PENINSULA RESILIENCE PLANNING PROJECT

TOWN OF ATHERTON
VULNERABILITY ASSESSMENT SUMMARY

March 2025

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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 Atherton and other 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.

As a participant in the project, Atherton is conducting technical work that will be used to support comprehensive update of its Safety Element. As part of this work, the PREP team prepared an updated Climate Change Vulnerability Assessment to analyze how climate-related hazards may harm the community. California law [*] requires 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.

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. These General Plans must cover eight mandatory topics: land use, circulation, housing, conservation, open space, noise, safety, and environmental justice (if applicable). General Plans typically organize one or more of these topics into dedicated chapters, known as elements.

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

The Vulnerability Assessment helps community members, Town 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 how Town and community resources help to improve resiliency in Atherton in an integrated, thorough, and tailored way. The findings from the Vulnerability Assessment process will support future updates to the Safety Element, working in combination with the San Mateo County Multi-jurisdictional Local Hazard Mitigation Plan to help safeguard Atherton against both current and future hazard conditions, including the changes in hazard events from climate change.

[*] California Government Code Section 65302(g)(4), established by Senate Bill 379 in 2015.

Community Profile

Atherton is a small community of approximately 7,200 people in the southern part of San Mateo County's urbanized bayside region, bordered by the town of Woodside and the cities of Redwood City and Menlo Park. There are no freeways in Atherton, but El Camino Real runs through the center of the town, providing connections to other communities along the peninsula. Atherton is a residential community, made up of low-density single-family homes on larger lots. Six multifamily homes were built in 2020. The only nonresidential uses permitted in Atherton are schools, the Town's Civic Center, and parks and open spaces.

As Atherton does not have commercial properties, the jobs in the town are mostly at the schools and public facilities in the community. The education, public administration, health care/social assistance, and similar service industries make up most of the town's economy. About 95 percent of Atherton residents work elsewhere, especially in Redwood City, Menlo Park, San Francisco, San Jose, and San Mateo.[1] Most of Atherton's revenue comes from property taxes.[2]

Atherton is different from most of the rest of San Mateo County in many ways, as shown in the town's 2022 demographics in **Table 1**. The median income in the town is more than $250,000, and by some estimates exceeds $500,000.[3] The town has much higher rates of home ownership than the San Mateo County average and very few overcrowded households or households without access to a vehicle. Reflecting the high cost of living in the Bay Area and in Atherton in particular, the Town's proportion of cost-burdened households (those paying at least 30 percent of their income on housing) is lower than the county average, but over 30 percent of Atherton households still meet this definition, and 18 percent of households spend at least 50 percent of their income on housing.[4]

Atherton has a very low rate of linguistically isolated persons (those who are not proficient in English) and a smaller percentage of people who work outdoors compared to the county's average. The town does have a higher proportion of older adults than the overall county, as close to 25 percent of Atherton residents are at least 65 years of age.

Table 1. 2022 Demographics in Atherton and San Mateo County

Demographic	Atherton		San Mateo County	
	Number	Percentage	Number	Percentage
Population	**7,188**	-	**754,250**	-
Children (under 18 years old)	1,419	19.90%	150,187	19.90%
Linguistically isolated persons	279	4.00%	116,306	16.30%
Older adults (65 years and older)	1,702	23.90%	127,520	16.90%
Persons with disabilities	566	7.90%	65,466	8.70%
Persons working outdoors	198	2.75%	41,748	5.44%
Persons in poverty	260 *	3.90%	48,137	6.40%

Demographic	Atherton		San Mateo County	
	Number	Percentage	Number	Percentage
Unhoused persons	2	-	1,142	-
Number of households	**2,183**	-	**264,323**	-
Median household income	$250,000+	-	$175,000	-
Households without a vehicle	29	1.30%	14,752	5.58%
Cost-burdened households	642	30.51%	94,625	36.55%
Overcrowded households	8	0.37%	19,366	7.33%
Rental households	309	14.15%	106,955	40.46%

* Due to the way the US Census Bureau determines poverty and counts different sources of income, these 260 people in Atherton may technically meet the definition of poverty, but this likely does not reflect the actual living conditions or socioeconomic characteristics of many of them.

Climate Hazards

Climate change represents the long-term shift in the 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 outlines the major hazards from climate change in Atherton and how these hazards are expected to change in the coming years and decades.

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*.

The Vulnerability Assessment for Atherton considers eight climate-related hazards and their effects on the community: air quality and smoke, drought, extreme heat and warm nights, flooding, human health hazards, landslides and debris flows, severe weather, and wildfire.

Air Quality and Smoke

Poor air quality and smoke affects the health and quality of life for Atherton community members. The health risks associated with these types of air pollutants are particularly severe for vulnerable populations, including children, older adults, and individuals with pre-existing respiratory or cardiovascular conditions. Exposure to air pollutants such as ozone and particulate

matter (PM) can lead to respiratory conditions, exacerbate asthma, and increase the risks of heart attacks, strokes, and certain types of cancer.

The increased frequency of wildfires in northern California is exacerbating these hazards.[5] Air pollutants come from mobile sources such as cars and trucks, 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. Warmer temperatures lengthen the growing seasons of plants and trees, increasing allergen production. Poor air quality leads to more health issues, strains healthcare systems, and restricts outdoor activities.

The financial burden of poor air quality in the Bay Area region is estimated at $32 billion annually, which includes costs associated with premature deaths, healthcare expenses, reduced productivity, and other related issues.[6] The Bay Area Air Quality Management District 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.[7]

During normal conditions, the air quality in Atherton is generally very good. According to the California Office of Environmental Health Hazard Assessment, the town ranks well below California averages for levels of ozone and $PM_{2.5}$ (very small particulate matter, which forms the greatest health risk). Atherton does have higher levels of PM from diesel engines, although these levels are at or below the average for California communities and are well below that of some neighborhoods in nearby Redwood City, Palo Alto, and East Palo Alto. However, during regional wildfires, air pollution levels throughout the Bay Area, including in Atherton, can rise to dangerous levels. For example, in September 2020 when there were numerous wildfires burning across the Bay Area and elsewhere in Northern California, PM levels in Redwood City (the nearest air quality monitoring station to Atherton), were measured at "Very Unhealthy" levels.[8]

Bay Area Air Quality Management District Programs

The Bay Area Air Quality Management District 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.

Drought

A drought is where conditions are drier than normal for an extended period, making less water available for people and ecosystems. While drought is a normal occurrence in California, prolonged drought conditions can harm ecosystems and the regional economy. Droughts do not typically cause direct loss of life or structural damage, but they can lead to critical environmental and economic harm, including agricultural losses, increased water costs, habitat degradation, and heightened wildfire risks. Water demands, such as population growth, exacerbate these impacts, complicating water allocation and potentially leading to restrictions and quality issues.

