PENINSULA RESILIENCE PLANNING PROJECT

SAN BRUNO
VULNERABILITY ASSESSMENT SUMMARY

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Public Draft

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Introduction

There are nine jurisdictions in San Mateo County working collaboratively on the Peninsula Resilience Planning (PREP) project: San Mateo County; the Town of Atherton; and the cities of Belmont, Brisbane, Burlingame, East Palo Alto, Half Moon Bay, Pacifica, and San Bruno. The PREP project is a coordinated effort to identify the hazards facing communities across San Mateo County, evaluate how these hazards may change with the changing climate, recognize the communities and features that are most vulnerable, and develop strategies for improving community safety and resilience.

What Is a General Plan?

A general plan is each local government's blueprint for meeting the community's long-term vision for the future, with goals, policies, and actions for achieving the vision. All cities and counties in California are required to have general plans with, at minimum, eight chapters, or elements: Land Use, Circulation, Housing, Conservation, Open Space, Noise, Safety, and Environmental Justice (if applicable).

Source: Governor's Office of Planning and Research. 2017. *State of California General Plan Guidelines*.

As a participant in PREP, San Bruno is conducting a comprehensive update of its Safety Element. As part of the technical background work for the update to the San Mateo County Safety Element, the PREP team prepared an updated Climate Change Vulnerability Assessment to analyze how climate-related hazards may harm the community. California law requires that, as part of the need to assess and protect against hazards, that safety elements analyze climate vulnerability, which is the degree to which people, nature, the built environment, and other systems are susceptible to harm from climate change and associated hazards. This includes physical and mental injuries, property damage or destruction, environmental harm, economic damage, and other factors.

The Vulnerability Assessment helps community members, City staff, and decision makers understand how climate change hazards may alter community conditions and what parts of the community (people and places) should be prioritized for adaptation and resilience. The Vulnerability Assessment identifies City and community resources to improve resiliency in San Bruno in an integrated, thorough, and tailored way. The Vulnerability Assessment also informs updates to the Safety Element, which, in combination with the San Mateo County Multijurisdictional Local Hazard Mitigation Plan (MJLHMP), will help safeguard San Bruno against both current and future hazard conditions, including the changes in hazard events from climate change. The findings from the Vulnerability Assessment process will be used to inform the goals, policies, and actions in San Bruno's updated Safety Element. This assessment does not include hazards that are present in the community but are not affected by climate change, such as earthquakes.

Community Profile

San Bruno is in northern San Mateo County, extending from the foothills down to low-lying areas near San Franciso International Airport and San Francisco Bay. In addition to its residential neighborhoods, San Bruno is home to Skyline College, the Golden Gate National Cemetery, open space areas, and multiple commercial centers, including its downtown corridor, The Shops at Tanforan mall, and Towne Center. Eastern San Bruno, near Highway 101, has a high concentration of frontline communities and some of the highest pollution levels in San Mateo County.*

Frontline Communities of Concern

A frontline community of concern refers to groups disproportionately impacted by environmental, social, or economic challenges. Often marginalized and with few resources to address these challenges, these communities face the most immediate effects of issues like climate change, pollution, and inequality. The term emphasizes the need for equitable solutions that prioritize those most affected.

San Bruno's community demographics exhibit several distinct differences when compared to the broader San Mateo County. San Bruno distinguishes itself from San Mateo County, particularly in terms of outdoor workers, linguistic diversity, housing characteristics, and income levels. San Bruno has a lower median household income (approximately $136,000) compared to the County as a whole ($175,000). The home ownership rate in San Bruno is slightly lower than the County average, and approximately 36 percent of households experience significant housing cost burdens. San Bruno has a significantly larger proportion of persons working outdoors (about 9 percent), compared to the county rate of approximately 5 percent. Approximately 19 percent of San Bruno residents are linguistically isolated, compared to 16 percent for the entire county. **Table 1** shows some demographics in San Bruno compared to all of San Mateo County.

* CalEnviroScreen, an environmental justice index maintained by the California Office of Environmental Health Hazard Assessment, identifies the part of San Bruno east of Huntington Avenue as having a pollution burden in the 94th percentile statewide. This means that it has a higher pollution burden (which includes both air and water pollution) than all but 6 percent of census tracts in California. Eastern South San Francisco/Oyster Point is the only part of San Mateo County with a higher pollution burden.

Table 1: Community Demographics for San Bruno and San Mateo County

Demographic	San Bruno		San Mateo County	
	Number	Percentage	Number	Percentage
Population	**43,218**		**754,250**	
Children (under 18 years old)	8,111	18.80%	150,187	19.90%
Linguistically isolated persons	7,935	19.30%	116,306	16.30%
Older adults (65 years and older)	6,918	16.00%	127,520	16.90%
Older adults living alone	1,305	8.60%	26,168	9.90%
Persons with disabilities	3,906	8.60%	65,466	8.70%
Persons working outdoors	2,494	9.10%	41,748	5.44%
Persons in poverty	2,426	5.77%	48,137	6.40%
Unhoused persons	75	0.17%	1,092	0.14%
Number of households	**15,169**		**264,323**	
Median household income	131,669	-	175,000	-
Cost-burdened households	5,379	35.98%	94,625	36.55%
Households without access to internet	1,029	6.80%	14,371	5.40%
Households without a vehicle	963	6.30%	14,752	5.58%
Overcrowded households	1,185	7.81%	19,366	7.33%
Rental households	5,639	37.17%	106,955	40.46%

Source: American Community Survey, 2022, ACS 5-Year Estimates.

Eastern San Bruno faces distinct equity challenges compared to the broader community. Over one-quarter of the adult population has limited English proficiency, creating barriers to accessing essential community resources and services.[1] Housing-related constraints are significant in this neighborhood, with 10 percent of households experiencing overcrowding,[2] and 43 percent of homeowner households and 66 percent of renter households are cost-burdened, meaning they spend at least 30 percent of their income on housing costs.[3]

Educational attainment is another area of concern in eastern San Bruno, where 10 percent of adults lack a high school diploma,[4] limiting their employment opportunities and hindering long-term financial stability. The demographic composition is notably diverse, with 82 percent of the population identifying as non-white.[5] This diversity suggests that disparities may be influenced by cultural and racial factors, potentially exacerbating inequities in the community. Taken together, these challenges highlight significant equity issues in this San Bruno neighborhood, indicating a critical need for targeted resources and interventions.

Climate Hazards

Climate change is the long-term shift in average weather patterns, including significant alterations in temperature, precipitation, and wind patterns over an extended period—typically decades or longer. Rising global temperatures are causing more frequent and intense heatwaves, storms, floods, droughts, wildfires, and other hazards. These events are frequently concurrent, resulting in cascading impacts that are progressively more difficult to manage, such as droughts amplifying wildfire risk or extreme heat exacerbating water scarcity. This section lays out the major hazards that are affected by climate change in San Bruno, and how these hazards are expected to change in the coming years and decades. These hazards are air quality and smoke, drought, ecosystem pests, extreme heat and warm nights, flooding, human health hazards, landslides and debris flows, sea level rise and groundwater emergence, severe weather, and wildfire.

Air Quality and Smoke

Air quality directly affects the health, well-being, and everyday quality of life for all residents of San Bruno. Poor air quality poses significant health risks, such as respiratory and cardiovascular illness, and these concerns have become especially urgent due to the increasing frequency of wildfires in the region and other climate-related factors.[6] Air pollutants come from mobile sources such as cars and trucks, stationary sources like factories and other industrial sites, dust from construction sites, smoke from wildfires, and other sources. Climate change directly impacts and exacerbates air quality through increased temperatures, severe weather, wildfires, changes in precipitation patterns, and other mechanisms. Ozone (O_3) forms when pollutants from motor vehicles, industrial emissions, power plants, and refineries react with

Cascading and Compounding Effects

Cascading Effects: When an extreme event causes a series of secondary events that are larger than the initial impact.

Compounding Effects: When multiple hazards or drivers occur simultaneously, amplifying their collective impact.

Source: IPCC. 2019. *Extremes, Abrupt Changes and Managing Risk*.

Bay Area Air Quality Management District Programs

BAAQMD has several programs to reduce air pollution from multiple sources.

The **Spare the Air Program** issues alerts on days when air quality is expected to be poor due to high levels of ozone or particulate matter. On Spare the Air days, residents are encouraged to limit activities that contribute to air pollution, such as driving, using gas-powered equipment, or wood burning.

Employers with 50 or more full-time employees in the Bay Area are required to provide Commuter Benefits Programs to encourage the use of alternative modes of transportation, such as public transit, vanpool, or biking, to reduce emissions from commuting.

sunlight, and warmer temperatures speed up these reactions. In San Bruno, particulate matter (PM) from diesel engines is a pollutant of significant concern, especially in neighborhoods east of El Camino Real. This is likely due to emissions from trucks and other large vehicles traveling on Highway 101, as neighborhoods near major highways often experience higher levels of air pollution. Highway 101 serves as a major transportation corridor with significant freight and commuter traffic, leading to increased diesel emissions in adjacent areas. Warmer temperatures also lengthen the growing seasons of plants and trees, increasing allergen production. Air quality significantly affects our quality of life and poor air quality leads to more health issues, strains healthcare, and restricts outdoor activities. Ensuring clean air is vital, especially for frontline communities.

Exposure to air pollutants such as ozone and particulate matter can lead to respiratory conditions, exacerbate asthma, and increase the risks of heart attacks, strokes, and certain types of cancer. The financial burden of poor air quality in the Bay Area is estimated at $32 billion annually, which includes costs associated with premature deaths, healthcare expenses, reduced productivity, and other related issues.[7] These figures highlight the serious consequences for both individual health and the regional economy. The Bay Area Air Quality Management District (BAAQMD) has played a key role in monitoring and improving air quality throughout the region, resulting in notable progress even as population, traffic, and industrial activities have grown.[8] Despite these efforts, air quality hazards, such as ozone and particulate matter, remain persistent threats in the region.[9]

Wildfire smoke has become an increasingly significant concern for air quality in San Bruno and the broader region. Wildfire smoke contains a complex mixture of gases and fine particulate matter, especially $PM_{2.5}$, which consists of tiny particles that can penetrate deeply into lung tissue and impact cardiovascular health.[10] The health risks associated with wildfire smoke are particularly severe for vulnerable populations, including children, older adults, individuals with pre-existing respiratory or cardiovascular conditions, and low-resourced residents, who may experience more severe acute and chronic health effects.[11] The frequency of wildfires has been rising, driven by hotter and drier conditions associated with climate change and resulting in more frequent exposure to hazardous air quality conditions for many residents and visitors.

Drought

A drought is where conditions are drier than normal for an extended period, making less water available for people and ecosystems. Drought is part of a normal climate cycle in California, but prolonged drought conditions can harm ecosystems and the regional economy. Though droughts do not typically cause direct loss of life or extensive structural damage, they can lead to critical environmental and economic harm, including crop loss, higher water costs, habitat degradation, and heightened wildfire risks. They can also cause some minor damage to sewer systems from reduced water flows. Increases in water demands from population growth exacerbate these impacts, complicating water allocation and potentially leading to restrictions and quality issues.

During a drought, groundwater reserves deplete faster from more pumping and less replenishment from precipitation. This can lead to lower groundwater levels and issues like diminished pumping capacity. Lower groundwater negatively impacts stream flows, particularly in summer. Prolonged drought conditions also increase wildfire susceptibility due to dried vegetation and vulnerability to pests.

California regularly experiences droughts, but scientists predict climate change will result in more frequent and severe droughts across the state. Overall, precipitation levels are expected to stay similar or even increase in some places; however, more years with extreme levels of precipitation, both high and low, are likely as a result of climate change. Reduced winter precipitation levels and warmer temperatures have greatly decreased the size of the Sierra Nevada snowpack (the volume of accumulated snow), which in turn makes less fresh water available for communities throughout California, including cities like San Bruno that receive water from the Hetch Hetchy Regional Water System.[12] More intense droughts are expected to harden

Water Delivery in San Bruno

Water supplied through the City's water system is a combination of purchased water and groundwater pumped from the City's groundwater supply wells. The City purchases its treated water from the San Francisco Public Utilities Commission and North Coast County Water District. The City also sources local groundwater from the Westside Groundwater Basin (specifically the South Westside Basin) using four wells. The City's Public Works Department (Water Division) owns, operates, and maintains the potable water distribution system that serves drinking water to users in its water service area.

In recent years, approximately 90 percent of the City's water supply has been purchased from the San Francisco Public Utilities Commission, with smaller amounts from North Coast County Water District and the City's groundwater wells. Approximately 85 percent of the water supply to the San Francisco Public Utilities Commission Regional Water System originates in the Hetch Hetchy watershed in the Sierra Nevada and flows down the Tuolumne River into the Hetch Hetchy Reservoir. The remaining 15 percent of the water supply originates in the Alameda and Peninsula watersheds. Groundwater previously accounted for about 50 percent of the City's total water supply. In 2016, the City reduced its use of groundwater in accordance with the Regional Groundwater Storage and Recovery Project.

soil, resulting in more water runoff and less infiltration potentially causing downstream flooding when rains return.. Higher temperatures will further increase evaporation, worsening drought conditions.

Extreme Heat and Warm Nights

Extreme heat is an increasingly serious issue for San Bruno, becoming more frequent and intense, and threatening public health, infrastructure, and the environment. Extended periods of extreme heat, known as heat waves, threaten community safety, drive up energy costs, and exacerbate the risks of wildfires and water shortages. An extreme heat day in San Bruno is one where maximum temperature exceeds 85.9 degrees Fahrenheit. As shown in **Figure 1**[*], climate change is expected to increase extreme heat days in the city from a historic annual average (measured between 1961 and 1990) of 3 days per year to 8 days per year by midcentury (2035 to 2064) and 15 days per year by late century (2070 to 2099).[13]

When the daily minimum temperatures remain significantly above normal, warm nights worsen extreme heat days because overnight temperatures do not get low enough to provide any relief from high temperatures. A warm night occurs when temperatures remain above 57.6 degrees in San Bruno. As shown on **Figure 2**, climate change is expected to increase warm nights from a historical 8 nights per year, to 48 nights per year by mid-century and 125 nights per year by late century.[14]

Extreme heat is one of the deadliest climate-related hazards nationwide; the Center for Disease Control and Prevention noted a rise in heat-related deaths—from 297 in 2004 to over 2,300 in 2023.[15, 16] The rising frequency and intensity of extreme heat events pose significant public health concerns, especially in areas such as San Bruno that have historically experienced milder temperatures and are home to residents without access to climate-controlled environments. Warmer temperatures and the urban heat island effect can exacerbate extreme heat impacts in densely populated areas, especially those that have limited tree canopy. **Figure 3** shows the areas of San Bruno that may experience higher temperatures on extreme heat days due to limited shade cover and presence of heat-absorbing materials. Areas most at risk include the east San Bruno residential neighborhoods.

[*] The Cal-Adapt database at time of writing uses Representative Concentration Pathways (RCPs) to project future conditions. The projections listed in this report use RCP 8.5, which assumes global emissions continue to increase at least until the end of century, which is consistent with the International Panel on Climate Change Sixth Assessment Report.

