City of Vacaville

Safety Element Update Background Report

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The Safety Element is a state-mandated element of the City of Vacaville's General Plan that must identify potential natural and human-created hazards that could affect Vacaville's residents, businesses, and services. The purpose of the Safety Element is to establish a framework that anticipates these hazards and prepares the community to minimize exposure to these risks.

The Safety Element contains the City's goals, policies, and actions to minimize the hazards to safety in and around Vacaville. It identifies the natural and human-caused hazards that affect existing and future development, describes present and expected future conditions, and sets policies and standards for improved public safety. This includes efforts to minimize physical harm to the buildings and infrastructure in and around Vacaville to reduce damage to local economic systems, community services, and ecosystems.

Some degree of risk is inevitable because the potential for many disasters cannot be eliminated completely, and the ability to predict such disasters is limited. The Safety Element serves the following functions:

- Develops a framework by which safety considerations are introduced into the land use planning process.
- Facilitates the identification and mitigation of hazards for new development, and thus strengthens existing codes, project review, and permitting processes.
- Presents policies directed at identifying and reducing hazards in existing development.
- Strengthens emergency preparedness planning and post-disaster reconstruction policies, including for earthquake, flood, dam inundation, and wildland fires.
- Identifies how natural hazards, including those linked to climate change, are expected to change in the future and provides policies to increase community resilience through preparedness and adaptation.

The Safety Element addresses the topic of public health and safety following state requirements in Section 65302(g) of the California Government Code. State law requires that the Safety Element contain background information and policies to address multiple natural hazards, analyze the vulnerabilities from climate change and contain policies to improve climate change resilience, and assess residential areas with evacuation constraints The public safety issues in Vacaville include seismic and geologic hazards, flooding and dam inundation, wildfire, hazardous materials, disaster and emergency preparedness, and other climate-related hazards such as drought, extreme heat, and severe weather. The Safety Element identifies goals and policies for each of these hazards.

Introduction

Community Profile

The City of Vacaville was established in 1851, when livestock and wheat production were the principal economic products in Solano County. The completion of nearby railroads in the late 1860s provided a way for ranchers to get their crops to market, but the higher cost of rail transport coupled with increased competition led to the decline of the area's wheat industry in the 1880s. Solano County farmers turned to other crops, most of which required irrigation. While rail transport had contributed to the decline of wheat production, the ease of access it provided gave a boost to produce farming. By the 1890s, Vaca Valley and the foothills of the Vaca Mountains were covered with orchards, and in 1892 Vacaville was formally incorporated.

After peaking in the mid-1910s, fruit production in the Vacaville area declined due to drought and soil depletion, competition during the Great Depression, and overproduction for the World War I war effort. In the mid-20th century, new employers arrived in the area, resulting in explosive growth in Vacaville. The now-defunct Basic Vegetable Products company located a 1,000-worker onion dehydrating facility in Vacaville, and in 1942, Suisun Air Base (now Travis Air Force Base) was established just to the south of the city.

With its industry, ease of access, and proximity to the core of the Bay Area, Vacaville saw its population double between 1940 and 1950. Ongoing freeway construction and increasing employment in the Bay Area led to Vacaville's continued growth through the end of the 20th century and the beginning of the 21st.

Vacaville covers a total area of 29.42 square miles. The city is in the northern portion of Solano County, northeast of Fairfield and Suisun City. To the west, Vacaville is bordered by large hills, the north side of which contain the unincorporated community of Bucktown. East from Bucktown, the small communities of Hartley, Allendale, and Batavia form a border around the northern edge of Vacaville.

According to the 2020 American Community Survey, approximately 99,960 people live in Vacaville, an increase of approximately 4 percent since 2010. The racial makeup of Vacaville is primarily White (65 percent). Approximately 24 percent of the population identifies as Hispanic or Latino, 10 percent identify as Black or African American, and 9 percent identify as Asian. Mixed-race persons make up approximately 9 percent of the population. Native Americans constitute 0.8 percent of the population, and Native Hawaiians and other Pacific Islanders make up 0.9 percent. As of the 2020 American Community Survey, approximately 47,580 Vacaville residents are active in the labor force. By employment, the largest industries are education and healthcare (22 percent of civilian labor force); public administration (11 percent); retail (10 percent); construction (10 percent); arts, entertainment, and accommodation and food services (10 percent); and professional, scientific, and management services (9 percent). Approximately 2.7 percent of the civilian labor force is unemployed, and the citywide median income is $93,291. The city's principal employers are the California Department of Corrections, Vacaville Unified School District, Kaiser Permanente, Genetech, and the City of Vacaville.

