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VALLEY OF THE MOON WATER DISTRICT

LOCAL HAZARD MITIGATION PLAN

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Contents

1 INTRODUCTION

The Valley of the Moon Water District (District) prepared this Local Hazard Mitigation Plan (LHMP) to guide planning efforts to better protect the customers and critical water supply facilities and infrastructure of the District from the effects of natural hazard events. It serves as a tool to help decision makers direct mitigation activities, to coordinate District resources, and maintain eligibility for State and Federal funding. This plan also demonstrates the District's commitment to reducing risks from hazards to the Sonoma Valley community.

1.1 Background and Scope

Each year in the United States, natural disasters take the lives of hundreds of people and injure thousands more. Nationwide, taxpayers pay billions of dollars annually to help communities, organizations, businesses, and individuals recover from disasters. These monies only partially reflect the true cost of disasters because additional expenses to insurance companies and non-governmental organizations are not reimbursed by tax dollars. Many natural disasters are predictable, and much of the damage caused by these events can be alleviated or even eliminated.

Hazard mitigation is defined by the Federal Emergency Management Agency (FEMA) as "any sustained action taken to reduce or eliminate long-term risk to human life and property from a hazard event." The results of a three-year, congressionally mandated independent study to assess future savings from mitigation activities provides evidence that mitigation activities are highly cost-effective. On average, each dollar spent on hazard mitigation can save a national average of $4 to $11, with some measures yielding up to $13 in avoided future losses (National Institute of Building Sciences 2025).

Hazard mitigation planning is the process through which hazards that threaten communities are identified, likely impacts of those hazards are determined, mitigation goals are set, and appropriate strategies to lessen impacts are determined, prioritized, and implemented. This plan documents the District's hazard mitigation planning process and identifies relevant hazards, vulnerabilities, and strategies that the District will use to decrease vulnerability and increase resiliency of water infrastructure in Sonoma Valley.

1.2 Regulatory Authority

1.2.1 Federal

This plan was prepared pursuant to the requirements of the Disaster Mitigation Act of 2000 (Public Law 106-390) and the implementing regulations set forth by the Interim Final Rule published in the Federal Register on February 26, 2002, (44 CFR §201.6) and finalized on October 31, 2007. (Hereafter, these requirements and regulations will be referred to collectively as the Disaster Mitigation Act or DMA of 2000.) The DMA of 2000, also commonly known as "The 2000 Stafford Act Amendments," constitutes an effort by the Federal government to reduce the rising cost of disasters. The Act stresses the importance of coordination and disaster preparedness prior to an event and emphasizes the need for mitigation planning.

Section 322 of the regulations established the requirements that LHMPs must meet in order for a local jurisdiction to be eligible for certain Federal disaster assistance and hazard mitigation funding under the Robert T. Stafford Disaster Relief and Emergency Act (Public Law 93-288). To facilitate implementation of the DMA of 2000 and the Stafford Act Amendments, FEMA created an Interim Final Rule (the Rule), published in the Federal Register in February of 2002 in Section 201 of 44 CFR (44 CFR §201.6). The Rule spells out the mitigation planning criteria for States and local communities.

In June 2025, FEMA released a revised version of the *Local Mitigation Planning Handbook* (Handbook) as the official guide for local governments to develop, update and implement local mitigation plans. The Handbook complements and references the April 2025, *FEMA Local Mitigation Plan Review Guide* (Guide) in order to help "Federal and State officials assess Local Mitigation Plans in a fair and consistent manner." Local jurisdictions, including special districts, must demonstrate that proposed mitigation actions are based upon a sound planning process that accounts for the inherent risk and capabilities of the individual communities as stated in Section 201.5 of the Rule. The Handbook and Guide were routinely reviewed during the development of the District's 2026 LHMP for the purpose of ensuring thoroughness, diligence, and compliance with the DMA of 2000 planning requirements. The District also reviewed the *2020 California Adaptation Planning Guide* (APG) among other state-focused planning guides (e.g., California Department of Water Resources Climate Action Plan) to inform the climate vulnerability assessment and development of climate-specific adaptation goals and strategies. Additionally, the District reviewed the California Office of Emergency Services LHMP guidance documents, such as the FEMA Region IX Plan Review Tool, which must be completed for Cal OES and FEMA plan approval.

This plan was also developed so the District can be eligible for certain federal disaster assistance, specifically, the FEMA Hazard Mitigation Assistance (HMA) grants including the Hazard Mitigation Grant Program (HMGP) and HMGP Post Fire funding associated with Fire Management Assistance Grant (FMAG) declarations and the Building Resilient Infrastructure and Communities (BRIC) program funding associated with the 2018 Disaster Recovery Reform Act (DRRA).

1.2.2 State and Local

During the development of the District's LHMP, District staff initiated a review of their *2025 Water Master Plan Update* and *2020 Urban Water Management Plan* to ensure consistency with hazards and mutually reinforcing policies related to their water supply system needs. Information in this plan will be used to guide and coordinate mitigation activities and decisions for water facility and infrastructure planning in the future. Proactive mitigation planning will help reduce the cost of disaster response and recovery to communities in Sonoma Valley and by protecting critical water supply and distribution facilities, reducing liability exposure, and minimizing overall impacts and disruptions to the District's water system assets and in turn their customers. The District's service area has been affected by hazards in the past and the District is committed to reducing future impacts from hazard events, building community resilience to future disasters, and becoming eligible for mitigation-related federal funding.

1.3 Plan Organization

The District's LHMP is organized as follows:

- Executive Summary
- Chapter 1: Introduction
- Chapter 2: District Profile
- Chapter 3: Planning Process
- Chapter 4: Risk Assessment
- Chapter 5: Mitigation Strategy
- Chapter 6: Plan Adoption, Implementation, and Maintenance
- Appendices

2 DISTRICT PROFILE

The Valley of the Moon Water District (District) provides drinking water to approximately 23,004 people via approximately 6,971 service connections (VOMWD 2025). The District's service area is located in Sonoma County, approximately 50 miles north of San Francisco, and to the northwest of the City of Sonoma. The service area encompasses approximately 11.8 square miles that span the majority of central Sonoma Valley and includes the small unincorporated spa and resort communities northwest of the City of Sonoma, including El Verano, Boyes Hot Springs, Agua Caliente, Glen Ellen, and Fetters Hot Springs, as well as the residential and commercial customers from the Trinity Oaks subdivision to the north to the Temelec subdivision to the south. Elevations in the service area range from approximately 60 feet above mean sea level (msl) to approximately 1,190 feet msl.

The Sonoma Local Agency Formation Commission (LAFCo) determines the District's Sphere of Influence (SOI) boundary, which indicates the likely eventual limits of the District's service area. The Sonoma LAFCo amended the District's SOI in 2017 to include two areas beyond the District's current service area: the territory previously served by the Sobre Vista Mutual Water Company and the territory occupied by the Sonoma Development Center (SDC). The territory occupied by the SDC included a municipal water supply, treatment, and distribution system on the campus. A 2024 Municipal Service Review and SOI Study by the Sonoma LAFCo further recommends amending the SOI to include properties in the Trinity Oaks area and a parcel on Flicker Hill Road which have experienced groundwater issues and require access to the District's water services.

The Hazard Mitigation Planning Committee (HMPC) selected the District's service area as the Planning Area for this plan. The District also depicts the SOI in the Local Hazard Mitigation Plan (LHMP) because it represents the eventual limits of the District's boundaries. The Planning Area is shown in Figure 2-1.

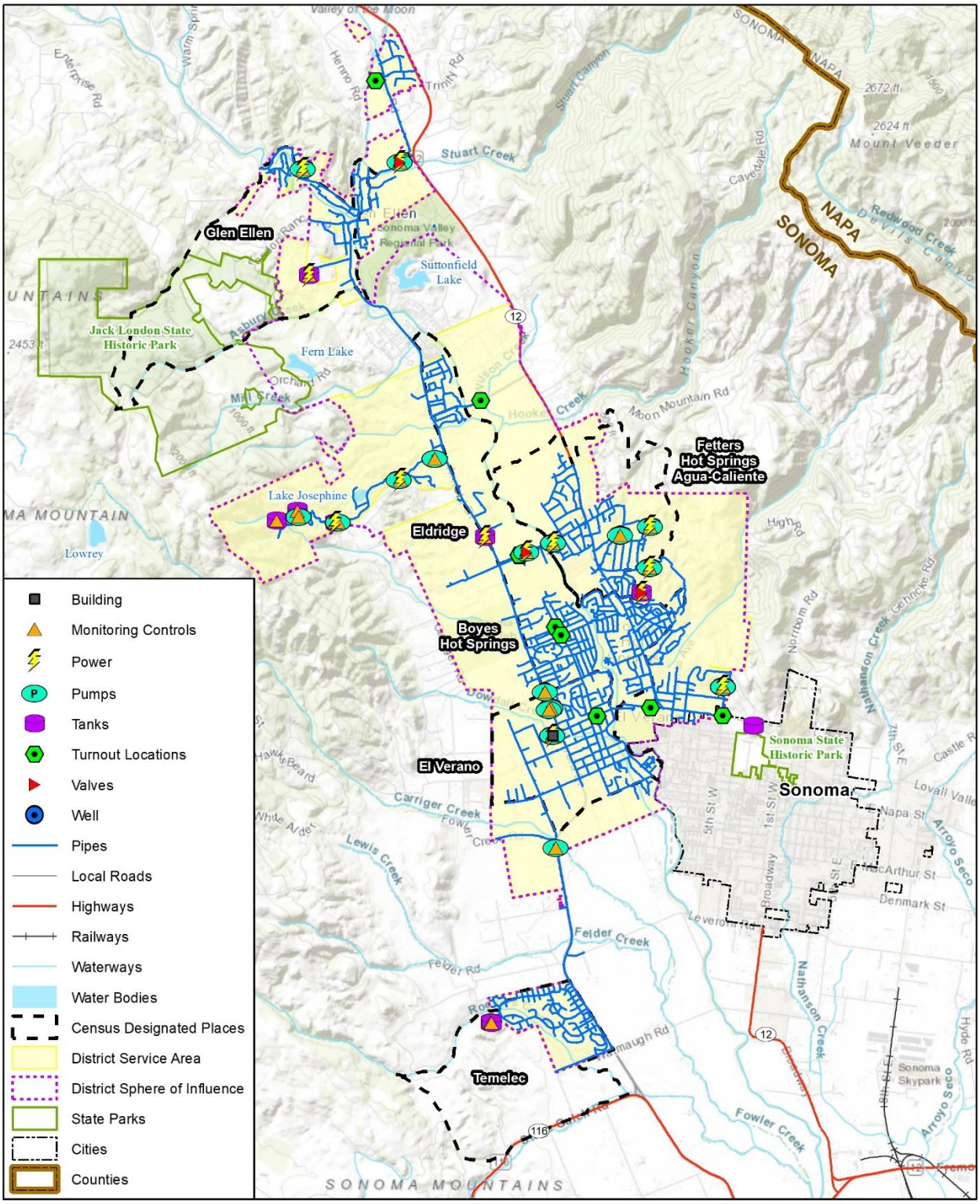
2.1 Location and Geography

The District's service area is defined mostly by the surrounding natural landscape and topography. Sonoma Valley lies between two mountain ranges along the eastern portion of Sonoma County. The District's service area includes the central portion of Sonoma Valley between the Mayacamas Mountains and Sonoma Mountains. The entire valley stretches from Bennet Valley and Kenwood in the north to San Pablo Bay in the south. Sonoma Creek flows through the valley from the headwaters in Sugarloaf Mountain State Park to where it discharges towards the alluvial plain, estuaries, and tidal marshlands in the San Pablo Bay and the Napa Sonoma Marsh. The main tributaries of Sonoma Creek include Yulupa Creek, Graham Creek, Calabazas Creek, Bear Creek, Schell Creek, and Carriger Creek.

Sonoma Valley's road network is centered on Highway 12, the main north-south route connecting Santa Rosa and the City of Sonoma. Southern access is provided by Highway 121 (Carneros Highway) linking to Napa Valley and Highway 37 (Sears Point Road) from the wider North Bay area, while Highway 116 (Stage Gulch Road) offers western access. Significant internal and scenic roads include Arnold Drive, Bennett Valley Road, Warm Springs Road, and Trinity Road/Moon Mountain Road.

The climate in Sonoma Valley is characterized by warm and dry summers and winters that are relatively mild with more rainfall.

Figure 2-1 Valley of the Moon Water District Planning Area



Map compiled 2/2026;
intended for planning purposes only.
Data Source: Sonoma County, CalTrans, US Census TIGER Database, CA Open Data Portal, EKI Environment & Water, Inc., CA Parks and Rec.

2.1.1 Land Use

The District serves primarily residential and commercial customers in the urban portion of Sonoma Valley including the unincorporated communities of Agua Caliente, Glen Ellen, Fetter Hot Springs, El Verano, and Boyes Hot Springs. The balance of the valley's population is scattered in rural agricultural and hillside areas at very low densities, where individual on-site wells are the main source of water supply for the rural portion of the community. Agriculture, particularly vineyards, wine processing, and tourism are the main economic drivers of the Sonoma Valley community. Most of the local employment consists of the retail and service sector and many workers commute to jobs outside the Valley.

Sonoma Valley's land use pattern has been defined by commercial and urban and rural residential development comprised of small and medium density residential planned communities surrounded by agricultural lands. This land use pattern translates to the number of historic and current potable water service connections by customer type in the District. These land uses are shown in Figure 2-2.

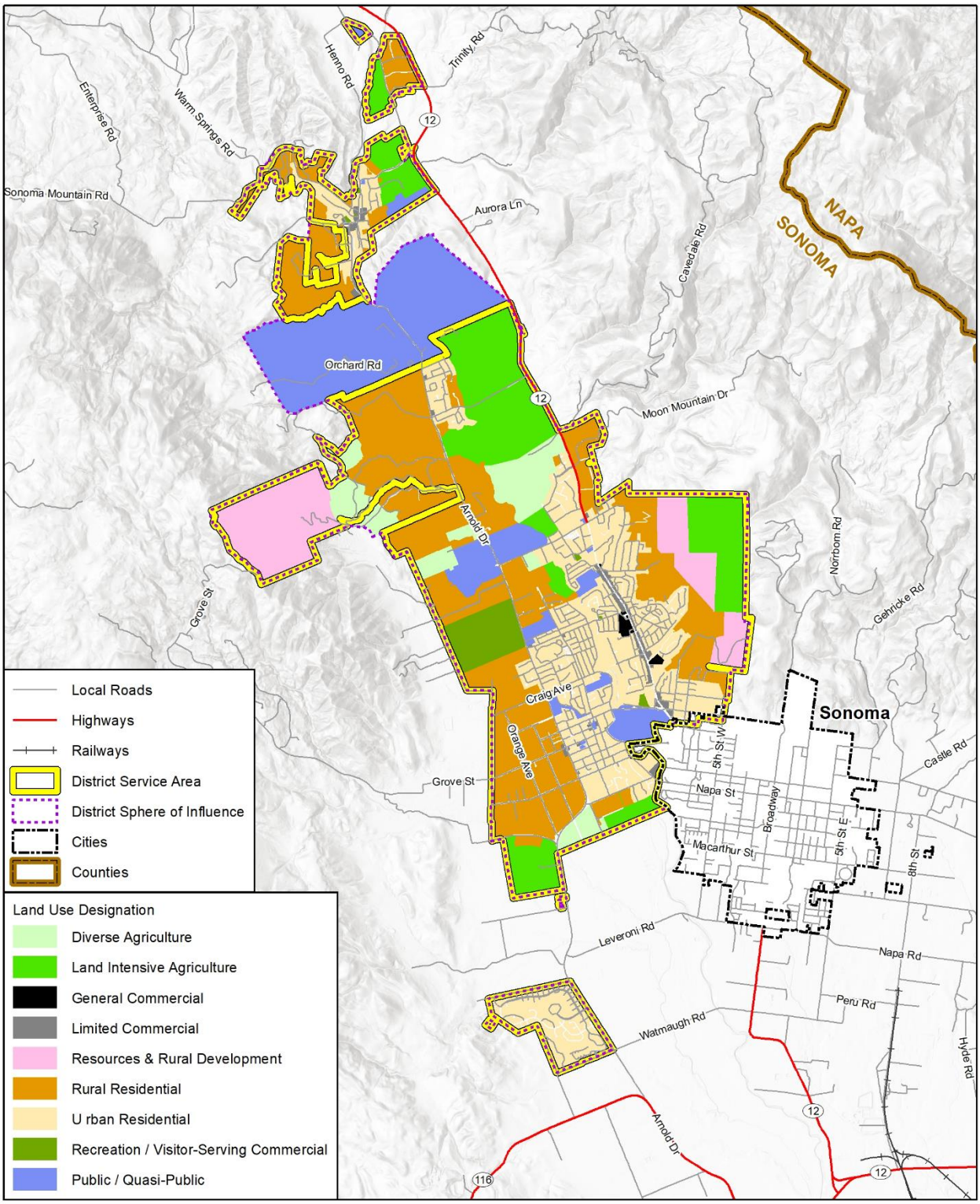
Single-family residential uses make up approximately 90 percent of the customers, followed by multi-family residential at 6.4 percent, commercial at 2.5 percent, and institutional and government uses at 0.5 percent (VOMWD 2025). A detailed breakdown of land use in the District by the number of potable water service connections is listed in Table 2-1.

Table 2-1 District Historical Potable Water Service Connections by Customer Type

Water Use Sector (by land use type)	Number of Potable Water Service Connection (2024)	Percentage of Total
Single Family Residential	6,258	89.8%
Multi-Family Residential	447	6.4%
Commercial	172	2.5%
Institutional/Governmental	35	0.5%
Irrigation Multi-Family	24	0.3%
Irrigation Commercial	14	0.2%
Other/Construction	21	0.3%
Total	**6,971**	**100%**

Source: VOMWD 2025

Figure 2-2 Valley of the Moon Water District Land Use Distribution



2.2 History

The District encompasses a significant portion of the area known as “The Valley of the Moon.” This phrase comes from the Native American word “Sonoma.” The City of Sonoma, adjacent to the District is the oldest town north of the San Francisco Bay. The City of Sonoma incorporated in 1850 and is the site of the most northerly mission of the 21 California missions. In 1834, the Mexican government sent General Mariano Vallejo to colonize the Sonoma area and in 1836, he was named Commanding General of all Mexican military forces in California and controlled the land north of the San Francisco Bay while California was under Mexican rule (VOMWD 2020). In 1846, during the Mexican-American War, Sonoma and California became officially occupied by the United States. The City of Sonoma was incorporated as a City in 1850 and then unincorporated in 1862 over various boundary disputes. The City was then reincorporated in 1883 after the boundary disputes were settled.

Since mid-1880, small, unincorporated centers northwest of the City of Sonoma such as El Verano, Boyes Hot Springs, Agua Caliente and Fetters Hot Springs were established as spas and resorts around the natural mineral hot springs and promoted by the railroad companies. Today, these communities are within the District’s service area. Water service in the Sonoma Valley and City of Sonoma area was originally provided by private water companies and the Sonoma Water and Irrigation Company, which incorporated in 1904 and was one of the oldest water companies (VOMWD 2020). A major consolidation of water companies occurred in 1921, and the Sonoma Water and Irrigation Company purchased the Sonoma Valley Water, Light and Power Company, the Sonoma Vista Water Company, and Sonoma Water Works. Sonoma Water Works served the area within the City of Sonoma and was sold to the City of Sonoma in 1933. The Sonoma Water and Irrigation Company then purchased the Boyes Hot Springs Company and the Agua Caliente Water Works in 1927, the Boyes Springs Park Company in 1943, and the Donaghy Water Company in 1959 (VOMWD 2020).

Another major water company serving this area was established in 1921 by Mr. N. M. Petersen, Senior. He bought four smaller water companies and combined them into Mountain Avenue Water System. Acquisitions of other water systems by the Mountain Avenue Water System continued through 1935. In 1957, the Valley of the Moon Fire District was evaluated by the Pacific Fire Board, which at that time noticed the lack of a dependable water supply source. Subsequent inquiries of the Fire District Board found that many wells in the area were failing due to drops in the groundwater levels in the Valley. Early attempts to have Sonoma County build an aqueduct from Santa Rosa to the Sonoma Water and Irrigation Company failed due to the inability to deposit a $25,000 cash bond with the County.

An election was scheduled for the purpose of organizing a public water district and to authorize the issuance of bonds. Proceeds of the bond issue were to be used for the acquisition of the two major private water companies operating in the area, for installation of new mains connecting the distribution systems of the two companies, and for providing a tie to the future Sonoma Aqueduct. The election was held on May 24, 1960, and the formation of the District and the issuance of bonds were approved by the voters. Acquisition of the Sonoma Water and Irrigation Company and the Mountain Avenue Water System was completed in early 1962 and the District started management and operation of the systems on June 1, 1962 (VOMWD 2020).

During this time, additional water supply sources were needed to allow for growth of the communities served in Sonoma Valley. Many other communities in Sonoma County were in a similar situation and in 1955, voters in the Sonoma County Water Conservation and Flood Control District issued bonds for projects to provide water to different parts of the County. The Sonoma County Water Conservation and Flood Control District, later called the Sonoma County Water Agency (now Sonoma Water), awarded a

construction contract for the first of these projects, starting with the Santa Rosa Aqueduct in 1956, followed by the construction of the Sonoma Aqueduct project in 1963. This project consisted of a booster pump in Santa Rosa, and 17 miles of 16" and 20" diameter pipeline from Santa Rosa through the center of the District's service area to the City of Sonoma.

At this time, the northern portion of the District's service area consisted of the community of Glen Ellen, where the water distribution system dates back to the 1890's. Different private parties operated water systems in this area until 1963 when the District acquired the facilities of the Glen Ellen Water Company and annexed its service area.

Until 1979, water districts in California organized under the authority of Division 12, Section 30.000 et seq. of the California Water Code (CWC). In late 1979, the State Legislature approved a change in Section 30.006 which allowed water districts organized under the CWC to drop the word "County" from their titles. The Board of Directors (Board) of the District passed a resolution to change the name to Valley of the Moon Water District on January 21, 1980.

2.3 Demographics

Data on the District's demographics was based on population estimates and forecasts summarized in the 2025 VOMWD *Water Master Plan and Capital Improvement Plan Update*. The demographics of the District's customers include a range of income levels, household sizes, and water demands. More affluent households are located along the foothills and are characterized by larger lots and homes with higher water demands for irrigation. Due to the District's setting in the heart of a tourist destination, Sonoma Valley, another factor impacting water use in recent years has been the increase in the number of second homes and vacation rentals. These accounts tend to have higher water use because the sites do not have full-time owners looking for leaks and managing irrigation water use in accordance with weather patterns (VOMWD 2019).

2.3.1 Population and Growth Projections

The District's population consisted of approximately 23,003 residents in 2024. The 2024 population estimate was determined utilizing the persons-per-connection methodology in alignment with the approach outlined in the District's 2020 Urban Water Management Plan (UWMP). This method involved aggregating population data derived from the persons-per-connection calculation. According to the State Water Board Division of Drinking Water (DDW) Electronic Annual Report (EAR), the District's persons-per-connection factor is 3.3. The 2020 UWMP projected an annual population growth rate of 1.5% from the 2020 baseline. The 2024 population aligns with projections for 2025. A summary of existing and projected service area populations, as established by the UWMP, is provided in Table 2-2.

Table 2-2 District Population Estimates and Projections

	2025	2030	2035	2040	2045
Population Estimates	24,860	26,782	28,851	31,081	33,483

Source: 2025 VOMWD Water Master Plan and Capital Improvement Plan Update

2.3.2 Housing

Housing tenure for the unincorporated communities of Fetter Hot Springs, Boyes Hot Springs, El Verano, Eldridge, Glen Ellen, and Temelec were obtained through the U.S. Census Bureau American Community

Survey (ACS) and shows roughly 62% of residents live in a home they own. Table 2-3 breaks down the differences in housing tenure.

Table 2-3 Housing Tenure in the Unincorporated Communities in District Service Area, 2023

	Boyes Hot Springs	Eldridge	El Verano	Fetters Hot Springs	Glen Ellen	Temelec
Owner-occupied	1,578	373	802	719	385	878
Renter-occupied	1,045	83	427	473	195	136
Vacant	106	37	65	230	67	74
Total	**2,729**	**493**	**1,294**	**1,422**	**647**	**1,088**

Source: U.S. Census Bureau ACS, 2018-2023, www.census.gov/

2.3.3 Race and Ethnicity

Table 2-4 shows the comparative demographic estimates between 2018 and 2023 based on ACS data.

The racial and ethnicity makeup of the District is slightly different than the County, where 79.8 percent of the population is White, and 26.5 percent of the population is Hispanic or Latino. In Sonoma Valley, a smaller portion of the population is White (approximately 55 percent), but the Hispanic and Latino population is similar to the County makeup (25.7 percent of the population).

Table 2-4 Race and Ethnicity in the Unincorporated Communities in District, 2023

	Boyes Hot Springs	Eldridge	El Verano	Fetters Hot Springs	Glen Ellen	Temelec
American Indian and Alaska Native	0	0	0	0	0	0
Asian	25	38	1	35	0	16
Black or African American	0	0	12	6	0	0
Hispanic or Latino	3,591	292	922	1,795	64	88
Native Hawaiian and Pacific Islander	9	0	0	0	0	0
Other	88	6	0	0	0	0
Two or More Races	125	135	63	184	24	29
White	3,193	655	2,156	1,421	996	1,563
Total	**3,154**	**3,441**	**1,084**	**1,696**	**3,154**	**3,441**

Source: U.S. Census Bureau ACS 2018-2023,,www.census.gov/

2.3.4 Income and Poverty

Individual households are commonly expected to use private resources and funds to prepare for, respond to, and recover from disasters. This means that households living in poverty are disadvantaged when confronting natural and human-caused hazards. Households living in poverty may occupy poorly built or inadequately maintained housing. These housing types may be more susceptible to damage in earthquakes or flood events than other types of housing.

Households living in poverty may also live in older houses and multi-family housing that is constructed of un-reinforced masonry (URM), a building type that is susceptible to damage during earthquakes. Cities have largely complied with a 1986 law requiring the reinforcement of URM buildings across the State; however, as of 2014, 170 un-retrofitted URM buildings stood in unincorporated areas of Sonoma County. Many of these buildings are historic landmarks, increasing the costs of potential renovations. Further, residents living below the poverty level are less likely to have insurance to compensate for the losses incurred from natural disasters.

Persons under 18 years old in Sonoma County may also be disproportionately affected by poverty. According to the 2018-2023 ACS data, 9.3 percent of the County's total residents under the age of 18 were living in poverty, compared to about 8.5% in Census Tracts overlapping the District's service area (see Table 2-5 below). Based on the demographics for Sonoma Valley, the median household income and per capita income are similar to the County, while unemployment is slightly higher.

Table 2-5 District's Comparative Economic Characteristics, 2023

Characteristic	Children under 18 below Poverty Level	Median Household Income	Per Capita Income	Percent Population 16+ in Labor Force	Unemployment Rate
Sonoma County	9.3%	$124,032	$54,941	64.5%	3.3%
Census Tract 1502.05	0.0%	$145,515	$58,971	59.9%	3.9%
Census Tract 1503.03	6.1%	$162,202	$76,363	45.7%	4.3%
Census Tract 1503.04	8.7%	$128,841	$50,628	57.0%	3.9%
Census Tract 1503.05	14.2%	$93,438	$36,016	73.4%	1.6%
Census Tract 1503.06	7.2%	$122,841	$54,341	62.4%	5.1%
Census Tract 1505.01	0.0%	$159,167	$122,309	51.7%	2.4%
Census Tract 1505.02	2.7%	$111,173	$73,125	58.6%	6.5%

Source: U.S. Census Bureau ACS, 2018-2023. Census Tract data obtained from U.S. Census Bureau 2020 Census Data Map

2.4 Social Vulnerability

Social vulnerability considerations were included in the development of this plan to identify populations (and customers) across the District's Planning Area that might be more vulnerable to hazard impacts based on a number of factors. Hazard events can have very different impacts for different segments of a community, even if the hazard affects the entire District. The combination of socioeconomic status, household composition, physical disabilities, age, race and ethnicity, education level, primary language, housing type, and transportation barriers can alter the way communities prepare for and respond to hazard events. For example, as stated in the previous section, families with lower household incomes may not be able to renovate their home to be more resilient to flooding and earthquakes, and as a result these households may be disproportionately affected by a flood or earthquake event. The elderly population may have limited mobility due to age and physical disabilities, which could lead to less accessibility during hazard events. It may also be more time-intensive for this population to receive hazard information and respond in the event of a hazard.

The social vulnerability considerations in this plan cover household income, ethnicity, English proficiency, the senior and disabled population, and single-parent households metrics. The considerations are broad

in scope and are based on best available data and mapping information from the Center for Disease Control's (CDC) Agency for Toxic Substances and Disease Registry (ATSDR) Social Vulnerability Index (SVI).

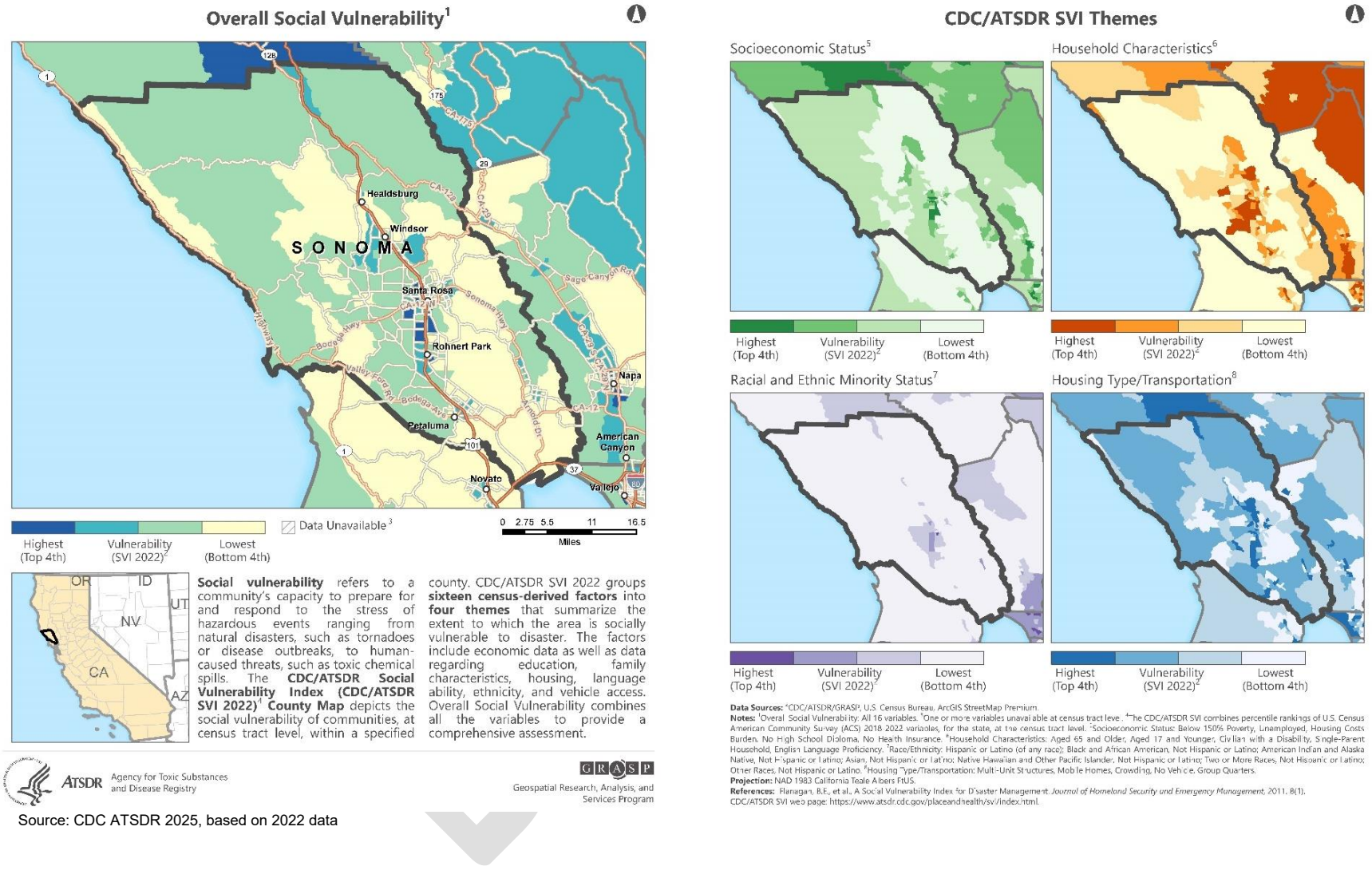
CDC Agency for Toxic Substances and Disease Registry Social Vulnerability Index

The SVI was developed by the CDC ATSDR and their Geospatial Research, Analysis & Services Program, as a way to portray communities' capacities to prepare for and respond to natural and man-made disasters. The SVI provides information on vulnerable populations to assist emergency response planners and public health officials in the identification of communities more likely to require additional support before, during, and after a hazardous event. The CDC's SVI includes county- and state-level maps that show relative vulnerability, provide key socially and spatially relevant information on communities' populations, and compare the SVI based on Census Tracts. This SVI index combines four main themes of vulnerability: socioeconomic status, household composition and disability, minority status and language, and housing and transportation. The information from the SVI data informs the vulnerability of people, as qualitatively discussed in the vulnerability assessment for each hazard in Chapter 4.

An overview of social vulnerability for the Sonoma County and the District's Planning Area is shown in Figure 2-3 based on CDC SVI data aggregated to census tracts. The SVI map depicts that within the District's Planning Area, there is one census tract (Census Tract 1503, SVI Score = 0.7383) with a higher vulnerability score (in pale blue) compared to Sonoma County, which overall has a low to moderate vulnerability to disasters (in pale green). The census tracts shaded in green and yellow have moderate to low vulnerability to disasters.

The DWR Disadvantaged Communities Mapping Tool developed by the California Department of Water Resources (DWR) also shows disadvantaged communities (DAC) using income-based definitions tied to state funding. DACs are shown at the block group, tract, and place levels. According to the tool, there are two census block groups (Tract 150305 and 150304) that are designed as DACs within the District's Planning Area (DWR 2026).

Figure 2-3 Socially Vulnerable Communities in Sonoma County based on CDC ATSDR SVI Tool



Source: CDC ATSDR 2025, based on 2022 data

2.5 Economy and Employment

The most comprehensive economic data available for the unincorporated communities that comprise Sonoma Valley comes from the U.S. Census ACS data. Select estimates of economic characteristics for the District's Planning Area are summarized below.

As of 2023, Fetter Hot Springs and Boyes Hot Springs, three of the larger and urbanized unincorporated communities in Sonoma Valley had relatively lower unemployment rates (2.5% and 2.2%, respectively) than Sonoma County (3.3%), while El Verano's rate was higher (6.4%). Table 2-6 illustrates the breakdown of employment by industry in the larger unincorporated communities in the District's Planning Area and in Sonoma Valley from 2018-2023, as well as the number of people employed by each industry.

Table 2-6 District's Employment by Industry, 2023 5-Year Estimates

Industry	Boyes Hot Springs		El Verano		Fetter Hot Springs	
	# Employed	% Employed	# Employed	% Employed	# Employed	% Employed
Ag., forestry, fishing and hunting, and mining	118	3.6%	92	6.3%	42	2.4%
Construction	309	9.4%	278	19.0%	251	14.4%
Manufacturing	303	9.3%	135	9.2%	127	7.3%
Wholesale trade	38	1.2%	25	1.7%	13	0.7%
Retail trade	377	11.5%	161	11.0%	237	13.6%
Transportation and warehousing, and utilities	71	2.2%	0	0.0%	25	1.4%
Information	45	1.4%	22	1.5%	22	1.3%
Finance and insurance, real estate, rental, leasing	300	9.2%	0	0.0%	30	1.7%
Professional, scientific, and mgmt. & admin. and waste mgmt. services	422	12.9%	291	19.9%	307	17.6%
Educational services, health care & social assistance	420	12.8%	153	10.5%	484	27.7%
Arts, entertainment, rec., accommodation & food services	526	16.1%	169	11.6%	125	7.2%
Other services, except public administration	264	8.1%	55	3.8%	84	4.8%
Public administration	82	2.5%	79	5.4%	0	0.0%

Source: U.S. Census Bureau ACS, 2023 www.census.gov/

2.6 Growth and Development Trends

The District has experienced steady development and is experiencing steady population growth as a result of residential developments in Sonoma Valley. As the District continues to identify additional planned developments within its service area, it will continually need to reassess water demand projections to accommodate this future growth.

Additional information on development trends in the District's Planning Area can be found in the Recent and Future Development section of each hazard profile in Chapter 4.

2.7 Mitigation Capability Assessment

During plan development, the District's HMPC completed a mitigation capability assessment to identify existing programs, policies, and resources that are already in place. When combined with the risk assessment, this evaluation defines the District's net vulnerability to disasters, and more accurately focuses the goals, objectives, and proposed actions of this plan.

The HMPC used a two-step approach to conduct the capability assessment for the District. First, an inventory of common mitigation activities was made through the use of a matrix. The purpose of this effort was to identify policies and programs that were either in place, needed improvement, or could be undertaken if deemed appropriate. Second, the HMPC conducted an inventory and review of existing policies, regulations, plans, and programs to determine if they contributed to reducing hazard-related losses or if they inadvertently contributed to increasing such losses.

Similar to the HMPC's effort to describe hazards, risks, and vulnerability of the District's critical water facilities and infrastructure, this mitigation capability assessment describes the District's existing capabilities, programs, and policies currently in use to reduce hazard impacts or that could be used to implement hazard mitigation activities. It identifies select county, regional, state, and federal departments/agencies that can supplement the District's mitigation capabilities. This also determines where the plan can be integrated into other planning mechanisms, such as applicable County plans and policies (e.g., *Sonoma County General Plan 2020*, *2023 Community Wildfire Protection Plan [CWPP]*) This assessment is divided into four sections: regulatory mitigation capabilities, administrative and technical mitigation capabilities, fiscal mitigation capabilities, and mitigation outreach and partnerships.

2.7.1 District's Regulatory Mitigation Capabilities

Table 2-7 lists planning and land management tools typically used by special districts to implement hazard mitigation activities and indicates those that are in place at the District. Excerpts from applicable policies, regulations, plans, and program descriptions follow to provide more detail on existing mitigation capabilities.

Table 2-7 District's Regulatory Mitigation Capabilities

Regulatory Tool (ordinances, codes, plans)	Yes/No	Comments
General Plan	No	The *Sonoma County General Plan 2020* is the County's blueprint for land use in the unincorporated County. It provides the basis for development while maintaining the quality of life in Sonoma County. The County also implements the *2021 Sonoma County Multi-Jurisdictional Hazard Mitigation Plan* (MJHMP) to guide hazard mitigation planning activities. The current plan addresses the following natural hazards: earthquake, flooding, wildfire, landslide, drought, extreme heat and cold, extreme wind, dam failure, sea level rise, tsunami, and the secondary impacts of these hazards. The 2026 MJHMP has not yet been adopted but is in progress and under State and FEMA review. Upon adoption of the MJHMP, the County will integrate the plan into the Public Safety Element of the *County's General Plan 2020*.

Regulatory Tool (ordinances, codes, plans)	Yes/No	Comments
Zoning Ordinance	No	Sonoma County implements the *Sonoma County Zoning Regulations* (Chapter 26 of the Municipal Code). The Zoning Regulations promote the public health, safety, peace, comfort, convenience and general welfare in the County. It guides orderly and beneficial land use in the County, protects the character and economic stability of agricultural, residential, commercial, and industrial uses, and protects public safety and welfare by regulating the location and uses of structures and land.
Subdivision Ordinance	No	Chapter 25 of the *Sonoma County Municipal Code* contains the County's subdivision ordinance. Major and minor subdivisions in the County are also governed by the Subdivision Map Act (California Government Code, Section 55410, et. Seq.).
Growth Management Ordinance	No	Chapter 26 of the *Sonoma County Municipal Code* contains a residential growth management plan for Sonoma Valley. The growth management measures apply to properties in Planning Area No. 9 within the Sonoma Valley planning area.
Floodplain Ordinance	No	Chapter 7 and 7B of the *Sonoma County Municipal Code* contain building regulations and flood damage preventions measures that are required before the construction and development of structures within any area of special flood hazard. Article 56 – F1 Floodway Combining District provides land use regulations for properties situated in floodways to safeguard against the effects of bank erosion, channel shifts, increased runoff or other threats to life and property. Article 58 – F2 Floodplain Combining District of the *Sonoma County Municipal Code* provides for the protection from hazards and damage which may result from flood waters.
Other special purpose ordinance (e.g., stormwater, steep slope, wildfire)	No	The *Sonoma County Municipal Code* contains stream setbacks, scenic corridor protections, and various requirements for buildings located in any Fire Hazard Severity Zone (FHSZ) or Wildland-Urban Interface (WUI) Zone in Chapter 7 – Building Regulations. The County also implements Chapter 13 – Sonoma County Fire Safety Ordinance and Chapter 13A – Abatement of Hazardous Vegetation and Combustible Material (adopts by reference the California Fire Code [Title 24] requirements and Fire Safe Standards to provide for the removal of hazardous vegetation around the exterior of improvements in the unincorporated area of the County to reduce the potential for fire. Additionally, the County implements Chapter 11A to protect stormwater quality. The County also adopted amendments to Chapter 25B – Water Well Construction Standards that created a new process for well permits that require public trust review and added water conservation requirements and water metering and monitoring requirements.
Building Code	No	The County's Building Code is set forth in Chapter 7 of the *Sonoma County Municipal Code*. The building standards for work authorized by a new permit shall be governed by the codes in force at the time of a new permit application as described in Chapter 1, Division 1 of the California Building Code (CBC).

Regulatory Tool (ordinances, codes, plans)	Yes/No	Comments
Fire department Insurance Services Office (ISO) rating	Yes	The City of Sonoma and Sonoma Valley Fire District has an Insurance Services Office (ISO) rating of Class 1. ISO ratings around Glen Ellen are Class 2.
Erosion or Sediment Control Program	No	Sonoma County implements Chapter 11A to protect stormwater quality. The District can integrate erosion and stormwater management policies into District plans to better protect water supply facilities and infrastructure.
Storm Water Management Program	No	The *Southern Sonoma County Storm Water Resources Plan* (May 2019) developed and prioritized multi-benefit projects that capture and treat stormwater in the County. The District participated in the collaborative planning process and the development of the plan as a participating entity on the Technical Advisory Committee.
Site Plan Review Requirements	No	The County requires an Administrative Design and Review Permit prior to construction. Chapter 7, Article II of *Sonoma County's Municipal Code* outlines the building regulations for the County and most construction in the County requires a building permit through either a Plan Check process for projects that require building plans, or No Plan Check process for simpler projects. Projects are also required to follow environmental and inspection requirements.
Capital Improvements Plan	Yes	The District's 2025 WMP contains recommended capital improvements for the next 5 to 10 years. These improvements cover the District's supply and storage facilities, hydraulic capacity improvement projects, additional pipeline condition projects to replace pipelines that have reached their useful lives, and improvements identified in previous planning documents. The projects are organized by cost and organized into three levels of prioritization based on projects that should be initiated as soon as possible (next 5 years), near-term projects (next 5 to 10 years), and long-term projects (10 years or more). The location of each project is also illustrated in the plan to show its connection to the larger water supply and distribution system.
Economic Development Plan	No	The District does not have an Economic Development Plan.
Local Emergency Operations Plan (EOP)	Yes	The District has an Emergency Response Plan (ERP) in place that was last prepared in 2021. The District plans to update the plan in 2026.
Other special plans	Yes	The 2025 Water Master Plan (WMP) Update provides the District an overall plan for infrastructure improvements to ensure the District can reliably and cost-effectively serve its customers through 2045. The 2020 UWMP describes and evaluates how the current and future water resources and demands within the District's service area will be managed to provide an adequate and reliable water supply. The Water Supply Contingency Plan (WSCP) is required under the Urban Water Management Planning Act, which states that each water supplier outline how the supplier will prepare for and respond to water shortages. Additional internal plans the District uses for regulatory mitigation include a Cross-Connection Control Plan, Risk and Resiliency

Regulatory Tool (ordinances, codes, plans)	Yes/No	Comments
		Assessment (RRA), Draft Seismic Vulnerability Assessment Report, Annual Water Supply and Demand Assessment, Water Storage Plan, Strategic Water Supply Plan, Emergency Notification Plan, and Bacteriological Sample Siting Plan.
Flood Insurance Study (FIS) or other engineering study for streams	Yes	The County has participated in the National Flood Insurance Program (NFIP) since 1978 and began implementing their NFIP floodplain regulations in 1982 when they received Digital Flood Insurance Rate Maps (DFIRMs), floodway maps, and attendant certification requirements. The latest FIS applicable to the District was included in a five-volume report along with other incorporated jurisdictions and unincorporated areas studied in Sonoma County; this recent report was revised July 31, 2024. The latest effective date for the DFIRMS in the County is March 7, 2017. Chapter 7B of the *Sonoma County Municipal Code* sets forth regulations to reduce flood hazards by regulations and restricting development in flood prone areas by establishing specific review requirements and performance standards in conformance with the NFIP regulations. These procedures have been in place since 1982. FEMA determined the ordinance to be NFIP-compliant.
Elevation certificates	Yes	Sonoma County's Flood Elevation Mitigation Program implements structural elevations as an efficient and cost-effective way to mitigate against future flood losses. According to Chapter 7 of the *Sonoma County Municipal Code* all new construction must be elevated above the base flood elevation (BFE) by at least 12 inches. BFE certification must then be provided by a registered professional engineer.

Source: HMPC Data Collection Guide

As indicated in the table above, the District has several plans and programs that guide the District's development in hazard-prone areas. Starting with the 2025 WMP, which is the most comprehensive of the District's plans when it comes to mitigation, these relevant plans and programs are described in more detail below.

Water Master Plan (2025)

The WMP provides the District an overall plan for infrastructure improvements to ensure the District can reliably and cost-effectively serve its customers through 2045. The plan describes the District's existing water infrastructure, existing and future water demands, the District's main water supply sources, and assesses supply and storage capacity in the District. The WMP includes a water system hydraulic model to assess the District's existing infrastructure to evaluate capacity needs for the current and future demand conditions. Based on this assessment, the plan identifies recommended improvement projects related to supply and storage deficiencies.

Five-Year Capital Improvement Program

The District's five-year Capital Improvement Program (CIP) is included in the WMP. The goal of the CIP is to provide a multi-year roadmap for the strategic prioritization, scheduling, and financing of major infrastructure and asset investments. Significant projects outlined in the current CIP include replacing

Chestnut and Donald booster pump stations with upgraded pumps, improving fire flow at Warm Springs Road and Altimira Middle School, and installing flow metering at several locations.

Urban Water Management Plan (2020)

The District's UWMP is prepared to meet the requirements of the CWC, which requires "every urban water supplier providing water for municipal purposes either directly or indirectly to more than 3,000 customers or supplying more than 3,000 acre-feet of water annually to adopt and submit an UWMP every five years." The purpose of the plan is to describe and evaluate how the current and future water resources and demands within the District's service area will be managed to provide an adequate and reliable water supply. It includes several objectives designed to help the District meet their future water demands and develop performance and operational criteria. It describes the constraints on the District's water supplies and outlines their WSCP and demand management measures. It also presents the implementation measures achieved over the past five years and those planned for the future. Several of the guiding principles, objectives, and actions outlined in the plan will help the District minimize drought and water supply hazards. The District is currently preparing their 2025 UWMP.

Emergency Response Plan

The ERP is a companion plan to the District's initial vulnerability assessment and was developed to comply with the Safe Drinking Water Act as amended by the Public Health Security and Bioterrorism Preparedness and Response Act of 2002. The purpose of the current 2002 ERP is to provide the District with a standardized response and recovery protocol to prevent, minimize, and mitigate injury and damage resulting from emergencies or disasters of man-made or natural origin. The ERP describes how the District will respond to potential threats or terrorist scenarios identified in the vulnerability assessment, as well as additional emergency response situations. The plan identifies emergency planning partnerships, mutual aid agreements, and emergency response policies, procedures, and documents. ERPs also include specific action plans that will be used to respond to events and incidents. While these plans are focused on emergency response, during the next update the District can integrate applicable LHMP mitigation actions into the plan that should improve emergency planning incident response activities.

Water Shortage Contingency Plan

The WSCP is an integrated chapter in the 2020 UWMP. The Urban Water Management Planning Act requires that each water supplier provide a WSCP that outlines how the supplier will prepare for and respond to water shortages. The District's plan addresses the requirement by describing the staged actions it would implement in response to water shortage events that occur over a period of time, such as a drought or interruption in supply due to a catastrophic event. During the next UWMP update, the District should review the staged actions and determine if any of the LHMP mitigation actions can be integrated into the plan.

Risk and Resilience Assessment

The District's RRA evaluates the District's exposure and vulnerability to natural hazards, climate impacts, and human-caused threats, and assesses the District's ability to maintain, recover, and adapt essential water services. The assessment examines risks to water supply sources, treatment facilities, distribution systems, power and communications dependencies, cyber systems, and critical operations from hazards such as drought, wildfire, flooding, earthquakes, extreme heat, and cybersecurity incidents. Findings are used to identify priority vulnerabilities, assess consequences to customers and public health, and inform

targeted mitigation, capital planning, emergency response, and long-term resilience strategies in compliance with America's Water Infrastructure Act requirements.

Seismic Vulnerability Assessment Report

The purpose of the District's Seismic Vulnerability Assessment Report is to evaluate how earthquakes, including ground shaking and liquefaction, could damage the District's critical water supply, treatment, storage, and distribution assets, and to identify priority vulnerabilities that could disrupt water service, fire flow availability, and emergency response. The assessment was completed to inform engineering-level mitigation actions, including retrofit, replacement, and hardening projects, and to support updates to the District's RRA, ERP, and LHMP.

2.7.2 Federal Regulatory Mitigation Capabilities

Safe Drinking Water Act

Under the Safe Drinking Water Act (SDWA), the U.S. EPA sets standards for drinking water quality and oversees the states, localities, and water suppliers who implement those standards. The District must meet all existing and proposed regulatory requirements of the SDWA.

Source Water Assessment Program

Source water protection is a national priority as a result of the 1996 amendments to the SDWA and provides a comprehensive watershed-based approach to improving and preserving water quality of the public water supply source. States have a great deal of flexibility in how they design their program. California's Source Water Assessment and Protection program allows water utilities to conduct their own assessments to improve and preserve water quality of the public water supply sources and provide information to communities that wish to develop local programs to protect their sources of drinking water. Because of the significant negative effects of wildfires on watersheds, potential wildfire mitigation measures could be linked to source water protection for District and in coordination with Sonoma Water.

2.7.3 State Regulatory Mitigation Capabilities

California State Hazard Mitigation Plan (2023)

The California State Hazard Mitigation Plan (SHMP) establishes goals and priorities for Cal OES to carry out disaster mitigation activities. The plan provides the basis for funding pre-mitigation priorities for projects and consolidates the plans of other state agencies and interagency groups into a comprehensive set of recommendations for California's long-term mitigation strategy. The District's multi-hazard mitigation planning process used the State plan for information to conduct their risk assessment, to identify mitigation goals and objectives, and to prioritize potential mitigation projects.

California's Wildfire and Forest Resilience Action Plan (2026)

The Wildfire and Forest Resilience Action Plan is a comprehensive strategy to reduce wildfire risk, restore forest health, and accelerate climate change adaptation. The Plan was written and developed by the California Wildfire & Forest Resilience Task Force, and integrates recommendations from more than two dozen interagency workgroups and stakeholder organizations, including the Governor's Office of Land Use and Climate Innovation (LCI) (formerly the Office of Planning and Research), the Indigenous Stewardship Network, and academic partners such as forest ecologists from UC Berkeley. As of January

2026, the plan has evolved into a 10-Year Roadmap to Resilience, which offers tailored strategies for diverse regions and shifts toward outcome-based measures to ensure projects are effectively reducing risk.

California Water Plan Update (2023)

The California Water Plan Update provides a framework for water managers to consider options and make decisions regarding California's water future. The plan presents basic data and information on California's water resources, including water supply evaluations and assessments of agricultural, urban, and environmental water uses to quantify the gap between water supplies and uses. The plan also provides water managers with general guidance on preparing for climate change and sudden changes caused by natural disasters.

California Water Code

Sections of the CWC related to the District and hazards mitigation are summarized below:

- Water Code 350. Gives the governing body of a public water supply distributor the power to declare a water shortage emergency condition within their area when ordinary demands and requirements of water consumers cannot be satisfied without depleting the water supply to the extent that there would be insufficient water for human consumption, sanitation, and fire protection.
- Water Code 8000-8129. Local Flood Control. Empowers counties and local jurisdictions to appropriate and expend money from the general fund for:
  - The construction of works, improvements, levees or check dams to prevent overflow and flooding.
  - The protection and reforestation of watersheds.
  - The conservation of the flood waters.
  - The making of all surveys, maps and plats necessary to carry out any work, construction or improvement authorized by this article.
  - The carrying out of any work, construction or improvement authorized by this article outside the county if the rivers or streams affected flow in or through more than one county.
- Water Code 10910. Requires cities and counties to identify the public water system that will supply water for a new project subject to the California Environmental Quality Act (CEQA). If the city or county is not able to identify any public water system, then they must prepare a water supply assessment. The city or county must request each public water system to determine whether the projected water demand associated with a proposed project was included as part of the most recently adopted UWMP. If the projected water demand was not accounted for, or there is no urban water management plan, "the water supply assessment for the project shall include a discussion with regard to whether the public water system's total projected water supplies available during normal, single dry, and multiple dry water years during a 20-year projection will meet the projected water demand associated with the proposed project, in addition to the public water system's existing and planned future uses, including agricultural and manufacturing uses."

2.7.4 Local Regulatory Mitigation Capabilities

Sonoma County General Plan (2020)

Sonoma County's General Plan 2020 is the blueprint for land use in unincorporated Sonoma County. The purpose of the General Plan is to outline policies that will guide decisions on future growth, development, and conservation of resources in a manner that is consistent with the goals and quality of life desired by

the County's residents. The Water Resources Element addresses surface and groundwater quality, water conservation and re-use, and public water systems. The Public Safety Element provides procedures for development projects located in areas subject to natural hazards. This element also addresses seismic and geologic hazards, flooding, hazardous materials, and susceptibility to wildland fires. The County began an update to their General Plan in 2024.

Sonoma County Multi-Jurisdictional Hazard Mitigation Plan (2021, Pending Draft 2026)

The *Sonoma County Multi-Jurisdictional Hazard Mitigation Plan* assesses the County's vulnerabilities to hazards and presents a mitigation strategy of actions intended to reduce the disruption to life, property, and economy that might result from a natural disaster. The MJHMP focuses on earthquake, flood, wildland fire, and landslide hazards, as they were considered to constitute the greatest risk to the County based on past disaster events, future probabilities, and vulnerability. The MJHMP risk assessment also addresses secondary and tertiary impacts, such as winter storms, coastal erosion, bluff failure, tsunamis, and post fire erosion.

Sonoma County Community Wildfire Protection Plan Update (2023)

The Sonoma County CWPP consists of three components: a collaborative effort of input from various agencies and community members, the identification of prioritized treatment areas and mitigation strategies, and the recommendation of measures to reduce ignitability of structures. The plan was developed in coordination with Fire Safe Sonoma, CAL FIRE, and Sonoma County. The Sonoma County Board of Supervisors unanimously approved the Fire Safe Sonoma's 2023 CWPP.

2.7.5 District Administrative/Technical Mitigation Capabilities

Table 2-8 identifies personnel responsible for activities related to mitigation and loss prevention at the District.

Table 2-8 District's Administrative and Technical Mitigation Capabilities

Personnel Resources	Yes/No	Department/Position
Planner/engineer with knowledge of land development/land management practices	No	
Engineer/professional trained in construction practices related to buildings and/or infrastructure	Yes	
Planner/engineer/scientist with an understanding of natural hazards	Yes	EKI, Infraterra, the District currently relies on consultant staff for natural hazard expertise.
Personnel skilled in GIS	Yes	
Full-time building official	No	
Floodplain manager	No	
Emergency manager	No	
Grant Writer	Yes	EKI, District currently relies on consultant staff for grant writing.
GIS Data Resources (Hazard areas, critical facilities, land use, building footprints, etc.)	No	

Personnel Resources	Yes/No	Department/Position
Warning Systems/Service (Reverse 911, cable override, outdoor warning signals)	Yes	

Source: HMPC Plan Update Guide

The District has emergency generation capabilities at all its critical facilities. The District can improve their administrative and technical capabilities through better coordination with Sonoma County, regular updates to their GIS data (with support from consulting staff, if necessary), scheduling regular review meetings on plan implementation (e.g. LHMP implementation and maintenance), and providing more training opportunities for staff to ensure they are well-informed of changing regulations.

The District has started to develop several strategic emergency communication response actions internally, including a District-wide emergency call-out that messages all employees in extreme emergencies with one action.

Valley of the Moon Water District Governance

The Board oversees all District operations by setting goals for the District's General Manager. The five-member Board adopts policies to guide the General Manager and District staff in providing efficient and effective services to present and future District customers. The District consists of the following three departments:

- **General Manager.** The General Manager is responsible for organizing, supervising, and directing activities of the District and carrying out policies set by the Board to ensure that efficient and effective services are provided through the approved policies and budget.
- **Administration.** The Administrative Department consists of an Administration Manager and two full-time employees. Responsibilities of this group include customer services, office services, human resources, risk management, regulatory compliance, project administration, public information, and Board administration.
- **Finance.** The Finance Department consists of a Finance Manager and one full-time employee. Responsibilities of this department include budget creation, accounting, and audit preparation.

  Operations and Maintenance. The Operations and Maintenance Department consists of a Water System Manager, eight Water Distribution/Treatment System Operators, and one Water Service Field Representative. The primary responsibility of this department is to ensure the uninterrupted delivery of water by locating and fixing leaks, flushing lines, repairing mains, operating wells, and replacing aging infrastructure. The department also monitors water quality, inspects construction projects in progress, performs preventive maintenance and repairs of all water system facilities, and performs building and ground maintenance of District facilities.

2.7.6 District's Fiscal Mitigation Capabilities

Table 2-9 identifies financial tools or resources that the District could potentially use to help fund mitigation activities. Mitigation funding opportunities are also discussed in Chapter 5 under each existing and new mitigation action. For example, there are various mitigation funding opportunities available through the Federal Emergency Management Agency (FEMA) (e.g. Hazard Mitigation Grant Program [HMGP]), Cal OES, and other state and local agencies. The District's capital improvement planning process may also identify new funding sources for CIP projects that may occur over 5-year periods.

Table 2-9 District's Fiscal Mitigation Capabilities

Financial Resources	Accessible/Eligible to Use (Yes/No)	Comments
Community Development Block Grants	No	
Capital Improvements Project funding	Yes	
Authority to levy taxes for specific purposes	No	
Fees for water services	Yes	Utility, connection, and water use fees can be used for hazard mitigation of water supply and connection projects
Impact fees for new development	No	
Incur debt through general obligation bonds	Yes	
Incur debt through special tax bonds	No	
Incur debt through private activities	Yes	
Withhold spending in hazard prone areas	Yes	

Source: HMPC Data Collection Guide

Other key federal and state funding sources include the U.S. Bureau of Reclamation WaterSMART Drought Resiliency Grant program funds (drought preparedness, aquifer storage and recovery [ASR], and conveyance upgrades), U.S. Department of Agriculture Emergency Community Water Assistance Grants, U.S. Environmental Protection Agency Drinking Water Revolving Funds (DWSRF) (low-interest loands and grants for drinking water infrastructure upgrades), Clean Water State Revolving Funds (CWSRF), DWR Integrated Regional Water Management Implementation Grants (IRWM), Small Community Drought Relief Program funding, and State Water Resources Control Board (SWRCB) Drinking Water State Revolving Funds.

2.7.7 Mitigation Outreach and Partnership Capabilities

Table 2-10 provides an overview of the District's outreach and partnership capabilities related to hazard mitigation. This table summarizes current efforts and programs focused on raising public awareness, fostering partnerships, and engaging the community in reducing risks. The capabilities listed reflect both existing initiatives and areas where improvements may be needed to enhance the District's overall resilience.

Table 2-10 District's Outreach and Partnership Capabilities

Outreach Resource	Yes/No	Notes
Hazard Awareness/Education Campaigns		
Firewise	No	
Storm Ready	No	
Severe Weather Awareness Week	No	
School programs	No	
Other	Yes	Sonoma Marin Saving Water Partnership efforts
Methods Used to Communicate Hazard Information to the Public		
Local News	Yes	Sonoma Marin Saving Water Partnership

Outreach Resource	Yes/No	Notes
Social media	Yes	
Community Newsletters	Yes	
Utility Bill Inserts	Yes	
Community Events	Yes	
Organizations that represent or work with underserved or vulnerable communities		
American Red Cross	No	
Salvation Army	No	
Community Groups		
Veterans Groups	No	
Environmental/Conservation Groups	Yes	Sonoma Ecology Center, Sonoma Land Trust, Sonoma Resource Conservation District
Homeowner/Neighborhood Associations	Yes	
Chamber of Commerce	No	
Community Organizations (Lions, Kiwanis, etc.)	Yes	La Luz Center, Sonoma Valley Community Health Center, Boys and Girls Club of Sonoma Valley
Others	No	

Source: HMPC Data Collection Guide

Sonoma-Marin Saving Water Partnership

The District and Sonoma Water are members of both the Sonoma-Marin Saving Water Partnership and the California Water Efficiency Partnership. These groups have taken active steps to conserve water and prepare for droughts. While their approaches may differ, both partnerships support emergency preparedness, as using less water during normal times reduces the demand if an emergency occurs.

Sonoma County Regional Water Supply Resiliency Plan

The District is participating in the Sonoma County Regional Water Supply Resiliency Plan, an ongoing effort by Sonoma Water to ensure a reliable water supply against climate change impacts, focusing on strategies like conjunctive use (groundwater during drought, Russian River in wet years), enhancing infrastructure (Santa Rosa Plain Drought Resiliency Project), climate adaptation, and integrating with broader hazard mitigation and energy resiliency policies, all while collaborating with local partners to meet future water needs.

Sonoma County Drought Resilience Plan

Sonoma County is preparing a Drought Resilience Plan that addresses drought risk, short-term response actions, and long-term strategies specifically for small water systems and domestic well users. It is developing the plan with oversight from a Drought & Water Shortage Task Force. The County established the Drought Task Force to coordinate Senate Bill (SB) 552 implementation, technical assistance, and guidance. As of 2025, the County hosted public meetings to share progress and gather input on the DRP's development.

Valley of the Moon Water District Website

The District's website provides public information and resources on water supply planning in Sonoma Valley. Including information on water conservation effort, hazard mitigation, and emergency water

supply. The District's social media accounts (Facebook, NextDoor) are used to disseminate public information.

2.7.8 Opportunities for Enhancement

Based on the District's current mitigation capabilities across regulatory, administrative/technical, fiscal, and outreach/partnership domains, several opportunities exist to strengthen hazard mitigation and overall resilience:

- The District could benefit from hiring or contracting additional personnel, such as a full-time planner with land management expertise, a dedicated floodplain manager, or a grant writer to pursue funding for mitigation projects. Increasing in-house GIS resources and regular data updates will also support more informed decision-making and hazard mapping.
- While the District uses capital improvement funding, utility fees, and can incur debt through bonds, it has not applied for post-disaster emergency funding through the HMGP since the last plan update. HMGP funds become available to jurisdiction and special districts to fund mitigation projects following federal disaster declarations. Two such declarations occurred in Sonoma County since the last plan update (DR-4699-CA and DR-4683-CA). Additionally, exploring partnerships with local government to unlock additional funding sources such as Community Development Block Grants could significantly expand the District's mitigation capacity.
- Enhance the District's critical facilities inventory by incorporating engineering-level vulnerability screenings and the District's Seismic Vulnerability Assessment Report findings for the District's most critical assets. This detail will help the District prioritize projects and tie the need to clear risk reduction and cost effectiveness information. It will also help the District create grant-ready information for funding applications.
- Expand coordination with Sonoma County and Sonoma Water focused on emergency management and imported and emergency water supplies. Specifically develop coordination protocols with these agencies to support future identification of mitigation actions that reduce single-point-of-failure risks within the regional water system.
- Align the District's mitigation actions with Sonoma County's SB 552 Drought Resilience Plan, particularly where the District services adjacent customers or supports vulnerable populations that rely on domestic wells or State Small Water Systems (SSWS). This effort would support both short-term preparedness actions focused on emergency water supply continuity and long-term mitigation solutions that support back-up power and coordination.
- The District's outreach relies primarily on the Sonoma-Marin Saving Water Partnership and standard communication channels. There is opportunity to develop and implement additional targeted hazard awareness campaigns. For example, portions of Glen Ellen are already recognized as Firewise communities. The District could leverage its influence to encourage the expansion of Firewise communities, particularly in areas surrounding its critical infrastructure. Supporting hazard awareness campaigns, school programs, and partnerships with groups representing vulnerable populations can help the District improve public education on water risks, conservation, and emergency preparedness.

By pursuing these enhancements, the District can address current gaps, adapt to future challenges, and improve the safety and reliability of its water supply.

3 PLANNING PROCESS

44 U.S. Code of Federal Regulations Requirements §201.6 Local Mitigation Plans (b) and §201.6(c)(1): An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include:

1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;

2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia, and other private and nonprofit interests to be involved in the planning process; and

3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.

[The plan shall document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.

3.1 Background on Mitigation Planning in the Valley of the Moon Water District

The primary purpose of the Valley of the Moon Water District's (District's) Local Hazard Mitigation Plan (LHMP) Update is to reduce or eliminate long-term risk to people and property from natural hazards and their effects on the District Planning Area. The District recognized the importance of developing their first LHMP in 2021, and is responsible for initiating its update in 2026. The goal of the LHMP is to develop practical, attainable, and cost-effective mitigation actions to reduce vulnerability to the identified hazards and reduce human, property, and economic losses from hazard events. The District contracted with WSP Earth & Environment (WSP) to facilitate and develop the plan. WSP's role was to:

- Assist in establishing the Hazard Mitigation Planning Committee (HMPC) as defined by the Disaster Mitigation Act (DMA) of 2000 (Public Law 106-390), commonly known as the 2000 Stafford Act Amendments;
- Meet the DMA requirements as established by federal regulations and follow the Federal Emergency Management Agency (FEMA) planning guidance;
- Facilitate the entire planning process based on a Community Engagement Strategy that outlines tools and touchpoints to inform and involve stakeholders and the public;
- Identify the data requirements for the HMPC and conduct the research and documentation necessary to augment that data;
- Perform risk assessments that identify, evaluate, and prioritize natural and human-caused hazards that could impact the District;
- Conduct a vulnerability assessment to identify the hazard's impacts on the District's critical facilities, infrastructure, property, and on recent and future development;
- Assist in facilitating the public input process;
- Integrate the risk and vulnerability assessment to help the District determine appropriate mitigation goals and objectives to minimize long-term vulnerabilities to the identified hazards;
- Produce draft and final plan documents; and
- Coordinate with California Office of Emergency Services (Cal OES) and FEMA Region IX plan reviews.

This LHMP is tailored to address the natural, human-health, and human-caused hazards in the District's Planning Area, the identified hazard impacts specific to the District's critical facilities and infrastructure,

and the development of a locally attainable mitigation strategy. The LHMP will involve adopting, implementing, assigning responsibility, monitoring, and reviewing the mitigation actions over time to ensure the goals and objectives of the plan are being achieved, and the plan remains relevant. The remainder of this chapter provides a narrative of the steps taken to prepare the LHMP.

3.2 Local Government Participation

The LHMP is a special-district plan that covers the District's Planning Area, which is the same boundary as the District's service area. The DMA planning regulations and guidance stress that each local government seeking FEMA approval of their mitigation plan must participate in the planning effort in the following ways:

- Participate in the process as part of the HMPC;
- Identify potential mitigation actions; and
- Formally adopt the plan.

For the District's HMPC, "participation" was defined at the outset of the planning process as the following:

- Providing facilities for meetings;
- Attending and participating in three HMPC meetings;
- Completing and returning the WSP Plan Update Guide;
- Collecting and providing other requested data (as available);
- Managing administrative details;
- Engaging specific stakeholder groups and facilitating formal HMPC meetings;
- Making decisions on plan process and content;
- Identifying mitigation actions for the plan;
- Reviewing and providing comments on the Administrative and HMPC plan drafts;
- Informing the public, local officials, and other interested parties about the planning process and providing opportunity for them to comment on the plan;
- Advertising, coordinating, and participating in the public input process; and
- Coordinating the formal adoption of the plan by the Board of Directors (Board).

The District met all FEMA's requirements for plan participation. The District brought together a local planning team with representatives from the District and the District's Board to help collect data, identify mitigation actions and implementation strategies, and review and provide data on plan drafts. The District engaged several federal, state, regional, and local stakeholder representatives from various agencies and municipalities in the region. The District also specifically invited, informed, and involved agencies involved in hazard mitigation or development regulation (Sonoma County); neighboring jurisdictions and water districts (Sonoma Water, City of Sonoma); Community Stakeholders and Non-Governmental Organizations (La Luz Center); and private sector, academia, and other organizations (business representatives, school district, major employers). In most cases, one or more representatives from each District department and each agency attended the HMPC meetings.

The preparation of the LHMP was also intended to assist the District in reducing its risk from natural and man-made hazards by identifying resources, information, and strategies for risk reduction. For the District's HMPC, the intention of the plan is to help guide and coordinate mitigation activities throughout the District's departments. As a result, the HMPC set out to develop a plan that would meet the objectives summarized below.

- The plan would meet or exceed program requirements specified under the DMA of 2000.

- The plan would not only meet Cal OES and FEMA requirements, but also the specific needs of the District.
- The plan would coordinate existing and ongoing plans and programs already established at the District so that high priority initiatives and projects to mitigate possible disaster impacts would be funded and implemented.
- The plan would create a linkage between the LHMP and established plans such as the District's *2025 Water Master Plan* (WMP) so that existing planning mechanisms can be integrated to help the District achieve successful mitigation.

Given plan integration is a key strategy in the success of LHMP implementation, the HMPC focused on consistency between plans and programs at the District. The HMPC also focused on ensuring District representatives consulted with their individual departments in between meetings to ensure existing capabilities were adequately documented in the LHMP and that mitigation actions were thoroughly reviewed and developed by the District. Appendix B provides additional information and documentation of the planning process.

3.3 The Four-Phase/Nine-Step Planning Process

WSP established the planning process for the District's LHMP using the DMA planning requirements and FEMA's associated guidance. This guidance is structured around a four-phase process:

1. Organize Resources
2. Assess Risks
3. Develop the Mitigation Plan
4. Implement the Plan and Monitor Progress

WSP integrated the more detailed nine-step planning process from FEMA's *2025 Local Mitigation Planning Handbook* within the four-phase process. Table 3-1 summarizes the four-phase DMA process, the detailed nine-step planning tasks, and where the results are captured in the plan. The sections that follow describe each planning step in more detail, including information on the LHMP schedule and general timeframe of activities that took place to develop the plan.