Figure 1. Observed and Projected Extreme Heat Days in San Bruno*

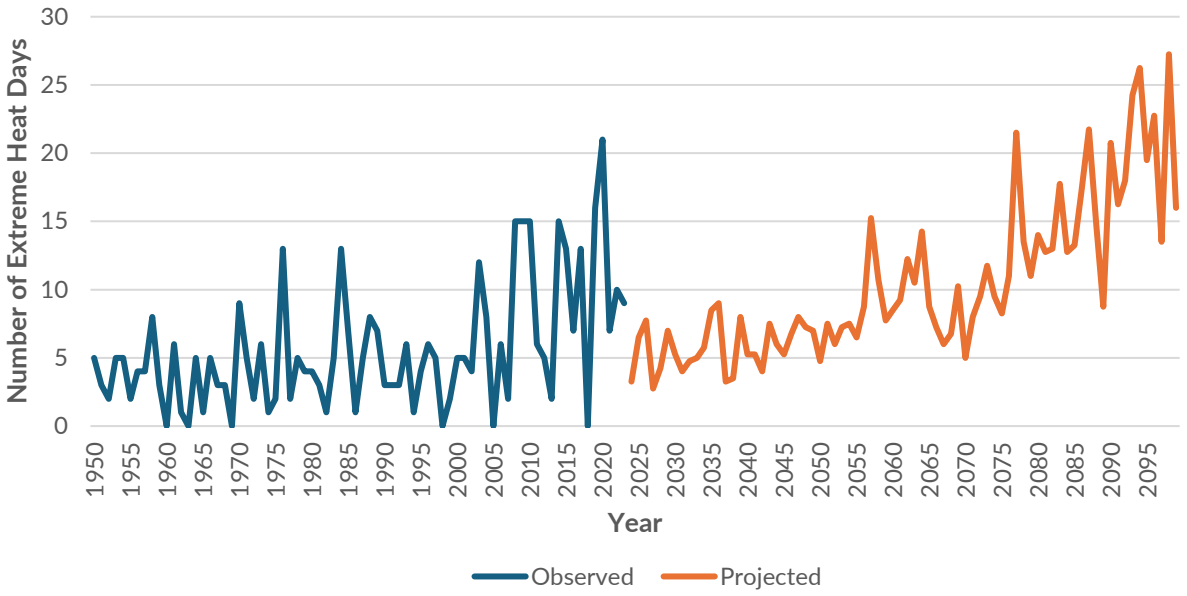
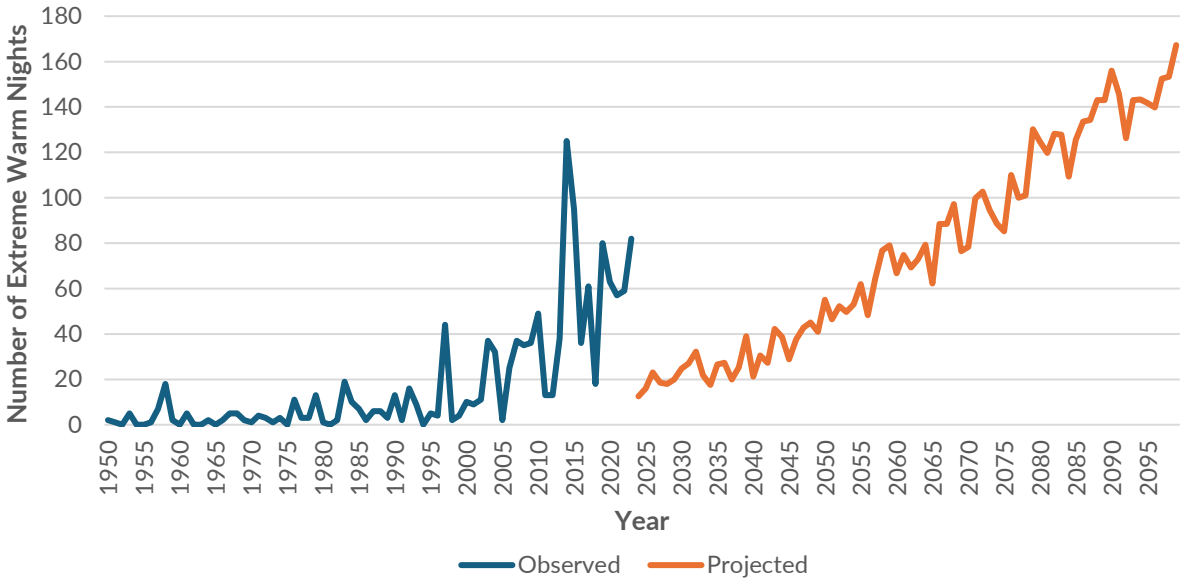
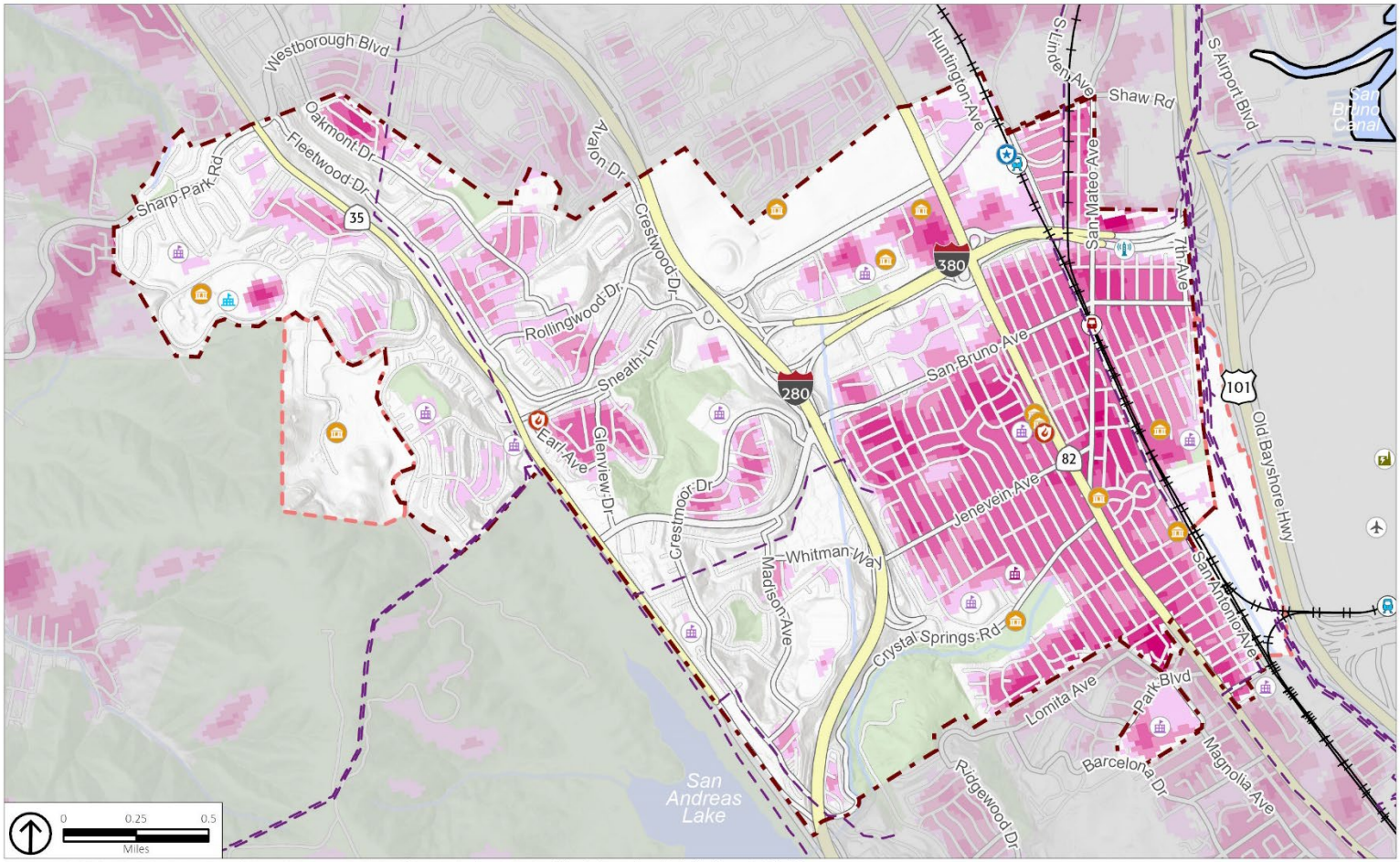


Figure 2. Observed and Projected Warm Nights in San Bruno



* Figures 1 and 2 use observed data from the Cal-Adapt database, which provides data from 1950 to 2005, the nearest National Weather Service weather stations, which provides data from 2006 to 2023, and projected data from the Cal-adapt database, which provides data from 2024 to 2099. Due to the different database sources, the observed and projected data may not match.

Figure 3. Heat Severity Index in San Bruno



Source: ESRI, 2023; County of San Mateo, 2023; PlaceWorks, 2023; The Trust for Public Land, 2019

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Heat Severity Index

- Mild
- Mild to Moderate
- Moderate
- Moderate to High
- Severe

Even slight increases in temperature can overwhelm a community's adaptive capacity,* straining public health systems and infrastructure. This leads to heightened risks of dehydration, heat-related illnesses, and respiratory issues, disrupting daily life and economic activity.[17] Higher demand for air conditioning due to extreme heat risks can overload the power grid and cause outages, and very high heat can degrade transportation systems, leading to delays and damage. Rising temperatures also harm local ecosystems by increasing water temperatures in local lakes and streams, harming fish and plant species.

Ecosystem Pests

Ecosystem pests are plant and animal species that can harm San Bruno's opens spaces, aquatic habitats, and urban forest. Climate change is expected to worsen these problems by increasing the abundance and range of both native and nonnative pests. Invasive plant species threaten local ecosystems by outcompeting native flora, disrupting habitats, and reducing biodiversity.

Warmer temperatures and shifting precipitation patterns can weaken plants and trees, making them more susceptible to infestations and infections. It also creates favorable conditions for invasive species to establish themselves, as extreme weather events disrupt native communities. In aquatic environments, rising temperatures and drought conditions decrease dissolved oxygen levels, causing harmful algal blooms and allowing invasive species to thrive, complicating management efforts. While San Bruno consists of an urban and built-up environment, ecosystem pests could still cause lasting damage to the urban tree canopy that helps reduce the urban heat island effect, and the wetlands adjacent to the city that help protect San Bruno from sea level rise and flooding. Ecosystem pests can significantly disrupt the ecological functions of wetlands by causing vegetation loss. This loss, whether due to insect outbreaks or invasive species, impacts hydrological processes by increasing runoff and erosion, which ultimately degrades water quality in wetlands. Reduced vegetation cover also leads to elevated water temperatures, negatively affecting aquatic species that depend on cooler environments. Additionally, changes in vegetation disrupt water dynamics, influencing water availability and threatening the stability of the entire ecosystem.

Atmospheric Rivers

An atmospheric river is a long, narrow band of moisture in the atmosphere moving from the tropics that can cause heavy rain or snow when it moves over land. These storms are responsible for over half of California's water supply, but also the majority of the flooding and mudslide events across the State.

Sources: Emily Mendez. 2024. *A Climate Expert Explains Why Atmospheric Rivers Are Causing Historic Rainfall in California*. Lamont-Doherty Earth Observatory: Columbia Climate School.

Flooding

Flooding occurs when normally dry land is covered by water and is a significant concern for San Bruno. This can include creeks and streams

* *Adaptive capacity* is the ability of people and assets to adjust to potential damage from climate change hazards, to take advantage of existing opportunities such as funding, tools, and resources, or to respond to the impacts of climate change.

overtopping their banks, heavy rainfall that surpasses the capacity of drains to carry the water away, and very high tides. It can also be a result of dam failure, water or wastewater infrastructure failure, or tsunamis. Floods are among the costliest natural disasters in terms of human hardship and economic loss nationwide, threatening the health and life of community members and causing substantial damage to structures, landscapes, and utilities in the region. Standing water can weaken structural foundations, damage electrical systems, and create breeding grounds for vector-borne illnesses. Flooding also accelerates soil erosion, reduces water quality, and leads to the loss of important environmental resources, making ecosystems more vulnerable. The impacts of increased flooding go beyond immediate property damage. Flooding can lead to long-term public health problems if mold and mildew grow in buildings, displace communities if homes are destroyed or become uninhabitable, and increase economic burdens, such as rising home insurance costs.

Climate change is expected to make flood events worse by causing a smaller number of more intense precipitation events, in the form of atmospheric rivers.[18] For example, what is currently a 200-year storm, or one that has a 1 in 200 chance of occurring each year, by 2100 could increase in frequency by 40 to 50 years (to a 1 in 150/160 chance each year).[19] This means that the 100-year and 500-year floodplains may expand, and the current floodplains may become 40- to 50-year floodplains. Climate change is also likely to increase the frequency and severity of droughts that cause soil to dry out and harden. When precipitation does return, more water runs off the surface than is absorbed into the ground, which can increase flooding downstream.

Floodplains and Flood Recurrence

According to the Federal Emergency Management Agency (FEMA), a floodplain is any area of land that could be flooded by water from any source, but are often next to creeks, lakes, oceans, and ponds. The 100-year floodplain is the area that has a 1 percent (1 in 100) chance of being flooded in any given year. This would also be the area that would flood during a 100-year storm. The 500-year floodplain is the area that has a 0.2 percent (1 in 500) chance of being flooded in any given year due to a 500-year storm.

As shown in **Figure 4** and on the online PREP Map Viewer, several areas in San Bruno fall within mapped flood areas. The 100- and 500-year flood zones (as designated by the Federal Emergency Management Agency) are in eastern San Bruno. Flooding also occurs outside of these mapped floodplains, especially in low-lying areas with inadequate drainage, which subjects these areas to tidal influences. The City's storm drain system does not operate effectively at times of high tide combined with heavy rain. Areas that occasionally flood include:

- Downtown's San Mateo and Mastick Avenues, north of Sylvan Avenue.
- Kains Avenue, east of Green Avenue.
- First through Seventh Avenues, south of Pine Street.
- City Park and portions of Crystal Springs Road.
- Magnolia Avenue, adjacent to Capuchino High School.
- Santa Helena and San Juan Avenues at San Antonio Avenue.

- El Camino Real, including the 600 block.

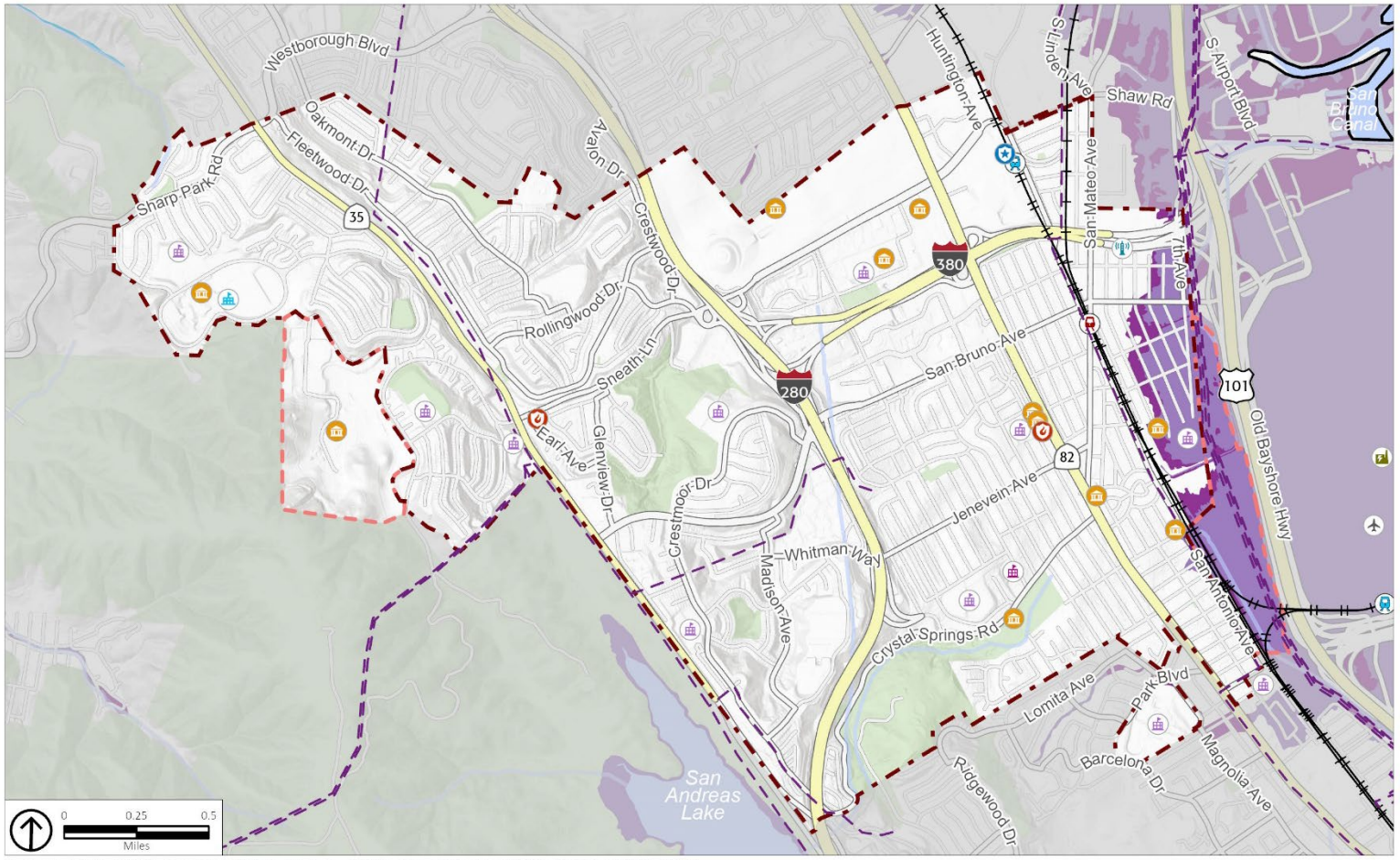
Floodplain areas near the bay shoreline are likely to expand as sea level rises and the tide regularly moves farther inland.