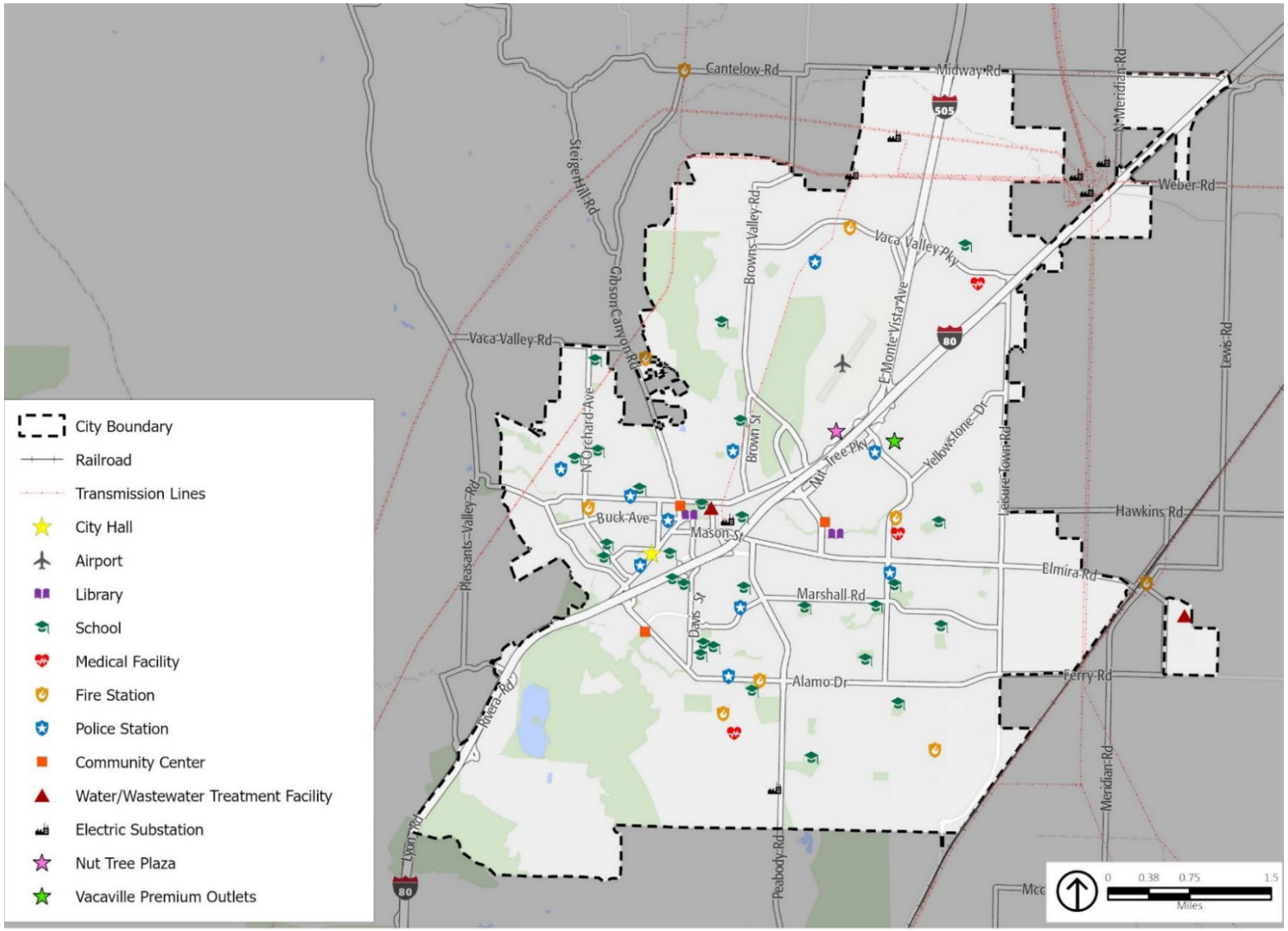
Interstate 80 (I-80) is a prominent transportation route that runs from the southwest to the northeast of the city. I-505 also diverges from I-80 in Vacaville and runs northwards to connect to I-5. The historic Nut Tree complex is near the intersection of I-80 and I-505.

To the west of Vacaville are two hilly outcroppings that are foothills of the Vaca Mountains. On the north side, the hills begin just west of Browns Valley Road, and on the south side, west of Alamo Drive. Eastward of the city around Allendale and Elmira, it turns to farmland. To the north and south there are mainly fields and residential areas. Within the city itself, the elevation is between 300 and 90 feet, sloping from the west to the east. Vacaville is divided by the Putah South Canal, which runs north to south just east of the center of the city. There are three bodies of water within the city limits, and they lie along I-80. In the southeast corner of the city, Lagoon Valley Lake is the largest of the three at 105 acres. The next, near the center of the city, is in Centennial Park. Former wastewater treatment plant ponds are at the very northeast corner of the city, next to the Vaca-Dixon Substation.

Vacaville enjoys a Mediterranean climate characterized by dry, warm to hot summers, with wet, cool winters. Located on the edge of the Bay Area, Vacaville occasionally experiences the cooling influence of marine air spilling through the Carquinez Strait during the otherwise warm spring, summer, and early fall. Winters are at times foggy and cold, but snow is exceedingly rare. Historically, Vacaville has received 22.6 inches of rain per year. The annual average high has been 74.2°F and the annual average low has been 46.6°F.

A map of Vacaville and key community features appears in **Figure SAF-1,** including medical facilities, schools, police and sheriff stations, fire stations, electrical substations/transmission lines, community centers, libraries, railways, airports, water and wastewater facilities, and major retail centers.

Figure SAF-1 Community Overview



Source: CalOES 2021, Solano County 2021, PlaceWorks 2022, ESRI

Relationship to Other Planning Efforts

California Government Code Section 65302(g) (GC 65302) requires all local jurisdictions to review and as necessary update their Safety Element upon each revision of the Housing Element or Local Hazard Mitigation Plan, or at least once every eight years. The State of California specifies types of information that must be updated—notably, climate change resiliency and adaptation mitigation. Other topics relating to natural hazards, which are already addressed in the Safety Element but may be updated as necessary to reflect new information, include: fire risk, seismic risk, flood risk, site contamination, and the City's ability to respond to natural and humanmade disasters.

The Safety Element is one of several elements of the Vacaville General Plan. Other social, economic, political, and aesthetic factors must be considered and balanced with safety needs. Rather than compete with the policies of related elements, the Safety Element provides policy direction that complements the intent and policies of other General Plan elements. Crucial relationships exist between the Safety Element and the other General Plan elements. How land uses are determined in areas prone to natural hazards, what regulations limit development in these areas, and how hazards are mitigated for existing development, are all issues that all elements must address. For instance, Land Use Element policies must consider the potential for various hazards identified in the Safety Element and must be consistent with the policies to address those hazards. The Conservation and Open Space Element is also closely related to the Safety Element. Floodplains, for example, are not only hazard areas, but often serve as sensitive habitat for threatened or endangered species or provide recreation or passive open space opportunities for residents and visitors. Therefore, flood and inundation policies balance the need to protect public health and safety with the need to protect habitat and open space. Safety Element policies, especially those concerning evacuation routes and critical facilities, must also be consistent with those of the Transportation Element. Policies and information in the updated Safety Element should not conflict with those in other elements.

The Safety Element Update draws from information appearing in the Multi-Jurisdictional Hazard Mitigation Plan (MJHMP) for Solano County. The MJHMP for Solano County was developed in accordance with the Disaster Mitigation Act of 2000 and followed the Federal Emergency Management Agency's (FEMA) Local Hazard Mitigation Plan guidance. Solano County's MJHMP is a plan to identify and profile hazard conditions, analyze risk to people and facilities, and develop mitigation actions to reduce or eliminate hazard risks in the incorporated and unincorporated areas of Solano County. Section 6 of Solano County's MJHMP contains an annex discussing hazards specific to Vacaville. FEMA approved the MJHMP in December 2021 and the City adopted it in 2022.

The MJHMP and the Safety Element address similar issues, but the Safety Element provides a higher-level framework and set of policies, and the MJHMP focuses on more specific mitigation actions. The implementation of these mitigation actions, which include both short- and long-term strategies, involve planning, policy changes, programs, projects, and other activities.