Atherton receives water from the California Water Service's (Cal Water) Bear Gulch district, a private water company. The San Francisco Public Utilities Commission (SFPUC) provides most of Cal Water's supply, which primarily comes from San Francisco's Hetch Hetchy Reservoir, fed by rainfall and snowmelt in the Tuolumne River watershed in the Sierra Nevada. The SFPUC supplements its supply with water from lakes and reservoirs in Alameda and San Mateo Counties. Cal Water's remaining water supply comes from the Bear Gulch Creek watershed, where it is diverted and treated at the Bear Gulch Reservoir in southern Atherton.

Scientists predict climate change will result in more frequent and severe droughts across the state. Overall, precipitation levels are expected to increase slightly in Atherton. More years with extreme levels of precipitation, both high and low, are likely because of climate change. Locally, more intense droughts are expected to harden soil and reduce the water supply from Bear Gulch Creek. When rains return, more water will run off rather than infiltrate into the ground, potentially causing localized flooding. Higher temperatures will further increase evaporation, worsening drought conditions.

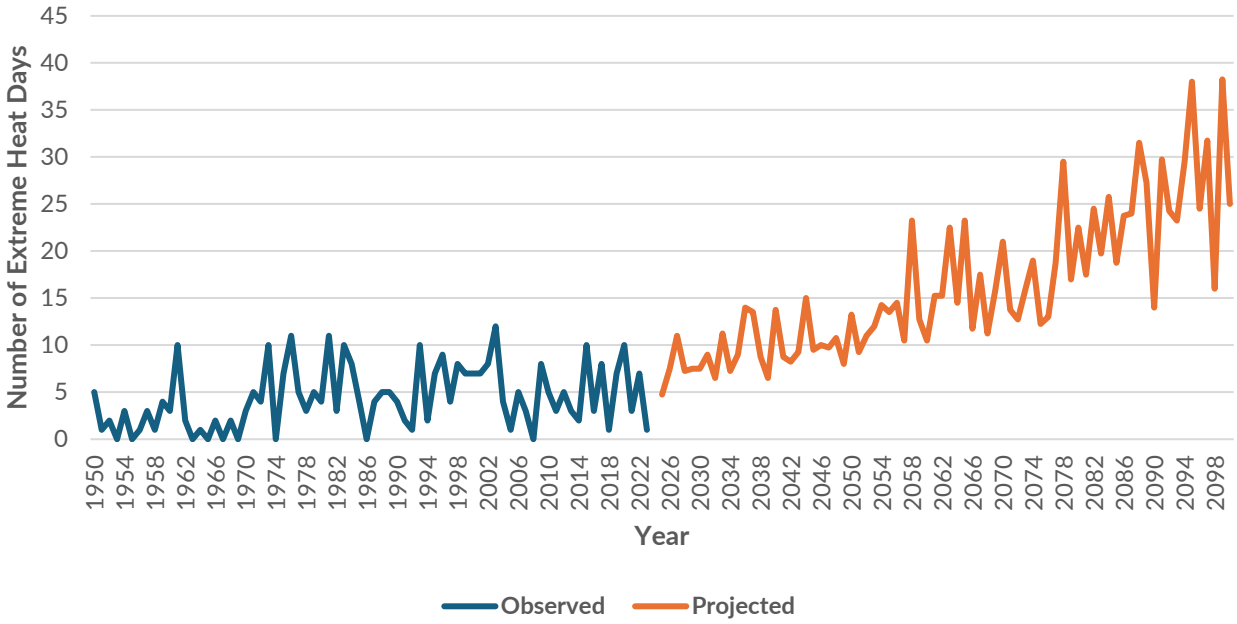
Of greater concern to Atherton's water supply are projections of reduced winter precipitation levels and warmer temperatures in the Sierra Nevada. These changes decrease the size of the Sierra Nevada snowpack (the volume of accumulated snow), which in turn makes less fresh water available for communities throughout California, including those that receive water from the Hetch Hetchy system. The Cal-Adapt database reports that climate scientists project over a 60 percent decline in the snowpack immediately around Hetch Hetchy in the second half of the century.

Extreme Heat and Warm Nights

Extreme heat is a growing topic of concern for Atherton and other communities in the region. Extreme heat days, which are those with temperatures exceeding 98 percent of historical highs, are becoming more frequent and intense due to climate change. They pose significant health risks, can result in loss of power and high energy bills, and can help increase the risk of wildfires.

According to the Cal-Adapt database, an extreme heat day in Atherton is one where the temperature exceeds 95.2 degrees Fahrenheit. As shown in **Figure 1,**[†] climate change is expected to increase extreme heat days in the town from a historic annual average (1961 to 1990) of 5 days per year, to an average of 13 days per year by mid-century (2035 to 2064) and an average of 23 days per year by late-century (2070 to 2099). By late century, Atherton is expected to see an average of 10 days a year with temperatures at or above 100 degrees Fahrenheit, compared to a historical average of 1 such day annually.[9, ‡]