Human Health Hazards

Human health hazards, including bacteria, viruses, parasites, and other pathogens, pose significant concerns in San Bruno. These conditions can result in physical injuries, fatalities, mental health issues, and exacerbate pre-existing conditions like asthma and allergies. Rats, mice, ticks, and mosquitos are common vectors, meaning that they often spread the pathogens that can cause illness. Rising temperatures and changing precipitation patterns due to climate change promote the proliferation of disease-carrying vectors. Warmer, wetter conditions allow for increased populations of mosquitoes and ticks, extending their geographic range and spreading diseases like West Nile virus, dengue fever, and Lyme disease.[20] As temperatures rise and extreme weather events, such as heavy rainfall, become more frequent, these vectors can spread more broadly, transmitting diseases that threaten public health.[21]

Heatwaves, another increasing hazard due to climate change, can directly impact human health by causing heat-related illnesses and deaths, while also worsening respiratory conditions due to increased air pollution. The combination of these factors suggests that human health hazards will become more pervasive and severe as climate change progresses, making proactive public health measures even more critical. The implications of these health hazards extend beyond individual well-being, placing strain on healthcare systems, increasing economic burdens, and affecting mental health.

Figure 4. Flood Hazard Zones in San Bruno



Source: ESRI, 2023; County of San Mateo, 2023; PlaceWorks, 2023; FEMA; DWR, 2021

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Designated Flood Hazard Zones

- 100 Year Flood Plain (DWR)
- 100 Year Flood Zone (FEMA)
- 500 Year Flood Zone (FEMA)

Landslides

A landslide, defined as the movement of rock, soil, or debris down a slope, is often triggered by natural events such as heavy rainfall, floods, or wildfires. In San Bruno, landslides commonly occur during or after intense rainfall, particularly in areas previously affected by wildfires where vegetation loss destabilizes slopes. These events threaten homes and infrastructure, disrupt transportation networks, and contribute to downslope erosion. Landslides can travel significant distances, accumulating debris and amplifying their destructive impact as they move downslope. Landslides are most frequent during very wet winters, when frequent heavy rains saturate soils and cause sliding on steep slopes.

As shown on **Figure 5** and on the online PREP Map Viewer, the area with the highest landslide susceptibility is the upland areas west of Interstate 280,as well as areas around Junipero Serra County Park, which could be more likely to experience landslides due to the presence of undeveloped, natural slopes. These areas have a history of previous landslide movements. However, landslides can occur outside these high-risk areas as well, including areas where few landslides occur and activity is considered moderate. These moderately susceptible areas experience fewer landslides but remain at some risk of future events.

Climate change is expected to exacerbate landslide hazards by increasing the frequency of wildfires and severe storms, which can elevate the risk of landslides, particularly fast-moving debris flows. Wildfires remove stabilizing vegetation and alter soil properties, making slopes more vulnerable to erosion during and after subsequent storms. As the climate becomes drier, with occasional extreme rainfall events, the city will experience more landslides and mudslides, which pose significant challenges to regional safety. Landslides can displace residents, block emergency routes, and damage critical infrastructure, disrupting daily life and requiring costly repairs. To reduce these impacts, proactive planning, community awareness, and resilience efforts are essential to protect residents and maintain infrastructure integrity.

Sea Level Rise and Emergent Groundwater

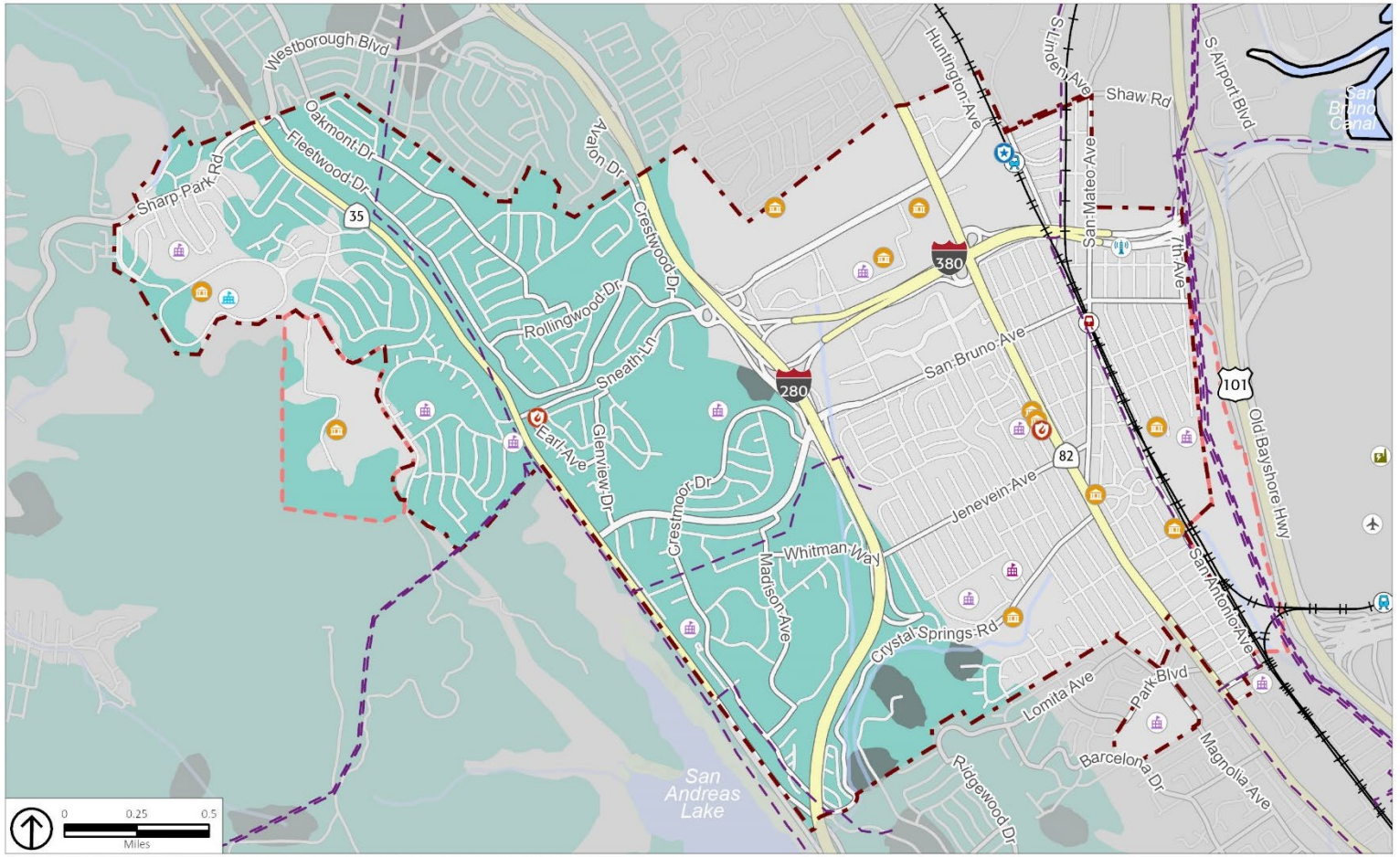
As global temperatures rise, glaciers and other polar ice melt, flowing into the ocean, and sea levels rise. High average temperatures can also cause ocean water to expand, causing further rises in sea levels. According to the 2024 California Ocean Protection Council's *State of California Sea Level Rise Guidance*, sea levels along the Bayside are projected to increase by as much as 0.4 feet (5 inches) by 2030, 1.3 feet (16 inches) by 2050, and 5 feet (78 inches) by 2100. However, sea levels could also rise faster than these projections, and storm surge, wave runup, and King Tide events could add an additional 24 to 36 inches of temporary flooding that would move farther inland.[22] San Bruno and its buildings and infrastructure adjacent to Highway 101 and the shoreline are already vulnerable to damage from storms, which will likely increase as the sea level continues to rise and move farther inland.

As shown in **Figure 6** and on the online PREP Map Viewer, portions of eastern San Bruno east of El Camino Real are vulnerable to the potential effects of sea level rise. Depending on the severity of sea level rise, an estimated 65 acres of land in the city could be inundated by 2050, increasing to 128 acres by 2100.[23]

OneWatershed: Building Regional Climate Resilience

OneWatershed is a comprehensive framework that addresses the shared risks of climate change to water infrastructure and resources across San Mateo County, including stormwater, wastewater, and drinking water systems. This innovative approach emphasizes building adaptive capacity for climate impacts, with a particular focus on the county's most vulnerable communities. OneWatershed builds on years of climate resilience planning, harnessing resources and partnerships under a unified program to advance shared goals around overlapping climate risks. By taking a watershed-based perspective, OneWatershed enables coordinated planning and implementation of climate adaptation strategies that benefit both infrastructure systems and the communities they serve. The framework represents phase one of a multi-year strategy to build systematic and transformational change in how San Mateo County approaches integrated watershed management and climate resilience.

Figure 5. Landslide Susceptibility in San Bruno



Source: ESRI, 2023; County of San Mateo, 2023; PlaceWorks, 2023; USGS

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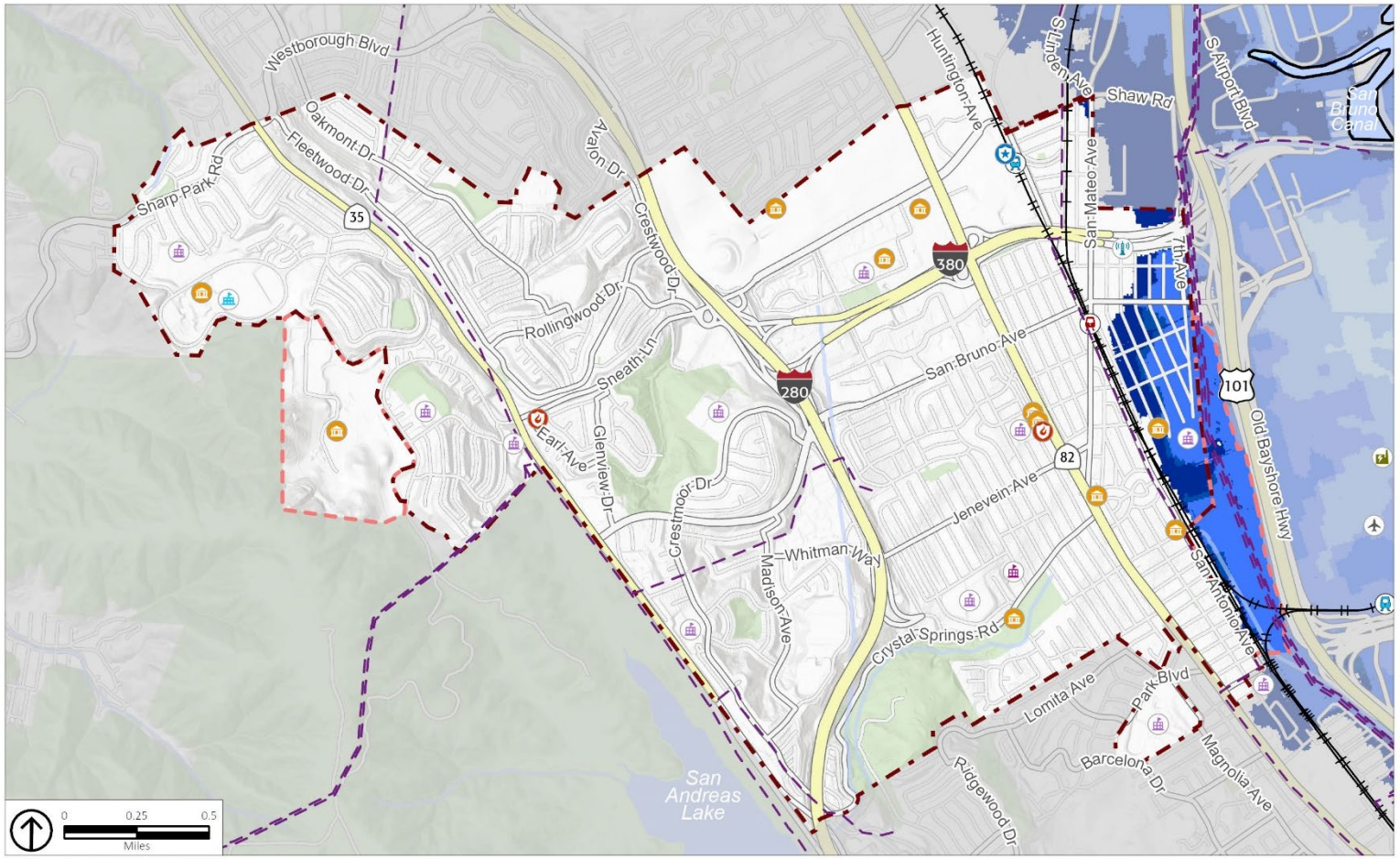
Landslide Susceptibility

- Most landslides
- Few landslides
- Surficial deposits

Figure 6. Sea Level Rise Projections in San Bruno



Source: ESRI, 2023; County of San Mateo, 2023; PlaceWorks, 2023; USGS CoSMoS

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Sea Level Rise

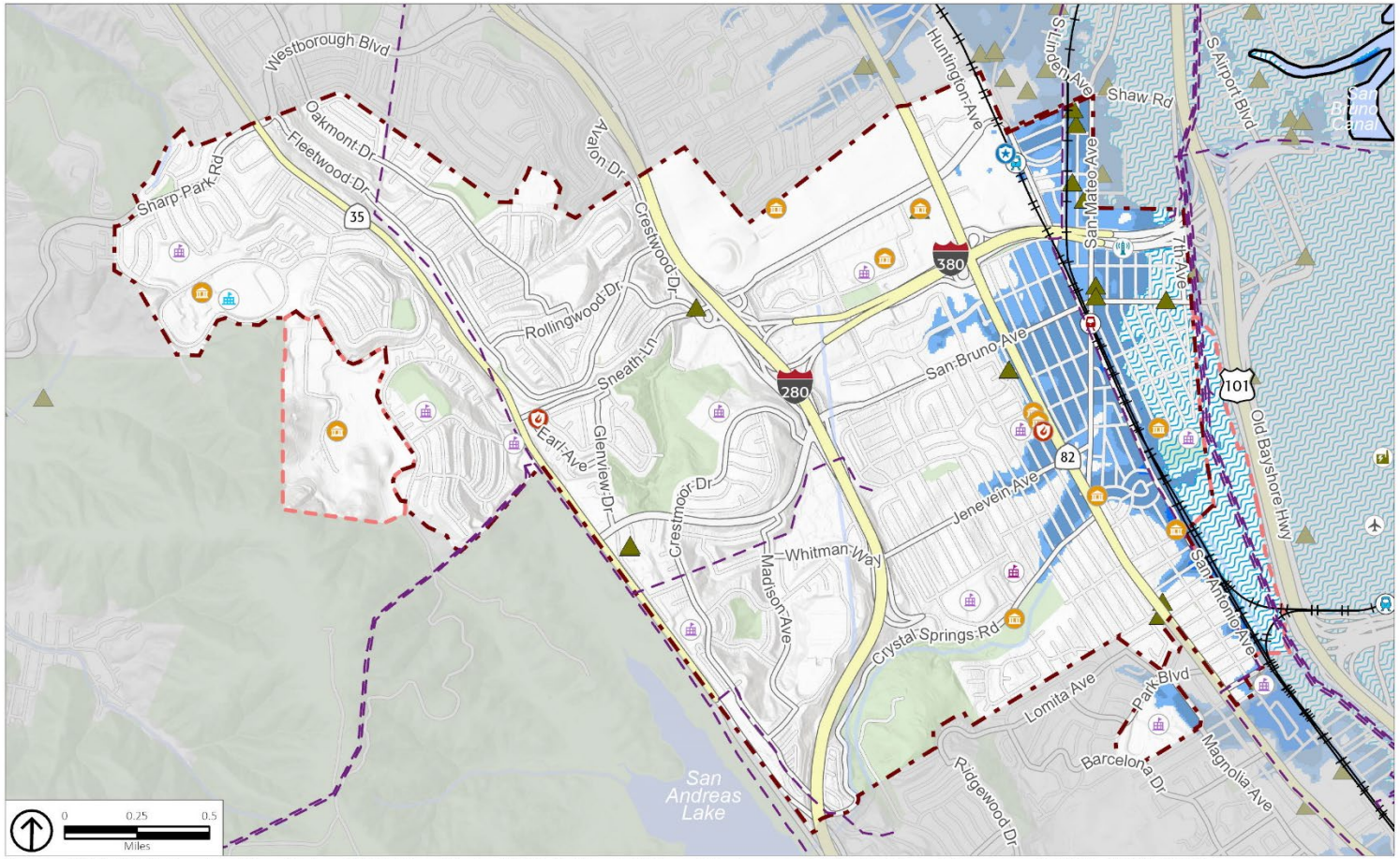
- 0 ft + 100-year storm
- 0.8 ft + 100-year storm
- 3.3 ft
- 3.3 ft + 100-year storm
- 6.6 ft
- 6.6 ft + 100-year storm

Liquefaction

Liquefaction occurs when water-saturated soils are shaken so violently that the individual grains lose contact with one another and float freely in the water, turning the ground into a pudding-like liquid. Building and foundations lose strength and may sink into what was previously solid ground. Unless properly secured, hazardous materials can be released, causing significant damage to the environment and people.