Climate Change Vulnerability

Changes to the global climate system are expected to affect future occurrences of natural hazards in and around Vacaville. Many hazards are projected to become more frequent and intense in coming years and decades, and in some cases, these trends have already begun. Key climate change considerations that affect Vacaville include increasing temperatures and changes in precipitation. Overall, precipitation levels are expected to increase slightly, with more years of extreme precipitation events (both high and low levels) and droughts that last longer and are more intense. According to California's *Fourth Climate Change Assessment*,[1] Vacaville can expect to experience various changes to climate change hazard events.

What is vulnerability?

Vulnerability is 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 a capacity to adapt.

Source: California Governor's Office of Emergency Services. 20202. California Adaptation Planning Guide. https://www.caloes.ca.gov/climate.

Both droughts and floods are expected to become more frequent because rainfall is expected to occur in fewer, more intense storms due to climate change, which may also expand the parts of the city that are considered prone to flood, especially in areas adjacent to Ulatis Creek, Alamo Creek, Encinosa Creek, and the Putah South Canal. Climate change is expected to also increase the frequency and severity of droughts that cause soil to dry out and condense. When precipitation does return, more water runs off the dry surface rather than being absorbed into the ground, which can lead to floods. Drought conditions will likely strain the water supplies from the State Water Project and Solano Project, increasing reliance on groundwater from the Solano Subbasin and causing the water shortage contingency plan to go into effect more frequently.

- Severe weather events, such as lightning, hail, heavy rainfall, and high winds, may become more frequent and intense due to climate change. Climate change is expected to cause an increase in intense rainfall, which is usually associated with strong storm systems. Heavy rainfall may also contribute to an increased risk of landslides in the hills in western Vacaville. Most severe weather events in Vacaville consist of atmospheric rivers or high winds. Although the connection between climate change and severe weather is not as well established as other hazards, severe winds such as the Diablo winds, which tend to be most frequent during the fall and winter months, may coincide more frequently with wildfire conditions. This can cause fires to grow and spread more rapidly and cause public safety power shutoffs (PSPS) to prevent wildfires from sparking.

- Warmer temperatures are projected to cause an increase in extreme heat events. The number of extreme heat days, defined in Vacaville as a day when the high temperature is at least 102.5°F, is expected to rise from a historical annual average of 5 days per year to 28 days per year by the middle of the century (2035 to 2064), and to an average of 49 days per year by the end of the century (2070 to 2099). In addition to the increases in extreme heat events, Vacaville is expected to see an increase in the average number of warm nights. The number of warm nights, defined in Vacaville as a night when the minimum temperatures stay above 63.5°F, is expected to rise from a historical annual average of 6 nights per year to 35 nights per year by the middle of the century (2035 to 2064), and to an average of 83 nights per year by the end of the century (2070 to 2099). Extreme heat and warm nights pose a significant human health risk, especially to senior citizens, outdoor workers, and persons who do not

have access to adequate cooling, including people experiencing homelessness. Some buildings and infrastructure systems may be damaged by very high temperatures, constraining their ability to meet community needs.

- Hotter, drier weather due to climate change is expected to increase wildfires in the areas surrounding the city and across Solano County. Climate change is expected to cause an extended wildfire season, with dry conditions earlier in the year leaving most of the region in moderate to extreme dry conditions prior to summer. These continued dry conditions with above-normal temperatures through spring will leave fuel moisture levels lower than normal, increasing the potential for wildfire activity. Increased winds may result in more erratic fire behavior, making fires harder to control and increasing the likelihood that wildfires will travel into Vacaville from the Vaca Mountains and English Hills to the west and north, respectively. Furthermore, an extended wildfire season increases the likelihood that Diablo wind events will coincide with wildfires, which can allow wildfires to spread more rapidly. Across the region, more frequent and intense wildfires may also create poor air quality for Vacaville.

- Agricultural and ecosystem pests and diseases can affect crop plants, vineyards, and ecosystems throughout and surrounding Vacaville. These pests and diseases, such as the glassy winged sharpshooter, sudden oak death, Asian citrus psyllid, Japanese beetle, European grapevine moth, and Mediterranean fruit fly, can slow the growth of plants and damage them so that their products are less appealing and harder to sell, or even kill them. Though there are treatment options for many agricultural pests and diseases, some have no cure. Many pests and organisms that carry diseases are most active during warmer months, so the threat of infection or infestation is higher during that time of year. Projection trends show temperatures getting warmer earlier in the year and remaining warmer until later in the year due to increases in air temperature, which creates a wider activity window for pests and diseases.

- Climate change can increase the rates of infection for various diseases because many of the animals that carry diseases are more active during warmer weather. There are several diseases that are linked to climate change and can be harmful to the health of Vacaville community members, such as hantavirus pulmonary syndrome, Lyme disease, and West Nile fever. Many of these diseases are carried by animals, such as mice and rats, ticks, and mosquitos, which are usually seen as pests even if they do not cause infections. Warmer temperatures earlier in the spring and later in the winter can cause these animals to be active for longer periods, increasing the time that these diseases can be transmitted.

Vulnerability Assessment Methods

The Vulnerability Assessment primarily follows the recommended process in the *California Adaptation Planning Guide* (APG), published in 2020 by the California Governor's Office of Emergency Services. This includes a four-step process: (1) characterizing the city's exposure to current and projected climate hazards; (2) identifying potential sensitivities and potential impacts to city populations and assets; (3) evaluating the current ability of the populations and assets to cope with climate impacts, also referred to as its adaptive capacity; and (4) identifying vulnerabilities based on systematic scoring. **Figure SAF-2** presents these steps.

Figure SAF-2 California Adaptation Planning Guide Recommended Model

Step 1. Identify Exposure

The goal of this step is to characterize the community's exposure to current and projected climate change hazards. The climate change hazards included in the Vulnerability Assessment are **agricultural and ecosystem pests, drought, extreme heat and warm nights, human health hazards, inland flooding, landslides, severe weather, and wildfire and wildfire smoke**.

Projections of climate change hazards rely on multiple scenarios that reflect different levels of GHG emissions and concentrations over time. The Cal-Adapt database, which provides California-specific climate change hazard projections, uses Representative Concentration Pathway (RCP) 4.5 for a low-emissions scenario and RCP 8.5 for a high-emissions scenario.[2] The Governor's Office of Planning and Research's *Planning and Investing for a Resilient California* and the *California Adaptation Planning Guide* recommend using RCP 8.5 for analyses considering impacts through 2050 and 2100, because there are minimal differences between emission scenarios for the first half of the century, and this is a more conservative and risk-averse approach for late-century projections. The RCP 8.5 scenario was used as input for global climate models on the Cal-Adapt database and other resources.