Figure 1. Observed and Projected Extreme Heat Days in Atherton

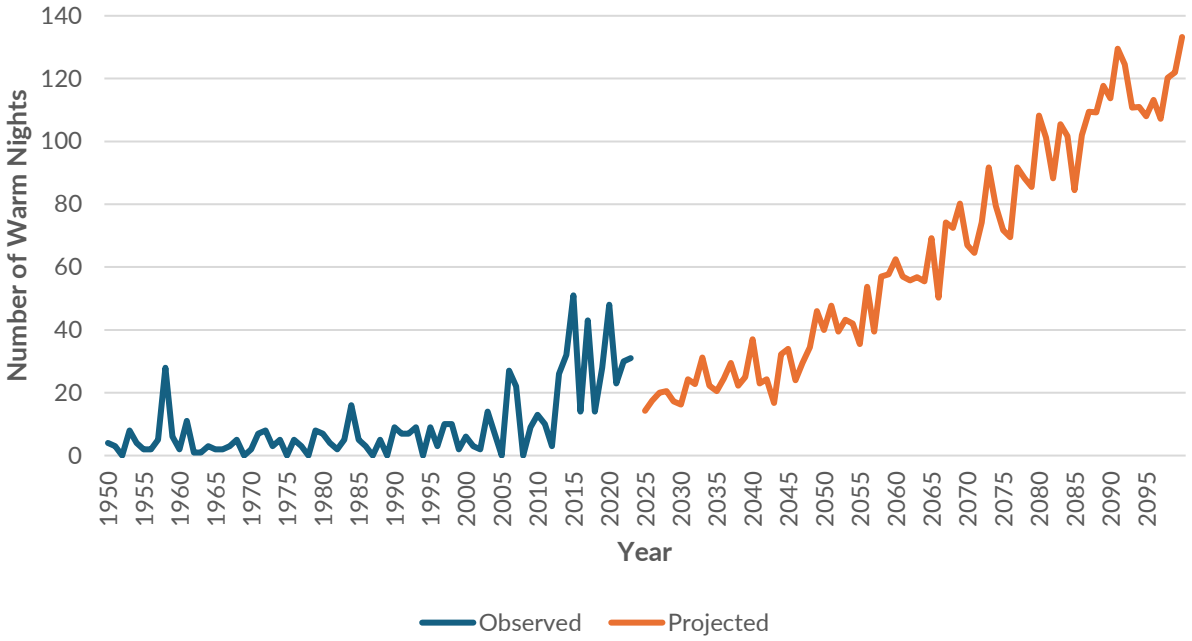


The harm of extreme heat is often compounded when nighttime temperatures do not cool off to more normal levels, which means that the community gets little or no relief for the duration of the heat wave. A warm night in Atherton is when temperatures remain above 59.6 degrees. As shown in **Figure 2**, warm nights are projected to increase from a historic 6 nights per year to 41 nights per year by midcentury and 101 nights per year by late century.[10]

[†] 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 the century, which is consistent with the International Panel on Climate Change Sixth Assessment Report.

[‡] 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 2. Observed and Projected Warm Nights in Atherton



Extreme heat is one of the deadliest climate-related hazards nationwide, with the Center for Disease Control and Prevention noting a rise in heat-related deaths—from 297 in 2004 to over 2,300 in 2023.[11, 12] These numbers are likely a significant undercount, as they do not include deaths caused by other factors that are exacerbated by extreme heat. The rising frequency and intensity of extreme heat and warm nights pose significant public health concerns.

Extreme heat levels in Atherton are lower than in more inland parts of California. However, although the absolute temperature levels may not be as high as other parts of the state, they can still be dangerous, since community members and local systems are not used to extreme heat. In some instances, Atherton can face more harm than heat-adapted locations. Extreme heat leads to heightened risks of dehydration, heat-related illnesses, and respiratory issues, disrupting daily life and economic activity.[13] Extreme heat also stresses infrastructure, as more residents install air conditioning units and electricity demand increases, it risks overloading the power grid and causing outages. While air conditioning is relatively prevalent in Atherton compared to other parts of San Mateo County, not all homes have such systems installed, and those that do can still suffer a loss of cooling services during power outages.

Flooding

Flooding occurs when normally dry land is covered by water. This can include creeks and other water bodies overtopping their banks and when heavy rainfall surpasses the capacity of drains to carry the water away. It can also occur because of dam failure or water or wastewater infrastructure failure.

Floods are among the costliest natural disasters in terms of human hardship and economic loss nationwide, significantly threatening the health and life of community members and causing substantial damage to structures, landscapes, and utilities serving the town. Flooding can lead to long-term public health problems if mold and mildew grow in buildings; displace residents if homes are destroyed or become uninhabitable; and increase economic burdens, such as rising home insurance costs. They can also contribute to other natural hazards, especially landslides.

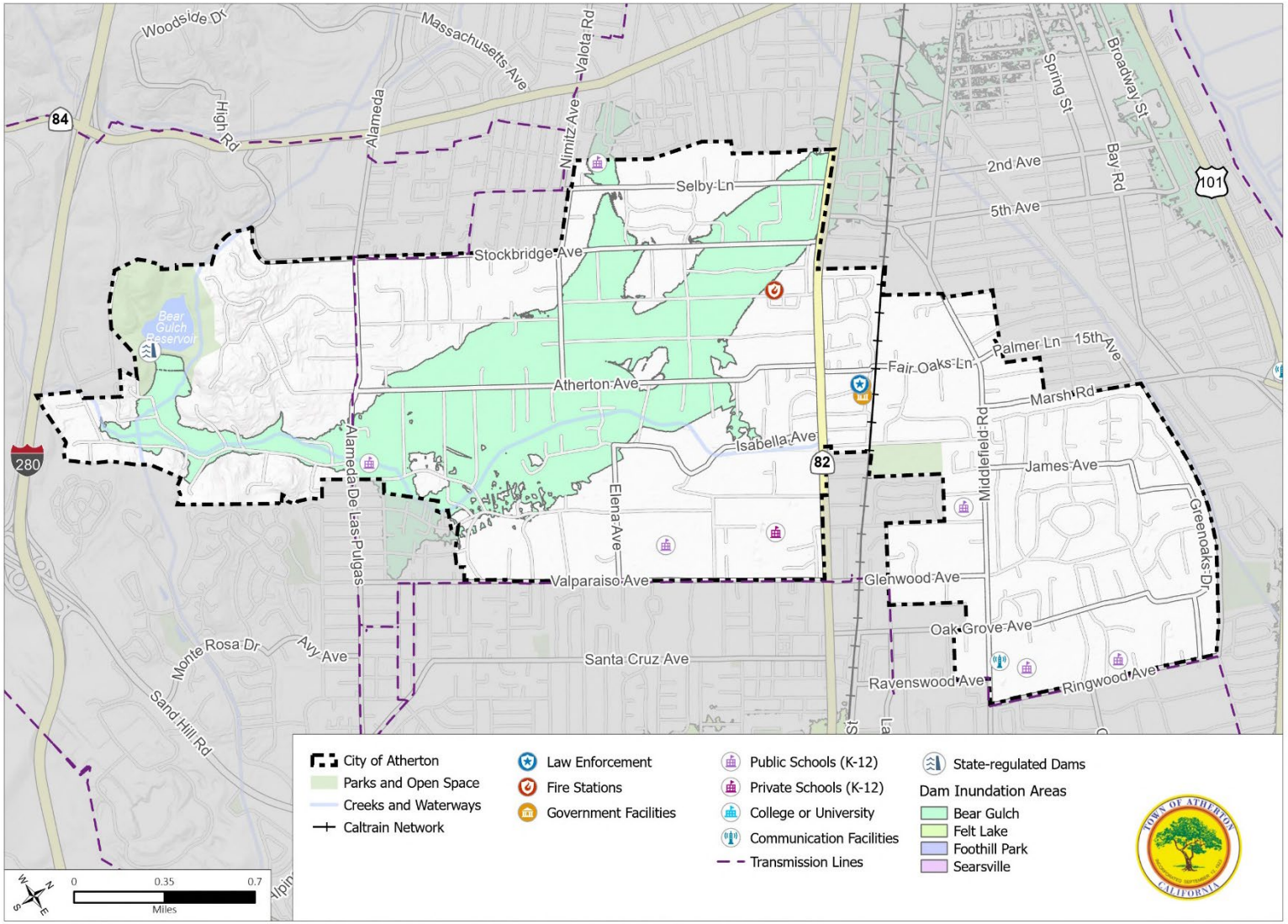
Climate change is expected to increase the risk of flooding across much of California. Even though overall precipitation levels may not change substantially, climate change is expected to shift precipitation to both more extreme highs and lows, increasing the frequency and intensity of strong storms such as those associated with atmospheric rivers. For example, storms that have a 1 in 200 (0.5 percent) chance of occurring in any given year (known as a 200-year storm) could increase in frequency and become storms with a 1 in 150 chance of occurring in a year. Areas at risk of flooding are likely to increase. Climate change is also likely to increase the frequency and severity of droughts that cause soil to dry out and become hard. When rainfall does return, more water runs off the surface than is absorbed into the ground, which can increase flooding downstream.