Table 3-1 Mitigation Planning Processes Used to Develop the District's LHMP

FEMA 4 Phase Guidance Phases	2025 FEMA Local Mitigation Planning Handbook Steps (44 CFR Part 201)	Location in LHMP
Phase 1: Organize Resources	1: Determine the Planning Area and Resources	Chapters 1, 2, and 3
	2: Build the Planning Team 44 CFR 201.6(c)(1)	Chapter 3, Section 3.3.1
	3: Create an Outreach Strategy 44 CFR 201.6(b)(1)	Chapter 3, Section 3.3.1
	4: Review Community Capabilities 44 CFR 201.6(b)(2) & (3)	Chapter 2, Section 2.2; Chapter 3, Section 3.3.1
Phase 2: Identify Hazards and Assess Risks	5: Conduct a Risk Assessment 44 CFR 201.6(c)(2)(i) 44 CFR 201.6(c)(2)(ii) & (iii)	Chapter 4, Sections 4.1 through 4.3
		Chapter 4, Sections 4.1 through 4.3
Phase 3: Develop a Mitigation Strategy	6: Develop a Mitigation Strategy 44 CFR 201.6(c)(3)(i); 44 CFR 201.6(c)(3)(ii); and 44 CFR 201.6(c)(3)(iii)	Chapter 5, Section 5.2
		Chapter 5, Section 5.3
		Chapter 5, Section 5.4
	7: Review and Adopt the Plan	Chapter 6, Appendix D

FEMA 4 Phase Guidance Phases	2025 FEMA Local Mitigation Planning Handbook Steps (44 CFR Part 201)	Location in LHMP
Phase 4: Implement the Plan and Monitor Progress	8: Keep the Plan Current	Chapter 6
	9: Create a Safe and Resilient Community 44 CFR 201.6(c)(4)	Chapter 6

3.3.1 Phase 1: Organize Resources

Planning Step 1: Organize the Planning Effort

With the District's commitment to develop the plan, WSP worked with the District's Administration and Finance and Operations departments to establish the framework and organization for the planning process. Organizational efforts were initiated with the District to inform and educate the plan participants of the purpose and need for the District's LHMP. WSP held an initial call on October 3, 2025, to discuss the organizational aspects of this planning process with District staff. The District formally initiated the planning process with the HMPC on November 13, 2025. The schedule of subsequent planning activities is summarized in Table 3-2.

Table 3-2 Local Hazard Mitigation Plan Schedule of Planning Activities

Project Task	Meeting Date(s)
Project Kick-Off Meeting	October 3, 2025
Circulate Draft HMPC Invitee List	October 9, 2024
HMPC Meeting #1	November 13, 2025
Submit Draft Community Engagement Strategy	November 11, 2025
District and HMPC Review of Community Engagement Strategy	November 12, 2025
Submit Final Community Engagement Strategy	November 13, 2025
HMPC Meeting #2	February 23, 2026
Submit Hazard Identification and Risk Assessment	March 16, 2026
Public Workshop	March 12, 2026
Revise Existing Goals and Objectives	March 12, 2026
HMPC Meeting #3	March 12, 2026
Compile Mitigation Action Worksheets	March 18, 2026
Submit 1st Administrative Draft LHMP	March 25, 2026
District and HMPC provides consolidated comments on 1st Administrative Draft LHMP	April 3, 2026
Submit 2nd Administrative Draft LHMP	April 10, 2026
Complete FEMA Region IX Review Tool: Elements A through D	April 13, 2026
Circulate Public Review Draft LHMP	May 1, 2026
Public Review Ends (2-week public review)	May 1 – May 14, 2026
Submit Final Draft LHMP to Cal OES for review (45-day review period)	May 8, 2026
Submit Final Draft LHMP to FEMA Region IX for review	June 22, 2026

Project Task	Meeting Date(s)
Board Hearing*	TBD

*Board of Directors Meetings are held on the first Tuesday of each month at 6:30 p.m.

Invitations to the kick-off meeting were extended to key District staff, federal and state agencies, Sonoma County, neighboring municipalities, and key stakeholders in Sonoma Valley. Using FEMA planning guidance, representatives from each District department established the base membership for the HMPC stakeholder committee and two Board directors participated. The HMPC also included multiple representatives from state and local agencies, and stakeholders from the local school district, community hospital, and other organizations. Key representatives from neighboring communities included staff from Sonoma County, City of Sonoma, Sonoma Water, Sonoma Valley Groundwater Sustainability Agency (GSA), Sonoma Union School District, La Luz Center, and Sonoma Ecology Center. The list of agencies and individuals invited to participate is shown in Table 3-3.

Table 3-3 List of HMPC Participants for the 2026 LHMP Update

Stakeholder Group	Agency/Organization	Name
Local and regional agencies involved in hazard mitigation activities	Valley of the Moon Water District, General Manager	Matt Fullner
	Valley of the Moon Water District, Administrative Manager	Amanda Hudson
	Valley of the Moon Water District, Operations Manager	Clayton Church
	Sonoma County, Office of Emergency Services	Arielle Bubu-Jones
	Sonoma County, Office of Emergency Services	Pat Gilardi
	Sonoma County, First District	Betzy Picazo Chavez
	City of Sonoma, Public Works Director	Mike Berger
	Sonoma Valley Fire Protection District	Steve Akre
	Sonoma Valley Groundwater Sustainability Agency	Bill Keene
	Sonoma Valley Groundwater Sustainability Agency	Caitlin Cornwall
	Sonoma Valley Unified School District	Rena Seifts
	Sonoma Valley Unified School District	Steve Jordan
Agencies that have the authority to regulate development	Sonoma County, Office of Emergency Services	Arielle Bubu-Jones
	Sonoma County, Office of Emergency Services	Pat Gilardi
	Sonoma County, First District	Betzy Picazo Chavez
	City of Sonoma, Public Works Director	Mike Berger
Neighboring communities	Sonoma County, Office of Emergency Services	Arielle Bubu-Jones
	Sonoma County, Office of Emergency Services	Pat Gilardi
	Sonoma County, First District	Betzy Picazo Chavez
	City of Sonoma, Public Works Director	Mike Berger
	City of Petaluma, Public Works Project Manager	Diane Ramirez
	Transition Sonoma Valley, Sierra Club Sonoma Group	Tom Conlon

Stakeholder Group	Agency/Organization	Name
Representatives of businesses, academia, and other private organizations	Sonoma News	Isabel Beer
	Sonoma Ecology Center	David Morell
	Kenwood Press	Jay Gamel
	Member of the Public	Donna Piranha
Representatives of nonprofits organizations, including community-based organizations that work directly with and/or provide support to underserved communities and socially vulnerable populations, among others.	La Luz Center	Sharon Somogyi
	Team Rubicon	John Saguto

The HMPC was established as a result of this effort, as well as through interest generated through outreach conducted for this project, which is outlined in more detail in the Community Engagement Strategy. As part of this effort, the District and HMPC also tracked participation by other stakeholders and external groups that indicated they were interested in being part of the process during the public survey, public workshop, and public review period.

The HMPC collectively developed the plan with leadership from the District and facilitation by WSP. The HMPC meetings also had participation from other agency stakeholders with an interest in hazard mitigation, which is described in Planning Step 3. A list of participating HMPC representatives is also included in Appendix A. This list includes all HMPC members that attended one or more HMPC meetings detailed in Table 3-2 and most of the core members shown in Table 3-3. Most of these stakeholders were encouraged to share the public press releases, re-share the public survey, distribute Save the Date flyers to other interested parties for the public workshop, and post materials on their social media channels in an effort to further increase public participation. The District also utilized the support of staff in order to collect and provide requested data and to conduct timely reviews of draft documents. Note that the core HMPC group was also supplemented by input from government and stakeholder representatives that contributed to the planning process as identified in Planning Step 3: Coordinate with Other Department and Agencies.

Internal District Kickoff Meeting

The planning process officially began with a kick-off meeting on October 3, 2025. The meeting covered the scope of work and an introduction to the DMA of 2000 requirements. Participants were provided with a Plan Update Guide, which included worksheets to facilitate the collection of information necessary to support development of the plan. Using FEMA guidance, WSP designed these worksheets to capture information on past hazard events since the previous plan, identify hazards of concern to the District, quantify values at risk to identified hazards, inventory existing capabilities, and record possible mitigation actions. A copy of WSP's Plan Update Guide for this project is included in Appendix B. The District completed and returned the worksheets in the Plan Update Guide to WSP staff for incorporation into the plan.

During the planning process, the HMPC communicated through face-to-face meetings, email, and monthly Microsoft Teams video conferences, and added information to the District's LHMP Webpage. Draft documents were distributed via email to the District's project manager and then distributed to the HMPC stakeholders. The HMPC met three times during the planning period (October 3, 2025, through March 12, 2026).

The dates and purposes of these meetings are described in Table 3-4. The HMPC also met internally between meetings on a monthly basis to help the District's project manager track deliverables, worksheet materials, and public outreach documentation. Agendas for each of the meetings and lists of attendees are included in Appendix B.

Table 3-4 Schedule of Planning Meetings

Meeting Type	Meeting Topic	Meeting Date(s)
HMPC Meeting #1	Kick-off meeting: introduction to DMA, the planning process, and hazard identification	June 25, 2020
HMPC Meeting #2	Risk assessment overview and work session on goal development	September 24, 2020
HMPC Meeting #3	Development of mitigation actions; selection and prioritization of mitigation recommendations	December 10, 2020

HMPC Meeting #1

At HMPC Meeting #1, the planning process scope and schedule were discussed, along with the list of hazards addressed in the plan, followed by a presentation that summarized hazard vulnerability. The group was asked what hazards presented the greatest concern and completed a poll to rank the most critical natural, human-health, and human-caused hazards in the District's Planning Area.

HMPC Meeting #2

HMPC Meeting #2 focused on the findings from the Risk Assessment and the specific vulnerabilities to the District's critical water supply assets and infrastructure that need to be addressed in the mitigation strategy. The HMPC also developed broad goals and objectives during HMPC Meeting #2. This led to further discussion and the prioritization of mitigation actions developed at the HMPC Meeting #3.

HMPC Meeting #3

HMPC Meeting #3 focused on the update of the District's Mitigation Strategy. The HMPC reviewed mitigation action categories such as the four A's: how to avert the hazard, avoid the hazard, alter the hazard, and adapt to the hazard. Mitigation topics also covered the four FEMA mitigation types: plans and regulations, structure and infrastructure projects, natural systems protection, and education and outreach efforts. The HMPC participated in four interactive exercises to update the plan that included staff and stakeholders that attended the meeting in-person and virtually. These exercises included completion of a goals worksheet, review of progress updates on existing mitigation actions, development of new mitigation actions, and a discussion on selection and prioritization criteria. The HMPC decided to rank the actions once a more complete list of actions was compiled, and this was conducted later in the planning process.

Planning Step 2: Involve the Public

Early discussions with the District established the initial plan for public involvement. At the kick-off meeting, the HMPC discussed options for public involvement and agreed to an approach using established public information mechanisms and resources within the community. This approach was outlined in the project's Community Engagement Strategy (included in Appendix B). The approach was also supported and implemented by the District's general manager.

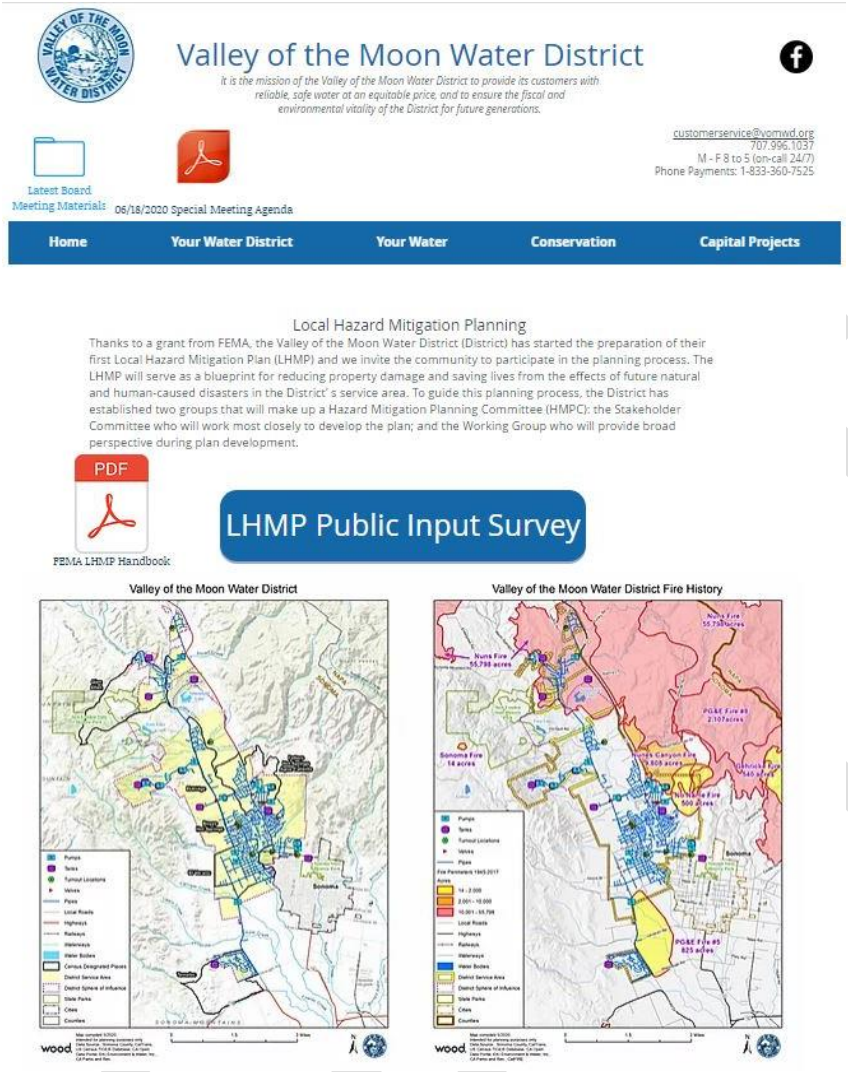
Public outreach was initiated during the plan development process with an informational press release to notify the public of the purpose of DMA of 2000 and the hazard mitigation planning process for the District. The District project manager distributed a press release to their social media platforms and circulated a public survey prior to a public workshop. The public survey was circulated for a 3-month

period. Public involvement activities also included the development of the LHMP Webpage, organization of the public workshop, and circulation of social media postings, and a 14-day public review period. The District compiled public comments received during the public workshop and based on the online survey.

Project Webpage

At the beginning of the planning process, the District updated a LHMP Webpage linked to the District's main website to keep the public informed on hazard mitigation, the development of the LHMP and the planning process, and as a place to solicit public input. The LHMP Webpage includes a background section on hazard mitigation planning and the DMA of 2000. It also highlights recent natural hazard events that have occurred in the District's Planning Area and the Sonoma Valley portion of unincorporated Sonoma County. The LHMP Webpage publicized on all media releases, mailings, newsletters, public workshop advertisements, and the online survey. It has a sidebar with the meeting agenda's, minutes, sign-in sheets, and presentations from the various HMPC meetings and the public workshop. The District also intends to keep the LHMP Webpage active after the plan is completed to keep the public informed about the status of the mitigation actions. Figure 3-1 shows the District LHMP Webpage. The District made the Public Review Draft LHMP available on the LHMP Webpage in May 2026 and it is available here: https://www.vomwd.org/local-hazard-mitigation.

Figure 3-1 Valley of the Moon Water District Local Hazard Mitigation Plan Webpage



Public Workshop

An in-person public workshop was held on March 12, 2026. Where appropriate, stakeholder and public comments were incorporated into the plan, including the sections that address mitigation goals and strategies. The public workshop scheduled and organized by the District is detailed in Table 3-5.

Table 3-5 Public Workshop

Meeting Topic	Meeting Dates	Meeting Locations
Public Workshop	March 12, 2026	In-Person Workshop at District Headquarters

The Public Workshop was held to solicit public and stakeholder input during draft development of the plan. Public outreach included an email distribution with a notice of the public meeting to the HMPC with direction to share with other associations, boards and committees, and postings around the workplace. The meeting notice was also posted on the District's LHMP Webpage. Five people participated in the public workshop. The public workshop was recorded; other workshop materials are included in Appendix B.

Figure 3-2 Public Workshop

Source: WSP 2026

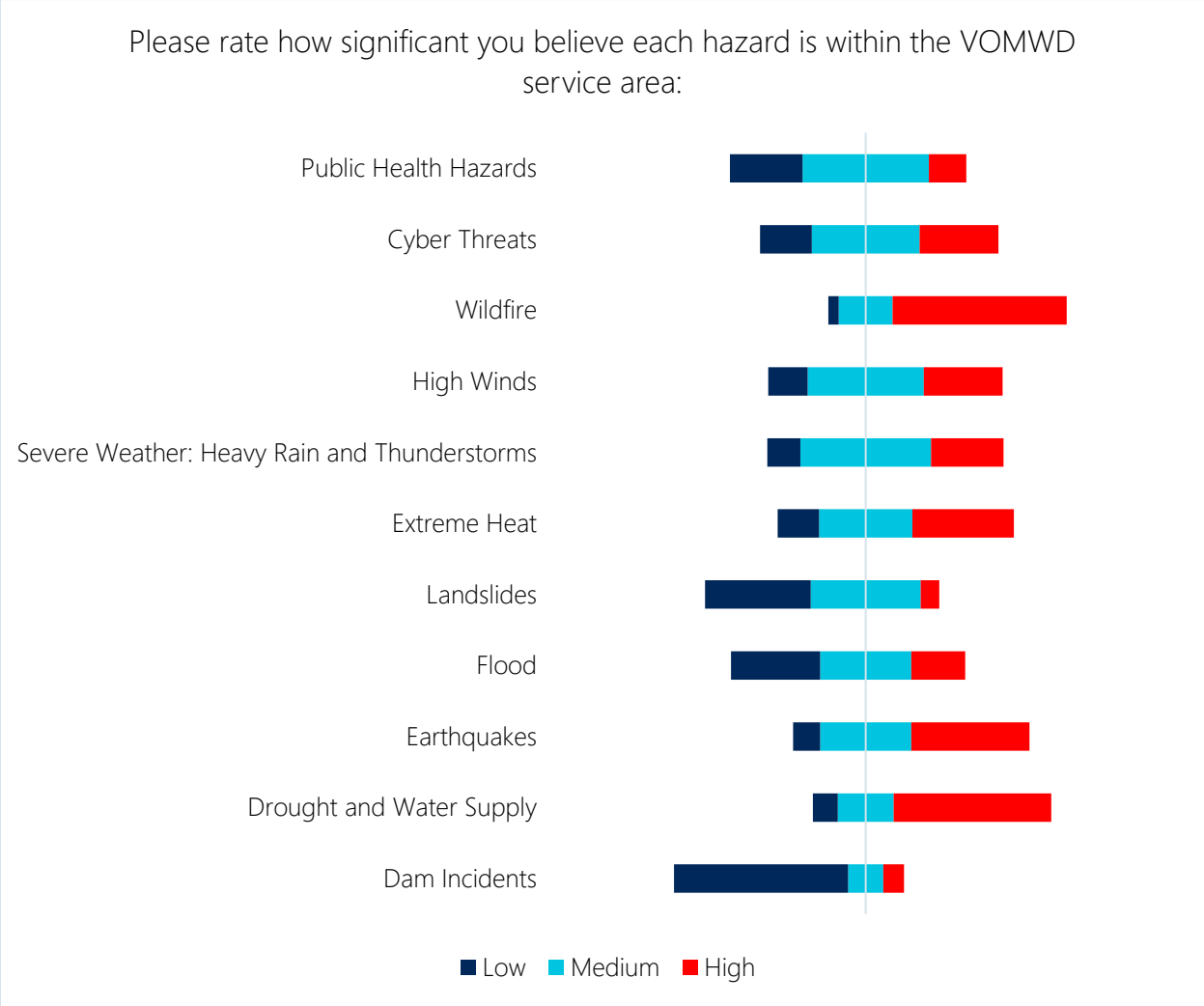
Public Survey

During the planning process and drafting stage, a public survey was developed as a tool to gather public input. The online survey was for the public to provide feedback to the HMPC on topics related to hazard concerns and reducing hazard impacts. The public survey provided an opportunity for public input during the planning process and prior to finalization of the plan. It gathered public feedback on concerns about wildfires, floods, earthquakes, climate change, and other hazards and solicited input on strategies to reduce their impacts. The survey was released on November 20, 2025, and closed on January 19, 2026 (3-month comment period). The HMPC provided links to the online survey by distributing it using social media, email, posting the link on the District Webpage, and making the survey link available on information flyers included in customer bills. 116 responses were received on the survey. This information was shared with the HMPC to inform the process.

The survey included a total of 14 questions. There was a short section of questions on demographics, specifically on whether participants were customers within the District's Planning Area. The next section included questions on ranking hazard significance. The results generally track with the significance levels noted in Chapter 4 of this plan, with earthquake, drought and water supply, flooding, and wildfire being considered the most significant. Drought, high wind events, and public safety power shutoffs (PSPS) also ranked highly in significance based on the public input. The last section of the survey focused on questions related to mitigation actions that the District should consider in the plan. The results indicated that back-up power/generators for critical facilities, critical facilities resiliency, water conservation, wildfire fuels treatment projects, and aquifer recharge programs were popular topics to the public. These results were shared with the HMPC and considered during the planning process. Figure 3-3 shows an example

of one of the public survey responses from the survey. The full results of the survey are included in Appendix B.

Figure 3-3 Valley of the Moon Water District Public Survey Response



Source: WSP 2026

Social Media

The District used the following social media platforms to circulate information on the LHMP:

- Valley of the Moon Water District Facebook (200+ followers);

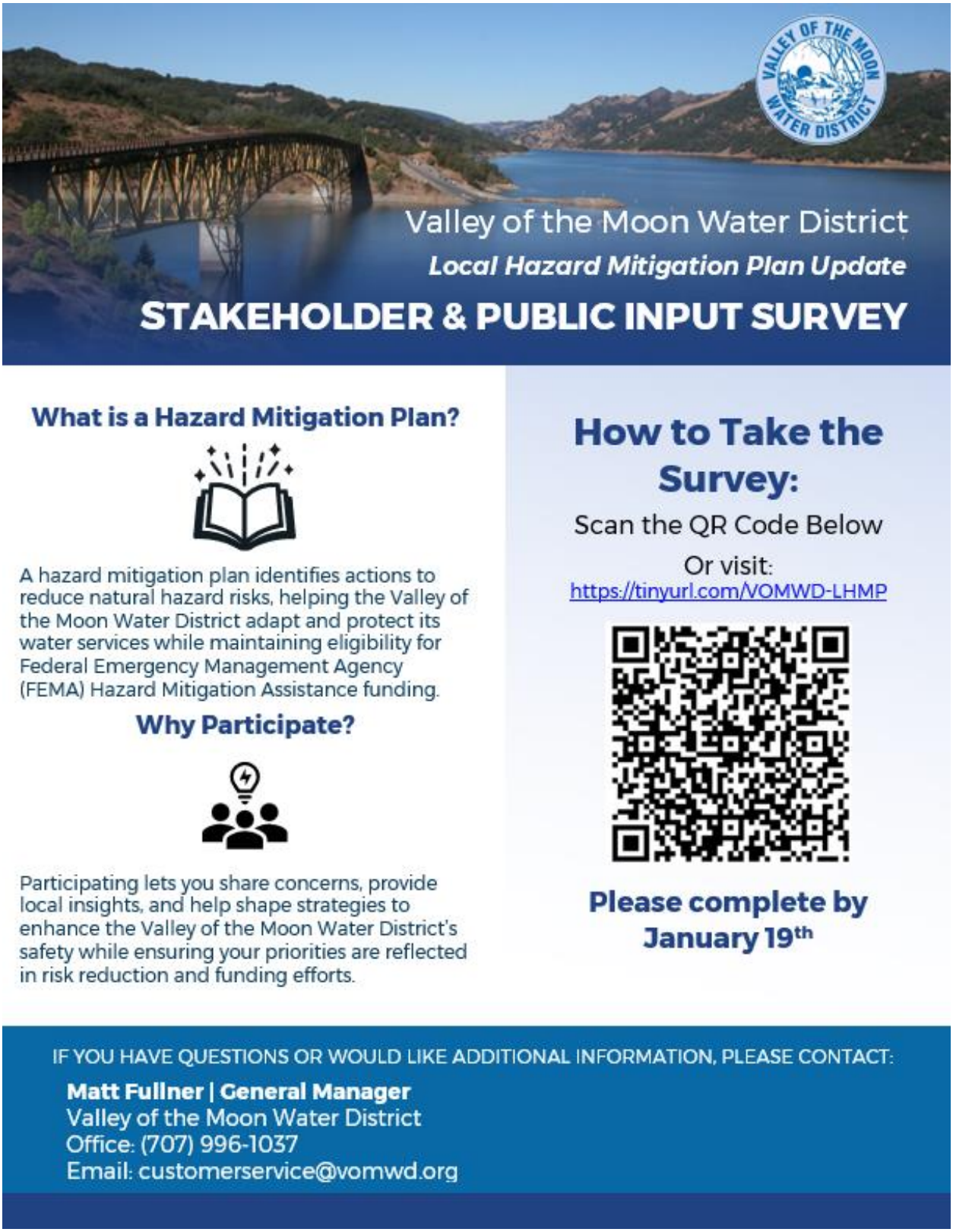
An announcement posted on the social media platform highlighted the kick-off of the LHMP planning process, advertised the District's LHMP Webpage and other events, included a link to the online survey, notified the public about meetings and workshop, and announced the availability of the plan for public input and comment. Figure 3-4 is a notice of the community workshop on Facebook.

Figure 3-4 Social Media Announcement for Community Workshop on District's Facebook Page

Press Releases

The District distributed and circulated press releases over the course of the LHMP development. The District's project manager and WSP staff also encouraged HMPC participants and stakeholders to distribute press releases during the project. Press releases were distributed as informational flyers, advertisements, and public notices. These communication platforms were used to spread the news about the LHMP and invite the public to participate in the process. Figure 3-5 is an example of a press release used to announce the public survey and to notify the public about the update.

Figure 3-5 Press Release for the Valley of the Moon Water District LHMP Public Survey



Public Review and Comments on the Draft LHMP

The District circulated the Public Review Draft LHMP for 14 days; it was posted on the District's LHMP Webpage and circulated from May 1, 2026 through May 14, 2026. The District solicited public input on the Draft LHMP by collecting and reviewing comments received during the public review period. These comments were submitted by email and through an online electronic comment form. The District received a total of (INSERT # OF COMMENTS) public comments on the plan. A summary of these comments and the comment-response matrix is included in Appendix B. The District incorporated public input by reviewing the comments and revising the LHMP prior to submittal to Cal OES and FEMA Region IX.

Planning Step 3: Coordinate with Other Departments and Agencies

Early in the planning process, the HMPC determined that data collection, mitigation strategy development, and plan approval would be greatly enhanced by inviting state and federal agencies and organizations to participate in the process. Based on their involvement in hazard mitigation planning, their landowner status in the County, and/or their interest as a neighboring jurisdiction, representatives from the following agencies were invited to participate on the HMPC:

- City of Sonoma
- Kenwood Press
- La Luz Center
- Members of the Public
- Sonoma County
- Sonoma Ecology Center
- Sonoma News
- Sonoma Sun
- Sonoma Valley Fire Protection District
- Sonoma Valley Groundwater Sustainability Agency
- Sonoma Valley Groundwater Sustainability Agency Advisory Committee
- Sonoma Valley Unified School District
- Sonoma Water
- Team Rubicon
- Transition Sonoma Valley, Sierra Club Sonoma Group
- VOMWD

WSP in coordination with the District and the HMPC also used technical data, reports, and studies from the following agencies and groups:

- American Red Cross
- California Department of Finance
- California Department of Fish and Game
- CAL FIRE
- California Department of Parks and Recreation Office of Historic Preservation
- California Department of Public Health
- California Department of Water Resources
- California Emergency Management Agency
- California Geological Survey
- Sonoma County Department of Health Services Environmental Health and Safety Division
- U.S. Army Corps of Engineers
- U.S. Center for Disease Protection
- U.S. Bureau of Land Management
- U.S. Bureau of Reclamation
- U.S. Fish and Wildlife Service
- U.S. Forestry Service
- USGS
- U.S. Census Bureau
- Federal Emergency Management Agency
- National Weather Service
- National Oceanic and Atmospheric Administration, National Climatic Data Center
- National Resource Conservation Service

Several opportunities were provided for the above groups to participate in the planning process. At the beginning of the planning process, invitations were extended to the first group to actively participate on the HMPC and as a stakeholder representative to support the DMA planning process. Specific participants from these groups are detailed in Table 3-3 and in Appendix A.

City of Sonoma, Sonoma County, and Sonoma Water staff worked most closely with the District as part of the HMPC. Others assisted in the process by providing data directly as requested in the Plan Update Guide or through data contained on their websites or as maintained by their offices. These groups were also invited to participate through the public outreach process, which included a public workshop as previously described. As part of the HMPC and public outreach processes, all groups were invited to review and comment on the plan during public review and prior to submittal to Cal OES and FEMA.

Other Community Planning Efforts and Hazard Mitigation Activities

Coordination with other community planning efforts is paramount to the success of this plan. Hazard mitigation planning involves identifying existing policies, tools, and actions that will reduce a community's risk and vulnerability to hazards. As a water supply provider and special district, the District uses a variety of comprehensive water supply forecast and planning mechanisms, such as an Urban Water Management Plan (UWMP) to guide growth and development. Integrating existing planning efforts and mitigation policies and action strategies into this plan establishes a credible and comprehensive plan that ties into and supports other community programs. The development of this plan incorporated information from the plans, studies, reports, and initiatives listed in Table 3-6. Other related planning efforts were inventoried in the capability assessment in Chapter 2.

Table 3-6 Incorporated Planning Mechanisms

District Plans	How Plan is Incorporated in LHMP
Water Master Plan (2025)	The District's water supply and distribution system facilities and infrastructure are assessed in the Water Master Plan (WMP). The LHMP incorporated information on the District's existing infrastructure and the capacity needs for future demand, and cross referenced the recommended capital improvement projects related to water supply and shortage deficiencies in the LHMP. The LHMP references the capital improvement projects included in the WMP and emphasized the three levels of prioritization in the Capital Improvement Plan (CIP) section in the LHMP mitigation strategy. These prioritization levels were also discussed in comparison to other prioritization criteria at HMPC Meeting #3. This process ensures the mitigation actions are consistent and complement the same or similar actions in the WMP.
Urban Water Management Plan (2020)	The UWMP evaluates the required potable water supplies and transmission and storage facilities required to serve the District's customers in 2020. The LHMP integrates availability and reliability information on the District's existing and future water supplies and cross references goals and projects outlined in the UWMP, specifically those related to new groundwater facilities. Similar mitigation actions were prioritized by the HMPC during HMPC Meeting #3 and incorporated into the District's mitigation strategy. The LHMP additionally integrates water conservation principles and strategies developed in the plan related to the District's capital improvement program, Water Supply Contingency Plan (WSCP), demand management measures, and plans for potable and groundwater system facilities.

District Plans	How Plan is Incorporated in LHMP
Five-Year Capital Improvement Program	The basis for this plan is the District's WMP and significant projects outlined in the WMP are included in the District's 5-year CIP. The plan is also included in the District's annual budget plan. The LHMP integrated the top priorities from the CIP into the planning process and mitigation alternative development associated with HMPC Meeting #3 and the District's LHMP mitigation strategy.
California State Hazard Mitigation Plan (2023)	Under 44 CFR Section 201.6, LHMPs must be consistent with the California State Hazard Mitigation Plan (SHMP). In updating this plan, HMPC and consultant staff reviewed California's SHMP to identify key relevant state plan elements. The LHMP reviewed and compared the goals and hazard assessments of the SHMP with those in the 2026 Sonoma County MJHMP, focusing on newly identified risks affecting community resilience. The LHMP also incorporated disaster declaration data and key findings from the SHMP into its update. Following the structure of the 2023 California SHMP, the District and HMPC addressed climate change hazards throughout the Risk Assessment, noting that climate change is expected to worsen existing risks in the District's Planning area.
California State Drought Contingency Plan (2016)	The District reviewed the state's strategies and actions to prepare for and respond to future droughts and other water shortage events, as well as plan goals related to adequate water supply, species protection, and water management.
California Water Plan Update (2023)	The District reviewed 5-year update to plan to integrate information on water supply trends in California that also occur in Sonoma County. Integrated water management toolbox strategies to reduce water demand, increase water supply, improve water quality, practice resource stewardship, and improve flood management were considered.
Sonoma County Multi-Jurisdictional Hazard Mitigation Plan (Draft 2026)	Hazard profile information from the 2026 Sonoma County MJHMP was incorporated throughout the LHMP, where appropriate; this included information on earthquakes, flooding, landslides, wildfire hazards. The District and HMPC assumed this plan would be adopted prior to the District's 2026 LHMP. The HMPC also reviewed the Sonoma County MJHMP goals during the development of the District's LHMP goals and objectives. There are comparative tables on the hazards profiled in the state and county plan to those considered in the District's LHMP. This information was helpful for the HMPC to compare which hazards to address and which to prioritize for the District's Planning Area.
Sonoma County Community Wildfire Protection Plan (2023)	The District staff reviewed the County's Community Wildfire Protection Plan (CWPP) and discussed the prioritized treatment areas and mitigation strategies during HMPC Meeting #3. The Sonoma Valley Fire District was invited to participate in all meetings.
Sonoma County Operational Area Emergency Operations Plan Annex: Pandemic Response (2020)	The District reviewed the Annex's outlines of policies and procedures in place to guide local government and special districts during the outbreak of pandemic diseases. This plan serves as an update to the Sonoma County Department of Health's 2007 Pandemic Flu Plan. It explains risk levels and major impacts to the community.

District Plans	How Plan is Incorporated in LHMP
	The District's HMPC prioritized public health hazards in the LHMP; this Annex was reviewed, and key actions related to the District's authority as a special district were integrated into the mitigation strategy.
Sonoma County Operational Area Emergency Operations Plan (2025)	The Sonoma County Operations Emergency Operations Plan (EOP) addresses the planned response to extraordinary situations associated with large-scale disasters affecting the County. It establishes emergency management organization, operational concepts, and a platform for planning and response to all hazard emergencies. The EOP facilitates multi-jurisdictional coordination between County, local governments, and special districts. Strong emphasis on mitigation phase and post-disaster mitigation during recovery is discussed in plan. The EOP discusses drought threats and the various water agencies that supply water to the urbanized areas in the County. These threats were reviewed in the development of the District's risk assessment to ensure the key findings were consistent in the District's LHMP. The District reviewed planning methods for mitigation, such as amending ordinances, initiating structural retrofits, assessing tax abatements, assessing land use patterns, and emphasizing public education.
Sonoma County Emergency Action Plan	The County's Emergency Action Plan (EAP) identifies immediate responses to an emergency or disaster in context of the environment. The County's plan adheres to the California Occupational Safety and Health Administration (OSHA) standards. The District implements a water district-specific EAP; this plan was recently updated to integrate emergency measures that address employee health and safety in the workplace to prevent the spread of human-health hazards, such as COVID-19 pandemic.
Sonoma Valley Groundwater Sustainability Agency (GSP) Groundwater Sustainability Plan for the Sonoma Valley Groundwater Subbasin (2021)	The GSP establishes a standard for sustainability of groundwater management and use, and determines how the basin will achieve this standard by 2042. The plan integrates the interests of many users and uses of groundwater resources within the Sonoma Valley Basin through public and community engagement. The District and several members of the HMPC familiar with the GSP discussed key hazards and mitigation actions addressed in the draft plan during HMPC meetings, and incorporated specific information related to drought mitigation actions into the LHMP.
Sonoma County Flood Insurance Study (2024)	Sonoma County has participated in the National Flood Insurance Program (NFIP) since 1978 and implemented their floodplain regulations in 1982. The District reviewed the latest 2024 Flood Insurance Study (FIS) and Digital Flood Insurance Rate Maps (DFIRMs); these DFIRMs were used to determine whether critical water assets were identified within flood hazard zones.

Other documents were reviewed and considered, as appropriate, during the collection of data to support Planning Steps 4 and 5, which include the hazard identification, vulnerability assessment, and capability assessment. Appendix C identifies additional documents and community planning efforts utilized in the development of this plan, such as FEMA mitigation planning guides and other federal and state technical sources. Specific references relied on in the development of this plan are also sourced throughout the document as appropriate.

3.3.2 Phase 2: Assess Risks

Planning Steps 4 and 5: Identify the Hazards and Assess the Risks

WSP led the HMPC in a comprehensive research effort to identify and document all the hazards that have, or could, impact the District's Planning Area. Plan Update Guide worksheets were developed and used in this effort to aid in determining hazards and vulnerabilities and where risk varies across the Planning Area. Geographic information systems (GIS) were used to display, analyze, and quantify hazards and vulnerabilities. The HMPC also conducted a capability assessment to review and document the District's current capabilities to mitigate risk and vulnerability from hazards.

Using this information, WSP developed the risk assessment portion of the plan, which contained the hazard identification, the vulnerability assessment, and the capability assessment.

- **Vulnerability Assessment**—The District assessed their critical water supply and distribution facilities at risk to natural hazards. These assets included critical water facilities and infrastructure, such as pump stations and water tanks; and natural, historic, and cultural assets. The HMPC also analyzed development trends in hazard areas within Sonoma Valley.
- **Capability Assessment**— The HMPC conducted a capability assessment update to review and document the current capabilities in the Planning Area to mitigate risk and vulnerability from natural hazards. By collecting information about existing state and local government programs, policies, regulations, ordinances, and emergency plans, the HMPC can assess those activities and measures already in place that contribute to mitigating some of the risks and vulnerabilities identified.

WSP completed the risk assessment in March 2026, and the information was presented at the second and third HMPC Meetings in February and March 2026. A more detailed description of the risk assessment process and the results are included in Chapter 4 Risk Assessment.

3.3.3 Phase 3: Develop the Mitigation Plan

Planning Steps 6 and 7: Set Goals and Review Possible Activities

WSP facilitated brainstorming and discussion sessions with the HMPC on March 12, 2026, including a description of the purpose and process of developing planning goals, as well as discussion of a comprehensive range of mitigation alternatives, and a method of selecting recommended mitigation actions using a series of selection criteria. The HMPC was also requested to review and update the existing mitigation goals as part of a Goals Worksheet exercise. Additional details of the process to develop goals and actions is included in Chapter 5 Mitigation Strategy. Documentation on the process the HMPC used to develop the goals and strategy is in Appendix B.

Planning Step 8: Draft an Action Plan

Based on input from the HMPC during the March 12, 2026, meeting, and from subsequent review of the draft risk assessment and the goals and activities identified in Planning Steps 6 and 7, WSP produced a complete first draft of the plan. This complete draft was internally circulated for HMPC review and comment via email in March 2026. HMPC and agency comments were integrated into the second draft in April 2026.

Public Review Draft LHMP

The Public Review Draft LHMP was advertised and distributed to collect public input and comments. The District circulated the Public Review Draft LHMP for 14 days from May 1, 2026 through May 14, 2026. During this time, WSP integrated comments and issues from the public and stakeholders, as appropriate,

along with additional agency and other stakeholder internal review comments. During the public review period, the District received (Insert Number of Comments) comments from the public. Public comments are briefly summarized in Table 3-6. Detailed responses to public comments are included in Appendix B.

Table 3-6 Summary of Comments Received during Public Review

Comment	Response
Comment #1	
Comment	Insert
Comment #2	
Comment	Insert
Comment #3	
Comment	Insert
Comment #4	
Comment	Insert

WSP will produce a final Draft LHMP in May 2026 for Cal OES and FEMA Region IX staff to review and approve, contingent upon final adoption by the District Board of Directors.

3.3.4 Phase 4: Implement the Plan and Monitor Progress

Planning Step 9: Adopt the Plan

In order to secure buy-in and officially implement the plan, the plan will be reviewed by the HMPC and adopted by the Board on the dates included in the corresponding resolution in Appendix D: Adoption Resolution.

Planning Step 10: Implement, Evaluate, and Revise the Plan

The true worth of any mitigation plan is in the effectiveness of its implementation. In the previous steps of the planning process the HMPC's efforts have been directed at researching data, gathering information for the plan, and developing appropriate mitigation actions. Each recommended action includes key descriptors, such as a lead entity and possible funding sources, to help initiate implementation. An overall implementation strategy for the District's LHMP is described in Chapter 6 Plan Implementation and Maintenance.

Finally, there are numerous organizations within the District's Planning Area whose goals and interests' interface with hazard mitigation. Coordination with these other planning efforts, as addressed in Planning Step 3, is key to the ongoing success of this plan and mitigation in the District and is addressed further in Chapter 6, along with a plan update and maintenance schedule and a strategy for continued public involvement.

4 RISK ASSESSMENT

44 U.S. Code of Federal Regulations Requirement §201.6 Local Mitigation Plans (c)(2): [The plan shall include] A risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

As defined by the Federal Emergency Management Agency (FEMA), risk is a combination of hazard, vulnerability, and exposure. "It is the impact that a hazard would have on people, services, facilities, and structures in a community and refers to the likelihood of a hazard event resulting in an adverse condition that causes injury or damage."

A key step in preventing disaster losses in the Valley of the Moon Water District's (District) service area is developing a comprehensive understanding of the District's hazards, vulnerabilities, and risks. The risk assessment process identifies and profiles relevant hazards and assesses the exposure of lives, property, and infrastructure to these hazards, as well as the vulnerabilities of a community. The process allows for a better understanding of a jurisdiction's or special district's potential risk to hazards and provides a framework for developing and prioritizing mitigation actions to reduce risk from future hazard events. Environmental and social impacts are taken into consideration wherever possible. The following terms are used throughout the Plan.

- **Exposure:** The people, property, or infrastructure that could be affected or lost if a hazard event occurs. It refers to what is located within the geographic area that a hazard could impacts, regardless of whether damage actually occurs.
- **Hazard:** Event or physical condition that has the potential to cause fatalities, injuries, property damage, infrastructure damage, agricultural loss, damage to the environment, interruption of business, other types of harm or loss.
- **Risk:** The potential for damage, loss, or other impacts created by the interaction of hazards with vulnerabilities.
- **Vulnerability:** Degree of susceptibility to physical injury, harm, damage, or economic loss; depends on an asset's construction, contents, and economic value of its functions.

The relationship between hazards, vulnerabilities, and risk is depicted in Figure 4-1. This risk assessment covers critical water transmission and distribution facilities within the District's service area, or Sphere of Influence (SOI) boundary, herein referred to as the District's Planning Area. In sections of this chapter, critical facilities outside the District's service area that could provide back-up water supply are also addressed.

Figure 4-1 Risk Graphic

This risk assessment followed the methodology described in the FEMA *Local Mitigation Planning Handbook* (FEMA 2023), which breaks the assessment into a five-step process:

- Identify hazards
- Describe hazards
- Identify assets
- Analyze impacts
- Summarize vulnerability

In other words, this risk assessment evaluates potential loss from hazards by assessing the vulnerability of the District's water utility services, critical facilities, buildings and infrastructure, and customers and staff. Data collected through this process has been incorporated into the following sections of this chapter:

- **Section 4.1 Hazard Identification** profiles the natural hazards that threaten the District's Planning Area and describes why some hazards have been omitted from further consideration.
- **Section 4.2 Asset Summary** describes the methodology for determining vulnerability of the Planning Area to the identified hazards.
- **Section 4.3 Hazard Profiles and Risk Assessment** discusses the threat to the Planning Area and describes previous occurrences of hazard events and the likelihood of future occurrences. All the hazards identified in Section 4.1 are profiled and assessed individually in this section. Research and information from the District's Hazard Mitigation Planning Committee (HMPC) are integrated into this section. This section also includes the identified vulnerability to each of the priority hazards, describing the impact that each hazard would have on the District. The vulnerability assessment quantifies, to the extent possible, using best available information, assets at risk to hazards and estimates potential losses.

If any location information of the District's water supply infrastructure is considered sensitive, this spatial information was excluded from this assessment. Sensitive information may include portions of the District's potable water supply and distribution system (e.g. water pipelines, etc.) or cross references to other risk and vulnerability assessments and reports. For these instances, the vulnerability of the potable water supply facilities is addressed more broadly and qualitatively compared to the level of detail considered for other water facilities. Additional information on the District's Planning Area as it pertains to this plan is provided in Chapter 2 District Profile.

4.1 Hazard Identification

44 U.S. Code of Federal Regulations Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the type…of all natural hazards that can affect the jurisdiction.

The first step in developing a risk assessment is identifying the natural hazards. The HMPC conducted a hazard identification poll during the first planning meeting to determine the hazards that threaten the Planning Area.

4.1.1 Methodology and Results

Using existing natural hazards data and input gained through planning meetings, the HMPC agreed upon a list of natural and public hazards that could affect the District. Hazards data was examined to identify and assess the significance of these hazards to the Planning Area and to prioritize which hazards to address in detail in the risk assessment. The sources of data included information from the California Office of Emergency Services (Cal OES), FEMA, the National Oceanic and Atmospheric Administration (NOAA), Sonoma County Department of Emergency Management, and other sources as referenced in this assessment. The assessment relied on relevant District planning documents, such as the *2026 Draft Seismic Vulnerability Assessment and Development of a Prioritized Capital Improvement Project List, 2026 Community Water System Risk and Resilience Assessment (Seismic Vulnerability Assessment Report), 2026 Risk and Resilience Assessment (RRA), 2025 Water System Master Plan Update*, *2020 Urban Water Management Plan* (UWMP), and adopted hazard mitigation plans in the region (i.e., *Sonoma County Multi-Jurisdictional Hazard Mitigation Plan* (MJHMP). The assessment also references the *2021 Sonoma Valley Groundwater Sustainability Plan for the Sonoma Valley Groundwater Subbasin* (SVGSP), *2019-2020 Sonoma County Civil Grand Jury Investigation*, and three subsequent companion reports to the investigation: *Will There Be Water After an Earthquake?, Emergency Water Shortages in Sonoma Valley*, and *Sonoma Valley Regional Water Resources.*

Table 4-1 below provides a crosswalk of the hazards identified in the *2026 Sonoma County MJHMP*, *2026 Sonoma County Water Agency Annex to the Sonoma County MJHMP (*herein referred to as the Sonoma Water Annex), and *2023 California State Hazard Mitigation Plan* (SHMP). The crosswalk was used to develop a list of preliminary hazards for the HMPC to evaluate which were most relevant to the District's Planning Area.

The significance of each hazard was measured in general terms and focused on key criteria such as frequency and resulting damage, which includes deaths, injuries, and property and economic damage. The natural and human-caused hazards evaluated as part of this plan include those that occurred in the past or have the potential to cause significant human and/or monetary losses in the future.

Table 4-1 Crosswalk with Other Hazard Mitigation Plans

Hazard	Sonoma County MJHMP (2026)	California SHMP (2023)	Sonoma Water Annex (2026)	VOMWD LHMP (2026)
Natural, Human-Health, and Climate and Weather-Influenced Hazards				
Agricultural and Silvicultural Pests and Diseases		✓		
Air Pollution		✓		
Aquatic Invasive Species		✓		
Avalanches		✓		

Hazard	Sonoma County MJHMP (2026)	California SHMP (2023)	Sonoma Water Annex (2026)	VOMWD LHMP (2026)
Dam Incidents	✓	✓	✓	✓
Drought and Water Shortage	✓	✓	✓	✓
Climate Change	✓	✓		
Earthquake and Geologic Hazards (liquefaction, subsidence, landslides)	✓	✓	✓	✓
Energy Shortage and Energy Resiliency		✓		
Epidemic/Pandemic/Vector-Borne Disease		✓		
Flood: 100-, 200-, 500-Year Events	✓	✓	✓	✓
Sea Level Rise	✓	✓	✓	
Severe Weather: Extreme Cold	✓	✓	✓	
Severe Weather: Extreme Heat	✓	✓	✓	✓
Severe Weather: Heavy Rain/ Thunderstorm/Lightning/Hail/Fog		✓		✓
Severe Weather: Wind and Tornado	✓	✓	✓	
Tree Mortality		✓		
Tsunami	✓	✓	✓	
Volcano		✓		
Wildfire	✓	✓	✓	✓
Technological Hazards				
Hazardous Materials Release		✓		
Oil Spills		✓		
Natural Gas Pipeline Hazards		✓		
Radiological Accidents		✓		
Transportation Accidents		✓		
Threat and Disturbance Hazards				
Terrorism		✓		
Cyber Threats		✓		
Civil Disorder		✓		

Hazards listed are based on the natural, technological, and human-caused hazards in the California SHMP.

In alphabetical order, the natural hazards identified and investigated for the District's 2026 LHMP update include:

- Dam Incidents
- Dense Fog
- Drought and Water Supply
- Earthquake
- Extreme Heat
- Flood
- High Winds
- Landslides
- Severe Weather
- Wildfire

To better assess risk and vulnerability in the Planning Area, the severe weather profiles from the 2021 LHMP have been restructured. The former Section 4.3.7 "Severe Weather: Heavy Rain/Thunderstorm/ Hail/Lightning/Dense Fog" has been split into "Dense Fog" (4.3.2) and "Severe Weather" (4.3.9), while Section 4.3.5 "Severe Weather: General" has been merged into "Dense Fog," "High Winds" (4.3.7), and "Severe Weather" to reduce duplicative hazard information.

The human-health hazards identified and investigated for the District's LHMP include:

- Cyber threats
- Public Health Hazards (Disease/Epidemic/Pandemic)

Based on discussions at the early planning analyses, the following natural and human-health hazards were eliminated from further consideration in this risk assessment because of a lack of past occurrences in the District at the time or based on minimal potential impacts. Certain hazards were also eliminated based on separate State and Sonoma County regulatory programs and planning documentation that thoroughly addresses the hazard profile.

The District's Planning Area is largely surrounded by rural land uses in the unincorporated portion of Sonoma County that consist of single-family residences, agriculture, and open space. Land uses include farms, dairies, livestock ranches, and vineyards, and the larger properties and adjacent open spaces function as a separation between the more urbanized areas near the City of Sonoma. Agricultural uses are also common in Sonoma Valley, thereby minimizing the perception that agricultural operations are nuisances. Land use compatibility with agricultural operations and related pest nuisances is also sufficiently addressed by Sonoma County's General Plan 2020.

Air quality and emissions within the Bay Area are generated by a variety of sources, including stationary sources, such as fireplaces and heating systems to mobile sources, such as vehicles and truck traffic. The Bay Area Air Quality Management District (BAAQMD) is the regional agency with the authority to develop and enforce regulations for the control of air pollution throughout the Bay Area. The Clean Air Plan is the BAAQMD's triennial plan for reducing air pollutant emissions in the Bay Area. The Bay Area is considered in "attainment" for all of the national standards of carbon monoxide, nitrogen dioxide, sulfur dioxide, lead, and particulate matter, with the exception of ozone. Given there are federal, state, and local laws and regulations in place for controlling air pollution, in addition to air quality management plans administered by the California Air Resources Board and BAAQMD, air pollution hazards and programs are not addressed in this plan.

Aquatic invasive species are non-indigenous species transported to new environments through human activities. The introduction of non-indigenous species into Sonoma Valley's marine, estuarine, and freshwater environment can cause economic, human health, and ecological impacts. Known past occurrences related to aquatic invasive species in the District's Planning were not emphasized during the initial HMPC meetings given this hazard is currently addressed by the District's main water supplier, Sonoma Water. Aquatic invasive species are also addressed by the Sonoma County Department of Health Services (DHS), Environmental Health and Safety Public Health Division. The Division regularly tests water bodies in the County for aquatic invasive species, and specifically algae blooms at various beach and river park locations throughout the County. Given County monitoring programs are in place, this hazard was not addressed in this plan.

Avalanches and volcano hazards were not addressed in this plan. Sonoma Valley does not receive snowfall to have avalanche hazards. According to the 2018 California SHMP, only ten volcanic eruptions have occurred in California in the last 1,000 years, and the likelihood of another eruption in the state is low (Cal OES 2018). Of the 20 volcanoes in the state, only a few are active and pose a threat (Cal OES 2018). Of these, the Clear Lake Volcano is the closest volcano to Sonoma Valley, and while it has been known for substantial geothermal activity, there are no past occurrences associated with the volcano. Given this volcanic field is approximately 80 miles to the north, volcano hazards were not addressed in this plan.

Energy shortage hazards can include energy disruptions related to electricity, renewable energy, natural gas, and gasoline and diesel fuels. Based on the energy types, electrical power outages, both planned and unscheduled disruptions can result in cascading hazards related to traffic, economic losses, other utility disruptions, and extreme heat and public health hazards. Climate change is also expected to bring more frequent and intense natural disasters, which could result in planned or unscheduled power outages or energy shortages. Given Pacific Gas & Electric's (PG&E) Public Safety Power Shutoffs (PSPS), energy shortage hazards are a major concern for the region and Sonoma Valley. Energy shortages are discussed as a secondary hazard impact in the Wildfire section, and in the vulnerability assessment in the High Winds section of this chapter.

Drought conditions can cause increased tree mortality associated with lack of moisture, pest infestations, and other drought-related issues. Tree mortality is discussed in more detail as a subsection of the Drought and Water Shortage section and as a secondary hazard.

The District's Planning Area is situated approximately 10 miles upstream of the tidally influenced portion of Sonoma Creek and the Napa-Sonoma Marshes Wildlife Area near the San Pablo Bay. Based on the U.S. Geological Survey (USGS) Tsunami Inundation Map for Emergency Planning (Cal EMSA, CGS, and USC 2009) the District's Planning Area lies approximately nine miles upstream from the northern extent of the tsunami inundation area near Sears Point. Based on this information, tsunami and coastal erosion hazards were not further analyzed in this plan.

Sea level rise was also not addressed in this chapter given most projections for sea level rise along the tidally-influenced rivers in the San Pablo Bay do not project inundation areas within or near the District's Planning Area (OCOF 2020).

The District acknowledged natural gas pipeline hazards, oil spills, radiological incidents, as well as transportation accidents associated with these hazards. Gas pipeline hazards are addressed as a secondary hazard associated with earthquakes in the vulnerability assessment. Oil spill and radiological accidents were not further evaluated in this plan, as there are few oil pipelines or oil wells in the District's Planning Area, and few areas at risk of radiological accidents according to the HMPC.

Other human-caused hazards, such as terrorism, and civil unrest or disturbances were considered and discussed during HMPC meetings, but these issues are thoroughly addressed in the 2026 RRA prepared by the District to comply with the American Water Infrastructure Act (AWIA) and were therefore not discussed in detail in this plan.

4.1.2 Overall Hazard Significance Summary

Overall hazard significance was based on a combination of geographic extent, probability of future occurrences, and potential magnitude/severity. Climate change considerations are discussed qualitatively in each hazard profile, specifically on whether it is anticipated to have a low, medium, or high influence on future impacts. The individual ratings shown in Table 4-2 are based on or interpolated from the analysis of the hazards in the sections that follow.

Table 4-2 Valley of the Moon Water District Hazard Significance Summary

Hazard	Geographic Extent	Probability of Future Occurrence	Magnitude/ Severity	Overall Significance
Dam Incidents	Limited	Unlikely	Limited	Low
Dense Fog	Limited	Likely	Limited	Low

Hazard	Geographic Extent	Probability of Future Occurrence	Magnitude/ Severity	Overall Significance
Drought and Water Supply	Extensive	Highly Likely	Critical	High
Earthquake	Extensive	Likely	Catastrophic	High
Extreme Heat	Extensive	Likely	Limited	Low
Flood	Limited	Likely	Limited	Medium
High Winds	Significant	Likely	Limited	Medium
Landslides	Limited	Likely	Negligible	Low
Severe Weather*	Extensive	Likely	Limited	Medium
Wildfire	Extensive	Highly Likely	Catastrophic	High
Cyber Threats	Extensive	Likely	Critical	High
Public Health Hazards	Extensive	Occasional	Critical	High

Geographic Extent

Limited: Less than 10% of planning area

Significant: 10-50% of planning area

Extensive: 50-100% of planning area

Probability of Future Occurrences

Highly Likely: Near 100% chance of occurrence in next year or happens every year.

Likely: Between 10 and 100% chance of occurrence in next year, or a recurrence interval of 10 years or less.

Occasional: Between 1 and 10% chance of occurrence in the next year or has a recurrence interval of 11 to 100 years.

Unlikely: Less than 1% chance of occurrence in next 100 years or has a recurrence interval of greater than every 100 years.

Magnitude/Severity

Catastrophic—More than 50 percent of property severely damaged; shutdown of facilities for more than 30 days; and/or multiple deaths

Critical—25-50 percent of property severely damaged; shutdown of facilities for at least two weeks; and/or injuries and/or illnesses result in permanent disability

Limited—10-25 percent of property severely damaged; shutdown of facilities for more than a week; and/or injuries/illnesses treatable do not result in permanent disability

Negligible—Less than 10 percent of property severely damaged, shutdown of facilities and services for less than 24 hours; and/or injuries/illnesses treatable with first aid

Overall Significance

Low: minimal potential impact

Medium: moderate potential impact

High: widespread potential impact

*Severe weather includes heavy rain, thunderstorms, hail, and lightning

4.1.3 Disaster Declaration History

One method the HMPC used to identify hazards was researching past events that triggered federal and state emergency or disaster declarations in the Planning Area. Federal and state disaster declarations may be granted when the severity and magnitude of an event surpasses the ability of the local government to respond and recover. Disaster assistance is supplemental and sequential. When the local government's capacity has been surpassed, a state disaster declaration may be issued, allowing for the provision of state assistance. Should the disaster be so severe that both the local and state governments' capacities are exceeded, a federal presidential emergency or disaster declaration may be issued allowing for the provision of federal assistance to help disaster victims, business, and public agencies.

The federal government may issue a disaster declaration through FEMA, the U.S. Department of Agriculture (USDA), or the Small Business Administration (SBA). FEMA also issues emergency declarations which are more limited in scope and without the long-term federal recovery programs of

major disaster declarations (Farm Service Agency 2018). The quantity and types of damage are the determining factors in the type of declaration issued. This section focuses on state and federal disaster and emergency declarations. Details on federal and state disaster declarations were obtained by the HMPC, FEMA, and Cal OES and compiled in chronological order in Table 4-3.

Table 4-3 Sonoma County, State, and Federal Disaster Declarations, 1950-2025

Year	Disaster Name	Date of Local Declaration	Date of State Declaration	Federal Declaration Number
1950	1950 Flood, Statewide	—	11/21/1950	—
1954	Flood and Erosion, Statewide	—	12/22/1955	DR-15
1955	1955 Floods, Statewide	—	12/22/1955	DR-47
1958	1958 April Storms & Floods, Statewide	—	4/2/1958	DR-82
1961	1961 Major Fires	—	9/8/1961	—
1963	Severe Storms and Flooding, Statewide	—	—	DR-138
1963	Severe Storms, Heavy Rains and Flooding, Statewide	—	—	DR-145
1964	Fires and High Winds	—	9/22/64	—
1964	1964 Late Winter Storms	—	12/22/64	DR-183
1964	Seismic Sea Wave, Statewide	—	—	DR-169
1965	1965 Fires	—	9/18/1965	—
1965	Heavy Rains and Flooding	—	—	
1969	1969 Storms	—	1/23/1969	DR-253
1970	1970 Freeze	—	5/1/70	—
1977	Drought	—	—	EM-3023
1978	Flood	—	2/13/1978	—
1979	Gasoline Shortage	—	5/8/79	1979
1982	1982 Winter Storms	—	1/5/82	DR-651
1982	1982-83 Floods	—	12/8/82	DR-677
1986	1986 Storms	—	2/18/86	DR-758
1990	1990 Freeze	—	12/19/90	DR-894
1992	1992 Late Winter Storms	—	1/7/93	DR-979
1994	Salmon fisheries	—	34474	DR-1038
1995	1995 Winter Storms (Northern CA)	1/8/1995	01/09/95	DR-1044
1995	1995 Late Winter Storms (Northern CA)	—	03/12/95	DR-1046
1996	Jenner Sand Barrier	7/3/1996	—	—
1996	Cavedale Fire	8/1/1996	—	—
1997	1997 January Floods	—	1/2/97	DR-1155
1998	1998 El Nino Floods	2/2/1998	—	DR-1203
1999	Sonoma Road Failure	2/9/1999	3/29/1999	—
2001	Energy Emergency, Statewide	—	1/1/2001	—
2002	Severe Storm(s)	9/20/2002	—	—

Year	Disaster Name	Date of Local Declaration	Date of State Declaration	Federal Declaration Number
2003	State Road Damage	—	1/1/2003	—
2004	Geysers Fire	—	—	FM-2554
2005	Hurricane Katrina Evacuations, Statewide	—	—	EM-3248
2006	2005/06 Winter Storms	12/31/2005	1/12/2006	DR-1628
2006	Spring Storms 2006	4/12/2006	4/10/2006	DR-1646
2007	2007 Severe Freeze, Statewide	—	01/12/07	DR-1689
2007	SF Oil Spill	11/8/2007	11/9/2007	—
2009	H1N1 Influenza Pandemic	5/4/2000	—	—
2011	Tohoku Tsunami	3/11/2011	3/11/2011	—
2014	South Napa Earthquake	—	8/24/2014	DR-4193
2014	Drinking Water Shortage, Statewide	—	9/18/2014	—
2014	Severe Storm(s)	12/11/2014	—	—
2015	Tree Mortality, Statewide	—	10/30/2025	—
2015	Valley Fire	—	—	FM-5112
2017	January 2017 Storms	—	1/23/2017	DR-4301
2017	Late January 2017 Storms	—	2/10/2017	DR-4305
2017	February 2017 Storms	—	3/7/2017	DR-4308
2017	October 2017 Wildfires (Patrick, Nuns, Tubbs)	10/9/2017	10/9/2017	DR-4344 (FM-5222, FM-5220, FM-5215-CA)
2019	Late February 2019 Storms	2/26/2019	5/18/2019	DR-4434
2019	PG&E Public Safety Power Shutoff (PSPS)	9/23/2019		
2019	PG&E PSPS	10/7/2019		
2019	PG&E PSPS	10/22/2019		
2019	Kincade Fire	10/31/2019	10/25/2019	FM-5295
2019	PG&E PSPS	11/19/2019	—	—
2020	JRT Encampment	7/10/2018	—	—
2020	California COVID-19 Pandemic, Statewide	3/4/2020	3/4/2020	DR-4482
2020	August 2020 Wildfires (LNU Lightning Fire Complex)	8/20/2020	8/18/2020	DR-4558 (FM-5376)
2020	September 2020 Wildfires(Glass Fire)	9/28/2020	9/28/2020	DR-4569 (FM-5331)
2020	PG&E PSPS	10/24/2020	—	—
2021	Drought	4/27/2021	4/21/2021	—
2023	2022-2023 Early Winter Storms	1/3/2023	1/4/2023	DR-4683
2023	Late February-Early March 2023 Winter Storms	2/25/2023	3/1/2023	DR-4699
2024	February 2024 Atmospheric River Storms	—	2/4/2024	—
2024	March 2024 Winter Storm	—	3/22/2024	—
2024	Point Fire	6/17/2024	--	—

Year	Disaster Name	Date of Local Declaration	Date of State Declaration	Federal Declaration Number
2024	Atmospheric River Storms	11/20/2024	--	—
2025	February 2025 Winter Storms	2/4/2025	7/29/2025	—

Sources: 2023 California State Hazard Mitigation Plan, FEMA, 2021 Sonoma County Hazard Mitigation Plan, FEMA 2026

Most disaster declarations are issued on a county-wide basis. In some limited instances a city or area within a county is specifically designated. Since 2012, there have been 12 drought declarations issued by the USDA, all of which were "Fast Track Secretarial Disaster" designations. According to the USDA, a Fast Track designation is for a severe drought and provides an automatic designation when any portion of the County meets the severe drought intensity value for eight consecutive weeks during the growing season. Refer to Section 4.3.3 on drought and water shortage hazards for more details on previous occurrences of drought events

This combined federal and state disaster history suggests that Sonoma County (and the District) experiences a major event worthy of a disaster declaration almost every year on average. The County has an 80 percent chance of receiving a disaster declaration in any given year. Further, a review of these events helps the District identify risk reduction targets and ways to improve their capabilities to avoid large-scale hazard events in the future.

4.1.4 Climate Change Considerations Summary

Climate change is an increasingly important factor now affecting all phases of the disaster management cycle. Sonoma County acknowledges that climate change is occurring and began to plan for it when they initiated climate change efforts in 2009 by the establishment of the North Bay Climate Adaptation Initiative (NBCAI) and the Regional Climate Protection Authority (RCPA). The NBCAI is a coalition of natural resource managers, policy makers, and scientists working together to create climate adaptation solutions for the ecosystems and watersheds in Sonoma County. Likewise, the RCPA was formed through locally sponsored state legislation to coordinate countywide climate protection efforts among Sonoma County's nine cities and multiple county agencies. The RCPA focuses on efficient buildings, clean energy, alternative transportation, and conservation and adaptation. In 2014, the RCPA prepared a climate hazard and vulnerability assessment, known as *Climate Ready Sonoma County: Climate Hazards and Vulnerabilities*. In 2016, the RCPA prepared Sonoma County's *Regional Climate Action Plan: Climate Action 2020 and Beyond* (referred to as the County's RCAP). These plans were updated as part of the County of Sonoma Climate Resilience Comprehensive Action Plan (2024) and included several supporting plans, such as the Sonoma County Climate Change Vulnerability

What is Climate Change?

Climate change refers to distinct changes in weather conditions that result from increased atmospheric greenhouse gas (GHG) emissions. Monthly mean carbon dioxide (CO_2) levels now exceed 410 parts per million (ppm) for the first time in recorded history. This GHG increase has trapped heat in the atmosphere and is linked to an increase in average global temperature and the global temperature and GHG increases are resulting in a series of changes to the global climate. These changes include shifts in seasonal temperature patterns; altered precipitation timing, amount, and location; sea level rise due to melting glaciers and ice caps; ocean acidification due to increased CO_2 absorption; and altered wind and storm event frequency and severity, including more frequent and intense storms, droughts, and heat waves. Climate change is not a discrete event, but a long-term hazard that already affects communities in California.

Sources: NOAA 2021; IPCC 2018; SHMP 2018

Assessment (2024), Sonoma Water Adaptation Plan (2021), and Climate Resilient Lands Strategy (2023).

Although not formally adopted by the County, climate change projections summarized in the RCAP are based on the Basin Characterization Model (BCM) prepared by scientists from the USGS and the University of California, Davis Center for Environment. The projections were developed by applying scaled-down models that identify watershed-level climate change impacts specific to Sonoma County; the projections represent the best available climate data for the County (RCPA 2016). The BCM projections and recent studies indicate that climate change could affect Sonoma County (and the District's Planning Area) in the following ways:

- **Higher Average Temperature and More Extreme Heat Events:** Sonoma County is expected to experience more very hot days and overall higher temperatures over a longer warm season. Most climate change models project that temperatures will continue to rise under both high and mitigated carbon emission trends. For scenarios with mitigated emissions, summer high temperatures are expected to rise by 1 to 2°F; scenarios with unmitigated emissions project average summer high temperatures will increase by up to 9 to 11°F by 2100.
- **More Frequent and Intense Droughts:** Whether Sonoma County experiences more or less rainfall overall, the land will likely be drier because warmer temperatures increase evapotranspiration even under wetter scenarios. Three of the four climate scenarios examined indicate a rising climate water deficit (CWD), a numeric measure of drought stress, over this century, producing 10 to 20 percent drier soil conditions in the summer months. The greatest increases in soil dryness are projected to occur in the south and southeastern portions of the County (including the District's Planning Area).
- **More Frequent and Intense Wildfire:** Wildfire risk will continue to rise due to increased dryness of vegetation compounded by the productivity of plants in the spring, as this creates more fuel for dry season wildfires. By the end of the century, the chances of one or more fires during a 30-year period are projected to increase from 15 to 20 percent to 25 to 33 percent in the mountainous areas of the County. It should be noted that this finding on more frequent and intense wildfire risk was made before the Sonoma County firestorms in 2017, 2018, and 2020. Taking into consideration the wildfire activity that occurred recently in the County, the frequency and severity of wildfires has increased, and this projection from the County's RCAP was a conservative forecast of future fire probability.
- **Fewer Winter Nights that Freeze.** Projected winter low temperatures are expected to rise in the future. Generally, the coast, ridges, and mountain peaks will experience the most significant warming whereas valley bottoms are projected to warm less dramatically. For scenarios with mitigated emissions, winter low temperatures are expected to rise by 1 to 2°F. In the two scenarios with unmitigated emissions, average winter low temperatures are projected to increase by up to 7 to 9°F by 2100. These increases have potential implications for controlling disease vectors, agricultural pests, and agricultural practices that may impact the land management practices surrounding the District's Planning Area.
- **More Variable Rain:** Future rainfall models vary across global climate models, and some models project less annual rainfall in Sonoma County, while others predict more rainfall. However, all climate scenarios project more variation in the timing and amount of precipitation from individual rain events. All of the scenarios indicate that Sonoma County will continue to have years with precipitation similar to historic averages interspersed with more extreme conditions. For 2040 through 2069, the wettest scenario projects a 25 percent increase in average annual rainfall compared to historical conditions, whereas the driest scenario projects a 19 percent decrease. While the County may experience more or less total rainfall, the land will be drier because warmer temperatures increase evapotranspiration from soil and plants.
- **Increased Risk of Extreme Floods:** Climate scenarios project increased seasonal variability of precipitation, runoff, and stream flows for Sonoma County, along with increased likelihood of "extreme" precipitation and drought events. There may be more years with more frequent storm events and occasional events that are much stronger than historical ones, and the length of season

over which storm events occur is predicted to increase. These changes to the patterns of storm events may result in more frequent and more severe floods in Sonoma County and the District's Planning Area.

- **More Frequent Coastal Flooding, Increased Erosion, and Saltwater Intrusion:** Sea levels are projected to rise between 16.5 and 65.8 inches by 2100. Rising sea levels combined with increased storm surge will lead to more frequent inundation of the low-lying areas, and flooding of homes, infrastructure, agricultural land, and natural areas on the shores of San Pablo Bay located to the south of the District's Planning Area. The greatest impacts are anticipated during winter storms.

The important consideration for hazard mitigation is that climate change is exacerbating the hazards which are already identified and profiled in this plan. The District and California are also already experiencing the impacts of climate change including prolonged drought, increased flooding, increased average temperatures, shifts in the water cycle, and changes to precipitation patterns and the intensity of extreme events resulting from hazards, such as wildfires. Climate change not only results in progressive changes, such as shifting weather patterns, but also affects the frequency and severity of hazard events (SHMP 2018). Climate change also results in an increase in the variance of climate patterns, and this increased variance creates challenges for hazards planning, which previously used historic recurrence rates to predict future events, and now must incorporate changes to the frequency, severity, and location of natural hazards due to climate change.

Risk assessment for hazards is built upon the frequency of past events and the assumption that historic occurrence rates are a good predictor of future event probability. With climate change; however, history is not an adequate predictor of the probability of future occurrences (SHMP 2018). Planning for climate change (and understanding the probability of future occurrences [see Section 4.3 below]) is therefore now based on understanding and integrating evolving climate change science and modeled projections that account for shifts in historic conditions due to climate change into hazard mitigation planning (SHMP 2018).

4.2 Asset Summary

The HMPC assessed the District Planning Area's vulnerability to identified hazards by developing an inventory of the District's critical water facilities and infrastructure that could be impacted during a hazard event. If a catastrophic disaster were to occur in the Planning Area, this section describes significant assets exposed or at risk. Data used in this baseline assessment included:

- People at risk (includes District customers and staff);
- Critical water facilities and infrastructure assets at risk;
- Cultural, historical, and natural resources; and
- Future development trends.

4.2.1 Customers at Risk

Residents and business customers throughout the Planning Area rely on the District for daily domestic water use and sanitation. Water services also support local economic activity and tourism associated with the tourism, wine and hospitality, and agricultural businesses in the Sonoma Valley region. Because the District provides water services, disruptions to water infrastructure may have community-wide impacts. Extended service interruptions could also affect residential livability, emergency response capabilities, and local economies.