Step 2. Identify Sensitivities and Potential Impacts

This step involved evaluating potential future climate change impacts to community populations[3] and assets. City staff first identified a comprehensive list of populations and assets to understand how susceptible the people, places, ecosystem services, and services within the community are to climate change hazards. After confirming this list, City staff looked at which hazards are likely to affect which populations and assets. For example, human health hazards are likely to impact most populations, but would not physically affect buildings.

After this applicability review, City staff evaluated potential impacts to the applicable populations and community assets. Based on the results of the impact assessment, each population and asset was identified as experiencing low, medium, or high impacts for each relevant hazard. Impact is considered a negative quality, so a higher impact score means a higher potential for harm to a population or asset. A lower impact score means a lower potential for harm to a population or asset.

Step 3. Assess Adaptive Capacity

Adaptive capacity is the ability of populations and community assets to prepare for, respond to, and recover from the impacts of climate change using existing resources and programs. Vacaville, Solano County, and community-based organizations already provide some of these tools and resources to both populations and community asset owners or managers.

Based on the results of the adaptive capacity assessment, the City ranked the adaptive capacity of each population or asset as low, medium, or high for each relevant hazard. Adaptive capacity is considered a positive attribute, so a higher adaptive capacity score means that a population or asset may be more adaptable to the hazard. A lower adaptive capacity score means that a population or asset may have a harder time adjusting to the changing conditions given available resources.

Non-climate Stressors

Non-climate stressors are trends unrelated to climate hazards that can exacerbate impacts or impede adaptive capacity, making populations or assets more vulnerable. They are also known as pre-existing conditions that make populations or assets more susceptible to harm from hazards because the stressors may impair their ability to prepare for, respond to, or recover from hazards. Addressing non-climate stressors can improve the adaptive capacity of populations and community assets.

Source: United State Global Change Research Program. 2016. "U.S. Climate Resilience Toolkit". https://toolkit.climate.gov/.

Step 4. Conduct Vulnerability Scoring

The City used the impact and adaptive capacity scores for each population and asset for each relevant hazard to determine the vulnerability score. The vulnerability score reflects how susceptible a population or asset is to harm from a particular hazard. Vulnerability is assessed on a scale from V1 to V5, with V1 meaning minimal vulnerability and V5 meaning severe vulnerability. The following list describes the level of vulnerability:

- V1: Minimal vulnerability
- V2: Low vulnerability
- V3: Moderate vulnerability
- V4: High vulnerability
- V5: Severe vulnerability

Having a low vulnerability score does not mean that the population or asset will be unaffected by climate change, but that the effects are likely to be less substantial. The matrix in **Figure** SAF-**3** shows how impact and adaptive capacity scores combine and translate into a vulnerability score. For example, extreme heat would create a high impact on energy delivery services because mechanical failures, heat damage, and high demand for electricity from cooling equipment can disrupt this service. Adaptive capacity is low because many

community members need to use more electricity on extreme heat days to keep cool and retrofitting electrical equipment can be expensive. Therefore, energy delivery services have a high vulnerability to extreme heat.

Figure SAF-3 Vulnerability Scoring Matrix

	Low Impact	Medium Impact	High Impact
Low Adaptive Capacity	V3	V4	V5
Medium Adaptive Capacity	V2	V3	V4
High Adaptive Capacity	V1	V2	V3

Vulnerability Assessment Results

Under California law, the Safety Element is required to include a vulnerability assessment that looks at how people, buildings, infrastructure, and other key community assets may be affected by climate change. The City conducted a Climate Change Vulnerability Assessment in the spring of 2022 to analyze Vacaville's susceptibility to climate change hazards. Vacaville's vulnerability assessment, prepared in accordance with the most recent available guidance in the *California Adaptation Planning Guide*, assesses how eight different climate-related hazards (agricultural and ecosystem pests, drought, extreme temperatures, human health hazards, inland flooding, landslides, severe weather, and wildfire and wildfire smoke) may affect 66 different population groups and community assets. Of the 528 potential pairings, 393 applicable pairing were scored for vulnerability. Each population or asset received a score of V1 (minimal vulnerability) to V5 (severe vulnerability) for each climate change hazard.

Overall, populations in Vacaville tend to be most vulnerable to wildfire and wildfire smoke, extreme temperatures, inland flooding, and human health hazards, which directly affects the health of community members. The most vulnerable communities include immigrant communities, outdoor workers, households in poverty, and low-resourced people of color. Nearly all populations are severely vulnerable when multiple hazards occur simultaneously. For example, when a regional wildfire is burning and extreme heat occurs, residents may have to choose whether to open windows in their homes to cool the air but bring in wildfire smoke, or keep windows closed and face high indoor air temperatures. Additionally, during rolling blackouts or Public Safety Power Shutoffs (PSPSs), residents may not receive notifications for evacuation warnings for flooding and wildfire events.

Climate change could affect the transportation network and associated economic activity in Vacaville by putting strain on transportation infrastructure, resulting in impacts to travel behavior, goods movement, and supply-chain business continuity. Transportation infrastructure such as roadways, bridges, and the railway are all potentially at increased risk due to inland flooding, wildfire, and severe weather events. When parts of the transportation infrastructure network fail, services such as public transit or emergency medical response could be disrupted. Damage to this infrastructure could also significantly impact the transportation of goods and services provided in and through the city, the ability to evacuate during an emergency, and the livelihood of many businesses. Food processing and wholesale trade, which rely heavily on the transportation network to receive agricultural products and export goods, can face financial hardship if the transportation network is not functioning as needed.

The agricultural industry, which Vacaville has traditionally relied upon to support economic activity in the city, is the most vulnerable economic driver. Extreme heat will increase water demands and drought conditions will likely make it difficult to meet those demands, ultimately weakened crops and livestock. Weakened crops and livestock may be unable to recover from agricultural pests, severe weather events, and inland flooding. Smoke from regional wildfire can also damage crops by changing the nutrients in the soil and causing the plants to die or not product useable fruit, which is especially prevalent in wine grapes. Harm to the agricultural industry can indirectly increase vulnerability to the wholesale trade and food processing industries, as well as outdoor workers and immigrant communities.

Citywide, energy delivery is vulnerable to multiple hazards, including severe weather, such as high winds that can trigger PSPS events; extreme temperatures that reduce the capacity and strains the system; and wildfires and landslides that damage the system, ultimately disrupting energy service. Extreme temperatures can also lead to power outages by causing mechanical failure of grid equipment and heat damage to power lines, and by creating a high demand for electricity to power air conditioners, all of which place stress on the network and lead to rolling blackouts. Electrical transmission infrastructure is subject to harm from landslides, which can undermine the foundations of transmission towers and flood substations, straining the overall electricity delivery system.

