of the technical rescue risk by planning zone.

Table A45—Technical Rescue Risk Assessment

Technical Rescue Risk	Planning Zone				
	Station 61	Station 62	Station 63	Station 64	Station 65
Probability of Occurrence	*Possible*	*Possible*	*Possible*	*Possible*	*Possible*
Probable Impact Severity	*Moderate*	*Moderate*	*Moderate*	*Moderate*	*Moderate*
Overall Risk	***Moderate***	***Moderate***	***Moderate***	***Moderate***	***Moderate***