In addition to permanent residents, the service area experiences seasonal fluctuations in population due to tourism and employment patterns associated with the wine and hospitality industries that characterize

much of the Sonoma Valley. These fluctuations may increase demand on water infrastructure during certain times of the year and could complicate emergency response and restoration during hazard events.

The disruption of the delivery of water services due to hazards can also affect the District's administrative and operation staff by requiring them to work longer hours during disruptions to resume service or to respond to disruptions that require the implementation of short-term response actions.

While hazards affecting the District may impact all customers and District staff, certain populations may face greater challenges during water supply interruptions, infrastructure damage, or emergency conditions. These populations may include:

- **Older adults or those with limited mobility or health conditions**, as they may have difficulty obtaining alternative water supplies during extended service disruptions. Older residents may also be more sensitive to heat or sanitation challenges if water access is limited.
- **Infants and young children** are particularly sensitive to water quality issues and sanitation disruptions.
- **Low-income populations and households with limited financial resources** may face additional barriers in responding to service disruptions, such as purchasing bottled water or relocating during extended outages.
- **Individuals with disabilities or medical needs**, including residents who depend on medical equipment, home services, or specialized sanitation needs, may be disproportionately affected by disruptions to water service.
- **Residents in remote or topographically elevated areas** where access routes and infrastructure may be more vulnerable to wildfire, landslides, or storm damage, may require additional time following hazard events to have services restored.

A complete profile of customers in the Planning Area is included in Section 2.3 "Demographics," while populations who are potentially more vulnerable to hazard impacts are displayed geographically in Section 2.4 "Social Vulnerability."

4.2.2 Critical Water Facilities and Infrastructure Assets at Risk

A spatial inventory containing the District's water supply infrastructure assets, such as aboveground water storage tanks, pump stations, groundwater wells, pressure reducing valves (PRVs), and flow meters was provided by the District. This spatial inventory dataset included replacement value information for all the District's assets and provided the baseline for an inventory of the total exposure of developed assets owned and operated by the District. This dataset ensures that the LHMP can be updated over time to reflect changes in water supply facilities and infrastructure development.

The total value of the District's critical water supply transmission and distribution infrastructure at risk was then assessed and organized by aboveground assets, including water storage tanks, booster pump stations; and underground assets, including below ground pipelines, PRVs, and flow meters comprising the water distribution system. The data also provides information on which District water assets are potentially at risk and vulnerable to the damaging effects of natural hazards. Other data, such as jurisdictional boundaries, roads, and natural resource features were obtained from Sonoma County GIS and Sonoma County Local Agency Formation Commission (LAFCo) to support the mapping and analysis of assets at risk.

The District's aboveground assets are categorized as water storage tanks, pump stations, and other supporting facilities that comprise the water supply system and include 119 assets. The underground assets are categorized as water pipelines totaling 486,604 linear feet, or 92 miles. The critical water assets include:

- Water Supply Transmission and Infrastructure Assets – water storage tanks, pump stations, and hydrants
- Water Distribution and Infrastructure Assets – water pipelines, PRVs, isolation valves, groundwater wells, and flow meters

Table 4-4 lists the total values of the District's aboveground water assets by facility type. Land values have been purposely excluded because the land remains following disasters, and subsequent market devaluations are frequently short term and difficult to quantify. Additionally, federal and state disaster assistance programs generally do not address loss of land or its associated value.

Table 4-4 Valley of the Moon Water District Asset Values by Type

Asset Type	Count	Replacement Value
Building	3	$1,132,072
Monitoring Controls	33	$1,020,942
Power	16	$779,522
Pump	25	$1,409,324
Tank	15	$9,330,344
Turnout Location	10	$2,500,000
Valve	3	$180,112
Well	8	$13,000,000
Grand Total	**113**	**$29,352,315**

Source: VOMWD 2025

The District's water distribution network consists of approximately 92 miles of pipe ranging from 3/4 inches to 14 inches in diameter. Pipe materials are primarily asbestos cement pipe (ACP) and polyvinyl chloride (PVC) pipe, but there are also sections of cast-iron pipe (CIP), ductile iron pipe (DIP), steel pipe, and high-density polyethylene (HDPE) pipe. Table 4-5 lists the total values of the District's underground water assets by pipeline size and type.

Table 4-5 Valley of the Moon Water District Asset Values by Type – Water Pipeline

Pipeline Diameter (inches)	Length (feet)						Length (miles)
	ACP	CIP	DIP	HDPE	PVC	Steel	
<2	89	--	--	759	1,691	6,738	1.76
3	--	--	--	--	--	249	0.05
4	30,069	81	615	6,610	3,880	2,520	8.29
5	160,838	--	10,549	3,586	53,899	274	43.40
6	91,005	--	4,291	--	58,357	1,107	29.31
8	19,621	--	742	--	6,019	--	5.00
10	7,497	--	1,457	73	11,305	--	3.85

Pipeline Diameter (inches)	Length (feet)						Length (miles)
	ACP	CIP	DIP	HDPE	PVC	Steel	
14	2,684	--	--	--	--	--	0.51
Total	**311,804**	**81**	**17,654**	**11,028**	**135,151**	**10,889**	**92.16**

Source: VOMWD 2020; NOTE: Pipeline lengths, diameters, and materials include all active potable water transmission and distribution pipelines present in the GIS dataset and in the 2019 WMP provided by the District and EKI.

While this is the best available data, the vulnerability assessment should be used as an initial guide to the overall values associated with the District assets. In the event of a disaster, structures and other infrastructure improvements are at the greatest risk of damage. Depending on the type of hazard and resulting damages, the land itself may not result in impacts or damages. For this reason, the values of structures and other infrastructure improvements are the greatest concern for the District.

Detailed Asset Inventory

The District currently provides water supply to a population of 23,004 via 6,971 service connections. Population figures are obtained by multiplying the District's number of service connections by a factor of 3.3 (VOMWD 2025). All facilities owned by the District are considered critical water facilities. There are 113 facilities owned by the District, summarized in Table 4-6 and are shown in Figure 4-2.

Table 4-6 Detailed Facilities in the Valley of the Moon Water District Planning Area

Asset Type	Site Name	Description	Replacement Value
Building	DISTRICT OFFICE COMPLEX	OFFICE	$1,114,708.54
	DONALD AVENUE	TANK SITE	$9,173.28
	SOBRE VISTA	SOBRE VISTA #1 TANK & UPPER BOOSTER	$8,190.27
Monitoring & Controls	AGUA CALIENTE	CHLORINE RESIDUAL ANALYZER, ANCILLARY DEVICES	$32,816.94
	AGUA CALIENTE	SCADA	$79,610.82
	ARNOLD	SCADA	$44,464.63
	BOLLI TANKS	SCADA EQUIOMENT W/ SOLAR PANEL,BATTERY	$36,759.71
	CHESTNUT	SCADA	$26,467.84
	CRAIG WELL	PROMINENT CL2 ANALYZER	$8,120.00
	CRAIG WELL	SCADA EQUIPMENT	$5,441.26
	DONALD AVENUE	SCADA / TELERMETRY EQUIPMENT/TURBIDIMETER	$31,241.70
	DONALD AVENUE	SCADA EQUIPMENT	$46,579.60
	DONALD AVENUE	YASKAWA VFD	$8,120.00
	GLEN ELLEN PUMP STATION	SCADA EQUIPMENT	$23,291.19
	GLEN ELLEN PUMP STATION	YASKAW VFD, SCADA, TELEMETRY	$26,034.75
	GLEN ELLEN STORAGE TANK	SCADA EQUIPMENT, SOLAR PANEL, BATTERY	$35,462.31
	HANNA BOOSTER STATION	SCADA EQUIPMENT	$34,082.10
	HANNA CENTER	SCADA EQUIPMENT W/SOLAR PANEL, BATTERY	$36,759.71
	LARBRE WELL	SCADA EQUIPMENT AND CL2 INJECTION	$20,300.00
	MOUNTAIN AVENUE	SCADA	$25,831.96
	MOUNTAIN AVENUE	YASKAWA VFD	$8,120.00
	PARK AVENUE	SCADA	$39,594.61
	PEDRONCELLI WELL	CHEMICAL PRO MC2 , TANK, INJECTION	$5,441.26
	PEDRONCELLI WELL	PROMINENT CL2 ANALYZER	$8,120.00
	PEDRONCELLI WELL	SCADA EQUIPMENT	$5,441.26
	SADDLE TANK SITE	SCADA EQUIPMENT W/ SOLAR PANEL, BATTERY	$41,490.66
	SOBRE VISTA	SCADA	$52,932.89
	SOBRE VISTA	SCADA	$26,465.04
	SOBRE VISTA	SCADA	$39,594.61

Asset Type	Site Name	Description	Replacement Value
	SOBRE VISTA	SCADA	$14,423.76
	SOBRE VISTA	SCADA	$44,856.81
	SOBRE VISTA	SCADA	$14,423.76
	SOBRE VISTA	SCADA	$43,977.21
	TEMELEC #1	SCADA EQUIPMENT	$19,681.76
	TEMELEC #2	SCADA EQUIPMENT W/ SOLAR PANEL, BATTERY	$30,055.18
	VERANO WELL (WELL #5)	SODIUM HYPROCHLORITE GENERATION SYSTEM,INCLUDE TANK, EYE WASH, PUMPS, METER, PIPING .AND OTHER ANCILLARY EQUIPMENT	$104,938.56
Power	AGUA CALIENTE	EMERGENCY GENERATOR, KATOLIGHT, PROPANE, W/OUTDOOR ENCLOSURE, AUTOMATIC TRANSFER SWITCH	$120,750.35
	BOLLI TANKS	SOLAR PANEL	$27,206.31
	CHESTNUT	EMERGENCY GENERATOR, GENERAC W/TANK, CONTROLS, ATS	$51,755.69
	DONALD AVENUE	BLUESTAR DIESEL GEN-SET TIER 4, 500 GAL FUEL TANK	$91,067.47
	GLEN ELLEN PUMP STATION	EMERGENCY GENERATOR W/CONTROLS, TANK, ATS	$77,795.87
	GLEN ELLEN STORAGE TANK	SOLAR PANEL	$27,206.31
	HANNA BOOSTER STATION	BATTERY WALL	$10,150.00
	HANNA BOOSTER STATION	EMERGENCY GENERATOR, W/TANK, CONTROLS, ATS	$90,761.85
	HANNA CENTER	SOLAR PANEL	$27,206.31
	MOUNTAIN AVENUE	EMERGENCY GENERATOR, DIESEL, DETROIT DIESEL, OUTDOOR ENCLOSURE	$99,125.92
	SADDLE TANK SITE	SOLAR PANEL	$27,206.31
	SOBRE VISTA	EMERGENCY GENERATER, W/TANK, CONTROLS, ATS	$38,897.94
	SOBRE VISTA	EMERGENCY GENERATER, W/TANK, CONTROLS, ATS	$42,787.73
	SOBRE VISTA	SOLAR PANEL W/BATTERY	$10,372.78
	SOBRE VISTA	SOLAR PANEL W/BATTERY	$29,158.92
	VERANO WELL (WELL #5)	TRANSFER SWITCH	$8,071.88
Pump	AGUA CALIENTE	PUMP W/MOTOR, VERTICAL TURBINE, MCC, SURFACE MOUNT, GRU	$63,416.66
	AGUA CALIENTE	WELL PUMP W/MOTOR, SUBMERSIBLE, 300',MCC	$52,256.38
	ARNOLD	PUMP W/MOTOR, SUBMERSIBLE,MCC, MTS, METAL CLAD	$82,239.83
	CHESTNUT	PUMP W/MOTOR, SUBMERSIBLE,MCC	$34,668.58
	CRAIG WELL	PUMP W/MOTOR, SUBMERSIBLE, VFD, MCC, PIPING, (4") METER	$114,266.52
	DONALD AVENUE	PUMP W/MOTOR, SUBMERSIBLE,MCC	$23,541.91

Asset Type	Site Name	Description	Replacement Value
	DONALD AVENUE	PUMP W/MOTOR, SUBMERSIBLE,MCC	$31,144.56
	DONALD AVENUE	PUMP W/MOTOR, VERTICAL CENTRIFUGAL, MCC	$15,759.97
	DONALD AVENUE	WELL PUMP W/MOTOR, SUBMERSIBLE, MCC, SETTING 189' DEEP	$37,632.32
	GLEN ELLEN PUMP STATION	PUMP W/MOTOR, SUBMERSIBLE,MCC	$50,417.34
	HANNA BOOSTER STATION	PUMP W/MOTOR, SUBMERSIBLE, MCC, VFD, PIPING, VALVES, METER	$91,067.33
	LARBRE WELL	WELL PUMP W/MOTOR, SUBMERSIBLE	$44,645.31
	MOUNTAIN AVENUE	WELL PUMP W/MOTOR, SUBMERSIBLE, MCC,PUMP SETTING 189'	$34,571.93
	PARK AVENUE	WELL PUMP W/MOTOR, SUBMERSIBLE, MCC,PUMP SETTING 130'	$23,504.10
	PEDRONCELLI WELL	PUMP W/ MOTOR, SUBMERSIBLE, VFD, MCC,PIPING, (6") METER	$141,472.83
	SADDLE TANK SITE	PUMP W/MOTOR, VERTICAL TURBINE, MCC, PIPING	$75,850.97
	SOBRE VISTA	HEAVEN HILL LOWER PUMP STATION	$6,557.55
	SOBRE VISTA	PUMP W/MOTOR, VERTICAL TURBINE, MCC, SURFACE MOUNT, GRUNDFOS	$43,090.62
	SOBRE VISTA	PUMP W/MOTOR, VERTICAL TURBINE, MCC, SURFACE MOUNT, GRUNDTOS	$47,008.19
	SOBRE VISTA	LOWER PUMP STATION	$56,232.74
	SOBRE VISTA	PUMP W/MOTOR, VERTICA TURBINE, SURFACED MOUNTED, GRUNDFOS	$31,762.26
	SOBRE VISTA	PUMP W/MOTOR, VERTICAL TURBINE, SURFACE MOUNTED, GRUNDFOS	$29,367.17
	SOBRE VISTA	UPPER PUMP STATION	$60,572.23
	VERANO WELL (WELL #5)	PUMP STATION	$89,706.60
	VERANO WELL (WELL #5)	PUMP W/MOTOR, SUBMERSIBLE, MCC, VFD'S	$128,569.77
Tank	BOLLI TANK 1	TANKS, WELDED STEEL-CATHODIC PROTECTION	$784,794.65
	BOLLI TANK 1	TANKS, WELDED STEEL-CATHODIC PROTECTION	$784,794.65
	CHESTNUT	HYDROPNEUMATIC TANK W/COMPRESSOR	$33,218.91
	CHESTNUT	TANK, WELDED STEEL W/FENCING, CATHODIC PROTECTION	$627,657.83
	DONALD AVENUE	HYDROPNEUMATIC TANK W/COMPRESSOR	$33,218.91
	DONALD AVENUE	TANK, WELDED STEEL W/FENCING, ALTITUDE VALVE,, CATHODIC PROTECTION	$509,328.13
	GLEN ELLEN STORAGE TANK	TANK, WELDED STEEL W/ALTITUDE VALVE,CATHODIC PROTECTION	$920,444.27
	HANNA CENTER	TANK, WELDED STEEL-CATHODIC PROTECTION, ALTITUDE VALVE	$2,339,277.38
	HEAVEN HILL	WOOD ROOF, CONICAL, 6 FT HIGH, 15' DIAMETER, COMP SHINGLE	$39,645.04

Asset Type	Site Name	Description	Replacement Value
	SADDLE TANK SITE	TANK, WELDED STEEL W/FENCING, 6 IN ALTITUDE VALVE,, CATHODIC PROTECTION	$468,767.51
	SOBRE VISTA	TANK, BOLTED STEEL	$384,737.67
	SOBRE VISTA	TANK, BOLTED STEEL	$108,327.86
	SOBRE VISTA	TANK, BOLTED STEEL	$131,911.31
	TEMELEC #1	TANK, WELDED STEEL, ALTITUDE VALVE, CP	$519,431.13
	TEMELEC #2	TANK, WELDED STEEL W/ALTITUDE VALVE,CATHODIC PROTECTION	$1,644,789.01
Turnout Location	AGUACALIENTETO	Turnout Location	$250,000.00
	ALTIMIRATURNOUTPRV	PRV	$250,000.00
	BOYESBLVDTURNOUTPRV	PRV	$250,000.00
	GLENELLENTRNOUT	Turnout Location	$250,000.00
	HANNATURNOUT	Turnout Location	$250,000.00
	MADRONETURNOUTPRV2	PRV	$250,000.00
	TRINITY TURNOUT PRV2	PRV	$250,000.00
	VERANO	Turnout Location	$250,000.00
	VERANO AND FIFTH	Turnout Location	$250,000.00
	VERANO MAIN TO	Turnout Location	$250,000.00
Valve	BOLLI TANKS	ALTITUDE VALVE	$20,300.00
	GLEN ELLEN PUMP STATION	VAULT	$30,299.67
	HANNA BOOSTER STATION	VAULT, CONCRETE W/GRADE COVERS	$129,511.93
Well	AGUA CALIENTE	PUMP STATION AND WELL	$1,500,000
	CRAIG WELL	CRAIG WELL	$1,500,000
	DONALD AVENUE WELL	WELL	$1,500,000
	LARBRE WELL	WELL SITE	$1,500,000
	MOUNTAIN AVENUE	WELL SITE	$1,500,000
	PARK AVENUE	WELL SITE	$1,500,000
	PEDRONCELLI WELL	PEDRONCELLI WELL	$1,500,000
	VERANO WELL (WELL #5)	TANK, BACKWASH AND FILTER W/DECANT PUMP,CL2 PUMP, PIPING	$2,500,000

Source: VOMWD 2025

4.2.3 Critical and District Facility Inventory

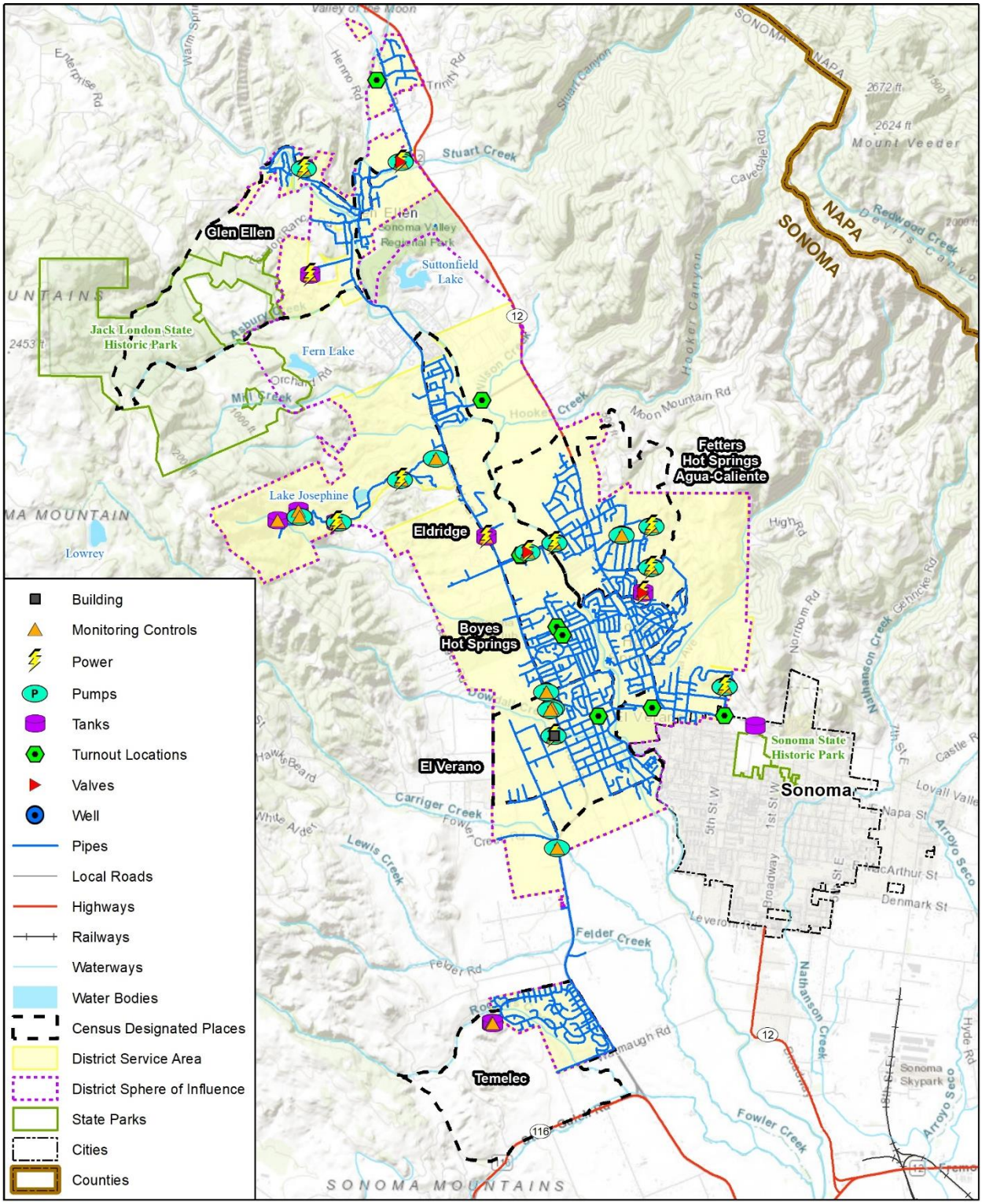
A critical facility is defined (within the context of this plan) as a facility that is essential in providing utilities or support either during the response to an emergency or during a recovery operation. The following eight FEMA Community Lifelines were used to differentiate critical assets and facilities in the District's Planning Area based on FEMA Community Lifelines (framework):

- **Safety & Security:** Law enforcement, fire service, search and rescue, continuity of government
- **Food, Hydration, and Shelter:** Food supply, potable water access, emergency sheltering, agriculture
- **Health & Medical:** Hospitals, EMS, public health, patient movement, medical supply chains
- **Energy:** Electric power, natural gas, fuel supply
- **Communications:** 911, dispatch, alerts and warnings, responder communications
- **Transportation:** Roads, bridges, transit, rail, ports, aviation
- **Hazardous Materials:** HAZMAT facilities, spills, contaminants
- **Water Systems:** Potable water infrastructure and wastewater management

Lifeline utility systems for potable water supply are critical facilities, so all District's water facilities are critical. In addition, the HMPC identified other major water suppliers in Sonoma Valley, such as Sonoma Water, another special water district and the major water supplier in Sonoma County. It operates the Sonoma Aqueduct that delivers water from the Russian River to more than 600,000 residents in portions of Sonoma County and northern Marin counties. The agency is a water wholesaler, selling potable water primarily to nine cities and special districts, including the District, which these jurisdictions and water districts then sell to their customers.

Standby power is also necessary for critical facilities in the event of a power outage (planned or unplanned), which can be the result of many natural hazard events, such as severe weather, high winds, earthquake, or wildfire. The District has emergency generation capabilities at all its critical facilities.

Figure 4-2 Critical Water Facilities in District by Type



Map compiled 2/2026;
intended for planning purposes only.
Data Source: Sonoma County, CalTrans, US Census TIGER Database, CA Open Data Portal, EKI Environment & Water, Inc., CA Parks and Rec.

0 1.5 3 Miles

N

4.2.4 Cultural, Historical, and Natural Resources

Assessing the District's vulnerability to disaster also involves inventorying the natural, historical, and cultural assets of the area. This step is important for the following reasons:

- The community may decide that these types of resources warrant a greater degree of protection due to their unique and irreplaceable nature and contribution to the overall economy.
- In the event of a disaster, an accurate inventory of natural, historical, and cultural resources allows for more prudent care in the disaster's immediate aftermath when the potential for additional impacts is higher.
- The rules for reconstruction, restoration, rehabilitation, and/or replacement are often different for these types of designated resources.
- Natural resources can have beneficial functions that reduce the impacts of natural hazards, for example, wetlands and riparian habitat which help absorb and attenuate floodwaters and thus support overall mitigation objectives. Similarly, watershed protection improves water quality and drinking water supply by safeguarding the natural land and water systems upstream of drinking sources.

Cultural Resources

Historical resources are buildings, structures, objects, places, and areas that are eligible for listing in the National Register of Historic Places (NRHP), the California Register of Historic Resources (CRHR), or the County's List of Historic Resources, have an association with important persons, events in history, or cultural heritage, or have distinctive design or construction method.

For purpose of federal actions, a qualified historic resource is defined as a property listed in or formally determined eligible for listing in the NRHP before a disaster occurs. The NRHP is part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect historic and archeological resources. Properties listed include districts, sites, buildings, structures, and objects that are significant in American history, architecture, archeology, engineering, and culture. The National Register is administered by the U.S. Department of the Interior National Park Service. Local and state agencies may consider a broader definition of qualified historic properties in the review, evaluation, and treatment of properties damaged during a disaster.

The State of California Office of Historic Preservation can provide technical rehabilitation and preservation services for historic properties affected by a natural disaster. Depending on the hazard, protection could range from emergency preparedness, developing a fire safe zone around sites susceptible to wildfires, or seismically strengthening or structurally reinforcing structures.

State and local registers of historic resources provide designated Historical Landmarks, Points of Historical Interest, and Historic Buildings. These resources include, but are not limited to:

- The California Register of Historical Resources (CRHR)
- The California Historical Landmarks
- The California Inventory of Historical Resources
- The California Points of Historical Interest
- Sonoma County Historic Landmarks

Historical resources designated the NRHP and by Sonoma County are provided in Table 4-7. Some of these historic and cultural places are duplicative in both the County and National databases.

Table 4-7 Sonoma Valley Historical Resources

Historical Resource Name	Listed Date	Location	Community	Other Names or Description
National Register of Historic Places				
Sonoma State Home – Main Building	10/6/2000	15000 Arnold Drive	Eldridge	Sonoma State Hospital; Sonoma Development Center
Glen Oaks Ranch	10/21/1994	13255 Sonoma Highway	Glen Ellen	Glen Ellen Vineyard; Cochran, Roswell and Camille M. Ranch
Hotel Chauvet	2/25/1990	13756 Arnold Drive	Glen Ellen	Chauvet Hotel
Jack London Ranch	10/15/1966	0.4 miles west of Glen Ellen in Jack London Historical State Park	Glen Ellen	Jack London Home and Ranch
Buena Vista Vineyards-Buena Vista Vinicultural Society	7/24/1986	18000 Old Winery Rd.	Sonoma	Buena Vista Winery
Carriger, Nicholas, Estate	11/16/2001	18880 Carriger Rd.	Sonoma	Yulupa Ranch
Orange Lawn	6/9/2008	645 Charles Van Damme Way	Sonoma	Young Mansion
Sonoma Depot	4/3/1975	284 1st St., W	Sonoma	Sonoma Valley Railroad Station
Sonoma Grammar School	11/28/1980	276 E. Napa St.	Sonoma	Sonoma Community Center
Sonoma Plaza	4/3/1975	Center of Sonoma	Sonoma	Ol Sonoma; Sonoma Pueblo; Vallejo Estate
Sonoma Valley Woman's Club	1/7/2015	574 1st St., E.	Sonoma	Historic clubhouse
Temelec	4/19/2006	220 and 221 Temelec Circle	Sonoma	Temelec Farm
Vallejo Estate	6/29/1972	Corner of Spain and W. 3rd Sts.	Sonoma	Lachryma Montis
Sonoma County Historical Landmarks (1st District Sites)				
Arnold Drive Bridge #20C-213	1998	Arnold Drive	Glen Ellen	Arnold Bridge
Calabezas Creek Bridge #20C-324	1981	O'Donnell Lane	Glen Ellen	O'Donnell Lane Bridge
Chateau Saint Jean	1981	843 Saint Jean Court	Kenwood	Goff Residence
Chauvet Building	1981	13740 Arnold Drive	Glen Ellen	Chauvet Building
Freestone House/Clemente Inn	1989	17341 Highway 12	Agua Caliente	Clementi Inn Fetters Hot Springs
Gaige House	1980	13540 Arnold Drive	Glen Ellen	Gaige House
General Joseph Hooker's Ranch	1981	16601 Meadow Oaks Drive	Aqua Caliente	Hooker Ranch, Hooker Oaks Watriss Ranch, Serres Ranch
Glen Oaks	1981	13255 Highway 12	Glen Ellen	Glen Oaks Vineyards
Hotel Chauvet	1981	13756 Arnold Drive, #1B	Glen Ellen	Glen Ellen Hotel Four Nations Restaurant
Jack London Barn	1998	1467 Hill Road	Glen Ellen	Jack London Barn
Jack London Village: Stone Winery Building	1981	14301 Arnold Drive	Glen Ellen	Jack London Village; Stone Winery Building
Joshua Chauvet House	1980	13760 Arnold Drive	Glen Ellen	Joshua Chauvet House

Historical Resource Name	Listed Date	Location	Community	Other Names or Description
Kenwood Community Church	1981	9655 Channing Row	Kenwood	First Congregational Church of Los Guillicos
Kenwood Depot	1980	314 Warm Springs Road	Kenwood	Kenwood Railroad Depot South Guillicos Station
Kenwood Winery	1981	9592 Highway 12	Kenwood	Pagani Winery & Home
Mervyn Hotel Site	1990	13751 Arnold Drive	Glen Ellen	Mervyn Hotel Site
Monroe Ranch/Coops House	1998	8790 Highway 12	Kenwood	Monroe Ranch/Coops House
Partis Residence	1981	98 Shaw Avenue	Kenwood	Partis Residence
Fetter's Hot Springs Depot	1975	215 Depot Road	Fetter's Hot Springs	Northwestern Pacific Railroad Depot
Agua Caliente Springs Hotel	1975	17250 Vailetti Drive	Agua Caliente	Agua Caliente Villa
Sonoma Mission Inn	1986	18140 Highway 12	Boyes Hot Springs	Sonoma Mission Inn
Superintendent's House, Sonoma State Hospital	1981	15000 Arnold Drive	Glen Ellen	California Home for the Care and Training of Feeble-Minded Children
Ten Oaks Ranch	1981	12783 Dunbar Road	Glen Ellen	Kate Warfield Ranch Decker House Cool Ranch
Thompson Ranch and Cemetery	1979	7301 Enterprise Road	Glen Ellen	Redwood Farm
Triniti School	NA	11790 Dunbar Road	Glen Ellen	Triniti School
Valley of the Moon Winery	1997	751 Madrone Road	Glen Ellen	Valley of the Moon Winery
Wake Robin Lodge	1981	4100 Wake Robin Drive	Glen Ellen	Wake Robin Lodge
Wegenerville Resort	1979	1883 London Ranch Road	Glen Ellen	Wegenerville Resort
Wildwood Vineyards	1981	11011 Highway 12	Kenwood	James Shaw Ranch
Zane House	NA	3443 Warm Springs Road	Glen Ellen	Zane House

Source: National Register of Historic Places, 2025; Sonoma County 2025

Lists of designated historical resources change periodically, and they may not include those currently in the nomination process and not yet listed. Additionally, as defined by the National Environmental Policy Act (NEPA), any property over 50 years of age is considered a historic resource and is potentially eligible for listing on the National Register. Thus, in the event that the property is to be altered, or has been altered, as the result of a major federal action, the property must be evaluated under the guidelines set forth by NEPA. Structural mitigation projects are considered alterations for the purpose of this regulation.

Cultural resources defined in California Environmental Quality Act (CEQA) Section 15064.5 include prehistoric and historic archaeological resources; historic-period resources (buildings, structures, area, place, or objects). Archaeological resources reflect past human activity extending from Native American prehistoric cultures throughout the early 20th century. The artifacts left by previous occupants may be encountered in small to large residential sites, or special use areas.

Many cultural and historical resources in the District's Planning Area are vulnerable to several hazards due to location and the nature of their construction. Some of these risks include earthquakes, wildfires, or adverse weather.

Tribal Cultural Resources

Tribal cultural resources are defined in Public Resources Code (PRC) Section 21074.1 as a site, feature, place, cultural landscape that is geographically defined in terms of the size and scope of the landscape, sacred place, or object with cultural value to a California Native American tribe. A Native American tribe is defined as "a federally recognized California Native American tribe or a non-federally recognized California Native American tribe that is on the contact list maintained by the Native American Heritage Commission". Traditional tribal cultural places are defined in PRC Sections 5097.9 and 5097.993 to include sanctified cemeteries, places of worship, religious or ceremonial sites, or sacred shrines, or any historic, cultural, or sacred site that is listed on or eligible for the CRHR including any historic or prehistoric ruins, burial grounds, or archaeological site. Cultural and tribal resources are governed primarily by federal, state, and local laws that regulate potential impacts on such resources. State regulations that were established to encourage the preservation and protection of traditional tribal cultural resources include:

- **Assembly Bill 52** (PRC Section 21080.3.1) mandates early tribal consultation prior to and during CEQA review to consider tribal cultural values in determination of project impacts and mitigation.
- **Senate Bill 18** (Government Code 655352.3) requires cities and counties to consult with Native American tribes early during broad land use planning efforts on both public and private lands, prior to site- and project-specific land use decisions. Consultation is intended to encourage preservation and protection of traditional tribal cultural places by developing treatment and management plans that might include incorporating the cultural places into designated open spaces.
- **State Executive Order B-10-11 (2011)** established the Governor's Tribal Advisor position and established Administration Policy to encourage State Agencies to communicate and consult with Californian tribes regarding tribal cultural resources.

Natural Resources

The District's Planning Area in Sonoma Valley contains diverse natural resources, exemplified by the creeks and rivers and salt marshes within the Sonoma Creek watershed that drain inland mountains to the confluence of the Sonoma Creek and San Pablo Bay.

Natural resources are important to include in benefit/cost analyses for future projects and may be used to leverage additional funding for mitigation projects that also contribute to community goals for protecting sensitive natural resources. Inventory and awareness of natural resource assets is vital to meeting conservation objectives. For example, protecting wetland areas provides sensitive habitat protection as well as floodwater conveyance and storage, which further enhances public safety.

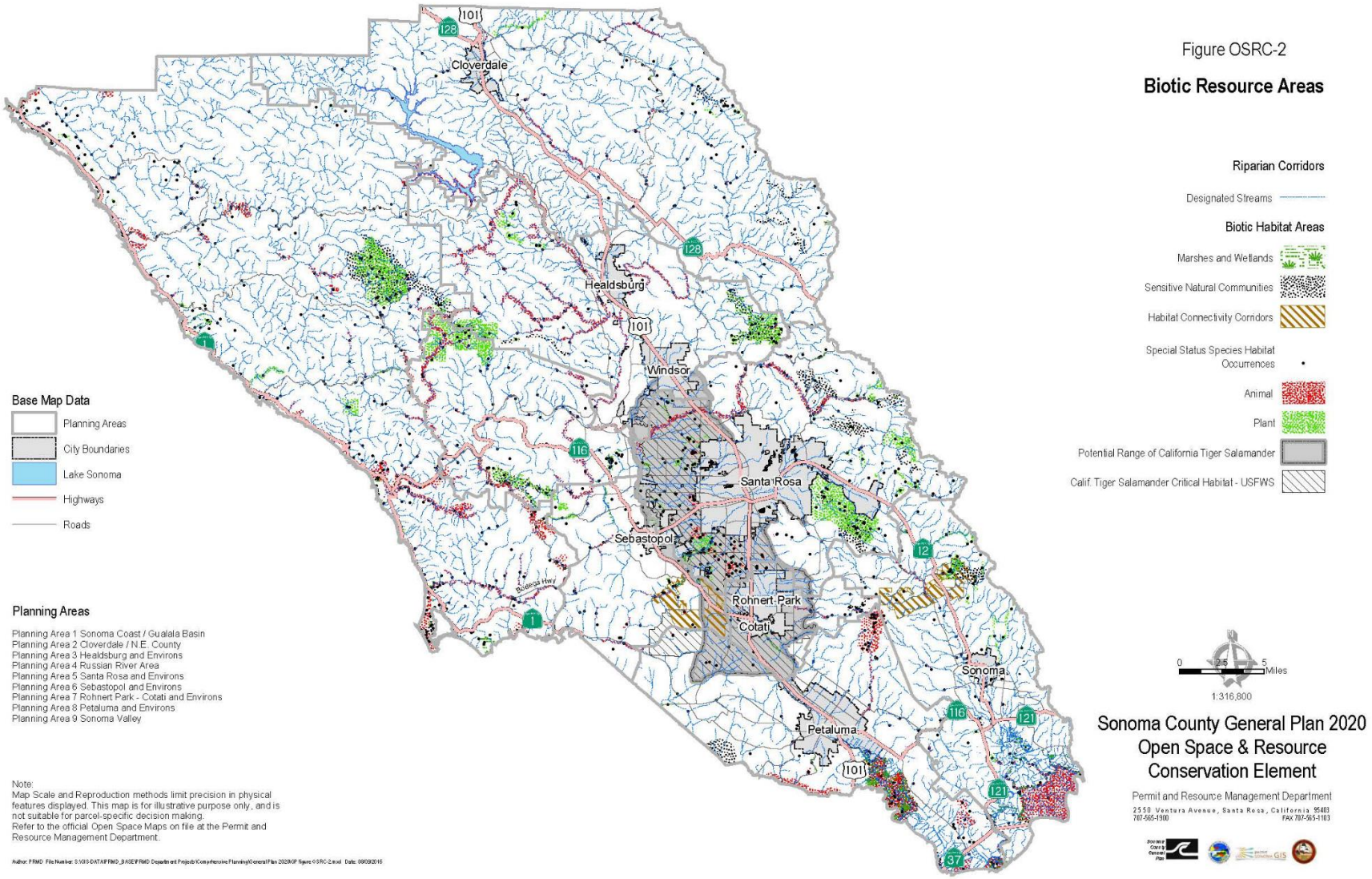
Natural resources also exhibit varied levels of resiliency to anthropogenic impacts, climate change, and natural hazards such as flooding, drought, or wildfire. Habitat resiliency is exemplified in coastal habitat migration to inland areas as a result of sea level rise, and recovery of burn areas following a wildfire. Figure 4-3 illustrates the biotic resources and habitat areas in Sonoma Valley and the Sonoma Creek watershed.

Special Status Species

To further understand natural resources that may be particularly vulnerable to hazard events, as well as those that need consideration when implementing mitigation activities, it is important to identify at-risk species (endangered and threatened species) potentially located in the District's Planning Area. The US Fish and Wildlife Service (USFWS) maintains a list of federally-listed threatened and endangered species for the country, which can be queried at the state and county levels. The California Department of Fish and Wildlife (CDFW) also maintains species lists and accounts for threatened and endangered species.

State and federal laws protect the habitat of these species through the environmental review process. Species of special concern may additionally include species that meet the State definition of threatened or endangered but has not been formally listed, experiences serious population declines or habitat decline, or has naturally small populations exhibiting high susceptibility to population decline (CDFW 2019). Table 4-8 summarizes those special status animal species as indicated in the USFWS database that are located in Sonoma County and likely the areas surrounding the District's Planning Area within Sonoma Valley.

Figure 4-3 Biotic Resources in Sonoma Valley



Source: Sonoma County 2020

Table 4-8 Threatened and Endangered Species in Sonoma Valley and greater Sonoma County

Group	Status	Common Name	Scientific Name
Amphibians	Endangered	California tiger Salamander	*Ambystoma californiense*
Amphibians	Proposed Threatened	Western spadefoot	*Spea hammondii*
Amphibians	Threatened	California red-legged frog	*Rana draytonii*
Birds	Endangered	Hawaiian petrel	*Pterodroma sandwichensis*
Birds	Endangered	Short-tailed albatross	*Phoebastria (=Diomedea) albatrus*
Birds	Endangered	California least tern	*Sternula antillarum browni*
Birds	Endangered	Hawaiian petrel	*Pterodroma sandwichensis*
Birds	Endangered	California Ridgway's rail	*Rallus obsoletus obsoletus*
Birds	Threatened	Northern spotted owl	*Strix occidentalis caurina*
Birds	Threatened	Marbled Murrelet	*Brachyramphus marmoratus*
Birds	Threatened	Western snowy plover	*Charadrius nivosus nivosus*
Birds	Threatened	Yellow-billed Cuckoo	*Coccyzus americanus*
Crustaceans	Endangered	California freshwater shrimp	*Syncaris pacifica*
Crustaceans	Endangered	Conservancy fairy shrimp	*Branchinecta conservatio*
Crustaceans	Threatened	Vernal pool fairy shrimp	*Branchinecta lynchi*
Fishes	Endangered	Tidewater goby	*Eucyclogobius newberryi*
Fishes	Endangered	Longfin Smelt	*Spirinchus thaleichthys*
Fishes	Proposed Threatened	Clear Lake Hitch	*Lavinia exilicauda chi*
Flowering Plants	Endangered	Vine Hill clarkia	*Clarkia imbricata*
Flowering Plants	Endangered	Baker's larkspur	*Delphinium bakeri*
Flowering Plants	Endangered	Contra Costa goldfields	*Lasthenia conjugens*
Flowering Plants	Endangered	Pitkin Marsh lily	*Lilium pardalinum ssp. pitkinense*
Flowering Plants	Endangered	Few-flowered navarretia	*Navarretia leucocephala ssp. pauciflora (=N. pauciflora)*
Flowering Plants	Endangered	Many-flowered navarretia	*Navarretia leucocephala ssp. plieantha*
Flowering Plants	Endangered	Lake County stonecrop	*Parvisedum leiocarpum*
Flowering Plants	Endangered	Sonoma sunshine	*Blennosperma bakeri*
Flowering Plants	Endangered	Sonoma spineflower	*Chorizanthe valida*
Flowering Plants	Endangered	Burke's goldfields	*Lasthenia burkei*
Flowering Plants	Endangered	Sebastopol meadowfoam	*Limnanthes vinculans*
Flowering Plants	Endangered	Monterey clover	*Trifolium trichocalyx*
Flowering Plants	Endangered	Loch Lomond coyote thistle	*Eryngium constancei*
Flowering Plants	Endangered	Clover lupine	*Lupinus tidestromii*
Flowering Plants	Endangered	Showy Indian clover	*Trifolium amoenum*
Flowering Plants	Endangered	Sonoma spineflower	*Chorizanthe valida*
Flowering Plants	Endangered	Monterey clover	*Trifolium trichocalyx*
Flowering Plants	Endangered	Pennell's bird's-beak	*Cordylanthus tenuis ssp. capillaris*
Flowering Plants	Endangered	Yellow larkspur	*Delphinium luteum*
Flowering Plants	Endangered	Pennell's bird's-beak	*Cordylanthus tenuis ssp. capillaris*
Flowering Plants	Endangered	Clara Hunt's milk-vetch	*Astragalus clarianus*

Group	Status	Common Name	Scientific Name
Flowering Plants	Endangered	Sonoma alopecurus	*Alopecurus aequalis var. sonomensis*
Flowering Plants	Endangered	White sedge	*Carex albida*
Flowering Plants	Endangered	Kenwood Marsh checker-mallow	*Sidalcea oregana ssp. valida*
Flowering Plants	Threatened	Slender Orcutt grass	*Orcuttia tenuis*
Flowering Plants	Threatened	Marin dwarf-flax	*Hesperolinon congestum*
Insects	Endangered	Lotis blue butterfly	*Lycaeides argyrognomon lotis*
Insects	Endangered	Myrtle's silverspot butterfly	*Speyeria zerene myrtleae*
Insects	Endangered	Behren's silverspot butterfly	*Speyeria zerene behrensii*
Insects	Endangered	Callippe silverspot butterfly	*Speyeria callippe callippe*
Insects	Endangered	Lotis blue butterfly	*Lycaeides argyrognomon lotis*
Insects	Proposed Threatened	Monarch butterfly	*Danaus plexippus*
Mammals	Endangered	Salt marsh harvest mouse	*Reithrodontomys raviventris*
Mammals	Not Listed	Fisher	*Pekania pennanti*
Mammals	Under Review	Little brown bat	*Myotis lucifugus*
Reptiles	Proposed Threatened	Northwestern Pond Turtle	*Actinemys marmorata*
Reptiles	Threatened	Green sea turtle	*Chelonia mydas*

Source: USFWS – Environmental Conservation Online System, 2026

4.2.5 Population, Growth, and Development Trends

Over the past five years, there has been limited residential, commercial, and industrial development within the service area, with careful attention paid to hazard-prone locations. In response to potential risks, the District implemented a global water assessment process designed to evaluate smaller-scale developments and ensure that new growth does not threaten water supply or increase community vulnerability. As a result, development patterns have not significantly increased vulnerability in hazard areas since the previous plan was approved, as proactive measures have been taken to manage water resources and mitigate associated risks.

The District's customer base was 23,004 in 2024 (VOMWD 2025). Population projections for the District summarized in the 2025 Water Master Plan (WMP) indicate an increase to 33,484 customers by 2045, or an increase of about 45 percent over the next two decades (VOMWD WMP 2025). According to the 2015 UWMP and 2020 SVGSP, Sonoma Valley has experienced significant growth and land use changes over the last 30 years, especially with regard to irrigated agriculture, such as vineyards. While water demand decreased slightly, the District estimates that future water demand will plateau and remain relatively stable, despite additional population and economic growth (VOMWD 2016). This projection reflects anticipated sustained decreases in per capita water use as a result of continued investment in water efficiency improvements by the District and customers.

The demographics of the District's customers include a range of income, household size, and water demands. The more affluent households located along the foothills are characterized by larger lots and homes with higher water demands for irrigation. Also, as a tourist destination, Sonoma Valley has a high concentration of second homes and vacation rentals. These customers have higher water use because the sites do not have full-time owners looking for leaks and managing irrigation water use in accordance with weather patterns (VOMWD 2019).

According to the 2025 WMP, the District anticipates providing connections and service to the following major developments in the future:

- **810 West Agua Caliente Road**: The proposed development includes the construction of a hotel, townhomes, affordable housing units, and a retirement community on vacant land at the intersection of Arnold Drive and Agua Caliente Road (EKI, 2021a);
- **Verano Ave Multi-Family Residential Development**: An 80-unit multi-family development on Verano Avenue across from Maxwell Farms Regional Park anticipated to be completed by late 2026; and,
- **The Springs Specific Plan**: The proposed development includes 124 single-family dwelling units, 561 multi-family or live-work dwelling units, 167,000 square feet of commercial space, 120 hotel rooms, 82,000 square feet of office space, and 27,000 square feet of recreational area anticipated to be completed over the next 50 years.

Sonoma Development Center

Further development is projected within the District's SOI as part of the planned redevelopment of the Sonoma Developmental Center (SDC), currently owned by the State of California. The SDC site has established rights and access to local surface water supplies, as well as related treatment, storage, and distribution infrastructure. While the SDC water system was previously permitted and operated as a public water system, it ceased operations in 2019 following the closure of the SDC. Situated within the District's sphere of influence, the District intends to annex the SDC area and integrate the SDC water system into its own system upon site redevelopment. The anticipated development is expected to comprise between 200 and 500 residential units. However, the timeline for this future development remains uncertain, and the site is not presently included within the District's service area.

4.3 Hazard Profiles and Risk Assessment

44 U.S. Code of Federal Regulations Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.

44 U.S. Code of Federal Regulations Requirement §201.6(c)(2)(ii): [The risk assessment shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community.

44 U.S. Code of Federal Regulations Requirement §201.6(c)(2)(ii)(A): The plan should describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas.

44 U.S. Code of Federal Regulations Requirement §201.6(c)(2)(ii)(B): [The plan should describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(A) of this section and a description of the methodology used to prepare the estimate.

44 U.S. Code of Federal Regulations Requirement §201.6(c)(2)(ii)(C): [The plan should describe vulnerability in terms of] providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.

The hazards identified in Section 4.1 Hazard Identification: Natural Hazards are profiled individually in this section. In general, information provided by HMPC is integrated into this section with information from other data sources. These profiles set the stage for the vulnerability assessment for each natural hazard that follows the detailed hazard profiles.

Each hazard is profiled in the following format:

- **Hazard Description** - This section includes a description of the hazard and associated issues followed by details on the hazard specific to the District's Planning Area.
- **Geographic Location** – This section provides a spatial description of the potential locations or geographic areas and extents in the District's Planning Area of where the hazard is expected to impact.
- **Magnitude/Severity** - This section describes the potential strength or magnitude of the hazard as it pertains to the District. Different hazards may have different measures of severity.
- **Previous Occurrences** - This section contains information on historical incidents, including impacts where known. The extent or location of the hazard within or near the Planning Area is also included in this subsection. Historical incident worksheets and other data sources were used to capture information on past occurrences.
- **Probability of Future Occurrence** - The frequency of past events is used in this section to gauge the likelihood of future occurrences. Where possible, frequency was calculated based on existing data. Frequency was determined by dividing the number of events observed by the number of years on record and multiplying by 100. This gives the percentage chance of an event happening in any given year (e.g., three droughts over a 30-year period equates to a 10 percent chance of a drought in any given year). The likelihood of future occurrences is categorized into one of the following classifications:
  - **Highly Likely** - Nearly 100 percent chance of occurrence in next year or happens every year.
  - **Likely** - Between 10 and 99 percent chance of occurrence in next year or has a recurrence interval of 10 years or less.
  - **Occasional** - Between 1 and 10 percent chance of occurrence in the next year or has a recurrence interval of 11 to 100 years.
  - **Unlikely** - Less than 1 percent chance of occurrence in next 100 years or has a recurrence interval of every 100 years or greater.
- **Climate Change Considerations** – This section addresses the probable effects of climate change qualitatively and as a secondary impact for each identified hazard. It describes the potential for climate change to affect the frequency and severity of natural hazards and summarizes this effect as to whether it will have a low, medium, or high influence on the hazard. Impacts can include water supply shortages, changes in the frequency, intensity, and extent of drought and extreme heat events, more precipitation and flooding risks, and increasing temperatures.
- **Vulnerability Assessment** – The vulnerability of the Planning Area to a specific natural hazard is assessed through the study of potential impacts to specific sectors:
  - People (Customers, District Staff)
  - Property
  - Critical Water Facilities and Infrastructure
  - Economy
  - Historic, Cultural, and Natural Resources
  - Future Development

  An estimate of the vulnerability of the District to the priority hazards, in addition to the estimate of risk of future occurrence, is provided in each of the hazard-specific sections that follow. Vulnerability is measured in general, qualitative terms and is a summary of the potential impact based on past occurrences, spatial extent, and damage and casualty potential. It is categorized into the following classifications:

  - **Low**—Minimal potential impact. The occurrence and potential cost of damage to life and property is minimal.
  - **Medium**—Moderate potential impact. This ranking carries a moderate threat level to the general population and/or built environment. Here the potential damage is more isolated and less costly than a more widespread disaster.
  - **High**—Widespread potential impact. This ranking carries a high threat to the general population and/or built environment. The potential for damage is widespread. Hazards in this category may have occurred in the past.

Vulnerability can be quantified in those instances where there is a known, identified hazard area, such as a mapped floodplain. In these instances, the numbers and types of water assets subject to the identified hazard can be counted and their values tabulated. Other information can be collected regarding the hazard area, such as the location District water facilities, historic structures, and valued natural resources (e.g., an identified wetland or endangered species habitat). Together, this information conveys the impact, or vulnerability of that area to that hazard.

- **Risk Summary** – This is a summary of key findings and risk based on threat, vulnerability and impacts to the Planning Area from the specific hazard. The significance of each hazard was determined based on the hazard profile, focusing on key criteria such as frequency and resulting damage, including deaths/injuries, and property and economic damage. This assessment was used by the HMPC to prioritize those hazards of greatest significance to the Planning Area thereby allowing the District to focus resources where they are most needed. The following sections provide profiles of the natural hazards, listed by priority based on HMPC input.

4.3.1 Dam Incidents

Geographic Extent	Probability of Future Occurrences	Magnitude/ Severity	Overall Significance
Limited	Unlikely	Limited	Low

Hazard Description

A dam incident is the loss, or threatened loss, of control at a dam that produces an abnormal release of stored water and a rapid rise in downstream stages. It is driven by the volume stored behind the structure, how quickly that volume is released, and how much warning time exists between the dam and the affected areas. In general, there are three types of dams: concrete arch or hydraulic fill, earth-rockfill, and concrete gravity. Each type fails in different ways. Concrete arch or hydraulic-fill dams can fail almost instantaneously if structural stability is compromised, sending a sharp flood wave that peaks quickly, then declines. Earth-rockfill dams most often fail by overtopping or internal erosion; once a breach forms, discharge builds as the breach enlarges, then tapers as the reservoir drains. Concrete gravity dams can fail abruptly or progressively through section loss or sliding, generating either a sudden or a staged release.

Initiating conditions include warm winter storms and rain-on-snow events that push inflow beyond spillway capacity, rapid drawdown or misoperation during gate movements, chronic seepage and piping through embankments or foundations, blockage or damage at spillways and outlets, earthquake shaking that degrades embankment strength or appurtenant works, and cascading effects from an upstream facility. Any of these can produce either a breach or high controlled releases that still flood downstream channels, road crossings, and low areas.

Dam-inundation maps published by owners and the State define breach footprints, representative depths, and, where available, arrival times and velocities. These datasets are separate from FEMA Flood Insurance Rate Maps (FIRMs) and are used in this plan as the life-safety basis for evacuation planning, route protection, and identification of at-risk District facilities. Where recent restoration grading, channel adjustments, or capital changes are not captured, this plan notes data gaps for future updates.

The California Department of Water Resources (DWR) Division of Safety of Dams (DSOD) has jurisdiction over impoundments that meet certain capacity and height criteria. Embankments that are less than six feet high and impoundments that can store less than 15 acre-feet are non-jurisdictional. Additionally, dams that are less than 25 feet high can impound up to 50 acre-feet without being jurisdictional.

Geographic Location

Limited – The District serves the Sonoma Valley between the Sonoma Mountains and the Mayacamas Range, with development concentrated along Sonoma Creek and its tributaries through Agua Caliente, Boyes Hot Springs, El Verano, and unincorporated neighborhoods west and north of the City of Sonoma. The valley floor is low-gradient and confined by alluvial fans and foothills, and short, steep upland channels drain rapidly toward Sonoma Creek. Small on-channel impoundments and hillside reservoirs are common and store modest volumes for supply, irrigation, and recreation. In a dam incident, effects are limited to extent and track the creek corridor and immediate overbanks, with the highest exposure at low river bends, crossings, and road dips and a quick taper with distance and elevation from the channel.

Downstream conveyance follows Sonoma Creek toward San Pablo Bay, where backwater can slow drainage during large storms or king tides but does not broaden the footprint far beyond the corridor. Regionally, Lake Sonoma and Lake Mendocino shape water management and coordination, but local dam-incident exposure for the District is driven by these smaller facilities within or just upstream of the service area and by the narrow, fast-response nature of the tributary network.

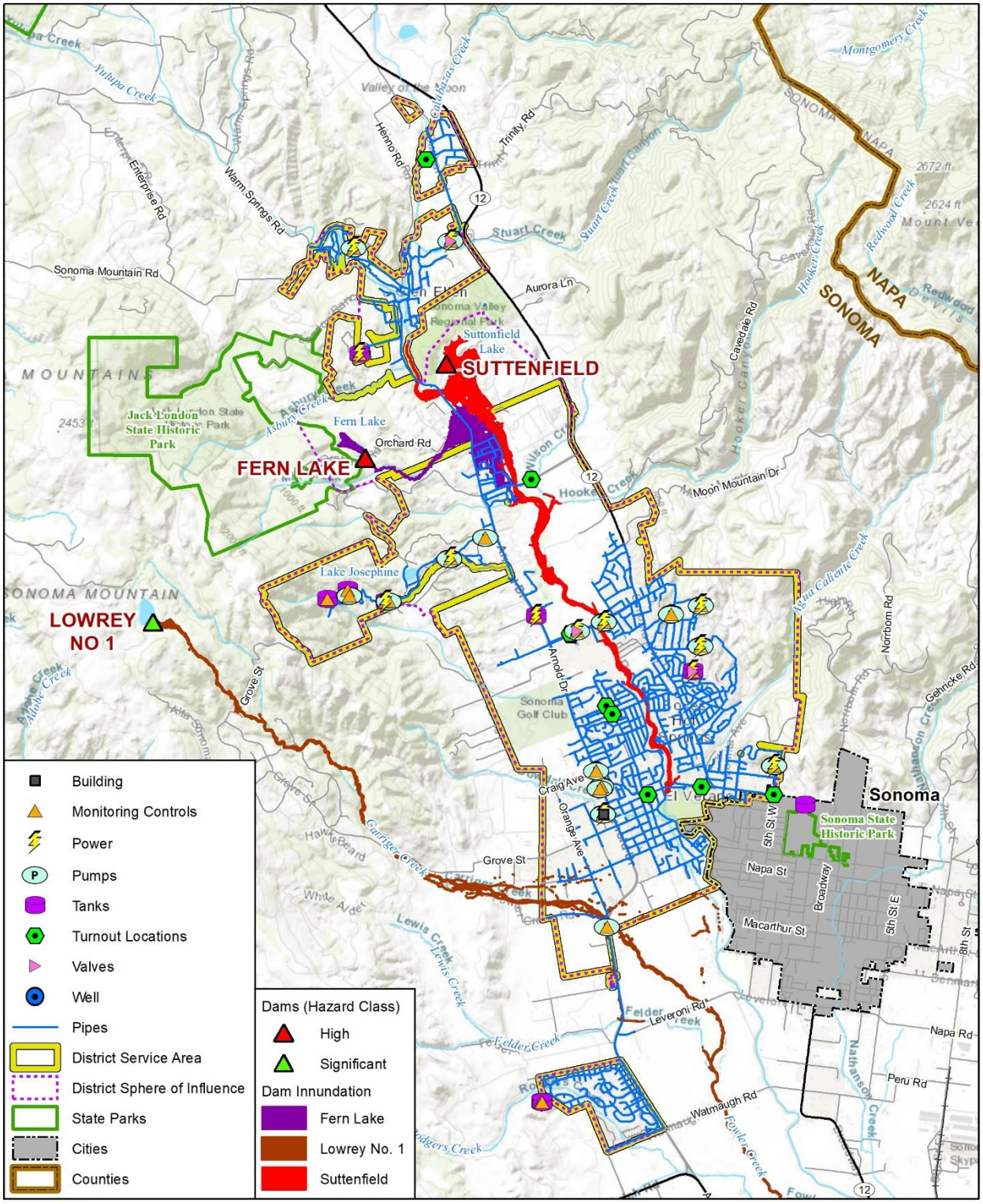
According to the DOSD September 2025 *Dams Within Jurisdiction of the State of California*, there are two potential dams of concern in the District's Planning Area, and one potential dam of concern upstream of the District's Planning Area. Of these dams, two are rated as High Hazard and one is rated as Significant Hazard, according to DSOD ratings defined in the Magnitude/Severity section. Table 4-9 details the dams that could potentially affect the District's Planning Area given their close proximity and potential to inundate if either were to fail. Figure 4-4 illustrates the locations of the identified dams of concern near the District's Planning Area.

Table 4-9 Characteristics of the Dams of Concern Upstream of the District's Planning Area

Hazard Rating	Dam Name	River Drainage	Downstream Community	Dam Type	Dam Height	Storage Capacity	EOP	Dam Owner
High	Fern	Tributary to Mill Creek	El Verano, Boyes Hot Springs, Sonoma	Earth	40 feet	241 acre-feet	Yes	Department of General Services
High	Suttonfield	Sonoma Creek	El Verano, Boyes Hot Springs, Sonoma	Earth	76 feet	600 acre-feet	Yes	Department of General Services
Significant	Lowrey No. 1	Tributary to Carriger Creek	Sonoma	Earth	19 feet	82 acre-feet	No	Private Entity

Source: Valley of the Moon Water District, DWR, DSOD, WSP Analysis
Note: 1 acre-foot = 325,851 gallons

Figure 4-4 Dams of Interest Upstream of the District's Planning Area



Magnitude/Severity

Limited – Standard practice among federal and state dam safety offices is to classify a dam according to the potential impact a dam failure (breach) or mis-operation (unscheduled release) would have on downstream areas. Dams in California are classified in four categories defined by the California DWR DSOD that identify the potential hazard to life and property:

- **Extremely High Hazard** – Expected to cause considerable loss of human life or would result in an inundation area with a population of 1,000 or more.
- **High Hazard** – Expected to cause loss of at least one human life.
- **Significant Hazard** – No probable loss of human life but can cause economic loss, environmental damage, impacts to critical facilities, or other significant impacts.
- **Low Hazard** – No probable loss of human life and low economic and environmental losses. Losses are expected to be principally limited to the owner's property.

For the District, exposure arises from regional reservoirs that influence flows in the Russian River supply system and from smaller local impoundments in the Sonoma Creek watershed. A breach near full pool would deliver high depths and velocities with short warning time, mobilizing debris, undermining crossings, and overtopping low structures before attenuating downstream. Even without failure, large releases during atmospheric rivers can elevate stages, back up at bridges and culverts, and create ponding in developed low points that affect access to wells, tanks, pump and lift stations, and the wastewater system. Below-grade electrical and control equipment is vulnerable to shorting, and first-flush sediment and organic loads can foul intakes and mechanical equipment.

Since there are three potentially hazardous dams upstream of the District's Planning Area, there is some limited potential for loss of life and/or property and water infrastructure damage. Adjacent unincorporated portions of Sonoma County and portions of the City of Sonoma could also be affected by a dam failure upstream of the District's Planning Area and the City of Sonoma, although the specific extent of impacts would depend on the nature of the failure, local emergency response capabilities, people and property found in the path of the dam inundation areas, and other such factors.

Based on the dam capacities of the dams upstream of the Planning Area with Emergency Action Plans (EAPs) and dam inundation mapping data, the extent of dam inundation for both Fern Lake and Suttonfield Lake affects discrete areas of the District south towards Arnold Drive along Sonoma Creek and Mill Creek, respectively. GIS analysis was conducted and determined that approximately 1.6 percent (92.6 acres) of the District would be inundated by the failure the Fern Lake Dam and approximately 1.3 percent (97.1 acres) of the District would be inundated by the failure of the Suttonfield Lake Dam. The time for flooding to reach the Harney/Redwood Drive intersection southeast of Fern Lake is 5 to 10 minutes. The time for flooding to reach the Railroad/Sunrise intersection south of Suttonfield Lake is 5 to 10 minutes. The extent of the two major inundation areas covers a portion of the community of Eldridge and a small portion of the community of El Verano, but most of the inundation area around El Verano is confined to Sonoma Creek. Inundation of Lowrey No. 1 would impact an insignificant amount of the Planning Area.

For the significant dams upstream of the District's Planning Area, it is unlikely that much risk would be imposed on those areas near the District's Planning Area, nor their water infrastructure given the smaller size of each water supply reservoir and the distance of the water bodies to the downstream communities.

Previous Occurrences

There is no history of dam incidents or failures affecting the District.

Probability of Future Occurrences

Unlikely – The District remains at risk to upstream dam failures or incidents, particularly from the two dams that are classified as high hazard structures that are within the District Planning Area. However, based on the lack of previous dam inundation events, HMPC input, two active EAPs in place, and the rigorous monitoring and inspection requirements for dams, dam failure and dam incidents are unlikely in the area. Nevertheless, the potential exists for future dam incidents in the Planning Area or portions of it, but the likelihood of this is low. Uncontrolled or controlled release flooding as well as spillway flooding below dams due to excessive rain or runoff are more likely to occur than failures.

Climate Change Considerations

In the District, climate change is expected to modestly raise the stress on small on-channel impoundments and hillside reservoirs but does not broadly expand the dam-incident footprint beyond creek corridors. Warmer, wetter winters increase the share of precipitation falling as rain at mid-elevations and raise the frequency of rain-on-snow events. Atmospheric River (AR) sequences can deliver larger, more sustained inflows that test freeboard, spillway capacity, and outlet reliability. Longer dry spells between storms can also increase vegetation growth and debris loading, which can impair spillways and outlet works when the first major storm arrives.

Many local facilities impound relatively small volumes, and routine operations or diversions often keep storage well below crest outside peak winter. Seasonal drawdown, available freeboard, and active spillway management limit overtopping risk in typical years. Reservoir levels may also trend lower in drought, reducing stored energy even when intense storms occur. The net effect is that climate change is likely to increase short-duration hydrologic stress (bigger peaks, tighter sequencing, more debris) on small dams and appurtenances, but with impacts that remain linear along Sonoma Creek and its tributaries and taper quickly with distance and elevation from the channel. Overall, climate influence on dam incidents remains low, with emphasis on winter ARs, rain-on-snow, spillway debris management, and coordination of drawdown ahead of forecasted sequences

Vulnerability Assessment

The District lies in a narrow valley where four main creeks (Sonoma, Calabazas, Carriger, and a Mill Creek tributary) collect rapid runoff from nearby mountains and channel it through several communities toward San Pablo Bay. The area features steep upland channels, low-gradient sections along Sonoma Creek, and small reservoirs used for supply, irrigation, and recreation. Dam-related risks are therefore limited to specific corridors. Consequences of dam failure are governed by the storage and condition of a few small facilities within or just upstream of the service area, the tight topography that focuses flows, and the short warning times typical of steep tributaries. In this context, dam incidents are classified as limited, credible, but spatially confined to mapped or expected inundation paths along the creeks and their immediate floodplains.

People

Communities situated below Suttonfield Dam and Fern Lake Dam, and along Sonoma Creek and its tributaries through Eldridge, Agua Caliente, Boyes Hot Springs, and El Verano, remain the populations (i.e., customers and/or District staff working in vicinity) of concern. These areas include residential blocks, so a failure could produce temporary evacuations, short-term displacement, and localized losses of customers and revenue for the District. Risk to individuals depends on proximity to the mapped path, local topography, reservoir level at the time of breach or incident, and time of day. Standing water after a breach carries the same health and safety hazards as any flood, including debris, contamination, and access limits.

Property

Dam-incident exposure to property within the District is spatially limited and concentrated along mapped inundation paths for Suttonfield and Fern, with smaller, dispersed pockets below minor hillside impoundments. Based on the District's prior GIS overlays, approximately 97.1 acres (about 1.3 percent of the Planning Area) fall within the Suttonfield inundation area and about 9.26 acres (about 1.6 percent) fall within the Fern inundation area. Within these footprints, damage potential tracks depth, velocity, debris load, and warning time.

Affected structures would be along Sonoma Creek and short tributaries in Eldridge, Agua Caliente, Boyes Hot Springs, and El Verano. Typical effects include first-floor and crawlspace inundation, under-slab undermining, fence and outbuilding damage, and loss of contents and mechanicals located at low grades. Older pier-and-post foundations are more sensitive at shallow depths; modern slab-on-grade construction tolerates shallow sheet flow better but can still suffer from cabinetry, appliances, and HVAC losses once water reaches interior spaces.

Accessory and site improvements are also at risk: private laterals, small pumps, wells, septic systems on low terraces, and vineyard or landscape infrastructure can be buried by sediment or fouled by turbid flows. Roadside frontages and shared private drives at dip crossings are vulnerable to overtopping, rutting, and culvert plugging during a drawdown release or outlet blockage incident. Where inundation overlaps mapped FEMA AE/AO/AH zones, depth–damage relationships for riverine flooding are a reasonable proxy; where dam-specific maps extend beyond National Flood Hazard Layer (NFHL) limits, localized velocities may exceed those assumed in standard riverine curves and increase scouring at corners, steps, and utility penetrations.

Critical Water Facilities and Infrastructure

A total dam failure would drive fast, debris-laden water through established corridors, damaging roads, bridges, and buried utilities and cutting access to the District's concentration of wells, tanks, pressure-zone appurtenances, and lift stations. Even a high but controlled release can wash out low crossings, force detours, and delay generator refueling and level reads. Any District asset within a mapped or anticipated inundation path is exposed to scour, electrical faults in below-grade conduits and panels, sediment intrusion, and prolonged site inaccessibility until debris is cleared, and spans are inspected.

District GIS screening against Suttonfield, Fern and Lowrey No. 1 dam-inundation maps identified no District critical facilities within any footprint. This lowers direct structural risk from those reservoirs, but operational effects remain plausible: bridge or road closures along Sonoma Creek and its tributaries would slow crew routing, and sediment and organic loads during first flush could clog inlets and vaults and increase maintenance at access points.

Regional reservoirs on the Russian River system affect supply rather than structural inundation within the service area. Major incidents at Lake Mendocino (Coyote Valley Dam) or Lake Sonoma (Warm Springs Dam) would be managed by Sonoma Water and the Corps once levels rise into flood-control pools; the Corps assumes release control above the supply pool at Mendocino and above elevation 451 feet at Lake Sonoma. Emergency or sustained high releases could constrain Sonoma Water's conveyance via the Sonoma Aqueduct, creating secondary effects on deliveries to the District. Any extended curtailment would require coordinated outage contingencies with Sonoma Water and alignment with DWR DSOD and the Corps on timing of restarts as channel conditions stabilize.

Economy

The District does not own or operate any dams, reducing direct operational liability. However, in the unlikely event of a catastrophic dam failure, localized flooding could damage residential and commercial properties, transportation routes, and portions of the District's water distribution infrastructure. Such

impacts could lead to temporary business closures, property damage, repair costs for utilities and roads, and short-term disruptions to tourism and agricultural activities in the affected areas. Because the exposed area represents a relatively small portion of the total Planning Area, the overall economic vulnerability to dam failure to both the District and local economy is considered low, with impacts likely to be localized rather than district-wide.

Historic, Cultural, and Natural Resources

Dam-related inundation would behave much like other floodwater in Sonoma Valley: it would cut banks, scour channels, deposit sediment and debris on floodplains, and stress riparian corridors. Recovery of natural systems is likely over seasons to years, but immediate effects include turbidity, channel reshaping, vegetation loss, and debris loads in Sonoma Creek and short tributaries such as Calabazas and Carriger.

Within the service area, the resources most at risk are those that sit in low ground along established corridors. These include riparian habitat and valley-oak woodland fringing Sonoma Creek and its fans, as well as community assets in Agua Caliente, Boyes Hot Springs, and El Verano where historic resort-era buildings and older neighborhoods occupy low terraces. North of these areas, the SDC campus at Eldridge contains historic structures near Suttonfield and Fern impoundments.

While District facilities are not mapped in their inundation footprints, an uncontrolled release could still damage roads, bridges, and utilities that provide access to cultural sites and State and County parklands and could strand debris and fine sediments on landscaped grounds. Downstream, prolonged high flows would carry sediment and large woody material toward lower Sonoma Creek, with potential for short-term habitat degradation and episodic fish passage issues until channels restabilize.

Recent and Future Development

Recent and future growth in the Sonoma Valley will continue along the Sonoma Creek corridor and within the unincorporated communities of Eldridge, Agua Caliente, Boyes Hot Springs, and El Verano. Portions of these areas lie near small on-channel impoundments and hillside reservoirs or within low terraces subject to rapid runoff. Development in these settings may experience short-notice inundation from a dam incident, outlet malfunction, or controlled release, as well as limited access where crossings are low and rely on a single route.

Future redevelopment of the SDC occurs adjacent to Suttonfield and Fern impoundments. Increases in residential or critical uses at this location would place additional people (and District customers if annexed) and essential services within mapped dam-inundation areas. Even shallow depths can interrupt emergency response, restrict evacuation, and delay restoration of utilities.

Downstream, high flows in Sonoma Creek and seasonal backwater toward San Pablo Bay can reduce outfall capacity and prolong standing water near low creek banks and storm-drain outlets. New future projects that concentrate population or critical facilities in these low areas face higher operational risk from extended ponding after an incident or large storm.

For the District, the principal implications for future development are siting, access, and utility continuity. Projects located below high or significant hazard impoundments, or on low terraces along Sonoma Creek and its tributaries, should demonstrate redundant ingress and egress, elevation or floodproofing of essential equipment, and coordination with current dam-inundation mapping where available. Overall, recent development has been negligible within mapped inundation areas, and future development at the SDC does not occur within inundation areas. Therefore, this development will not change the District's vulnerability to dam incidents.