PSPS events or interruptions in energy service due to extreme heat can create vulnerabilities for Vacaville community members. A loss of electricity can cause a loss of refrigeration for food and medical supplies, limited cooking, loss of cooling (particularly dangerous during extreme heat events) and lighting and limited or no access to the internet or other information systems. Many businesses are forced to close during a power outage, causing economic hardships and depriving community members of important services, such as grocery stores, gas stations, and banks/ATMs. Power outages may also be harmful to people who depend on electrically powered medical devices.

Climate change is also expected to affect parts of the city that are considered prone to inland flooding, due to stronger storm systems. As a result, homes, historic structures, and park and recreation facilities adjacent to Ulatis Creek, Alamo Creek, Encinosa Creek, and the Putah South Canal will likely experience an increase in the frequency and magnitude of inland flood events in future years. Increases in damaging flood events in the city are expected to cause greater property damage, public health and safety concerns, displacement, and loss of life.

The Safety Element includes goals, policies, and implementation actions to increase community resilience and help lower vulnerability scores, particularly for the populations and assets that received a score of V4 or V5 in the Vulnerability Assessment. Vulnerability assessment results specific for each hazard are included as part of that hazard's discussion.

Public Safety Issues

This section outlines the existing and likely future hazardous conditions and other public safety issues in Vacaville. The public safety issues in Vacaville include:

- Seismic and geologic hazards
- Flooding and storm drainage
- Wildland fires
- Hazardous materials and waste
- Disaster and emergency preparedness
- Additional climate-related hazards (drought, extreme heat, and severe weather)

This section provides details pertaining to probable locations each hazard or issue is likely to occur (per availability of data), past notable events in and around Vacaville, agencies responsible for providing protection from these public safety issues, and other background information required by California Government Code Section 65302(g)(4). The results of the Vulnerability Assessment are integrated into the hazards and other public safety issues previously mentioned.

Seismic and Geologic Hazards

Earthquake Hazards

While Vacaville is at risk from many natural and human-caused hazards, the event with the greatest potential for loss of life or property and economic damage is an earthquake. This is true for most of the San Francisco Bay Area region, since damaging earthquakes affect large areas and can trigger many secondary effects that can overwhelm the ability of local jurisdictions to respond. The Bay Area region, including Vacaville, lies within the active boundary between the Pacific and the North American tectonic plates. The Pacific Plate is constantly moving northwest past the North American Plate at a rate of about two inches per year. Earthquakes in the Bay Area result from strain energy constantly accumulating because of the motion of the Pacific Plate along the North American Plate.

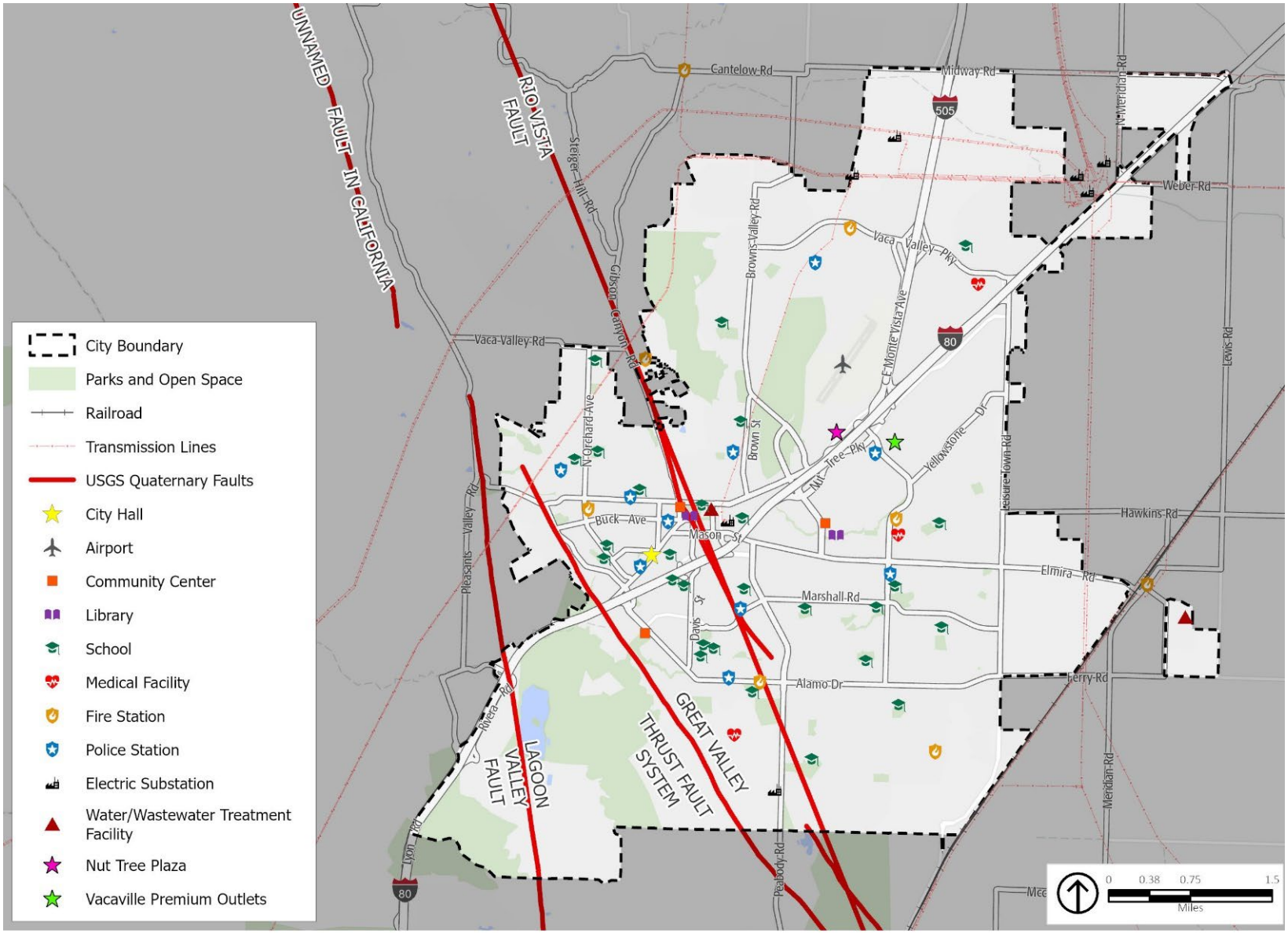
Major named faults near Vacaville include the Rio Vista Fault system, the Great Valley Fault Thrust system, and the Lagoon Valley Fault. The Great Valley Fault is an active fault and has been responsible for occasional moderate or major earthquakes, including an estimated M_W 6.5 earthquake in 1892 centered near Bucktown north of Vacaville. The Green Valley Fault, west of Vacaville, is also considered an active fault, last causing an earthquake sometime in the past 200-400 years. There are no records of substantial earthquakes along the Rio Vista Fault system, and the Lagoon Valley Fault is considered inactive. Also, an unnamed fault lies northwest of the city.