There are no officially mapped floodplains in Atherton, although the town's northern border with Menlo Park is adjacent to a mapped flood hazard zone (named Flood Park). Despite this, there remains a risk of flooding in the town. During heavy rainfall, water can collect in low-lying areas with inadequate drainage, resulting in standing water.

There is also a risk of flooding from an infrastructure failure at Bear Gulch Reservoir. While a serious failure at the dam is very unlikely, it could result in widespread flooding along Atherton Channel, and in a large section of central Atherton between Alameda de Las Pulgas and El Camino Real. According to the LHMP, over 20 percent of both the property and population in Atherton are in the dam failure hazard zone. The property, which includes 526 homes and a small number of nonresidential facilities, is valued at approximately $580 million as of 2021. **Figure 3** shows the mapped dam failure inundation zones in the town.

Atherton is far enough from the bayshore that it would not be directly affected by sea level rise within the range of reasonable projections by 2100. However, projections for sea level rise by 2100 would likely inundate key regional infrastructure, including Highway 101, and numerous job centers throughout the county, which would likely create indirect but potentially severe impacts for Atherton residents. The 2021 LHMP estimates that across all of San Mateo County, sea level rise could directly impact 29 percent of all properties, valued at an estimated $55 billion.

Figure 3. Atherton Dam Inundation Areas



Source: ESRI, 2023; County of San Mateo, 2023; PlaceWorks, 2023; California Division of Safety of Dams, 2023

Human Health Hazards

Human health hazards, including bacteria, viruses, parasites, and other pathogens, pose significant concerns in Atherton. 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.[14] According to the California Office of Health Hazard Assessment, 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.[15]

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 (as discussed previously in the Air Quality and Extreme Heat sections). The combination of these factors suggests that human health hazards will become more widespread and severe as climate change progresses, making proactive public health measures even more critical, especially in areas that have limited healthcare services. The implications of these health hazards extend beyond individual well-being, placing strain on healthcare systems, increasing economic burdens, and affecting mental health.

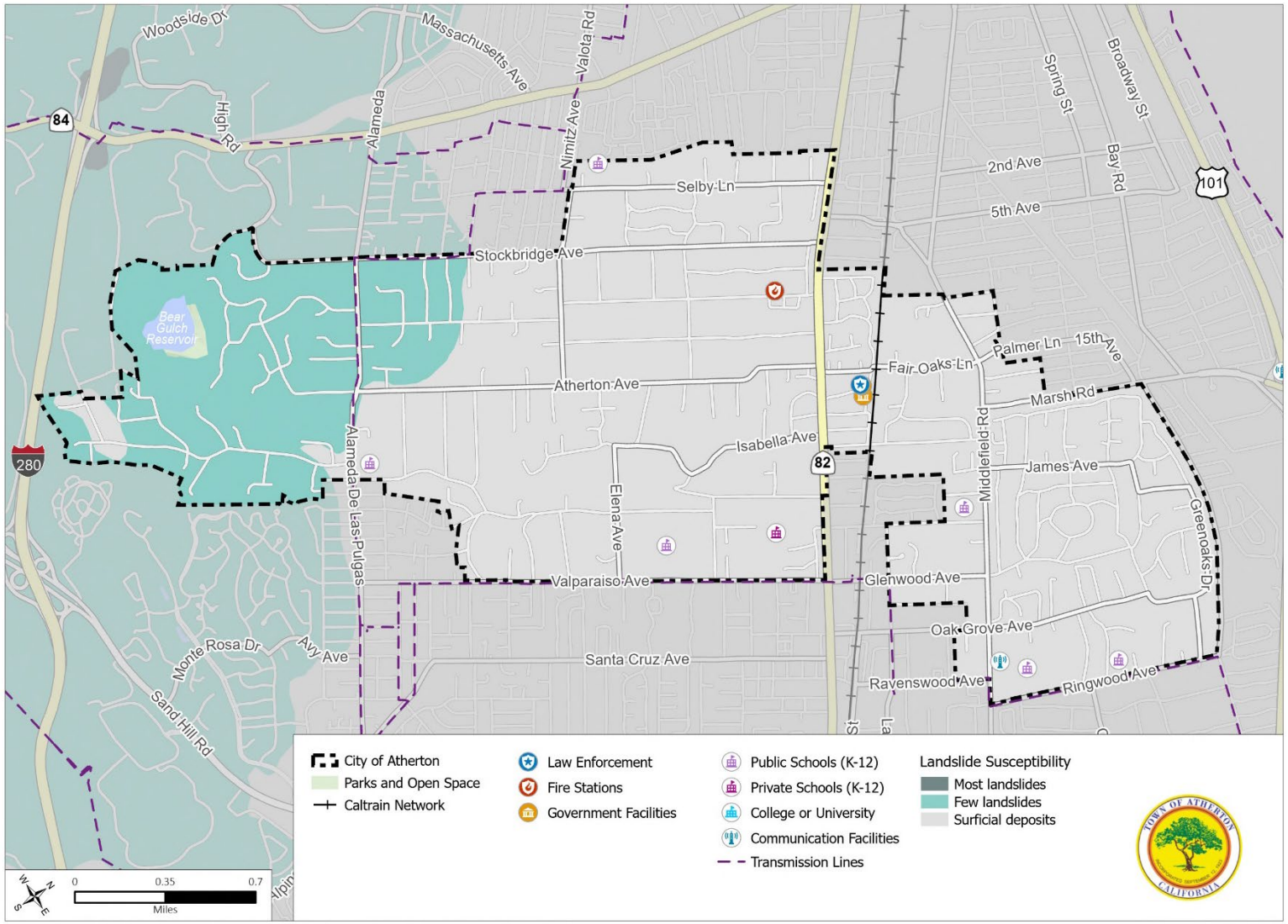
Landslides and Debris Flows

Landslides are the movement of rock, soil, or debris down a hill or mountain. They are often triggered by natural events such as heavy rainfall, floods, or earthquakes. Wildfires can indirectly cause landslides by burning away vegetation that help stabilize the slope, making it more susceptible to sliding.