Emergent groundwater is a consequence of sea level rise. It occurs when freshwater is pushed upward by denser saline water that travels further inland, causing temporary or permanent inundation.[24] Higher groundwater levels, even if water does not emerge on the surface, can infiltrate storm drains, destabilize pipes, spread soil or groundwater contamination, undermine building foundations, corrode infrastructure not designed for saline groundwater, and increase liquefaction hazards.[25] Emergent groundwater is expected to rise at the same rate as sea level rise in areas within half a mile of the shoreline. However, in areas where groundwater is actively pumped, this rise could extend farther inland, meaning that the effects of sea level rise on groundwater might spread beyond this half-mile zone.[26] As shown on **Figure 7** and the online PREP Map Viewer, emergent groundwater affects a larger area of San Bruno east of El Camino Real. Though the exact level of future sea level rise is uncertain, it is expected to increase the frequency, duration, and magnitude of flood events and push groundwater to an emergent level farther inland. As sea levels rise and emergent groundwater increases, the number of individuals and properties at risk will increase, which will in turn lead to a higher likelihood of flood damage and other adverse consequences for both coastal and inland areas. Sea level rise and emergent groundwater will interact directly with stormwater from inland sources, causing more severe flooding near creeks and at the outlets of drainage systems.

Figure 7. Emergent Groundwater in 2100 in San Bruno



Source: ESRI, 2023; County of San Mateo, 2023; PlaceWorks, 2023; California Office of Environmental Health Hazard Assessment, 2021; USGS, 2020

- City of San Bruno
- Sphere of Influence
- San Mateo County Boundary
- Parks and Open Space
- Creeks and Waterways
- BART Stations
- BART Network
- Caltrain Stations
- Caltrain Network
- Airport
- Law Enforcement
- Fire Stations
- Government Facilities
- California Power Plants
- Public Schools (K-12)
- Private Schools (K-12)
- College or University
- Communication Facilities
- Transmission Lines
- Hazardous Material Cleanup Sites
- Emergent Groundwater
- 6.6ft Sea Level Rise

Groundwater depth below surface

- 0 - 3.3 feet (Very Shallow)
- 3.3 - 6.6 feet (Shallow)

Severe Weather

Severe weather poses a significant threat to San Bruno and the greater region, disrupting daily life, compromising safety, and affecting infrastructure and ecosystems. Severe weather is usually caused by intense storm systems, although types of strong winds can occur without a storm. The types of dangers posed by severe weather include injuries or deaths, damage to buildings and structures, fallen trees, roads blocked by debris, and fires sparked by lightning. Severe weather often produces high winds and lightning that can damage structures and cause power outages. Lightning from these storms can ignite fires and cause explosions that damage buildings and endanger people. High wind events can also exacerbate the risk of wildfires in the region, which can harm local air quality.

Public Safety Power Shutoff events are a preventive strategy to reduce wildfire risk during severe weather, especially during high winds and dry conditions. Utility companies like Pacific Gas and Electric Company may shut off power lines during severe weather to prevent them from sparking fires, which could cause power outages that may last for extended periods. Without power, communication networks may be disrupted, making it harder for residents to receive emergency notifications and for first responders to coordinate effectively. People who depend on medical devices, such as oxygen concentrators or ventilators, are at greater risk during power outages, as are those who need electricity for climate control to keep indoor temperatures safe. The loss of power to communications and other critical infrastructure disrupts access to goods and services. Major riverine or urban flooding can result from heavy rain, often overwhelming drainage systems and leading to significant disruptions. For instance, in November 2018, a major storm brought heavy rain to San Bruno and the surrounding region, flooding roads near the Caltrain station and causing traffic slowdowns. Additionally, weeklong storms in January 2023 resulted in heavy rainfall throughout the Bay Area, including in San Mateo County. In San Bruno, flooding caused road closures and necessitated rescues for some community members trapped in flooded areas. These events highlight the persistent and multifaceted challenges posed by severe weather and heavy rain.

Wildfire

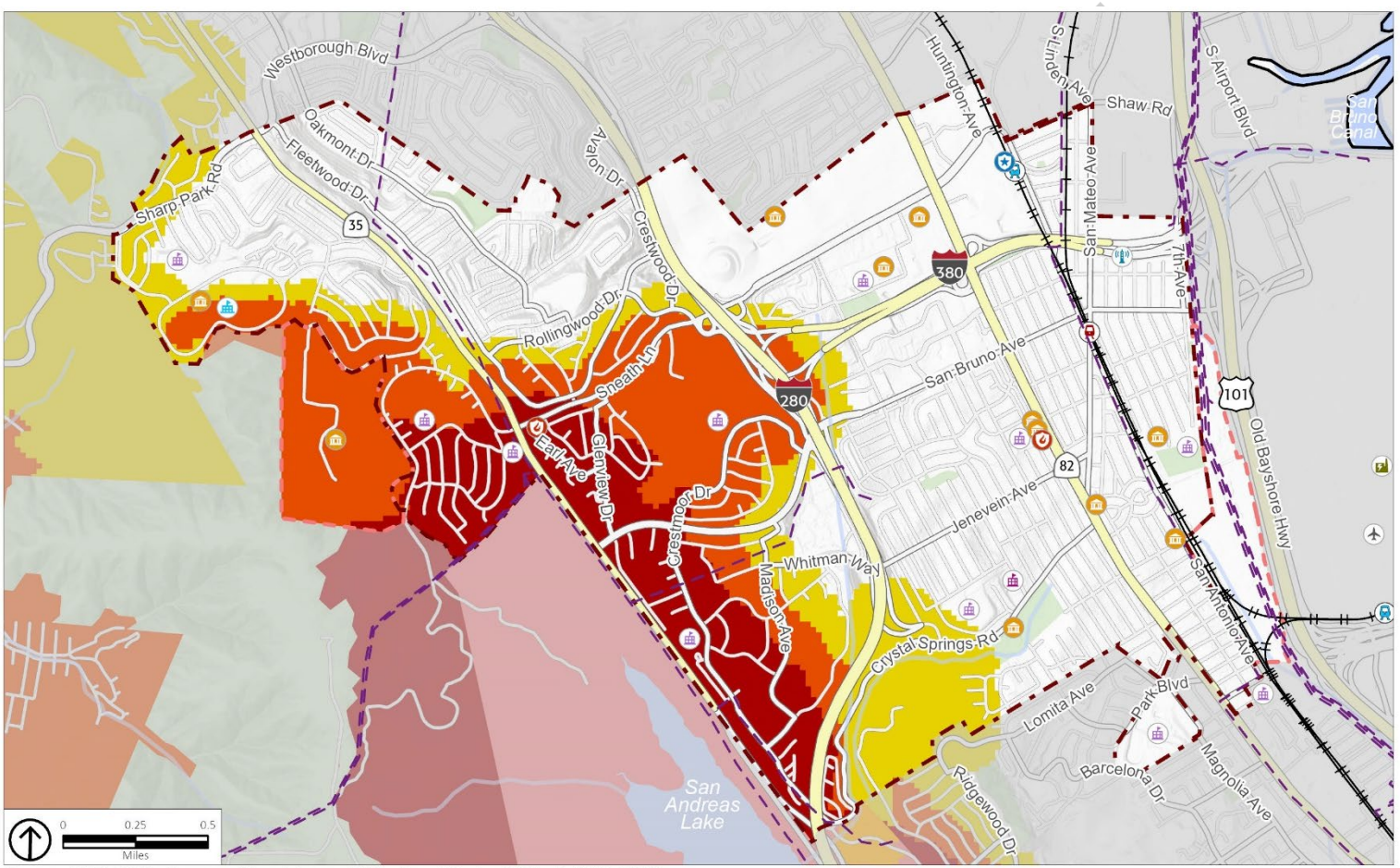
Wildfires pose a significant and growing threat to San Bruno and the greater region. The city's Mediterranean climate, topography, and diverse plant communities create ideal conditions for wildfire. Historically, the fire season extended from early summer through late fall of each year during the hotter, dryer months, although it is becoming a year-round hazard, leaving communities vulnerable for much longer periods. Rising temperatures and prolonged droughts dry out vegetation, creating abundant fuel for fires. Pest outbreaks, such as bark beetle infestations, leave behind weakened and dead trees as additional fuel, and extreme heat and erratic wind conditions make wildfires more unpredictable and harder to control.

The California Department of Forestry and Fire Protection (CAL FIRE) designates lands under state and local control as fire hazard severity zones, ranked as zones of Moderate, High, or Very High hazard severity. There are 1,354 acres of land in San Bruno designated as a fire hazard

severity zone, including 427 acres designated as Very High severity. The fire hazard severity zones are located in the hillside neighborhoods, with the very high zones located near Skyline Boulevard. There are also fire hazard severity zones immediately adjacent to the community in the unincorporated areas west of Skyline Boulevard. Figure 8 and on the online PREP Map Viewer illustrates the fire hazard severity zones in and adjacent to the city. Human activities are the leading cause of wildfires, and more development near these wildland areas has amplified the risk of wildfire events.[27] Wildfires not only destroy homes and infrastructure but can also displace entire communities and degrade critical wildlife habitats. The economic consequences are significant, ranging from property damage and fire suppression costs to long-term business disruptions. Moreover, the loss of natural spaces impacts recreation, tourism, and local biodiversity.

While CAL FIRE has not reported any significant wildfires in San Bruno in the past 75 years, projections from the Cal-Adapt database anticipate that the average annual burned areas in San Mateo may more than double by the end of the century compared to historical norms (1961 to 1990). Though some years are likely to see little or no wildfires in the city, other years are likely to see much larger fires. Historically, San Mateo County has experienced a prolific fire history, although few of its fires have caused enough damage to trigger a state or federal disaster declaration. Notable fires include the November 1929 fire near Montara and the August 2020 CZU Lightning Complex in Santa Cruz and San Mateo Counties, caused by lightning.

Figure 8. Fire Hazard Zones



Source: ESRI, 2023; County of San Mateo, 2023; PlaceWorks, 2023; CalFIRE, 2025

- City of San Bruno
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- Private Schools (K-12)
- College or University
- Communication Facilities
- Transmission Lines

Fire Hazard Severity Zone (State Responsibility Area)
- Very High
- High
- Moderate

(Local Responsibility Area)
- Very High
- High
- Moderate

Key Findings

The following section presents the key findings of the Vulnerability Assessment for San Bruno, highlighting the people and community features that were identified as priority vulnerabilities. Priority vulnerabilities are the people, buildings, infrastructure, economic drivers, ecosystems and natural resources, and key services that should be considered the City's priorities in adaptation and resilience planning. Identifying a population or a community asset as a priority vulnerability reflects the severity of climate change impacts and level of harm, but also considers other factors such as the size of the population, current and historic injustices and discrimination, the role that the asset plays in maintaining community-wide well-being, and the potential of the population or asset to be impacted by compounding or cascading effects of interacting hazards. Severe weather is responsible for the most priority vulnerabilities in San Bruno, followed by flooding, extreme heat, and landslides. Populations that are priority vulnerabilities for the greatest number of hazards include low-resourced households, persons with chronic illnesses and/or disabilities, and older adults.

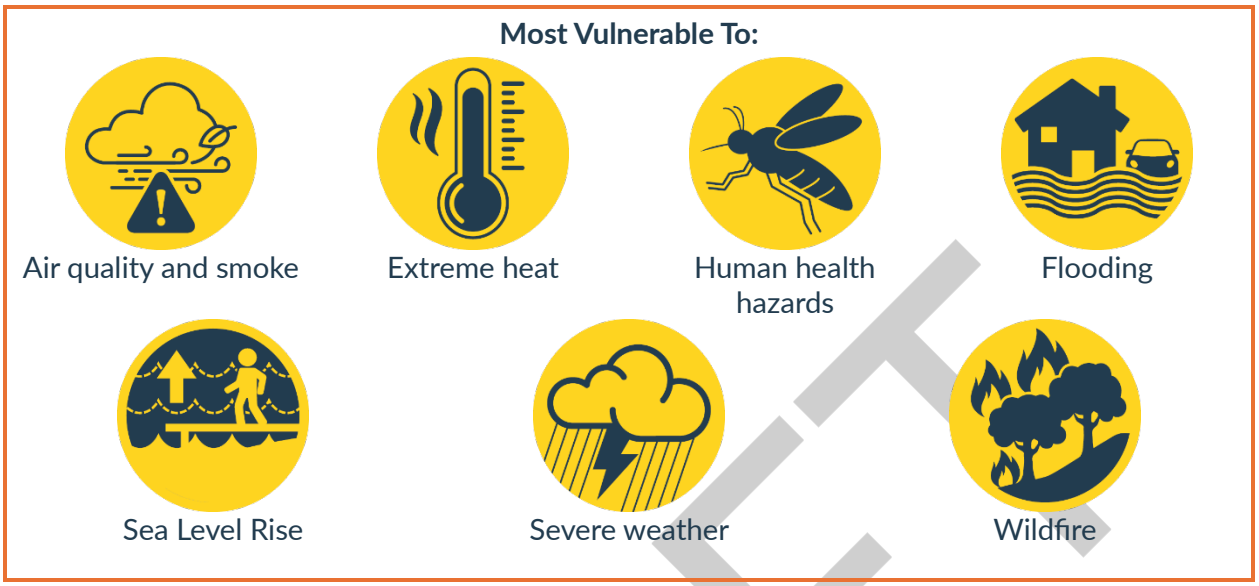
Climate change is expected to affect everyone and all locations in San Bruno to some degree. This section does not describe all impacts from climate change and associated hazards. Rather, it identifies the populations and assets who are most frequently designated as priority vulnerabilities. Other populations and assets not listed here may still face significant harm from climate change.

Priority Vulnerabilities

In addition to the severity of impacts from climate change and related hazards, other factors that affect whether a population or asset is considered a priority vulnerability include:

- Size of the population or the importance of the asset.
- Equity considerations and history of marginalization.
- Role in supporting community well-being.
- Community values and concerns.
- Ability to resist and recover from hazards.
- Potential for cascading and compounding impacts.