Risk Summary

- Three dams of concern fall upstream of the District: Suttonfield Dam, Fern Dam, and Lowrey No. 1 Dam.
- Dam incident exposure is limited to specific creek corridors and immediate floodplains within the District, primarily in areas near Sonoma Creek and its tributaries.
- Suttonfield Dam is a high hazard earthen dam and owned by the State of California, Department of General Services (DGS). It is located south of the community of Glen Ellen along Sonoma Creek and has a storage capacity of 600 acre-feet. This dam has an active EAP and dam inundation mapping.
- The second dam of concern is the Fern Dam, another high hazard earthen dam owned by the State of California, DGS. Fern Dam is located just over 2 miles west of Suttonfield Dam along a tributary of Mill Creek. This significant hazard dam has a storage capacity of 241 acre-feet and an EAP and dam inundation mapping.
- The Lowrey No. 1 dam is a significant hazard earthen dam with 82 acre-feet of capacity for water supply. It is owned by a private entity and lacks an EAP.
- None of the District's critical water facilities or infrastructure fall within the Suttonfield Lake Dam or Fern Lake Dam inundation areas, but operational disruptions (e.g., access delays and maintenance needs) remain possible during incidents.
- The overall significance of dam inundation in the District is **Low**.

4.3.2 Dense Fog

Geographic Extent	Probability of Future Occurrences	Magnitude/ Severity	Overall Significance
Limited	Likely	Limited	Low

Hazard Description

Fog results from air being cooled to the point where it can no longer hold all of the water vapor it contains. For example, rain can cool and moisten the air near the surface until fog forms. A cloud-free, humid air mass at night can lead to fog formation, where land and water surfaces that have warmed up during the summer are still evaporating water into the atmosphere. This is called radiation fog. A warm moist air mass blowing over a cold surface also can cause fog to form, which is called advection fog.

Geographic Location

Within the service area, fog pools along low-gradient ground and riparian terraces adjacent to Sonoma Creek and its tributaries, then thins with elevation on surrounding alluvial fans. Advection events ride inland overnight and before sunrise, reducing visibility first along southwest–northeast corridors that align with the Petaluma Gap, then along north–south routes that follow the creek. Highway 12 and Arnold Drive experience the earliest and most consistent reductions in visibility, with localized pockets near creek crossings and depressions that hold cool air. Radiation fog can also form on clear winter nights wherever soils are moist, and winds are light, again favoring low creek flats. Overall, exposure is localized and episodic, highest in the southern valley and transportation low points, and limited in scope compared to coastal areas directly under the marine layer.

Magnitude/Severity

Severity is driven by visibility and duration. Dense fog hazard is best expressed through visibility reduction, since visibility governs operational and public safety impacts. Visibility is the distance at which an object or light is clearly discerned, and it depends on the transparency of the air column. The National Weather Service (NWS) issues a Dense Fog Advisory when surface visibility is one quarter mile or less. Aviation categories that describe operational limits are displayed in Table 4-10. These thresholds matter for general aviation at Sonoma Valley Airport and for helicopter access during emergencies. The duration of dense fog events in the service area can vary from less than an hour to several hours, with the longest periods typically occurring overnight and into the early morning.

Table 4-10 Aviation Visibility Conditions

Category	Ceiling	and/or	Visibility
Visual Flight Rules (VFR)	Greater than 3,000 feet AGL	and	Greater than 5 miles
Marginal Visual Flight Rules (MVFR)	1,000 to 3,000 feet AGL	and/or	3-5 miles
Instrument Flight Rules (IFR)	500 to below 1,000 feet AGL	and/or	1 mile to less than 3 miles
Low Instrument Flight Rules (LIFR)	Below 500 feet AGL	and/or	Less than 1 mile

Source: NOAA Weather
Note: AGL=Above Ground Level

Observed effects concentrate on mobility and operations rather than damage to assets:

- Visibility commonly drops to one quarter mile or less before sunrise along Highway 12, Arnold Drive, and low creek crossings, with pockets below one eighth mile in riparian depressions.

- Advection events can produce rapid onset and spatially uneven visibility. Radiation fog can repeat on successive nights during stagnant patterns.
- Secondary issues include slower response times, higher collision risk at merge points and signals, and rare freezing-fog icing on elevated surfaces during cold snaps.

Physical impacts on wells, tanks, pipelines, and treatment facilities are minimal. The principal concern is safe crew movement and access routing during dense fog advisory periods.

The inland protrusion of the marine stratus layer against the Mayacamas Mountains, Sunday, August 6, 2022.

Photo Credit: Kent Porter/The Press Democrat, 2023

Previous Occurrences

The NOAA NCEI Storm Events Database lists nine dense fog events (no freezing fog events were recorded) that occurred in Sonoma County from January 1, 2000, to December 20, 2025. One incident on February 9, 2012, resulted in an estimated $100,000 in property damage and two minor injuries when dense fog contributed to 11 vehicle crashes on Highway 37 near Skaggs Island Road. There were 31 vehicles involved in these crashes.

Probability of Future Occurrences

Likely – Dense fog will recur in the District in most years. Expect multiple advisory-level mornings in typical cool seasons, with clustering during stagnant high-pressure periods and after wet weeks that leave soils and creek bottoms saturated. Interannual variability will track storm timing, soil moisture, and strength of the marine layer. Based on the NCEI Storm Events Database records over a 25-year period, a dense fog event occurs every 2.75 years; however dense fog events are likely much more common, especially during summer mornings when the marine-layer fog drifts inland overnight and into the early morning.

Climate Change Considerations

Signals for dense fog under climate change are mixed in coastal Northern California. Warmer nights and reduced radiational cooling tend to suppress classic radiation fog, while wetter winters, higher soil moisture, and longer dew-point depressions near dawn can support it after storms. Marine-layer behavior is also in flux: a stronger, more persistent summertime inversion can maintain advection fog and low stratus intrusions through the Petaluma Gap, yet offshore or northerly patterns in drought years can thin or delay it.

For Sonoma Valley, the net effect of climate change is variability rather than a clear directional trend. The District can expect tighter clustering of fog events around wet weeks and calm, cool nights, with year-to-year swings tied to storm tracks and high-pressure regimes. Secondary influences include urban heat-island warming in the Highway 12 corridor, post-fire aerosols that can change near-surface cooling and visibility, and San Pablo Bay humidity anomalies during prolonged wet periods. On balance, dense fog remains a recurring cool-season hazard, but its frequency and timing windows are likely to shift within seasons rather than as net increase or decrease over time. For these reasons, climate change is expected to have a medium influence on the impacts of dense fog hazards.

Vulnerability Assessment

Dense fog is a recurring but low-consequence hazard for the District. It forms most often overnight and near dawn when cool, moist air pools in the Sonoma Creek corridor and low terraces between the

Sonoma Mountains and the Mayacamas Range. Advection fog from San Pablo Bay pushes into southern Sonoma Valley; radiation fog forms on clear, calm nights across flats near Agua Caliente, Boyes Hot Springs, El Verano, and Eldridge. Impacts are short-lived and localized, driven by visibility below 1 mile (IFR) and, at times, below ½ mile (LIFR). Property and utility systems generally tolerate these conditions; the primary risks are to people in motion and to field operations that rely on safe road access and clear sight lines.

People

Risk concentrates on motorists, cyclists, and pedestrians during the early-morning commute, school transport windows, and evening temperature inversions. Sudden drops from MVFR to IFR/LIFR along dips, vineyard edges, and creek crossings can reduce reaction time, lengthen stopping distances, and elevate the chance of multi-vehicle collisions. Vulnerable groups include school bus routes, shift workers, older drivers, and visitors unfamiliar with local fog belts. For District staff, the highest exposure is driving between sites at dawn and dusk and working on shoulders with limited sight distance.

Property

Direct damage to buildings and equipment from fog is rare. Occasional secondary effects include surface condensation on exposed metals, short-lived slickness on walkways and drives, and minor corrosion where moisture frequently condenses and evaporates on outdoor fixtures, gates, and enclosures. Vehicle incidents in low-visibility pockets can produce property losses at driveway aprons, fences, and frontage improvements along State Route 12 and Arnold Drive, but these are episodic and small in scale. Overall, parcel-level exposure is minimal.

Critical Water Facilities and Infrastructure

Core assets (wells, tanks, pump stations, and buried mains) are largely insensitive to fog. Operational nuisance issues include wet, slippery access surfaces, condensation on exterior panels and within unsealed control cabinets, occasional false trips from optical sensors, and reduced radio or camera performance from lens fogging. The larger constraint is logistics: slowed travel on SR-12, Arnold Drive, and local collectors can delay crew deployment, generator refueling, and SCADA troubleshooting that requires a site visit. These effects are brief and schedule-manageable.

Economy

Dense fog can disrupt the delivery of water services by limiting visibility and access to District facilities, slowing operations and maintenance activities, emergency response, and repair crews' ability to safely reach wells, tanks, and pump stations. These delays can increase the duration of service disruptions or pressure limitations, particularly during concurrent events such as wildfire or power outages.

Operational slowdowns and increased response costs associated with fog events can also create financial strain for the District, while service interruptions or reduced reliability may affect local businesses, agriculture, tourism, and emergency services that depend on consistent water supply, with ripple effects on the local economy.

Historic, Cultural, and Natural Resources

Dense fog has negligible direct impact on historic structures or cultural sites. Repeated wetting can contribute over time to surface staining, mildew on untreated wood, and accelerated fastener corrosion on outdoor features, but routine maintenance controls these risks. Natural resources generally benefit from fog drip that adds moisture to riparian corridors and vineyard edges during dry spells.

Recent and Future Development

Future or redeveloped development in known fog corridors should account for recurring low visibility without material changes to land use. Practical considerations include driveway spacing and sight distance on fog-prone frontages, high-contrast pavement markings, retroreflective address signage for

emergency response, non-glare task lighting at gates and panels, sealed electrical enclosures, and camera housings with heaters or hydrophobic lenses. Recent changes in development in Sonoma Valley has resulted in slight increases in population and motorists, which may slightly increase the overall vulnerability of the community to dense fog. However, for District operations, staging yards and crew parking that avoid steep dips and low swales improve access reliability on high-fog mornings. Recent development is also not expected to substantially change or alter the District's vulnerability to dense fog given most of these risks can be minimized by following emergency procedures during standard operations.

Risk Summary

- Visibility drops to IFR (1 mile to less than 3 miles) and at times LIFR (less than a mile) along the Sonoma Creek corridor and low terraces, peaking near dawn and after sunset.
- Primary risk is to people in motion, with higher crash potential on SR-12, Arnold Drive, and creek crossings; impacts are short-lived and localized.
- Direct damage to property and water assets is minimal; nuisance effects include condensation, slick surfaces, and occasional sensor or camera fogging.
- Operations risk is schedule delay, not loss of function, as fog slows crew travel, generator refueling, and site access during morning windows.
- Natural systems often benefit from fog drip; long-term impacts to historic or cultural resources are negligible with routine maintenance.
- The overall significance of dense fog on the District is **Low**.

4.3.3 Drought and Water Supply

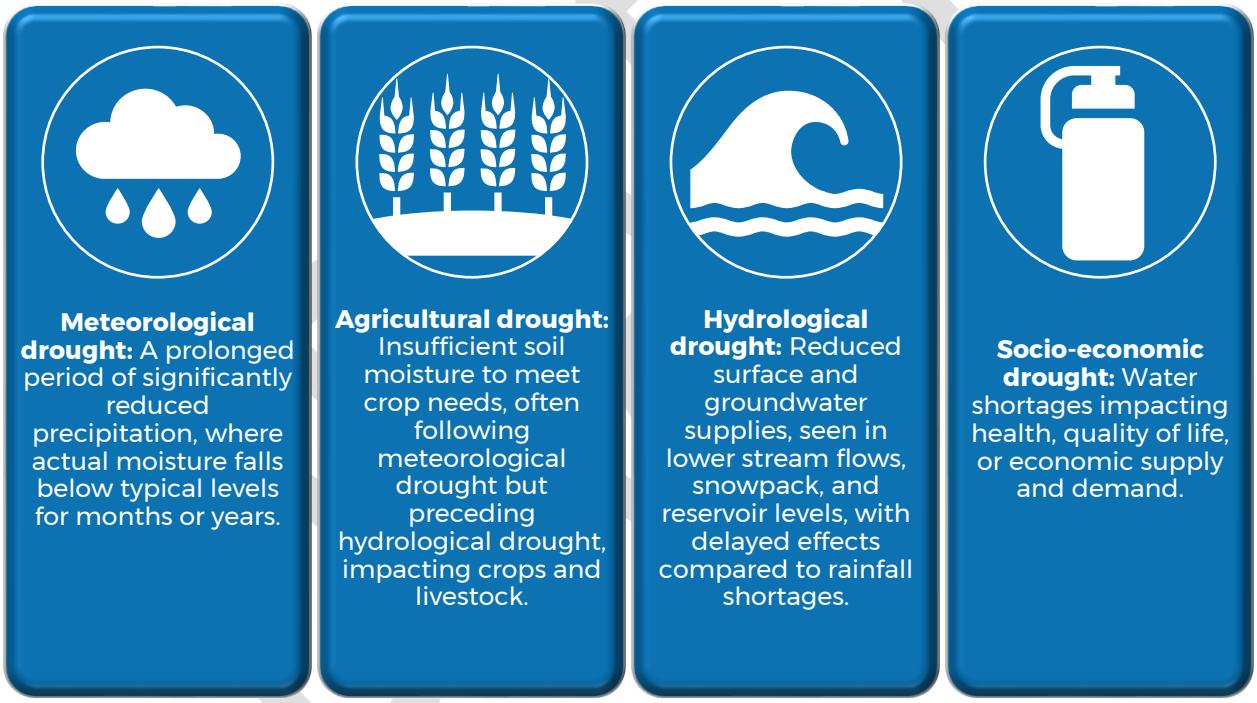
Geographic Extent	Probability of Future Occurrences	Magnitude/ Severity	Overall Significance
Extensive	Highly Likely	Critical	High

Hazard Description

Drought is a gradual phenomenon. Although droughts are sometimes characterized as emergencies, they differ from typical emergency events. Most natural disasters, such as floods or forest fires, occur relatively rapidly and afford little time for preparing for disaster response. Droughts occur slowly, many times over a multi-year period, and it is often not obvious or easy to quantify when a drought begins and ends. Drought is a complex issue involving many factors; it occurs when a normal amount of moisture is not available to satisfy an area's usual water-consuming activities.

Drought can often be defined regionally based on its effects, as shown in Figure 4-5 below.

Figure 4-5 Types of Droughts



Modified from NWS; https://www.weather.gov/safety/drought-types

The California DWR says the following about drought:

"One dry year does not normally constitute a drought in California. California's extensive system of water supply infrastructure—its reservoirs, groundwater basins, and inter-regional conveyance facilities—mitigates the effect of short-term dry periods for most water users. Defining when a drought begins is a function of drought impacts to water users. Hydrologic conditions constituting a drought for water users in one location may not constitute a drought for water users elsewhere, or for water users having a different water supply. Individual water suppliers may use criteria such as rainfall/runoff, amount of water in storage, or expected supply from a water wholesaler to define their water supply conditions."

The drought issue in California is further compounded by water rights. Water is a commodity possessed under a variety of legal doctrines. The prioritization of water rights between farming and federally protected fish habitats in California is part of this issue.

The District purchases approximately 79% of its potable water from Sonoma Water (the Sonoma County Water Agency) in a normal year. Sonoma Water's primary source is the Russian River watershed, which is heavily influenced by regional precipitation patterns, snowpack storage in the upper watershed, and reservoir operations in Lake Mendocino and Lake Sonoma. Prolonged drought conditions reduce Russian River flows, impair reservoir refill, and increase the likelihood of mandatory conservation measures. Because the District relies primarily on this imported surface water, regional drought conditions directly translate to supply reductions or operational constraints.

The District's remaining water is supplied by seven groundwater wells operated by the District (VOMWD 2025). Four of the District's wells are located within the Sonoma Valley Subbasin and managed by the Sonoma Valley Groundwater Sustainability Agency (GSA); the other wells are outside of the DWR-defined groundwater basins (VOMWD 2025). The District cycles through these wells, with each well typically active for nine months, followed by a three month off-cycle recovery period. In early 2026, three of the groundwater wells went offline due to PFAS contamination issues, which has further reduced the operational flexibility of the District and increased reliance on imported supply (HMPC Input). An additional well has also tested positive for PFAS, though currently at low levels. District staff are currently predicting that all of the wells will be affected by PFAS contamination in the near future and will need to be taken offline. The wells can only be brought back online if and when a treatment system is installed at each effected well.

The District has emergency water connections with the City of Sonoma, SDC and Sobre Vista Mutual Water Company (SVMWC). If an emergency occurs, the District can provide potable water via these connections under their respective agreements. The District also had the ability to obtain water from SDC before the treatment plant shut down in 2019; however, since SDC now relies on the Sonoma Water Aqueduct instead of its local surface water supply, it would be unable to supply the District if the aqueduct became unavailable. The City of Sonoma does operate local groundwater wells and may have additional capacity to aid the District in short-term emergency scenarios. However, the more likely scenario is that the District would be able to assist the City of Sonoma by supplying local groundwater or using its distribution system to convey water stored on northerly sections of the Sonoma Aqueduct that the City of Sonoma may not have access to during the emergency.

Geographic Location

Extensive – Drought is a regional hazard that affects large geographic areas rather than isolated locations. For the District, drought conditions are driven by hydrologic and climatic patterns across Sonoma County and the Russian River watershed. Because of this, any drought affecting the broader Russian River basin will have a direct impact on District operations. When regional drought occurs, the resulting impacts, including reduced reservoir storage, lower Russian River flows, and declining groundwater recharge, create constraints that extend across the full District.

Magnitude/Severity

Critical – Magnitude can be measured according to a scale developed by the United States Drought Monitor, which measures drought in five categories: "abnormally dry," "moderately dry," "severely dry," "extremely dry," and "exceptionally dry." The observed impacts of each category are detailed in Table 4-11. As shown in Figure 4-6 in the Previous Occurrences section, the District is vulnerable to all levels of

drought, which are further subject to the effects of climate change, precipitation trends, and wet and dry periods.

Table 4-11 Historically Observed Impacts by Drought Monitor Category in California

Category	Historically Observed Impacts
D0 – Abnormally Dry	Soil is dry; irrigation delivery begins early
	Dryland crop germination is stunted
	Active fire season begins
D1 – Moderate Drought	Dryland pasture growth is stunted; producers give supplemental feed to cattle
	Landscaping and gardens need irrigation earlier; wildlife patterns begin to change
	Stock ponds and creeks are lower than usual
D2 – Severe Drought	Grazing land is inadequate
	Fire season is longer, with high burn intensity, dry fuels, and large fire spatial extent
	Trees are stressed; plants increase reproductive mechanisms; wildlife diseases increase
D3 – Extreme Drought	Livestock need expensive supplemental feed; cattle and horses are sold; little pasture remains; fruit trees bud early; producers begin irrigating in the winter
	Fire season lasts year-round; fires occur in typically wet parts of the State; burn bans are implemented
	Water is inadequate for agriculture, wildlife, and urban needs; reservoirs are extremely low; hydropower is restricted
D4 – Exceptional Drought	Fields are left fallow; orchards are removed; vegetable yields are low; honey harvest is small
	Fire season is very costly; number of fires and area burned are extensive
	Fish rescue and relocation begins; pine beetle infestation occurs; forest mortality is high; wetlands dry up; survival of native plants and animals is low; fewer wildflowers bloom; wildlife death is widespread; algae blooms appear

Source: US Drought Monitor, https://droughtmonitor.unl.edu/

Drought can have a widespread impact on the environment and economy in the Planning Area, but it typically does not result in loss of life or damage to property. Rather, drought may have an impact on agriculture, business, and the movement of goods and services related to agricultural, commodities, tourism and recreation, and water supply sectors. Given that the District's water users fall within the categories of residential (79% of water users) and commercial and institutional (non-residential represents 21% of water users), it can be assumed that three main factors have an effect on water demands: climatic, demographic, and economic. These are described below and are expected to influence water demands in the future, as they have in the past.

- **Climatic.** The weather in Sonoma Valley is mild with distinct wet and dry seasons and a mean annual temperature of 70 degrees Fahrenheit. Average annual precipitation is about 28 inches based on observed data from a climate station located near the General Vallejo Home State Park near the City of Sonoma. Climate has the most dramatic annual effect on water demands, and severe deviations from normal temperatures and average rainfall can increase or decrease annual water demands. Although the District's water supply doesn't fully rely on surface water sources, precipitation shortages can have negative effects on what the District receives from and can process for potable and other key uses.
- **Demographic**. Since water use is related to demographics and population change, an accurate description of population and housing stock in the service area serves as a basis for water planning activities described in the District's 2020 UWMP or other planning mechanisms. According to the District's 2020 UWMP, the District's customer base was 23,077 in 2020. Population projections for the District summarized in the 2020 UWMP indicate an increase to 33,483 by 2045, or an increase of 45 percent.

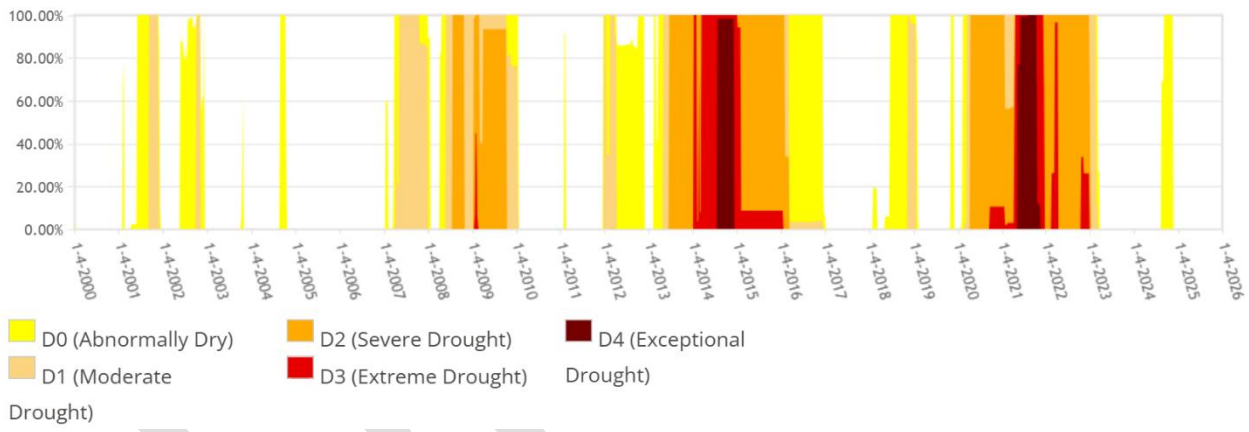
- **Economic.** Commercial water users have the second highest water demand after residential users (both single family and multi-family). According to the District's 2020 UWMP, commercial water users demand for potable and non-potable water is projected to increase from a volume of 210 acre-feet in 2020 to 393 acre-feet by 2045. Although agricultural areas are within the District's Planning Area, the District does not supply water to these areas.

The magnitude or severity of a drought across the District could vary and is difficult to predict. However, understanding the total population affected as well as economy and resources vulnerable provides insight on how to estimate potential losses and damages to the District's assets; drought related information can be obtained and measured from the National Drought Mitigation Center's (NDMC) Impact Reporter and Drought Monitor tools.

Previous Occurrences

Historically, California has experienced multiple severe droughts. According to California's DWR, droughts exceeding three years are relatively rare in Northern California, the source of much of the state's developed water supply. The 1929-34 drought established the criteria commonly used in designing storage capacity and yield of large Northern California reservoirs. Figure 4-6 depicts drought conditions in Sonoma County from 2000-2025, extracted from the NDMC which considers several factors including the Palmer Drought Index, Soil Moisture Models, U.S. Geological Survey (USGS) Weekly Streamflow, Standardized Precipitation Index, and Satellite Vegetation Health Index.

Figure 4-6 Drought Conditions in Sonoma County, 2000 – 2025



Source: U.S. Drought Monitor https://droughtmonitor.unl.edu/Data/Timeseries.aspx

Since the year 2000 there have been several cases of multi-year droughts across California; these are described below:

- **2007-2009** – At the time, the water years 2007-2009 were the seventh driest three-year period in the measured record for state-wide precipitation and the fifteenth driest three-year period for DWR 8-station precipitation index (a rough indicator of potential water supply available to the State Water Project and Central Valley Project). The 2007–09 drought was California's first drought for which a statewide proclamation of drought emergency was issued without requiring most counties to have to declare their own local emergencies first.
- **2012-2016** – California experienced its driest three-year period from 2012 to 2015, coinciding with record-breaking warmth. These conditions led to extreme dryness and disaster declarations in Sonoma Valley, with Sonoma County officially declaring a local emergency from February to December 2015. Before 2014, the District managed water reduction through board resolutions and community outreach rather than implementing its Water Shortage Contingency Plan (WSCP). During the 2012-2015 drought, the State Water Resources Control Board set mandatory statewide conservation targets, prompting the District to move from voluntary to mandatory water use

reductions. Stage 2 of the WSCP was enacted in August 2014 and extended twice as drought conditions persisted. Following improved rainfall, restrictions were lifted in May 2016.

- **2020-2022** – The 2020-2022 drought was one of the most severe in recent history, resulting in near-record-low storage levels in Lake Mendocino and significantly reduced levels in Lake Sonoma. These conditions prompted the SWRCB to issue drought emergency regulations limiting Russian River diversions, alongside conservation mandates from Sonoma Water and County agencies. For the District, reduced surface water deliveries required the District to implement drought stages, increase reliance on groundwater supplies, and reduce customer demand through conservation campaigns and mandatory usage restrictions. According to the Household Water Supply Shortage Reporting System, since 2014, seven wells have been reported as having gone dry across Sonoma County, all reported in 2021.

Table 4-12 summarizes the drought-related disaster declarations proclaimed for Sonoma County from 1976 through 2025. These declarations include those from the Sonoma County Board of Supervisors, FEMA, the USDA's Secretary of Agriculture, and events noted in the *2023 California SHMP*.

Table 4-12 Disaster Declarations and Proclamations Related to Drought in Sonoma County

Year	Agency	Declaration or Order
1977	State of California	Declaration of a State of Emergency
1977	FEMA	EM-3023
2009	State of California	Proclamation No. 2009-18
2012	Secretary of Agriculture	S3248, S3452
2013	Secretary of Agriculture	S3565, S3569
2014	Sonoma County	Proclamation of Local Emergency
2014	State of California	Proclamation No. 1-17-2014
2014	Secretary of Agriculture	S3637, S3743, S3797
2015	Secretary of Agriculture	S3784, S3943
2016	Secretary of Agriculture	S3952, S3964
2017	Secretary of Agriculture	S4163
2019	State of California	Declaration of a State of Emergency
2020	Secretary of Agriculture	S4691, S4697
2021	Sonoma County	Proclamation of Local Emergency
2021	Secretary of Agriculture	S4916
2022	Secretary of Agriculture	S5146
2023	Secretary of Agriculture	S5371

Source: USDA Disaster Designations 2025; California SHMP 2023; FEMA 2025, County of Sonoma 2025

Probability of Future Occurrences

Likely – Since the year 2000, there have been three California statewide emergency proclamations of drought and two Sonoma County proclamations, all related to the multi-year droughts profiled in Previous Occurrences. These multi-year droughts spanned a cumulative 11 years of the last 25, equating to a roughly 44% chance that the County of Sonoma and the District will be in a severe drought in any given year.

Climate Change Considerations

Scientific studies prepared for California climate assessments and adaptations strategies show that drought conditions in California are likely to become more frequent and persistent over the next century due to climate change. Temperatures are warming, heat waves are more frequent, and precipitation has become increasingly variable (Natural Resources Agency 2018a). Water resources are also already experiencing the following stresses: population growth, poor water quality, groundwater overdraft, and aging water infrastructure.

The recent drought conditions over the past decade underscore the need to examine water supply and distribution management, conservation, and use policies. California and Sonoma County have experienced a succession of dry spells, and with warmer temperatures the impacts of drought conditions have increased (OEHHA 2018). In an average year, approximately 40 percent of the state's total water supply comes from groundwater, and during a dry year this increases to more than half of the state's water supply, with groundwater acting as a critical buffer against the impacts of drought and climate change (Natural Resources Agency 2018a). The District only uses groundwater in emergencies, but the Sonoma Valley Subbasin has shown to have a reduction in groundwater levels (Sonoma Valley GSA 2020).

Climate Change Impacts On Water Resources

Sea Level
Sea level rise in nearby coastal areas may alter regional groundwater gradients and indirectly affect long-term water supply reliability for VOMWD.

Vegetation
Warming and drying conditions will lengthen the local fire season and expand the area burned, increasing erosion and watershed impacts that affect water quality.

Soil Moisture
Hotter temperatures and longer dry seasons will reduce soil moisture in the Sonoma Valley, increasing irrigation demand for vineyards and agriculture that rely on VOMWD supplies.

Snowpack
Although VOMWD does not rely directly on snowpack, statewide reductions will strain regional water systems and increase competition for limited surface water during dry years.

Runoff
Climate warming is expected to shift runoff to earlier in the winter and reduce summer baseflows, limiting natural groundwater recharge in the Sonoma Valley.

Hydropower
Reductions in statewide hydropower generation could increase energy costs and strain electricity supplies needed for VOMWD pumping and treatment operations.

Precipitation
Warmer winters will favor rainfall over snow and increase precipitation variability, contributing to more intense storm events and longer dry periods in the Sonoma Valley.

Groundwater
Extended drought and reduced surface water reliability will increase dependence on local groundwater, heightening the need for sustainable basin management.

Modified from:
http://frap.fire.ca.gov/data/assessment2010/pdfs/3.1water.pdf

According to California's Climate Adaptation Strategy, also referred to as *Safeguarding California Plan: 2018 Update*, climate change is likely to significantly diminish California's future water supply. As a result, the state must change its water management, as climate change will create greater competition for limited water supplies (California Natural Resources Agency 2018b). Similarly, as summarized in the Sonoma County RCAP, climate change could result in hotter and drier weather, and more frequent and intense droughts. The CWA (numeric measure of drought stress that quantifies the extent to which plants need for water exceeds moisture available in soil) for the region is projected to increase over this century, producing 10 to 20 percent drier soil conditions in the summer months, leaving less water available for groundwater recharge or runoff into rivers and creeks (RCPA 2016).

The greatest increases in soil dryness are projected in the south and southeastern portions of the County, where the District is located (RCPA 2016). These water management concerns, need to protect scarce resources and increase resiliency to respond to water emergencies will impact Sonoma Water, the District's main water supplier, as well as all the separate water districts and entities in the County. For these reasons, climate change would have a high influence on drought hazards and water shortages.

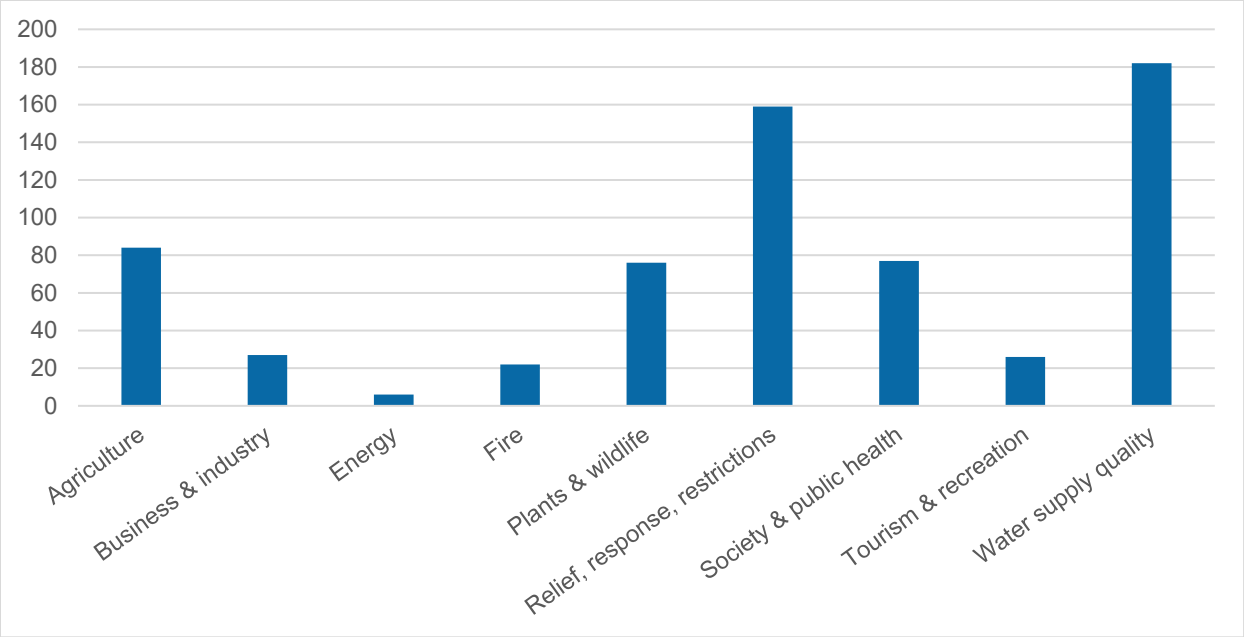
Vulnerability Assessment

Based on historical information, the occurrence of drought in California, including Sonoma Valley, is cyclical, driven by weather patterns. Drought has occurred in the past and will occur in the future. Periods of actual drought with adverse impacts can vary in duration, and the period between droughts is often extended. Although an area may be under an extended dry period, determining when it becomes a drought is based on impacts to individual water users. The vulnerability of the District to drought is District wide and countywide, but the extent of the impacts may vary by area and include reduction in water supply, agricultural losses, and an increase in dry fuels.

Figure 4-7 graphically displays the number and type of drought-related reported impacts to Sonoma County (United States Drought Impact Reporter 2026). A total of 250 reports were made within Sonoma County between January 1, 2005, and December 31, 2025, and it is assumed that these drought-related impacts for areas across the County are likely to have also affected the District at some point or to some extent. One report can fall into multiple categories, resulting in 659 total impacts. The categories with the most reports are Relief, Response, & Restrictions; and Water Quality & Supply. The definitions of these categories are as follows:

- Relief, Response & Restrictions refers to drought effects associated with disaster declarations, aid programs, requests for aid, water restrictions, or fire restrictions, including examples like USDA Secretarial disaster declarations, state-level water shortage or emergency declarations, and NWS Red Flag warnings.
- Water Supply & Quality refers to effects associated with physical water availability and condition, such as dry wells, mandatory restrictions, changes in water rates, quality issues (color, odor, turbidity), and changes in infrastructure like pumps or well permits.

Figure 4-7 Drought Impact Reporter Impacts in Sonoma County, 2005-2025



Source: National Drought Mitigation Center Drought Impact Reporter, 2025

People

Drought poses risks to customers served by the District as reductions in available surface water and groundwater can affect the reliability of drinking water, sanitation, and fire protection services. Prolonged drought may require mandatory water use restrictions, which can create hardship for households, especially those with medical needs, large families, limited income, or properties dependent on outdoor water use. Reduced surface water deliveries from Sonoma Water, combined with constrained groundwater production, may increase the likelihood of localized service disruptions or reduced system pressure, affecting customers across the District's service area. These disruptions also put additional strain on District staff and employees that need to respond to constrained conditions.

Certain populations may also be disproportionately vulnerable during drought conditions, including older adults, young children, residents with health conditions that require stable indoor temperatures or frequent water use, and renters who have limited control over property-level conservation actions. Drought-related water quality challenges such as higher temperatures, stagnation risks, or changes in groundwater chemistry may also necessitate additional treatment or operational modifications. Any deterioration in water quality or availability could particularly affect sensitive individuals who rely on consistent potable water supplies.

Drought can also increase risks to public safety by elevating wildfire hazards, which place people at greater risk of displacement, smoke exposure, and loss of essential services. Reduced water availability and lower storage tank levels can impair fire flow capacity, further increasing vulnerability for residents, businesses, and critical community services. Additionally, long-term conservation requirements may create financial strain for households and communities, particularly when paired with rising water rates needed to offset reduced consumption.

Property

Drought poses a range of risks to the District's physical property, including supply infrastructure, groundwater wells, distribution pipelines, storage reservoirs, and operational support systems. Because drought affects both water quantity and quality, it can increase stress on infrastructure, elevate operational demands, and accelerate wear on equipment.

While the District does not own the Sonoma Water aqueduct system through which it receives water from the Russian River, reduced deliveries can affect the performance and reliability of its property, particularly storage tanks and distribution systems. Reduced flows can also elevate reliance on District-owned facilities and create operational vulnerabilities if pressure zones cannot be maintained.

Reduced Russian River deliveries limit the District's primary water supply and increases dependence on local groundwater. However, groundwater production is also strained during droughts as declining water levels reduce well yields, increase pumping loads, and increase the risk of equipment failure. The 2020 Sonoma County Civil Grand Jury report documented that District's well production has already fallen behind projections, heightening vulnerability. Well production has also been recently affected by the District stopping production from two wells that were impacted by PFAS contamination issues (HMPC Input).

Critical Water Facilities and Infrastructure

Drought poses a direct risk to the District's water supply by affecting water storage, treatment, distribution, and conveyance systems. If wells or treatment facilities are damaged or experience operational issues during drought conditions, the District may be required to rely more heavily on higher cost imported water, placing financial strain on both the District and its customers. In 2019, the District said their customers are at a greater risk of emergency now than a year ago due to the State of California Department of General Services closure of the SDC WTP. According to the Sonoma County's *Emergency Water Shortages in Sonoma County* report, the need for potable water becomes critical during emergency conditions associated with drought.

While there are water intensive agricultural uses within the District's Planning Area, the District does not supply the major agricultural areas with potable water. However, long-lasting droughts can be indirectly detrimental to the District's groundwater supply, as there has been a significant increase in irrigated agriculture, such as vineyards. According to the Sonoma Valley Groundwater Sustainability Plan, more than half (52%) of the water demand in Sonoma Valley is met by groundwater, followed by approximately a quarter of total water demand supplied by water imported from the Russian River, and the remaining demand met by recycled water and local surface water at less than 10% each (SVGSA 2021). Agriculture made up the largest use of groundwater is at 59%, followed by rural residential use at 15%, industrial and commercial at 13%, golf-courses and schools at 10%, then municipal/urban demand at 3% (SVGSA 2024).

Drought also affects lifeline components within the distribution system, including pressure zones, pipelines, and pump stations. Soil drying can increase pipeline stress, while conservation-related constraints may limit flushing and negatively impact water quality. Reduced water availability combined with increased wildfire risk can threaten the District's ability to maintain adequate fire protection.

2019-2020 Sonoma County Civil Grand Jury Investigation

The Sonoma County Civil Grand Jury investigated both emergency water shortages in Sonoma Valley and regional water resource availability in 2019, as documented in *Emergency Water Shortages in Sonoma Valley* and *Sonoma Valley Regional Water Resources*. Based on the findings, the demand for potable water becomes critical during emergency conditions related to drought, earthquakes, flooding, and wildfires because the District has historically relied on the surface water supplies at the SDC campus. As a result, proper emergency response often means close cooperation among the regional water suppliers.

The reports concluded that the District must deal with the reductions in its emergency water resources given they are the presumed water supplier for the SDC campus because it is within the District's SOI. The lack of adequate emergency water supply for the District presents significant water resource planning, costs, financial investments, and unclear liabilities due to the aging infrastructure associated with the SDC WTP. Both reports concluded that the water districts in Sonoma Valley will need to adopt a

regional approach to water management because of the ongoing challenges, such as population growth and climate change in the region.

Economy

Drought directly affects the District's ability to provide reliable water service by reducing available surface supply and increasing reliance on groundwater wells. If wells or treatment facilities are constrained or damaged during drought conditions, the District may also need to purchase higher cost imported water, placing financial strain on operations and customers.

Compliance with the SWRCB-mandated reduction targets may also result in negative economic impacts on the District's revenue stream when water use demand decreases due to the restrictions. Further, while population growth in the District's Planning Area has remained stable, few new service connections limit the District's ability to collect new sources of revenue, which may further limit the District's ability to obtain funding. Reduced revenue may also reduce the District's budget for routine maintenance and repair activities, which could in turn shorten the lifespan of the District's existing facilities and infrastructure.

Historic, Cultural, and Natural Resources

Severe, prolonged drought can impact the natural environment. Wildlife and natural habitats including the Sonoma Creek can be affected, including the shrinkage of habitat, habitat fragmentation, reduced food supply for wildlife, and possibly the migration of species in the nearby hillsides that define the Sonoma Valley landscape. Prolonged drought can also cause poor soil quality, loss of wetlands, tree mortality, and increased soil erosion. Prolonged drought conditions and water diversions have also reduced the water levels at Suttonfield Lake and Fern Lake, which provide valuable habitat for wildlife and recreational opportunities for residents.

Tree mortality is identified as a cascading impact that can amplify other hazards, such as wildfire and wind conditions. For example, drought-impacted trees can become susceptible to diseases and insect infestations that further exacerbate the risk of tree mortality. Bark beetles can infest the inner bark along trucks and branches of trees, which can in turn weaken, stress, or eventually kill the trees. Sudden Oak Death, which is caused by a water mold pathogen, is also common in Sonoma County. One of the most prevailing impacts of drought to the natural environment is the increased risk of wildfires, as seen during the 2017-2018 and 2019-2020 wildfire seasons. Wildfires now burn larger and more intensely during dry conditions and are happening outside the typical fire season. Lastly, drought conditions can cause soil to compact and not absorb water well, potentially making an area more susceptible to flooding.

Impacts to the historic and cultural building inventory within Sonoma Valley may be negligible to drought, and District may have limited regulatory authority as a water district to prevent impacts on these resources. The County open spaces and park and public lands can suffer during droughts, as well as the adjacent City of Sonoma open spaces and park facilities. However, the City of Sonoma's ability to use recycled water for irrigation purposes can help to offset this vulnerability.

Recent and Future Development

Recent and future development patterns and water conservation are the focus of each update to the District's UWMP and this planning process specifically address drought conditions and water contingencies. The UWMP describes how current and future water resources and demands within the District's service area will be managed to provide adequate and reliable water supply. As the population grows and planned development continues, the District will have to revise their reliability and supply projections from Sonoma Water through a multi-agency planning effort or development of a regional water management plan. Sonoma Water may reduce water deliveries as water levels in major reservoirs decrease. Therefore, as new potential or planned development occurs in the District's Planning Area,

particularly associated with the *Sonoma Development Center Specific Plan*, it will be important to assess the availability and reliability of multiple water sources, such as groundwater and recycled water.

The District currently supplies a majority of water supply to single family and multi-family residents. Between 2015 and 2020, the District's potable water demand increased by approximately 19%, largely as a result of the rebound from the multi-year drought. However, current demand for potable and raw water is expected to slightly decrease by less than one percent by 2040 based on a sustained decrease in per capita water use as a result of water efficiency improvements by the District and their customers. Also, consistent with Senate Bill 610, any proposed developments in the County are mandated to estimate future water uses and identify water supplies that may be used to meet their uses. This water supply assessment process is intended to ensure that adequate water supplies exist to support new growth; such assessments are included in the Environmental Impact Report for the *Sonoma Development Center Specific Plan*. Therefore, although overall demand for potable water is expected to decrease due to water efficiency improvements, increasing development pressure is likely to increase the District's overall vulnerability to drought. The exception to this statement would be the proposed redevelopment of the SDC. If the water sources from SDC are brought back on-line, it would once again represent the only large-scale, local, and sustainable water supply in the valley. Other local water supplies (namely groundwater) are less sustainable and are reliant upon a groundwater basin known to be declining over time.

Risk Summary

- Droughts are gradual, complex hazards that can last multiple years, making it difficult to pinpoint their beginning and end, and their impacts can vary widely across different water users and geographic areas.
- The District relies heavily on imported surface water from the Russian River watershed (via Sonoma Water) and local groundwater wells, making it especially vulnerable to regional droughts that reduce reservoir levels, river flows, and groundwater recharge.
- Magnitude and severity of droughts can range from "abnormally dry" to "exceptionally dry," with direct impacts on water supply, agriculture, business, recreation, and public services in the District.
- Historically, the region has experienced several multi-year severe droughts (notably 2007–2009, 2012–2016, and 2020–2022), leading to state and county emergency proclamations, mandatory water use restrictions, and increased dependence on groundwater.
- Climate change is expected to make droughts more frequent, intense, and persistent in Sonoma County, exacerbating competition for limited water resources, increasing soil dryness, and stressing aging water infrastructure.
- Drought poses risks to the District's infrastructure, potentially reducing system reliability, accelerating equipment wear, and limiting fire suppression capability due to reduced water availability.
- According to the RRA, drought increases the District's risk of water supply disruption by limiting available sources, increasing reliance on higher-cost imported water, and affecting the District's ability to meet domestic potable water demand and fire suppression for structure fire demand.
- Vulnerable populations, including older adults, young children, and those with health or financial challenges, face heightened risks from water shortages, service disruptions, and water quality issues during droughts.
- Prolonged droughts can damage natural resources, including wildlife habitats, local lakes, and increase the risk of wildfires, tree diseases, and soil erosion, with cascading effects on the environment and public safety.
- The overall significance of drought on the District's water supply is **High**.

4.3.4 Earthquakes

Geographic Extent	Probability of Future Occurrences	Magnitude/ Severity	Overall Significance
Extensive	Likely	Catastrophic	High

Hazard Description

California is one of the most seismically active regions in the United States, with numerous faults distributed throughout the state. The California Geological Survey (CGS) defines an active fault as one that has experienced surface rupture or displacement within the past 11,000 years (Holocene period). Faults that have not ruptured during this time but show evidence of movement within the last 1.8 million years (Quaternary period) are classified as potentially active, while faults older than the Pleistocene are considered inactive. Importantly, the absence of recent surface displacement does not preclude the possibility of future seismic activity.

Earthquakes occur when accumulated stress in the Earth's crust is released through sudden slip along a fault, generating seismic waves that produce ground shaking. Earthquake severity is commonly described using both magnitude, which measures the energy released at the source, and intensity, which describes the level of shaking experienced at a specific location. Strong ground shaking is the primary cause of damage during earthquakes and is responsible for most structural and infrastructure losses.

Earthquakes can result in structural damage, injuries, and loss of life, as well as disruption to water, power, gas, communications, and transportation systems. Primary earthquake hazards include surface rupture and strong ground shaking, while secondary hazards arise when shaking affects unstable soils or vulnerable systems. These secondary effects include liquefaction, lateral spreading, settlement, landslides, rockfall, debris flows, and fires or flooding caused by damaged utility infrastructure. Together, these impacts can damage buried pipelines, storage tanks, and pump stations; disrupt lifeline corridors; and trigger cascading service outages that complicate emergency response and recovery.

Sonoma County is located at the northern edge of the seismically active San Francisco Bay Area, where regional strain is accommodated by the San Andreas Fault system. Faults that influence seismic risk in and around the county include the offshore and coastal San Andreas Fault and inland faults such as the Rodgers Creek, Maacama, Bennett Valley, and West Napa faults. Several of these faults have produced large historical earthquakes and remain capable of generating significant future seismic events.

Ground Shaking

When movement occurs along a fault, the energy generated is released as waves, which cause ground shaking. Ground shaking intensity varies with the magnitude of the earthquake, the distance from the epicenter, and the type of rock or sediment through which the seismic waves move. The geological characteristics of an area can be a greater hazard than the area's distance to the earthquake epicenter.

Surface Fault Rupture

In a large earthquake, a fault can break to the ground surface and displace the land by several feet. The ground on one side moves relative to the other, creating permanent offset and intense distortion. Structures and buried lines that straddle the break can crack, shear, or pull apart. Tanks may rock on their foundations, appurtenances can tear, and long pipelines can part at joints or fittings.

Liquefaction

Liquefaction is the loss of soil strength or stiffness when strong shaking drives up pore-water pressure in loose, saturated sands and silty sands. The soil briefly behaves like a dense fluid, allowing foundations

and buried appurtenances like water infrastructure to settle, tilt, or float. Where a liquefiable layer lies beneath non-liquefiable cover, the overlying mass can translate laterally toward a free face such as a creek bank or road embankment. This lateral spread mechanism is often more damaging to linear infrastructure than vertical settlement alone because it imposes large horizontal strains over tens to hundreds of feet.

This hazard profile is informed by the Valley of the Moon Water District's Draft *Seismic Vulnerability Assessment and Development of a Prioritized Capital Improvement Project List* (Seismic Vulnerability Assessment Report), prepared by InfraTerra, Inc. (InfraTerra 2026). The assessment finds that the District faces a high level of earthquake risk due to its location within the seismically active North Bay region of the San Andreas Fault system, where strong ground shaking, liquefaction, and localized landslides pose the greatest threats to water system performance. Although surface fault rupture does not directly affect District facilities, proximity to the Rodgers Creek Fault combined with young alluvial soils and shallow groundwater increases the likelihood of widespread pipeline damage, tank instability, and service disruptions during a major earthquake. The assessment further concludes that a magnitude 7.0 earthquake would significantly challenge the District's ability to rapidly restore service to customers and critical facilities without targeted seismic mitigation and emergency preparedness investments. Additional findings from the assessment are incorporated throughout this hazard profile and vulnerability analysis.

Geographic Location

Extensive – The San Francisco Bay Area and Sonoma County are considered seismically active due multiple active right-lateral strike-slip faults in the San Andreas Fault system. Notable faults adjacent to the District's Planning Area with the greatest potential of impacting the District's water supply facilities and infrastructure are described in more detail below.

- **San Andreas Fault.** The San Andreas Fault west of the District is an approximately 75-mile long right lateral strike-slip fault and is considered the most active fault in California. It has been the source of several larger earthquakes in modern recorded history and is expected to continue being the source of future earthquake activity in Sonoma County. The major faults within the San Andreas Fault system include the Hayward, Rodgers Creek, Calaveras, San Gregorio and Maacama faults.
- **Rodgers Creek Fault**. The Rodgers Creek Fault is an approximately 35-mile long right lateral strike-slip fault associated with the Santa Rosa Plain, in Sonoma County. It is located approximately 4.5 miles west of the District's central service area, and the dominant contributor to local seismic hazards. It is considered the northern extension of the Hayward fault. The most notable earthquake activity along this fault took place in 1969 during the Santa Rosa Earthquakes. These were magnitude 5.6 and 5.7 strikes early October of that year, in Santa Rosa County to the north of the District's Planning Area. The Rodgers Creek Faults was identified in the Sonoma County Water Agency's past LHMP as the greatest potential for damaging the Water Agency's water infrastructure.
- **Bennett Valley Fault**. The Bennett Valley fault is a northwest-southeast-striking fault that trends subparallel to the Rodgers Creek fault, located approximately 11.5 miles north of central District's service area.
- **West Napa Fault**. The West Napa fault is a right-lateral strike-slip fault that is also part of San Andreas Fault System located approximately 8 miles east of central VOMWD service area along the west side of Napa Valley. The West Napa fault is approximately 43 miles long and is considered the source of the 2014 M6.0 South Napa earthquake, which exhibited surface rupture from Cuttings Wharf Road to the City of Napa.

Other sources of seismic hazards in the region include the Geysers Geothermal Field, located to the north of Sonoma Valley in the Geysers-Clear Lake area. This area covers approximately 45 square miles between Lake, Mendocino, and Sonoma counties. Based on studies conducted by USGS, activities associated with the withdrawal of steam for producing electric power have been shown to cause or induce small quakes to occur in the field (USGS).

Liquefaction susceptibility is also highest in low-lying alluvial areas near Sonoma Creek, where young sediments and shallow groundwater conditions coincide, while landslide hazards are more localized in hilly terrain near Saddle and Sobre Vista tank sites. The VOMWD Seismic Vulnerability Assessment Report indicated that there are numerous stream crossings that intersect with the pipeline and distribution system that could be at risk to over six inches of settlement in high liquefaction zones and up to several feet of lateral spreading at select stream crossings. The report also noted that service area is not impacted by fault rupture hazard (InfraTerra 2026).

Magnitude/Severity

Catastrophic – Extent (meaning the severity of an earthquake) refers to the amount of energy released during an earthquake and is usually expressed in terms of intensity or magnitude. These metrics are measured directly from the earthquake as recorded on seismographs. Seismologists have developed several magnitude scales; one of the first was the Richter Scale, developed in 1932 by Dr. Charles F. Richter of the California Institute of Technology. The Moment Magnitude Scale is the current scale used to quantify the magnitude or strength of the seismic energy released by an earthquake.

Intensity represents the observed effects of ground-shaking at any specified location, and earthquake shaking decreases with distance from the earthquake epicenter. Intensity is an expression of the amount of shaking at any given location on the ground surface based on felt or observed effects. Seismic shaking is typically the greatest cause of losses to structures during earthquakes. Intensity is measured with the Modified Mercalli Intensity (MMI) scale.

Table 4-13 compares magnitude and the felt effects associated with the MMI scale. Damage typically occurs in MMI of VII or above and is based on ground shaking potential.

Table 4-13 Magnitude and Mercalli Intensity Scale Measurements and Associated Characteristics

Magnitude	Mercalli Intensity	Effects	Frequency
> 2.0	I	Micro-earthquakes, not felt or rarely felt; recorded by seismographs.	Continual
2.0-2.9	I to II	Felt slightly by some people; damages to buildings.	Over 1M per year
3.0-3.9	II to IV	Often felt by people; rarely causes damage; shaking of indoor objects noticeable.	Over 100,000 per year
4.0-4.9	IV to VI	Noticeable shaking of indoor objects and rattling noises; felt by most people in the affected area; slightly felt outside; generally, no to minimal damage.	10K to 15K per year
5.0-5.9	VI to VIII	Can cause damage of varying severity to poorly constructed buildings; at most, none to slight damage to all other buildings. Felt by everyone.	1K to 1,500 per year
6.0-6.9	VII to X	Damage to a moderate number of well-built structures in populated areas; earthquake-resistant structures survive with slight to moderate damage; poorly designed structures receive moderate to severe damage; felt in wider areas; up to hundreds of miles/kilometers from the epicenter; strong to violent shaking in epicentral area.	100 to 150 per year

Magnitude	Mercalli Intensity	Effects	Frequency
7.0-7.9	VIII<	Causes damage to most buildings, some to partially or completely collapse or receive severe damage; well-designed structures are likely to receive damage; felt across great distances with major damage mostly limited to 250 km from epicenter.	10 to 20 per year
8.0-8.9	VIII<	Major damage to buildings, structures likely to be destroyed; will cause moderate to heavy damage to sturdy or earthquake-resistant buildings; damaging in large areas; felt in extremely large regions.	One per year
9.0 and Greater	VIII<	At or near total destruction - severe damage or collapse to all buildings; heavy damage and shaking extends to distant locations; permanent changes in ground topography.	One per 10-50 years

Source: USGS

Ground Shaking

The intensity of ground shaking at a particular location is measured in terms of ground acceleration that generally decreases with distance from the earthquake source unless modified by local subsurface conditions. The maximum acceleration recorded at a location is referred to as the peak ground acceleration (PGA) and is reported as a fraction of earth's gravitational acceleration (g). The total force experienced by a structure can be related directly to the level of acceleration it experiences.

Given the proximity to the San Andreas fault and the Rodgers Creek fault, all parts of Sonoma County including the District's Planning Area are exposed to long duration peak ground accelerations greater than 0.15g (SCWA 2018). A high-magnitude earthquake on one of these faults could cause moderate to high ground shaking within the District's Planning Area and may impact the District's water supply infrastructure. According to the District's *Seismic Vulnerability Assessment Report*, earthquake ground-shaking intensity is expected to be severe during a major event, with peak ground accelerations ranging from approximately 0.53g to 0.59g for 475-year return period events and approaching or exceeding 0.9g for rare, high-consequence earthquakes. A credible magnitude 7.2 scenario earthquake on the Rodgers Creek fault would generate shaking levels comparable to the Maximum Considered Earthquake used in modern seismic design standards.

Surface Fault Rupture

Consequences of surface rupture are corridor-focused rather than areawide. Damage concentrates where a fault intersects linear facilities, stream and roadway crossings, and sites that span a trace. For a water system this includes transmission and distribution mains, creek siphons, bridge attachments, interties, tank inlet and outlet piping, and electrical and control conduits. Breaks can cause rapid loss of pressure, localized flooding, and service outages. Isolation valves may become inaccessible if roads are offset, or embankments fail. Where rupture aligns with steep ground or channel banks, secondary effects such as settlement, lateral spreading, and embankment slumping can amplify damage. Short-term water quality impacts can arise from intrusion, sediment mobilization, or cross-connection at broken mains. Even when shaking damage is limited, a single rupture crossing can interrupt supply to downstream zones until crews can isolate and bypass the break.

Liquefaction

Expected liquefaction effects concentrate in valley-bottom corridors and filled ground. Buried pipelines can ovalize, pull apart at joints, or shear at transitions and bridge attachments. Creek siphons and crossings are vulnerable to lateral spread that displaces banks and abutments. Tanks on shallow, non-uniform soils can settle differentially; attached piping, vaults, and electrical/conduit penetrations are common weak points. Roadway and bridge approaches may slump or crack, complicating isolation-valve

access and lengthening repair times. Even where District facilities avoid direct damage, liquefaction can rupture adjacent wastewater or private lateral systems, introduce turbidity and fines, and create short-term water quality risks during low-pressure events. According to the District's *Seismic Vulnerability Assessment Report* liquefaction-induced ground deformation, including settlement exceeding six inches and lateral spreading of several feet at select stream crossings, represents the most damaging seismic mechanism for buried infrastructure.

In 2014 a 6.0 magnitude earthquake occurred in the southern portion of the City of Napa on the West Napa Fault, approximately nine miles southeast of the District's Planning Area The event was the largest earthquake in the San Francisco Bay Area since the 1989 Loma Prieta earthquake. Total damage in the southern Napa and Vallejo areas ranged from $362 million to $1 billion.

Photo Credit: LA Times 2014

Previous Occurrences

Earthquakes affecting the Planning Area reflect the regional San Andreas system and its branches, especially Rodgers Creek, Healdsburg, Maacama, and West Napa faults.

- **1906 San Francisco earthquake.** A very large event on the northern San Andreas caused severe shaking across Sonoma County. Santa Rosa suffered catastrophic building losses and fatalities. Reported shaking lasted on the order of a minute and destroyed many non-wood structures. This remains the benchmark regional scenario for long-period, damaging motion in the county. The 1906 San Francisco earthquake resulted in 15 feet of horizontal displacement along the San Andreas Fault in Sonoma County (SWCA, 2023).
- **1969 Santa Rosa sequence**. Magnitudes 5.6 and 5.7 on the Healdsburg fault ruptured two miles north of Santa Rosa. Damage concentrated in unreinforced masonry and older wood-frame buildings. About 99 structures were significantly damaged, and total losses exceeded several million dollars. No fatalities were recorded.
- **1989 Loma Prieta earthquake**. A magnitude 6.9 on the San Andreas system caused major regional impacts, with only minor structural effects in Sonoma County. The event nonetheless demonstrated the potential for long-duration shaking and cascading lifeline outages across the Bay Area.
- **2014 South Napa earthquake**. A magnitude 6.0 on the West Napa Fault struck on August 24, 2014. The epicenter lay about nine miles southeast of the City of Sonoma. Reported intensity reached VII in parts of the valley, with injuries, one fatality regionwide, and an estimated 400 million dollars in losses. Several structures in eastern Sonoma County were damaged. A state emergency proclamation and a federal disaster declaration followed, with state and federal assistance and SBA disaster loans supporting recovery. Additionally, earthquake impacts to water district infrastructure occurred during the 2014 South Napa Earthquake. The surface fault rupture and ground shaking caused physical damages to City of Napa's water system including over 200 water leaks, significant damages to water storage tanks causing it to drain, in addition to damages to roads and highways. In total, the city's water system suffered over $6.4 million in damages (SCWA 2018).
- **2016 The Geysers event**. A magnitude 5.0 west of The Geysers was widely felt in Clearlake, Santa Rosa, and across the Bay Area. Damage in Sonoma County was limited, but the event underscored frequent moderate seismicity associated with the geothermal field.

Overall, these events show that Sonoma Valley can experience strong to very strong shaking from nearby faults with short warning and from large regional ruptures that drive long-period motions. The 2014 South Napa event is the most relevant modern analog for the Planning Area, given its proximity to the Sonoma Valley and reported intensities and extensive infrastructure damage in the planning area. The County's 2026 MJHMP indicates no new significant earthquake impacts since the last plan, but the historic record and active fault geometry confirm ongoing risk to people, buildings, and linear water infrastructure in and around the District's service area.

Probability of Future Occurrences

Likely – Given the information presented herein as well as recent earthquake activity history, earthquake hazards are expected to be a likely occurrence in the District's boundaries as well as in Sonoma County. It is estimated that similar seismic activity events may occur every 20 to 30 years in the Planning Area and the overall San Francisco Bay region (State of California Seismic Safety Commission). Based on the past five major earthquakes over an approximate 120-year period, the District can expect there is a 4% chance of an earthquake occurring in any given year. Based on the District's *Seismic Vulnerability Assessment Report*, a significant likelihood of moderate to large earthquakes occurring within the planning horizon, including an estimated 14.5 percent probability of a magnitude 6.7 or greater earthquake on the Rodgers Creek fault over a 30-year period (InfraTerra 2026). Further, given the absence of a documented historic rupture on the Rodgers Creek fault and its relatively high slip rate, the potential for a large, damaging earthquake in the future remains elevated (InfraTerra 2026).

Climate Change Considerations

Climate change is not expected to alter the rate or size of earthquakes, but it can worsen their indirect effects. More frequent, intense storms raise groundwater levels and keep soils saturated, which increases the likelihood and severity of liquefaction when strong shaking occurs. The same wet conditions add weight to steep slopes and elevate pore-water pressures, reducing shear strength and raising landslide potential during and after earthquakes. The District's *Seismic Vulnerability Assessment Report* noted that climate change can increase groundwater levels, soil saturation, and erosion in flood-prone and riparian areas over time and these conditions can heighten liquefaction susceptibility and worsen lateral spreading and slope instability during seismic events (InfraTerra 2026). In short, wetter antecedent conditions make shaking consequences worse even if the shaking itself is unchanged (SHMP 2023). For these reasons, climate change would have a low influence on earthquakes.

Vulnerability Assessment

Ground shaking is the primary earthquake hazard affecting the District and is the leading cause of damage to buildings and water infrastructure. Damage severity depends on factors such as proximity to active faults, earthquake magnitude, and local soil conditions, with structurally damaging effects generally occurring at Modified Mercalli Intensity (MMI) VII or greater.

As shown in Figure 4-8, U.S. Geological Survey seismic hazard mapping for a 2 percent probability of exceedance in 50 years (a 2,500-year event) indicates that much of the District would experience strong shaking capable of causing significant infrastructure damage. While surface fault rupture is limited to locations where infrastructure crosses faults, such as the Sonoma Aqueduct at the Spring Valley Fault, strong ground motions pose widespread risk, particularly near the Rodgers Creek, Healdsburg, and Maacama faults. As shown in Figure 4-9, liquefaction further increases vulnerability in areas underlain by young alluvial soils and shallow groundwater, especially along Sonoma Creek, where pipeline failures and lateral spreading could disrupt transmission reliability.

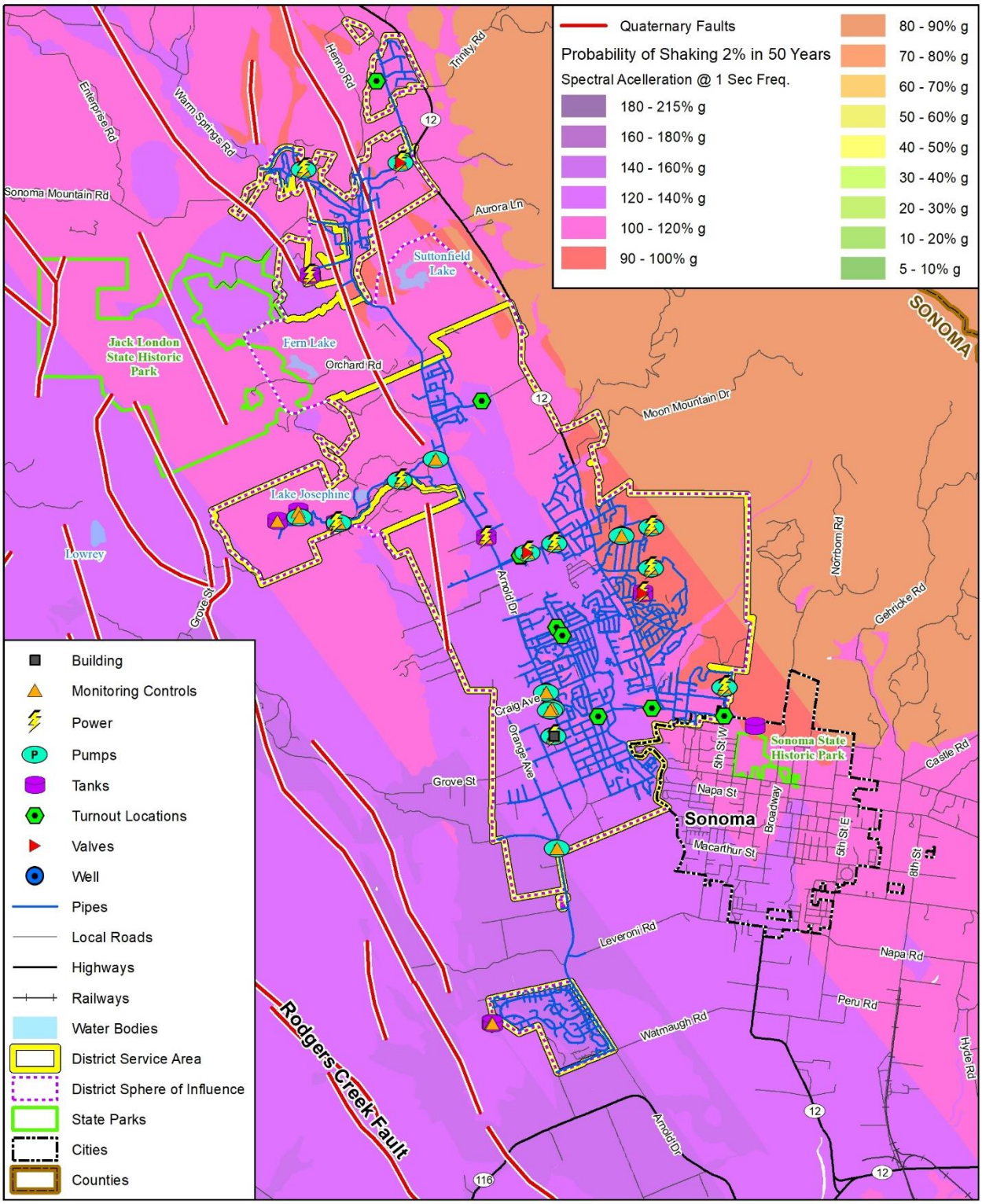
The District's *Seismic Vulnerability Assessment* concludes that reliance on a limited pipeline network and the concentration of facilities in liquefaction-prone areas make customers, critical infrastructure, and the local economy highly vulnerable to earthquake impacts. A major earthquake could result in widespread pipeline damage, tank failures, and service outages lasting days to weeks, affecting residents, businesses, emergency response, healthcare, and wildfire suppression during recovery.

Other common impacts from earthquakes include damage to infrastructure and buildings (e.g., crumbling of unreinforced masonry, failure of architectural facades, rupturing of underground utilities, and road closures). Earthquakes also frequently trigger secondary hazards, such as dam and levee failures, flooding, and fires that can become disasters themselves.

People

Sonoma County and the District's service area are highly vulnerable to earthquake impacts due to the region's seismic setting and reliance on centralized water infrastructure. Residential customers account for nearly 80 percent of District demand, increasing the consequences of service disruptions. Damage from ground shaking or liquefaction to the water supply system or Sonoma Aqueduct could disable storage tanks, booster pump stations, and transmission facilities, leading to extended outages particularly in higher-elevation areas. Earthquake-related power outages may further delay recovery, while loss of water pressure and fire flows could elevate wildfire risk during constrained emergency response. Liquefaction-related failures may also introduce sediments or contaminants into the system, compounding public health and operational challenges, with vulnerable populations facing the greatest risk due to limited resources, reduced mobility, and higher dependence on continuous water service.

Figure 4-8 Potential Ground Shaking Probability in the Valley of the Moon Water District

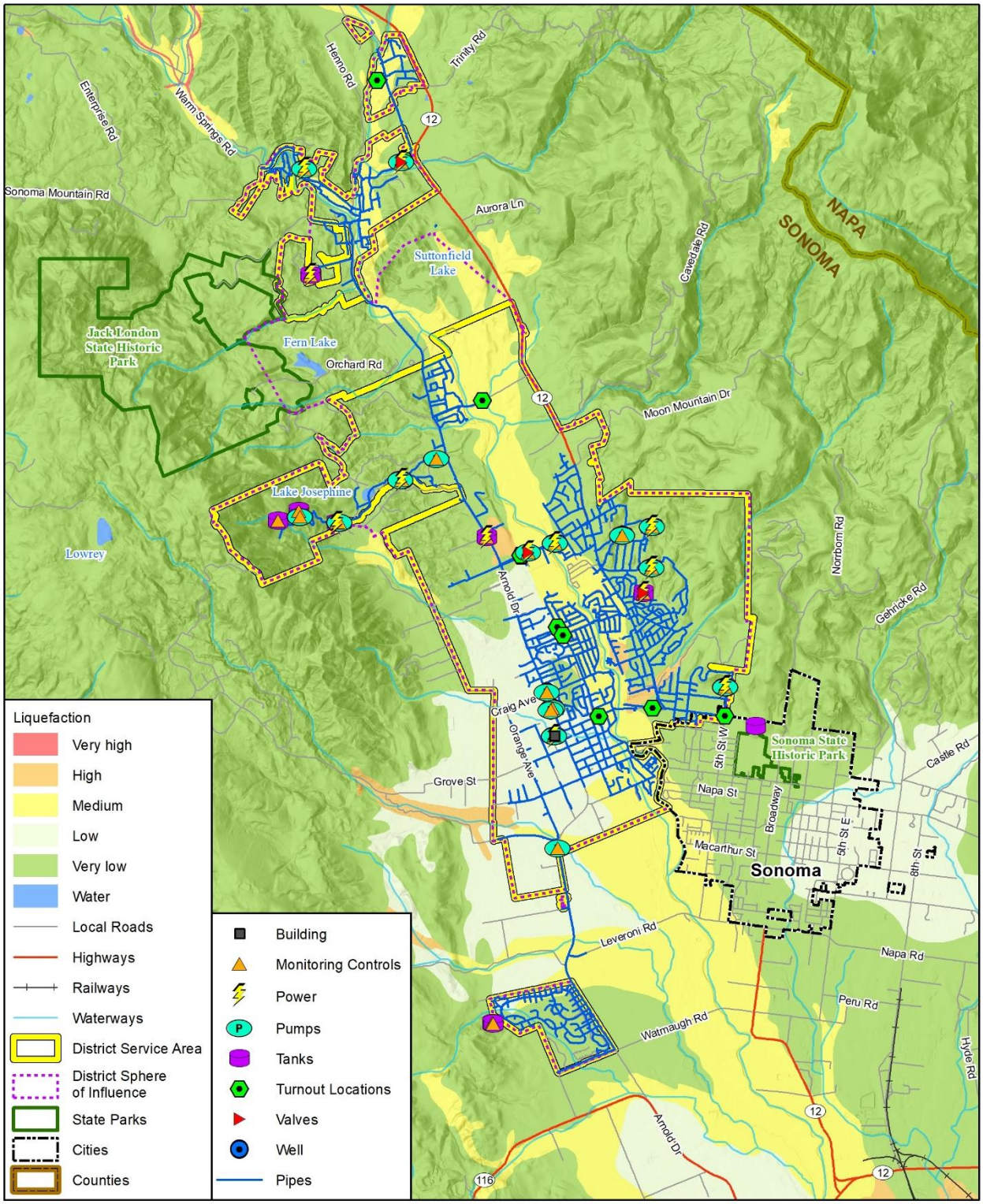


Map compiled 2/2026;
intended for planning purposes only.
Data Source: Sonoma County, CalTrans,
US Census TIGER Database, CA Open
Data Portal, EKI Environment & Water, Inc.,
CA Parks and Rec., California Dept. of Conservation

0 1.5 3 Miles

N

Figure 4-9 Liquefaction Susceptibility in the Valley of the Moon Water District



Map compiled 2/2026;
intended for planning purposes only.
Data Source: Sonoma County, CalTrans, US Census TIGER Database, CA Open Data Portal, EKI Environment & Water, Inc., CA Parks and Rec., Dept. of Conservation

Property

Ground shaking is the primary cause of earthquake-related damage in the District's service area. Older wood frame homes with cripple walls or weak soft story garages particularly in Agua Caliente, Boyes Hot Springs, El Verano, and older areas of the City of Sonoma are vulnerable to foundation sliding and structural failure, while small unreinforced masonry commercial buildings are susceptible to cracking and parapet collapse.