As shown in **Figure 4** and on the online PREP Map Viewer, the southern, more hilly neighborhoods of Atherton have an elevated risk of landslides. Most of the land south of Alameda de Las Pulgas is potentially prone to landslides, including the land around Bear Gulch Reservoir. Although not directly in Atherton, Interstate I 280, a key regional highway, runs mostly through potential landslide hazard zones between Cupertino and Daly City.

Climate change is expected to exacerbate landslide hazards by increasing frequency of wildfires and severe storms that can likely elevate the risk of landslides, particularly fast-moving debris flows. Landslides can displace residents, block key transportation routes such as Alameda de Las Pulgas, and damage critical infrastructure such as electricity, water, and sewer pipelines. Such impacts can disrupt daily life in Atherton and deprive community members of key services and access, even for those not near the landslide hazard zones. The 2021 LHMP estimates that 15 homes (valued at approximately $10 million) are in a zone of high landslide susceptibility, and a further 49 homes (valued at approximately $46 million) are in a zone of moderate landslide susceptibility.

Figure 4. Landslide Hazard Zones in Atherton



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

Severe Weather

Severe weather, such as high winds and thunderstorms, poses a threat to Atherton. The Multi-Jurisdictional Hazard Mitigation Plan considers severe weather to have the highest risk of any climate change-related hazard in the town and the second highest of any hazard, with earthquakes (a non-climate change-related hazard) as the one that poses the greatest risk. Severe weather is usually caused by intense storms, although some types of strong winds can occur separately from storm systems. The types of dangers posed by severe weather include injuries or deaths, damage to buildings and structures, fallen trees, and 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 wildfires and structure fires that can cause damage to buildings and endanger people. Objects such as vehicles, unprotected structures like bus stops or carports, fences, telephone poles, or trees can also be struck directly by lightning, which may cause an explosion or fire.

The most common severe weather events that have historically impacted Atherton are heavy rains (usually a result of atmospheric rivers), thunderstorms, and windstorms. As mentioned previously, while average annual rainfall may increase only slightly in Atherton, climate change is expected to cause an increase in the number of years with intense levels of precipitation. Heavy rainfall can increase the frequency and severity of other hazards, including localized flooding and landslides.

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.

Public Safety Power Shutoff events are used as a preventive strategy to reduce wildfire risk during severe weather, especially during high winds and dry conditions. PG&E may shut off power lines during severe weather to prevent them from sparking fires, causing power outages that may last for extended periods. According to data from utility companies and the California Public Utilities Commission, Atherton has not been directly affected by Public Safety Power Shutoff events, although surrounding communities such as Woodside and Redwood City have. This does not mean that Atherton could never experience a Public Safety Power Shutoff event in the future. There is also always the possibility of unscheduled power outages from severe weather, which have happened before in Atherton and will almost certainly happen again. Loss of power, for any reason, can disrupt communication networks in the town, harm people dependent on medical devices, and result in a loss of goods that need to be kept in specific conditions (refrigerated, for example). A loss of power can also interrupt heating or cooling services, which can be dangerous if it occurs at the same time as extreme temperatures.

Wildfire

Wildfire is a hazard of some concern in Atherton, as it is in many parts of California. Historically, fire season ran during the hotter, drier months from early summer until late fall, although it is increasingly a hazard that can occur year-round due to higher temperatures, lower moisture content in air and plant matter, accumulation of vegetation, and high winds. Rising temperatures and prolonged droughts dry out vegetation, creating abundant fuel for fires.

Human activities are the leading cause of wildfires, and increased development near these wildland areas has amplified the likelihood and risk of wildfire events.[16] 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. Climate change is expected to make wildfires worse throughout California by raising temperatures, increasing the frequency and severity of drought events that can dry out vegetation and make it more likely to burn, and increasing pest and disease activity that can kill vegetation that acts as fuel for fires.

Atherton does not have any officially mapped fire hazard zones, and the California Department of Forestry and Fire Prevention (CAL FIRE) does not have records of past wildfires occurring in the town. However, CAL FIRE identifies the land south of Alameda de Las Pulgas as a Wildland-Urban Interface zone, meaning that it is an area where development mixes with and borders vegetation that is prone to wildfire. The Wildland-Urban Interface includes Bear Gulch Reservoir and comes close to (although does not touch) Las Lomitas Elementary. Additionally, it is worth remembering that wildfires can extend from wildland areas into development that is far outside of a mapped hazard zone, and that such events are increasingly likely given the more frequent and intense wildfires expected because of climate change.

Key Findings

The following section presents the key findings of the Vulnerability Assessment for Atherton, 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 who should be considered as the Town's priorities in adaptation and resilience planning. Identifying a population or a community asset as a priority

Priority Vulnerabilities

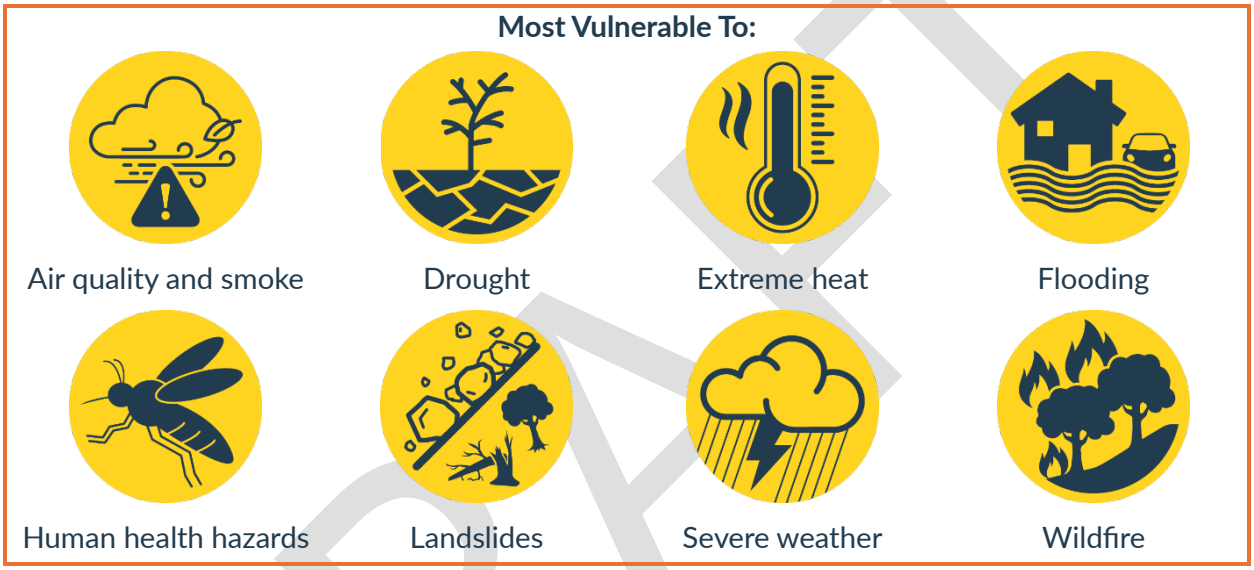
In addition to the severity of impacts from climate change and related hazards, other factors that affect whether a population or asset is considered a priority vulnerability include:

- 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.

vulnerability reflects the severity of climate change impacts and level of harm, but also considers several other factors.

All eight climate hazards discussed in this report are of concern to Atherton, although severe weather creates the most priority vulnerabilities, followed by wildfire and extreme heat. Climate change is expected to affect all populations and assets in the town to some degree. This section does not describe all potential harm in Atherton but focuses on the most substantial findings from the vulnerability assessment. Other populations and assets that are not designated as priority vulnerabilities may also face substantial impacts from climate change.

Older Adults and Persons with Limiting Health and Wellness Issues

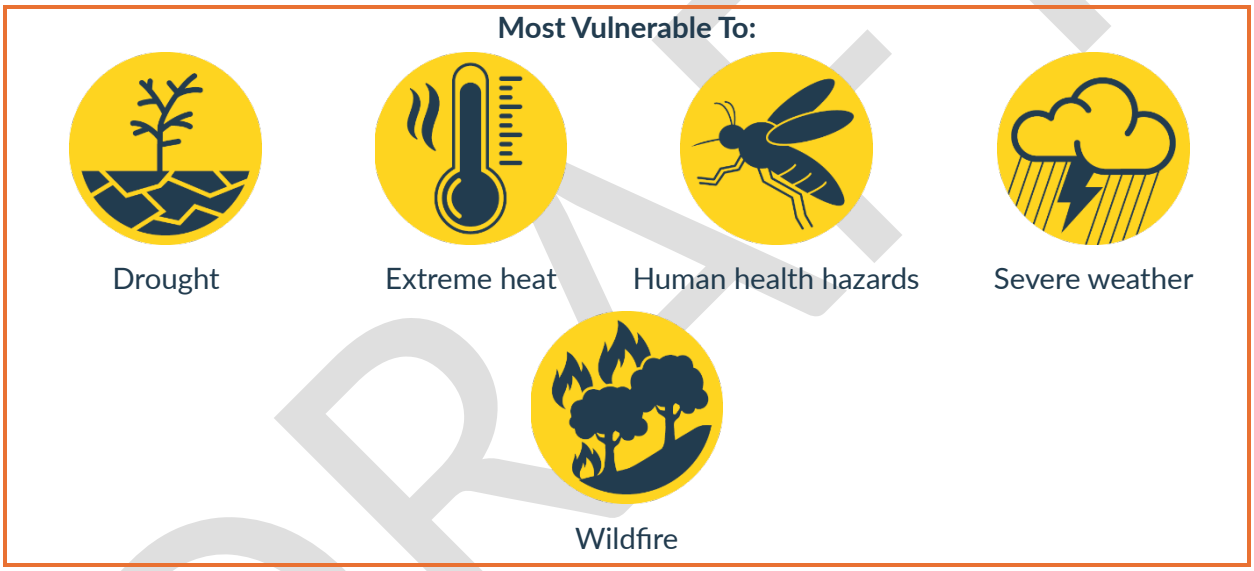


Older adults and people with limiting health and wellness factors, which includes people with disabilities, other access and functional needs, and chronic illnesses, are priority vulnerabilities for all eight climate-related hazards in Atherton. They are generally more susceptible to illness or injury from a natural disaster. Mobility challenges can make it more difficult for these individuals to evacuate from a hazardous condition, and physically they may be more likely to be harmed by a hazard than a younger person or those without limiting health and wellness factors. Older adults and persons with these limiting issues often face difficulty evacuating due to limited mobility or challenges driving, even if they do have reliable access to a vehicle, as almost 99 percent of Atherton households do.

Air quality, extreme heat, and vector-borne human health hazards create additional risks for older adults and others with underlying health issues. Many of these individuals have conditions such as heart disease, respiratory illnesses, or diabetes. Poor air quality, extreme heat, and some diseases can exacerbate these underlying issues. Prescription medications can compound this risk, as some medicines (for example, some ACE inhibitors that are often used as treatments for people with high blood pressure) can increase the risk of dehydration and so can make extreme heat conditions more dangerous.

Older adults and persons with chronic health issues are also more likely to face difficulty preparing for natural hazards, which can include hardening or retrofitting their homes (filling sandbags or maintaining defensible space, for example), or securing emergency supplies. The generally high income levels in Atherton can often help mitigate this vulnerability, although this is not always the case. The US Census Bureau noted that in 2022 65 percent of householders in Atherton 65 years of age or older report household incomes of at least $150,000, compared to 82 percent of Atherton householders younger than 65.[17] Similarly, the Census Bureau reports that persons with disabilities in Atherton had an average annual income of only about $11,350 in 2022, compared to $103,250 for persons who do not have a disability.[18] While these numbers are likely skewed based on how the Census counts income, there is most likely a stark disparity in financial resources for older adults and persons with limiting health and wellness factors that contributes to the threat they face from climate change-related hazards.

Outdoor Workers



Outdoor workers in Atherton include those who work in construction, landscaping, and similar occupations. Although very few of these workers live in the town (as shown in **Table 1**, less than 3 percent of Atherton residents are outdoor workers, about half of the county average), they play a vital role in keeping Atherton running smoothly. However, their jobs and socioeconomic characteristics make them more susceptible to hazards than many other members of the town community.

The jobs of outdoor workers mean that they are more exposed to harmful conditions, including extreme heat, vector-borne diseases, and smoke from wildfires. Many outdoor jobs require that workers wear heavy protective gear, and outdoor jobs often require physical labor, which can compound the risk from extreme heat. Outdoor workers can also be exposed to severe weather conditions, particularly at the onset of a severe weather event, and so may be harmed before they can seek shelter.