Low-Resourced Households



Low-resourced households are among the populations most at risk of climate change hazards in San Bruno. This includes cost-burdened households (those that pay more than 30 percent of their income on housing costs), low-income households, and households in poverty. Low-resourced people of color and immigrants are even more susceptible, owing to marginalization and discrimination, and in some cases distrust of government services and lack of a social support network.

Approximately 5 percent of San Bruno residents earn incomes at or below poverty level. Approximately 9 percent of San Bruno homes are overcrowded.

Source: American Community Survey. 2022. ACS 5-Year Estimates.

Low-resourced households typically lack sufficient resources to invest in home repairs and weatherization improvements, air conditioning and efficient appliances, health care, and other means to prepare for and recover from hazardous events. Evacuation concerns are significant for these households, as they may lack access to reliable transportation or the financial means to leave during emergencies, making it difficult to comply with evacuation orders. Additionally, they often lack access to critical lifelines, such as emergency shelters that can accommodate their needs or have the capacity for large families.

These individuals are less likely to have insurance, meaning that they can face a significant financial burden for home repairs, rebuilding, or replacement of personal possessions. Many low-resourced households are renters, and they often lack renter's insurance, leaving them particularly vulnerable to financial hardship in the event of property damage or loss. This lack of coverage exacerbates their challenges in maintaining financial stability. These challenges are compounded for low-resourced persons of color, who must often contend with challenges and barriers created by systemic biases that affect access to and willingness to receive assistance

from government organizations. Limited financial resources may prevent these households from affording adequate housing, which means they are more likely to live in older buildings with poor maintenance, structural damage, or inadequate sanitation. These conditions create an ideal environment for pests that can carry harmful pathogens. Overcrowded households may have limited ability to cope with illnesses caused by vectors, extreme temperatures, or exposure to mold and mildew, because persons living in these households are in close proximity to others, causing illnesses to spread more easily. These households may be financially strained by medical costs and inability to work due to illness. To address these challenges, FEMA may provide disaster assistance in the form of grants to help pay for temporary housing, essential home repairs, and other disaster-related needs such as medical and dental expenses, transportation, childcare, and moving expenses. Additionally, emergency alerts are available via SMC Alert and the Genasys Protect citizen site and app, which allow users to receive immediate alerts and stay informed about evolving emergencies.

During drought, low-resourced households may be especially vulnerable to increases in water price due to water conservation pricing and may be unable to afford water-efficient appliances. The Pacific Gas and Electric Company offers water efficiency programs and rebates, which may help reduce water costs. However, some households may not be able to participate in these programs. Available incentives and rebates may not be sufficient to support households in poverty, who may be disproportionately impacted by cost increases associated with drought and unable to afford water efficiency measures.

Outdoor Workers

Most Vulnerable To:


Ecosystem pests


Air quality and smoke


Extreme heat


Human health hazards


Landslides


Severe weather


Wildfire

Outdoor workers spend significant time outdoors, which can bring them into direct contact with numerous hazard conditions, such as poor air quality and extreme heat. Extreme heat can lead to heat exhaustion or heat stroke, and poor air quality, often exacerbated by wildfire smoke, can cause respiratory issues and worsen existing health conditions. These hazards pose significant health risks, particularly for individuals who cannot easily access shelter, air conditioning, or healthcare services to mitigate their exposure. Outdoor workers in San Bruno, who are often employed in industries such as landscaping, construction, and recreation, are especially vulnerable due to the physical nature of their work, which requires them to be outdoors for extended periods of time.

Workers in landscaping, construction, and recreation are often more accessible to those facing challenges such as a lack of legal status, language barriers, or a lack of formal education. Systemic barriers limit access for many people of color to higher-paying, safer jobs, leading to a concentration in low-wage, physically demanding work. Individuals living in poverty or experiencing economic instability are more likely to take on low-paying, high-risk jobs with limited protections—many of which are outdoor occupations. These positions are often seasonal or temporary, which further contributes to their economic insecurity.

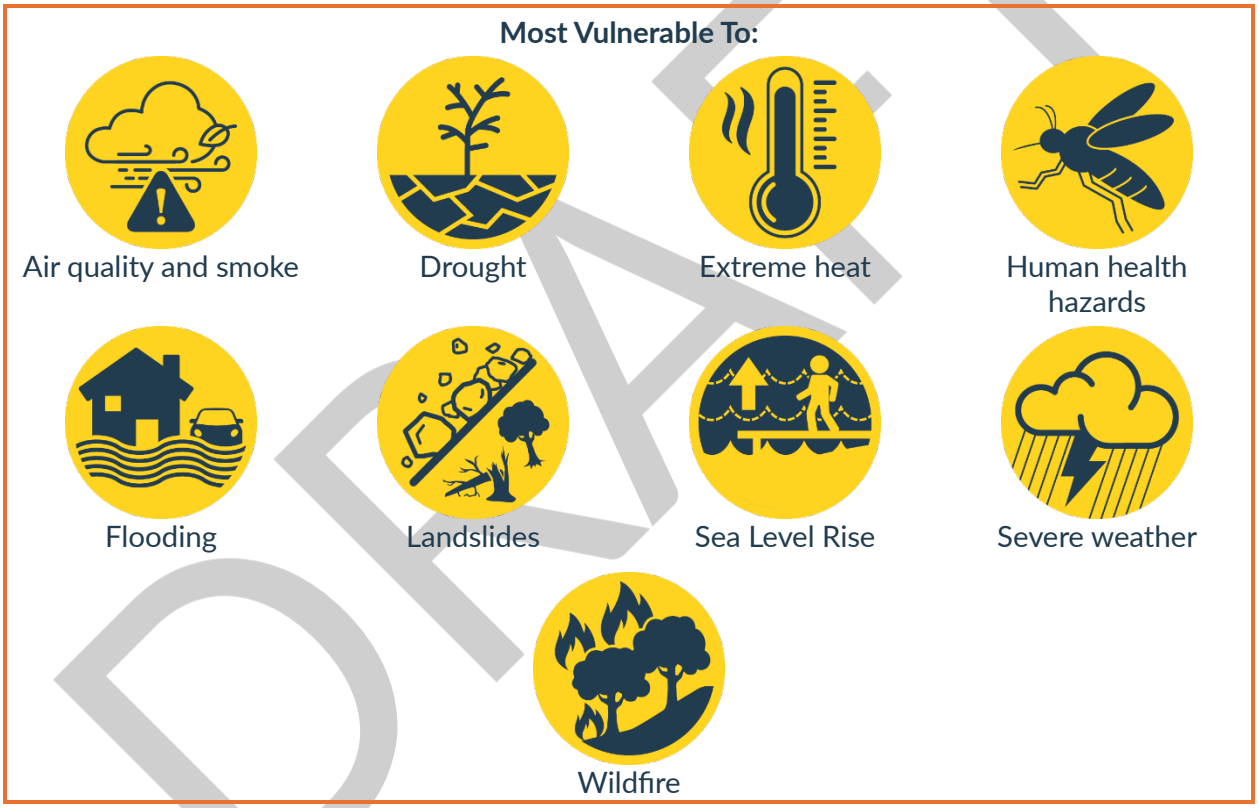
Outdoor workers are often from low-resourced households, including immigrant communities, low-income households, and low-resourced people of color. Many immigrants and people of color are disproportionately represented in outdoor occupations. The physical demands of their jobs often require wearing heavy gear and performing manual labor, which increases their susceptibility to heat-related illnesses during periods of extreme heat.

Outdoor workers are at a higher risk of encountering pests compared to the general population due to the nature of their work. Pest infestations can disrupt their activities, leading to economic consequences if work is delayed or halted. Additionally, the increased use of pesticides and

insecticides to manage pest outbreaks can pose health risks to these workers, potentially resulting in both acute and long-term health issues. Furthermore, if pest-related forest damage deters visitors, it can lead to fewer job opportunities and economic difficulties for outdoor workers who depend on tourism and related activities.

Natural disasters, such as wildfires or severe weather, can disrupt their ability to work, leading to economic instability. This financial strain can limit their access to timely medical care, creating a cycle of vulnerability that is difficult to break. Individuals experiencing homelessness face even greater challenges. Without consistent access to adequate shelter, they are left exposed to extreme weather events and hazardous conditions, putting their health and safety at significant risk.

Persons with Chronic Illnesses and/or Disabilities



Approximately 8 percent of San Bruno's population has some form of disability.

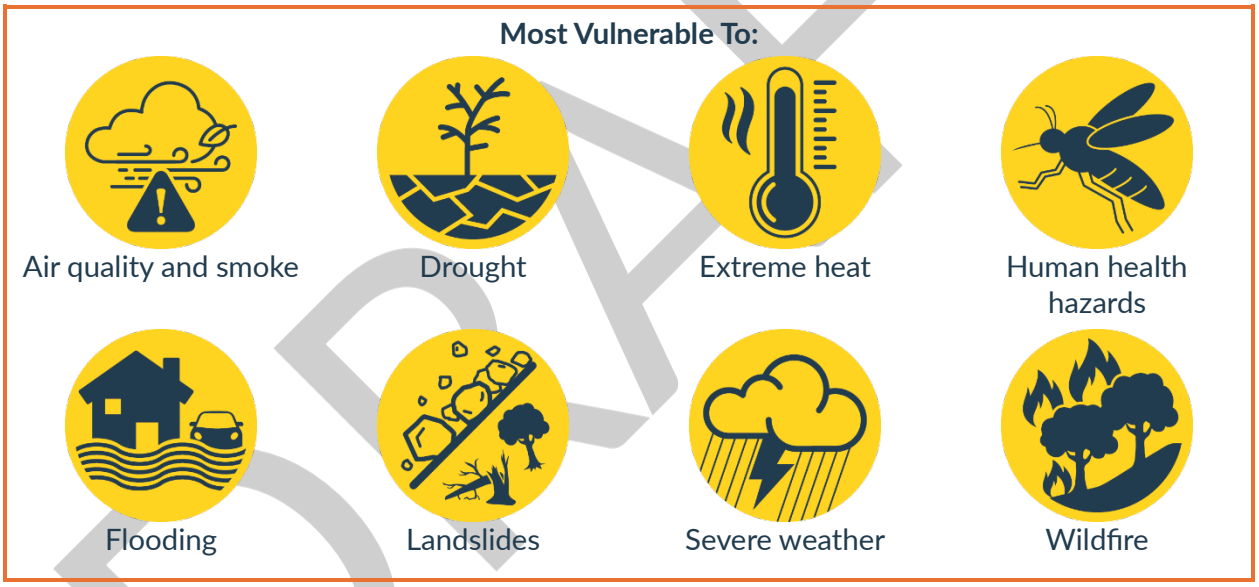
Source: American Community Survey. 2022. ACS 5-Year Estimates

Persons with chronic illnesses or disabilities are among the most vulnerable populations during emergencies due to physical, medical, and social factors that limit their ability to respond and recover effectively. Many individuals with chronic illnesses or disabilities have weakened immune systems due to pre-existing conditions or medications, which makes it harder for them to fight off new illnesses. Exposure to allergens and vector-borne diseases can exacerbate existing conditions, complicating treatment and recovery.

Additionally, these individuals are more sensitive to heat-related health effects and smoke exposure, making them particularly at risk during extreme weather events.

Hazards, including flooding, poor air quality, drought, extreme heat, severe weather, and wildfire, pose additional risks, as individuals with chronic conditions or disabilities may be more likely to be injured or become ill, and they may rely on medications or medical devices that can be lost, damaged, or rendered unusable. Poor air quality and wildfire smoke can exacerbate respiratory conditions, and drought can limit access to clean water, further impacting health. Extreme heat increases the risk of heat-related illnesses, and severe weather events can lead to injuries and disrupt essential medical care. Loss of power, such as during a public safety power shutoff, can be especially dangerous for those who need electricity to operate medical devices or store medications, a situation that becomes more likely during extreme heat, severe weather, or flooding. Furthermore, people with disabilities often face barriers in preparing their homes for emergencies and evacuating to safety before and during severe weather or flooding events.

Older Adults



Older adults face a distinct set of vulnerabilities during emergencies, and it is essential to understand these challenges to protect this population effectively. Many older adults experience reduced mobility, impaired vision, and hearing loss, which can make it difficult for them to respond quickly to sudden threats such as natural disasters. For instance, attempting to evacuate during a wildfire, or accessing San Bruno's cooling centers (San Bruno Library and San Bruno Senior Center) while dealing with mobility impairments or vision issues significantly increases their risk. These impairments mean that it can take longer for older adults to respond, increasing their risk

Older adults constitute 16 percent of San Bruno's population. Approximately 6 percent of San Bruno households consist of older adults living alone.

Source: American Community Survey. 2022. ACS 5-Year Estimates

of harm. Furthermore, they are more susceptible to injuries from a hazardous event and may face a more difficult recovery. Older adults are highly susceptible to cascading and compounding impacts from natural hazards, because the interplay of physical limitations, chronic health issues, economic constraints, and limited access to information can converge to place their lives at considerable risk.

Chronic health conditions further exacerbate these vulnerabilities. Conditions such as heart disease, diabetes, and respiratory issues can be significantly worsened during crises, particularly when exposed to wildfire smoke or extreme heat. Additionally, many older adults depend on regular medication, and the unavailability of these medications during disasters can have severe consequences. Disrupted access to essential medications during a major flood could escalate an already dangerous situation into a life-threatening emergency.

Older adults in care homes face additional vulnerabilities, as they rely on caregivers and institutional protocols for emergency response, which may vary in effectiveness, depending on the availability and capability of caregivers or the adequacy of institutional protocols. During emergencies, such as wildfires or extreme weather events, the adequacy of care can be compromised by limited staff availability, as caregivers may also be affected or unable to reach the facility. This situation is particularly concerning during widespread emergencies, where swift evacuations or the provision of necessary care can be severely delayed, increasing the risks faced by these individuals. Older adults in care homes may also have complex medical needs that require specialized attention, and disruptions in care can have severe, potentially life-threatening consequences.

Economic and social factors also compound these risks. Older adults receive, on average, less income than middle-aged adults. While some continue to work in high-income positions or have ample financial resources due to retirement funds or other investments, many have limited, fixed incomes, which limits their ability to invest in necessary disaster preparedness measures, such as purchasing emergency supplies or making their homes more resilient to natural hazards; this ultimately can increase their vulnerability to hazard events. Many older adults are unable to drive, leaving them dependent on external assistance if they need to evacuate. The digital divide is another key factor given that some older adults may be less familiar with digital technology, making it difficult for them to receive timely alerts and critical information disseminated through smartphones, social media, or emergency apps.

Transportation Infrastructure and Services

The City's transportation infrastructure, including roads, highways, bridges, evacuation routes, transit networks, and services, is crucial for community health, safety, and well-being. Additionally, the San Francisco International Airport (SFO) is considered as part of the City's transportation infrastructure and services given its influence and proximity to the city. San Francisco International Airport is one of the busiest airports in the United States, and any disruptions to the airport could severely interfere with domestic and international air travel.[28] These systems are vulnerable to poor air quality, flooding, landslides, sea level rise, severe weather, and wildfire. During normal conditions, damage to transportation infrastructure and services prevents people from going about their daily lives, interrupts many key services, and disrupts freight and shipping, including vital supply chains that support both businesses and households. Damage to transit networks also significantly impacts mobility for those who rely on public transportation, leading to reduced access to jobs, healthcare, and other essential services. During emergency events the potential for harm is even greater because damaged transportation networks can block evacuations, prevent or delay emergency response, and significantly hinder deliveries of vital supplies.

Roadways can be blocked or damaged by wildfires, landslides, flooding, or severe weather, cutting off major routes and isolating the community. Damage to these roads could limit evacuation options and delay healthcare and emergency services. Freight movement is also impacted because Highway 101 and Interstate 280 are essential for the transport of goods across the region. Disruptions to key routes not only affect local deliveries but also have broader economic implications for the region. In an extreme scenario, these hazards could block multiple roads in the unincorporated communities, significantly limiting evacuation options and delaying access to healthcare and other emergency services.