Regionally, the Hayward-Rodger's Creek Fault, part of the Hayward Fault System, lies roughly 24 miles to the southwest of Vacaville. The Hayward fault is considered active and moves at a rate of approximately 0.2 inches per year.[4] Scientists have found extensive evidence for 12 earthquakes on the Hayward Fault during the past 1,900 years. The last six earthquakes, the most recent in 1868, occurred at intervals of 95 to 183 years, with an average interval of about 150 years.[5] Geologists estimate that the Rodgers Creek-Hayward Fault system has a 33 percent chance of causing an earthquake of M_w 6.7 or greater by 2043.

In the event of a major earthquake, the location of the epicenter, time of day, and season of the year would have profound effects on the number of casualties as well as property damage. A large earthquake along any of the major faults in the region could result in substantial casualties and damage from collapsed buildings, damaged roads and bridges, fires, flooding, and other threats to life and property. Most of the loss of life and injuries from earthquakes are due to damage and collapse of buildings and structures. Building codes for new construction have generally been made more stringent following damaging earthquakes. However, homes and structures built prior to 1980 may not be seismically sound. The damage caused by the shaking of earthquakes may trigger secondary hazards, including urban fires, dam failures, and toxic chemical releases.

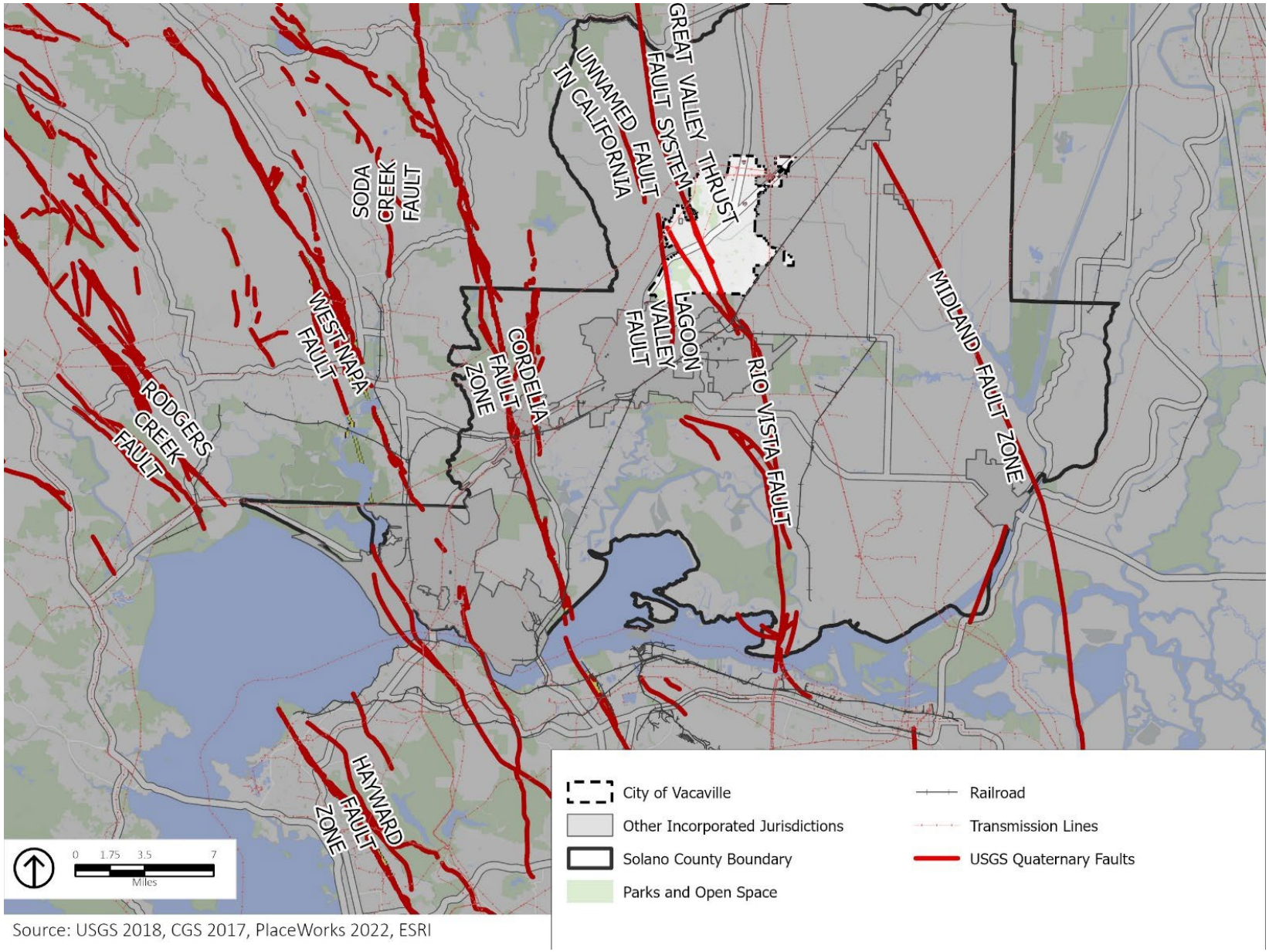
The law requires the California Geological Survey to establish regulatory zones (known as Earthquake Fault Zones or Alquist-Priolo Zones) around the surface traces of active faults and to issue maps to all affected cities, counties, and State agencies for use in planning and controlling development. **Figure SAF-4** shows the approximate location of local faults; Figure SAF-5 shows the major regional fault zones in the Vacaville region.

Figure SAF-4 Local Faults



Source: USGS 2018, CGS 2017, PlaceWorks 2022, ESRI

Figure SAF-5 Regional Faults



Ground Shaking

Vacaville is in a seismically active region, and earthquakes have the potential to cause ground shaking of significant magnitude. The intensity of the ground shaking depends on the severity of earthquake activity, proximity to that activity, and local soil and geological conditions.