Water infrastructure is especially vulnerable where pipelines cross young alluvial soils along the Sonoma Creek corridor, where strong shaking or lateral spreading can cause pipe breakage and joint failure. Unbraced equipment at tanks and pump stations may also be damaged, and even limited structural impacts can result in widespread nonstructural losses. Fire following earthquakes remains a significant secondary risk if service lines fail and access is constrained, while damage to security features may increase the risk of unauthorized access or contamination of District facilities.

Critical Water Facilities and Infrastructure

Large earthquakes could have catastrophic impacts on the District's water supply and distribution system, as well as on Sonoma Water infrastructure that the District relies on for imported supply. Seismic damage could affect pipelines, tanks, pump stations, electrical controls, and access roads, significantly limiting the District's ability to operate and restore service. A 2020 Hazus analysis estimates that approximately 578 miles of potable water pipelines could experience about 428 breaks and 1,713 leaks, resulting in an estimated $7.7 million in economic losses representing roughly 41 percent of the total system value (VOMWD 2021).

The District's *Seismic Vulnerability Assessment* confirms that both ground shaking and liquefaction pose substantial risks to buried pipelines, valves, tanks, pump stations, and associated electrical and control systems, leading to leaks, breaks, and operational disruptions. The 2026 RRA further indicates that earthquake-related ground shaking may damage physical security features, increasing the risk of unauthorized access or intentional contamination, while damage to water lines, pumps, storage tanks, and chlorine injection systems could result in loss of pressure, untreated water entering the system, and potential bacteriological contamination (VOMWD 2026). Power outages may also disable SCADA and remote monitoring, limiting the District's ability to detect and respond to treatment failures.

As shown in Figure 4-8, GIS-based analysis of District assets using U.S. Geological Survey seismic hazard data for a 2 percent probability of exceedance in 50 years shows that all 113 District assets are exposed to moderate to high ground shaking, with expected spectral accelerations of at least 90 percent of gravity. Damage to these facilities could require redistribution of water from alternate backup sources. Ground shaking exposure for District assets are summarized in Table 4-14.

Table 4-14 District's Assets at Risk to 2 Percent Probability of Ground Shaking in 50 Years

Spectral Acceleration at 1 Sec Freq.	Asset Type	Count	Replacement Value
90-100%	Building	1	$9,173
	Monitoring & Controls	7	$183,121
	Power	4	$269,155
	Pump	6	$177,319
	Tank	6	$2,773,013
	Valve	1	$20,300
	Well	2	$3,000,000
	Total	**27**	**$6,432,082**

Spectral Acceleration at 1 Sec Freq.	Asset Type	Count	Replacement Value
100%-120%	Monitoring & Controls	3	$90,817
	Power	2	$105,002
	Pump	2	$126,268
	Tank	1	$468,768
	Turnout Location	1	$250,000
	Valve	1	$30,300
	Building	1	$8,190
	Monitoring & Controls	7	$249,804
	Power	4	$121,217
	Pump	6	$244,529
	Tank	4	$664,622
	Turnout Location	3	$750,000
	Well	1	$1,500,000
	Total	**36**	**$4,609,517**
120%-140%	Monitoring & Controls	6	$245,197
	Power	5	$276,075
	Pump	5	$260,306
	Tank	2	$3,259,722
	Turnout Location	6	$1,500,000
	Valve	1	$129,512
	Well	1	$1,500,000
	Building	1	$1,114,709
	Monitoring & Controls	8	$202,267
	Power	1	$8,072
	Pump	6	$600,901
	Well	4	$7,000,000
	Total	**46**	**$16,096,760**
140%-160%	Monitoring & Controls	2	$49,737
	Tank	2	$2,164,220
	Total	**4**	**$2,213,957**
	Grand Total	**113**	**$29,352,315**

Source: Valley of the Moon Water District, California Dept. of Conservation, WSP Analysis

Liquefaction

Sonoma Creek, which crosses through the center of the District's boundaries, is identified in the Sonoma County Hazard Mitigation Plan as an area susceptible to liquefaction. Based on the GIS analysis conducted, a majority of District's assets (99 of the 113 assets) are located in areas considered to have low to very low risk to liquefaction. The 14 remaining assets, with a total replacement value of $2,954,424, are at medium risk to liquefaction. Assets vulnerable to liquefaction are detailed in Table 4-15. The Sonoma Aqueduct was identified in the 2021 Sonoma Water LHMP as vulnerable to liquefaction due to locations where the aqueduct crosses creeks and streams as well as the Spring Valley Fault. Damage to the Sonoma Aqueduct due to an earthquake or liquefaction would result in major impacts on the Districts' ability to supply water to customers.

Table 4-15 District Assets at Risk to Liquefaction

Liquefaction	Asset Type	Count	Replacement Value
Medium	Monitoring & Controls	3	$146,510
	Power	3	$221,662
	Pump	3	$206,740
	Turnout Location	3	$750,000
	Valve	1	$129,512
	Well	1	$1,500,000
	Total	14	$2,954,424
Low	Building	1	$1,114,709
	Monitoring & Controls	8	$202,267
	Power	1	$8,072
	Pump	6	$600,901
	Turnout Location	4	$1,000,000
	Well	4	$7,000,000
	Total	**24**	**$9,925,948**
Very Low	Building	2	$17,364
	Monitoring & Controls	22	$672,165
	Power	12	$549,788
	Pump	16	$601,682
	Tank	15	$9,330,344
	Turnout Location	3	$750,000
	Valve	2	$50,600
	Well	3	$4,500,000
	Total	**75**	**$16,471,943**
	Grand Total	**113**	**$29,352,315**

Source: Valley of the Moon Water District, California Dept. of Conservation, WSP Analysis

Several of the regional water agency's diversion facilities and Sonoma Aqueduct are also located in areas of moderate, high, and very high liquefaction potential and areas with high lateral spread hazards (Sonoma Water 2018). The Sonoma Aqueduct crosses the Spring Valley segment of the Bennet Valley fault zone and has an increased likelihood of failure in a surface rupturing event on this fault (Sonoma Water 2018). The most obvious locations of potential failure are where diversion pipelines and aqueducts cross active faults, creeks, stream crossings, and other areas with high potential for lateral spread. The District's *Seismic Vulnerability Assessment Report* also found that liquefaction would cause buried water pipelines to ovalize, pull apart at joints, shear at transitions, or rupture at creek crossings due to settlement and lateral spreading, making pipelines the most vulnerable component of the District's system (InfraTerra 2026). Lateral spreading along streambanks can also displace bridge abutments and creek siphons and damage attached pipelines, which could create failure points that are time consuming to repair (Infra Terra 2026).

Economy

Ground shaking and liquefaction associated with a major earthquake could result in substantial economic impacts to the District through costly repairs to damaged pipelines, tanks, pump stations, and access routes, as well as increased emergency response and operational expenditures. Service disruptions would also result in significant revenue losses. Hazus-based analyses from the 2021 LHMP, estimated

millions of dollars in direct losses to potable water distribution infrastructure from pipeline breaks and leaks, with extended outages placing additional strain on District finances and capital improvement programs. Disruptions to water service would also affect local businesses, agriculture, tourism, and emergency services throughout Sonoma Valley, resulting in lost productivity, delayed recovery, and secondary economic losses. Prolonged restoration timelines, particularly in liquefaction-prone areas, could compound these impacts by delaying reopening of businesses and increasing community-wide recovery costs.

Historic, Cultural, and Natural Resources

Earthquakes in or near the District's Planning Area could trigger landslides, debris flows, and other forms of ground deformation that damage habitat, alter stream channels, and degrade water quality. The Russian River system, the primary water source for Sonoma Water and the District, is particularly vulnerable to liquefaction. Previous hazard mitigation planning indicates that strong shaking could temporarily reduce aquifer permeability beneath and adjacent to the Russian River through compression or dilation, limiting production capacity, although recovery is generally expected within a short period.

In addition to imported Russian River supplies, the District relies on groundwater wells, which may experience temporary changes in groundwater levels during large earthquakes as seismic waves pass through the subsurface; the extent of these impacts depends on local geologic conditions. Many historic structures within the County, including those in the District's Planning Area, are located in areas susceptible to liquefaction. Although some of these structures have withstood past earthquakes, their continued performance during future seismic events cannot be assumed and they may be at risk.

Recent and Future Development

Due to the District's proximity to the San Andreas and Rodgers Creek faults it is likely a major earthquake would take place in the future. There has been some residential development that has occurred in the District's service area since the last plan update, and there is the potential for future development within the SDC Campus area. The location of future water distribution lines, tanks, valves and other water infrastructure should take liquefaction susceptibility and ground shaking into consideration in their design and placement. The recent changes in development are also likely to increase the District's overall vulnerability to earthquake hazards. This would occur because additional demand on water infrastructure would expand the number of customers dependent on water service. It would also increase exposure of new pipelines and storage tanks to ground shaking. This would also occur if older infrastructure at the SDC Campus is relied on instead of new and upgraded water infrastructure.

Risk Summary

- Earthquakes and seismic activity are expected to have a probability of occasional occurrence in the future, given the local seismic conditions, past history, and input from the District.
- There are five earthquake faults of concern that can affect the District. The San Andreas Fault and the Rodgers Creek Fault are considered to be currently active and the faults that may lead to more damages or losses in the future. The Bennett Valley, West Napa, and Maacama faults are also significant right-lateral strike-slip faults that could affect water system vulnerability due to ground shaking, surface fault rupture, liquefaction, and slope instabilities.
- The majority of the Planning Area is found in moderate, high, or very high ground shaking susceptibility.
- The central portion of the District's Planning Area near the Sonoma Creek is considered to be in medium liquefaction zones. 14 assets valued at $2.9 million are in medium liquefaction risk zones; the remaining facilities have low or very low liquefaction risk.
- 113 District assets valued over $29 million are at risk from strong ground shaking;

- The Sonoma Aqueduct, which supplies a majority of the water for the District is considered to be highly vulnerable to surface fault rupture from the Spring Valley Fault and highly susceptible to liquefication in some areas.
- According to the District's *Seismic Vulnerability Assessment Report*, the District's water system, customers, and local economy are highly vulnerable to earthquake impacts due to the concentration of critical water infrastructure in liquefaction-prone areas and reliance on a limited pipeline network, such that a major earthquake could result in dozens of pipeline failures, damage to storage tanks, and water service outages lasting from several days to multiple weeks
- The overall risk significance of earthquake hazards to the District is **High**.

4.3.5 Extreme Heat

Geographic Extent	Probability of Future Occurrences	Magnitude/ Severity	Overall Significance
Extensive	Likely	Limited	Low

Hazard Description

Extreme heat is an increasingly significant hazard, where rising temperatures can threaten public health, strain infrastructure, and stress natural and agricultural systems. Cal-Adapt defines an extreme heat day as one when the daily maximum temperature exceeds the 98th percentile of the historical daily extremes for that location; in Sonoma County, the threshold defined by Cal-Adapt is 93.9°F. As climate change increases, the frequency, duration, and intensity of heat waves, communities that historically experienced moderate temperatures, such as those in Sonoma Valley, face increasing vulnerability. Heat waves increase the risk of heat exhaustion, heat stroke, and cardiovascular stress, particularly for older adults, young children, medically vulnerable individuals, outdoor workers, and households without sufficient cooling.

The topography of the service area within Sonoma Valley can trap warm air and reduce coastal cooling. Extreme heat events also elevate water demand for drinking, irrigation, and cooling, while intensifying evaporation and water quality challenges. Prolonged high temperatures can increase community water demand, strain pumping and treatment equipment, reduce operational efficiency, and elevate the risk of mechanical failure. While extreme heat does not typically cause direct physical damage to facilities, it can lead to service disruptions, increased operational costs, and heightened vulnerability when combined with related hazards such as poor air quality, power outages, and wildfire.

Geographic Location

Extensive – Extreme heat events in the Planning area have an extensive geographic extent, affecting nearly all communities within the Sonoma Valley due to the region's overall warm, inland climate. Lower-elevation valley floor communities such as Boyes Hot Springs, Agua Caliente, El Verano, and Temelec tend to experience the most persistent high temperatures because they are farther from coastal breezes and can trap heat between Sonoma Mountain and the Mayacamas. Areas closer to riparian corridors, such as along Sonoma Creek, may experience slightly more moderate temperatures, while higher elevation zones near Glen Ellen and Kenwood can cool more quickly at night but still face daytime extremes during major heat events.

Magnitude/Severity

Limited – The District's Planning Area begins to experience hot weather in June or July of each year, and the heat continues throughout the summer months. According to the Western Regional Climate Center (WRCC), the average high temperature for Sonoma Valley in July is 88.6°F. Extreme heat at this level does not typically cause direct physical damage to buildings or infrastructure, but it can significantly strain water system operations, reduce water quality, and increase demand across the service area.

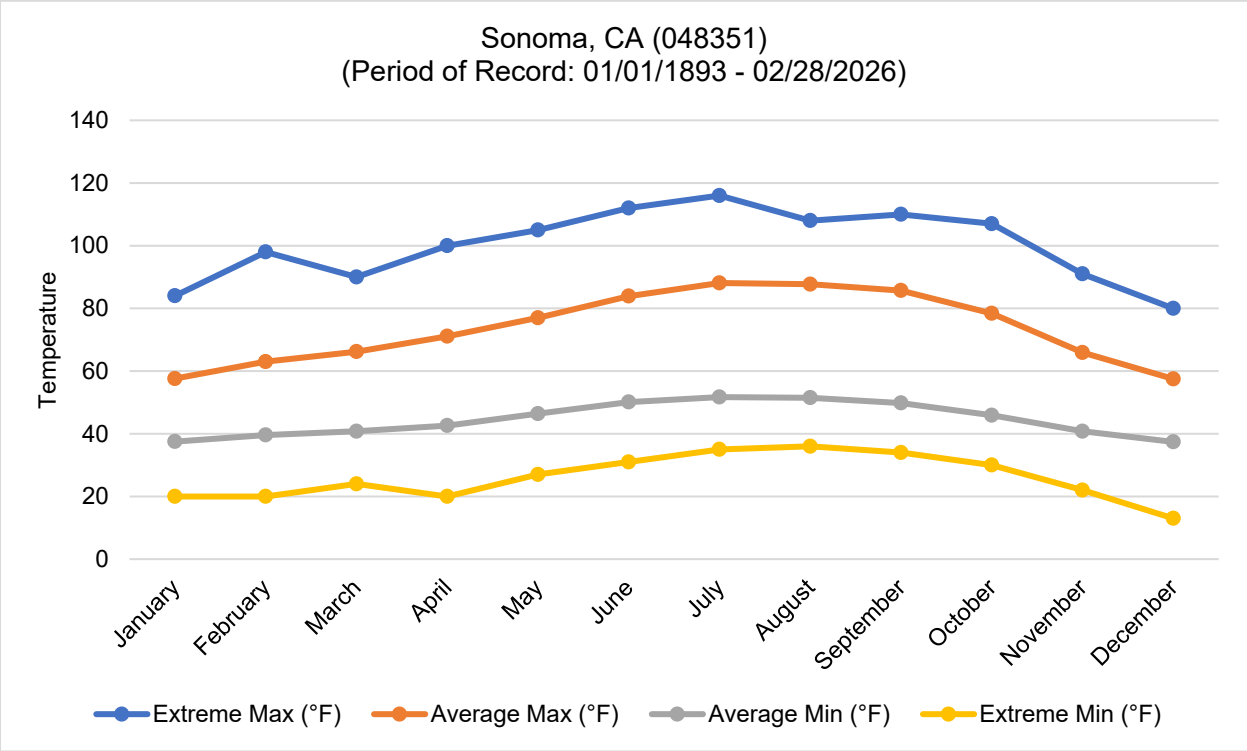
During sustained heat waves, elevated temperatures can cause increased drinking water use, increased irrigation demand, and higher system stress that may hinder service reliability, potentially leading to temporary reductions in pressure or localized services disruptions. Public health impacts, particularly among older adults, medically vulnerable individuals, and outdoor workers, can rise sharply, and prolonged heat can elevate emergency medical events beyond normal capacity. While widespread structural damage is unlikely, prolonged or repeated extreme heat events can place operation strain on

VOMWD infrastructure and staff and may contribute to cascading effects such as power outages or water quality challenges.

Previous Occurrences

Information from the closest weather station with the most comprehensive data, the Sonoma Weather Station (048351), is summarized below and in Figure 4-10 to illustrate daily temperature averages in the District's Planning Area. In the City of Sonoma, monthly average maximum temperatures in the warmest months (May through October) range from the mid-70s to the upper 80s. Monthly average minimum temperatures from November through April range from the mid-50s to low-70s. The highest recorded daily extreme was 116°F on July 13, 1972. The lowest recorded daily extreme was 13°F on December 22, 1990. In a typical year, maximum temperatures do not exceed 88°F, and minimum temperatures do not fall below 37°F.

Figure 4-10 Sonoma Daily Temperature Averages and Extremes



Source: Western Regional Climate Center, www.wrcc.dri.edu/

Table 4-16 Sonoma (048351) High Temperature Summary (01/01/1893 - 01/31/2026)

Summary Period	Monthly Mean Average Temperature	Monthly Mean Maximum Temperature	Daily Extreme High Temperature and Date	Monthly Extreme Highest Mean Temperature and Year
Spring	57.3°F	71.6°F	105°F (5/12/1976)	62.3°F (1905)
Summer	68.8°F	86.7°F	116°F (7/14/1972)	71.5°F (1981)
Fall	61.0°F	76.9°F	110°F (9/1/1955)	63.2 (2025)
Winter	48.7°F	59.3°F	98°F (2/26/1894)	52.6°F (2015)

Summary Period	Monthly Mean Average Temperature	Monthly Mean Maximum Temperature	Daily Extreme High Temperature and Date	Monthly Extreme Highest Mean Temperature and Year
Annual	58.6°F	73.7°F	116°F (7/14/1972)	60.8°F (2024)

Source: Western Regional Climate Center (WRCC), https://wrcc.dri.edu/Climate/summaries.php
*Winter = Dec., Jan., and Feb.
**Summer = Jun., Jul., and Aug

There have been 16 heat and excessive heat events recorded in Sonoma County between 2000-2025. There have been six deaths and 28 injuries associated with these events. These events which resulted in injury or death are summarized in Table 4-17 below.

Table 4-17 Heat and Excessive Heat Events in Sonoma County

Date	Deaths	Injuries	Event Summary
7/21/2006	1	0	Heat advisory conditions settled over the North Bay Valleys on July 21st and persisted for 5 days. High temperatures ranged from 108 to 113, and elevated humidity levels at night kept low temperatures in the 70s. One fatality was reported in Napa County.
6/11/2019	3	0	The combination of high pressure and strong offshore flow resulted in an early season heat wave across the Bay Area from June 9th to the 11th. Multiple daily records were broken across the region, and multiple power outages were reported due to the heat. Approximately 26,000 people across the region lost power on Monday, followed by an additional 30,000 on Tuesday. Three fatalities were reported during the heat event. One man died as a direct result of heat related illness while two others drowned while attempting to cool down during the heat wave. Hot temperatures and dry grass resulted in a vegetation fire that spread to a residence.
9/4/2022	0	4	A strong ridge of high-pressure lead to anomalously hot temperatures along the California coast, and even more extreme temperatures in interior valleys and all mountain zones, where very hot daytime temperatures combined with a lack of overnight cooling created extreme heat risk. Excessive Heat Warnings were issued for interior valleys and mountain zones around the San Francisco Bay Area from September 4th through 8th. Several daily record high temperature records were shattered, along with a handful of monthly and all-time records. Triple digit temperatures were reported across a vast swath of the interior, with some sites reaching 110 degrees and higher. Reports of power outages, heat related illnesses, and deaths were received. Four calls received by EMS for heat-related illness. Of those, three were low-priority and one was Code 3 (emergency).
7/1/2023	0	0	The Santa Rosa co-op site recorded a daily record high of 104, from a previous record of 101 in 1972.
7/16/2023	0	0	The Santa Rosa co-op site tied the daily record of 99, achieved in 1935.
6/11/2024	0	5	An upper level ridge contributed to a period of days when temperatures went above seasonal averages across inland areas of central California. Several people were overcome by the heat at the American Canyon High School graduation. Three people were taken to the hospital and two more got medical attention on site. Temperatures in the area reached 91 degrees.
7/3/2024-7/10/2024	1	0	A prolonged and extended heat wave impacted the state of California from the early to the middle of July. An upper level ridge set up over the region, leading to a historically long period of dangerous heat. The event resulted in the issuing of an Excessive Heat Warning for interior regions of the Bay Area and

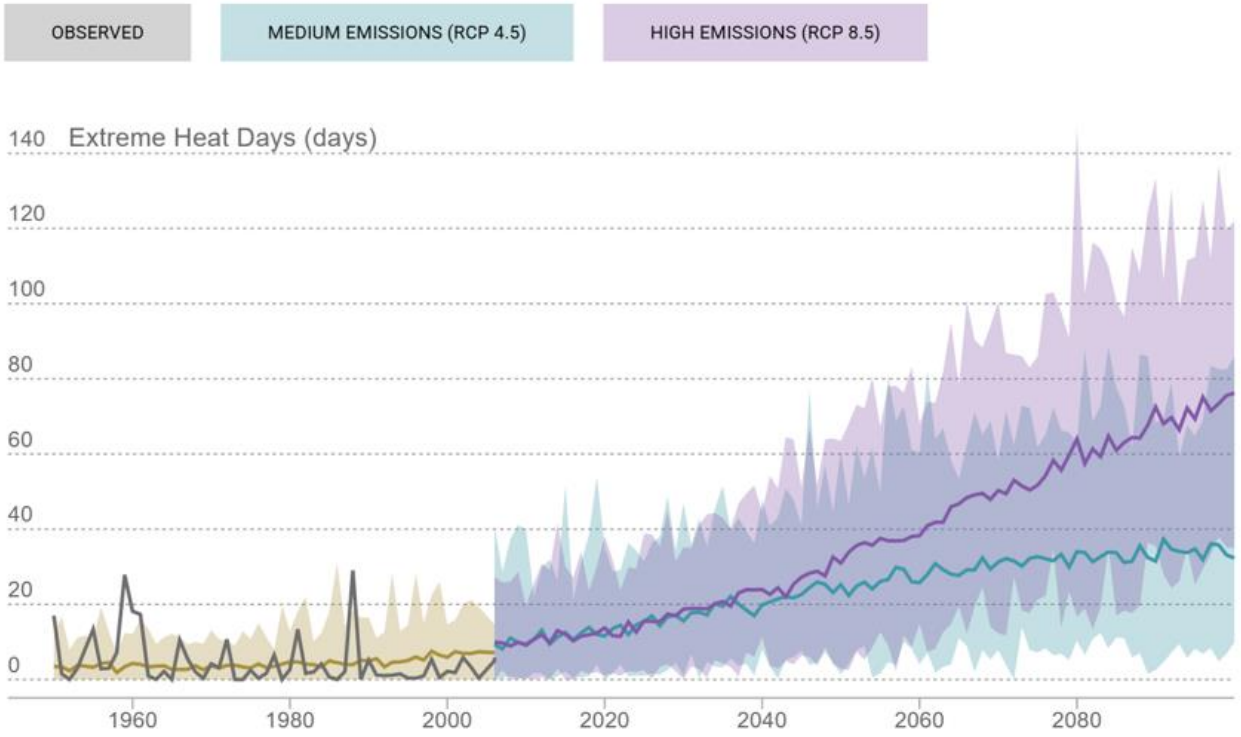
Date	Deaths	Injuries	Event Summary
			Central Coast, which extended From July 2 to the 10th and became the longest recorded Excessive Heat Warning issued by the NWS Bay Area. A 28-year-old man drowned in the Russian River near the Patterson Point Preserve on Wednesday July 3, while seeking relief from the heat. A 51-year-old man drowned in the Russian River on Saturday July 6.
10/2/2024	0	19	A series of high-pressure systems contributed to a week-long heat wave to begin the month of October. During this period, every long-term climate site in the region set or tied at least one daily high temperature record. In San Jose, a high of 106 recorded on October 2 set a monthly high temperature record. Sonoma County reported 19 calls to 911 for heat related illnesses between October 2 and 7.

Source: NCEI Storm Events Database, 2025. https://www.ncei.noaa.gov/stormevents/

Probability of Future Occurrences

Likely – As climate change progresses, extreme heat events are likely to become more common. Future frequency projections from Cal-Adapt for Sonoma County under high (RCP 8.5) and low (RCP 4.5) emission scenarios are shown in Figure 4-11. The graph shows the number of days per year when daily maximum temperature is above the locally-defined extreme heat threshold of 93.9°F. (Note: The threshold temperature used in Cal-Adapt is defined as the 98th percentile value of historical daily maximum temperatures from 1961–1990, between April and October.) As shown, the modeled historical baseline 30-year average is 4 extreme heat days annually. By end-century, this number is expected to increase to 13 days under a low emissions scenario and 23 days under a high emissions scenario. This data is explored further in Table 4-18.

Figure 4-11 Future Projection of Extreme Heat Days in Sonoma County



Source: Cal-Adapt 2025, https://v2.cal-adapt.org/

Table 4-18 Snapshot of Extreme Heat Days for Three 30-Year Time Periods

Timeline	30-Year Average Observed	Medium Emissions (RCP 4.5)		High Emissions (RCP 8.5)	
		30-Year Average	30-Year Range	30-Year Average	30-Year Range
Baseline (1961-1990)	4 days	--	--	--	--
Mid-Century (2035-2064)	--	10 days	4-15 days	12 days	4-18 days
End-Century (2070-2099)	--	13 days	5-22 days	23 days	7-43 days

Source: Cal-Adapt 2025, https://v2.cal-adapt.org/

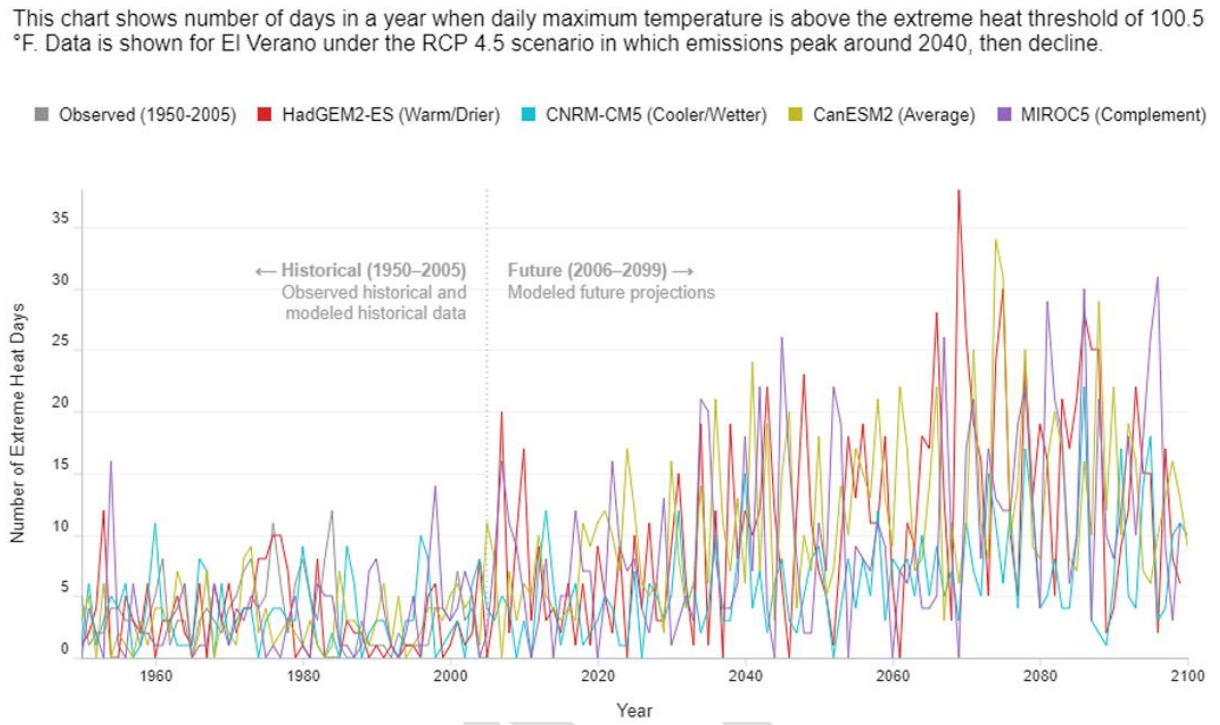
Climate Change Considerations

Heat waves are likely to become more frequent, which will have direct impacts on human health in terms of heat-related illness. With the general trend of increased warming of average temperatures, extreme high temperatures will likely also increase. Cascading impacts include increased stress on water quantity and quality, degraded air quality, and increased potential for more severe or catastrophic natural events such as heavy rain, droughts, and wildfire. Another cascading impact includes increased duration and intensity of wildfires with warmer temperatures.

Future temperature estimates from Cal Adapt for the community of El Verano, a community in the VOMWD Planning Area, under high and low emission scenarios are shown in Figure 4-12. The graph shows the number of days per year when daily maximum temperature is above the extreme heat threshold of 100.5°F under the RCP 8.5.

Historically, the region experienced very few days where the temperatures peaked above 100.5°F. Under RCP 8.5, extreme heat days begin to rise sharply around 2030, reaching 10-30 days per year by mid-century, and then 40-70 days per year by end-century, with some models showing 80+ days. Although magnitude differs between climate models, all models agree that extreme heat days will become significantly more frequent than the historical baseline. For the District, this means far more intense and prolonged heat, increasing risk to water demand, systems reliability, and vulnerable populations.

Figure 4-12 El Verano – Projected Number of Extreme Heat Days



Source: Cal-Adapt 2025, https://v2.cal-adapt.org/

For these reasons, climate change would have a high influence on extreme heat.

Vulnerability Assessment

Cascading impacts are the impacts that result when one type of hazard event triggers one or more other hazard events, which may in turn trigger others. Examples of cascading impacts associated with extreme heat events are detailed in Table 4-19.

Table 4-19 Cascading Impacts of Extreme Heat

Air Quality 	– Extreme heat can worsen air quality by creating stagnant atmospheric conditions that trap ozone and particulate matter near the surface. Elevated temperatures accelerate ozone formation, which can worsen respiratory conditions among District staff, particularly those working outdoors or operating field equipment.
Disease 	– Increasing temperatures and more frequent heat waves may expand the range or seasonality of vector-borne diseases. Mosquitoes and other vectors thrive in warmer conditions and may proliferate around standing water sources, recycled water systems, or slow-moving segments of wastewater collection systems. The presence of these vectors raises health risks for District employees and could complicate field operations in vegetated or wet areas.

Power 	– Extreme heat increases regional electricity demand due to widespread use of air conditioning or other cooling systems. High strain on the grid may elevate the risk of localized outages during peak-demand periods, which can disrupt the District's pumping and distribution systems. Backup power supplies may need to operate more frequently, increasing fuel use and maintenance needs. – Public Safety Power Shutoffs (PSPSs) are a cascading hazard associated with extreme heat events. PSPSs can directly impact the District's ability to operate critical facilities if sustained outages occur. Water and wastewater systems may require extended generator use to maintain service, and communication with customers may be affected.
Wildfire 	– Extreme heat contributes to more severe wildfires and a longer wildfire season, which can threaten the District's infrastructure both directly through exposure of facilities, pipelines, and watershed lands, and indirectly through impacts to air and water quality. – Wildfire smoke can reduce visibility for field crews and significantly worsen health conditions for outdoor workers. Post-fire effects on watershed lands such as erosion, sedimentation, and polluted runoff can place stress on water treatment systems.
Water 	– Heat evaporation can lead to loss of stored water in reservoirs and aqueducts. The amount of water lost depends largely on local climate conditions. High air temperatures, low humidity, strong winds, and sunshine will increase evaporation. – Increased evaporation combined with warm temperatures can impact raw water quality by promoting algal growth and increasing organic material, placing strain on treatment processes. – Heat-driven increases in customer water use may further strain pumping capacity and distribution system pressures.

Modified from 2023 State Hazard Mitigation Plan, https://www.caloes.ca.gov/wp-content/uploads/Hazard-Mitigation/Documents/2023-California-SHMP_Volume-1_11.10.2023.pdf

People

The District's workforce, especially field crews, are vulnerable to heat-related illnesses during extreme heat events. Staff working outdoors, in confined spaces, or in areas with heat-generating equipment face increased risks of dehydration, heat exhaustion, and common heat-related illnesses described in Table 4-20. Poor air quality accompanying extreme heat further compounds these risks, especially for employees with respiratory sensitivities. Extreme heat may also disproportionately affect vulnerable residents and water customers within the service area, such as older adults, low-income households, or people without access to cooling who depend on reliable water and wastewater services during heat events.

Table 4-20 Typical Heat-Related Illnesses

Illness	Definition	Symptoms	First Aid
Heat Rash	Heat rash is a skin irritation caused by excessive sweating during hot, humid weather.	Red clusters of pimples or small blisters, usually on the neck, upper chest, groin, under the breasts, and in elbow creases	▪ Work in a cooler, less humid environment if possible ▪ Keep rash area dry ▪ Apply powder to increase comfort ▪ Do not use ointments or creams
Heat Cramps	Heat cramps usually affect workers who sweat a lot during strenuous activity. This sweating depletes the body's salt and moisture levels. Low	Muscle cramps, pain, or spasms in the abdomen, arms, or legs	▪ Drink water and have a snack or drink that replaces carbohydrates or electrolytes every 15 to 20 minutes ▪ Avoid salt tablets

Illness	Definition	Symptoms	First Aid
	salt levels in muscles cause painful cramps. Heat cramps may also be a symptom of heat exhaustion.		▪ Get help if the sufferer has heart problems, is on a low-sodium diet, or has cramps that do not subside within 1 hour
Heat Syncope	Heat syncope is a fainting (syncope) episode or dizziness that usually occurs when standing for too long or suddenly standing up after sitting or lying. Factors that may contribute to heat syncope include dehydration and lack of acclimatization.	Fainting (short duration); dizziness; light-headedness from standing too long or suddenly rising from a sitting or lying position	▪ Sit or lie down in a cool place ▪ Slowly drink water, clear juice, or a sports drink
Rhabdomyolysis	Rhabdomyolysis is a condition linked to heat stress and intense exertion, where muscle breaks down quickly. This process releases electrolytes and proteins into the blood, leading to possible heart issues, seizures, and kidney damage.	Muscle cramps/pain; abnormally dark urine; weakness; exercise intolerance	▪ Stop activity ▪ Drink more liquids (water preferred) ▪ Seek immediate care at the nearest medical facility ▪ Ask to be checked for rhabdomyolysis
Heat Exhaustion	Heat exhaustion occurs when the body loses too much water and salt, often from heavy sweating. It mainly affects older adults, young children, people with chronic illnesses, athletes, pregnant women, and those exposed to heat while working outside or in hot settings.	Headache; nausea; dizziness; weakness; irritability; thirst; heavy sweating; elevated body temperature; decreased urine output	▪ Take to clinic or ER for evaluation ▪ Call 911 if no medical care available ▪ Stay with person until help arrives ▪ Move to cool area, give fluids ▪ Remove extra clothing ▪ Cool with cold compresses or water ▪ Offer small sips of water often
Heat Stroke	Heat stroke occurs when the body can no longer control its temperature: the body's temperature rises rapidly, the sweating mechanism fails, and the body is unable to cool down. When heat stroke occurs, the body temperature can rise to 106 °F or higher within 10 to 15 minutes.	Confusion, altered mental status, slurred speech; loss of consciousness (coma); hot, dry skin or profuse sweating; seizures; very high body temperature; fatal if treatment delayed	▪ Call 911 ▪ Stay with sufferer until help arrives ▪ Move sufferer to a shaded, cool area and remove outer clothing ▪ Circulate air to speed cooling ▪ Place cold wet cloths or ice on head, neck, armpits, and groin

Source: 2023 State Hazard Mitigation Plan, https://www.caloes.ca.gov/wp-content/uploads/Hazard-Mitigation/Documents/2023-California-SHMP_Volume-1_11.10.2023.pdf

Critical facilities may be vulnerable to the indirect impact of prolonged excessive heat (i.e., electrical power outages), which may impact response capabilities or care capabilities for hospitals and clinics. Hospitals and clinics may see a surge in patients during the heat event as the exposed population suffers from the effects of the heat, but it is not anticipated that these temperature increases will overwhelm the capacities of hospitals and clinics in Sonoma.

Property

Extreme heat does not typically cause direct structural damage to property. However, prolonged high temperatures can accelerate the wear and deterioration of the District's assets. Equipment such as pumps, motors, electrical components, and treatment systems may overheat or operate less efficiently, increasing the likelihood of mechanical failure. Elevated temperatures can also degrade roofing, asphalt surfaces, and materials used in tanks and pipelines, raising long-term maintenance and replacement costs. Facilities that rely on climate-sensitive processes, such as wastewater treatment, may experience increased strain, indirectly increasing the vulnerability of District property to operational strain.

Critical Water Facilities and Infrastructure

Extreme heat presents significant vulnerability for District critical facilities and infrastructure. High temperatures can reduce the efficiency of electrical systems, stress SCADA components, and require additional cooling for sensitive equipment. Increased water demand may strain distribution system pressures and require extended pump operation, elevating the risk of mechanical failure. PSPSs, which are more common during high-heat and high-fire risk periods, can disrupt facility operations, and increase reliance on backup generators, reducing system redundancy.

While extreme heat can affect critical infrastructure, impacts are expected to be minimal given there are a limited number of days where temperatures stay high, which give critical infrastructure periods to cool down between temperature cycles. However, critical infrastructure that relies on public utility systems that could be overloaded may result in impacts during extreme heat events. As previously mentioned, the loss of utilities or power outages during extreme heat events could also result in adverse secondary impacts to sensitive populations.

Economy

Extreme heat increases water demand by placing strain on wells, storage tanks, and distribution infrastructure during peak usage periods. Elevated temperatures can also reduce operational efficiency by stressing pumps, electrical equipment, and power systems, increasing the risk of outages or mechanical failure. Together, higher demand and operational stress may limit the District's ability to maintain adequate pressure for domestic use, increasing risks to public safety and system reliability.

Historic, Cultural, and Natural Resources

Extreme heat affects natural watershed lands that support the District's water supply. Higher temperatures can stress forest health, increase susceptibility to pests and disease, and make vegetation more prone to wildfire. Post-fire erosion can introduce sediment, nutrients, and contaminants into water sources, raising treatment burdens. Sensitive habitats may also be impacted by warming temperatures, potentially influencing water quality in tributaries and groundwater recharge areas. While the District does not directly manage historic or cultural resources, extreme heat and related wildfire risk may affect archeological sites and cultural landscapes within the service area.

Recent and Future Development

Because extreme temperature fluctuations typically do not directly damage structures, both past and future development have been less affected by this hazard compared to others addressed in the plan. Historically, development has proceeded with minimal disruption from extreme heat, but as population growth continues, a larger number of residents may be exposed to temperature variations. Future development may increase the number of people vulnerable to extreme heat, especially as climate projections indicate rising frequency and intensity of heat waves. Public education initiatives should aim to help both current and future residents understand the risks and vulnerabilities associated with outdoor activities, property maintenance, and regular exposure during periods of extreme heat.

Risk Summary

- The average high temperature for Sonoma Valley in July is 86.7°F and the highest recorded temperature was 116°F on July 14,1972.
- Cal-Adapt defines an extreme heat day in Sonoma County as one exceeding 93.9°F, although local conditions may vary. An extreme heat day in El Verano is defined as one exceeding 100.5°F, and one exceeding 102.4°F in the City of Sonoma.
- Heat waves are becoming more frequent, intense, and prolonged due to climate change, raising vulnerability for communities that historically had moderate temperatures, especially older adults, young children, medically vulnerable individuals, outdoor workers, and households lacking sufficient cooling.
- Sonoma Valley's topography can trap warm air, reducing coastal cooling and causing persistent high temperatures, particularly in lower-elevation communities such as Boyes Hot Springs, Agua Caliente, El Verano, and Temelec.
- Extreme heat increases water demand for drinking, irrigation, and cooling, strains pumping and treatment equipment, reduces operational efficiency, and may lead to service disruptions and increased costs, especially when combined with hazards like poor air quality, power outages, and wildfire.
- Climate projections indicate that the number of extreme heat days in Sonoma County will rise from a historical average of 4 days annually to as many as 23 days by the end of the century under high emissions scenarios, with cascading impacts including degraded air and water quality, increased disease risks, and greater wildfire threat.
- While extreme heat rarely causes direct structural damage, it accelerates wear and tear on equipment and facilities, increases maintenance costs, and can stress natural resources, especially watershed lands, leading to post-fire erosion and water quality challenges.
- Extreme heat impacts on critical water infrastructure are expected to be minimal given there are a limited number of days where temperatures stay high, which give critical infrastructure periods to cool down between temperature cycles.
- The significance of extreme heat is **Low.**

4.3.6 Flood

Geographic Extent	Probability of Future Occurrences	Magnitude/ Severity	Overall Significance
Limited	Likely	Limited	Medium

Hazard Description

A flood is an overflow of water onto normally dry land, typically caused by heavy rainfall, storms, or other hydrological events. Floods are among the most frequent and costly natural hazards, producing life-safety risks, property loss, utility disruption, and long recovery timelines. In Sonoma County, flooding is the most common cause of disaster declarations and cumulative damages. Regional flood drivers are winter Pacific storms and atmospheric rivers that deliver prolonged, high-intensity rainfall, sometimes in back-to-back sequences. Secondary drivers include saturated soils, snowmelt contributions in higher terrain during warm storms, and releases from upstream impoundments made to preserve dam safety or restore storage.

Floodplains are the low-lying lands adjacent to rivers, streams, and other conveyances that store and convey floodwater. FEMA maps these areas for regulatory and insurance purposes. The Special Flood Hazard Area (or SFHA) represents the 1 percent annual chance floodplain, commonly called the 100-year floodplain. The 0.2 percent annual chance floodplain approximates the extent of larger, less frequent events. These mapped limits change over time with new hydrology, watershed conditions, and improved topographic and modeling data. Land use and drainage alterations can also shift local flood behavior, creating ponding or concentrated flow paths outside mapped floodplains.

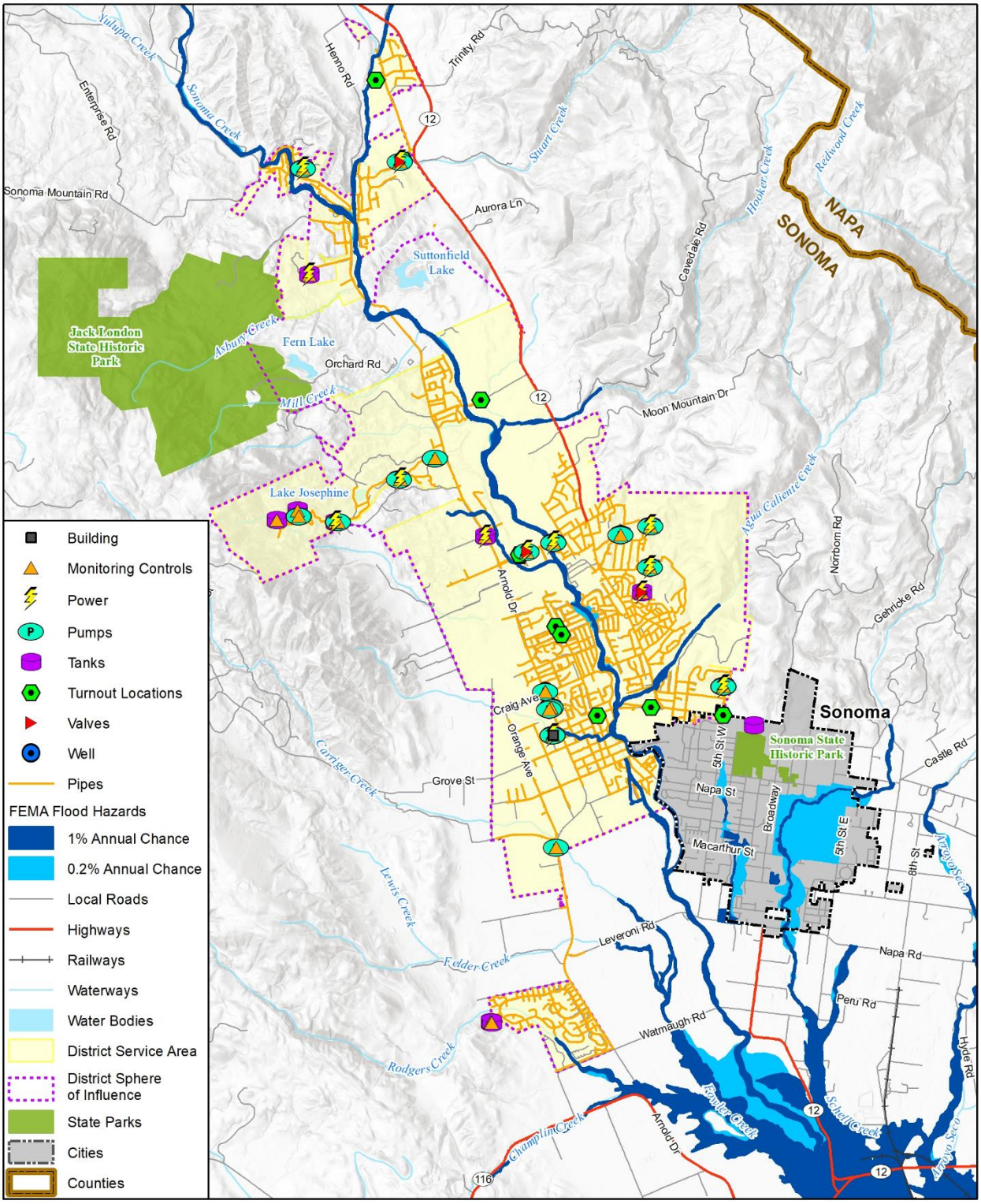
Within the District's Planning Area, riverine flooding is the dominant mechanism. Slow-rise flooding occurs when Sonoma Creek and its tributaries exceed bankfull capacity after multi-day rainfall on already wet soils. Short, steep upland channels can also produce rapid rises and localized flash flooding during intense cells. In the lower valley, high stages on Sonoma Creek can back water into tributaries and slow drainage, and elevated San Pablo Bay water levels during storms can hold tailwater and prolong inundation near the outlet. Operational releases from small reservoirs in and upstream of the service area may contribute to high flows when combined with storm runoff, though releases are managed to reduce overtopping risk.

Factors that directly affect the amount of flood runoff include precipitation amount, intensity and distribution, the amount of soil moisture, seasonal variation in vegetation, snow depth, and water-resistance of the surface due to urbanization. In the District's Planning Area, flooding is largely caused by heavy and continued rains, increased outflows from upstream dams, and heavy flow from tributary streams. Local intense storms can overwhelm nearby waterways as well as the integrity of flood control structures. The warning time associated with slow rise floods assists in life and property protection.

Geographic Location

Limited – The 1 percent (100-year) and 0.2 percent (500-year) floodplains of the Sonoma Creek are located within central and eastern portions of the District's Planning Area. GIS analysis shows impacts to District water facilities and infrastructure from Sonoma Creek is less likely to impact the District's system compared to flooding on the Russian River. The District receives a majority of its water supply from the Russian River, delivered from the Sonoma Aqueduct through purchases from Sonoma Water. As a result, riverine flooding from the Russian River poses the greatest risk to Sonoma Water infrastructure including the Sonoma Aqueduct. Figure 4-13 shows the 1 percent and 0.2 percent floodplains within the District's boundaries.

Figure 4-13 Valley of the Moon Water District FEMA 100-year and 500-year Flood Hazards



Map compiled 2/2026;
intended for planning purposes only.
Data Source: Sonoma County, CalTrans,
US Census TIGER Database, CA Open
Data Portal, EKI Environment & Water, Inc.,
CA Parks and Rec., FEMA NFHL Effective 7/31/2024

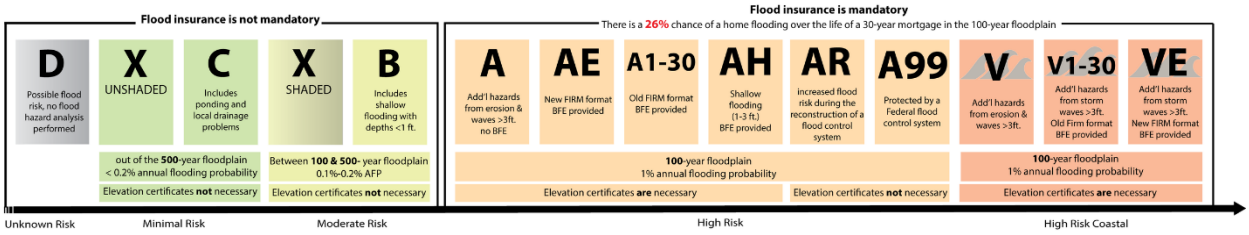
Floodplain Mapping and Studies

FEMA established standards for floodplain mapping studies as part of the National Flood Insurance Program (NFIP). The NFIP makes flood insurance available to property owners in participating communities adopting FEMA-approved local floodplain studies, maps, and regulations. Floodplain studies that may be approved by FEMA include federally funded studies; studies developed by state, city, and regional public agencies; and technical studies generated by private interests as part of property annexation and land development efforts. Such studies may include entire stream reaches or limited stream sections depending on the nature and scope of a study. A general overview of floodplain mapping and related components is provided in the following paragraphs.

- **Flood Insurance Study (FIS) -** The FIS develops flood-risk data for various areas of a community that are used to establish flood insurance rates and assist the community in its efforts to promote sound floodplain management. The latest FIS applicable to the District was included in a five-volume report along with other incorporated jurisdictions and unincorporated areas studied in Sonoma County; this recent report was last revised July 31, 2024.
- **Flood Insurance Rate Map (FIRM) -** The FIRM is designed for flood insurance and floodplain management applications. For flood insurance, the FIRM designates flood insurance rate zones to assign premium rates for flood insurance policies. The designated flood zones are based on flood risk in the area. For floodplain management, the FIRM delineates 100- and 500-year floodplains, floodways, and the locations of selected cross sections used in the hydrology and hydraulic analyses and local floodplain regulations.

Areas that are at high risk within the 100-year floodplain are called SFHAs and are mapped as A or AE zones. Flood zones are determined by assessing the expected height of a 100-year flood, as well as potential wave heights, distance from the nearest water body, and ground elevation. While there is only a 1 percent chance of a flood of such magnitude to occur every year, there is a 26 percent chance of such a flood to occur over the lifecycle of a 30-year mortgage. The difference between A and AE flood zones is the level of detail in analysis and mapping, so that A zones are more general while AE contain additional detail and also display Base Flood Elevations (BFEs). In communities that participate in the NFIP, mandatory flood insurance purchase requirements apply to Zones A and AE. Flood zones are defined in Figure 4-14.

Figure 4-14 Flood Zone Definitions



Source: Wetlands Watch 2019

The Sonoma County FIRMs, as with most portions of California and larger developments across the U.S., have been replaced by new digital flood insurance rate maps (or DFIRMS) as part of FEMA's Risk Map and Map Modernization programs. DFIRMs and related datasets (e.g. cross sections used in floodplain studies and analyses, BFEs, etc.) are now accessible for free online at FEMA's Flood Map Service Center site.

These DFIRMs achieve the following purposes:

- Incorporate the latest flood study updates (Letter of Map Revision [LOMRs] and Letter of Map Amendment [LOMAs])
- Utilize community supplied data
- Verify the currency of the floodplains and refit them to community supplied base maps and base data
- Upgrade the FIRMs to a GIS database format to set the stage for future updates and to enable manipulation, storage, and support for GIS analyses and other digital applications
- Solicit community participation

The most current DFIRMs for the unincorporated areas within Sonoma County are included in the County's NFHL database, with effective dates ranging from December 2, 2008, to July 31, 2024.The spatial features available in this NFHL database, such as floodplains and levees, were used for the analyses and mapping in this plan as they relate to flooding hazards.

Flood maps can be used as an indicator of flood extent, but floods can and do occur outside of mapped floodplains. Flood depth and velocity also affect the extent of flood hazards and resulting damage. The deeper and faster flood flows become, the more damage they can cause in a community. However, shallow flooding with high velocities (e.g., such as a flash flood event caused by precipitation) can cause as much damage as deep flooding with a slow velocity (e.g., from a riverine flood event). This typically happens when a channel migrates over a floodplain and redirects flows and transports debris and sediment.

Major Sources of Flooding

Flooding in Sonoma County is driven primarily by winter storm sequences, especially atmospheric rivers that deliver prolonged, high-moisture inflow to coastal ranges and interior valleys. These events account for a large share of annual and seasonal precipitation and have produced most of the region's historical floods. In Sonoma Valley, flood responses typically occur within 24 to 48 hours of peak rainfall and recede within several days, with severity amplified when storms arrive over saturated soils or follow closely spaced systems that limit watershed recovery time.

Within the District, mapped 1-percent and 0.2-percent annual-chance floodplains follow the Sonoma Creek corridor and its tributaries through Agua Caliente, Boyes Hot Springs, El Verano, and the City of Sonoma. According to county flood studies, the Sonoma Creek basin is prone to short, intense rainfall embedded within longer storm periods, producing high peak discharges of moderate duration. Local geomorphology (narrow valley floors, alluvial fans at tributary mouths, and shallow overbank benches) concentrates flow and can push water quickly onto roadways and low terraces. Debris-related conveyance losses at culverts and bridges, especially where leaf litter and woody material accumulate during early storms, further increase localized flooding.

Backwater influences can compound these conditions. During large bay tides or coastal low-pressure events, elevated tailwater toward San Pablo Bay can slow drainage from lower Sonoma Creek, lengthen inundation, and increase ponding behind low crossings. In wetter winters, rain-on-wet-soil and rain-on-recent-snow at higher elevations in the Mayacamas can add short-lived but sharp runoff contributions to already full channels.

Flood Hazard by Watershed

Flooding patterns relevant to the District differ by basin. The Sonoma Creek system controls direct exposure within the service area. The Russian River basin influences regional water supply operations and access to Sonoma Water facilities that feed the Sonoma Aqueduct. The Petaluma River basin sits outside the District but can shape regional response and mutual aid during larger flood events.

- **Sonoma Creek and Tributaries.** Flooding in the Sonoma Creek basin is driven by short, intense rainfall embedded in longer winter storms. The basin has a concentration time of less than six hours, so runoff accumulates and peaks quickly. Within the District, mapped floodplains and frequent nuisance flooding align with Sonoma Creek and its tributaries through Agua Caliente, Boyes Hot Springs, and El Verano, including Agua Caliente Creek, Nathanson Creek, Fryer Creek, Calabazas Creek, and Carriger Creek. Tidal backwater from San Pablo Bay can slow drainage in lower Sonoma Creek, extend inundation, and increase ponding behind low crossings. Typical event duration ranges from one to three days, with faster recession in upper tributaries and longer standing water where bay influence is present or where debris reduces culvert capacity.
- **Russian River and Tributaries.** The Russian River basin commonly sees multi-day floods, with peaks that follow one to two days after heavy rainfall and flood stages that persist for three to four days. Although the channel lies outside the District, large Russian River events can constrain Sonoma Water operations, limit site access, and divert crews, which can indirectly affect deliveries along the Sonoma Aqueduct and the timing of repairs at creek crossings. Rapid rises on Russian River tributaries also point to the need for coordinated warning and contingency supply planning when back-to-back storms occur.
- **Petaluma River and Tributaries.** Petaluma River flooding is generally flashier and short-lived, often developing within a day of a storm and receding within hours. This basin is outside the District, but regional impacts there can draw on the same contracting, materials, or mutual aid resources needed for Sonoma Creek response. Sheet-flow and drainage limitations adjacent to the Petaluma River illustrate similar urban ponding mechanisms that can occur along low points within the District's local network during high-intensity bursts.

Magnitude/Severity

Limited – Rainfall and the intensity and duration of events are an important factor in determining the magnitude of flooding. Table 4-21 from the NOAA Atlas 14 point Precipitation Frequency Data Server shows the projected rainfall levels expected in the southeast portion of Sonoma County, where the District is located, during recurring storms.

Table 4-21 Rainfall intervals Associated with 24 Hour Storm Events in Southeast Sonoma County

Average Recurrence Interval	Inches
2-year	3.0
10-year	3.5
25-year	4.0
50-year	4.5
100-year	5.0

Source: Western Precipitation Frequency Maps, NOAA

Table 4-22 below summarizes the general FEMA-available flood zones for context.

Table 4-22 FEMA's Special Flood Hazard Area Zone Descriptions

Flood Zone	Definition
FEMA Special Flood Hazard Areas (SFHA) Subject to Inundation by the 100- or 500-Year Floods	
Zone A	100-year floodplain, or areas with a 1% annual chance of flooding. Because detailed analyses are not performed these areas, no depths or base flood elevations are shown in Zone A areas.
Zone AE	Detailed studies for the 100-year floodplain. The base floodplain where base flood elevations are provided. AE Zones are now used on new format FIRMs instead of A1-A30 zones.

Flood Zone	Definition
Zone AH	Areas with a 1% chance of shallow flooding, usually in the form of a pong with an average depth ranging from 1 to 3 feet. These are flood elevations derived from detailed analyses.
Zone AO	River or stream flood hazard areas and areas with a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet. Average flood depths derived from detailed analyses.
Zone A99	100-year floodplain, areas with a 1% annual chance of flooding that will be protected by a federal flood control system where construction has reached specified legal requirements. No depths or base flood elevations are shown within these zones.
Other Flood Areas	
Floodway	A regulatory floodway is the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height.
Zone X (shaded)	Areas with a 0.2% annual chance flooding (1 in 500 chance), between the limits of the 100-year and 500-year floodplains. This zone is also used to designate base floodplains of lesser hazards, such as areas protected by levees from the 100-year flood, shallow flooding areas with average depths of less than one foot, or drainage areas less than 1 square mile.
Zone X (unshaded)	500-year floodplain (0.2% annual chance). Area of minimal flood hazard.

Source: FEMA Flood Map Service Center, 2018

Previous Occurrences

Table 4-23 shows local, State, and federal flood disaster declarations that have affected Sonoma County.

Table 4-23 Flooding Event in Sonoma County, 2000-2025

Event Name/Description	Date of Local Proclamation	Date of State Proclamation	Federal Disaster Number
Atmospheric Rivers; Winter Storm/Flooding: Landslides, flooding, damaged roads, cold temps	2/4/2025	--	--
Atmospheric Rovers: Winter Storm/Flooding: Utility outage, road damages, tree debris	11/20/2024	--	--
Severe Winter Storms, Flooding, Landslides, and Mudslides	--	3/1/2023	DR-4699
Atmospheric Rivers; Winter Storm/Flooding: 7 storms; roads, power	1/3/2023	1/4/2023	DR-4683
2019 Flood; Winter Storm/Flooding: River to 45.4'	2/26/2019	2/28/2019	DR-4434
2017 ("Four-peat") Flood; Winter Storm/Flooding: River to 35'	1/8/2017	1/23/2017	DR- 4301
Flood; Winter Storm/Flooding: Healdsburg flooding	12/11/2014	--	--
Spring 2006 Flooding; Winter Storm Floding: Slides, roads	4/12/2006	4/10/2006	DR-1646
New Year's Flood; River to 41.8'	12/31/2005	1/12/2006	DR-1628
Winter Storms; River to 35.7'	9/20/2002	--	--

Source: Sonoma County Emergency Management, 2026; California SHMP, 2023; FEMA, 2026

According to the HMPC, the Boyes Boulevard water line also sustained damage as a result of a flood; the line is now in girders of bridge where it is more protected.

Probability of Future Occurrences

Likely – Flooding that affects the District is expected in most winters and based on 10 past occurrences primarily during winter and spring months over a 23-year period, results in a 43 percent chance of a flood in any given year. Short-duration, high-intensity rainfall embedded in multi-day storms routinely produces nuisance street and yard flooding along Sonoma Creek and its tributaries in Agua Caliente, Boyes Hot Springs, El Verano, and the City of Sonoma. One to three moderate events per wet season are typical, with at least one event in most years that triggers localized road closures or overtopping at low crossings. Tidal backwater from San Pablo Bay elevates tailwater in lower Sonoma Creek several times each water year, extending ponding and slowing recession after storms and during king tides.

Riverine flooding meeting NFIP mapping extents on Sonoma Creek has a lower frequency but remains credible within the planning horizon. One percent annual chance floods are plausible during back-to-back atmospheric rivers, rain-on-saturated-soil conditions, or when tributary debris reduces conveyance. The 0.2 percent annual chance flood is less common but possible during multi-event sequences in a wet year. Flashier responses on Agua Caliente, Nathanson, Fryer, Calabazas, and Carriger Creeks can occur multiple times per season, often developing within hours of peak rainfall.

Regional flooding on the Russian River recurs in many winters and can constrain Sonoma Water operations and site access, indirectly affecting deliveries along the Sonoma Aqueduct and the timing of repairs at creek crossings. Petaluma River floods are brief and outside the service area, but concurrent response demands there can compete for contractors and materials that the District also relies on during Sonoma Creek events.

Climate Change Considerations

Emerging findings from California's Fourth Climate Assessment show that costs associated with direct climate change impacts by 2050 will be dominated by human mortality, coastal damage, and the potential for droughts and mega-floods (California Natural Resources Agency 2018). Scientific studies outlined in the same assessment also indicated shifts in California's precipitation regime, which show more dry days, more dry years, and a longer dry season, mixed with increases in occasional heavy precipitation events and floods (i.e. a shift towards potentially less frequent but more extreme precipitation events). Studies also project great storm intensity with climate change, resulting in more direct runoff and flooding due to the flash flooding or precipitation nature of these expected events. As a result of fewer but more violent precipitation events, high frequency flood events will increase with climate change. Also, with wildfires already being a problem in California, increasing periods of drought and lack of precipitation are expected to exacerbate conditions for fires to occur, and in turn worsen the potential for runoff and flooding associated with burned areas due to increased impermeability and damage to terrain and soils.

The Fourth Climate Assessment indicates that climate change is expected to alter built water supply systems, so that current management practices for flood control and water supplies across the state of California may need to be revised. Future revisions should aim to account for subsidence-prone infrastructure (e.g. levees), which coupled with rising sea levels and worsening storm conditions can lead to overtopping or failure of these flood control structures (California Natural Resources Agency 2018).

Based on Sonoma County's 2016 RCAP and GHG emission modelling, climate change is projected to result in an increased risk of extreme flooding, and an increased seasonal variability of precipitation, runoff, and stream flows for Sonoma County, along with increased likelihood of extreme precipitation and drought events. There may be more years with more frequent storm events and occasional events that are much stronger than historical ones and the length of season over which storm events occur is predicted to increase (RCPA 2016). Also, according to the RCAP, more frequent coastal flooding and

increased erosion is anticipated. In addition to flooding, sea levels are projected to rise between 16.5 and 65.8 inches by 2100. Rising sea levels combined with increased storm surge is anticipated to lead to more frequent inundation of the low-lying areas, and flooding of homes, infrastructure, agricultural land, and natural areas on the shores of San Pablo Bay to the south of the District's Planning Area. Climate change is therefore expected to have a high influence on flood hazards.

Vulnerability Assessment

Flooding is not expected to directly impact the District's water facilities and infrastructure. Other problems associated with flooding that could directly impact Sonoma Water's ability to supply water to the District include erosion, sedimentation, degradation of water quality, loss of environmental resources, certain health hazards, and the inconvenience or potential financial and accessibility issues that come with road closures and other access issues due to flooding. These direct impacts on Sonoma Water's critical water facilities would result in indirect impacts on the District's water supply.

The District is a special district and is not eligible to participate in the NFIP. Therefore, the District does not have any repetitive or severe repetitive loss of properties related to flooding.

People

Flooding is frequent in all of Sonoma County, leading to the County being the top ranked County in California for repetitive losses, as defined by the NFIP. While the District's assets may not suffer direct impacts from flooding, its likely water customers of the District, particularly those residing along Sonoma Creek may be impacted by flood events. Large events that have the ability to directly impact water conveyance to these residents may result in temporary water delivery disruptions.

Life safety concerns stem from sudden onset, limited sight distance at night, and fast-moving shallow sheet flow at intersections. Short-notice flooding can close Arnold Drive and neighborhood connectors, which can delay emergency response and strand residents who rely on routine medical care. Seniors, people with limited mobility, and households without vehicles are more likely to be isolated by a single flooded crossing. Post-event health risks include mold exposure in older housing, contact with contaminated standing water near onsite wastewater systems, and disruption of routine medications and dialysis.

Beyond the immediate physical damage to school buildings, according to the HMPC the 2017 Four-peat Flood created severe infrastructure and logistical barriers that compromised daily operations of Sonoma County schools. Impassable roads across major County arteries prevented both students and faculty from reaching their campuses, while power outages forced the closure of schools. These disruptions also extended to essential services; for example, Forestville Union was forced to cancel classes because food vendors were unable to navigate the flooded routes to deliver student lunches (HMPC Input). The flood event also caused significant displacement, as hundreds of students and staff members were either evacuated or lost their homes when the Russian River reached flood stage.

Property

Residential exposure clusters along the valley floor in Agua Caliente, Boyes Hot Springs, El Verano, and the City of Sonoma, where older homes sit close to grade and on small lots. Recurrent issues include floor and wall finishes damaged by shallow inundation, HVAC and water heater loss in garages and first floors, crawl space wetting, and vehicle losses on streets that pond. Drainage problems arise where small side channels meet Sonoma Creek, where private driveways constrict flow, and where undersized culverts plug with leaf litter and woody debris. Commercial strips along Highway 12 also face short closures, inventory loss at slab-on-grade shops, and cleanup costs from fine sediment. Outside storage, fencing, and low utilities take repeat hits that do not trigger major claims but add cumulative cost. Tidal

backwater from San Pablo Bay slows recession in the lower valley, which prolongs moisture damage and mold growth in marginally vented structures. Overall effects to District property however remains minor.

Critical Water Facilities and Infrastructure

While there are mapped flood hazard areas, there are no District water assets within these flood hazard areas. Water supply may be impacted if the Sonoma Water's infrastructure is impacted by flooding. The Russian River poses the greatest risk to the water agency. Some of Sonoma Water's infrastructure risk has been mitigated through the elevation of the water facilities located in the floodplain, including pumps and a generator that are now sited above the 100-year BFE.

Operational challenges during floods are also a concern. Access to well sites, tanks, interties, and control equipment can be cut by localized street flooding or debris at culverts. Brief power interruptions can increase generator demand and fuel logistics. Turbidity pulses and sediment movement after back-to-back storms can drive operational adjustments at regional facilities. Sonoma Aqueduct creek crossings face bank erosion and approach scour during high flows. Even where elevated equipment prevents direct damage, road closures and saturated ground can delay inspections, valve exercises, and minor repairs.

Economy

Since no District infrastructure is located within the mapped floodplains, vulnerability arises primarily from indirect exposure through customers, regional infrastructure, and supply dependencies. Flood events affecting residential, agricultural, and tourism-related customers could result in property damage, temporary business closures, and reduced water demand, which could affect District revenue derived from services charges and water sales. In addition, flooding that disrupts upstream infrastructure or transportation networks could indirectly affect water deliveries or operation activities.

Historic, Cultural, and Natural Resources

Climate change studies at the County and regional level indicate the likelihood that increasingly unpredictable flash flooding and uncertainty in storm occurrence will lead to a worsening in erosion and sedimentation conditions. However, natural areas within the floodplain often benefit from periodic flooding as a naturally recurring phenomenon, and these natural areas often reduce flood impacts by allowing absorption and infiltration of floodwaters. Nevertheless, other cultural or historical resources such as older buildings in Sonoma Valley may be more affected by these flooding hazards, given their likely older construction methods, weaker materials, and failure to meet current building code standards.

Recent and Future Development

The District has not developed any structures or added water infrastructure in the floodplain since the last plan update. Similarly, future development is most likely going to occur near the SDC campus, which is located outside of mapped floodplains. However, should future development occur in or near the floodplains, these developments should maintain freeboard, elevate mechanical systems, and preserve storage and overbank flow paths with low impact development practices. New utility extensions and private crossings should be sized for debris passage and checked against updated hydrology and tide-influenced tailwater conditions in the lower Sonoma Valley. Overall recent development in Sonoma Valley is not anticipated to change the District's overall vulnerability to flood hazards.

Risk Summary

- Flooding is primarily caused by winter Pacific storms and atmospheric rivers, with secondary factors including saturated soils, snowmelt, and upstream reservoir releases.
- Riverine flooding is dominant, especially along Sonoma Creek and its tributaries. Flash floods can occur from intense storms, and backwater from San Pablo Bay can prolong inundation.

- Flood impacts are likely to directly impact the Sonoma Water's water assets and ability to supply water to the District.
- Climate change is expected to increase the risk of extreme flooding, with more intense storms, and greater seasonal variability leading to more frequent inundation of low-lying areas.
- None of the District's critical water facilities or infrastructure occur within the 100-year or 500-year floodplain.
- The significance of flood hazards is **Medium**.

4.3.7 High Winds

Geographic Extent	Probability of Future Occurrences	Magnitude/ Severity	Overall Significance
Significant	Likely	Limited	Medium

Hazard Description

High winds, often accompanying severe thunderstorms, can cause significant property and crop damage, threaten public safety, and have adverse economic impacts from business closures and power loss. The predominant wind pattern in Sonoma Valley is out of the northwest and tends to be light in the morning and windier in the afternoon, but compared to the coastal portion of the County, Sonoma Valley is drier and less windy.

Windstorms in the District are typically straight-line winds. Straight-line winds are generally any thunderstorm wind that is not associated with rotation (i.e., is not a tornado). These winds can exceed 100 miles per hour (mph) and are responsible for most wind damage related to thunderstorms. These winds can overturn mobile homes, tear roofs off houses, topple trees, snap power lines, shatter windows, and sandblast paint from cars. Other associated hazards include utility outages, arcing power lines, debris blocking streets, dust storms, and an occasional structure fire.

Diablo winds are also a common hot, dry, offshore wind that affects all of the County and much of northern California, mostly during the late summer and fall months, when wildfire risk is the highest. They typically blow from the northeast or east, descending from inland high-pressure systems toward lower pressure along the coast, warming and drying as they move downslope over the Coast Ranges and into Sonoma County. In Sonoma County, Diablo winds are especially hazardous because they can produce strong ridge-top and downslope winds, low humidity, and rapid drying of vegetation. These conditions can accelerate wildfire ignition and spread, as seen during the 2017 wildfires (Nuns, Atlas, Tubbs), where Diablo winds played a key role in extreme fire behavior and rapid fire growth.