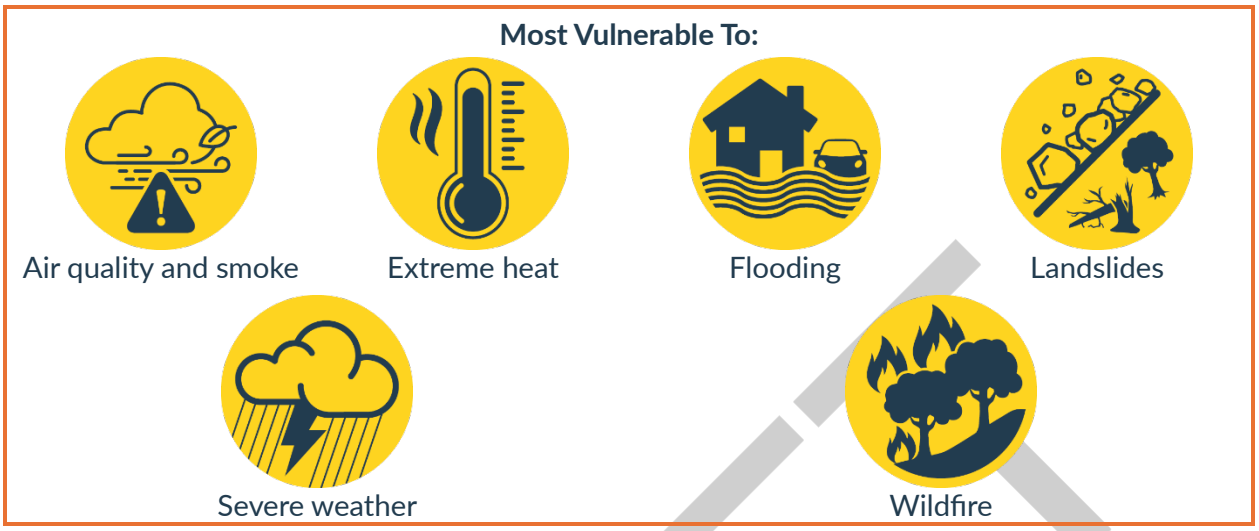
Many roads in eastern San Bruno are in mapped floodplains, making them vulnerable to damage or blockage from floodwaters. This includes San Bruno Avenue, a key route for SamTrans buses.

Loss of bus access can be particularly disruptive for low-income households, individuals with chronic illnesses or disabilities, and older adults. Just outside the city limits, the Caltrain line and Highway 101 near San Bruno are also in a mapped floodplain, creating a risk of regional movement disruptions. Damaged or blocked routes can prevent people from reaching work and disrupt freight shipping, causing economic hardships.

Sea level rise and flooding may damage pavement, increasing road maintenance costs and creating unsafe conditions for driving, walking, and biking. These hazards also impact transit services by disrupting access to routes and facilities, reducing service reliability and increasing travel times. Critical routes such as Highway 101 are within the 100- and 500-year floodplains and will face greater exposure to flooding over time, particularly with 3.3 feet of sea level rise during a 100-year storm event. Flooding of main access points could make travel to and from San Bruno challenging, and neighborhood roads with poor drainage could experience long-term delays and costly cleanup.

As sea levels rise, the risk of storm surge also increases, threatening critical infrastructure, including airport access roads and public transit connections. SFO Airport is vulnerable at 3.3 feet of sea level rise during a 100-year storm event. Inundation from sea level rise, storm surges, and inland flooding could overwhelm airport drainage systems, causing standing water on runways, terminals, and other critical infrastructure. Damage to airport facilities could lead to costly repairs, prolonged closures, and significant economic losses for local businesses. Such disruptions could hinder travel to and from the airport, negatively impacting the county's recreation and tourism industries, including attractions, hospitality services, and seasonal events. To address these challenges, SFO has implemented the Shoreline Protection Program, aimed at safeguarding airport assets and operations from flooding due to storm surges and future sea level rise. This program focuses on developing a comprehensive shoreline protection system to protect travelers, airport workers, and critical infrastructure. Sea level rise impacts extend beyond immediate flood zones, affecting key infrastructure in flood-prone areas. Disruption of these services due to flooding will have cascading effects throughout the city, impacting daily life, economic stability, and overall resilience, increasing isolation for vulnerable populations and reducing mobility for those relying on public transit.

Emergency Services



San Bruno's emergency services include emergency medical response, fire protection services, and law enforcement response. These are critical services at all times, including during and immediately after emergency events. However, several climate hazards can disrupt these services, putting community members at risk. Poor air quality and extreme heat can significantly increase the number of calls for emergency response, putting stress on the services and potentially leading to a shortage of care providers. Since these are often regional events, San Bruno and its emergency providers may not be able to rely on automatic aid or mutual aid to compensate for shortages.

Severe weather is another major hazard of concern for San Bruno's emergency service providers. Strong winds during severe weather can knock down trees and blow debris onto roadways. Heavy rains can cause flooding or even landslides, which can also block roadways. If roadways are obstructed, emergency responders may be delayed. This is of particular concern for neighborhoods on the hillsides, which have limited road connections. Emergency responders may also be constrained during major public health emergencies, when responders may be short-staffed due to people on medical leave.

Other Priority Vulnerabilities

Although the following populations and assets are not identified as priority vulnerabilities for as many hazards as those discussed above, they are still of significant importance and concern to the community. Given the potential consequences for harm to these populations and assets, it is essential that they are recognized for community planning and risk assessment efforts. Addressing these priority vulnerabilities proactively can help mitigate their impacts and enhance the City's overall resilience.

Isolated Persons

Most Vulnerable To:


Air quality and smoke


Sea Level Rise


Severe weather


Wildfire

Isolated persons are another group in San Bruno who are priority vulnerabilities for many hazards. This includes people who do not speak English, who in San Bruno are predominantly Spanish-, Chinese-, and Tagalog-speaking households;[29] lack access to a personal vehicle or telecommunications; or otherwise lack regular social and technological connections. In the Lomita Park neighborhood, approximately 17 percent of households do not have a vehicle.[30]

In San Bruno, approximately 19 percent of households are limited English-speaking, 7 percent lack internet access, and 6 percent do not have a personal vehicle.

Source: American Community Survey. 2022. ACS 5-Year Estimates

Although these populations are a relatively small proportion of the total population, their isolated nature means that they often do not receive information about protecting against hazards or responding to imminent or ongoing hazards. This can include lifesaving information, such as evacuation orders or the location of cooling centers. Community-based organizations such as El Concilio, which provide services and outreach to marginalized and isolated persons in San Mateo County, help to reduce these vulnerabilities, but their capacity and resources are limited.

Homes

Most Vulnerable To:

Homes and residential structures are an essential part of every community, and San Bruno, like in other areas of the Bay Area and California, faces a chronic housing crisis fueled by high costs of housing and a limited supply of housing. Climate change has the potential to make this crisis worse. Houses and apartment buildings throughout the community can be damaged or destroyed by wildfires, flooding events, landslides during or after heavy rainfall, inundation from sea level rise, and severe storms. Even if initial damage is minor, standing or retained water can allow mold and mildew to grow, causing homes to become uninhabitable. Although extreme heat events and poor air quality may not affect the structural integrity of homes and residential structures, these events can cause unhealthy indoor air temperatures and quality, resulting in dangerous living conditions for occupants.

If homes become uninhabitable, residents can be displaced and may face significant challenges in finding alternative housing options, often resulting in prolonged periods of instability or even homelessness. These equity considerations underscore the need for targeted support and resources for vulnerable populations, including affordable housing programs, emergency assistance, and community planning efforts, to ensure fair access to safe and affordable housing and to prevent displacement.

Utility Infrastructure and Services

Most Vulnerable To:


Extreme heat


Landslides


Sea Level Rise


Severe weather


Wildfire

Residents, visitors, and workers rely on the City's energy and communication infrastructure and services to work, play, and remain healthy and safe. Energy delivery and communication infrastructure and services are highly vulnerable to hazards that could undermine their foundations or cause damage to the powerlines, including flooding, landslides, sea level rise, severe weather, and wildfire. This infrastructure supports electricity, natural gas, internet, and phone services for residents, visitors, and businesses.

Sea level rise poses a significant threat to the city's energy and communication infrastructure, especially when combined with extreme storm events. Impacts to transmission could lead to power outages, which would hinder emergency response and coordination during severe events. This loss of power would disrupt daily activities, affect communication networks, and compromise life support systems, putting residents' health and safety at risk.

Landslides, wildfire, and severe weather can down or damage power lines and disrupt natural gas supplies. Downed or damaged infrastructure may damage roads and buildings, posing risks to people and potentially requiring road closures. Damaged infrastructure may also create fire hazards. This infrastructure may also be damaged by floodwaters and extreme heat.

Extreme heat can regularly cause power outages due to a combination of mechanical failure of electrical grid equipment, heat damage to the wires themselves, and high demand for electricity because of cooling equipment, all of which causes stress on the grid. The heat also causes more demand for electricity (usually to run air conditioning units), causing further stress on the power lines that may lead to brownouts and blackouts. A power or communication outage, whether due to extreme heat, severe weather, or other causes, could affect emergency medical response and emergency resource services. Delayed or interrupted response to these services could have a direct impact on the health and well-being of residents in San Bruno such as older adults, low-income households, and persons with chronic illnesses and/or disabilities. The loss of power

often means a loss of refrigeration, ruining food in homes and businesses. This can be particularly harmful to financially constrained households and small businesses.

Water and Wastewater Infrastructure and Services

Water supplied through the City's water system is a combination of purchased water and groundwater pumped from the City's groundwater supply wells. The City purchases its treated water from the San Francisco Public Utilities Commission and North Coast County Water District. The City also sources local groundwater from the Westside Groundwater Basin (specifically the South Westside Basin) using four wells and a fifth well that is undergoing replacement. Portions of this infrastructure are at risk from flooding, emergent groundwater, sea level rise, landslides, and wildfires. The City of San Bruno Wastewater Division provides wastewater collection services to San Bruno, which face similar threats to their infrastructure, including flooding, emergent groundwater, sea level rise, landslides, wildfires, and drought.

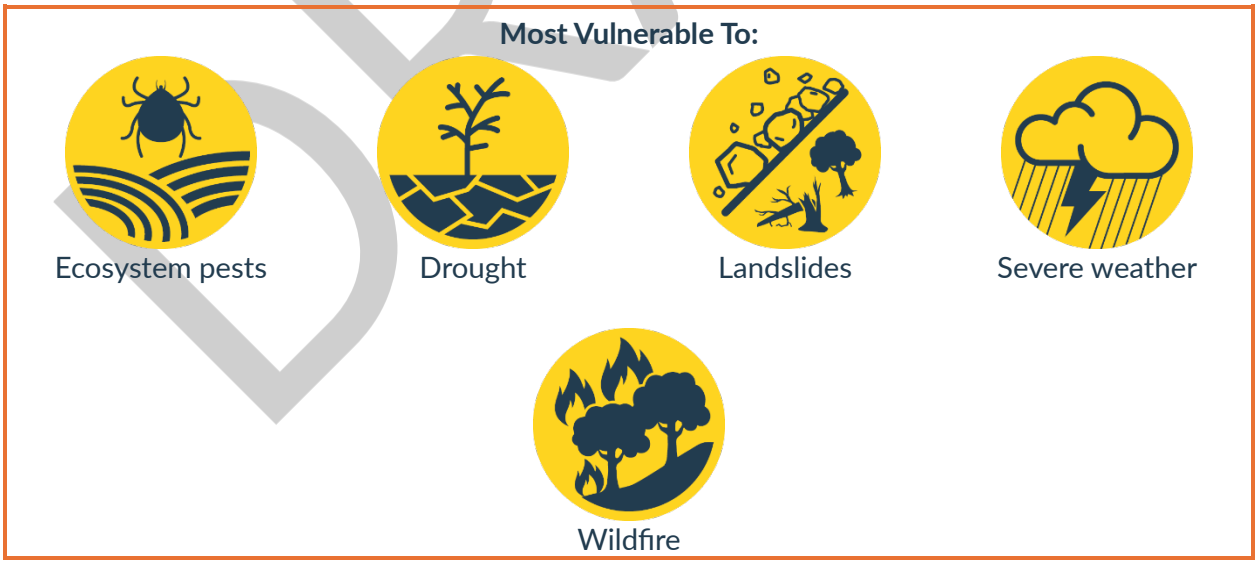
Drought has the potential to impact San Bruno's water supplies, and alternative sources such as surface water, groundwater, and recycled water are currently not viable or cost-effective. Drought conditions can also impact San Bruno's ability to provide reliable water services, leading to water use restrictions that limit the amount of water available to residents and businesses and may increase water costs. Drought can reduce sewer flow, making wastewater more concentrated and requiring additional treatment to meet water quality standards, which in turn increases energy use. Reduced flow also decreases the flushing of debris from pipes, reducing system efficacy and potentially leading to infrastructure damage or service disruptions.

San Bruno's sewer system is vulnerable to flooding, sea level rise, and emergent groundwater, particularly in areas between State Route 82 and US Highway 101 near the eastern city limits. Damage to wastewater systems could have widespread public health impacts if untreated wastewater contaminates the water and soil.

Flooding from heavy rain can damage both water and wastewater pipelines and treatment facilities. Landslides can damage water and wastewater lines, leading to sewer overflows or suspension of water services. The South San Francisco-San Bruno Water Quality Control Plant is in a 100-year floodplain and an area subject to inundation at 3.3 feet of sea level rise, making it particularly vulnerable. Damage to water and wastewater infrastructure could compromise service availability and expose residents to contaminants, significantly impacting community health and well-being. If the treatment plant fails, sewage backups could occur, contaminating streams and water systems. Pump stations, which collect sewage, are vulnerable to saltwater intrusion during storm events and sea level rise, potentially causing wastewater to overflow into the environment and create human and ecosystem health hazards.

If electrical systems at pump stations are compromised, water service and sewage pumping could be interrupted, leading to significant public health risks due to sewage contamination. However, these systems are usually designed to include backup power. Backup power systems and storage tanks are essential for mitigating these risks. Backup power ensures continuous operation during outages, while storage tanks provide a buffer for water supply and sewage management, helping to maintain essential services and protect public health during disruptions. Buried water pipelines are also at risk due to changes in soil water content caused by flooding, emergent groundwater, and sea level rise. Saltwater exposure can damage these utilities, often with damage going unnoticed until major failures occur. Damage to the water system could also increase vulnerability to wildfire because the system is essential for firefighting efforts, though it is not designed to handle major wildfires. Wildfires can further degrade water supplies if facilities such as San Andreas Lake are contaminated by ash, reducing water availability.