Liquefaction

Liquefaction occurs when loosely packed sandy or silty materials saturated with water are shaken hard enough to lose strength and stiffness, affecting structures built on or in them. Liquefied soils behave like a liquid and are responsible for tremendous damage in an earthquake, such as building collapse, pipe leakage, and road damage.

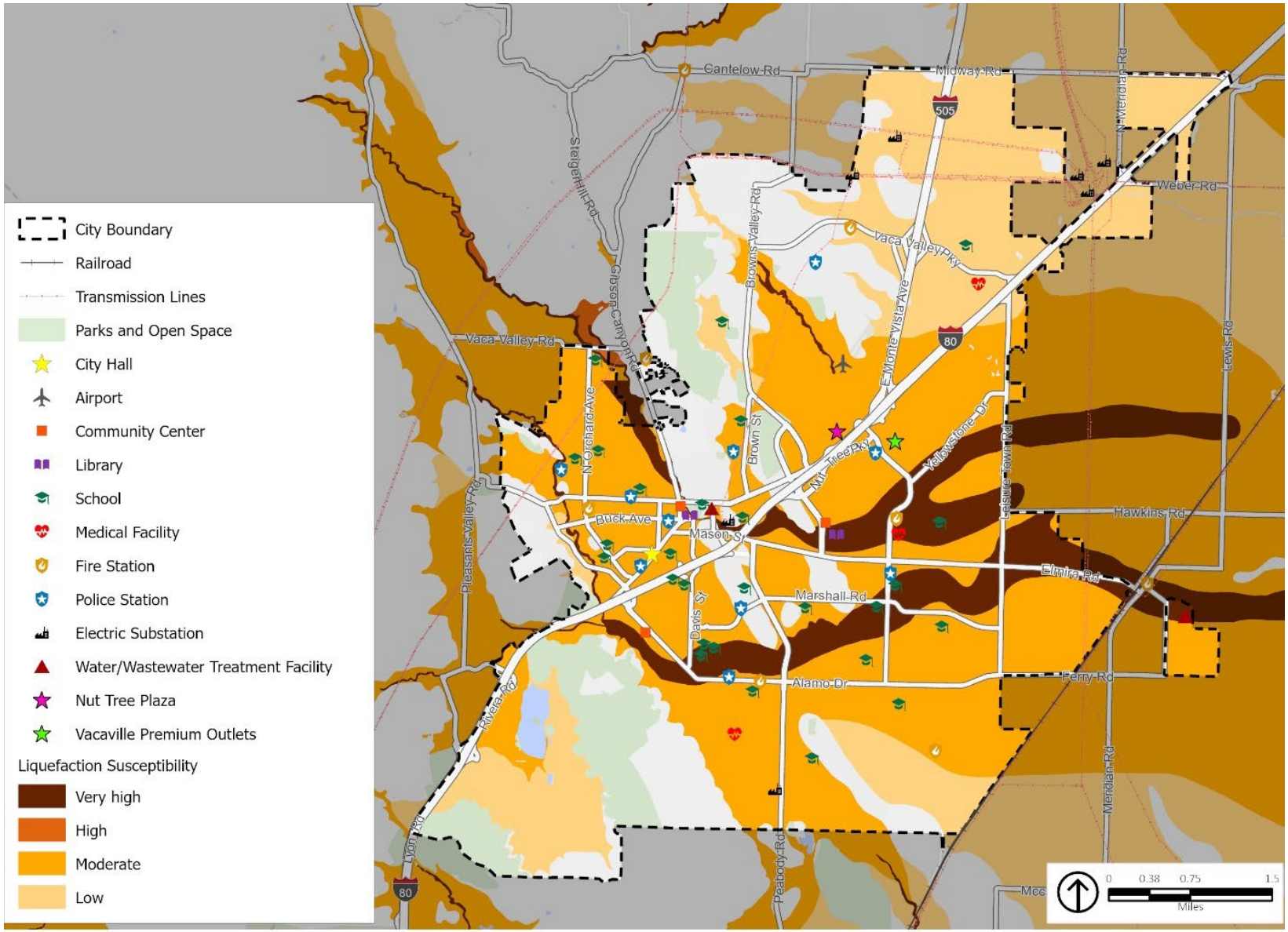
As shown in **Figure SAF-6**, Vacaville is generally characterized by areas of very low, low, and moderate risk of liquefaction. However, there are some areas with a high and very high risk of liquefaction in Vacaville due to the underlying soil types or other geologic features. For example, areas along and adjacent to Vacaville's major water ways, Ulatis and Alamo Creeks, feature high and very high levels of liquefaction susceptibility. These creek corridors cross through the community and include central areas of the city.

Landslides and Ground Failure

Landslides and slope instability are characterized by the movement of soils and bedrock down steep slopes. This movement results from wet weather; seismic shaking; and/or improper construction, grading, and drainage. Because portions of western Vacaville include the foothills of the Vaca Mountains, there is a potential for landslides throughout this area.