High winds and tornadoes can cause damage to property and loss of life. Property damage can include damage to buildings, fallen trees and power lines, broken gas lines, broken sewer and water mains, and the outbreak of fires. Agricultural crops and industries may also be damaged or destroyed. Access roads and streets may be blocked by debris, delaying necessary emergency response.

Geographic Location

Extensive – Strong winds have the potential to happen anywhere in the District's Planning Area. The resulting damage from wind events may be most severe in the downtown area of the District where there are more large trees, infrastructure, and higher density development.

Magnitude/Severity

Significant – The prevailing winds in Sonoma Valley come from the northwest. Winds tend to be lighter in the morning and stronger in the afternoon as the ocean air arrives over the Sonoma Mountains. The Beaufort Wind Scale is commonly used to assess wind speeds, ranging from Force 0 (calm) to Force 12 (hurricane), as shown in Table 4-24. This scale describes the visible condition various wind speeds can be experienced in a community. In the Planning Area, winds up to 89 mph have been recorded, but more common high wind speeds range from 35-55 mph (NCEI 2026)

Table 4-24 Beaufort Wind Scale

Beaufort Scale Force	Wind Speed (mph)	Description—Visible Condition
0	0	Calm; smoke rises vertically
1	1-4	Light air; direction of wind shown by smoke but not by wind vanes
2	4-7	Light breeze; wind felt on face; leaves rustle; ordinary wind vane moved by wind
3	8-12	Gentle breeze; leaves and small twigs in constant motion; wind extends light flag
4	13-18	Moderate breeze; raises dust and loose paper; small branches are moved
5	19-24	Fresh breeze; small trees in leaf begin to sway; crested wavelets form on inland water
6	25-31	Strong breeze; large branches in motion; telephone wires whistle; umbrellas used with difficulty
7	32-38	Moderate gale whole trees in motion; inconvenience in walking against wind
8	39-46	Fresh gale breaks twigs off trees; generally, impedes progress
9	47-54	Strong gale slight structural damage occurs; chimney pots and slates removed
10	55-63	Whole gale trees uprooted; considerable structural damage occurs
11	64-72	Storm very rarely experienced; accompanied by widespread damage
12	73+	Hurricane devastation occurs

Source: NWS

Based on NCEI records between 2000 and 2025, there have been 128 high wind, strong wind, thunderstorm wind, and tornado events in Sonoma County, causing over $4 million in property damage. The most damaging event took place on March 13-16, 2012, and was a 35-mph wind event that resulted in over $500,000 of property damage to both commercial and residential structures. High wind events in the County have led to 13 recorded fatalities and nine injuries, including one indirect injury and eight indirect deaths. High wind impacts would likely be limited, with a majority of impacts being related to property damages caused by down trees as well as power outages.

The most severe event recorded took place on October 27, 2019, during a series of offshore wind events across much of California. Strong surface high pressure built up over the Great Basin, while a trough formed along the California coast, creating ideal conditions for some of the strongest dry offshore winds the Bay Area had seen since the 2017 North Bay Fires. Wind gusts in the hills ranged from 60 to 80 miles per hour and stayed elevated for at least 24 hours. Near the Kincade Fire, a peak gust of 102 miles per hour was measured.

These intense winds fueled the rapid spread of the Kincade Fire and combined with very dry conditions, led to the ignition of several new wildfires throughout the Bay Area. As a result, a large section of Sonoma County was evacuated, especially areas downwind of the Kincade Fire. Additionally, before the high winds arrived, Pacific Gas & Electric (PG&E) proactively shut off power, as part of a Public Safety Power Shutoff (PSPS) to reduce wildfire risk.

Previous Occurrences

Despite being nearly 30 miles from the coast of the Pacific Ocean, Sonoma Valley's climate tends to be similar to inland coastal communities and drier and warmer. However, high wind events Sonoma Valley

have led to downed trees and power outages throughout Sonoma Valley. The following events are recorded in the NCEI Storm Events Database that are specific to the District's Planning Area.

- **January 10, 2010** – A major storm struck the San Francisco and Monterey Bay areas with strong winds and heavy rain, causing widespread power outages for over 180,000 customers. High winds toppled trees and power lines, leading to flooding, road closures, property damage, and $435,000 in losses.
- **January 20, 2012** – A storm system from the Gulf of Alaska brought gusty wind and periods of heavy rain across San Francisco and the Bay Area from January 19, 2012, through January 23, 2012. A large dead tree fell at a residence on Robin Drive and Arnold Drive in El Verano. The high wind event resulted in $4,500 in damages.
- **October 23, 2019** - Late October 2019 saw a series of strong offshore wind events in California, fueled by cut off lows in the Great Basin and high-pressure systems. These winds, with gusts up to 76 mph at Healdsburg Hills North Station, drove rapid growth of the Kincade Fire, which started on October 23 and continued burning into the month's end. Near-record temperatures were recorded on October 24 and 25. On October 9, PG&E pre-emptively shut off power to about 1 million Californians.
- **November 26, 2019** – A rapidly intensifying and ultimately record setting low pressure system moved into northern California and the Pacific Northwest in late November. A strong cold front associated with this system swept through the Bay Area bringing heavy rain, roadway flooding, strong winds, low elevation snow, small hail, and large waves to the region. The event occurred 1.7 miles south of the community of Temelec in Sonoma Valley.
- **February 9, 2020** - An offshore wind event impacted the region from February 8, 2020, through February 9, 2020, when an upper trough moved through the Great Basin. Widespread wind gusts of 45 to 60 mph were observed with gusts of 87 mph recorded on Mt St. Helena. Trees and power lines were knocked down, causing scattered power outages and property damage. Around 80,000 customers were without power across the Bay Area according to PG&E. A large oak tree crashed into a home and crushed two vans as well as damaged two additional cars on Riverside Dr. in Sonoma Valley. No one was injured.
- **January 19, 2021** – An unusually long and widespread offshore wind event impacted the Greater Bay Area. The region experienced gusts up to 80 mph at higher elevations, with some sites reaching 90 mph, and lower elevations over 40 mph. The strong winds caused tree damage, power outages, and prompted a rare January Red Flag Warning for Monterey and San Benito counties due to dry fuels. Around twelve small fires started in the Santa Cruz Mountains, two of which became relatively significant.
- **February 2, 2024** – A cyclone and atmospheric river combined from February 3rd to the 5th, creating a period of strong winds, heavy rain, and high surf. The entire region saw numerous impacts including roadway flooding, fallen trees, and power outages. Winds up to 95 mph were recorded. Flood prone areas near rivers and along the coast were evacuated. Notable impacts also included pre-emptive closing of state parks, the cancelation of the San Francisco Half-Marathon, and the PGA canceling the final round of the Pebble Beach Pro-Am golf tournament. On Monday, February 5, several schools were closed due to damage from the storm.
- **November 21, 2024** - The first atmospheric river of the winter storm season created flooding across the North Bay between November 20 and 23. The atmospheric river was accompanied by a very rapidly intensifying cyclone that deepened by 66 millibars within 24 hours, easily meeting the criteria for bomb cyclogenesis. The greatest impacts were concentrated across the North Bay as the river stalled over the region. The North Bay valleys received nearly a foot of rain in three days and the

mountains received as much as 22.57 inches. One person was injured when a tree fell on their home on Cozey Court in Forestville.

Probability of Future Occurrences

Likely – A total of 360 combined high and strong wind events have occurred in Sonoma County between 2005 and 2025, which equates to an average of 14 events in a typical year. Historical wind activity within the Planning Area indicates that the area will likely continue to experience high wind events during adverse weather conditions. The actual risk of a wind event to the District is dependent on the nature and location and the magnitude of a high wind event.

Climate Change Considerations

There presently is not enough data or research to quantify the magnitude of change that climate change may have related to wind frequency and intensity. Studies referenced in California's Fourth Climate Assessment indicated that extreme fire weather, particularly in the form of hot and dry winds, can strongly influence shrub-land fire regimes. Strong winds have also been associated with severe forest fires in California, meaning climate change impacts on wind patterns may also affect forest health and wildfire susceptibility. Lastly, other ongoing research compiled in the recent climate assessment has resulted in different conclusions on the effect of climate change on wind regimes, particularly extreme wind events, such as the Santa Ana and Diablo winds that created some of the most devastating wildfires (California Natural Resources Agency 2018a). At this time, these changing factors are not well understood and are still being incorporated into state and regional research and risk analysis. For these reasons, climate change would have a low influence on high wind hazards.

Vulnerability Assessment

People

District water customers are the most vulnerable to high wind events, particularly when they result in power outages that could in turn impact the delivery of drinking water. Overall, the most common problems associated with high winds are loss of utilities. Downed power lines can cause power outages, leaving large parts of the District's Planning Area isolated, and without electricity, water, and communication.

There are also segments of the population that are especially exposed to the indirect impacts of high winds, particularly the loss of electrical power. These populations include the elderly or disabled, especially those with medical needs and treatments dependent on electricity. Nursing homes, community-based residential facilities, other special needs housing facilities, and other socially susceptible populations are vulnerable if electrical outages are prolonged, since backup power generally operates only minimal functions for a short period of time.

The U.S. Department of Health and Human Services (HHS) emPOWER Map tool provides information on Medicare beneficiaries who rely on electricity-dependent medical equipment such as ventilators to live independently in their homes. According to the HHS emPOWER Map tool there are 12,245 Medicare beneficiaries located in the Planning Area (within the zip codes of 95452, 95476, and 95442). Of these individuals, 299 are considered electricity dependent and are highly vulnerable to power outages as a result of a high wind event.

Following the unprecedented 2018 wildfire season in California, PG&E announced it will be conducting PSPS when there are high winds and dry conditions and generally a heightened fire risk forecasted. The outages could last several days, and PG&E has suggested customers be prepared for outages that could

last longer than 48 hours. A majority of Sonoma County could be affected by the power outages including almost the entirety of the Sonoma Valley. PG&E has a plan to install a resource area at the Sonoma-Marin Fairgrounds within 24 hours of a PSPS, and will offer power, air conditioning, and updates for local residents.

Property

General damages from high wind events can be both direct and indirect impacts. Direct impacts refer to what the wind physically destroys, while indirect impacts include additional costs, damages and losses attributed to secondary hazards spawned by the event or resulting from the direct damages caused by the wind event. The District's above ground infrastructure, including Booster Pump Stations (BPSs), solar panels, and exposed transmission lines, are at greatest risk to direct damages due to high wind. Construction practices and building codes can help maximize the resistance of structures to damage.

Secondary or indirect impacts of damage caused by wind events often result from damage to infrastructure. Downed power and communications transmission lines, coupled with disruptions to transportation, create difficulties in reporting and responding to emergencies. These indirect impacts of a wind event put tremendous strain on a community.

Critical Water Facilities and Infrastructure

High wind events have the potential to impact all of the District's critical water facilities and infrastructure, but direct impacts are anticipated to be limited. Secondary impacts, due to the temporary loss of power, or from PSPS are expected to have longer-term effects if there are not adequate back-up power supplies to pump stations and other infrastructure that rely on electricity.

Economy

The District has limited direct economic exposure to high-wind hazards, as district facilities are generally designed and maintained to withstand typical wind conditions in the Sonoma Valley. However, the District's economic sector may be indirectly vulnerable to the effects of high wind events due to potential impacts on the surrounding community and regional infrastructure. Severe windstorms can cause power outages, downed trees, and structural damage that disrupt residential, commercial, agricultural, and tourism-related activities within the Planning Area. Such disruptions may temporarily reduce water demand or affect the ability of customers to pay utility bills, potentially impacting District revenue. In addition, high winds can damage electrical transmission systems and regional water infrastructure.

Historic, Cultural, and Natural Resources

High winds can cause massive damage to the natural environment, uprooting trees, and other debris. This is part of a natural process, and the environment will return to its original state over time. Wind damage to historic or cultural resources may result in more severe temporary and permanent damage that could impact the historic aesthetic of downtown Sonoma or the surrounding areas or require extensive restoration and rehabilitation of certain structures.

Recent and Future Development

Development since the last plan has not increased vulnerability to high winds, and future development is not expected to do so provided that all construction continues to adhere to current building codes and standards. Proper education on building techniques and the use of sturdy building materials, basements, attached foundations, and other structural techniques may minimize the property vulnerabilities to existing and new development, as well as the vulnerability of District aboveground infrastructure. Public shelters at parks and open spaces may help reduce the impacts of high wind events on the recreational populations exposed to storms.

Risk Summary

- Because most water district infrastructure is underground, direct damage from high winds is generally limited. However, aboveground assets to WTPs, pump stations, storage tanks, and associated electrical and communications equipment remain vulnerable to wind-related impacts.
- High winds can cause structural damage, disrupt power supply, limit site access due to debris or downed trees, and trigger cascading failures that impair system operations and service continuity.
- High winds can trigger or intensify secondary hazards such as wildfires and long-term power outages.
- The U.S. Department of Health and Human Services lists 299 individuals in the District's Planning Area as electricity dependent, and highly vulnerable to power outages due to high wind events.
- Damage to natural resource habitats and other resources may result from severe weather associated with wind.
- Severe wind events could result in the loss of water, communication lines, or power; closures to roads and transportation lifelines, which could impact, strand, and/or impair mobility for emergency responders and/or area residents.
- Severe wind hazards could result in loss or damages to historic and cultural resources, which could severely impact the social fabric and rural character of Sonoma Valley;
- Timely removal of debris, specifically downed trees, must be addressed, as this can impact the severity of the severe weather events and the secondary impacts (e.g. localized flooding, loss of power).
- The significance of severe weather associated with high winds is **Medium.**

4.3.8 Landslides

Geographic Extent	Probability of Future Occurrences	Magnitude/ Severity	Overall Significance
Limited	Likely	Negligible	Low

Hazard Description

A landslide is a geologic hazard where the force of gravity combines with other factors to cause earth material to move or slide down an incline. Some landslides move slowly and cause damage gradually, whereas others move so rapidly that they can destroy property and take lives suddenly and unexpectedly. Slopes with the greatest potential for sliding are between 34 degrees and 37 degrees. Although steep slopes are commonly present where landslides occur, it is not necessary for the slopes to be long.

Debris flows are a mixture of rock fragments, soil, vegetation, water and, in some cases, entrained air that flows downhill as a fluid. Debris flows can range in consistency from that of freshly mixed concrete to running water. Debris flows can be further classified as mudflows and earth flows depending on the ratio of water to soil and rock debris.

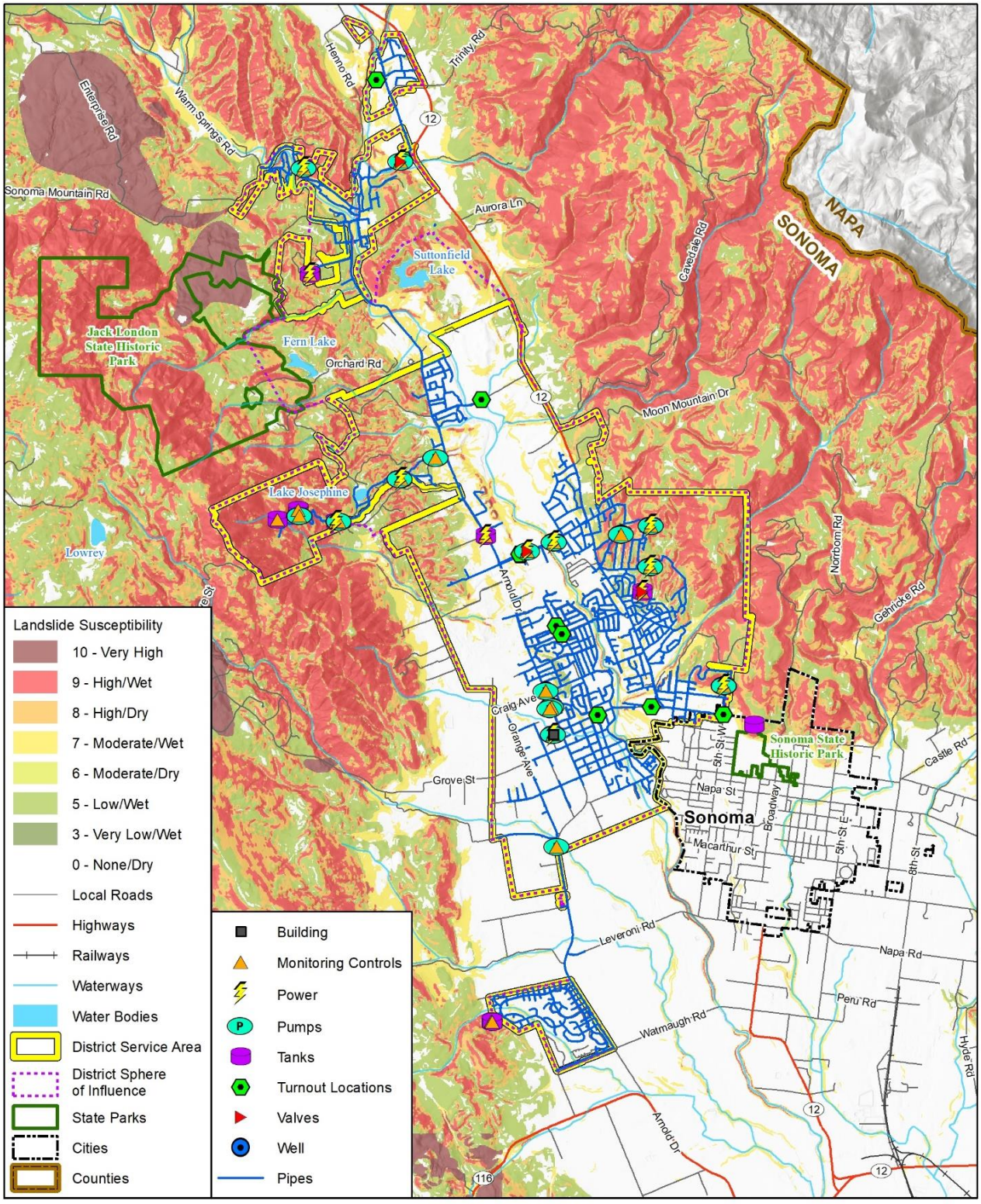
Landslides, rockslides, and debris flows occur continuously on all slopes; some processes act very slowly, while others occur very suddenly, often with disastrous results. Landslide and debris flow problems can be caused by land mismanagement, particularly in mountain, canyon, and coastal regions. In areas burned by forest and brush fires, a lower threshold of precipitation may initiate landslides and debris flows. As human populations expand over more of the land surface, these processes become an increasing concern.

There are predictable relationships between local geology and landslides, rockslides, and debris flows. The down-slope movement of earth material, either as a landslide, debris flow, mudslide, or rockslide, is part of the continuous, natural process of erosion. This process, however, can be influenced by a variety of causes that change the stability of the slope. Slope instability may result from natural processes, such as the erosion of the toe of a slope by a stream, or by ground shaking caused by an earthquake. Slopes can also be modified artificially by grading, or by the addition of water or structures to a slope. Development that occurs on a slope can substantially increase the frequency and extent of potential slope stability hazards. Knowledge of these relationships can improve planning and reduce vulnerability. Slope stability is dependent on many factors and their interrelationships, including rock type (unconsolidated soil or soft rock and sediments), moisture content, slope steepness, lack of vegetation, previous wildfires or other forest disturbances, and natural or man-made undercutting.

Geographic Location

Limited – In Sonoma County, there are several geologic formations commonly associated with slope stability problems. Figure 4-15, which is based on the California Geological Survey data, indicates that the central portion of the District has a low landslide susceptibility, but the surrounding areas to the north, east, and west have moderate to high landslide susceptibility. They are most expected in areas with steep slopes and weak soils. While there are few areas with very steep slopes in the District, steep slopes surround the District and cover large portions of Sonoma County where other water supply infrastructure is located. Regions affected by wildfires are prone to erosion during heavy rains, which can lead to landslides or debris flows. For information on where past fires might result in post-wildfire landslides, refer to Figure 4-19.

Figure 4-15 Landslide Potential in the Valley of the Moon Water District Planning Area



Map compiled 2/2026;
intended for planning purposes only.
Data Source: Sonoma County, CalTrans, US Census TIGER Database, CA Open Data Portal, EKI Environment & Water, Inc., CGS/CA, Dept. of Conservation

Magnitude/Severity

Negligible –The extent of landslides and debris flow events within the County range from negligible to significant but is considered to mostly be negligible for the District. Landslides and rockslides can result in damage to infrastructure such as water and sewer lines, electrical and telecommunications utilities and drainage.

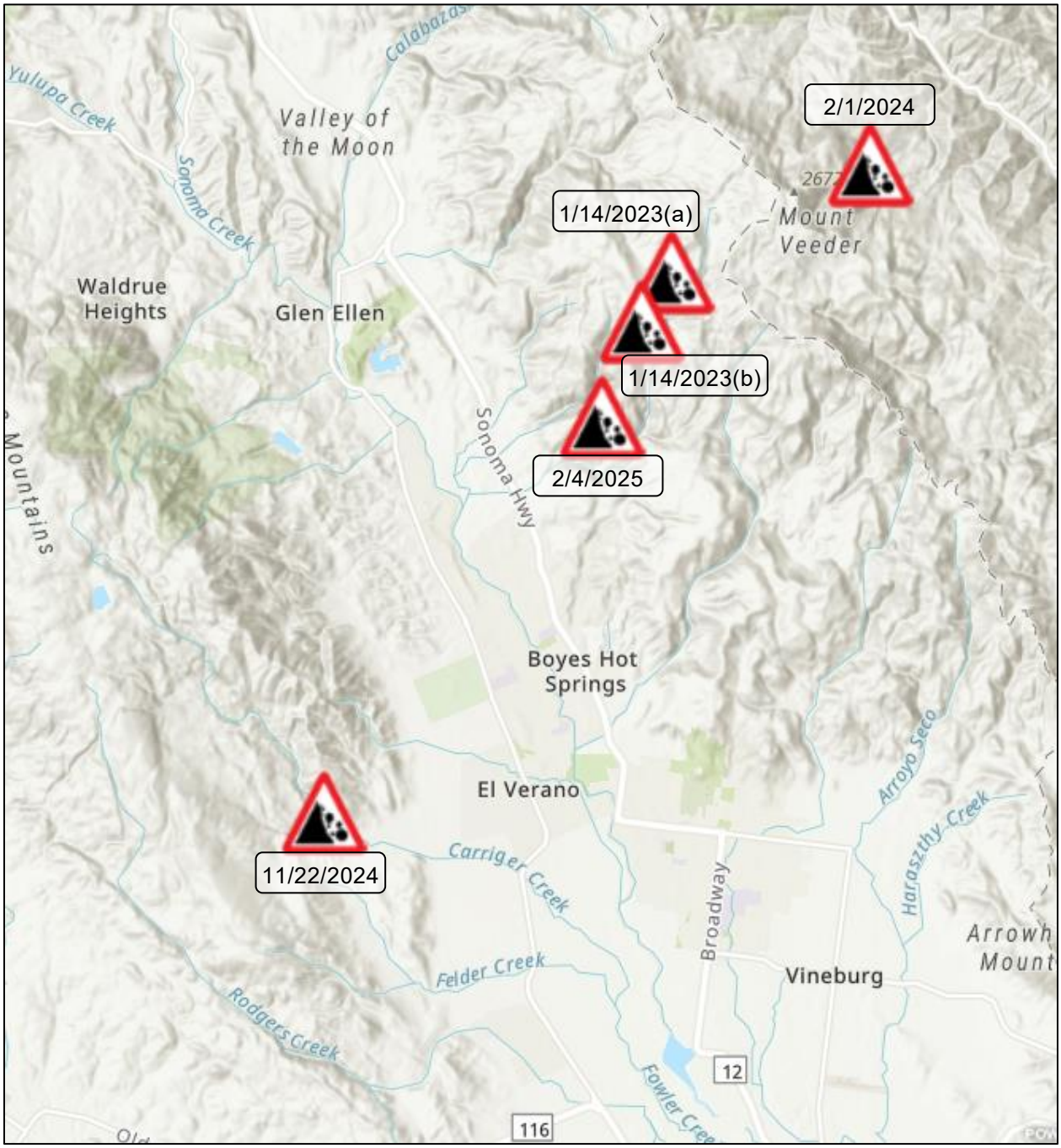
Previous Occurrences

Sonoma County has had 15 FEMA disaster declarations related to landslides, detailed in Table 4-25, but none impacted District property. The California Geological Survey recorded five recent nearby landslide incidents, shown in Figure 4-16 and detailed in Table 4-26, none of which affected District property.

Table 4-25 Landslide Declarations in Sonoma County

FEMA Declaration	Declaration Date	Incident Type	Declaration Title
DR-651-CA	1982-01-07	Flood	Severe Storms, Flood, Mudslides & High Tide
DR-677-CA	1983-02-09	Coastal Storm	Coastal Storms, Floods, Slides & Tornadoes
DR-979-CA	1993-02-03	Flood	Severe Winter Storm, Mud & Land Slides, & Flooding
DR-1046-CA	1995-03-12	Severe Storm	Severe Winter Storms, Flooding Landslides, Mud Flow
DR-1044-CA	1995-01-10	Severe Storm	Severe Winter Storms, Flooding, Landslides, Mud Flows
DR-1155-CA	1997-01-04	Severe Storm	Severe Storms, Flooding, Mud and Landslides
DR-1646-CA	2006-06-05	Severe Storm	Severe Storms, Flooding, Landslides, and Mudslides
DR-1628-CA	2006-02-03	Severe Storm	Severe Storms, Flooding, Mudslides, and Landslides
DR-4308-CA	2017-04-01	Flood	Severe Winter Storms, Flooding, and Mudslides
DR-4301-CA	2017-02-14	Severe Storm	Severe Winter Storms, Flooding, and Mudslides
DR-4434-CA	2019-05-17	Severe Storm	Severe Winter Storms, Flooding, Landslides, and Mudslides
DR-4699-CA	2023-04-03	Severe Storm	Severe Winter Storms, Straight-Line Winds, Flooding, Landslides, and Mudslides
DR-4683-CA	2023-01-14	Flood	Severe Winter Storms, Flooding, Landslides, and Mudslides
EM-3592-CA	2023-03-10	Flood	Severe Winter Storms, Flooding, Landslides, and Mudslides
EM-3591-CA	2023-01-09	Flood	Severe Winter Storms, Flooding, and Mudslides

Figure 4-16 Landslide Events Near the Planning Area



Source: Geologic Mapping Program, California Geological Survey, CA Department of Conservation, 2025

Table 4-26 Landslide Events Near the Planning Area

Date	Description
2/4/2025	CHP Napa reported two rockslides on Cavedale Road.
11/22/2024	CHP Napa reported two large boulders fell onto Grove Street.
2/1/2024	CHP Napa reported a landslide blocking the roadway.
1/14/2023(a)	Multiple mudslides block lanes, large boulders

Date	Description
1/14/2023(b)	Debris slide on Cavedale Road.

Source: Geologic Mapping Program, California Geological Survey, CA Department of Conservation, 2025

The HMPC noted that during the February 2025 winter storm events, Sonoma County faced landslides and floods which impacted multiple communities near to, but outside of, the Planning Area. In the Hacienda neighborhood of Forestville, a hillside failure caused an unoccupied home to slide into the Russian River. In Santa Rosa's Rincon Valley, an area still recovering from the Tubbs Fire burn scar, a landslide trapped local residents, prompting emergency assessments and evacuations of several homes.

Probability of Future Occurrences

Likely – Based on historical data documenting 15 significant landslides over a 43-year period and given the presence of landslide-susceptible geology and steep slopes in the District's Planning Area, landslide hazards have a 34% chance of occurring in any given year and are likely to continue on an annual basis, with damaging landslides occurring less frequently. Landslides are usually a cascading effect of severe weather. The probability for more severe and damaging landslides increases during El Niño years or severe winter storms. The potential for debris flows dramatically increases following a wildfire.

Climate Change Considerations

Landslides can result from intense rainfall and runoff events. Projected climate change-associated variance in rainfall events may result in more high-intensity events, which may increase landslide frequency. In addition, the increased potential of wildfire occurrence also escalates the risk of landslide and debris flows in the period following a fire, when slopes lack vegetation to stabilize soils and burned soil surfaces create more rainfall runoff. As climate change affects the length of the wildfire season, it is possible that a higher frequency of large fires may occur into late fall, when conditions remain dry, and then be followed immediately by intense rains early in the winter. This makes landslides highly susceptible to impacts from climate change and for these reasons, climate change would have a high influence on landslide susceptibility.

Vulnerability Assessment

People

People could be susceptible if they are caught in a landslide or debris flow, potentially leading to injury or death, but this risk is considered low in the District. There is also a danger to District drivers (i.e., crews) operating vehicles, as rocks and debris can strike vehicles passing through the hazard area or cause dangerous shifts in roadways. Also, since landslide occurrence can be linked to earthquake and general seismic activity, it is possible that landslide and debris flow hazards may cause similar risks as those tied to earthquake (e.g. inability for disabled or vulnerable populations to evacuate in a timely manner, inability to communicate critical information to those who may not speak English, or potential for populations to lose access to key resources such as life support technology).

Property

Landslides directly damage engineered structures such as buildings in two general ways: 1) disruption of structural foundations caused by differential movement and deformation of the ground upon which the structure sits, and 2) physical impact of debris moving downslope against structures located in the travel path. The District's main property and office building is not located in an area susceptible to landslides.

Critical Water Facilities and Infrastructure

Water facilities and infrastructure are vulnerable to the impact and ground deformation caused by slope failures. They present a particular vulnerability because of their geographic extent and susceptibility to physical distress. Critical water facility lifelines are generally linear structures like the Sonoma Aqueduct that, because of their geographic extent, have a greater chance of being affected by ground failure due to greater hazard exposure over larger geographical areas.

Extension, bending, and compression caused by ground deformation can break linear water facility lifelines. Failure of any component along the lifeline can result in failure to deliver service over a large region. Once broken, transmission of the commodity through the lifeline ceases, which can have catastrophic repercussions down the line, such as loss of water supply to critical facilities such as hospitals, contamination of water supplies, disruption of all forms of transportation, and even release of flammable fuels. Therefore, the overall impact of critical water facility lifeline failures, including secondary failure of systems that depend on lifelines, can be much greater than the impact of individual building failures.

Table 4-27 summarizes the results of the GIS analysis, which indicates the types of the District's critical water facilities that are located in areas of landslide potential. Based on this analysis, 64 District facilities are located in areas of landslide potential. District pipelines also traverse areas of landslide potential.

Table 4-27 Water Facilities within Landslide Potential Areas by Potential Category

Landslide	Asset Type	Count	Replacement Value
Low/Wet	Building	1	$8,190
	Monitoring & Controls	2	$75,057
	Power	2	$69,994
	Pump	1	$43,091
	Tank	2	$960,089
	Total	**8**	**$1,156,421**
Moderate/Wet	Monitoring & Controls	2	$66,060
	Pump	3	$77,070
	Well	1	$1,500,000
	Total	**6**	**$1,643,129**
High/Dry	Monitoring & Controls	6	$198,710
	Power	4	$105,636
	Pump	2	$85,600
	Tank	6	$4,226,875
	Valve	1	$20,300
	Total	**19**	**$4,637,121**
High/Wet	Building	1	$9,173
	Monitoring & Controls	9	$246,253
	Power	4	$269,155
	Pump	9	$345,505
	Tank	6	$1,804,103
	Well	2	$3,000,000
	Total	**31**	**$5,674,189**
	Grand Total	**64**	**$13,110,860**

Source: Valley of the Moon Water District, California Dept. of Conservation, WSP Analysis

According to the HMPC, there has been one small landslide event that impacted the Donald Tank in 2018. A small landslide occurred above the tank and damaged the perimeter fence but did not affect the facility. Future landslides in the vicinity have the potential to impact pumping and power generation equipment.

Economy

Landslides can cause ground movement that damages pipelines, wells, and other facilities, resulting in costly repairs and service interruptions. These disruptions can affect water delivery to residential, commercial, and agricultural customers in the Planning Area, potentially causing business interruptions and economic losses in sectors such as tourism, hospitality, and agriculture. In addition, landslides may block transportation routes, delay infrastructure repairs, and increase emergency response costs. As a result, the District may face increased operational expenses, infrastructure replacement costs, and the need for long-term investments, potentially causing financial strain to the District.

Historic, Cultural, and Natural Resources

As primarily a natural process, landslides and debris flows can have varying impacts on the natural environment. Landslides and debris flows also have the potential to permanently alter the natural landscape and any cultural resources.

Recent and Future Development

Over the past five years, the District has not expanded water infrastructure into areas identified as highly susceptible to landslides. Existing infrastructure has remained largely within previously developed service areas, limiting additional exposure to landslide hazards during this period. Recent growth since the last plan update has also been minor. However, anticipated future development associated with the SDC campus may require expansion of water infrastructure into areas with moderate to high landslide susceptibility. As redevelopment of the site progresses, new pipelines, service connections, and related facilities could be located within or near unstable slopes, potentially increasing the District's exposure to landslide-related impacts.

Risk Summary

- Landslides risk within the District is generally low, but exposure increases where linear water infrastructure extends into surrounding areas of Sonoma County with moderate to high landslide susceptibility and failures affecting water infrastructure, particularly linear water lines, could result in localized service disruptions that have disproportionate operational impacts.
- Landslides and debris flows can result in the destruction of critical water facilities and distribution infrastructure such as water pipelines.
- Although landslides affecting District facilities are infrequent, failures impacting critical water lifelines could result in high-consequence service disruptions due to ground deformation and cascading system effects.
- Sonoma County has experienced repeated landslide and debris flow events, including 15 FEMA disaster declarations since 1982, with recent nearby incidents confirming ongoing regional risk despite limited direct impacts to District facilities.
- Landslides are likely to continue occurring on an annual basis in the region, with damaging events most probable during severe winter storms, El Niño conditions, and in post-wildfire landscapes.
- Climate change is expected to increase landslide and debris flow risk by intensifying rainfall events and expanding post-wildfire conditions that reduce slope stability and increase runoff.
- Based on GIS analysis, there are a total of 64 water assets, with a replacement value of $13 million, at risk of this hazard.
- The significance of landslides and debris flows in the District's Planning Area is **Low.**

4.3.9 Severe Weather

Geographic Extent	Probability of Future Occurrences	Magnitude/ Severity	Overall Significance
Extensive	Likely	Limited	Medium

Hazard Description

Severe weather usually occurs in the Planning Area as localized thunderstorms that can bring heavy rain, hail, and lightning.

Heavy Rain

Precipitation data from the Sonoma Weather Station (048351), located near the General Vallejo's Home Sonoma State Historic Park, is summarized in Table 4-28. As shown, precipitation occurs throughout the year, with most occurring in winter. On average, the area gets 28.43 inches of precipitation annually, although rainfall reached 65 inches in 1983.

Table 4-28 Sonoma (048351) Precipitation Summary (01/01/1893 - 11/30/2025)

Summary Period	Precipitation Mean (in.)	Precipitation High (in.) & Year	Precipitation 1 Day Maximum (in.) & Date	Precipitation ≥ 0.50 in. Mean (# Days)	Precipitation ≥ 1.00 in. Mean (# Days)
Winter	16.22	34.45 (1998)	6.75 (1/4/1982)	11.3	4.8
Spring	6.4	19.98 (1983)	2.9 (3/9/1995)	4.5	1.3
Summer	0.31	2.27 (1967)	1.82 (6/2/1967)	0.1	0
Fall	5.47	15.3 (1973)	5.4 (11/21/1977)	3.7	1.5
Annual	28.43	65.45 (1983)	6.75 (1/4/1982)	19.7	7.8

Source: Western Regional Climate Center (WRCC), https://wrcc.dri.edu/Climate/summaries.php
*Winter = Dec., Jan., and Feb.
**Summer = Jun., Jul., and Aug

Atmospheric rivers are responsible for up to 50 percent of California's precipitation annually and 65 percent seasonally (Arcuni, 2019). An atmospheric river (AR) is a long, narrow region of the atmosphere, like a river in the sky, that transports most of the water vapor outside of the tropics. ARs can be 300 miles wide, a mile deep and more than 1,000 miles long and carry an amount of water vapor roughly the same as the average flow of water at the mouth of the Mississippi River (NOAA 2015). Warm water storms over the Pacific Ocean lead to evaporation and create a high concentration of moisture in the air, while prevailing winds create the distinctive river shape, which has been compared "to a fire hose pointed at California" (Arcuni 2019). When an atmospheric river reaches land, it releases the water vapor in the form of rain or snow. Atmospheric rivers play an important role in the global water cycle and are closely tied to both water supply and flooding risk.

Sonoma Water entered into a cooperative agreement with the Scripps Institution of Oceanography and the Center for Western Extremes (CW3E) to advance the research in ocean science and meteorology. Three projects have come from the initial agreement:

1. Research to help define the role of atmospheric rivers in filling Lake Mendocino and potentially offering predictability in retaining water without increasing flood risk;
2. A NOAA-funded climate program project to study the role of atmospheric rivers in ending droughts on the Russian River; and

3. Cooperation in developing a feasibility assessment for potential use of forecast-informed reservoir operations for Lake Mendocino in cooperation with the U.S. Army Corps of Engineers.

Hail

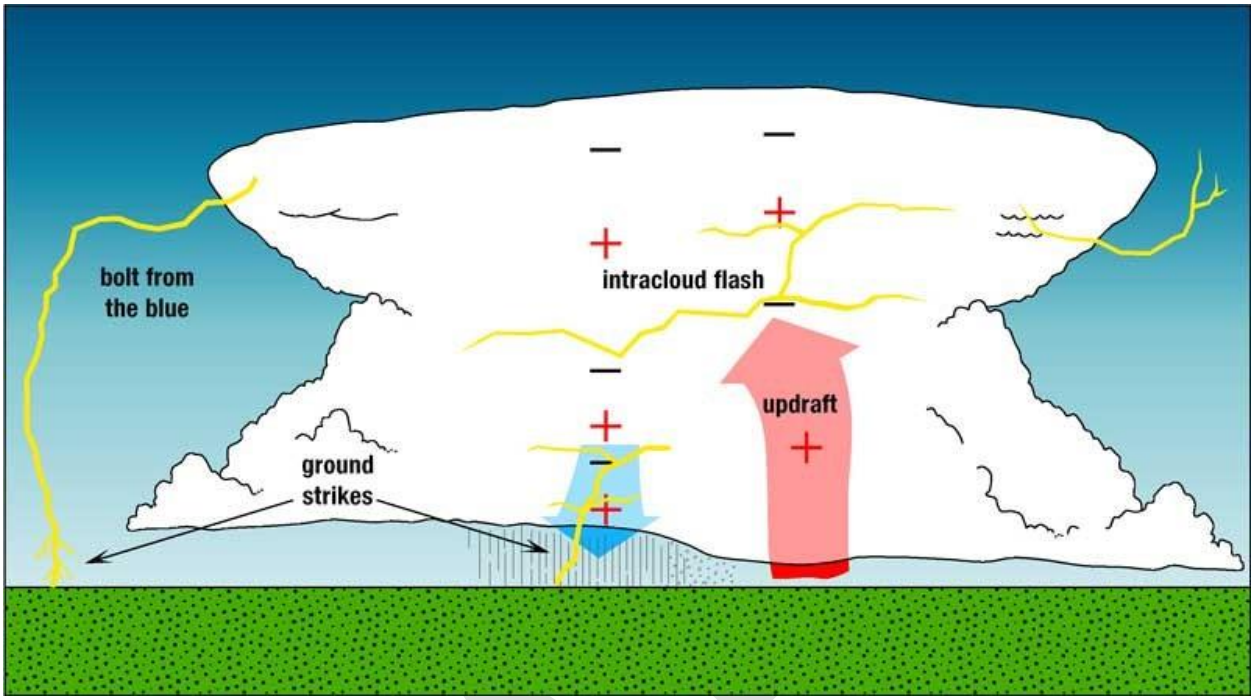
Hail is sometimes associated with severe storms within the Planning Area. Hail is formed when water droplets freeze and thaw as they are thrown high into the upper atmosphere by the violent internal forces of thunderstorms. Hail falls when it becomes heavy enough to overcome the strength of the updraft and is pulled by gravity towards the earth. Hailstorms occur throughout the spring, summer, and fall in the region, but are more frequent in late spring and early summer. Hailstones are usually less than two inches in diameter and can fall at speeds of 120 mph. If hail more than ¾ of an inch is produced in a thunderstorm, it qualifies as severe. Severe hailstorms can be quite destructive, causing damage to roofs, buildings, automobiles, vegetation, and crops.

Lightning

Lightning is an electrical discharge between positive and negative regions of a thunderstorm. Lightning is one of the more dangerous weather hazards in the United States. Each year, lightning is responsible for deaths, injuries, and millions of dollars in property damage, including damage to buildings, communications systems, power lines, and electrical systems. Lightning also causes forest and brush fires, and deaths and injuries to livestock and other animals. According to the National Lightning Safety Institute, lightning causes more than 26,000 fires in the United States each year. The Institute estimates property damage, increased operating costs, production delays, and lost revenue from lightning and secondary effects to be in excess of $6 billion per year. Impacts can be direct or indirect. People or objects can be directly struck, or damage can occur indirectly when the current passes through or near it.

Cloud-to-ground lightning is the most damaging and dangerous type of lightning, though it is also less common. Most flashes originate near the lower-negative charge center and deliver negative charge to earth. However, a large minority of flashes carry positive charge to earth. These positive flashes often occur during the dissipating stage of a thunderstorm's life. Positive flashes are also more common as a percentage of total ground strikes during the winter months. This type of lightning is particularly dangerous for several reasons. It frequently strikes away from the rain core, either ahead or behind the thunderstorm. It can strike as far as 5 or 10 miles from the storm in areas that most people do not consider to be a threat (see Figure 4-17). Positive lightning also has a longer duration, so fires are more easily ignited. When positive lightning strikes, it usually carries a high peak electrical current, potentially resulting in greater damage.

Figure 4-17 Cloud to Ground Lightning



Source: National Weather Service Pueblo Office

Geographic Location

Extensive – Severe weather has the potential to occur anywhere in the Planning Area. These events are regional in nature and will typically impact the entire Planning Area simultaneously.

Magnitude/Severity

Limited – Common problems associated with severe storms includes loss of utilities or immobility. Loss of utilities can occur when severe thunderstorms cause trees or tree limbs to fall and damage power lines. Lightning can also cause severe damage and injury, particularly when it causes wildfires. Loss of life is uncommon but can occur during severe storms. Immobility can occur when roads become impassable due to flooding, downed trees, ice, or landslides.

Heavy Rain

Atmospheric rivers are categorized by a unit of measurement known as the Integrated Water Vapor Transport (IVT), which considers the amount of water vapor in the system and the wind that moves it around. For a storm to be classified as an atmospheric river, it has to reach an IVT threshold of 250 units; 1,000 IVT or more is considered to be “extreme” (Arcuni, 2019). In 2019 a system for categorizing the strength and impacts of atmospheric rivers was developed by the Center for Western Weather and Water Extremes (CW3E), out of the Scripps Institution of Oceanography at the University of California San Diego. The newly developed scale ranks ARs into five categories, from weak to exceptional. Unlike the Fujita scale for tornadoes that focus on potential damages, the AR scale accounts for both storms that may be hazardous and storms that can provide benefits to the local water supply. A category one AR is considered to be primarily beneficial, generally lasting only 24 hours and produces modest rainfall. A category five AR is considered “exceptional” and primarily hazardous, lasting for several days and associated with heavy rainfall and runoff that may cause significant damages. Table 4-29 describes the

scale further. The Center developed the scale as a tool for officials with an operational need to assess flooding potential in their jurisdictions before the storms make landfall.

Table 4-29 Atmospheric River Categories

Category	Description
1: Weak	Primarily beneficial. For example, a Feb. 2, 2017, AR hit California, lasted 24 hours at the coast, and produced modest rainfall.
2: Moderate	Mostly beneficial, but also somewhat hazardous. An atmospheric river on Nov. 19-20, 2016 hit Northern California, lasted 42 hours at the coast, and produced several inches of rain that helped replenish low reservoirs after a drought.
3: Strong	Balance of beneficial and hazardous. An atmospheric river on Oct. 14-15, 2016, lasted 36 hours at the coast, produced 5-10 inches of rain that helped refill reservoirs after a drought, but also caused some rivers to rise to just below flood stage.
4: Extreme	Mostly hazardous, but also beneficial. For example, an atmospheric river on Jan. 8-9, 2017, that persisted for 36 hours produced up to 14 inches of rain in the Sierra Nevada and caused at least a dozen rivers to reach flood stage.
5: Exceptional	Primarily hazardous. For example, a Dec. 29, 1996, to Jan. 2, 1997, atmospheric river lasted over 100 hours at the Central California coast. The associated heavy precipitation and runoff caused more than $1 billion in damages.

Source: Center for Western Weather and Water Extremes, Scripps Institution of Oceanography at UC San Diego. Scale was developed by F. Martin Ralph Director of CW3E in collaboration with Jonathan Rutz of NWS.

Hail

There is no clear distinction between storms that do and do not produce hailstones. Nearly all severe thunderstorms probably produce hail aloft, though it may melt before reaching the ground. Multi-cell thunderstorms produce many hailstones, but not usually the largest hailstones. In the life cycle of the multi-cell thunderstorm, the mature stage is relatively short, so there is not much time for growth of the hailstone. Supercell thunderstorms have sustained updrafts that support large hail formation by repeatedly lifting the hailstones into the very cold air at the top of the thunderstorm cloud. In general, hail two inches (5 cm) or larger in diameter is associated with supercells (a little larger than golf ball size which the NWS considers to be 1.75 inches). Non-supercell storms are capable of producing golf ball size hail. The NWS classifies hail by diameter size, and corresponding everyday objects to help relay scope and severity to the population. Table 4-30 indicates the hailstone measurements utilized by the NWS.

Table 4-30 Hail Measurements

Average Diameter	Corresponding Household Object
.25 inch	Pea
.5 inch	Marble/Mothball
.75 inch	Dime/Penny
.875 inch	Nickel
1.0 inch	Quarter
1.5 inch	Ping-pong ball
1.75 inch	Golf-Ball
2.0 inch	Hen Egg
2.5 inch	Tennis Ball
2.75 inch	Baseball
3.00 inch	Teacup

Average Diameter	Corresponding Household Object
4.00 inch	Grapefruit
4.5 inch	Softball

Source: National Weather Service

In all cases, the hail falls when the thunderstorm's updraft can no longer support the weight of the ice. The stronger the updraft, the larger the hailstone can grow. When viewed from the air, it is evident that hail falls in paths known as hail swaths. They can range in size from a few acres to areas 10 miles wide and 100 miles long. In some instances, piles of hail have been so deep that snowplows were required to remove them, and occasionally hail drifts have been reported.

Lightning

Lightning is measured by the Lightning Activity Level (LAL) scale, created by the NWS to define lightning activity into a specific categorical scale. The LAL is a common parameter that is part of fire weather forecasts nationwide. The District is at risk of experiencing lightning in any of these categories. The LAL is reproduced in Table 4-31.

Table 4-31 Lightning Activity Level Scale

LAL Category	Description
LAL 1	No thunderstorms
LAL 2	Isolated thunderstorms. Light rain will occasionally reach the ground. Lightning is very infrequent, 1 to 5 cloud to ground strikes in a five-minute period
LAL 3	Widely scattered thunderstorms. Light to moderate rain will reach the ground. Lightning is infrequent, 6 to 10 cloud to ground strikes in a five-minute period.
LAL 4	Scattered thunderstorms. Moderate rain is commonly produced. Lightning is frequent, 11 to 15 cloud to ground strikes in a five-minute period.
LAL 5	Numerous thunderstorms. Rainfall is moderate to heavy. Lightning is frequent and intense, greater than 15 cloud to ground strikes in a five-minute period.
LAL 6	Dry lightning (same as LAL 3 but without rain). This type of lightning has the potential for extreme fire activity and is normally highlighted in fire weather forecasts with a Red Flag warning.

Source: National Weather Service

Previous Occurrences

The NOAA NCEI Storm Events Database lists 46 severe weather events, including heavy rain, hail, and lightning, that occurred in Sonoma County from January 1, 2000, to December 15, 2025, as shown in Table 4-32.

Table 4-32 NCEI Severe Weather Hazard Event Reports for Sonoma County 2000-2025

Type	# of Events	Property Loss	Crop Loss	Deaths	Injuries
Hail	21	$0	$0	0	0
Heavy Rain	22	$383,520	$20,000,000	4	3
Lightning	3	$1,000,000	$0	0	1
Total	**46**	**$1,383,520**	**$20,000,000**	**4**	**4**

Source: NOAA's National Centers for Environmental Information https://www.ncdc.noaa.gov/stormevents/

**Losses reflect totals for all impacted areas, inclusive of Sonoma County

Although the database has records of some severe weather events dating back to 1950, older entries are inconsistent and have been omitted from this table. A summary of those events which caused property loss, crop loss, death, or injury follows in Table 4-33.

Table 4-33 Severe Weather Event Descriptions

Event	Damages and Event Description
January 25, 2001 Lightning	One injury; $1,000,000 property damages. A lightning storm caused power outages for over 7,000 Sonoma County residents. At least one woman in Sonoma was struck during the storm.
December 16, 2008 Heavy Rain	$25,000 property damages; one death. From December 15 to 17, 2009, a cold core low brought winter storm conditions, with minor flooding, strong winds, and snow ranging from several inches in Bay Area hills to nine inches at Mount Hamilton. A 32-year-old man died after his car crashed during heavy rain, prompting a three-hour closure of Highways 116 and 121.
May 5, 2009 Heavy Rain	One death, one injury; $50,000 property damage. Heavy rain in Sonoma County caused widespread tree falls, resulting in road closures, property damage, several injuries, and the death of a five-year-old boy. One oak tree killed a child and injured his father on Bennett Valley Road, while others damaged a home on Poplar Avenue and blocked Highway 12. The severe weather also increased traffic accidents throughout the area.
February 16, 2011 Heavy Rain	$25,000 property damage. A strong low-pressure system brought six days of cool, wet weather marked by damaging winds, local flooding, and intense hail. Heavy rain in central Sonoma County led to localized flooding and several road closures, including Todd Road, Green Hill Road, and Green Valley Road, where vehicles became stuck in high water. Shiloh Road flooded near Windsor Road, and minor rock and mudslides occurred between Santa Rosa and Calistoga.
March 24, 2011 Heavy Rain	$28,500 property damages. A series of systems affected the San Francisco and Monterey Bay areas with heavy rain and strong winds. A 60-to-70-foot Fir tree crashed into a roof, punching holes through the ceiling.
June 4, 2011 Heavy Rain	$20,000,000 crop damages. A late-season cold front brought heavy rain and strong winds to Northern and Central California, damaging crops and causing significant losses for farmers. Torrential rains hit North Bay vineyards during a crucial flowering phase, resulting in about 10–15% crop loss and tens of millions of dollars in damages to Sonoma County agriculture.
December 22, 2012 Heavy Rain	$30,000 property damages; two injuries, one death. A series of Atmospheric Rivers brought heavy rain, strong winds, flooding, and mudslides. Damage included downed trees and powerlines. The storms also contributed to a fatal two-car crash during heavy rainfall in Napa County on December 22, resulting in one death and significant injuries to two others.
February 8, 2015 Heavy Rain	$25,000 property damages. After a record-dry January, a strong winter storm hit California, bringing heavy rain, winds up to 70 MPH, tree and power line damage, and minor urban flooding. Mountain areas saw 5–10+ inches of rain, while lower elevations got 1–3.5 inches. A fuel tanker accident spilled about 9,000 gallons of diesel into the ocean near Jenner in Sonoma County.
January 16, 2019 Heavy Rain	One death. An atmospheric river hit California mid-month, brining heavy rain, high winds (60–100 mph), flooding, high surf, and thunderstorms in the Bay Area. Reports included downed trees and power lines, resulting in two deaths, and a fatal car crash during heavy rain on Highway 121 near Napa Road.
March 9, 2023 Heavy Rain	$10,000,000 property damages. A sub-tropical jet stream brought heavy moisture to the California coast, causing widespread flooding, landslides, rapid river rises, and

Event	Damages and Event Description
	numerous power outages from downed trees and powerlines. Wind gusts reached 45–55 mph and a mudslide occurred on California Highway 116.
November 19, 2024 Heavy Rain	$10,000,000 property damages. Santa Rosa COOP station recorded 12.47 inches of rain, the station's wettest three-day period on record. An atmospheric river and rapidly intensifying cyclone caused widespread flooding in the North Bay, with valleys receiving nearly a foot and mountains up to 22.57 inches of rain.

Source: NOAA's National Centers for Environmental Information https://www.ncdc.noaa.gov/stormevents/

Probability of Future Occurrences

Likely – Heavy rain, thunderstorms, hail, and lightning events are well-documented seasonal occurrences that will continue to occur annually in the Planning Area. Based on information from the NCEI Storm Events Database, summarized in Table 4-32, there is a 100% chance of a severe weather event impacting Sonoma County on any given year. For example, the 46 severe weather events recorded over a 25-year period of time equates to an event every 1.8 years. Given the regional nature of these events, it is likely that the Planning Area will be impacted by these events.

Climate Change Considerations

As average temperatures increase over time, this generally will result in higher extreme temperatures and more warming in the atmosphere, which could result in more frequent extreme weather events. According to California's Fourth Climate Change Assessment, the number of days each year on which atmospheric rivers bring extreme amounts of rain and snow to the region are expected to increase under climate change projections. Pacific Northwest National Laboratory researchers found that atmospheric rivers will reach the West Coast more frequently if GHG emissions continue to rise under business-as-usual conditions. Currently, the West receives rain or snow from these atmospheric rivers between 25 and 40 days each year. By the end of this century, days on which atmospheric rivers reach the coast could increase by a third, between 35 and 55 days a year.

Table 4-34 presents Cal-Adapt data for both the City of Sonoma and Sonoma County under business-as-usual projections (RCP 8.5). Although the City of Sonoma is located outside the boundaries of the VOMWD, as the nearest incorporated municipality, its estimates may more accurately reflect local conditions than those representing the County as a whole.

Table 4-34 Cal-Adapt 30-Year Average Projections for City and County of Sonoma

Area	Indicator	Baseline (1961-1990)	Mid-Century Estimate (2035-2064)	End-Century Estimate (2070-2099)
City of Sonoma	Annual Precipitation	29.3 inches	30.0 inches	30.2 inches
	Max. 1-day Precipitation	1.974 inches	2.184 inches	2.394 inches
	Max. Length of Dry Spell	108 days	117 days	120 days
Sonoma County	Annual Precipitation	46.2 inches	47.8 inches	49.9 inches
	Max. 1-day Precipitation	3.013 inches	3.307 inches	3.597 inches
	Max. Length of Dry Spell	99 days	107 days	109 days

Source: Cal-Adapt 2025

As shown, total annual precipitation in the area is only expected to increase modestly. However, increases in maximum one-day-precipitation and lengths of dry spells indicate that precipitation is increasingly likely to occur in more intense, concentrated events instead of being distributed throughout

the year. This pattern suggests a higher likelihood of extreme weather occurrences, such as heavy rainfall and longer periods without precipitation, which can elevate the risk of both flooding and drought conditions. For these reasons, climate change would have a high influence on all severe weather hazards.

Vulnerability Assessment

People

Exposure is the most immediate threat to people and District customers during severe weather events, with risks such as lightning strikes, hail, and flooding, posing direct dangers. However, secondary impacts such as power outages can present even greater risks, particularly for populations dependent on continuous electrical service. Groups like the elderly, disabled individuals, and those receiving home health care are especially susceptible to harm if electricity is disrupted. Residents in nursing homes, residential facilities, or other special needs housing face heightened vulnerability during prolonged outages. Additionally, rural residents and agricultural operations that rely on electricity for essential services like heating, cooling, and water supply are at significant risk if backup power sources are unavailable.

Property

Based on historic information, these storms have not directly resulted in significant injury or damages to people and property, or the losses are typically covered by insurance. It is the secondary hazards caused by severe weather, such as floods, that have had the greatest impact on the District's Planning Area. But while the primary effects may not result in significant injury or property damage, all property is vulnerable during severe weather events; properties in poor condition or closer to overhead power lines and large trees may be more vulnerable to damage.

Critical Water Facilities and Infrastructure

Most critical infrastructure that is above ground, such as the District's water tanks and BPSs, are equally exposed to the impacts of severe weather. According to historical data, the Planning Area has experienced power outages in the past due to severe storms. However, due to the random nature of these hazards, a more specific risk assessment was not conducted for this plan.

Severe weather could significantly impact motorists travelling along U.S. Highway 101 and State Highway 116. Depending on the severity of the storm, these events could slow traffic, reduce visibility, and increase the likelihood of vehicle accidents along the highway, which may result in greater traffic delays. These effects are also likely to occur along highway segments in adjacent counties. These accidents can cause multiple injuries and deaths and could have serious implications for human health and the environment if a hazardous or nuclear waste shipment were involved. Other disruptions from severe weather include delayed emergency response vehicles and school closures.

Economy

Severe weather events regularly affect Northern California and can produce localized unplanned power outages that disrupt infrastructure and services. Heavy rainfall can lead to flooding, soil saturation, and stormwater runoff that may damage or expose buried water pipelines, wells, and other system components. These impacts can increase maintenance and repair costs while requiring emergency response actions to maintain system functionality. Severe storms may also block roadways with debris or flooding, delaying maintenance crews, and prolonging service disruptions that thereby affect local businesses.

Lightning and hail pose additional risks to above ground facilities such as electrical control systems and telemetry equipment. Lightning strikes can damage electrical components or trigger power outages,

temporarily interrupting pumping operations and water distribution. Because many water system components rely on electricity for pumping and monitoring, prolonged outages may require the use of backup generators and additional fuel and labor costs.

Historic, Cultural, and Natural Resources

Severe weather events are a natural environmental process. Environmental impacts include the sparking of potentially destructive wildfires by lightning and localized flattening of plants by hail. As a natural process, the impacts of most severe weather events by themselves are part of the overall natural cycle and do not cause long-term consequential damage.

Recent and Future Development

Over the past five years, the District has not undertaken development or infrastructure expansion that would increase the District's vulnerability to severe weather hazards such as heavy rain, lightning, or hail. Improvements during this period have generally occurred within existing developed service areas and have not significantly increased the exposure of district facilities or assets to severe weather impacts. There has also been minor new development in the District's Planning Area associated with new residential and commercial growth.

Planned development and infrastructure improvements are also not expected to substantially increase vulnerability. New critical facilities, such as steel water tanks, are anticipated to be built to withstand heavy rain, lightning, and hail damage. Future development projects for new District infrastructure will consider severe weather hazards at the planning, engineering, and architectural design stage with the goal of reducing vulnerability. In summary, future development is not expected to result in substantial enough population growth that would increase potential exposure to these weather hazards.

Risk Summary

- Severe weather in the Planning Area typically includes localized thunderstorms that can bring heavy rain, hail, and lightning, posing direct risks to people, property, and infrastructure.
- Heavy rainfall events, often driven by atmospheric rivers, contribute to flooding, crop loss, and property damage.
- The NOAA NCEI Storm Events Database lists 46 severe weather events that occurred in Sonoma County over a 25-year period of time equating to an event every 1.8 years.
- Severe weather events are regional and can impact the entire Planning Area simultaneously, leading to widespread utility loss, immobility from road closures, and increased risk of vehicle accidents.
- Climate change is expected to increase the frequency and intensity of extreme weather events, with projections indicating more intense rainfall over shorter periods and longer dry spells, elevating risk for both flooding and drought.
- Vulnerable populations and water customers including the elderly, disabled, and those dependent on electrical service are at increased risk during severe weather due to potential power outages and disruptions to essential services.
- Critical District infrastructure, such as water tanks and pumping stations, is exposed to severe weather impacts, with historical data showing power outages and physical damage during past storms.
- Future development and new critical facilities should be designed to withstand severe weather hazards, incorporating considerations for heavy rain, hail, and lightning at the planning and engineering stages.
- While most severe weather events do not cause long-term damage, their secondary effects, such as floods, wildfires, and prolonged outages, can have substantial implications for human health, safety, and the environment.

- Overall significance for other severe weather hazards such as heavy rain, thunderstorms, hail, and lightning is **Medium.**

4.3.10 Wildfire

Geographic Extent	Probability of Future Occurrences	Magnitude/ Severity	Overall Significance
Extensive	Highly Likely	Catastrophic	High

Hazard Description

Wildfires pose an increasingly significant threat across California, with their frequency, intensity, and overall scope rising dramatically over the past 25 years. The state is home to some of the nation's most fire-prone and fire-adapted landscapes, resulting in environments where wildfires can ignite and spread quickly. These uncontrolled fires typically occur in undeveloped or sparsely populated areas, demanding coordinated suppression efforts to protect lives, property, and vital infrastructure. While wildfires can be sparked by natural causes such as lightning, most are triggered by human activities including discarded cigarettes, arson, vehicle fires, abandoned campfires, and electrical equipment failures.

Wildfire Exposure

Wildfires originating in areas adjacent to the Planning Area can have both direct and indirect effects on people and property within the boundaries of the District. These fires pose immediate threats, exposing residents and assets to radiant heat, airborne embers, and flames, which may lead to injuries, fatalities, and significant damage or destruction of buildings and critical infrastructure. In addition to these direct impacts, wildfires can harm natural landscapes, cultural resources, and overall forest health, with the extent of damage depending on the fire's severity. While wildfire risk is highest in wildlands and sparsely populated rural regions, fires can also extend either directly or via drifting embers into more densely populated neighborhoods. Additionally, smoke generated by wildfires can adversely affect air quality and community health across the region.

Fire Weather, Seasonal Conditions and Land Management Practices

Fire conditions emerge from a combination of high temperatures, low humidity and rainfall, strong winds, and the accumulation of vegetation and surface fuels such as litter, duff, and dead plant material. Wildfires have occurred in both vegetated areas within and beyond the Planning Area. Typically, the local fire season spans from June through October, aligning with the region's hot, dry months. However, climate change trends are causing the fire season to start earlier in the spring and extend later into the fall statewide.

Wildland fires on public lands with little or no development are generally recognized as a natural part of ecological processes and can yield important environmental benefits. Historically, federal and state policies focused on aggressive fire suppression, which disrupted these natural fire cycles. More recently, land management agencies have shifted toward strategies that acknowledge the ecological role of wildfire and integrate it into sustainable forest and vegetation management practices.

Wildfires can also cause secondary impacts that lead to economic losses, such as reduced timber harvesting and declines in tourism. They may damage electrical power transmission infrastructure, contaminate water storage facilities, and increase runoff and slope failures due to vegetation loss and weakened soils. Following wildfires, rights-of-way along transmission and distribution lines often require clearing, and power poles frequently need replacement. High-intensity fires can damage soils, further increasing runoff, and adversely affect water quality.

For the District, wildfires present both direct and indirect risks. Fires may threaten wells, pump stations, and control systems, especially when these facilities are located near fire-prone wildland areas. Vegetation loss from wildfires can lead to increased soil erosion and potentially change the hydrology of the watershed, resulting in higher rates of sediment, ash, and contaminants entering the ground. These materials can percolate into aquifers, potentially degrading groundwater quality, increasing the need for water treatment, and challenging the safety of drinking water supplies.

Wildland Urban Interface

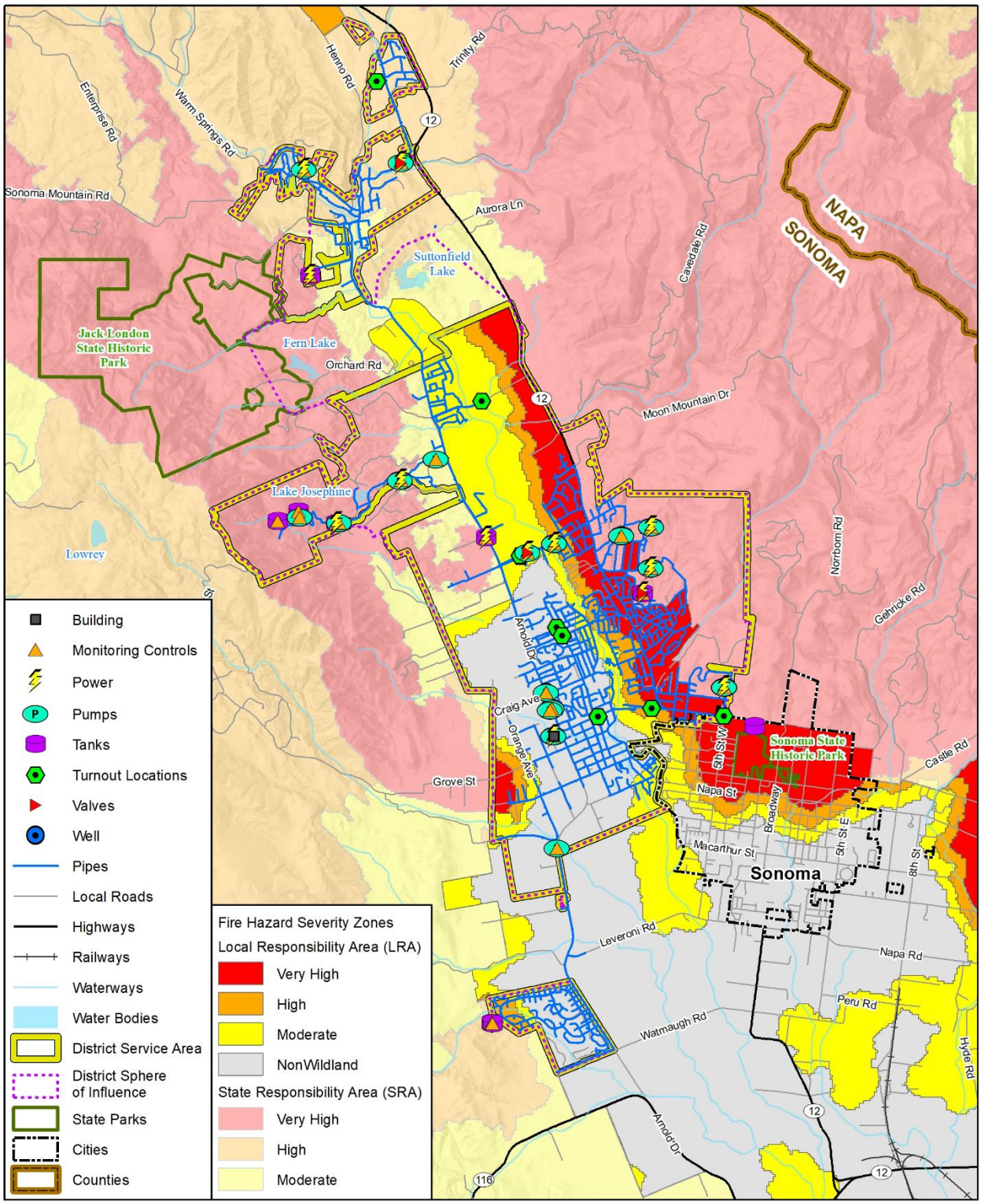
The wildland-urban interface (WUI) in Sonoma County consists of areas where residential and commercial development is located adjacent to or intermingled with fire-prone wildland vegetation. Much of the County's development pattern including hillside, valley edge, and rural residential areas falls within the WUI, increasing exposure to wildfire due to steep terrain, dense fuels, and limited access routes. Wildfires in the WUI can spread rapidly into communities, threaten homes and critical infrastructure, and complicate evacuation and emergency response. As development continues in these areas, wildfire risk to people, property, and essential services is expected to increase without targeted mitigation and land use planning.

Geographic Location

Extensive – Wildfires affect grass, forest, and brushlands, as well as any structures and populations located within or surrounding them. Where there is human access to wildland areas, the risk of fire increases due to a greater chance for human carelessness and historical fire management practices. In other areas, large concentrations of highly flammable brush and grasslands located in flat open spaces are also susceptible to wildfire. The California Department of Forestry and Fire Protection's (CAL FIRE) Fire and Resource Assessment Program (FRAP) models map wildfire hazards using a science-based approach and computerized techniques to classify moderate, high, and very high fire severity zones in a Fire Hazard Severity Zone (FHSZ) dataset. The model uses existing CAL FIRE data and hazard information based on fuel, weather, and terrain, explained in more detail in the Magnitude/Severity section below.

Figure 4-18 displays the FHSZs within and around the District. The areas north and east of the District's boundaries show high FHSZs mapped at both the SRA and LRA levels. Other potential areas of concern exist along the edges of the District boundary, on the western side where high and very high FHSZs intermingle.

Figure 4-18 FHSZs in SRAs around the Valley of the Moon Water District



Map compiled 2/2026;
intended for planning purposes only.
Data Source: Sonoma County, CalTrans,
US Census TIGER Database, CA Open
Data Portal, EKI Environment & Water, Inc.,
CA Parks and Rec., CalFIRE LRA as recommended by the State Fire Marshal in 2025, SRA Effective April 1, 2024

Magnitude/Severity

Catastrophic – Potential impacts from wildfires include damages to the District's facilities as well as Sonoma Water's facilities that supply water to the District, supply stress due to firefighting demands on water supply systems (for structural fire suppression), residual impacts to water quality and erosion or sediment filling the Lake Sonoma Reservoir, and impacts to the community's way of life in Sonoma Valley. According to the HMPC there is currently not enough water for fire suppression because District's water infrastructure was designed to respond to urban structure fires, not wildland fires. In addition, catastrophic wildfires can create favorable conditions for other secondary hazards such as flooding, landslides, and erosion during the rainy season.

There are three major factors that sustain wildfires and predict a given area's potential to burn. These factors are fuel, topography, and weather, as described below.

- **Fuel** - Fuel is the material that feeds a fire and is a key factor in wildfire behavior. Fuel is generally classified by type and by volume. Fuel sources are diverse and include everything from dead tree leaves, twigs, and branches to dead standing trees, live trees, brush, and cured grasses. Manmade structures, such as homes and other associated combustibles are also fuel sources. The type of prevalent fuel directly influences the behavior of wildfire. Fuel is the only factor that is under human control. Fuel types within Sonoma County are diverse with redwood forests found throughout. The southern portion of the County where the District is located is characterized by grasslands and oak woodland. East of the District boundary along the Napa County line is considered highly fire-prone nob cone pine and chaparral landscapes (Sonoma County 2017).
- **Topography** - An area's terrain and land slopes affect its susceptibility to wildfire spread. The Sonoma Valley's narrow, 17-mile-long shape between the Mayacamas and Sonoma Mountains acts as a natural wind tunnel, an orientation that can funnel and accelerate "Diablo winds" (hot, dry gusts from the northeast) which can significantly increase fire spread speed. Additionally, fires naturally move much faster and more intensely uphill because flames can easily pre-heat the fuel above them. The steep terrain surrounding towns like Glen Ellen creates an "uphill thermal rush," allowing fires to climb quickly from the valley floor to ridgelines. The natural ridges of the valley combined with rapidly climbing flames may cause evacuation challenges during a wildfire emergency.
- **Weather -** Weather components such as temperature, relative humidity, wind, and lightning also affect the potential for wildfire. High temperatures and low relative humidity dry out fuels that feed wildfires, creating a situation where fuel will more readily ignite and burn more intensely. Thus, during periods of drought, the threat of wildfire increases. Wind is the most treacherous weather factor. The greater a wind, the faster a fire will spread and the more intense it will be. Lightning can also ignite wildfires, often in difficult to reach areas for firefighters.