Oak Woodlands



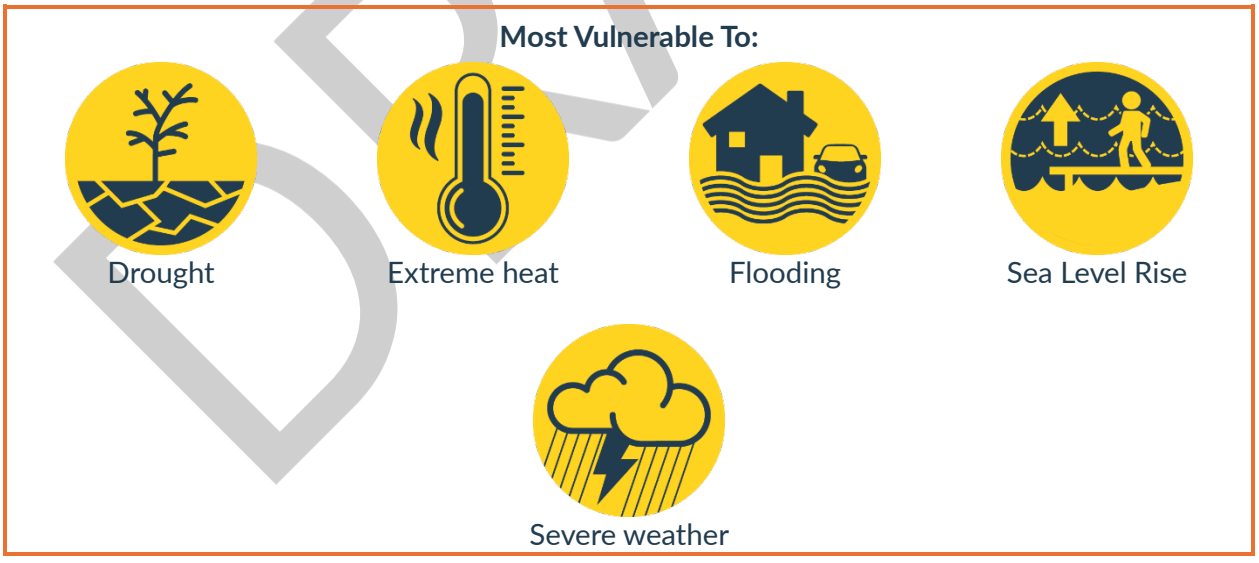
Oak woodlands provide a wide range of valuable ecological services, including supporting biodiversity, sequestering carbon, offering recreational opportunities, and stabilizing soil. However, these ecosystems are increasingly threatened by climate change hazards, largely due to

their significant overlap with high and very high fire severity zones, as well as the potential of cascading or compounding effects from drought, extreme heat, and ecosystems pest infestations.[31]

Oak woodlands, though resilient to low-intensity ground fires, are increasingly at risk from repeated high-intensity fires, which are becoming more frequent due to climate change. Repeated high-intensity fires can kill mature trees that would otherwise survive single low-intensity fires disrupting the ecosystem's balance.[32] Drought can kill or stress the trees in San Bruno, degrading the quality of the woodland and making the ecosystem more susceptible to fires. Such environmental stresses also increase the risk of diseases such as sudden oak death, which can further contribute to ecosystem loss. Insect infestation of wildland trees, in addition to harming tree health and leading to death, increases the fuel availability for wildfires. Insect pests and diseases such as bark beetles, sudden oak death, and pitch canker in trees can destroy large expanses of forest and woodland.

In the hillier areas of San Bruno, landslides pose a threat to the local oak woodlands. Mature trees can often survive smaller landslides, but these can kill ground cover that is a vital part of the ecosystem, and damage from frequent landslides can weaken the overall health of the ecosystem over time. Oak woodlands in San Bruno are also vulnerable to severe weather, which can blow down trees and branches. While this is unlikely to do long-term harm to the ecosystem on its own, it can affect ecosystem health in combination with other hazards that place additional stress on the local flora.

Aquatic Habitat



Aquatic habitats in the community include willow riparian areas such as San Bruno Creek, and the freshwater wetlands near the Caltrain rail line. Wetlands serve as natural buffers that absorb and slow floodwaters, helping to protect the community from flooding from the San Francisco Bay. The dense vegetation in wetlands physically slows the movement of water, allowing for gradual

absorption and infiltration into the soil. This reduces the speed and intensity of floodwaters. They also play a crucial role in water filtration, removing pollutants and improving water quality for both human and ecological needs. Additionally, wetlands offer critical habitat for diverse wildlife, supporting a variety of plant and animal species, some of which are rare or endangered. They provide essential breeding, feeding, and shelter areas for birds, fish, and other wildlife. Furthermore, these habitats offer recreational opportunities, such as birdwatching, hiking, and educational activities, contributing to the well-being of the community. The health of wetlands and other aquatic ecosystems is essential to protecting built infrastructure and services from sea level rise and flooding. However, these habitats are among the most vulnerable habitats in the community.

Several existing factors play a role in the sensitivity of these ecosystems to changing conditions, such as fragmentation, existing pollution levels, and built structures that may impede the natural adaptive migration of the ecosystems as sea levels rise, drought intensifies, and temperatures increase. During a drought, riparian areas can dry up, substantially changing the ecosystem's character. Lower water levels in a creek can result in higher water temperatures and lower dissolved oxygen levels, both potentially dangerous conditions for aquatic species. Riparian areas may be overwhelmed by floodwaters and damaged by debris. The San Mateo County Flood & Sea Level Rise Resiliency District, also known as OneShoreline, is collaborating with local jurisdictions, including San Bruno, to plan debris removal at five sites across four creeks, including San Bruno Creek. Programs like OneShoreline's Routine Maintenance Program for Bayside Creeks can help reduce flood risks in the community. However, the underlying vulnerabilities to flooding are likely to persist.

During drought conditions, wetlands can become increasingly fragmented due to the reduction in freshwater inflow. The absence of adequate freshwater input leads to sections of the wetlands drying out and breaking apart, resulting in a loss of habitat continuity and decreased ecological stability. During long-lasting droughts, the drier conditions may cause part of the wetland to transition to other ecosystems, causing permanent loss of more of an environment that has already been destroyed in much of the state. Floods and severe weather can cause the opposite problem, eroding the banks of riparian areas and upsetting the balance between freshwater and saltwater in the wetlands. Sea level rise similarly threatens San Bruno's freshwater wetlands, causing permanent inundation that can damage the ecosystem and contribute to their loss. Rising sea levels lead to increased inundation and conversion of vegetated wetland areas into open water, resulting in a loss of wetland functions. Wetlands have specific water elevation tolerances, and if the water is too deep, the area becomes open water rather than a vegetated wetland.[33]

Next Steps

The vulnerability assessment is a key technical study needed to update the Safety Element. The vulnerability assessment helps community members, agency staff, and decision makers understand how climate change hazards may alter community conditions and what parts of the community (people and places) should be prioritized for adaptation and resilience. The findings from the climate change vulnerability assessment process will be used to inform the goals, policies, and actions that will be included in the Safety Element.

Glossary

Adaptation: Making changes in response to current or future conditions (such as the increased frequency and intensity of climate-related hazards), usually to reduce harm and to take advantage of new opportunities. [34] [35]

Adaptive Capacity: The combination of the strengths, attributes, and resources available to an individual, community, society, or organization that can be used to prepare for and undertake actions to reduce adverse impacts, moderate harm, or exploit beneficial opportunities. [36]

Cascading or Compounding Effects: Extreme events that link together hazards over days, weeks, or months, resulting in multiplied effects that cause secondary and sometimes tertiary damage, exceeding the damage of the initial hazard event.

Climate Change: A change in the state of the climate that can be identified by changes in the mean, and/or the variability, of its properties, and that persists for an extended period, typically decades or longer.

Community Asset: A valued feature of a community that may be harmed by climate change. Community assets may include buildings, infrastructure, community services, ecosystems, and economic drivers.

Exposure: The presence of people; infrastructure; natural systems; and economic, cultural, and social resources in areas that are subject to harm. [37]

Goal: An ideal future end state related to public health, safety, or general welfare.

Hazard: An event or physical condition that has the potential to cause fatalities, injuries, property damage, infrastructure damage, damage to the environment, interruption of business, or other types of harm or loss. [38]

Impact: The effects (especially the negative effects) of a hazard or other conditions associated with climate change.

Policy: A specific statement that guides decision-making, indicating a commitment of the local legislative body to a particular course of action.

Program: An action, procedure, program, or technique that carries out a general plan policy.

Resilience: The capacity of any entity—an individual, a community, an organization, or a natural system—to prepare for disruptions, to recover from shocks and stresses, and to adapt and change from a disruptive experience. Community resilience is the ability of communities to withstand, recover, and to learn from past disasters to strengthen future response and recovery efforts.

Risk: The potential for damage or loss created by the interaction of hazards with assets such as buildings, infrastructure, or natural and cultural resources.

Vulnerability: The degree to which natural, built, and human systems are susceptible to harm from exposure to stresses associated with environmental and social change and from the absence of capacity to adapt. [39]

Vulnerability Assessment: An analysis of how a changing climate may harm a community and which elements—people, buildings and structures, resources, and other assets—are most vulnerable to its effects based on an assessment of exposure, sensitivity, potential impact(s), and the community's adaptive capacity.

Appendix A: Methods

The Vulnerability Assessment considers the threats from all relevant natural *hazards*, which are events or physical conditions that have the potential to cause harm or loss and will emphasize changes to hazard frequency and severity due to climate change. The Safety Element update addresses natural and human caused hazards, such as seismic hazards and hazardous materials. However, these hazards are not included in the Vulnerability Assessment, as climate change does not substantially change their frequency or severity. The Vulnerability Assessment also assesses *populations* and *assets* facing potential harm from the hazards. This includes the risk of physical damage to buildings and infrastructure, social vulnerability of persons likely to be disproportionately harmed by hazards, potential disruption to the city's economic engines, and loss of important services.

The Vulnerability Assessment is based on accurate and up-to-date information, including the Cal-Adapt database, the *California Adaptation Planning Guide (2020)*, and the *San Mateo County Multijurisdictional Local Hazard Mitigation Plan* (2021). As outlined in the *California Adaptation Planning Guide*, the Vulnerability Assessment follows a four-step process:

1. **Identify Exposure.** In a vulnerability assessment, *exposure* is the presence of people, infrastructure, natural systems, and resources (economic, cultural, and social) in areas subject to harm. A *hazard*, also called a climate change hazard, is an event or physical condition that has the potential to cause types of harm or loss. This step includes confirming applicable hazards in the city, describing historical hazards, describing how hazards are expected to change, and mapping the hazard-prone areas. The creation and review of this memo is part of this step of the Vulnerability Assessment.
2. **Analyze Sensitivity and Potential Impacts**. *Sensitivity* is the level to which changing climate conditions affect a population or community, species, natural system, government, asset, or resource. Potential *impacts* are the effects of a climate change hazard, or the combination of exposure to the hazard and sensitivity of a population or asset to it. For example, suppose an increase in extreme heat events is the hazard. In that case, the greater risk of heat-related illness in susceptible persons is the exposure, and the sensitivity is the degree of the impact from the exposure. Each population and asset in the City of San Bruno is likely to experience different impacts. The project team will assess the sensitivities and potential impacts to each population or asset from each applicable climate change hazard.
3. **Evaluate Adaptive Capacity.** *Adaptive capacity* is the ability of people and assets to adjust to potential damage from climate change hazards, to take advantage of existing opportunities such as funding, tools, and resources, or to respond to the impacts of climate change. The project team will assess the adaptive capacity of each population or asset for each applicable identified hazard. The City is already implementing several measures to increase adaptive capacity including the Municipal Code requirements, Capital Improvement Program, and Climate Action Plan.

4. **Conduct Vulnerability Scoring**. *Vulnerability* is defined as the combination of impact and adaptive capacity as affected by the level of exposure to changing climate conditions. Following the process in the *California Adaptation Planning Guide*, the project team will score impact and adaptive capacity for each population and asset affected by each hazard on a scale of low, medium, and high, to identify vulnerability on a scale of one to five and prioritize the most vulnerable populations and assets in San Bruno.

Appendix B: Populations and Assets

The City included the following populations and other assets in the Vulnerability Assessment. Each list includes a description and source of data needed to support the Vulnerability Assessment.

Populations

The City collected population data from the U.S. Census, the California Healthy Places Index, and the San Mateo County Homeless Point in Time Count. These 16 populations are:

1. Children (under 18).
2. Cost-burdened/low-income/overcrowded households: Cost-burdened households are those paying 30% or more of their income toward housing expenses.[40] The State identifies annual household income of $149,100 or lower as being considered low-income for a household of four people in San Mateo County in 2023.[41] Overcrowded households include housing units that have more than 1.0 persons or more per room (excluding bathrooms and kitchens) Approximately 9 percent of San Bruno homes are overcrowded.[42]
3. Households in poverty: The federal poverty line for a household of four is $31,200 a year.[43] However, in San Mateo County, the acutely low poverty line is even lower, which is $26,250 for a household of four. Approximately 5 percent of San Bruno residents earn incomes at or below poverty level.[44]
4. Immigrant communities/linguistically isolated persons: Communities consisting of foreign-born populations, including refugees, undocumented persons, and other immigrants. Linguistically isolated persons include households without a member who is fluent in English. Spanish, Chinese, and Tagalog are the primary languages in San Bruno among households that are not fluent in English.[45]
5. Low-resourced people of color: Persons identifying as a member of a racial and/or ethnic group and facing limited access to resources, such as financial, social, healthcare, or educational assistance.[46,47]
6. Outdoor workers: workers in landscaping, construction, outdoor recreation, etc.
7. Persons experiencing homelessness: 2024 Point In Time count reported 75 total persons experiencing homelessness (all unsheltered) within the City of San Bruno.[48]
8. Persons living on single access roads (roads with only a single entry or exit point). Single access roads are generally located to the west, in the hillsides of the community.
9. Persons with chronic illnesses and/or disabilities. Approximately 8 percent of San Bruno's population has some form of disability.[49]
10. Persons without a high school degree. Approximately 10 percent of San Bruno's adult population has not obtained a high school degree or equivalent.[50]
11. Persons without access to lifelines: Persons without reliable access to a car, transit, or communication systems. Approximately 6 percent of San Bruno households do not have access to a personal vehicle.[51] Approximately 7 percent of San Bruno households do not have an internet subscription.[52]

12. Renters. Approximately 39 percent of San Bruno housing units are renter occupied.[53]
13. Seniors (65+). Seniors constitute 16 percent of San Bruno's population.[54]
14. Seniors living alone. Approximately 6 percent of San Bruno households consist of seniors living alone.[55]
15. College students.
16. Unemployed persons. San Bruno's civilian labor force unemployment rate is approximately 3 percent.[56]

Infrastructure

The City gathered details on infrastructure from state and local GIS data and the 2021 San Mateo County Multijurisdictional Local Hazard Mitigation Plan. The seven asset groups are:

1. Energy and communication infrastructure:
    - Transmission Lines: Pacific Gas & Electric (PG&E).
    - Natural gas pipelines and structures: PG&E.
    - Cell towers, radio sites, fiber optic lines, and internet lines.
2. Flood control and stormwater infrastructure
3. Vehicle fuel stations:
    - Electric vehicle charging stations: seven public charging stations.[57]
    - Gas stations
4. Hazardous materials sites: 70 cleanup sites (11 with ongoing cleanup activities) identified via the State Water Control Board's GeoTracker database;[58] seven toxic substance sites (none with ongoing cleanup activities, although one needs evaluation) identified via the State Department of Toxic Substance Control's EnviroStor database.[59]
5. Transportation infrastructure:
    - Freeways and Highways: US Route 101, I-280, I-380, El Camino Real (State Route 82), and Skyline Boulevard (State Route 35).
    - Major roads: Crystal Springs Road, Elm Avenue, San Mateo Avenue, Valleywood Drive, Crestwood Drive, Sneath Lane, and San Bruno Avenue.
    - Transit facilities: stops and other facilities provided by SamTrans, Caltrain, and BART.
    - Railway: Caltrain, BART.
    - Airports: San Francisco International Airport.
6. Parks, recreational facilities, and open space:[60]
    - Pocket Parks: Catalpa Tot Lot, Earl and Glenview Park, Herman Tot Lot, Lomita Park, Posy Park.
    - Neighborhood Parks: Bayshore Circle Park, Buckeye Park, Commodore Park, Fleetwood Tot Lot, Forest Lane Park, Grundy Park, Lion's Field Park, Monte Verde Park, Pacific Heights Park, Ponderosa Park, Seventh Avenue Park, Seventh, Posey Park, Florida Avenue Park, Centennial Plaza, and Walnut Park.
    - Community Parks: City Park.
    - County Parks: Junipero Serra Park.

- Recreation Centers: Belle Air Community Center, Portola Performing Arts Center, San Bruno Senior Center, Recreation and Aquatic Center.
- Open Space: Crestmoor Canyon.

7. Water and wastewater infrastructure: South San Francisco-San Bruno Water Quality Control Plant, gravity sewers, lower laterals (privately maintained), force mains, lift stations, pump stations, storm drains, creeks, pipes, water storage tanks, groundwater wells, and reservoirs (including Hetch Hetchy, Calaveras, San Antonio, Crystal Springs, Pilarcitos, and San Andreas reservoirs – owned by SFPUC).