Outdoor workers often face financial challenges that compound these hazards. Although data on earnings for outdoor workers in Atherton itself are not available, the US Census Bureau reports that earnings for people in outdoor industries in San Mateo County are approximately 24 percent below the income of the average county resident.[19] These jobs often have fewer educational requirements, making them accessible to those facing challenges such as a lack of legal status, language barriers, or the need to support their families. Additionally, systemic barriers limit access for many people of color to higher-paying, safer jobs, leading to a concentration in low-wage, physically demanding work. These positions are often seasonal or temporary, which further contributes to their economic insecurity. As a result, workers may be more willing to accept unsafe working conditions, such as going without protective gear or not taking mandatory breaks during extreme heat events. Natural disasters, such as wildfires or severe weather, can disrupt their ability to work, leading to economic instability that heightens their susceptibility.

Energy Delivery and Communication Infrastructure and Services

The services that provide energy and communication to Atherton, and the infrastructure that supports these services, are critical for the town's well-being. These systems and services keep Atherton's government and schools running smoothly, help community members get important information and conduct business, maintain the town's water and sewer systems, and provide many other important roles. However, they are vulnerable to disruption from several hazards.

Extreme heat events can regularly cause power outages or a loss of communication services due to a combination of mechanical failure of equipment, heat damage to equipment or power wires, and high demand for electricity because of cooling equipment. These factors all put stress on the electrical grid or communication systems, causing them to fail. Landslides can knock over power lines, damage communication hubs, and in some cases may also disrupt underground natural gas lines. A key electrical transmission line runs along Alameda de Las Pulgas, through a zone of elevated landslide risk. Although the electrical grid in the region generally has a high degree of

redundancy that limits power outages if a single piece of the power grid is disrupted, there is still the possibility of loss of power service from a landslide in this area.

Flooding, severe weather, and wildfire also pose similar risks to the electrical and communication infrastructure in Atherton and their associated services. These hazards can all damage key pieces of infrastructure, resulting in a loss of service. The limited flooding that occasionally occurs in Atherton is likely not sufficient to cause substantial harm to the energy and communication infrastructure network, but a dam failure in the town would likely damage much of the local infrastructure and cause widespread loss of service.

Other Priority Vulnerabilities

Although the following populations and assets are not identified as priority vulnerabilities for as many hazards as discussed previously, they are still significant and are important to Atherton and represent critical concerns to community members. It is essential that this report recognize these other priority vulnerabilities for the purpose of community planning and risk assessment efforts. Addressing these vulnerabilities proactively can help to mitigate their impacts and support the town's overall resilience.

Cost-Burdened and Isolated Households

Most Vulnerable To:

Air quality | Human health hazards | Severe weather | Wildfire

Although income levels are high in Atherton, over 30 percent of households are considered cost-burdened. As a result, cost-burdened households often have limited financial resources to put toward miscellaneous items, which may include home hardening or other retrofits to help increase resilience to hazards. Isolated persons (those who do not regularly leave their homes, have little to no social network and access to communication, and may not be proficient in English), may have difficulty improving their homes to increase resilience. Such people are often unable to get useful information about adaptation and resilience or may be unaware of how to act on it. Isolated persons may also lack access to reliable vehicles, which can complicate evacuations if those become necessary.

Transportation Infrastructure

Most Vulnerable To:


Flooding


Severe weather


Wildfire

The transportation infrastructure in Atherton is made up of the local roads that connect different parts of the town and the larger regional routes that connect Atherton with neighboring communities, such as El Camino Real and Alameda de Las Pulgas. Roadways can be blocked or damaged by wildfires, 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. People who live in homes on single-access roads are particularly vulnerable to transportation disruptions, as it can be challenging for them to leave their home or for emergency responders to provide assistance if the only roadway access is blocked.

Riparian and Aquatic Environments

Most Vulnerable To:


Drought


Extreme heat


Flooding


Severe weather

The primary waterway in the town is Atherton Channel, which has natural habitats along its sides. These habitats help reduce flooding risk and control erosion. Several existing factors play a role in the sensitivity of this riparian ecosystem to changing conditions, such as fragmentation, existing pollution levels, and built structures that may impede the natural adaptive movement of the ecosystems as drought intensifies and temperatures increase. Droughts and extreme heat can raise water temperatures, leading to harmful algal blooms and lower dissolved oxygen levels for aquatic life. Severe storms and flooding can be detrimental to streambanks and riparian areas, causing higher peak flows that increase erosion along the channel.

Emergency Services

Most Vulnerable To:

Extreme heat | Human health hazards | Severe weather | Wildfire

The Menlo Park Fire Protection District provides fire and medical emergency response in the town, and Atherton Police Department provides law enforcement response. Extreme heat, human health hazards, severe weather, and wildfire hazards can all increase the need for these services, which can stress their capacity and increase response times. Severe weather and wildfire can block local roadways, which can cause further delays. Human health hazards can also reduce the capacity of town emergency response services in case first responders are affected by the hazard and need to take sick leave.

Water and Wastewater Services

Most Vulnerable To:

Drought | Flooding | Landslides | Wildfire

In Atherton, Cal Water provides water service, while the Fair Oaks Sewer District and West Bay Sanitary District serve as the wastewater providers in the town. Drought conditions can reduce both total water supply and effectiveness of the sewer system by reducing flow through the pipes. Floods, landslides, and wildfires can damage pipelines and other parts of the water and wastewater infrastructure, which can cause reduced or loss of service.

Children

Most Vulnerable To:

Air quality | Extreme heat

About 20 percent of Atherton residents are children. There are also seven schools in the town, which collectively have about 6,500 students. Children are more sensitive to elevated air pollution levels, which can exacerbate asthma and cardiovascular illnesses. Similarly, children may have greater susceptibility to extreme heat. This is especially risky for child athletes and for children younger than 10.

Urban Tree Canopy

Most Vulnerable To:

Drought | Landslides | Severe weather

Atherton's urban tree canopy, including the privacy hedges around some houses, is a critical part of the town's character, especially the heritage oaks and other high-priority trees. However, they are vulnerable to drought, landslides, and severe weather. Although these trees are typically well-adapted to drought, a substantial increase in drought conditions can stress these trees beyond their normal capabilities, potentially making them more susceptible to illness and other long-term harm. Landslides can topple the trees in the hillier parts of Atherton, and severe weather can blow down branches and trees throughout the town. Indirectly, the loss of urban trees and hedges can increase the severity of extreme heat, causing health impacts for Atherton community members.

Next Steps

The Vulnerability Assessment is a key technical study that can support future planning efforts in Atherton. This assessment helps community members, agency staff, and decision-makers understand how climate change hazards may impact local conditions and identify priority areas for adaptation and resilience. While its findings can inform updates to a General Plan Safety Element, they may also be used for other planning efforts, such as a Safety Element Update, Climate Action Plan, or other resilience-focused initiatives.