  Weather in Sonoma County during the wildfire season tends to be warmer and drier during the day. Peak summer day temperatures can be between 80° and 108°F, and relative humidity ranges between 10% and 35% (Sonoma County 2017). However, the climatological conditions proceeding the 2017 wildfires included above-normal temperatures during the summer and above-normal precipitation during the previous winter, which led to abundant dry grass that provided fuel for the wind-driven wildfires (Mass et all 2019).

Overall, wildfire severity can usually be quantified in terms of acres burned during an event, number and cost of properties/structures damaged (including critical facilities), money lost from disruption of services, and population affected by the fires (e.g. people displaced, injured, or killed).

Previous Occurrences

Wildfires are a significant concern throughout California. According to CAL FIRE, vegetation fires occur across California on a regular basis; most can be controlled and contained early with limited damage. For those ignitions that are not readily contained and become wildfires, damage can be extensive. There are

many causes of wildfire, from naturally caused lightning fires to human-caused fires linked to activities such as smoking, campfires, debris burning, equipment use, and arson. Recent studies conclude that the greater the population density in an area, the greater the chance of an ignition from human sources, as well as powerlines or other electrical or utility infrastructure.

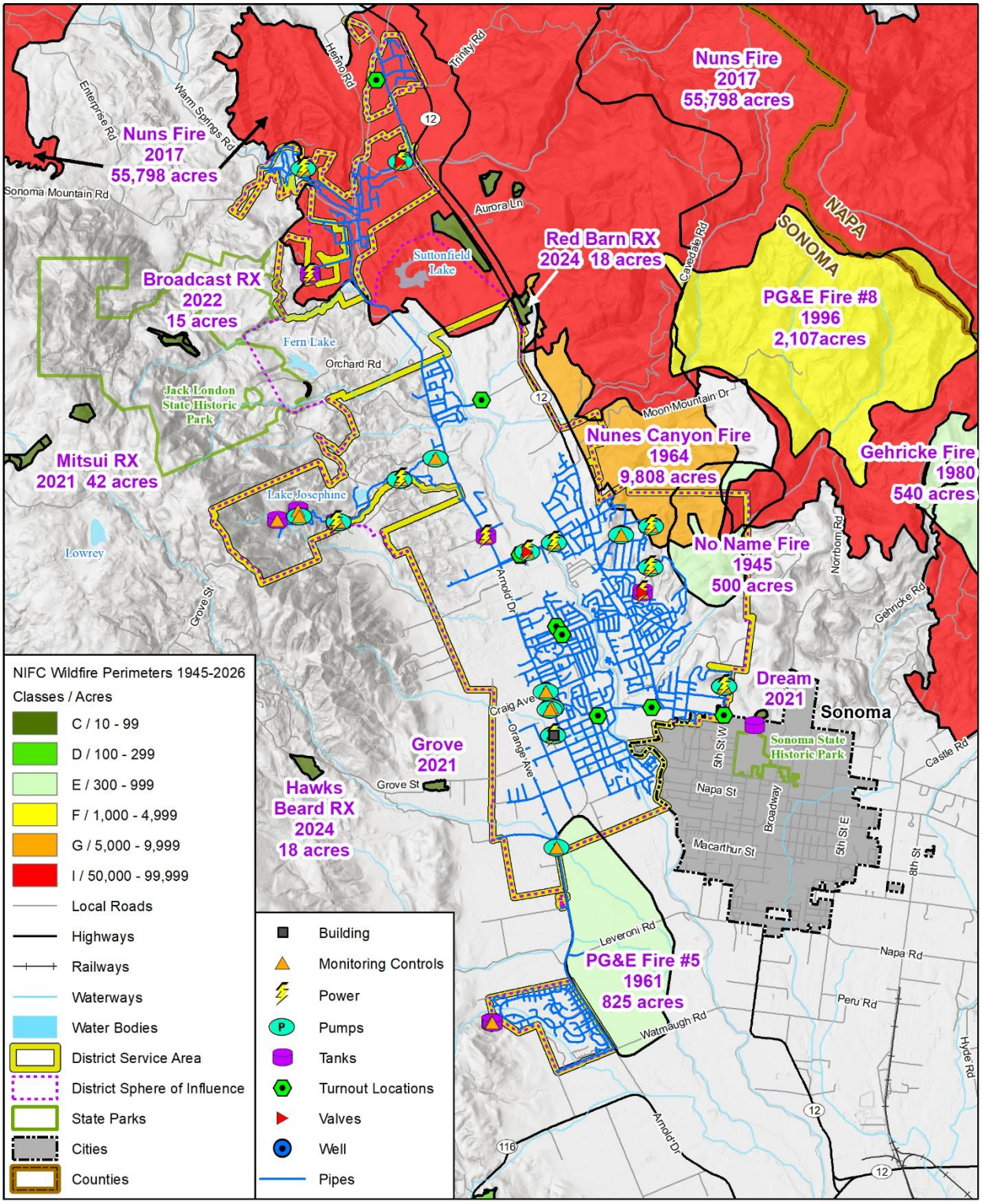
Since 1985 there have been 186 fires greater than ten acres within 30 miles of the Planning Area. While most fires are small, there have been 41 fires over 1,000 acres. Table 4-35 summarizes fires over 10,000 acres that occurred around the District's Planning Area, while Figure 4-19 displays fires that have occurred close to the District.

Table 4-35 Summary of Large Fire History near the Valley of the Moon Water District, 1985-2025

Fire Year	Fire Name	Acres Burned
1988	Miller	34,565
1995	Vision	12,361
1999	Sixteen	37,893
2004	Rumsey	38,763
	Geysers	12,244
2015	Valley	76,085
2017	Nuns	55,798
	Atlas	51,625
	Tubbs	36,702
2018	County	89,836
2019	Kincade	77,762
2020	Hennessey	305,352
	Glass	67,484
	Walbridge	55,209

Source: CAL FIRE FRAP 2025, USGS/BLM/BIA/FS/NPS (from Federal Wildland Fire Occurrence database, 2020)

Figure 4-19 Historical Fire Perimeters near the Valley of the Moon Water District, 1945-2025



Map compiled 2/2026;
intended for planning purposes only.
Data Source: Sonoma County, CalTrans,
US Census TIGER Database, CA Open
Data Portal, EKI Environment & Water, Inc.,
CA Parks and Rec., CalFIRE, National Interagency Fire Center (NIFC)

Several areas in the Sonoma Valley have been identified as historic wildland fire corridors, due to the valley's narrow shape and its alignment with the Diablo winds. This means that when a fire crosses the Mayacamas ridge, it frequently travels down the same canyons and into the residential neighborhoods along the valley floor. The most notable recent event was the Nuns Fire in 2017, which was part of the larger Sonoma Complex Fires and caused significant devastation in Glen Ellen and Kenwood. Over 56,000 acres were burned, with approximately 1,355 structures destroyed throughout the valley floor and extending into the Mayacamas Mountains. Neighborhoods along Warm Springs Road were leveled, and the historic grounds of the SDC sustained damage. The fire also directly impacted the District, destroying the Saddle Tank water facility and reducing the Glen Ellen Tank to only three feet of water. Historically, the Cavedale Fires of 1925 and 1966 are considered "ancestor" fires, as they followed almost the same path as the Nuns Fire.

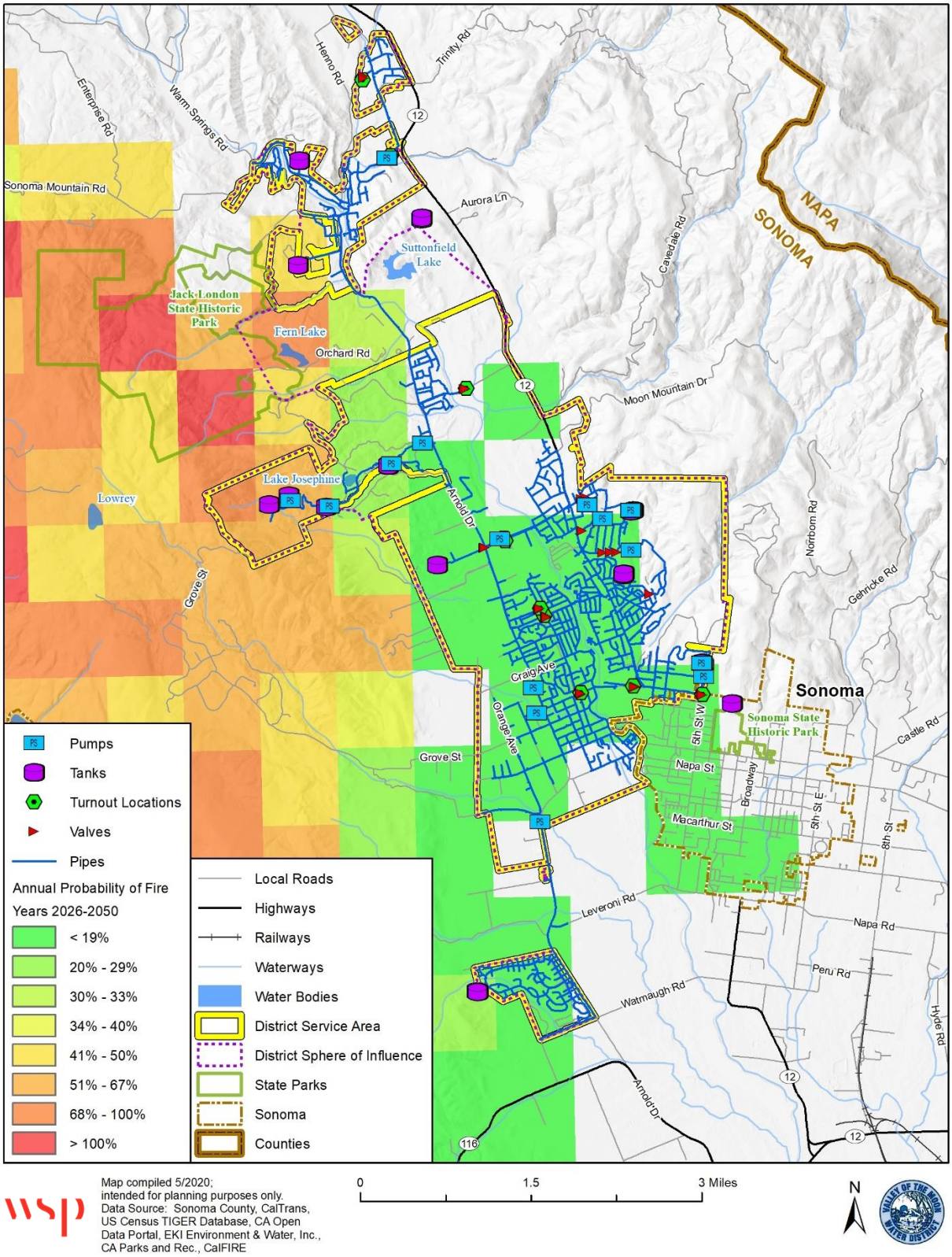
While north of the District, the Hanly Fire of 1964 also set a precedent by illustrating how wildfires can leap between Napa and Sonoma counties over the Mayacamas ridge, a pattern repeated by later events such as the 2017 Tubbs Fire. While the Tubbs Fire was north of the Valley, it travelled southwest and eventually merged with the Nuns Fire to create the 2017 Sonoma Complex Fires. In February 2025, severe storms in Sonoma County triggered landslides and flooding, including a landslide in Santa Rosa's Rincon Valley on the Tubbs Fire burn scar that trapped residents and forced home evacuations.

The Glass Fire of 2020, which began in Napa County, quickly spread across the ridgeline into the Oakmont area and eastern Santa Rosa, posing a direct threat to the northern entrance of the Valley of the Moon. The fire occurred in areas that had been largely untouched by previous major fires in recent years, specifically avoiding the burn footprints of the 2017 Tubbs, Nuns, and Atlas fires that surrounded the area. This fire burned into Sugarloaf Ridge State Park and Trione-Annadel State Park, destroying vegetation that had managed to survive the 2017 fires.

Probability of Future Occurrences

Highly Likely – A widely damaging wildland fire within the District's boundaries is considered to be unlikely, although increasing record-high temperatures accompanied by low humidity, strong winds, and drought conditions could worsen the likelihood of fires in the Planning Area in the future. Based on the CAL FIRE Probability and Carbon Accounting mapping, which is based on Mann et al.'s projections for the years 2026-2050 (shown on Figure 4-20 below), the annual probability of fire occurrence is low within most of the District. The northwest corner has a slightly higher probability. The areas west of the District's boundaries are considered to be 41 percent probability and greater in some areas. Nonetheless, given the high probability of a wildfire outside the District's Planning Area and the past occurrences, there is a highly likely probability of a future event to directly affect District infrastructure and surface water supply.

Figure 4-20 Annual Wildfire Probability in the Valley of the Moon Water District, 2026-2050



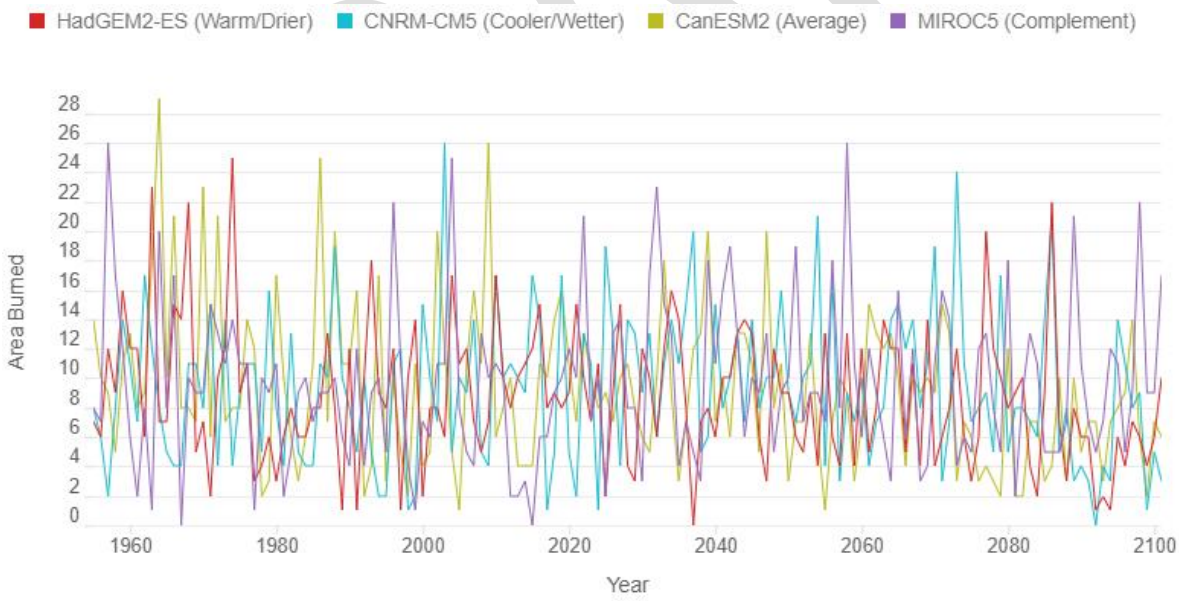
Climate Change Considerations

Rising GHG emissions, combined with ongoing population growth and development, are projected to continually affect California's forests and natural resources. Climate change will not only alter wildfire behavior, but also influence the frequency of ignitions, fire management practices, and the accumulation of fuels. As temperatures climb, the threat and vulnerability to wildfires will intensify, particularly in the grasslands surrounding the Planning Area, as well as in wildlands across Sonoma County.

While the precise impact of climate change on overall precipitation remains uncertain, current models indicate a likelihood of wetter conditions in northern California and drier conditions in the south (California Natural Resources Agency 2018). Forests are highly sensitive to fluctuations in precipitation and extended droughts, such as the severe multi-year drought from 2012 to 2017, which led to widespread tree mortality, including from pests and diseases like Sudden Oak Death, as warmer temperatures stressed trees and increased their vulnerability to pathogens (California Natural Resources Agency 2018). In Sonoma County, wildfire risk is expected to rise due to climate change driving drier conditions, more frequent droughts, and higher temperatures over a prolonged fire season (SCWA 2015).

Cal-Adapt has developed wildfire risk projections using statistical models based on historical climate data, vegetation, population density, and fire history. These simulations, which informed California's Fourth Climate Change Assessment, utilized four distinct climate models: a warm/dry scenario (HadGEM2-ES), a cooler/wetter scenario (CNRM-CM5), an average scenario (CanESM2), and a model representing conditions most divergent from the others (MIROC5) to ensure a comprehensive range of possible outcomes. The results of these wildfire risk simulations depicting modeled annual averages of area burned in the District under RCP 8.5 is illustrated in Figure 4-21.

Figure 4-21 Future Annual Averages of Acres Burned in the Valley of the Moon Water District under High Emission Scenarios



Source: Cal-Adapt 2020

Sonoma County's 2016 RCAP projects that climate change will drive more frequent and severe wildfires in the region. Increasing dryness of vegetation exacerbated by robust spring plant growth will elevate these risks. According to RCAP data, the likelihood of experiencing at least one wildfire within a 30-year period is expected to climb from 15–20 percent to 25–33 percent in the county's mountainous areas by the end of the century. Notably, these projections were made before the major firestorms of 2017, 2018, and 2020. Climate change is therefore expected to have a high influence on future wildfire impacts.

Vulnerability Assessment

People

Wildfires near the Russian River in northwestern Sonoma County could degrade water quality in Lake Sonoma, the primary source of supply for Sonoma Water, thereby affecting the District's ability to receive imported water. Wildfire-related damage to power and communications infrastructure may also disrupt pumping operations, including BPSs, leading to service interruptions and reduced system reliability. While the District supplies water to support firefighting activities for the Sonoma Valley and Glen Ellen Fire Departments, its infrastructure is designed primarily for urban fire suppression and not for large wildfires. As a result, wildfire events may strain system capacity and impact water availability for customers and emergency response.

Property

Wildfire poses a significant threat to the District's infrastructure, operations, and ability to provide safe and reliable water service. During the fire season, dry vegetation, hot and sometimes windy conditions, and increasing development elevate ignition risk and the potential for rapidly spreading, high-intensity fires. Wildfires can damage or disable BPSs, power supply, communications networks, and physical security features, limiting the District's ability to maintain system pressure and meet both domestic and firefighting demands simultaneously. Loss of pressure during fire events may also allow superheated gases to enter plastic mains and services, creating water quality risks such as benzene contamination that could require extensive system flushing or pipe replacement. In addition, fire-related damage or restricted access to facilities can delay operations and maintenance response, while post-fire runoff may introduce ash, chemicals, or heavy metals into groundwater supplies. These impacts could disrupt service to customers and businesses and impair the fire departments that depend on the District's water system for structure fire suppression, affecting public health, safety, and the community's overall resilience.

The CAL FIRE-produced FHSZs within LRAs and SRAs displayed in Figure 4-12 and 4-13, were used to assess general wildfire risk in the Planning Area. The District's asset inventory was used to identify the locations of each asset and overlaid with the CAL FIRE FHSZs in LRAs, ranked by severity to determine general risk based on the severity rank categorization, all in GIS. Through this process each asset was identified as either "in" a fire threat layer of type "moderate severity," "high severity," or "very high severity," or "out" of any of these fire threat categories (e.g. in Urban Unzoned or Non-Wildland/Non-Urban areas). Assets falling in the FHSZs are listed in Table 4-36 along with a summary of all replacement values. Using a similar methodology, assets at risk to wildfire in SRAs were also analyzed. Both analyses are shown in

The Walbridge Fire in northern Sonoma County started on August 17, 2020. It burned 55,209 acres west of Healdsburg within Dry Creek Valley. The smoke contributed to several weeks of extremely poor air quality in Sonoma Valley and the surrounding Bay Area. The Walbridge Fire was part of the larger LNU Lightning Complex Fire that contained the Hennessey, Gamble, 15-10, Spanish, Markley, 13-4, and 11-16 fires, which spread across five counties to the east and burned approximately 363,220 acres. During the same time, parts of Sonoma Valley were without electricity due to planned power shutoffs.

Photo Credit: John Burgess/The Press Democrat 2020

Figure 4-19 and Figure 4-20 above, which illustrates the areas surrounding the District pose a moderate to very high threat and high annual fire probability.

Critical Water Facilities and Infrastructure

Damages to the water supply and distribution assets could have significant impacts on the District's ability to serve customers primarily due to damage to physical water assets and access controls. The fire threat for the District, as shown in Figure 4-19 ranges from moderate to very high. In total, 90 of the District's assets with a combined replacement value of $20 million are located within these fire threat areas. Two water tanks, Temelec 1 and Temelec 2, are both located in very high threat areas. The District has a history of being directly impacted by wildfires. During the October 2017 Sonoma Fires the District's Saddle Tank was destroyed by the fire (EKI 2018). The Glen Ellen Tank, in the northeast portion of the District is also located in a high fire threat area, and experienced direct damages in 2017, draining it to only 3 feet. The Sonoma Aqueduct, while not a District owned asset, is surrounded by areas of moderate to very high fire threat. Further, any impacts to the Sonoma Aqueduct would directly impact the District's ability to supply water to customers, particularly given the limited back-up water supply.

The FHSZs and asset overlay analysis described above yielded the following results. In total there are 19 assets that fall within FHSZs in the LRAs, shown in Table 4-36. In terms of SRAs, 71 assets are located in FHSZs, as listed in Table 4-37.

Table 4-36 Assets in Fire Hazard Severity Zones within Local Responsibility Areas

LRA FHSZ	Asset Type	Count	Replacement Value
Very High	Turnout Location	1	$250,000
	Total	**1**	**$250,000**
High	Turnout Location	1	$250,000
	Total	**1**	**$250,000**
Moderate	Monitoring & Controls	4	$183,270
	Power	4	$248,869
	Pump	3	$206,740
	Tank	1	$2,339,277
	Turnout Location	3	$750,000
	Valve	1	$129,512
	Well	1	$1,500,000
	Total	**17**	**$5,357,668**
	Grand Total	**19**	**$5,857,668**

Source: Valley of the Moon Water District, CAL FIRE - LRA as recommended

Table 4-37 Assets in Fire Hazard Severity Zones within State Responsibility Areas

SRA FHSZ	Asset Type	Count	Replacement Value
Very High	Building	1	$9,173
	Monitoring & Controls	14	$428,792
	Power	8	$374,791
	Pump	11	$378,758
	Tank	10	$4,318,434
	Valve	1	$20,300
	Well	3	$4,500,000

SRA FHSZ	Asset Type	Count	Replacement Value
	Total	**48**	**$10,030,249**
High	Monitoring & Controls	5	$140,554
	Power	2	$105,002
	Pump	2	$126,268
	Tank	3	$2,632,988
	Turnout Location	2	$500,000
	Valve	1	$30,300
	Total	**15**	**$3,535,111**
Moderate	Building	1	$8,190
	Monitoring & Controls	2	$66,060
	Power	1	$42,788
	Pump	3	$96,656
	Tank	1	$39,645
	Total	**8**	**$253,339**
	Grand Total	**71**	**$13,818,699**

Source: Valley of the Moon Water District, CAL FIRE - SRA Effective April 1, 2024, WSP Analysis

A wildfire in the Russian River system could also result in cascading impacts on Sonoma Water's ability to provide drinking water to its service area and to the District. The intense heat of wildfire could modify the soil structure, which may result in hydrophobic soils that do not allow rainfall to infiltrate into the ground, which may result in increased runoff. These soil types, in combination with the lack of tree canopy and the relative slope around each reservoir (Lake Sonoma and Lake Mendocino), would increase runoff and erosion into the water supply system. Increased erosion would result in property loss, mobilize nutrients, create turbidity, reduce storage, and could potentially deposit debris in the riverbed causing flooding. This vulnerability could be further exacerbated by increased frequency of drought and flooding as a result of climate change (Sonoma Water 2018). Increased turbidity in the Russian River as a result of wildfires could also decrease overall water quality, which could potentially impact the diversion system and District's ability to deliver safe water supply. There is minimal vulnerability to Sonoma Aqueduct from fire because the piping is buried and constructed of fire-resistant materials consisting of mostly steel and concrete. The District's 2026 RRA references how fire-related damage to the transportation network can disrupt delivery of treatment chemicals, which will further threaten the District's ability to maintain safe drinking water.

Economy

Wildfires can directly damage critical infrastructure and disrupt system operations. Many of the District's assets are exposed to wildfire impacts, particularly in areas where facilities are located near WUI zones. Extreme heat from fires can damage pipelines, electrical components, and other equipment, leading to costly repairs or replacement. Wildfires may also damage electrical transmission infrastructure, resulting in prolonged power outages that disrupt pumping and water distribution and District revenues. In addition, utilities may implement PSPS during periods of high wildfire risk, which can temporarily interrupt power to water system facilities. These outages can require the District to rely on backup generators, increasing fuel, maintenance, and labor costs.

Historic, Cultural, and Natural Resources

A wildfire event near the Russian River would significantly impact Sonoma Water's ability to supply water to the District. Post-fire sedimentation or landslides into Lake Sonoma, the main supply for the Russian

River and the District would impact the Lake's water quality due to the increased sediment, dissolved organic carbon, metals and nutrients to waterways (SCWA 2018). In addition to threatening the water supply and quality for the District's customers, it could also impact sensitive and critical habitat, as well as potential impacts to the endangered and threated species in the watershed.

Recent and Future Development

Over the past five years, the District's development and infrastructure improvements have been minimal and largely remained within already developed areas, minimizing exposure to wildfire hazards. As a result, recent development has not significantly increased the District's vulnerability to wildfire impacts. Planned expansion and infrastructure projects are expected to follow current engineering standards and siting practices that account for wildfire risk. While some future facilities may be located near WUI interface zones, such as the SDC Campus, appropriate design, mitigation measures, and operational planning are expected to limit additional vulnerability. Additionally, if the SDC water sources are brought back on-line, they would represent additional fire-fighting capabilities both on the potable water side (hydrants), and on the raw-water/lake side (fire-fighting aircraft supply).

Risk Summary

- The level of wildfire risk will likely increase in the future due to the effects of climate change, and as the District assesses and monitors the level of risk, they will adjust the emergency preparedness and hazard mitigation efforts accordingly.
- Wildfires are expected to have a probability of occasional occurrence in the future, given the local fuel, topography, and weather conditions and the extent of the WUI. Based on recent CAL FIRE future fire occurrence probability mapping, portions of the District are expected to have a moderate to high likelihood of fire from years 2026 to 2050.
- The fire threat for the District ranges from moderate to very high and a total of 90 of the District's critical water assets with a replacement value of $19.6 million dollars, are located within these fire threat areas.
- Wildfires could cause post-fire sedimentation or landslides into Lake Sonoma, a main source of water supply for the District, which could have devasting impacts on water quality and the Sonoma Water's ability to supply water to the District.
- The overall risk significance of wildfire hazards to the District is **High.**

4.4 Human-Caused and Human-Health Hazard Profiles and Risk Assessment

The DMA does not require an assessment of human-caused or human-health hazards, but the District and HMPC decided to include human-caused hazards in this LHMP for several reasons. First, the District wants to inform the public about all hazards, including both natural and human-caused hazards given the past COVID-19 pandemic and other public health hazards. The District also intends to take a proactive approach to disaster preparedness, and the HMPC feels that preparation for and response to a major human-health event involves the same training and commitment of District resources as a natural hazard.

The District also recognizes that while Sonoma County has several public health programs in place, as a major water utility it is equally important to highlight the potential public health hazards present in the District's Planning Area in this plan for the purpose of public education and awareness. Similarly, the District wants to make certain its water customers are aware of the cyber security measures they have in place to protect water supply and water quality. The District also wants to ensure that human health hazards do not exacerbate secondary impacts associated with natural hazard events.

The following human-caused and human-health hazards are discussed in this plan:

- Cyber Threats/Cyber Security
- Public Health Hazards

Other potential human-caused hazards, such as hazardous materials, cyber threats, and terrorism threats, were dismissed from further study. The District and HMPC noted that most human-caused hazards are adequately covered by the planning mechanisms administered by Sonoma County's Fire Prevention Division and Environmental Health Department.

4.4.1 Cyber Threats

Geographic Extent	Probability of Future Occurrences	Magnitude/ Severity	Overall Significance
Extensive	Likely	Critical	High

Hazard Description

The California SHMP identifies cyber threats as "attempts by cyber criminals to attack a government, organization, or private party by damaging or disrupting a computer or computer network, or by stealing data from a computer or computer network for malicious use." A recent survey by the United States Government Accountability Office (GAO) found that "agencies having high-impact systems identified cyber-attacks from nation-states as the most serious and most frequently-occurring threat to the security of their systems."

Cyber-attacks and threats use malicious code to alter computer operations or data. The vulnerability of computer systems to attacks is a growing concern as people and institutions become more dependent upon networked technologies. The Federal Bureau of Investigation (FBI) reports that "cyber intrusions are becoming more commonplace, more dangerous, and more sophisticated," with implications for private- and public-sector networks. It is also identified as a high-risk threat across multiple asset types for water districts, including treatment, distribution, monitoring, financial systems, and operations.

There are many types of cyber-attacks. Among the most common is a direct denial of service, or DDoS attack. This is when a server or website will be queried or pinged rapidly with information requests, overloading the system, and causing it to crash.

Malware, or malicious software, can cause numerous problems once on a computer or network, from taking control of users' machines to discreetly sending out confidential information. Ransomware is a specific type of malware that blocks access to digital files and demands a payment to release them. Hospitals, school districts, state and local governments, law enforcement agencies, businesses, and even individuals can be targeted by ransomware. A 2017 study found ransomware payments over a two-year period totaled more than $16 million. Even if a victim is perfectly prepared with full offline data backups, recovery from a sophisticated ransomware attack typically costs far more than the demanded ransom. However, recent studies found that only 54% of organizations that paid a ransom actually recovered their data (Leyden, 2025).

Cyber spying or espionage is the act of illicitly obtaining intellectual property, government secrets, or other confidential digital information, and often is associated with attacks carried out by professional agents working on behalf of a foreign government or corporation. Recent federal and industry threat assessments indicated that cyber activity has shifted beyond traditional espionage. The Cybersecurity and Infrastructure Security Agency (CISA), the Federal Bureau of Investigation (FBI), and People's Republic of China (PRC), in 2024, noted that, "PRC state-sponsored cyber actors are seeking to pre-position themselves on IT networks to enable disruptive or destructive cyberattacks against U.S. critical infrastructure, rather than solely for traditional espionage purposes." This explicitly states the shirt from espionage to cyber disruption and references the focus on critical infrastructure and the general heightened geopolitical and domestic risks.

Major data breaches, like when hackers gain access to large amounts of personal, sensitive, or confidential information, have become increasingly common. The Symantec report says over 3.2 billion credentials were stolen in 2024, with info-stealing malware accounting for 75% of these thefts. In addition to networked systems, data breaches can occur due to the mishandling of external drives, as has been the case with losses of some state employee data.

Cybercrime can refer to any of the above incidents when motivated primarily by financial gain or other criminal intent. The most severe type of attack is cyber terrorism, which aims to disrupt or damage systems in order to cause fear, injury, and loss to advance a political agenda. The District's water utilities use Supervisory Control and Data Acquisition systems (SCADA). These systems operate over telecommunication lines or radio systems, which are vulnerable to cyber security breaches, thereby leaving water utilities like the District susceptible to such activity.

Location

Extensive – Cyber disruption events can occur or impact virtually any location where computing devices are used. Incidents may involve a single location or multiple geographic areas. A disruption can have far-reaching effects beyond the location of the targeted system; disruptions that occur far outside the state can still impact people, businesses, and institutions within the District's Planning Area.

Magnitude/Severity

Critical –The extent of a cyber disruption event is variable depending on the nature of the event. A disruption affecting a small, isolated system could impact only a few functions and processes. Disruptions of large, integrated systems could impact many functions and processes, as well as many individuals that rely on those systems.

Cyber security threat levels are defined by the California SHMP in Table 4-38. Data breaches are often described in terms of the number of records or identities exposed. Cyber threats and data breaches can

also occur on municipal water systems if computer and system infrastructure and software are underfunded.

Table 4-38 Cybersecurity Threat Levels

Level	Description
Level 5: Emergency (Black)	Imminent threat to critical services, government stability, or lives of U.S. persons.
Level 4: Severe (Red)	Significant impact to public health, safety, security, economy, foreign relations, or civil liberties.
Level 3: High (Orange)	Demonstrable effect on public health, safety, security, economy, foreign relations, civil liberties, or confidence.
Level 2: Medium (Yellow)	Possible impact on health, safety, security, economy, foreign relations, civil liberties, or confidence.
Level 1: Low (Green)	Unlikely to affect health, safety, security, economy, foreign relations, civil liberties, or confidence.
Level 0: Baseline (White)	Event is unsubstantiated or inconsequential.

Source: CA SHMP, 2023

Previous Occurrences

The District noted there are potential ransomware attacks on the District's IT system on a daily basis. Specific cyber incidents were not discussed.

The Privacy Rights Clearinghouse, a non-profit organization based in San Diego, maintains a timeline of 92,185 data breaches resulting from computer hacking incidents in the United States from 2005-2025. The database lists 4,433 data breaches in California during this timeframe, including attacks on private sector facilities, government agencies, schools and media entities. While none of those security breaches were specifically targeted at systems at the District, some of them included information on individuals who live in the community. Similarly, District customers were likely affected by national and international data breaches.

While the District itself has not been the victim of major cyber or ransomware attacks, examples from across the country show both the prevalence of cyber-attacks and potential impacts. In February 2021, the Oldsmar, Florida water treatment plant experienced a cyber-attack when an unauthorized individual remotely accessed its software using TeamViewer. The attacker attempted to significantly increase the concentration of sodium hydroxide (lye) from 100 ppm to 11,100 ppm, but the change was quickly reversed by an alert operator who noticed the mouse cursor moving. In April 2013, a small town in North Georgia faced unauthorized access to its monitoring system, which allowed cyber attackers to alter the fluorine and chlorine settings. As a precaution, residents were advised not to use tap water for several days following the incident.

California has experienced several notable cyber-attacks targeting water utilities as well. In October 2024, American Water, the nation's largest water provider operating in California and 13 other states, suffered a cybersecurity breach that prompted the company to take its customer portal and billing systems offline to contain unauthorized activity. Earlier, in January 2021, the Town of Discovery Bay faced a deliberate attack when a former contractor used remote access software to uninstall critical programs essential for maintaining water pressure, filtration, and chemical levels, after he had resigned. That same month, a water treatment plant in the San Francisco Bay Area was compromised by an unidentified hacker who

accessed the system and deleted several programs used for treating drinking water. The facility was able to restore the software the following day, preventing any disruption in water service.

Probability of Future Occurrences

Likely – Cyber-attacks occur daily, but most have negligible impacts at District-level and are blocked by the District's existing cyber security systems, emergency planning programs, and redundant protocols to ensure the viability of the critical infrastructure that provides water distribution and delivery and the safety and quality of the District's water supply. The possibility of a larger disruption affecting the District exists at all times, but it is difficult to quantify the exact probability due to such highly variable factors as the type of attack and intent of the attacker. Minor attacks against business and government systems have become commonplace occurrences but are usually stopped with minimal impact. Similar data breaches impacting the information of residents are almost certain to happen in coming years. Major attacks or breaches specifically targeting systems in the county are less likely but cannot be ruled out.

Climate Change Considerations

Climate change is not expected to have any direct impact on the vulnerability of the District's cyber security systems to an attack.

Vulnerability Assessment

People

Cyber-attacks can have a significant cumulative economic impact. A major cyber-attack has the potential to undermine public confidence and build doubt in their government's ability to protect them from harm. Injuries or fatalities from cyber-attacks would generally be a cascading result of specific system failure (i.e. injuries or fatalities caused by secondary incidents due to a compromised traffic light system) or a compromised electrical grid. Cyber-attacks may also disable access controls to the District's main administrative building, allowing unauthorized entry. Such a break-in to the District's facilities could result in assaults on office and operations staff, and result in critical IT/OT hardware, or theft of data (VOMWD 2026). Cyber-attacks to SCADA systems could also disable arms, alter chemical processing, or result in water outages or public health hazards (VOMWD 2026). Further, the loss of control over monitoring systems may prevent detection of low or high chlorine levels, which can increase the risk of bacteriological contamination or potential chemical exposure (VOMWD 2026). Refer to the Vulnerability Assessment under Section 4.3.7 High Winds for details on vulnerable populations, such as the number of Medicare beneficiaries that are electricity dependent in Sonoma Valley.

Critical Facilities and Infrastructure

Critical facilities, infrastructure and systems can make inviting targets for cyber threats, with the potential to cause widespread and damaging impacts. Ultimate impacts of a cyber-attack depend on both the method and success of the cyber-attack, as well as the type of critical asset affected. Most attacks affect only data and computer systems. Sabotage of utilities and infrastructure from a major cyber terrorist attack could potentially result in system failures that damage property on a scale equal with natural disasters. Facilities and infrastructure may become unusable as a result of a cyber-attack.

As previously noted, the District relies on SCADA systems to monitor and control critical operations such as water treatment, pumping stations, reservoir levels, and distribution networks. While these systems improve efficiency and reliability, they also present a growing target for cyber-attacks. Because SCADA networks often connect operational equipment to government IT networks or remote access systems, attackers may exploit vulnerabilities such as outdated software, weak authentication, or unpatched

devices to gain access. A successful cyber intrusion could allow an attacker to disrupt water delivery, manipulate treatment processes, or interfere with monitoring systems that ensure water quality and public safety. Therefore, while the District has implemented many priority cybersecurity practices, continued progress is needed to reduce exposure from removable media and insider threats.

Economy

According to the District's 2026 RRA, cyber threats can compromise monitoring systems that detect chlorine levels and bacteriological contamination, which if impacted could affect business's ability to provide drinking water to customers. Cyber threats would also affect District billing and financial systems, which could disrupt revenue collection, and therefore impair the District's ability to sustain operations during an emergency.

Historic, Cultural, and Natural Resources

Cyber threats are not expected to have any direct or indirect impacts on the vulnerability of cultural or natural resources.

Recent and Future Development

Traditionally, cyber threats should not have any bearing on recent and planned or potential future development. The prevalence and evolution of cyber threats do require continued District efforts to upgrade security systems and integrate redundant programs and protocols to meet evolving threats and safeguard the community's water supply. Recent development since the last plan update has not changed the District's vulnerability to cyber threats.

Risk Summary

- District systems are attacked multiple times a day; most attacks thwarted by existing security systems
- The District is proactive in cybersecurity and cyber prevention measures.
- Evolving cyber threats require a matching evolution in protection and deterrence techniques to match the threat.
- While the District hasn't suffered a specific, large-scale cyber infiltration, examples from around the world show how devastating these types of attacks can be on communities.
- Successful cyber incidents can have a variety of impacts, based on the targeted system(s), attack type, attack goals, and ultimate success of the attack.
- Cyber threats pose a systemwide risk to District operations, public health, and financial stability, with the potential to compromise SCADA systems, disable alarms and monitoring, alter chemical use or pump operations, disrupt water service, and interrupt billing and revenue collection.
- Cyber threats may also strain staff resources during response and recovery, compounding impacts during concurrent emergencies such as wildfire or earthquake.
- The significance of cyber threats is **High.**

4.4.2 Public Health Hazards: Disease/Pandemic/Epidemic

Geographic Extent	Probability of Future Occurrences	Magnitude/ Severity	Overall Significance
Extensive	Occasional	Critical	High

Hazard Description

A public health emergency is defined as an emergency need for health care or medical services to respond to a disaster, significant outbreak of an infectious disease, bioterrorist attack or other significant or catastrophic event. Public health emergencies can occur as primary events by themselves, or they may be secondary to another disaster or emergency, such as tornadoes, floods, or hazardous material incidents.

Public health emergencies have the potential to cause serious illness and death, especially among those who have compromised immune systems due to age or underlying medical conditions. There are several contagious and infectious diseases present in Sonoma County that constitute a public health risk. The Sonoma County Emergency Operations Plan (EOP) provides an organizational framework for public health and medical service preparedness, response, and recovery efforts for various emergency epidemics.

A pandemic can be defined as a disease that attacks a large population across great geographic distances. Pandemics are larger than epidemics in terms of geographic area and number of people affected. Epidemics tend to occur seasonally and affect much smaller areas. Pandemics, on the other hand, are most often caused by new subtypes of viruses or bacteria for which humans have little or no natural resistance. Consequently, pandemics typically result in more deaths, social disruption, and economic loss than epidemics.

There are three conditions that must be met before a pandemic begins:

1. A new virus subtype must emerge that has not previously circulated in humans (and therefore there is no pre-existing immunity),
2. This new subtype must be able to cause disease in humans, and
3. The virus must be easily transmissible from human to human.

Geographic Location

Extensive – Pandemics occur not only on a county or state level, but on a national and global scale. It is likely that most communities in Sonoma County would be affected, either directly or by secondary impacts. More highly-populated areas may be affected sooner and may experience higher infection rates.

Magnitude/Severity

Critical – The magnitude of a public health emergency will range significantly depending on the aggressiveness of the virus in question and the ease of transmission. Pandemic influenza is more easily transmitted from person-to-person but advances in medical technologies have greatly reduced the number of deaths caused by influenza over time.

Today, a much larger percentage of the world's population is clustered in cities, making them ideal breeding grounds for epidemics. Additionally, the explosive growth in air travel means the virus could literally spread around the globe within hours. Under such conditions, there may be very little warning

time. Outbreaks are expected to occur simultaneously throughout much of the nation, preventing shifts in human and material resources that normally occur with other natural disasters. These and many other aspects make influenza pandemic unlike any other public health emergency or community disaster. Pandemics typically last for several months to 1-2 years.

The Pandemic Intervals Framework (PIF) is a six-phased approach to defining the progression of an influenza pandemic. This framework is used to guide influenza pandemic planning and provides recommendations for risk assessment, decision-making, and action. These intervals provide a common method to describe pandemic activity which can inform public health actions. The duration of each pandemic interval might vary depending on the characteristics of the virus and the public health response.

The six-phase approach was designed for the easy incorporation of recommendations into existing national and local preparedness and response plans. Phases 1 through 3 correlates with preparedness in the **pre-pandemic interval**, including capacity development and response planning activities, while Phases 4 through 6 signal the need for response and mitigation efforts during the **pandemic interval**.

Pre-Pandemic Interval

- **Phase 1** is the natural state in which influenza viruses circulate continuously among animals but do not affect humans.
- **Phase 2** involves cases of animal influenza that have circulated among domesticated or wild animals and have caused specific cases of infection among humans.
- **Phase 3** represents the mutation of the animal influenza virus in humans so that it can be transmitted to other humans under certain circumstances (usually very close contact between individuals). At this point, small clusters of infection have occurred.

Pandemic Interval

- **Phase 4** involves community-wide outbreaks as the virus continues to mutate and become more easily transmitted between people (for example, transmission through the air)
- **Phase 5** represents human-to-human transmission of the virus in at least two countries
- **Phase 6** is the pandemic phase, characterized by community-level influenza outbreaks.

Previous Occurrences

Since the early 1900s, five lethal pandemics have swept the globe:

- **1918-1919 Spanish Flu:** The Spanish Flu was the most severe pandemic in recent history. The number of deaths was estimated to be 50-100 million worldwide and 675,000 in the United States. Its primary victims were mostly young, healthy adults. At one point, more than 10 percent of the American workforce was bedridden.
- **1957-1958 Asian Flu:** The 1957 Asian Flu pandemic killed 1-2 million people worldwide, including about 70,000 people in the United States, mostly the elderly and chronically ill. Fortunately, the virus was quickly identified, and vaccine production began in May 1957.
- **1968-1969 H3N2 Hong Kong Flu:** The 1968 Hong Kong Flu pandemic killed 34,000 Americans. Again, the elderly were more severely affected. This pandemic peaked during school holidays in December, limiting student-related infections, which may have kept the number of infections down. Also, people infected by the Asian Flu ten years earlier may have gained some resistance to the new virus.
- **2009-2010 H1N1 Swine Flu:** This influenza pandemic emerged from Mexico in early 2009 and was declared a public health emergency in the U.S. on April 26. By June, approximately 18,000 cases had been reported in the U.S. and the virus had spread to 74 countries. Most cases were fairly mild, with symptoms similar to the seasonal flu, but there were cases of severe disease requiring hospitalization

and a number of deaths. The Center for Disease Control (CDC) estimates that 43-89 million people were infected worldwide, with an estimated 8,870 to 18,300 H1N1 related deaths, including 12,469 deaths in the United States.

- **2020-2023 COVID-19:** This coronavirus pandemic was first detected in Wuhan, China, in late 2019 and was declared a Public Health Emergency in the U.S. on January 31, 2020. By April 2020, the virus had spread to nearly every country, with the U.S. reporting over 1 million confirmed cases and more than 20,000 deaths by the end of that month. While many experienced mild to moderate respiratory symptoms, the disease frequently caused severe illness, pneumonia, and multi-organ failure, particularly in older adults and those with underlying conditions. The World Health Organization (WHO) and CDC estimate that over 774 million people were infected worldwide, resulting in more than 7 million global deaths, including over 1.1 million deaths in the United States.

The California Department of Public Health and Environment releases an annual reportable disease summary for each county. Communicable diseases recorded in Sonoma County between 2014 and 2023 are summarized in Table 4-39. As shown, common communicable diseases in Sonoma County include Campylobacteriosis, Giardiasis, Lyme Disease, and Salmonellosis. Campylobacteriosis is a common bacteria infection in humans; it is often a food-borne illness. Giardiasis is a diarrheal disease caused by the microscopic parasite Giardia. Once a person has been infected with Giardia, the parasite lives in the intestines and is passed in feces. Lyme disease is a bacterial infection you get from the bite of an infected tick. Salmonellosis is also a common bacterial disease that affects the intestinal tract; humans become infected through contaminated food and water.

Table 4-39 Annual Cases of Communicable Diseases in Sonoma County: 2014 – 2023

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Grand Total
Anaplasmosis	-	-	2	2	-	-	6	2	2	2	**16**
Babesiosis	-	-	-	-	-	-	-	-	-	2	**2**
Botulism, Wound	2	-	-	-	-	-	-	-	-	-	**2**
Brucellosis	-	2	-	2	2	-	-	2	-	2	**10**
Campylobacteriosis	280	104	120	368	382	374	220	238	214	384	**2,684**
Chikungunya Virus Infection			-	-	-	-	-	-	-	2	**2**
Coccidioidomycosis	10	2	4	6	6	24	14	40	20	30	**156**
Creutzfeldt-Jakob Disease and other Transmissible Spongiform Encephalopathies	2	-	2	2	-	2	-	2	4	-	**14**
Cryptosporidiosis	8	10	6	14	12	14	10	14	16	20	**124**
Cyclosporiasis	-	-	-	-	2	-	-	-	-	2	**4**
Cysticercosis or Taeniasis	-	2	-	-	-	-	-	-	2	-	**4**
Dengue Virus Infection	10	-	4	2	-	8	10	-	-	8	**42**
Giardiasis	78	100	64	86	98	144	60	52	84	102	**868**
Hemolytic Uremic Syndrome	8	-	4	-	4	8	2	4	2	-	**32**
Hepatitis E, acute infection	12	2	4	6	2	4	-	-	2	4	**36**
Legionellosis	-	2	14	12	10	6	8	10	2	14	**78**
Leptospirosis	-	-	-	2	-	-	2	-	-	2	**6**
Listeriosis	6	2	6	2	4	2	-	2	6	4	**34**
Lyme Disease	24	26	30	38	22	20	-	8	10	22	**200**
Malaria	-	-	-	6	-	-	-	-	-	4	**10**
Paralytic Shellfish Poisoning	-	-	-	-	2	-	-	-	-	-	**2**
Q Fever	-	6	2	-	2	2	4	4	-	-	**20**
Relapsing Fever	-	-	-	2	-	-	4	-	-	-	**6**
Salmonellosis	120	116	118	160	166	122	114	106	137	210	**1,369**
Scombroid Fish Poisoning	-	-	-	-	-	-	-	2	-	-	**2**

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Grand Total
Shiga toxin-producing E. coli (STEC) with HUS	6	-	2	-	4	8	2	4	2	-	**28**
Shiga toxin-producing E. coli (STEC) without HUS	48	54	50	70	100	148	63	76	96	140	**845**
Shigellosis	22	20	24	70	142	102	50	34	54	98	**616**
Spotted Fever Rickettsiosis	-	-	2	-	-	-	-	-	-	2	**4**
Tularemia	-	2	-	-	-	-	-	2	-	-	**4**
Typhoid Fever, case	-	-	2	2	-	2	-	-	2	-	**8**
Vibrio Infection (non-Cholera)	10	10	6	8	4	20	4	8	14	12	**96**
Yersiniosis	-	-	2	-	2	2	2	2	12	14	**36**
Zika Virus Infection			20	14	2	2	-	-	-	-	**38**
Grand Total	**646**	**460**	**488**	**874**	**968**	**1,014**	**575**	**612**	**681**	**1,080**	**7,398**

Source: California Department of Public Health 2024.

Probability of Future Occurrences

Occasional – Even before the COVID-19 pandemic began, the California Department of Public Health (CDPH) considered a pandemic to be inevitable. However, there is no definite way to predict when the next pandemic might happen. Some indicators will be present, but not every new virus turns into a pandemic. Based on the five pandemics that have affected the United States in roughly the last 100 years, a pandemic occurs on average roughly every 20 years.

Climate Change Considerations

There is no direct evidence that climate change is influencing the spread of public health hazards, or the spread of COVID-19. Climate change does alter how we relate to other species, and that can affect human health and risk for infections. Many of the root causes of climate change can also increase the risk of pandemics (Bernstein 2020). Deforestation is the largest loss of habitat worldwide, and this loss forces animals to migrate and potentially contact other animals or people and spread germs. Large livestock can serve as a source for spillover infections from animals to people (Bernstein 2020). Climate change has also made conditions more favorable to the spread of some infectious diseases, including Lyme disease, waterborne diseases, and mosquito-borne diseases, such as malaria and dengue fever. In summary, future risks associated with climate change are difficult to predict, but it impacts when and where pathogens appear, particularly related to temperature and rainfall patterns. As a result, climate change is expected to have a low influence on public health hazards.

Vulnerability Assessment

Although the District's water facilities and infrastructure would not be directly affected by a public health hazard, or a pandemic, access to facilities and infrastructure in the area of the incident may be restricted or denied until decontamination and disinfection is complete and it is safe to access.

People

Public health hazards can significantly affect the District's workforce by limiting staff availability, restricting access to facilities, and increasing operational demands related to monitoring, testing, and safety protocols. During the COVID-19 pandemic, the District demonstrated its ability to maintain continuity of water operations by implementing remote work for administrative, engineering, and customer service functions, while field and operations staff continued on-site work under enhanced health and safety measures. These adaptations allowed essential water supply and distribution services to continue without interruption. If future public health emergencies occur, the District has the experience and capacity to again rely on remote operations where feasible, staggered staffing, and cross-training to ensure critical functions are maintained while protecting employee health and safety.

Critical Facilities and Infrastructure

Public health hazards may disrupt water supply and distribution operations when key facilities are taken temporarily offline for increased testing, precautionary monitoring, or response activities. Such disruptions can delay the delivery of essential services, including potable water, particularly when access to facilities or work sites is restricted due to concerns about environmental exposure, such as water-borne disease. In these situations, facilities may remain inaccessible until appropriate safety protocols are established, and remediation, sanitization, and enhanced hygiene practices are implemented.

Economy

Public health hazards can economically impact the District by increasing operational costs associated with emergency testing, treatment, staffing, and regulatory compliance, while reducing revenue if service

disruptions or payment delays occur. These impacts can ripple through the local economy by affecting businesses, healthcare facilities, and other sectors that rely on reliable water service, resulting in lost productivity and increased public health–related expenses.

Historic, Cultural, and Natural Resources

Public health hazards are not expected to result in any direct impacts on historic or cultural resources. Preliminary studies did indicate that shelter-in-place restrictions during the early stages of the COVID-19 pandemic may have improved habitat conditions for wildlife given there were less cars on the roads and fewer people outside.

Recent and Future Development

Recent development in the Planning Area has not increased enough to affect the transmission of public health hazards. However, future development has the potential to change how infectious diseases spread through the community and impact human health in both the short and long term, and this is dependent on the amount of population growth. For example, new development may increase the number of people and care facilities exposed to public health hazards. In general, greater population concentrations (often found in special needs facilities, businesses, school campuses) put more people at risk.

Population growth and development contribute the greatest to pandemic exposure. As populations increase and the cost of health care increases, potential losses can be expected to rise. It is also possible that infrastructure may not be able to be maintained as necessary during a pandemic because of a significantly decreased workforce. However, the development has not substantially changed since the last plan update to alter the District's vulnerability to public health hazards.

Risk Summary

- Pandemics occur on a national and global scale, and it is likely that most communities in Sonoma County would be affected, either directly or by secondary impacts. More highly-populated areas may be affected sooner and may experience higher infection rates.
- The Pandemic Intervals Framework (PIF) is a six-phased approach to defining the progression of an influenza pandemic. Phases 1 through 3 correlates with preparedness in the pre-pandemic interval, including capacity development and response planning activities, while Phases 4 through 6 signal the need for response and mitigation efforts during the pandemic interval.
- Common communicable diseases in Sonoma County include Campylobacteriosis, Giardiasis, Lyme Disease, and Salmonellosis.
- Five lethal pandemics have occurred since the early 1900s: 1918-1919 Spanish Flu, 1957-1958 Asian Flu, 1968-1969 H3N2 Hong Kong Flu, 2009-2010 H1N1 Swine Flu, and the COVID-19 Pandemic.
- Based on the five pandemics that have affected the United States in roughly the last 100 years, a pandemic occurs on average roughly every 20 years.
- When disruptions related to public health hazards impact key water supply and distribution facilities and result in critical facilities being temporarily offline, they may postpone the delivery of essential services, such as water supply.
- The significance of public health hazards is **High.**

5 MITIGATION STRATEGY

44 U.S. CFR Requirement §201.6(c)(3): [The plan shall include] a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.

This section describes the process to develop the mitigation strategy for the Valley of the Moon Water District (District) Local Hazard Mitigation Plan (LHMP). It describes how the District met the requirements for the Federal Emergency Management Agency (FEMA) 9-step planning process. This chapter specifically discusses Planning Step 6: Develop a Mitigation Strategy.

The results of the planning process, the risk assessment, the goal setting, the identification of mitigation actions, and the participation of the Hazard Mitigation Planning Committee (HMPC) led to the action plan documented in Section 5.3 Mitigation Action Plan. Taking all the above into consideration, the HMPC developed the following overall mitigation strategy:

- **Communicate** the hazard information collected and analyzed through this planning process so that the District's customers better understand what can happen in the service area and what they can do to be better prepared.
- **Implement** the mitigation actions and recommendations of this plan.
- **Use** existing policies, water supply and capital improvement plans, and safety procedures already in existence.
- **Monitor** multi-objective management actions so that funding opportunities may be shared, projects may be packaged, and broader constituent support may be garnered among neighboring communities and entities.

5.1 Goals and Objectives

44 U.S. Code of Federal Regulations Requirement §201.6(c)(3)(i): The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.

Up to this point in the planning process, the HMPC has organized resources, assessed hazards and risks, and documented mitigation capabilities. The resulting goals and mitigation actions were developed based on these tasks. The HMPC held a series of meetings and exercises designed to achieve a collaborative mitigation strategy as described further throughout this section.

During the initial goal-setting meeting, the HMPC reviewed the results of the hazard identification, vulnerability assessment, and capability assessment. This analysis of the risk assessment identified areas where improvements could be made and provided the framework for the HMPC to formulate planning goals and objectives and the ultimate mitigation strategy for the District's Planning Area.

5.1.1 Goals Development Process

Goals were defined for the purpose of this mitigation plan as broad-based public policy statements that:

- Represent basic desires of the District, water customers, and the Sonoma Valley community;
- Encompass all aspects of community, public and private;
- Are nonspecific, in that they refer to the quality (not the quantity) of the outcome;
- Are future-oriented, in that they are achievable in the future; and

- Are time-independent, in that they are not scheduled events.

Goals are stated without regard to implementation cost, schedule, and means. Goals are defined before considering how to accomplish them so that they are not dependent on the means or cost of achievement. The goal statements form the basis for objectives and actions that will be used as means to achieve the goals. Objectives define strategies to attain the goals and are more specific and measurable.

During the planning process, HMPC members were given a list of sample goals to consider from the California 2023 State Hazard Mitigation Plan (SHMP) as well as a list of goal statements from neighboring city and county hazard mitigation plans (e.g. 2026 Sonoma County Draft Multi-Jurisdictional Hazard Mitigation Plan), as well as water district plans. They were told that they could use, combine, or revise the statements provided or develop new ones, keeping the risk assessment in mind. Each member was asked to share a goal statement during the second HMPC meeting and write a goal statement in the meeting chat room. During the third HMPC meeting, the HMPC was asked to finalize these goal statement revisions by completing a *Goals Worksheet.* Based on the goal setting process, the HMPC identified the following four goals, which provide direction for reducing future hazard-related losses within the District's Planning Area.

- **Goal 1:** Increase resiliency and long-term reliability of the District's water supply system.
- **Goal 2:** Ensure continuity of water supplies during natural, human-health, and technological hazards to provide basic public health, safety, and sanitation and fire suppression needs.
- **Goal 3:** Reduce economic impacts and asset damage from hazards while positioning the District to remain eligible for FEMA grant funding for mitigation projects.
- **Goal 4:** Enhance collaboration and collaboration with regional agencies, mutual aid partners, and organizations to advance effective hazard mitigation.

5.1.2 Incorporation into Existing Planning Mechanisms

The information contained within this plan, including results from the vulnerability assessment, and the mitigation strategy will be used by the District to help inform updates and the development of local plans, programs and policies. The District may utilize the hazard information when implementing the District's 2025 WMP Update. The District may also incorporate information in this LHMP into future updates to the District's WMP and the Risk and Resilience Assessment (RRA) and Emergency Response Plan (ERP) updates. Information may include hazard profile information on climate change impacts and the incorporation of climate change adaptation strategies into other local and regional plans and outreach programs, and information on public health hazards and cyber threats. Future updates may also apply to hazard-specific studies, such as the District's Seismic Vulnerability Assessment Report.

Lastly, the HMPC representatives report on efforts to integrate the LHMP into local plans, programs, and policies and will report on these efforts at the annual HMPC plan review meeting.

5.2 Identification and Analysis of Mitigation Actions

44 U.S. Code of Federal Regulations Requirement §201.6(c)(3)(ii): The mitigation strategy shall include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.

In order to identify and select mitigation actions to support the mitigation goals, each hazard identified in Section 4.3 Hazard Profiles and Risk Assessment was evaluated, as well as human-caused and human-health hazards identified in Section 4.4 Human-caused and Human-health Hazards. The HMPC then

analyzed viable mitigation options that supported the identified goals and objectives. The HMPC was provided with the following list of categories of mitigation actions:

- **Local Plans and Regulations:** These actions include government authorities, policies, or codes that influence the way land, buildings, and infrastructure are developed and built to reduce hazard losses. This includes planning and zoning, floodplain regulations, facility development standards, capital improvement programs, open space preservation, and stormwater management regulations. These actions can also include development standards that are specific to special district facilities, such as avoiding critical water facilities and infrastructure development in hazard areas.
- **Structure and Infrastructure Projects:** These actions involve modifying existing structures and infrastructure to protect them from a hazard or remove them from a hazard area. This could apply to critical facilities and infrastructure. This type of action also involves projects to construct man-made structures to reduce the impact of hazards. This includes acquisition, elevation, relocation, structural retrofits, utility undergrounding, floodwalls, detention and retention structures, culverts, storm shutters, and shatter-resistant glass. Many of these types of actions are projects eligible for funding through the FEMA Hazard Mitigation Assistance (HMA) program.
- **Natural Systems Protection**: These actions reduce damage and losses by preserving or restoring natural systems that help protect critical water facilities. Measures may include sediment and erosion controls (such as stabilization at bridge crossings), stream corridor restoration, forest management practices (including defensible space around water storage tanks), conservation easements, and wetland restoration or preservation.
- **Education and Awareness Programs**: These actions inform and educate citizens and water utility customers, elected officials, and property owners about the hazards and potential ways to mitigate them. This includes outreach with water utility billings, hazard information kiosks, and education programs. These actions may also include participation in programs, such as StormReady or Firewise Communities.

At the third HMPC meeting, also referred to as the mitigation strategy meeting, the HMPC reviewed the four A's of mitigation: Avoid, Avert, Alter, and Adapt, which describe a progression of strategies to reduce risk from hazards. Avoid focuses on keeping people and infrastructure out of harm's way altogether through land use and siting decisions**.** Avert actions focus on preventing hazards from reaching people or assets in the first place, such as deflecting, controlling, or intercepting the hazard. Alter actions accept that exposure may occur and instead modify infrastructure, systems, or conditions to reduce damage and consequences when the hazard happens. Adapt recognizes that some risk remains and emphasizes building resilience, so communities and systems can function and recover during and after hazard events.

Additionally, the HMPC reviewed a matrix showing examples of potential mitigation action alternatives for each of the above categories for each of the identified hazards. The HMPC was provided a handout that explains the categories and provided further examples. Another reference document titled "Mitigation Ideas" developed by FEMA was distributed to the HMPC during the mitigation strategy meeting. This document lists the common alternatives for mitigation by hazard. The HMPC was instructed to consider both future and existing District buildings and water infrastructure in considering possible mitigation actions.

The HMPC was also asked to consider possible climate adaptation strategies in order to comply with California Government Code Section 65302 subsection (g)(4). This code section addresses Senate Bill 379 requirements related to the probable consequences of climate change and assesses how climate change may affect critical facilities, infrastructure, and land uses. The HMPC was also provided the California Adaptation Planning Guide (APG), which includes guidance to support communities in addressing the consequences of climate change. Specific climate adaptation strategies were discussed as they relate to profiled hazards. The HMPC also discussed which mitigation actions and strategies

should be pursued first to address immediate District and customer needs associated with the continuity of service during hazard events.

A facilitated discussion took place to examine and analyze the options. Appendix B provides the matrix of alternatives considered. Each proposed mitigation action or activity was verbally discussed during the third HMPC meeting.

5.2.1 Prioritization Process

Once the mitigation actions were identified, the HMPC was provided with several decision-making tools, including FEMA's recommended prioritization criteria, STAPLEE, to assist in deciding why one recommended action might be more important, more effective, or more likely to be implemented than another. STAPLEE stands for the following:

- **Social:** Does the measure treat people fairly? (e.g., social equity, different groups, different generations)
- **Technical:** Is the action technically feasible? Does it solve the problem?
- **Administrative:** Is there adequate staffing, funding, and other capabilities to implement the project?
- **Political:** Who are the stakeholders? Will there be political and public support for the project?
- **Legal:** Does the jurisdiction have the legal authority to implement the action? Is it legal?
- **Economic:** Is the action cost-beneficial? Is there funding available? Will the action contribute to the local economy?
- **Environmental:** Does the action comply with environmental regulations? Will there be negative environmental consequences from the action?

Given the unique needs of the District as a water provider, the HMPC also discussed prioritizing actions that focus on reliability, resistance, recovery of assets, and redundancy, also referred to as the four R's. They reviewed planning materials and tools designed to assist local water districts in the development of climate adaptation and resiliency actions, including the following resilience evaluation criteria:

- **Reliability:** This criterion addresses how likely it is that the service provided by the mitigation action or project will be disrupted due to an identified natural hazard. This criterion considers the capability of an infrastructure project to maintain operations under a range of conditions.
- **Resistance:** This criterion addresses how likely it is that the mitigation action or project will be damaged due to one or more of the identified natural hazards. This criterion considers the physical protection of the infrastructure project.
- **Recovery of Assets:** This criterion considers the cost is to resume service following exposure to the identified natural hazard. This criterion considers the ability to recover from disruption, or the costs associated with getting the infrastructure back in service following a hazard event.
- **Redundancy:** This criterion considers the ability of the mitigation action or project to continue service during exposure to a natural hazard even with some damage or impact to the infrastructure. This criterion considers the adaptability of the assets or networks or systems that are part of the project (e.g., alternate back-up system).

In accordance with the DMA requirements (44 CFR , Section 201.6(c)(3)), an emphasis was also placed on the importance of a benefit-cost analysis in determining action priority. As part of this evaluation, the benefits of proposed actions were weighed against estimated costs as part of the prioritization process. Other criteria used to assist in evaluating the benefit-cost of a mitigation action included:

- Does the action address priority hazards or areas with the highest risk?
- Does the action protect lives?
- Does the action protect infrastructure, community assets or critical facilities (lifelines)?

- Does the action meet multiple objectives (Multiple Objective Management)?
- What will the action cost?
- What is the timing of available funding?

During the mitigation strategy meeting the HMPC discussed the STAPLEE criteria, but focused the prioritization process on the four R's: Reliability (capacity of the infrastructure project to maintain operations), Resistance (direct physical protection of the infrastructure project), Recovery of Assets (ability to recover from disruption), and Redundancy (adaptability of the project assets or ability of the project to continue to provide service during disruptions) (resilience evaluation criteria). With these criteria in mind, team members were asked to prioritize each mitigation action and explain why they selected the action to be prioritized.

The process of identification and analysis of mitigation alternatives allowed the HMPC to come to consensus and to collectively prioritize recommended mitigation actions. Emphasis was placed on the importance of a benefit-cost review in determining project priority; however, this was not a quantitative analysis. Benefit-cost was considered in greater detail in the development of the Mitigation Action Plan detailed below in Section 5.3. For example, parameters were established for assigning subjective ratings (high, medium, low) to the benefits and costs of each mitigation action. Specifically, each action developed for this plan contains a description of the problem and proposed project, the entity with primary responsibility for implementation, any other alternatives considered, a cost estimate, expected project benefits as they relate to the 4 R's, potential funding sources, and a schedule for implementation. Development of these project details for each action led to the determination of an overall high, medium, or low priority for each action.

Recognizing the limitations in prioritizing actions from District departments and the regulatory requirement to prioritize by benefit-cost to ensure cost-effectiveness, the HMPC decided to pursue mitigation action strategy development and implementation according to the nature and extent of damages, the level of protection and benefits each action provides, political support, project cost, available funding, and regional partner's priorities (e.g., City of Sonoma, Sonoma Water). This process guided the development of a prioritized action plan for the District. Cost-effectiveness will be considered in greater detail through a formal benefit-cost analysis when seeking FEMA mitigation grant eligibility and funding (e.g. HMA Grant Program) for eligible actions associated with this plan.

5.3 Mitigation Action Plan

44 U.S. Code of Federal Regulations Requirement §201.6(c)(3)(iii): [The mitigation strategy section shall include] an action plan describing how the actions identified in section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.

This action plan was developed to present the recommendations developed by the HMPC for how the District can reduce the vulnerability of people, property, infrastructure, and natural and cultural resources to future disaster losses. Over time, the implementation of these projects will be tracked as a measure of demonstrated progress on meeting the plan's goals.

5.3.1 Compliance with the National Flood Insurance Program

Because the Valley of the Moon Water District is a special district, it is not eligible to participate in the National Flood Insurance Program.

5.3.2 Progress on the 2021 Hazard Mitigation Plan

The District has been implementing the actions identified in the 2021 LHMP and working steadily towards meeting the plan goals, objectives, and mitigation actions based on funding and staff availability. During the 2026 LHMP update process, the District reported on the status of all 33 of the actions identified in the previous plan. Table 5-1 summarizes progress on the 2021 mitigation action plan.

Table 5-1 Mitigation Action Progress Summary

Progress Category	Number of Mitigation Actions
Completed	13
Deleted	5
In Progress	6
Annual Implementation	5
Not Started	4

Table 5-2 indicates details on each completed and deleted action. Each remaining action from the 2021 LHMP, those indicated as not started, in progress, or implemented annually, were carried forward into the 2026 LHMP.

Table 5-2 Completed and Deleted Mitigation Actions

Mitigation Action Title	2026 Status and Implementation Notes
Develop a Risk and Resilience Assessment (RRA) and update the Emergency Response Plan	**Completed.** The RRA and Emergency Response Plan update was finished and submitted by their respective deadlines
Dam Incident Planning during Sonoma Development Center Specific Plan Process	**Completed.** This action was completed as part of the SDC Specific Plan process.
Emergency redundant main line connection to the City of Sonoma service area	**Completed.** This project changed to two stub outs with the ability to hook up a pump and water meter. These changes allowed the project to be completed in a reduced time frame and under budget while achieving the desired outcome.
Water mainline replacement and retrofit project	**Completed.** Completed in FY 2020/2021, the mainline serving the Boyes Hot Springs neighborhood was upgraded, removing undersized steel from the system. This was one of the last significant areas that needed undersized steel upgrading.
Enhance coordination with regional partners to increase public awareness related to drought restrictions	**Completed.** A 20% reduction was sought as Sonoma Water was required to make a 20% diversion reduction from Russian River allocations. Using the Marin-Sonoma Partnership, a 24% reduction was accomplished.
Mini-rate study that compares off-peak versus peak water use cost structures to meet water demand objectives during drought events	**Completed.** The District opted for full rate study that was performed in 2022. The District is currently halfway through the first year of five-year rate plan.
Boyes Boulevard water line replacement project	**Completed.** The Boyes Boulevard water line sustained damage as a result of a flood; the line is now in girders of bridge where it is more protected.
Donald Tank hillside stabilization	**Completed.** Completed FY 2020/2021 (shortly after the 2021 LHMP was approved)

Mitigation Action Title	2026 Status and Implementation Notes
Cross connection to City of Sonoma water system	**Completed.** This effort has been completed. Periodic training keeps staff up to date on interconnection procedures.
"Map your Neighborhood" Preparedness Program	**Deleted.** Not high priority action, nor an action the District had a role in implementing other than supporting the effort.
Scotts Dam removal at Lake Pillsbury	**Deleted.** This action is outside direct District's purview. Action was revisited as part of the 2026 plan process and deleted.
On-site solar power generation and battery storage project	**Completed.** This action has changed slightly – the District opted for EV plug installations instead of battery storage. To ensure full power needs could be reached in a power outage, the District maintained its on-site generators.
Ensure continuity of District operations through implementation of Public Health and Safety Plan	**Completed.** This action has been ongoing since the onset of the COVID-19 pandemic, which started during the development of the District's 2021 LHMP.
Solar power back-up generation and battery storage at water tanks and installation of SCADA systems	**Completed.** Several pilot installations were tested, followed by robust commercial systems. The District now has solar and battery back-up at all SCADA telemetry hubs making them completely independent of PG&E power. Any SCADA hub site where solar and batteries were not feasible (high power-demand sites like pump stations) now also have permanent stand-by generators.
Wildfire vulnerability assessment	**Completed.** The assessment was completed in-house and management is ongoing. It includes the regular inspection of facilities and vegetation growth and allocates funds for vegetation and fuels reduction. The following steps have been taken: cleared out open land with abundance of large trees within striking distance of critical pumping facilities; completion of Agua Caliente Well and Booster Station fire mitigation actions; and implementation of Chestnut Tank and Booster Station fire mitigation actions.
Implement Pilot wildfire mitigation incentive program	**Deleted.** This action was identified as a program that could be done but is not necessarily something that the District still wants to pursue. It would require intensive staff time and actions outside of the District's purview.
Implement fire safe standards, design review, and code enforcement inspections	**Deleted.** This was identified as an action that is feasible but is not necessarily something that the District wants to pursue. It would require intensive staff time and actions outside of the District's purview (i.e., assessment of building codes).
Increase water tank storage capacity	**Deleted.** In June of 2021 the District received a technical memorandum from EKI, outlining the District's true storage capacity, accounting for Sonoma County Water Agency infrastructure. Given that ". . . the SCWA system allows for the District to access SCWA storage in nearly all emergency scenarios", the District is no longer pursuing additional storage in the Glen Ellen Zone. Furthermore, due to the change in CIP planning to include District Metered Areas (DMAs) in Zone 1, and the resulting ability to manage pressures and maintain fire-flows, additional storage is no longer being sought there either.