Buildings

The City collected buildings data from Google Maps, the California School Database, and local agency websites and GIS records. The five asset groups are:

8. Government and community facilities: San Bruno City Hall (the city operates an EOC in the basement as needed), National Archives, Golden Gate National Cemetery, Leo J. Ryan Federal Building, San Bruno Public Library, Belle Air Community Center, Portola Performing Arts Center, San Bruno Recreation and Aquatic Center, and San Bruno Senior Center.
9. Commercial centers: San Bruno Towne Center, the Shops at Tanforan, Bayhill Shopping Center.
10. Homes and residential structures: Multi-family and single-family residences.
11. Public safety buildings: San Bruno Fire Department Station 51, San Bruno Fire Department Station 52, and San Bruno Police Department.
12. Schools
    - San Bruno Park School District:
      - Allen Elementary (K-5)
      - Belle Air Elementary (K-5)
      - John Muir Elementary (K-5)
      - Portola Elementary (K-5)
      - Parkside Intermediate School (6-8)
      - South San Francisco Unified School District:
      - Monte Verde Elementary (K-5)
    - Millbrae School District
      - Lomita Park Elementary School (K-5)
    - San Mateo Union High School District:
      - Capuchino High School (9-12)
    - Private Schools:
      - Stratford Elementary School (K-5)
      - Lydian Academy
      - Highlands Christian Schools
      - Happy Halls Schools
      - St. Robert Catholic Elementary School
      - California Montessori School

- San Mateo County Office of Education – Special Education
  - El Portal School (K-22 – Special Education)
  - Palos Verde School (K-22)
- San Mateo County Community College District
  - Skyline College

Economic Drivers

The City determined important economic assets based on the 2022 Comprehensive Annual Financial Report and land uses in the city. These six asset groups are:

1. Major employers: You Tube, Inc., Walmart eCommerce Corporate Office, Skyline College, Artichoke Joe's Casino, City of San Bruno.
2. Technology, research, and development.
3. Government administration.
4. Commercial and retail centers.
5. Education services.
6. San Francisco International Airport (major employer of city residents but not located within city boundary)

Ecosystems and Natural Resources

The City determined the ecosystems and natural resources based on information from the General Plan's Environmental Resources and Conservation Element. These four groups are:

1. Freshwater wetland: This transitional habitat occurs between terrestrial and aquatic systems where water tables are near the surface or land is covered by shallow water. Grass-like plants, which emerge from the water, form a dense canopy. Seasonal and permanent wetlands in eastern San Bruno include coastal freshwater marsh.
2. Willow riparian: Willow riparian habitat is a low shrubby tree structure that can cover an entire watercourse with an impenetrable understory and can include fallen limbs and other debris. Willow scrub community is a broad-leaved, winter-deciduous streamside thicket, dominated by any of several willow species, usually as small trees, or shrubs.
3. Mixed oak woodland: Mixed oak woodlands are dominated by any of several oak species, with an understory consisting of shrubs, non-native grasses, and wildflowers. Woodlands provide foraging, nesting, shelter, and migrating corridors for a variety of wildlife species.
4. Non-native annual grassland: Non-native grassland consists of annual grasses associated with a variety of broad-leafed herbs and perennial grasses.

Key Services

These assets are based on typical services provided in cities throughout California, which are supported by the infrastructure and buildings listed above. Key community services include the operation and functions needed to provide and maintain services. The Vulnerability Assessment assesses the infrastructure and people needed to support them separately. These eight service groups are:

1. Education services: San Bruno Park School District, South San Francisco Unified School District, San Mateo Union High School District, Millbrae School District, San Mateo County Office of Education, and the San Mateo County Community College District.
2. Emergency services: San Bruno Fire Department, San Bruno Police Department, San Mateo County Department of Emergency Management, San Mateo Operational Area Emergency Services Council.
3. Energy delivery and communication services: Peninsula Clean Energy, PG&E, radio, television, cellular and landline phone, and internet.
4. Government administration and community services.
5. Public transit access: BART, SamTrans, Caltrain.
6. Solid waste removal: Recology.
7. Water and wastewater: San Francisco Public Utilities Commission, City of San Bruno Public Works Department's Wastewater and Water Divisions.
8. CityNet (San Bruno's internet and cable enterprise)

Endnotes

[1] American Community Survey. 2015. 2015: ACS 5-Year Estimates, Language Spoken at Home by Ability to Speak English for the Population 5 Years and Over, B16001.
[2] American Community Survey. 2021. 2021: ACS 5-Year Estimates, Occupancy Characteristics, S2501.
[3] American Community Survey. 2021. 2021: ACS 5-Year Estimates, Physical Housing Characteristics for Occupied Housing Units, S2504.
[4] American Community Survey. 2021. 2021: ACS 5-Year Estimates, Educational Attainment, S1501.
[5] American Community Survey. 2021. 2021: ACS 5-Year Estimates, Demographic Characteristics, DP05.
[6] Environmental Protection Agency. 2024. Research on Health Effects from Air Pollution. https://www.epa.gov/air-research/research-health-effects-air-pollution
[7] Bay Area Air Quality Management District. April 19, 2017. *Final 2017 Clean Air Plan*. Appendix C. Available: https://www.baaqmd.gov/~/media/files/planning-and-research/plans/2017-clean-air-plan/attachment-a-proposed-final-cap-vol-1-pdf.pdf?la=en.
[8] Bay Area Air Quality Management District. 2024, October 24 (accessed). History of the Air District. https://www.baaqmd.gov/about-the-air-district/history-of-air-district
[9] Bay Area Air Quality Management District. 2023. 2023 Annual Report. https://www.baaqmd.gov/publications/annual-reports
[10] U.S. Environmental Protection Agency. 2024, October 10 (accessed). Why Wildfire Smoke is a Health Concern. https://www.epa.gov/wildfire-smoke-course/why-wildfire-smoke-health-concern
[11] Environmental Protection Agency. 2023. Health Effects Attributed to Wildfire Smoke. https://www.epa.gov/wildfire-smoke-course/health-effects-attributed-wildfire-smoke.
[12] Halofsky, J.E., Peterson, D.L., Buluç, L.Y., & Ko, J.M. 2021. Climate change vulnerability and adaptation for infrastructure and recreation in the Sierra Nevada. Gen. Tech. Rep. PSW-GTR-272. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station.
[13] Cal-Adapt. 2024, October 15 (accessed). Extreme Heat Days and Warm Nights. https://cal-adapt.org/tools/extreme-heat.
[14] Cal-Adapt. 2024, October 15 (accessed). Extreme Heat Days and Warm Nights. https://cal-adapt.org/tools/extreme-heat.
[15] Center for Disease Control and Prevention. 2022. QuickStats: Deaths Involving Exposure to Excessive Heat, by Sex — National Vital Statistics System, United States, 1999–2020. https://www.cdc.gov/mmwr/volumes/71/wr/mm7134a5.htm#:~:text=During%201999%E2%80%932020%2C%20the%20annual,than%20among%20females%20each%20year.
[16] U.S. Department of Health and Human Services. 2024. Extreme Heat. https://www.hhs.gov/climate-change-health-equity-environmental-justice/climate-change-health-equity/climate-health-outlook/extreme-heat/index.html#:~:text=Heat%2Drelated%20deaths%20have%20been,2022%2C%20and%202%2C302%20in%202023.
[17] U.S. Environmental Protection Agency. N.d. Climate impacts on Human Health. https://climatechange.chicago.gov/climate-impacts/climate-impacts-human-health#ref1.
[18] National Oceanic and Atmospheric Administration. 2023. What are atmospheric rivers?. https://www.noaa.gov/stories/what-are-atmospheric-rivers.
[19] Ackerly, David, Andrew Jones, Mark Stacey, Bruce Riordan. (University of California, Berkeley). 2018. San Francisco Bay Area Summary Report. California's Fourth Climate Change Assessment. Publication number: CCCA4-SUM-2018-005.
[20] California Office of Environmental Health Hazard Assessment. 2024. Vector-borne diseases. https://oehha.ca.gov/climate-change/epic-2022/impacts-human-health/vector-borne-diseases#:~:text=Warming%20temperatures%20and%20changes%20in,the%20blood%20of%20infected%20birds.
[21] California Office of Environmental Health Hazard Assessment. 2024. Vector-borne diseases. https://oehha.ca.gov/climate-change/epic-2022/impacts-human-health/vector-borne-

diseases#:~:text=Warming%20temperatures%20and%20changes%20in,the%20blood%20of%20infected%20birds.

[22] San Francisco Bay Conservation and Development Commission. 2024. Regional Shoreline Adaptation Plan. https://www.bayadapt.org/wp-content/uploads/2024/09/BCDC_Draft_Regional_Shoreline_Adaptation_Plan_Appendix-A_Spreads.pdf

[23] County of San Mateo. 2018. *County of San Mateo Sea Level Rise Vulnerability Assessment*. https://www.smcsustainability.org/wp-content/uploads/2018-03-12_SLR_VA_Report_2.2018_WEB_FINAL.pdf.

[24] Ocean Protection Council. 2024. State of California Sea Level Rise Guidance. https://opc.ca.gov/wp-content/uploads/2024/05/California-Sea-Level-Rise-Guidance-2024-508.pdf

[25] Ocean Protection Council. 2024. State of California Sea Level Rise Guidance. https://opc.ca.gov/wp-content/uploads/2024/05/California-Sea-Level-Rise-Guidance-2024-508.pdf

[26] Ocean Protection Council. 2024. State of California Sea Level Rise Guidance. https://opc.ca.gov/wp-content/uploads/2024/05/California-Sea-Level-Rise-Guidance-2024-508.pdf

[27] Western Fire Chiefs Association. 2024. What Causes Wildfires? https://wfca.com/wildfire-articles/what-causes-wildfires/#:~:text=Vehicles,Prescribed%20Burning%20&%20Arson

[28] San Francisco Department of Public Health. 2016. *Climate and Health Understanding the Risk: An Assessment of San Francisco's Vulnerability to Flooding & Extreme Storms*. https://www.sf.gov/sites/default/files/2023-05/FloodVulnerabilityReport_v5.pdf.pd

[29] American Community Survey. 2015. 2015: ACS 5-Year Estimates, Language Spoken at Home by Ability to Speak English for the Population 5 Years and Over, B16001.

[30] American Community Survey. 2021. 2021: ACS 5-Year Estimates, Selected Economic Characteristics, DP03.

[31] Dwomoh, FK., Brown, JF., Tollerud, HJ., Auch, RF. 2021. "Hotter Drought Escalates Tree Cover Declines in Blue Oak Woodlands of California." Frontiers. https://www.frontiersin.org/articles/10.3389/fclim.2021.689945/full

[32] Harper, J. M., Standiford, R. B., & LeBlanc, J. W. 1994. The role of fire in California's oak woodlands. UC Oaks. https://oaks.cnr.berkeley.edu/the-role-of-fire-in-californias-oak-woodlands-2/

[33] Texas A&M. 2024. Climate Change Impacts on Tidal Wetlands. Coastal Resilience. https://coastalresilience.tamu.edu/home/wetland-protection/intro-to-wetland-protection/.

[34] Louise Bedsworth, Dan Cayan, Guido Franco, Leah Fisher, Sonya Ziaja, "Statewide Summary Report," in *California's Fourth Climate Change Assessment*, publication number: SUMCCCA4-2018-013, 2018.

[35] California Natural Resource Agency, *Safeguarding California Plan: 2018 Update: California's Climate Adaptation Strategy*, 2018, http://resources.ca.gov/docs/climate/ safeguarding/update2018/safeguarding-california-plan-2018-update.pdf

[36] Intergovernmental Panel on Climate Change, "Annex II: Glossary," ed. K. J. Mach, S. Planton, and C. von Stechow, in *Climate Change 2014: Synthesis Report*, ed. Core Writing Team, R. K. Pachauri, and L. A. Meyer (Geneva, Switzerland: IPCC, 2014), p. 117–130, https://www.ipcc.ch/report/ar5/syr/

[37] Louise Bedsworth, Dan Cayan, Guido Franco, Leah Fisher, Sonya Ziaja, "Statewide Summary Report," in *California's Fourth Climate Change Assessment*, publication number: SUMCCCA4-2018-013, 2018.

[38] California Governor's Office of Emergency Services, *California State Hazard Mitigation Plan*, 2018, https://www.caloes.ca.gov/cal-oes-divisions/hazard-mitigation/hazard-mitigation-planning/state-hazard-mitigation-plan

[39] Neil Adger, "Vulnerability," *Global Environmental Change* 16 (2006): 268–281, https://www.geos.ed.ac.uk/~nabo/ meetings/glthec/materials/simpson/ GEC_sdarticle2.pdf

[40] City of San Bruno. 2015. City of San Bruno Housing Element 2015 - 2023. https://www.sanbruno.ca.gov/DocumentCenter/View/1676/2015-to-2023-Housing-Element-PDF

[41] San Mateo County. 2023. 2023 San Mateo County Income Limits. https://www.smcgov.org/media/144471/download?inline=.

[42] American Community Survey. 2021. 2021: ACS 5-Year Estimates, Occupancy Characteristics, S2501. https://data.census.gov/table?q=S2501&g=160XX00US0665028.

[43] Office of the Assistant Secretary for Planning and Evaluation. 2024. "HHS Poverty Guidelines for 2023." https://aspe.hhs.gov/topics/poverty-economic-mobility/poverty-guidelines.
[44] United States Census Bureau. San Bruno city, California. Available: https://data.census.gov/profile/San_Bruno_city,_California?g=160XX00US0665028.
[45] American Community Survey. 2015. 2015: ACS 5-Year Estimates, Language Spoken at Home by Ability to Speak English for the Population 5 Years and Over, B16001. https://data.census.gov/table?q=B16001&g=160XX00US0665028.
[46] Public Health Alliance of Southern California. 2018. *Healthy Places Index*. https://map.healthyplacesindex.org/
[47] Roos, Michelle. (E4 Strategic Solutions). 2018. Climate Justice Summary Report. California's Fourth Climate Change Assessment. Publication number: SUM-CCCA4-2018-012.
[48] County of San Mateo Human Services Agency. 2022. 2022 San Mateo Count One Day Homeless Count and Survey. https://www.smcgov.org/media/130611/download?inline=.
[49] American Community Survey. 2021. 2021: ACS 5-Year Estimates, Disability Characteristics, S1810. https://data.census.gov/table?q=S1810&g=160XX00US0665028.
[50] American Community Survey. 2021. 2021: ACS 5-Year Estimates, Educational Attainment, S1501. https://data.census.gov/table?q=S1501&g=160XX00US0665028.
[51] American Community Survey. 2021. 2021: ACS 5-Year Estimates, Physical Housing Characteristics for Occupied Housing Units, S2504. https://data.census.gov/table?q=S2504&g=160XX00US0665028.
[52] American Community Survey. 2021. 2021: ACS 5-Year Estimates, Types of Computers and Internet Subscriptions, S2801. https://data.census.gov/table?q=S2801&g=160XX00US0665028.
[53] American Community Survey. 2021. 2021: ACS 5-Year Estimates, Demographic Characteristics for Occupied Housing Units, S2502. https://data.census.gov/table?q=S2502&g=160XX00US0665028.
[54] American Community Survey. 2021. 2021: ACS 5-Year Estimates, Age and Sex, S0101. https://data.census.gov/table?q=S0101&g=160XX00US0665028.
[55] American Community Survey. 2021. 2021: ACS 5-Year Estimates, Selected Social Characteristics in the United States, DP02. https://data.census.gov/table?q=DP02&g=160XX00US0665028.
[56] American Community Survey. 2021. 2021: ACS 5-Year Estimates, Selected Economic Characteristics, DP03. https://data.census.gov/table?q=DP03&g=160XX00US0665028.
[57] U.S. Department of Energy. 2023. Electric Vehicle Charging Station Locations. https://afdc.energy.gov/fuels/electricity_locations.html#/find/nearest?fuel=ELEC&location=san%20bruno%20.
[58] California State Water Resources Control Board. 2023. GeoTracker Database. https://geotracker.waterboards.ca.gov/map/?CMD=runreport&myaddress.
[59] California Department of Toxic Substances Control. 2023. EnviroStor Database. https://www.envirostor.dtsc.ca.gov/public/map/?myaddress.
[60] City of San Bruno. 2009. City of San Bruno Open Space and Recreation Element. https://www.sanbruno.ca.gov/DocumentCenter/View/1662/Chapter-5-Open-Space-and-Recreation-PDF.