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 take advantage of new opportunities.[20, 21]

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.[22]

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.[23]

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.[24]

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 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.[25]

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. When Atherton updates its Safety Element, the update will address 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 town'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 Multi-jurisdictional 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*, in this context 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 county, describing historical hazards, describing how hazards are expected to change, and mapping the hazard-prone areas. The creation and review of this report 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, the combination of exposure to the hazard and sensitivity of the 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 Atherton 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 resources and opportunities such as funding or tools, and to respond to the impacts of climate change. The project team will assess the adaptive capacity of each population and asset for each applicable identified hazard. The Town is already implementing several measures to increase adaptive capacity, including the Municipal Code requirements and Capital Improvement Program.

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, which informs determination of the priority vulnerabilities among the populations and assets in Atherton.

Appendix B: Populations and Assets

Note that most of the demographic data is for the year 2022, which was the most recent year that Census data and data from other sources were available at the time the vulnerability assessment was prepared. Data for other years are noted where applicable.

Populations

1. Children and youth (under 18). Approximately 20 percent of Atherton residents are 18 years old or younger.
2. Low-resourced households and individuals, including:
    - Cost-burdened households: Cost-burdened households are those paying 30 percent or more of their income towards housing expenses.
    - Low-income households: The State identifies $149,100 as the low-income threshold for a household of four people in San Mateo County in 2023.
    - Residents in poverty: Approximately 3 percent of Atherton residents earn incomes at or below poverty level.
    - Overcrowded households: Overcrowded households include housing units that have more than one person per room (excluding bathrooms and kitchens). Less than 1 percent of homes in Atherton are overcrowded.
    - Those experiencing homelessness: The San Mateo County 2022 One Day Homeless Count reported three total persons experiencing homelessness (all unsheltered) in the Town of Atherton.
    - Those without a high school degree: Approximately 1 percent of Atherton's adult population has not obtained a high school degree or equivalent.
    - Persons and households with access to lifelines: Persons without reliable access to a car, transit, or communication systems. Approximately 1 percent of Atherton households do not have access to a personal vehicle. Approximately 4 percent of Atherton households do not have an internet subscription.
3. Immigrant communities/linguistically isolated persons: Communities consisting of foreign-born populations, including immigrants, refugees, and undocumented persons. Linguistically isolated persons include households without a member who is fluent in English. Spanish and Chinese are the primary languages in Atherton among households that are not fluent in English.
4. Outdoor workers: Workers in landscaping, construction, outdoor recreation, etc.
5. People living on single-access roads (roads with only a single entry or exit point). Single-access roads are generally west of Alameda de las Pulgas.
6. People with chronic illnesses and/or disabilities. Approximately 8 percent of Atherton's population has some form of disability.
7. Renters. Approximately 12 percent of Atherton housing units are renter-occupied.
8. Seniors (65+). Seniors constitute 24 percent of Atherton's population. Approximately 9 percent of Atherton households are made up of seniors living alone.

9. Unemployed persons. Atherton's civilian labor force unemployment rate is approximately 3 percent.

Infrastructure

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: Five public charging stations.
    - Gas stations
4. Hazardous materials sites: 12 cleanup sites (one undergoing active assessment) identified via the State Water Control Board's GeoTracker database; two toxic substance sites (none requiring further action) identified via the State Department of Toxic Substance Control's EnviroStor database.
5. Transportation infrastructure:
    - Local roads: El Camino Real, Atherton Avenue, Middlefield Road, Alameda de las Pulgas, Selby Lane, Marsh Road, Ravenswood Avenue, Valparaiso Avenue, Encinal Avenue, Fair Oaks Lane, Glenwood Avenue, Oak Grove Avenue, Ringwood Avenue, Watkins Avenue.
    - Transit facilities: Stops and other facilities provided by SamTrans.
    - Railway: Caltrain stations in Menlo Park and Redwood City.
    - Airports: San Francisco International Airport, Palo Alto Airport, and San Carlos Airport.
6. Parks and related recreational facilities: Holbrook-Palmer Park, Town Center Park, and Menlo Circus Club.
7. Water and wastewater infrastructure: Atherton Channel, sewers, lower laterals, force mains, lift stations, pump stations, storm drains, pipes, and water storage tanks and reservoirs (including Hetch Hetchy, Calaveras, San Antonio, Crystal Springs, Pilarcitos, Bear Gulch, and San Andreas reservoirs).

Buildings

1. Government and community facilities: Atherton Town Hall, Civic Center, Atherton Library.
2. Medical and care facilities: California Advanced Imaging at Atherton, local doctor's offices, Stanford Hospital and Medical Center in Palo Alto, Brouer Medical Center in Palo Alto, Menlo Park VA Medical Center in Menlo Park, Kaiser Permanente Redwood City Medical Center in Redwood City, Dignity Health Sequoia Hospital in Redwood City.
3. Historic buildings: Watkins/Cartan House, Water Tower, Gen Merrill Carriage House, Sacred Hearts School Main Building, Menlo School Stent Family Hall, Perry Stable, Caltrain Station, Town Hall.
4. Homes and residential structures: Multifamily and single-family residences.

5. Public safety buildings: Menlo Park Fire District Station 3, Police Department.
6. Schools: Encinal Elementary School, Las Lomitas Elementary School, Laurel Elementary School, Selby Lane School, Menlo-Atherton High School, Sacred Heart Schools, Menlo School, and Menlo College.

Ecosystems and Natural Resources

1. Atherton Channel and associated riparian habitats.
2. Bear Gulch Reservoir.
3. Groundwater: Santa Clara and San Mateo Plain Groundwater Subbasins.
4. Urban tree canopy: The Town's tree canopy consists of deciduous and evergreen hardwoods, sometimes mixed with scattered conifers.

Key Services

1. Education services: Las Lomitas Elementary School District, Menlo Park City School District, Menlo College, private schools, and childcare.
2. Emergency services: Menlo Park Fire Protection District, Atherton Police Department.
3. Energy delivery and communication services: Peninsula Clean Energy, PG&E, Atherton Fiber, radio, television, cellular and landline phone, and internet.
4. Government administration and community services.
5. Public transit access: SamTrans, Caltrain.
6. Solid waste removal: GreenWaste Recovery, South Bayside Waste Management Authority.
7. Water and wastewater treatment, distribution, and collection: Bear Gulch District (California Water Service), San Francisco Public Utilities Commission, West Bay Sewer Maintenance District, and Fair Oaks Sewer Maintenance District.

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