5.3.3 Mitigation Action Plan

This action plan presents the recommendations developed by the HMPC outlining how the District can reduce the risk and vulnerability of people, property, critical water supply and distribution infrastructure, and natural and cultural resources to future disaster losses. The District has other existing, detailed action descriptions in planning documents, such as the 2025 WMP, 2025 Capital Improvement Program (CIP) and Budgets, and other planning mechanisms. These actions are considered to be part of this plan, and

the details, to avoid duplication, should be referenced in their original source document. The HMPC also realizes that new needs, priorities, and adaptation strategies may arise as a result of a disaster or other circumstances and reserves the right to support new actions and strategies, as necessary, as long as they conform to the overall goals of this plan.

The actions included in this mitigation strategy are subject to further review and refinement; alternatives analyses; and reprioritization due to funding availability and/or other criteria. The District is not obligated by this document to implement any or all of these projects. Rather, this mitigation strategy represents the desires of the District and the community to mitigate the risks and vulnerabilities from identified hazards. Many of the action items included in this plan are also a collaborative effort among the District, Sonoma County, Sonoma Water, City of Sonoma, Sonoma Valley Groundwater Sustainability Agency (GSA) and other state, regional, and local agencies and stakeholders in the District's Planning Area and greater Sonoma Valley.

The mitigation actions developed by the HMPC are summarized in Table 5-3. It identifies the mitigation action title, lead agency/department, hazards mitigated, estimated costs, potential funding, timeline, priority, and status/implementation details. The 'Related Goal' column notes which of the four goals in Section 5.2 that the action helps achieve.

The **Estimated Cost** column describes the estimated project costs using the following categories:

- Little to no cost
- Low: Less than $10,000
- Moderate: $10,000-$100,000
- High: $100,000-$1,000,000
- Very High: More than $1,000,000

The **Timeline** column describes the estimated time of completion for each project using the following categories:

- Short Term: 1-2 years
- Medium Term: 3-5 years
- Long Term: 5+ years
- Ongoing: action is implemented every year

The **Status and Implementation** column describes the progress made on the actions so far using the following categories:

- Not Started: project is carried over from the previous plan; little to no work has been completed.
- In Progress: project is carried over from the previous plan; work has begun on the project and is proceeding.
- Annual: project is carried over from the previous plan and is implemented every year on an ongoing basis.
- New in 2026: The action is new to this plan update; little to no work has been completed.

The action worksheets that follow provide more background information, ideas for implementation, lead agency, partners, potential funding sources, cost estimates, benefits, and timeline for each identified action.

Table 5-3 Mitigation Action Summary Table

Action #	Mitigation Action Title	Hazard(s) and Goals Addressed	Responsible Agency	Estimated Cost and Potential Funding	Timeline	2026 Priority	Status and Implementation
1	Implement a five-year training plan to enhance system security and exercise a recovery plan for District facilities	Public Health Hazards 1, 3	**District Operations and Maintenance Staff**	Moderate Operations and Maintenance Budget	Medium Term	High	**Annual Implementation.** This effort is ongoing. Training is constant (bringing staff up to speed, updating firewall & security measures) so goal will likely not be completed, but will instead be continually implemented.
2	Leverage modern hardware and security system upgrades to improve risk management throughout District operations	Cyber Threats, Earthquake, Wildfires, Drought and Water Supply, Severe Weather, Dam Incidents, High Wind 1, 3	**District Operations and Maintenance Staff**	High Operations and Maintenance Budget	Short Term	High	**Annual Implementation.** This effort is ongoing. Security upgrades are constant (new SCADA server, new firewall, etc.) so goal will likely not be completed but will instead be continually implemented.
3	Alternative supplemental water supply project	Drought and Water Supply, Earthquake, Wildfire 1, 2, 4	**District Operations and Maintenance Staff** City of Sonoma, Sonoma County, California DGS, La Luz Center	Moderate Operations and Maintenance Budget	Long Term	High	**In Progress**. The Sonoma Developmental Center (SDC) represents the District's most viable large-scale local water supply opportunity. The District is actively engaged in discussions with the County, DGS, and the developer regarding potential ownership or operational control of portions of the SDC water system. The District's objective is to secure access to surface water rights, treatment facilities, and storage infrastructure to provide a reliable emergency and supplemental supply. This source is particularly critical in scenarios involving interruption of Sonoma Water deliveries (e.g., earthquake, wildfire). The District views SDC as a long-term, multi-benefit project that could support emergency supply, system redundancy, and potential aquifer storage and recovery (ASR) operations.
4	Collaborate with the Sustainable GSA on development of groundwater	Drought and Water Supply	**District Operations and Maintenance Staff**	Low Sonoma Valley GSA is funded by contributions	Short Term	Medium	**Annual Implementation.** After the GSP submittal, the Department of Water Resources (DWR) awarded the District $3 million in grant

Action #	Mitigation Action Title	Hazard(s) and Goals Addressed	Responsible Agency	Estimated Cost and Potential Funding	Timeline	2026 Priority	Status and Implementation
	management criteria and identifying recharge projects where there is groundwater depletion in the Sonoma Valley subbasin	1, 2, 3, 4	Sonoma Water, Sonoma County, City of Sonoma	from state grant revenue, member agencies, which will continue through the development of the GSP, and end in 2022			funding for Aquifer Storage and Recovery (ASR) projects. The District now owns two fully functional and permitted ASR facilities. The District also submitted a whitepaper to the GSA resulting in the GSA undertaking a "Project & Management Actions Evaluation". This focused the GSA's efforts on areas that would yield the greatest results for the least funding input.
5	Groundwater well installation and recharge to augment water supplies	Drought and Water Supply 1, 2, 3	**District Operations and Maintenance Staff** City of Sonoma	Very High Operations and Maintenance Budget	Medium Term	High	**In Progress**. Two sub-leased wells have been added. Park Well has been redrilled with a higher capacity (roughly 100 GPM now as opposed to 50 GPM from the old well). The exploratory drilling at Chestnut is now also complete, however, this well will not likely be built due to high water treatment costs. Also, the two new leased wells and an existing leased well have all tested above the federal MCL for PFAS, and have been isolated from the system. They will be brought back online if a cost-effective treatment can be identified, and negotiations with the owners are successful. Long-term supply will likely stay at approximately 80% surface water (from Sonoma Water) and 20% groundwater.
6	Recycled water system project in Sonoma Valley to augment water supplies	Drought and Water Supply 1, 2	**District Operations and Maintenance Staff** Sonoma Water, Sonoma County Sanitation District, City of Sonoma	Very High California Department of Water Resources (DWR) Proposition 84, State Bonds (Climate Resiliency Bond/Proposition 4)	Long Term	Low	**Not Started**. This action was discussed in the GSP, but no feasibility study has been done yet.
7	Initiate a study to determine costs of purchasing off-peak water for aquifer storage and recovery	Drought and Water Storage 1, 2, 3	**District Operations and Maintenance Staff** City of Sonoma, Sonoma Valley GSA	Moderate Operations and Maintenance Budget	Long Term	Medium	**Not Started**. This action is likely not feasibility under the restructured agreement between the District and Sonoma Water. The District proposes changing this action to evaluate possible sources of funding to purchase and wheel water for use in its two ASR facilities.
8	Conduct engineering-level study to understand seismic vulnerabilities of District critical assets	Earthquake 1, 2, 3	**District Operations and Maintenance Staff** Sonoma Water, City	High Operations and Maintenance Budget,	Short Term	High	**In Progress,** anticipated completion date June of 2026

Action #	Mitigation Action Title	Hazard(s) and Goals Addressed	Responsible Agency	Estimated Cost and Potential Funding	Timeline	2026 Priority	Status and Implementation
			of Sonoma	State bonds, Federal Grants: Hazard Mitigation Grant Program (HMGP) and Building Resilient Infrastructure and Communities (BRIC) Program			
9	Implementation of water pipe inspection and replacement program	Earthquake 1, 2, 3	**District Operations and Maintenance Staff** Sonoma Water, City of Sonoma	Very High Operations and Maintenance Budget	Medium Term	High	**In Progress**. This is an ongoing effort done annually alongside the District's valve turning and flushing program.
10	Earthquake hardening	Earthquake 1, 2, 3, 4	**District Operations and Maintenance Staff** Sonoma Water, City of Sonoma, Sonoma County	Very High Operations and Maintenance Budget/Capital funds, Funding Assistance through Cal OES HMGP and BRIC program grant funding, State bonds	Long Term	High	**In Progress**. Will have better information following the completion of the seismic vulnerability assessment this year.
11	Identification of water pipelines exposed to flooding and soil erosion along bridge crossings to prioritize and implement pipeline alignment upgrades	Flood 1, 2, 3	**District Operations and Maintenance Staff** City of Sonoma, Sonoma Water	Very High Operations and Maintenance Budget, State bonds, Federal Grants: HMGP and BRIC Programs funding	Short Term	High	**Annual Implementation.** In-house inspections are performed on a continuing basis which address the erosion and weak points so that the District can keep track on these locations.
12	Implementation of capital improvements in Water System Master Plan	Multi-Hazard, Earthquake, Wildfire, Flooding, Extreme Heat, High Wind, Severe Weather 1, 2, 3	**District Operations and Maintenance Staff**	High Operations and Maintenance Budget, State Bonds, Federal Grants: HMGP and BRIC Program funding	Short Term	High	**Annual Implementation.** The District is closely following the Water System Master Plan (and 2025 Update). Small diameter steel pipes have nearly all been replaced. Several fire flow upgrades are in the works or in the five-year CIP budget.
13	Conduct an Intertie Feasibility Study of new main aqueduct	Multi-Hazard, Earthquake,	**District Operations and Maintenance**	High Operations and	Long Term	Low	**Not Started.** The District is prioritizing local issues over regional projects; therefore, this

Action #	Mitigation Action Title	Hazard(s) and Goals Addressed	Responsible Agency	Estimated Cost and Potential Funding	Timeline	2026 Priority	Status and Implementation
	intertie from Sonoma Valley to Petaluma Valley	Wildfire, Flooding, Extreme Heat, Severe Weather, High Wind 1, 2, 4	**Staff** City of Petaluma	Maintenance Budget			action has not been initiated.
14	Conduct an Intertie Feasibility Planning Study of new main aqueduct intertie from Sonoma Valley to American Canyon	Multi-Hazard, Earthquake, Wildfire, Flooding, Extreme Heat, Severe Weather, High Wind 1, 2, 4	**District Operations and Maintenance Staff** City of Napa	High Operations and Maintenance Budget	Long Term	Low	**Not Started.** The District is prioritizing local issues over regional projects; therefore, this action has not been initiated.
15	Critical water facility and infrastructure hardening and resilience projects against severe weather	Severe Weather, High Wind, Dense Fog 1, 2, 3, 4	**District Operations and Maintenance Staff** City of Sonoma	Very High Operations and Maintenance Budget/Capital funds, Funding Assistance through Cal OES HMGP, BRIC program funding, State bonds Climate Resiliency Bond)	Medium Term	Medium	**In Progress.** A structure was rebuilt after a lightning strike on a water facility necessitated the redirection of electricity. Additional mitigation has been initiated and is in progress.
16	Pilot Testing and Design of PFAS Treatment System	Drought and Water Supply 1, 2, 3	**District Operations and Maintenance Staff** Well Owners	High FEMA BRIC / HMA; State Water Board grants; DWSRF loans; EPA research and demonstration grants; EPA technical assistance programs	Short Term	High	**New in 2026.**
17	Replacement of ten pipeline segments in liquefaction zones; isolation/bypass of four pipeline segments in landslide	Landslide, Earthquake 1, 2, 3	**District Operations and Maintenance Staff**	Very High FEMA and Cal OES HMGP; EPA Water Infrastructure Finance and	Long Term	High	**New in 2026.**

Action #	Mitigation Action Title	Hazard(s) and Goals Addressed	Responsible Agency	Estimated Cost and Potential Funding	Timeline	2026 Priority	Status and Implementation
	areas			Innovation Act (WIFIA); Bureau of Reclamation WaterSMART Grants; State Water Resources Control Board (SWRCB); Prop 4 Funding			
18	Tank Seismic Mitigation Projects	Earthquake, Drought and Water Supply 1, 2, 3	**District Operations and Maintenance Staff**	Very High FEMA BRIC; EPA Drinking Water System Infrastructure Resilience and Sustainability Program; Cal OES HMGP; SWRCB DWSRF	Long Term	High	**New in 2026.**
19	Well Seismic Mitigation Projects	Earthquake, Drought and Water Supply 1, 2, 3	**District Operations and Maintenance Staff**	Low FEMA HMGP; EPA Drinking Water System Infrastructure Resilience and Sustainability Program; Bureau of Reclamation WaterSMART Grants; SWRCB DWSRF	Medium Term	Low	**New in 2026.**
20	Manage Security Service Provider	Cyber Threats 1, 2, 3	**District Operations and Maintenance Staff**	Low Operations budget	Short Term	Low	**New in 2026.**
21	SDC Water System Rehabilitation and Integration for Emergency and Redundant Supply	Earthquake, Drought, Water Supply, Wildfire 1, 2, 3, 4	**District Operations and Maintenance Staff** State DGS, County of Sonoma, Developer	Very High FEMA BRIC; EPA Drinking Water System Infrastructure Resilience and Sustainability Program; Cal OES HMGP; SWRCB DWSRF, also funded by Developer and District Water Enterprise Fund.	Medium Term	High	**New in 2026.**
22	Wellhead PFAS Treatment System Installation	Earthquake, Drought, Water Supply,	**District Operations and Maintenance**	High FEMA BRIC; EPA	Short Term	High	**New in 2026.**

Action #	Mitigation Action Title	Hazard(s) and Goals Addressed	Responsible Agency	Estimated Cost and Potential Funding	Timeline	2026 Priority	Status and Implementation
		Wildfire 1, 2, 3	**Staff** Well Owners	Drinking Water System Infrastructure Resilience and Sustainability Program; Cal OES HMGP; SWRCB DWSRF, District Water Enterprise Fund, class action lawsuit.			
23	DMAs for Increased Pressure Management, Improved Leak Detection and Fire Flow Capabilities	Earthquake, Drought, Wildfire 1, 2, 3	**District Operations and Maintenance Staff**	High FEMA BRIC; EPA Drinking Water System Infrastructure Resilience and Sustainability (DWSIRS) Program; Cal OES HMGP; SWRCB DWSRF, District Water Enterprise fund, class action lawsuit.	Medium Term	High	**New in 2026.**
24	Address Over-constrained Connections to Reservoirs that Lack Seismic Specifications	Earthquake, 1, 2, 3	District Operations and Maintenance Staff	High FEMA BRIC, CA SWRCB DWSRF	Medium Term	High	**New in 2026.**
25	Address Liquefaction at Main Line Creek Crossings by Replacing Main with Seismic Reliant Pipe and Fittings	Earthquake 1, 2, 3	District Operations and Maintenance Staff	Very High FEMA HMGP and BRIC, EPA Drinking Water Grants	Long Term	High	**New in 2026.**

Funding Source Acronyms:

- BLM WaterSmart – Bureau of Land Management Small-Scale Water Efficiency Grants
- BRIC – Building Resilient Infrastructure and Communities
- Cal OES – California Office of Emergency Services
- DWR Proposition 84 – Department of Water Resources Proposition 84
- EPA DWSIRS Program – Environmental Protection Agency Drinking Water System Infrastructure Resilience and Sustainability Program
- EPA WIFIA – Environmental Protection Agency Water Infrastructure Finance and Innovation Act Program
- HMGP – Hazard Mitigation Grant Program
- SWRCB DWSRF – State Water Resources Control Board Drinking Water State Revolving Funds

1 Implement a five-year training plan to enhance system security and exercise a recovery plan for District facilities

Mitigation Project Title	Implement a five-year training plan to enhance system security and exercise a recovery plan for District facilities
Hazard(s) Mitigated	Cyber Threats
Project Description, Issue/Background	This training program focuses on regularly emphasizing the importance of cyber security awareness to District employees, such as safe internet browsing practices, and secure email handling. The purpose of implementing a recovery plan during an information technology (IT) disruption is to allow the District to continue services. It involves identifying stakeholders (customers), response team members (District staff), hardware inventory, back-up strategies, testing, communication execution, and training steps that must be completed during loss of service or IT security.
Related planning mechanisms	CIP, RRA, ERP Update
Other Alternatives	No Action
Responsible Office/ Agency	District Operations and Maintenance Staff
Partners	None
Priority (High, Medium, Low)	High
Cost Estimate	Moderate ($100,000)
Benefits (Avoided Losses)	Avoids potential security breaches and threats to District's information technology, operation systems, and water distribution system.
Potential Funding	Operations and Maintenance Budget
Timeline	Medium Term

2 Leverage modern hardware and security system upgrades to improve risk management throughout District operations

Mitigation Project Title	Leverage modern hardware and security system upgrades to improve risk management throughout District operations
Hazard(s) Mitigated	Cyber Threats
Project Description, Issue/Background	This action involves budgeting and acquiring modern hardware and security system upgrades to reduce the District's risk to cyber security and IT data breaches.
Related planning mechanisms	CIP, RRA, ERP Update
Other Alternatives	No Action
Responsible Office/ Agency	District Operations and Maintenance Staff
Partners	None
Priority (High, Medium, Low)	High
Cost Estimate	High ($200,000 - $400,000)
Benefits (Avoided Losses)	Avoids potential security breaches and threats to District's IT systems, operation systems, and water distribution system.
Potential Funding	Operations and Maintenance Budget
Timeline	Short Term

3 Alternative supplemental water supply project

Mitigation Project Title	Alternative supplemental water supply project
Hazard(s) Mitigated	Drought and Water Supply, Earthquake, Wildfire
Project Description, Issue/Background	The Sonoma Developmental Center (SDC) is a 945-acre property that includes a campus, agricultural lands, and open space that historically provided services to persons with developmental disabilities. The SDC closed in 2018, and the County is developing a specific plan for the property, including the reuse of the existing water supply reservoirs and water treatment facility. The District and the City of Sonoma are interested in exploring the feasibility of using the water supply available at the SDC Campus as an alternative emergency back-up source during wildfires and earthquakes. This action involves continued collaboration and engagement during the SDC Specific Plan process to provide local support and consideration of alternative water supplies at the campus.
Related planning mechanisms	CIP, 2019 WSP, SDC Specific Plan
Other Alternatives	No Action
Responsible Office/ Agency	District Operations and Maintenance Staff
Partners	City of Sonoma, Sonoma County, California DGS, La Luz Center
Priority (High, Medium, Low)	High
Cost Estimate	High ($200,000)
Benefits (Avoided Losses)	This potential project would avoid impacts associated with the District's inability to deliver water supplies during emergencies for fire suppression.
Potential Funding	Operations and Maintenance Budget
Timeline	Long Term

4 Collaborate with the Sustainable Groundwater Agency on development of groundwater management criteria and identifying recharge projects where there is groundwater depletion in the Sonoma Valley subbasin

Mitigation Project Title	Collaborate with the Sustainable Groundwater Agency (GSA) on development of groundwater management criteria and identifying recharge projects where there is groundwater depletion in the Sonoma Valley subbasin
Hazard(s) Mitigated	Drought and Water Supply
Project Description, Issue/Background	California's Sustainable Groundwater Management Act (SGMA) addresses groundwater and aquifer recharge needs. Groundwater management will provide a buffer against drought and climate change and contribute to reliable water supplies. The protection of critical recharge areas will be addressed in the Draft Sonoma Valley Groundwater Sustainability Plan (GSP). This action involves District participation on the Sonoma Valley GSA that include recommending provisions that guide development or curtail development in areas that would harm or compromise recharge areas and promote the identification of recharge projects where groundwater depletion occurs in Sonoma Valley.
Related planning mechanisms	GSP, WSP, UWMP, Sonoma Valley Groundwater Recharge Program
Other Alternatives	District is currently a participating special district on the Board of Directors for the Sonoma Valley GSA with Sonoma Water, Sonoma County, and the City of Sonoma
Responsible Office/ Agency	District Operations and Maintenance Staff
Partners	Sonoma Water, Sonoma County, City of Sonoma
Priority (High, Medium, Low)	Medium
Cost Estimate	Low ($25,000)
Benefits (Avoided Losses)	Participation in the development of the Sonoma Valley GSP will help avoid undesirable groundwater issues and lay the foundation for actions to achieve the subbasin's sustainability goals related to groundwater quality and declining groundwater levels.
Potential Funding	Sonoma Valley GSA was funded solely by contributions from state grant revenue and member agencies, which continued through the development of the GSP, and ended in 2022. The GSA has since adopted a rate schedule and is charging for groundwater by volume and customer type.
Timeline	Short Term

5 Groundwater well installation and recharge

Mitigation Project Title	Groundwater well installation and recharge
Hazard(s) Mitigated	Drought and Water Supply
Project Description, Issue/Background	The District's facilities currently consist of six groundwater wells and ten water turnouts for delivery of water purchased from Sonoma Water. Of these six wells, four are active, one is being repaired, and one needs to be reactivated. While the majority (approximately 85 percent) of the District's water comes from Sonoma Water purchases and deliveries, the remaining is supplied by these six wells. In recent years, some of the shallower groundwater wells have resulted in reduced production or are offline due to drought/dry conditions. The District is exploring options to add additional wells or recharge existing wells (i.e. drilling deeper) with enough capacity to achieve 1,775 gallons per minute (gpm). New groundwater wells would include the Labre Well rehabilitation/recharge project, Chestnut Well installation, and installation of Park Well. The new wells will also provide emergency generation back-up supply.
Related planning mechanisms	CIP, WSP, UWMP
Other Alternatives	No Action
Responsible Office/ Agency	District Operations and Maintenance Staff
Partners	City of Sonoma
Priority (High, Medium, Low)	Medium
Cost Estimate	Very High ($2,000,000 per well)
Benefits (Avoided Losses)	Installation and rehabilitation of these wells will expand the District's groundwater supply and meet demand and minimize limited water supply risks associated with reduced water deliveries from the Russian River system during drought events. Additional wells will also provide health and safety benefits and improved fire protection.
Potential Funding	Operations and Maintenance Budget
Timeline	Medium Term

6 *Recycled Water System Project in Sonoma Valley to augment water supplies*

Mitigation Project Title	Recycled water system project in Sonoma Valley to augment water supplies
Hazard(s) Mitigated	Drought and Water Supply
Project Description, Issue/Background	Recycled water is cleaned wastewater from homes and businesses. It is used for crop irrigation, landscaping, wildlife habitat enhancement and industrial water processes. Its benefits include the conservation of drinking water, wildlife habitat protection, and wetland restoration. Based on the actions developed as part of the Sonoma Valley GSP, the District would collaborate with member agencies to study and develop water reuse systems that could be constructed in the service area to supply recycled water. The District would also support implementation of a recycled water system project that includes a wastewater treatment facility, storage tank, water pipeline infrastructure, and a pumping station that are each geographically positioned to provide water supply to the District's residential and commercial customers.
Related planning mechanisms	CIP, WMP, RRA, ERP Update, UWMP
Other Alternatives	No Action, Continued reliance on surface water deliveries and groundwater
Responsible Office/ Agency	District Operations and Maintenance Staff
Partners	Sonoma Water, Sonoma County Sanitation District, City of Sonoma
Priority (High, Medium, Low)	Low
Cost Estimate	Very High ($3,000,000 to $5,000,000)
Benefits (Avoided Losses)	The recycled water will be used to offset potable drinking water supplies, limit groundwater pumping, and reduce local declines of groundwater levels in the Sonoma Valley subbasin.
Potential Funding	California Department of Water Resources (DWR) Proposition 84, State bonds (Proposition 4/Climate Bond)
Timeline	Long Term

7 Initiate a study to determine costs of purchasing off-peak water for aquifer storage and recovery

Mitigation Project Title	Initiate a study to determine costs of purchasing off-peak water for aquifer storage and recovery
Hazard(s) Mitigated	Drought and Water Supply
Project Description, Issue/Background	This action involves enhancing groundwater resources by expanding the District's water storage capacities to provide optimal sufficiency levels in the event of an extended drought or other natural disaster. The action consists of initiating a study to determine the planning, permitting, and implementation costs of purchasing off-peak water for aquifer storage and recovery and seeking funding for the development that allows the District to install additional wells or water storage facilities for recovery.
Related planning mechanisms	None
Other Alternatives	No Action, Continued purchase of peak water based on current demand
Responsible Office/ Agency	District Operations and Maintenance Staff
Partners	City of Sonoma, Sonoma Valley GSA
Priority (High, Medium, Low)	Low
Cost Estimate	Moderate ($50,000 to $100,000)
Benefits (Avoided Losses)	Reduces uncertainties in the reliability of future regional water supplies, including both surface and groundwater in Sonoma County. A feasibility study that explores a water storage and recovery facility would enhance the District's ability to manage water resources and allow the District to use stored water during drought or dry weather conditions (i.e., summer and fall seasons) or during emergencies. Like Aquifer Storage and Recovery (ASR) projects, this project would improve the resiliency and sustainability of water resources in Sonoma Valley and avoid impacts related to water restrictions.
Potential Funding	Operations and Maintenance Budget
(Timeline	Long Term

8 Conduct engineering-level study to understand seismic vulnerabilities of District critical assets

Mitigation Project Title	Conduct engineering-level study to understand seismic vulnerabilities of District critical assets
Hazard(s) Mitigated	Earthquake
Project Description, Issue/Background	California and the District's service area are located in a region with high seismic activity given its proximity to nearby faults, such as the Healdsburg-Rogers Creek fault. The main aqueducts and water lines serving the District area are mostly underground and susceptible to seismic activity. The aboveground infrastructure, such as water tanks could also crack, leak, or become unstable following an earthquake event. An engineering-level study that evaluates the seismic vulnerabilities of the District's critical water facilities should identify key stress points and weaknesses in the water system. The study will also make recommendations for specific retrofit, replacement, and facility hardening projects and identify detailed mitigation activities the District could consider integrating into the mandated RRA and ERP update and in the next LHMP update.
Related planning mechanisms	WMP, RRA, ERP, UWMP
Other Alternatives	None
Responsible Office/ Agency	District Operations and Maintenance Staff
Partners	District, Sonoma Water, City of Sonoma
Priority (High, Medium, Low)	High
Cost Estimate	High (100,000 to $200,000, Capital costs for project-specific retrofits could require up to $3 million in costs)
Benefits (Avoided Losses)	Addresses aging water distribution infrastructure that needs retrofitting and replacement and potential impacts to critical water infrastructure related to potential seismic damage (water line breaks, cracks, leaks) that could result in disruptions in the delivery of potable water supply.
Potential Funding	Operations and Maintenance Budget, State bonds, Federal Grants: Hazard Mitigation Grant Program (HMGP) and Building Resilient Infrastructure and Communities (BRIC) Program
Timeline	Short Term

9 Implementation of water pipe inspection and replacement program

Mitigation Project Title	Implementation of water pipe inspection and maintenance program
Hazard(s) Mitigated	Earthquake
Project Description, Issue/Background	The District includes a range of key facilities and maintenance projects in its CIP for the one and five-year periods. Prioritized projects include replacing undersized steel water main lines and continuing routine water pipe inspections for facilities that are reaching their end-of-life span. Several of these capital improvement projects address minimizing earthquake hazards on existing water infrastructure, which would minimize vulnerabilities to critical water main lines and other facilities near their end-of-life span.
Related planning mechanisms	CIP, WMP, RRA, ERP, UWMP, and Seismic Vulnerability Assessment
Other Alternatives	Retrofit critical water facilities, Implementation of routine and existing maintenance program
Responsible Office/ Agency	District Operations and Maintenance Staff
Partners	Sonoma Water, City of Sonoma
Priority (High, Medium, Low)	High
Cost Estimate	High (1.5 to $3 Million Annually)
Benefits (Avoided Losses)	Implementation of a maintenance program that monitors the conditions of critical water infrastructure and the potential for seismic damage (aging infrastructure, pipeline exposure/erosion concerns, water line breaks, cracks, leaks) could promote the early identification of issues, which would minimize the potential for disruptions in the delivery of potable water supply.
Potential Funding	Operations and Maintenance Budget
Timeline	Medium Term

10 Earthquake hardening

Mitigation Project Title	Earthquake hardening
Hazard(s) Mitigated	Earthquake
Project Description, Issue/Background	The District has water infrastructure that is critical to the delivery of water service to customers in Sonoma Valley. Several water facilities serve communities in Sonoma Valley that are at risk to serious ground shaking based on their proximity to major regional faults. In some cases, these facilities are not built to the latest seismic standards and able to withstand an earthquake; lack necessary seismic retrofits and upgrades; and are nearing the end of their service life. Damage to these facilities can result in a loss of potable water service for an extended period in Sonoma Valley. Following an engineering-level study listed in Mitigation Action E-1 that focuses on potential projects the District can take to harden facilities against earthquake hazards, this action would involve implementing hardening the most susceptible facilities or those most critical in ensuring the District's reliable delivery of potable water. Specific actions may include adding structural improvements to storage tanks, booster pump stations, and the office and corporation yard, or adding bracing during construction retrofits. Other hardening retrofits may involve upgrading the water main lines and bridge crossings that traverse major faults. The District standards could also be updated ensuring that facilities are built ready to withstand an earthquake from the beginning of their service life. The following facilities have been identified as being at high risk to earthquakes based on ground shaking potential (greater than 135 percent spectral acceleration): • Arnold Drive Pump station • Verano Well Pump Station • Labre Well Pump Station • Temelec Water Tank #1 • Temelec Water Tank #2 The list of facilities vulnerable to earthquakes could be prioritized based on how critical each facility is to the functionality of the entire water system and also how critical the needed upgrades are to the District.
Related planning mechanisms	CIP, WMP, RRA, ERP Update
Other Alternatives	Retrofit critical water facilities, implementation of routine and existing maintenance program
Responsible Office/ Agency	District Operations and Maintenance Staff
Partners	Sonoma Water, City of Sonoma, Sonoma County
Priority (High, Medium, Low)	High
Cost Estimate	Very High ($1,500,000 to $3,000,000 depending on the actions and needs identified)
Benefits (Avoided Losses)	The benefits are based on the losses avoided in terms of limiting potable water service disruptions and the replacement costs of damaged facilities from earthquake events.
Potential Funding	Operations and Maintenance Budget/Capital funds, Funding Assistance through Cal OES HMGP and BRIC program grant funding, State bonds
Timeline	Long Term

11 *Identification of water pipelines exposed to flooding and soil erosion along bridge crossings to prioritize and implement pipeline alignment upgrades*

Mitigation Project Title	Identification of water pipelines exposed to flooding and soil erosion along bridge crossings to prioritize and implement pipeline alignment upgrades
Hazard(s) Mitigated	Flooding
Project Description, Issue/Background	This project involves the identification of water pipelines that are exposed to soil erosion as a result of stormwater runoff and flooding along Sonoma Creek. It specifically involves the identification of pipelines along up to seven bridge crossings in Sonoma Valley that are potentially eroding or exposed due to localized runoff and flood events. The purpose of this project is to identify problem areas along exposed pipelines and to implement project upgrades at specific pipeline alignments and bridge crossings.
Related planning mechanisms	CIP, WMP, RRA, ERP Update, UWMP
Other Alternatives	Retrofit Water Pipelines, Implementation of routine and existing maintenance program
Responsible Office/ Agency	District Operations and Maintenance Staff
Partners	City of Sonoma, Sonoma Water
Priority (High, Medium, Low)	Medium
Cost Estimate	Very High ($1.75M)
Benefits (Avoided Losses)	The identification of the structural conditions of critical water infrastructure, including water main pipelines near areas susceptible to stormwater runoff and flooding along bridge crossings would promote the early identification of structural issues, which would minimize the potential for disruptions in the delivery of potable water supply.
Potential Funding	Operations and Maintenance Budget, State bonds, Federal Grants: HMGP and BRIC Programs funding
Timeline	Short Term

12 Implementation of capital improvements in Water System Master Plan

Mitigation Project Title	Implementation of capital improvements in Water System Master Plan
Hazard(s) Mitigated	Earthquake, Wildfire, Drought and Water Supply Severe Weather: Heavy Rain/Thunderstorms/Lightning/Hail, Multi-Hazard
Project Description, Issue/Background	The District's WMP was recently updated in 2019 to provide the District with an overall plan for infrastructure improvements to ensure the District can reliably and cost-effectively service its customers through 2050. Improvement projects were developed as part of the plan to identify supply and storage deficiencies and aging infrastructure. Priority projects include the replacement of all steel water mains, addressing fire flow deficiencies in sensitive areas (near schools, WUI, etc.), Saddle Tank Replacement Project, the Donald Tank Hillside Stabilization Project, and installation of new groundwater wells to meet a 40 percent local supply goal. This project would involve tracking and prioritizing specific capital improvements that best mitigate top natural hazards in the District's Planning Area, such as earthquake, wildfire, and severe weather hazards associated with high winds and lightning.
Related planning mechanisms	CIP, WMP
Other Alternatives	No Action
Responsible Office/ Agency	District Operations and Maintenance Staff
Partners	None
Priority (High, Medium, Low)	High
Cost Estimate	High ($500,000 to $1,000,000 depending on the size and scale of project)
Benefits (Avoided Losses)	The benefits are based upon the losses avoided in terms of potable water service delivery and replacement costs associated with damaged water facilities and infrastructure.
Potential Funding	Operations and Maintenance Budget, State Bonds, Federal Grants: HMGP and BRIC Program funding
Timeline	Short Term

13 *Conduct an Intertie Feasibility Planning Study of new main aqueduct intertie from Sonoma Valley to Petaluma Valley*

Mitigation Project Title	Conduct an Intertie Feasibility Study of new main aqueduct intertie from Sonoma Valley to Petaluma Valley
Hazard(s) Mitigated	Earthquake, Wildfire, Drought and Water Supply, High Winds, Multi-Hazard
Project Description, Issue/Background	The District's water supply is provided by a single point of delivery via the Sonoma Aqueduct that is part of the Sonoma Water supply and distribution system. In the event of a major earthquake or wildfire or emergency interruption to this facility, the District's service area could experience water shortages for unknown periods of time and with limited alternative sources of back-up supply. A feasibility study that considers the addition of a redundant emergency intertie to the City of Petaluma water supply system could provide an alternative source of water for the District.
Related planning mechanisms	CIP, ERP Update
Other Alternatives	No Action
Responsible Office/ Agency	District Operations and Maintenance Staff
Partners	City of Petaluma
Priority (High, Medium, Low)	Low
Cost Estimate	High ($300,000)
Benefits (Avoided Losses)	A feasibility planning study will determine the constructability and environmental constraints associated with an emergency intertie that may mitigate serious disruptions in water supply for the customers in Sonoma Valley and protect public health and safety during potential disaster events. This could also serve as a multi-jurisdictional project in coordination with the City of Sonoma, the City of Petaluma, and small water purveyors in Sonoma Valley.
Potential Funding	Operations and Maintenance Budget
Timeline	Long Term

14 Conduct an Intertie Feasibility Planning Study of new main aqueduct intertie from Sonoma Valley to American Canyon

Mitigation Project Title	Conduct an Intertie Feasibility Planning Study of new main aqueduct intertie from Sonoma Valley to American Canyon
Hazard(s) Mitigated	Earthquake, Wildfire, Drought and Water Supply, Severe Weather: Heavy Rain/Thunderstorms/Lightning/Hail, Multi-Hazard
Project Description, Issue/Background	The District's water supply is provided by a single point of delivery via the Sonoma Aqueduct that is part of the Sonoma Water supply and distribution system. In the event of a major earthquake or wildfire or emergency interruption to this facility, the District's service area could experience water shortages for unknown periods of time and with limited alternative sources of back-up supply. A feasibility study that considers the addition of a redundant emergency intertie to the City of Napa water supply system in American Canyon could provide an alternative source of water for the District.
Related planning mechanisms	CIP, ERP Update
Other Alternatives	No Action
Responsible Office/ Agency	District Operations and Maintenance Staff
Partners	City of Napa
Priority (High, Medium, Low)	Low
Cost Estimate	High ($300,000)
Benefits (Avoided Losses)	A feasibility planning study will determine the constructability and environmental constraints associated with an emergency intertie that may mitigate serious disruptions in water supply for the customers in Sonoma Valley and protect public health and safety during potential disaster events. This could also serve as a multi-jurisdictional project in coordination with the City of Sonoma and small water purveyors in Sonoma Valley.
Potential Funding	Operations and Maintenance Budget
Timeline	Long Term

15 Critical infrastructure hardening and resilience projects against severe weather

Mitigation Project Title	Critical water facility and infrastructure hardening and resilience projects
Hazard(s) Mitigated	Severe Weather: Heavy Rain/Thunderstorms/Lightning/Hail, High Wind
Project Description, Issue/Background	The District has many water tanks, pump stations, and other water infrastructure that are critical to the delivery of water service to customers in Sonoma Valley. Several water facilities serve communities in Sonoma Valley at risk to wildfire that are located in the WUI and at risk to lightning strikes and associated power surges. In some cases, these facilities are not constructed of fire-resistant materials, which was the case with the loss of Saddle water tank during the Tubbs fire; lack necessary retrofits and upgrades needed to withstand lightning strikes and power surges; and lack defensible space. Damage to these facilities can result in a loss of potable water service for an extended period. Following a wildfire vulnerability assessment listed in Mitigation Action W-1 that focuses on potential projects the District can take to harden facilities, this action would involve implementing hardening susceptible facilities against the threat of wildfires and other severe weather events related to lightning, thunder, and wind. Specific actions may include adding concrete, masonry, steel, or other ignition-resistant materials during construction retrofits; and incorporating baffled vents to prevent embers from entering structures and building panels. Actions may also include the installation of lightning protection devices (e.g. lightning rods and grounding devices) and surge protectors on electrical control panels and equipment at water storage tanks, pump stations, and other facilities with electronic devices. The following facilities have been identified as being at high risk to wildfire hazards and several of these facilities have also been impacted by past severe weather events related to lightning: Chestnut Booster Pump Station #1 Park Well Pump Station Aqua Caliente Well Pump Station Agua Caliente Booster Pump Station Chestnut Booster Pump Station #2 Temelec Water Tank #1 Temelec Water Tank #2 Chestnut Tank Chestnut Hydro-pneumatic Tank Glenn Ellen Tank Closed Isolation Valves (GV6, GV8, GV12) The list of facilities vulnerable to wildfire hazards and severe weather events could be prioritized based on how critical each facility is to the functionality of the entire water system and also how critical the needed upgrades are to the District.
Related planning mechanisms	WMP, Evaluation of a preferred hardening alternative by facility type (prioritization based on customers served and wildfire recurrence interval). If multiple projects are implemented, the District can maximize efficiencies through standard design requirements, bidding, and construction processes.
Other Alternatives	No Action, Replacement, Relocation of Pump Stations/Tanks, Re-construction with Ignition-Resistant Materials, Defensible Space and Fuel Reduction Only
Responsible Office/ Agency	District Operations and Maintenance Staff
Partners	City of Sonoma
Priority (High, Medium, Low)	High
Cost Estimate	Very High ($250,000 to $4,000,000 depending on the actions and needs identified)

Benefits (Avoided Losses)	The benefits are based on the losses avoided in terms of limiting potable water service disruptions and the replacement costs of damaged facilities from extreme weather events. The District standards would also be updated ensuring that facilities are ready to operate in any weather conditions.
Potential Funding	Operations and Maintenance Budget/Capital funds, Funding Assistance through Cal OES HMGP, BRIC program funding, State bonds (climate resiliency bond)
Timeline	Medium Term

16 PFAS Remediation Pilot Project(s)

Mitigation Project Title	Pilot Testing and Design of PFAS Treatment System
Hazard(s) Mitigated	Drought and Water Supply
Project Description, Issue/Background	Loss of local groundwater supply due to PFAS contamination reduces system redundancy and emergency response capability. Install and operate a pilot-scale PFAS treatment system at one District owned well to evaluate granular activated carbon, ion exchange, and reverse osmosis technologies. Use results to design a full-scale treatment system. Implementation Steps: 1. Conduct baseline PFAS monitoring 2. Procure and install pilot equipment 3. Operate pilot for 3–6 months 4. Analyze performance and lifecycle costs 5. Develop 30% design for full-scale system
Related planning mechanisms	CIP, WMP
Other Alternatives	No action
Responsible Office/ Agency	District Operations and Maintenance Staff
Partners	Upon full-scale implementation, the owners of three leased wells in the District will be brought on as partners.
Priority (High, Medium, Low)	High
Cost Estimate	High (Pilot: $100K–$500K; Design: $150K–$300K)
Benefits (Avoided Losses)	Brings wells into compliance with State and Federal regulations for PFAS
Potential Funding	FEMA BRIC / HMA; State Water Board grants; DWSRF loans; EPA research and demonstration grants; EPA technical assistance programs
Timeline	Short Term

17 Pipeline Seismic Mitigation Projects

Mitigation Project Title	Replacement of ten pipeline segments in liquefaction zones; isolation/bypass of four pipeline segments in landslide areas
Hazard(s) Mitigated	Landslide, Earthquake
Project Description, Issue/Background	VOMWD's pipeline infrastructure is at significant seismic risk, mostly due to earthquake-triggered liquefaction. Regional mapping shows much of the central service area has soils with moderate to high liquefaction susceptibility, potentially resulting in 32 backbone repairs and 87 system repairs after a major earthquake (RRA, 2026) VOMWD should prioritize hardening six vulnerable pipeline sections (about 1.6 miles) and seven stream crossings in areas of high susceptibility. An additional 7.6 miles of backbone pipelines and five stream crossings in moderately susceptible zones are lower priority. Landslide risks are mainly near the Saddle and Sobre Vista tanks. Mitigation options include pipeline re-routing or installing bypasses with valve boxes. VOMWD should install isolation valves in high-risk areas and continue replacing brittle pipes as part of ongoing maintenance. See Risk and Resiliency Assessment for more details.
Related planning mechanisms	Risk and Resiliency Assessment
Other Alternatives	No Action
Responsible Office/ Agency	District Operations and Maintenance Staff
Partners	None
Priority (High, Medium, Low)	High
Cost Estimate	Very High ($14.8M - $15.9M)
Benefits (Avoided Losses)	Increases resilience to seismic hazards
Potential Funding	FEMA and Cal OES HMGP; EPA Water Infrastructure Finance and Innovation Act (WIFIA); Bureau of Reclamation WaterSMART Grants; State Water Resources Control Board (SWRCB); Prop 4 Funding
Timeline	Long Term

18 Tank Seismic Mitigation Projects

Mitigation Project Title	Tank Seismic Mitigation Projects
Hazard(s) Mitigated	Earthquake, Drought and Water Supply
Project Description, Issue/Background	Lack of flexibility and over constrained piping have been observed in past earthquakes and presents high risk of damage. Piping retrofits at Donald and Temelec Tanks, anchorage retrofits at Donald, Saddle, Sonoma Mountain Upper, and both Temelec tanks, and adjustment of operation fill levels where possible at Glen Ellen and both Bolli tanks will reduce seismic demand. See Seismic Vulnerability Assessment for more details.
Related planning mechanisms	Risk and Resiliency Assessment
Other Alternatives	No Action
Responsible Office/ Agency	District Operations and Maintenance Staff
Partners	None
Priority (High, Medium, Low)	High
Cost Estimate	High ($948,000)
Benefits (Avoided Losses)	Increases resilience to seismic hazards
Potential Funding	FEMA BRIC; EPA Drinking Water System Infrastructure Resilience and Sustainability Program; Cal OES HMGP; SWRCB DWSRF
Timeline	Long Term

19 Well Seismic Mitigation Projects

Mitigation Project Title	Well Seismic Mitigation Projects
Hazard(s) Mitigated	Earthquake, Drought and Water Supply
Project Description, Issue/Background	Seven out of eight VOMWD wells meet Tier 1 seismic performance objectives. Although the estimated permanent ground deformation of the eighth well is not expected to significantly impact groundwater well operations or structural stability, an anchorage between the foundation and above ground structure will increase long term resilience. See Risk and Resiliency Assessment for more details.
Related planning mechanisms	Risk and Resilience Assessment
Other Alternatives	None
Responsible Office/ Agency	District Operations and Maintenance Staff
Partners	None
Priority (High, Medium, Low)	High
Cost Estimate	Low ($50,000)
Benefits (Avoided Losses)	
Potential Funding	FEMA HMGP; EPA Drinking Water System Infrastructure Resilience and Sustainability Program; Bureau of Reclamation WaterSMART Grants; SWRCB DWSRF
Timeline	Medium Term

20 Managed Security Service Provider

Mitigation Project Title	Managed Security Service Provider
Hazard(s) Mitigated	Cyber Threats
Project Description, Issue/Background	Contract with a managed security service provider to outsource monitoring of digital security for mission critical systems and devices. Conduct continuous surveillance and routine vulnerability assessments. Help maintain uniformly secure systems by installing latest patches and updates. Contain and minimize impact of attempted suspicious activity. Conduct RFP to select vendor or expand services with existing outsourced IT service provider.
Related planning mechanisms	RRA, ERP, and CIP.
Other Alternatives	None
Responsible Office/ Agency	District Operations and Maintenance Staff
Partners	None
Priority (High, Medium, Low)	Low
Cost Estimate	Low ($500 per Year)
Benefits (Avoided Losses)	Avoids potential security breaches and threats to District's information technology, operation systems, and water distribution system.
Potential Funding	Operations Budget
Timeline	Short Term

21 SDC Water System Rehabilitation and Integration for Emergency and Redundant Supply

Mitigation Project Title	SDC Water System Rehabilitation and Integration for Emergency and Redundant Supply
Hazard(s) Mitigated	Earthquake, Drought, Water Supply, Wildfire
Project Description, Issue/Background	This project involves the evaluation, rehabilitation, and integration of the former Sonoma Developmental Center (SDC) water supply, treatment, and storage infrastructure into the District's system to provide a reliable emergency and supplemental water supply. The project may include acquisition or long-term control of water rights, rehabilitation of treatment facilities, repair or replacement of conveyance infrastructure, and integration with the District's distribution system. This project is intended to reduce the District's reliance on a single imported water supply source and provide redundancy during hazard events such as earthquakes, wildfires, and power outages that may disrupt Sonoma Water deliveries. Additional benefits may include the ability to support aquifer storage and recovery (ASR), regional emergency interties, and improved system operational flexibility.
Related planning mechanisms	RRA, ERP, CIP, WMP, UWMP.
Other Alternatives	None
Responsible Office/ Agency	District Operations and Maintenance Staff
Partners	State DGS, County of Sonoma, Developer
Priority (High, Medium, Low)	High
Cost Estimate	Very High ($15,000,000 to $45,000,000 depending on the needs identified and cost sharing opportunities)
Benefits (Avoided Losses)	Restores the loss of the former SDC's emergency water supply locally and avoids potential loss of water service resulting from a loss of the Sonoma Water aqueduct or source. Provides additional flexibility for drought response and fire preparedness. Additional source of ASR supply water. Local, large scale, and sustainable, as opposed to groundwater which is declining over time.
Potential Funding	CIP Budget, development cost sharing, FEMA HMGP; EPA Drinking Water System Infrastructure Resilience and Sustainability Program; Bureau of Reclamation WaterSMART Grants; SWRCB DWSRF
Timeline	Medium Term

22 *Wellhead PFAS Treatment System Installation*

Mitigation Project Title	***Wellhead PFAS Treatment System Installation***
Hazard(s) Mitigated	Earthquake, Drought, Water Supply, Wildfire
Project Description, Issue/Background	This project involves the final design, construction, and installation of wellhead treatment systems to remove per- and polyfluoroalkyl substances (PFAS) from groundwater sources currently impacted by contamination. Treatment technologies may include granular activated carbon (GAC), ion exchange (IX), Reverse Osmosis (RO) or other best available technologies, based on site-specific water quality and pilot testing results. Several of the District's local groundwater wells have been removed from service due to PFAS detections exceeding State notification levels and/or federal maximum contaminant levels. As a result, the District has experienced a reduction in available local water supply and emergency response capacity. Installation of wellhead PFAS treatment systems will allow impacted wells to be returned to service in compliance with regulatory requirements, restoring critical local supply capacity. This project will improve system redundancy and operational flexibility, particularly during hazard events such as earthquakes, wildfires, droughts, or disruptions to imported water supplies. Project components follow assessment and pilot testing, and include final design, permitting, procurement, property acquisition, installation of treatment vessels and media, site piping and valving modifications, electrical and control system integration (SCADA), and long-term monitoring and maintenance planning.
Related planning mechanisms	RRA, ERP, CIP, WMP, UWMP.
Other Alternatives	None
Responsible Office/ Agency	District Operations and Maintenance Staff
Partners	Leased well owners in some cases
Priority (High, Medium, Low)	High
Cost Estimate	Very High ($100,000 to $250,000+ per well, times possibly all 8 sites = 800,000 to $2,000,000+ depending on the systems identified and water quality parameters identified)
Benefits (Avoided Losses)	Restores local water supply lost to PFAS contamination and avoids potential loss of water service resulting from a loss of the Sonoma Water aqueduct or source. Provides additional flexibility for drought response and fire preparedness.
Potential Funding	CIP Budget, FEMA HMGP; EPA Drinking Water System Infrastructure Resilience and Sustainability Program; Bureau of Reclamation WaterSMART Grants; SWRCB DWSRF
Timeline	Short Term

23 DMAs for Increased Pressure Management, Improved Leak Detection and Fire Flow Capabilities

Mitigation Project Title	***DMAs for Increased Pressure Management, Improved Leak Detection and Fire Flow Capabilities***
Hazard(s) Mitigated	Earthquake, Drought, Wildfire, Severe Weather (flooding, landslides)
Project Description, Issue/Background	This project involves the expansion and refinement of District Metered Areas (DMAs) and the installation of additional system isolation valves within the District's water distribution system to improve operational control, system resilience, and emergency response capability. The District's water system currently includes multiple pressure zones and operational areas; however, additional segmentation is needed to allow for more precise isolation of pipeline failures, leaks, or damaged infrastructure during hazard events such as earthquakes, wildfires, or severe weather. Without sufficient segmentation, system disruptions may require large portions of the distribution system to be taken out of service, resulting in widespread outages and reduced fire flow capacity. This project will include hydraulic analysis, design, and installation of new isolation valves, flow meters, and pressure monitoring equipment to create or enhance DMAs throughout the system. Improvements will allow the District to isolate smaller portions of the system during emergencies, maintain service to unaffected areas, and better manage system pressures and flows under both normal and emergency conditions. Additional benefits include improved leak detection, reduced water loss, enhanced system monitoring through SCADA integration, increased fire flow capabilities, and improved long-term asset management. By increasing system segmentation and operational flexibility, the District will reduce the potential extent and duration of service disruptions and improve overall system reliability during hazard events.
Related planning mechanisms	RRA, ERP, CIP, WMP, UWMP.
Other Alternatives	None
Responsible Office/ Agency	District Operations and Maintenance Staff
Partners	None
Priority (High, Medium, Low)	High
Cost Estimate	Very High (three areas identified so far: $330,000 + $620,000 + $920,000 = $1,870,000+ depending on the complexity of installation and integration)
Benefits (Avoided Losses)	Reduces the extent and duration of service outages by allowing rapid isolation of damaged or leaking pipeline segments. Maintains water service and fire flow in unaffected areas during emergency events. Improves system pressure management and reduces water loss, which is critical during drought and limited supply conditions. Enhances the District's ability to respond to and recover from infrastructure damage, thereby reducing repair costs, water loss, and impacts to public health and safety.

Potential Funding	CIP Budget, FEMA HMGP; EPA Drinking Water System Infrastructure Resilience and Sustainability Program; Bureau of Reclamation WaterSMART Grants; SWRCB DWSRF
Timeline	Medium Term

24 Address Over-constrained Connections to Reservoirs

Mitigation Project Title	Address Over-constrained Connections to Reservoirs that Lack Seismic Specifications
Hazard(s) Mitigated	Earthquake
Project Description, Issue/Background	Install flexible seismic connections at reservoirs that lack seismic specifications to allow for movement between tanks and pipes, and anchor reservoirs to prevent tanks from sliding or buckling during an earthquake.
Related planning mechanisms	RRA, ERP, CIP, WMP, UWMP.
Other Alternatives	No Action; Install flexible internal liners
Responsible Office/ Agency	District Operations and Maintenance Staff
Partners	None
Priority (High, Medium, Low)	High
Cost Estimate	High ($600,000+ per tank)
Benefits (Avoided Losses)	Avoids movement and rupturing of tanks, Prevents the loss of water following an earthquake; Avoids flooding and erosion; Protects downstream pipes
Potential Funding	FEMA BRIC, CA SWRCB DWSRF
Timeline	Medium Term

25 Address Liquefaction at Main Line Creek Crossings

Mitigation Project Title	Address Liquefaction at Main Line Creek Crossings by Replacing Main with Seismic Reliant Pipe and Fittings
Hazard(s) Mitigated	Earthquake, Landslide
Project Description, Issue/Background	Address liquefaction at main line creek crossings by replacing the main line with seismic-resistant pipe and fittings. This action will also mitigate risks associated with erosion and landslides at these locations. Currently, 7.6% of the critical backbone of the water system (16 points out of 25) is located in high liquefaction areas, along with 20% of the distribution pipeline. Updating pipes and fittings will reduce the time estimate for repairs on the backbone to an estimated 7 days, which could significantly reduce the time required for the total restoration of the system. The total length of the backbone is noted as 20.7 miles, with 15.6 miles of a/c pipe needing to be replaced.
Related planning mechanisms	RRA, ERP, CIP, WMP, UWMP.
Other Alternatives	No Action; Install isolation valves; Install cured-in-place pipe
Responsible Office/ Agency	District Operations and Maintenance Staff
Partners	County of Sonoma
Priority (High, Medium, Low)	High
Cost Estimate	Very High ($10M+)
Benefits (Avoided Losses)	Reduces restoration time; Maintains water pressure for firefighting immediately after an earthquake; Avoids water service disruptions; Prevents groundwater contamination
Potential Funding	FEMA HMGP, BRIC, EPA Drinking Water Grants
Timeline	Long Term

6 PLAN ADOPTION, IMPLEMENTATION, AND MAINTENANCE

44 U.S. Code of Federal Regulations Requirement §201.6 Local Mitigation Plans (c)(5): The local hazard mitigation plan shall include] documentation that the plan has been formally approved by the governing body of the jurisdiction requesting approval of the plan (e.g., City Council, county commissioner, Tribal Council).

44 U.S. Code of Federal Regulations Requirement §201.6 Local Mitigation Plans (c)(4): The plan maintenance process shall include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.

6.1 Plan Adoption

The purpose of formally adopting this plan is to confirm support from the Valley of the Moon Water District (District), raise awareness of the plan, and formalize the plan's implementation. The adoption of this plan completes Planning Step 9 of the 10-step planning process: Adopt the Plan, in accordance with the requirements of DMA of 2000. The District Board of Directors has adopted this local hazard mitigation plan by passing a resolution. A copy of the generic resolution is included in Appendix D: Adoption Resolution. Once the plan is adopted, Appendix D will include the executed copies.

Implementation and maintenance of the plan is critical to the overall success of hazard mitigation planning. This is Planning Step 10 of the 10-step planning process. This chapter provides an overview of the overall strategy for plan implementation and maintenance, and outlines the method and schedule for monitoring, updating, and evaluating the plan. The chapter also discusses incorporating the plan into existing planning mechanisms and how to address continued public involvement.

6.2 Implementation

Once adopted, the plan faces the test of its worth: implementation. While this plan contains many worthwhile actions, the District will need to decide which action(s) to undertake first. Two factors will help with making that decision: the priority assigned to each action and funding availability. Low or no-cost actions more readily demonstrate progress toward successful plan implementation. Mitigation is most successful when it is incorporated into the day-to-day functions and priorities of government or special districts and development.

Implementation will be accomplished by adhering to the schedules identified for each action (see Chapter 5) and through constant and energetic efforts to update and highlight the multi-objective, win-win benefits of each project to the District's customers, community, and its stakeholders. These efforts include the routine actions of monitoring agendas, attending meetings, and promoting a safe, sustainable, and resilient community. The four main components of implementation are:

- **Implement** the actions recommended by this plan;
- **Utilize** and enforce existing rules, regulations, policies and procedures;
- **Communicate** the hazard information collected and analyzed through this planning process so that the community better understands what and where hazards can occur, and what they can do themselves to be better prepared; and
- **Publicize** the success stories that are achieved through the Hazard Mitigation Planning Committee's (HMPC) ongoing efforts.

An important implementation mechanism that is highly effective and low-cost is incorporation of the LHMP recommendations and their underlying principles into other plans, such as the District's 2020 *Urban*

Water Management Plan (UWMP) updates. The District already implements policies and programs to reduce losses to life and property from hazards. This plan builds upon the momentum developed through previous and related planning efforts and mitigation programs, such as the District's *2025 Water Master Plan (WMP)* and UWMP, and recommends implementing actions, where possible, through these other program mechanisms.

Simultaneously with these efforts, it is important to constantly monitor funding opportunities that can be leveraged to implement the more expensive recommended actions (for example, structural hillside stabilization and waterline repair projects). This will include creating and maintaining a bank of ideas on how to meet local match or participation requirements. When funding does become available, the District will be in a position to capitalize on the opportunity. Funding opportunities to be monitored include special pre- and post-disaster funds, special district budgeted funds, state and federal earmarked funds, and other grant programs, including those that can serve or support multi-objective applications.

With adoption of this plan, the District will be tasked with plan implementation and maintenance. The District agrees to:

- Provide a forum for hazard mitigation issues;
- Disseminate hazard mitigation ideas and activities to all participants;
- Pursue the implementation of high-priority, low/no-cost recommended actions;
- Keep the concept of mitigation in the forefront of community decision making by identifying plan recommendations when other community goals, plans, and activities overlap, influence, or directly affect increased community vulnerability to disasters;
- Monitor multi-objective cost-share opportunities to help the community implement the plan's recommended actions for which no current funding exists;
- Assist in implementation and update of this plan;
- Report on plan progress and recommended changes to the District's Board of Directors (Board); and
- Inform and solicit input from the public.

The primary duty of the District is to see the plan successfully carried out and to report to the Board and the public on the status of plan implementation and mitigation opportunities. Other duties include reviewing and promoting mitigation proposals, considering stakeholder concerns about hazard mitigation, passing concerns on to appropriate entities, and posting relevant information on the District's LHMP Webpage (and others as appropriate). These activities can be achieved through reconvening the HMPC on an annual basis.

6.3 Maintenance

Plan maintenance is defined as the ongoing effort to monitor and evaluate plan implementation, and to update the plan as progress, roadblocks, or changing circumstances are recognized.

The District will designate a Lead Hazard Mitigation Manager who will coordinate plan reviews in consultation with the District's departments and other participating jurisdictions and stakeholders. The District determined the General Manager will be designated the Lead Hazard Mitigation Manager and will be supported by the District's Administration Manager.

6.3.1 Maintenance Schedule

In order to monitor progress and update the mitigation strategies identified in the action plan, the Lead Hazard Mitigation Manager and the HMPC will revisit this plan annually and within 45 days after a hazard

event. The annual review will be conducted by the HMPC each year. The HMPC will review progress on the LHMP and complete an annual update to the Board.

This plan will also be updated, approved, and adopted within a five-year cycle as per Requirement §201.6(c)(4)(i) of the Disaster Mitigation Act of 2000 unless disaster or other circumstances (e.g., changing regulations) require a change to this schedule. With the initial approval of this plan occurring in 2026, the plan will need to be updated, reviewed and approved by Cal OES and by FEMA Region IX, and re-adopted by the Board of Directors by no later than December of 2027 (or within five years of the initial approval, which ever date occurs first).

The District will monitor planning grant opportunities from Cal OES and FEMA for funds to assist with the update.

6.3.2 Maintenance Evaluation Process

The HMPC will continually monitor the incorporation process, evaluation and update methodology, continued public participation, and completion of the actions/projects to ensure that the plan is being implemented. By monitoring these processes, the HMPC will be able to regularly evaluate the effectiveness of the plan and facilitate necessary changes as needed.

Evaluation of progress can be achieved by monitoring changes in vulnerabilities identified in the plan. Changes in vulnerability may include:

- Decreased vulnerability as a result of implementing recommended actions,
- Increased vulnerability as a result of failed or ineffective mitigation actions,
- Increased vulnerability as a result of new development (and/or annexation) and/or,
- Increased vulnerability as a result of new hazards or circumstances.

The HMPC will use the following process to evaluate progress of any changes in vulnerability as a result of plan implementation.

- A representative from District departments identified in each mitigation action will be responsible for tracking project status and reporting to the HMPC on an annual basis to provide feedback on whether the mitigation action as implemented meets the defined objectives and is likely to be successful in reducing vulnerabilities (this action may apply best to the District's Hazard Mitigation Manager given the small size of the District).
    - If the project does not meet identified objectives, or if the mitigation action is new, the HMPC will determine what alternate mitigation actions (or projects) may be implemented, and an assigned individual will be responsible for facilitating and overseeing the scope of action definition. The assigned individual will make any required modification recommendations of the plan to the HMPC, implement the action, monitor the results of the action, and report the findings to the HMPC.
- Projects that were not ranked high priority but were identified as potential mitigation strategies will be reviewed for feasibility and continued appropriateness during the annual monitoring period and the five-year updating of this plan.
- Changes will be made to the plan to accommodate for mitigation action projects that have failed or are not considered feasible after a review for their consistency with established criteria, the time frame, priorities, and/or funding resources.

Updating of the plan will be by written changes and submissions, as the District deems appropriate and necessary, and as approved by the Board. Updates to this plan will:

- Consider changes in vulnerability due to action implementation;
- Document success stories where mitigation efforts have proven effective;
- Document areas where mitigation actions were not effective;
- Document any new hazards that may arise or were previously overlooked;
- Document hazard events and impacts that occurred within the five-year period;
- Incorporate new data or studies on hazards and risks, specifically on climate change and its effects on flooding and wildfires;
- Incorporate new capabilities or changes in capabilities;
- Incorporate documentation of continued public involvement;
- Incorporate documentation to update the planning process that may include new or additional stakeholder involvement;
- Incorporate growth and development-related changes to water supply and infrastructure demands;
- Incorporate new project recommendations or changes in project prioritization;
- Include a public involvement process to receive public comment on the updated plan prior to submitting the updated plan to Cal OES and FEMA Region IX; and
- Include adoption by the Board following Cal OES/FEMA approval.

Annual Review

As part of an annual review process, the District's HMPC will provide opportunities for public input on the LHMP. The District and HMPC will schedule formal LHMP updates at regularly scheduled public meetings to ensure routine maintenance and plan evaluation. The LHMP is designed to be a living document that can be annually updated. Review will involve the following planning processes to encourage public participation, evaluate the effectiveness of the plan, and track mitigation action progress:

- Circulate a press release announcement on the annual review meeting. The press release will advertise the date, time, and location of the public meeting and provide contact information of the Lead Hazard Mitigation Manager.
- Electronic mailings regarding the annual review meeting will be emailed to federal, state, and local agencies, the HMPC, and other representatives.
- Prior to the annual review meeting, the HMPC and District will provide an update on their mitigation actions.
- The Lead Hazard Mitigation Manager will announce the meeting using other forms of traditional and digital media platforms, such as newspaper notices, radio announcements, and social media posts.
- A summary of the annual review meeting will be posted on the District's LHMP Webpage and include an annual report on the status of the implementation of the mitigation actions.

The review process should also include information on changing conditions in the District. Specifically, the update should note growth and recent development changes in the District's Planning Area (number of new connections, new customers), the number of improved water supply assets and related infrastructure, natural hazard events and damage information, and major capital improvement projects to water facilities and infrastructure (e.g. water mains, utility access roads). The review process should also address changing legislation and new federal and state policies, so these policy updates can be incorporated into the LHMP.

6.3.3 Incorporation into Existing Planning Mechanisms

Planning mechanisms are governance tools used to manage local land use development and community decision-making, such as general plans, floodplain management plans, building codes, emergency

operation plans, capital improvement plans, or other long-range plans. Another important implementation mechanism that is highly effective and low-cost is incorporation of the LHMP recommendations and their underlying principles into existing District plans and mechanisms. Federal regulations require that LHMPs describe a process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms, such as a General Plan or Capital Improvement Plan. An example of incorporating mitigation actions into other planning mechanisms would be to identify the goals and strategies of the LHMP and document how they have been used to further mitigation efforts in other planning documents.

As previously stated in Section 6.2 of this plan, mitigation is most successful when it is incorporated into the day-to-day functions and priorities of government and development. As described in this plan's capability assessment, the District already implements policies and programs to reduce losses to life and property from hazards. This plan therefore builds upon previous related planning efforts and mitigation programs and recommends implementing actions, where possible, through these other program mechanisms.

Table 6-1 details where the District integrated their 2021 LHMP into existing planning mechanisms. Integration of the 2021 LHMP primarily occurred on a plan and on a project-specific basis (see Chapter 5 Mitigation Strategy for examples of how the LHMP informed specific mitigation projects). Plan integration since the last plan involved using the plan's risk assessment and mitigation priorities as a common framework across the District's standards, WMP, RRA, and the Seismic Vulnerability Assessment Report. This process ensured consistent assumptions about hazards, system vulnerabilities, and levels of water services. By cross-referencing LHMP findings in subsequent capital planning documents, the District was able to align infrastructure upgrades, seismic vulnerability needs and potential retrofits, and emergency preparedness and mitigation investments to address the same high-risk hazards identified in the LHMP. Integration constraints included limited planning authority, as land use and development decisions are managed by the County; a narrow range of formal planning documents (i.e. No General Plan), reducing traditional integration opportunities; and dependence on regional water systems, requiring coordination but limiting direct control.

Table 6-1 Integration of 2021 LHMP into Planning Mechanism

Planning Mechanism	How LHMP was integrated
Water Master Plan	Drought information referenced in the 2021 LHMP was integrated into existing and future water demands and specifically the District's total and per capita water use increases. Current and historical water production and consumption information are also consistently referenced in both documents using the same District and SWRCB sources. Both plans also include updated information on development trends; this information was included in the Anticipated Development Projections section of the WMP. Additionally, the WMP references drought emergencies and addressed the need to maintain approximately 40% of its maximum month demand through local sources to mitigate against drought emergencies. These same mitigation concepts were included in the 2021 LHMP.
Seismic Vulnerability Assessment	Seismic mitigation actions from the 2021 LHMP were considered and integrated where applicable.
Valley of the Moon District Standards	Hazard profiles and the mitigation strategy informed the water use efficiency vegetation standards update.
Risk and Resilience Assessment	Risk profiles and mitigation measures were integrated into the assessment.

The District will strengthen integration over the next planning cycle by formalizing how LHMP priorities are incorporated into its core functions. Examples of how the District will integrate the 2026 LHMP include:

- Incorporate LHMP actions into Capital Improvement Program (CIP) planning and prioritization
- Use the LHMP to inform infrastructure design, replacement, and upgrades
- Integrate mitigation considerations into water supply and emergency planning
- Coordinate with Sonoma County, Sonoma Water, the Sonoma Valley Groundwater Sustainability Agency, and other regional partners to align mitigation efforts
- Continue collaboration with regional water providers on shared risks (e.g., drought, wildfire, infrastructure vulnerability)
- Link LHMP actions to capital planning, asset management, and emergency response efforts
- Incorporate LHMP priorities into grant applications and funding decisions
- Review LHMP actions during periodic internal planning discussions
- Track progress using existing reporting mechanisms
- Identify opportunities to integrate mitigation into future planning updates

HMPC members involved in the updates to the planning mechanisms listed above will be responsible for integrating the findings and recommendations of this LHMP with these other plans, programs, and mechanisms as appropriate. As an action step to ensure integration with other planning mechanisms, the Lead Hazard Mitigation Manager will discuss this topic at the annual meeting (refer to Section 6.3.1, Maintenance Schedule) with the HMPC. The HMPC will discuss if there are opportunities to incorporate the plan into other planning mechanisms and who will be responsible for leveraging those opportunities. HMPC members representing local jurisdictions will work with their jurisdictional planning teams to integrate their identified mitigation actions into their own local plans, programs, and mechanisms. Efforts to integrate the hazard mitigation plan into local plans, programs, and policies will be reported during the annual HMPC plan review meeting. Successful integration efforts will be recorded during the meeting.

Specific examples of incorporation of the LHMP into existing planning mechanisms include:

- Integration of mitigation actions identified in this mitigation strategy with the actions and implementation priorities established in the WMP. Key people responsible for development of the WMP Plan should participate in the future HMPC, as they can identify key projects in the WMP and integrate them into the mitigation strategy of the LHMP. The implementation process will be successful through the coordination and effort of individuals from these various organizations.
- Using the risk assessment information in this plan to update any hazard analyses in other District vulnerability assessments.
- Integration of this LHMP into other District Infrastructure Master Plans and the Capital Improvement Program.

Efforts should continuously be made to monitor the progress of mitigation actions implemented through these other planning mechanisms and, where appropriate, the priority actions should be incorporated into updates of this hazard mitigation plan.

6.3.4 Continued Public Involvement

44 U.S. Code of Federal Regulations Requirement §201.6(c)(4): The local hazard mitigation plan shall include discussion on how the community will continue public participation in the plan maintenance process.

Continued public involvement is imperative to the overall success of the plan's implementation and goal(s). Efforts will be made to involve the public in the plan maintenance, evaluation, and review

process. This is the responsibility of the Lead Hazard Mitigation Manager at the District and includes maintaining a digital version of the plan on the District's LHMP Webpage for public review. In addition, information on whom to contact within the District will be posted with the plan. The designated Lead Hazard Mitigation Manager at the District will maintain a file of comments received for reference during the next five-year update. Any revisions to the plan that may occur as a result of a disaster will also be made public and posted on the District's LHMP Webpage.

Annual LHMP Review

Any revisions to the plan that may occur as a result of a disaster will also be made public and posted on the District's LHMP Webpage, social media sites, and local media platforms. The District's Lead Hazard Mitigation Manager will place an advertisement in the local newspaper and also circulate electronic press releases that specify the date and time for review and public input. The District will also invite federal, state, and local agencies to participate, with the HMPC.

Five-Year LHMP Update

The five-year update process provides an opportunity to solicit participation from new and existing stakeholders, to publicize success stories from plan implementation, and seek additional public comment. A public hearing(s) or survey to receive public comment on the plan will be held during the plan update period. When the HMPC reconvenes for the update, the planning process will involve all stakeholders participating in the planning process, including those who joined the HMPC after the initial effort, to update and revise the plan. Public participation will be encouraged and invited through LHMP Webpage postings and press releases, in addition to email and social media announcements.

Continued public outreach and education is a mitigation strategy in Chapter 5 of this plan, emphasizing a multi-hazard public education and awareness program to be conducted on an annual basis. Activities related to public involvement during the 2020-2021 planning process are documented in Chapter 3 and Appendix B. The District's Community Engagement Strategy also serves as a reference for continued public involvement over the next several years and lays the foundation for outreach associated with the next formal five-year LHMP update. Below are outreach tools from the Community Engagement Strategy:

- Recognizing that not everyone participates in the same way or at the same time, include a mix of participation strategies that provides for a broad and diverse set of engagement opportunities that consider the diversity of the District's Planning Area.
- Periodic presentations on the plan's progress to elected District Board member or other community groups.
- Ensure that the public has an opportunity to provide input during the planning process and prior to the finalization of the District's LHMP update.
- Ensure a "whole community" approach to building stakeholder and public support for, and ultimately ownership of, the District's LHMP.
- Identify specific outreach activities and document activities as the planning effort progresses.
- Distribute emails and postcards and newsletters to District water customers about hazard mitigation.
- Participate in existing community events to share information about hazard mitigation (e.g., community farmer's markets, library events, senior centers).
- Continue to use the District's LHMP Webpage as a distribution point or repository for plan information.

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