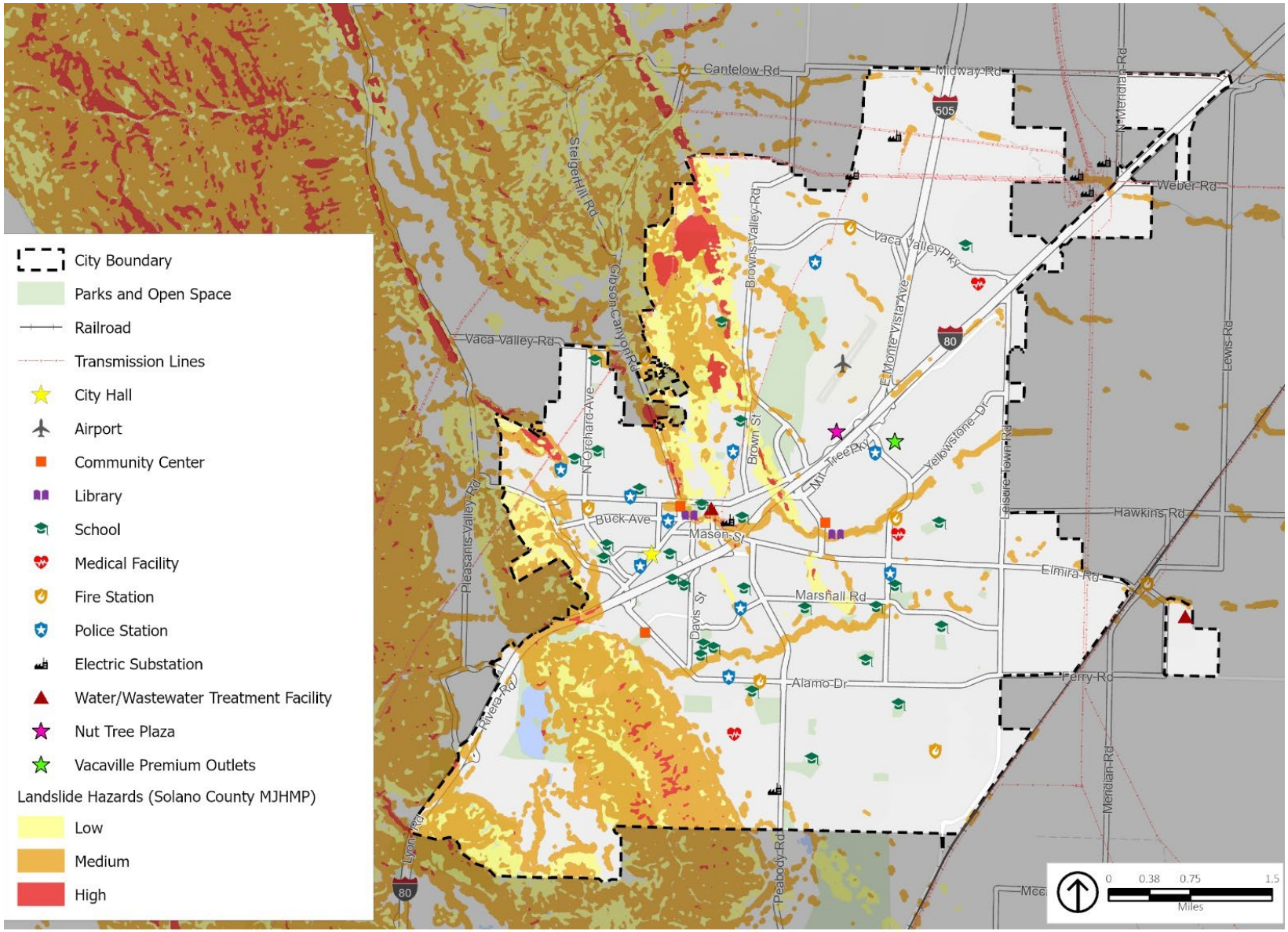
Most Vacaville's area is flat land, with some sloped areas having had small, scattered landslides. Very small areas on the northern and western edges of the city limit have had mapped landslides; however, these areas are sparsely developed. **Figure SAF-7** shows landslide-prone areas in Vacaville. Areas with steeper slopes in combination with other factors described above, are more susceptible to landslides than areas on shallow slopes.

Figure SAF-6 Liquefaction Potential



Source: USGS 2006, PlaceWorks 2022, ESRI

Figure SAF-7 Landslide Hazard Zones



Source: Solano County 2021, PlaceWorks 2022, ESRI

Expansive Soils

Certain types of soils have characteristics that make them more susceptible to geotechnical hazards, such as erosion and expansion. Soils subject to expansion increase when water is added and shrink when water dries out. Identifying local soil types and understanding their characteristics helps cities to establish appropriate engineering and construction standards for new buildings and remodeling. The primary soil types in the Vacaville area are silty, sandy, and clay loams, with a smaller portion being made up of purely clay soils. Though not all types of clay are expansive, soils with a clay component are more prone to expansion. Approximately 64 percent of Vacaville's soils contain at least some clay component. One large section of clay-containing soil moves diagonally from the western to the southern side of the city. Another large section of clay-containing soil occupies much of the eastern side of the city.

Subsidence

Land subsidence is the sinking of a large area of ground surface with little or no horizontal movement. Subsidence areas are associated with land over areas where groundwater or natural gas is extracted and can also occur as a result of seismic activity. There are two general types of subsidence: elastic (reversable) and inelastic (permanent). Subsidence can occur throughout Vacaville, but particularly in any areas where groundwater has been extracted. There is currently no documented inelastic subsidence due to groundwater pumping within the Solano Subbasin. Small amounts of subsidence recorded within the Subbasin have not resulted in reported adverse impacts to infrastructure or conditions at the land surface.[6]

Past Occurrences

Three major earthquakes occurred in the wider Vacaville area in recorded history:

- **1906, April 18: the Great 1906 San Francisco Earthquake, magnitude 7.8**. This earthquake ranks as one of the most significant earthquakes recorded in America. Benicia was hardest hit of nearby cities (damages included the Clock Tower at the Arsenal). Suisun also suffered damage and was nearly destroyed by fire. Vallejo received approximately 38,080 refugees. Structural damage was reported in Vallejo, Sacramento, and Woodland. Additional loss was slight in Dixon and Vacaville.

- **1989, October 17: Loma Prieta Earthquake (Santa Cruz mountains), magnitude 6.9**. This quake ended decades of seismic tranquility in the San Francisco Bay region. It killed 63 persons, injured 3,757, and displaced over 12,000. Over 20,000 homes and businesses were damaged and more than 1,100 destroyed. The quake caused $6 billion of damage. Damage occurred in and around Solano County in Benicia (Clock Tower and fire station) and Isleton (City Hall Community Center and fire station).

- **2014, August 24, Napa Earthquake, magnitude 6.0.** Occurring on the West Napa Fault, this earthquake caused extensive damage through both ground shaking and surface cracking (rupture). The earthquake fault rupture extended northward from the epicenter, directing much of the seismic energy toward the city of Napa. The ground shaking was very strong along the fault and in the Napa Valley. Structures in Yountville, Vallejo, and American Canyon were also damaged. Ongoing fault movement along the surface rupture continued for several months and caused further damage to foundations and structures.[7]

Future Risk

The Hayward-Rodgers Creek fault zone is considered the most likely Bay Area fault to experience an earthquake of magnitude 6.7 or greater within the next 30 years.[8] It has been estimated that there is a 33 percent chance of a magnitude 6.7 or greater earthquake on the combined Rodgers Creek-Hayward Fault System over the 30-year period between 2014 and 2043.[9] The United States Geological Survey estimates the probability of a magnitude 6.7 or greater earthquake along the Green Valley Fault system before 2036 to be 3 percent.

Climate Change and Seismic and Geologic Hazards

Though climate change is unlikely to increase earthquake frequency or strength, the threats from seismic and geologic hazards are expected to continue. Climate change may result in precipitation extremes (i.e., wetter rainfall periods and drier dry periods). Though total average annual rainfall may not change significantly, rainfall may be concentrated in more intense precipitation events. Heavy rainfall could cause an increase in the number of landslides or make landslides larger than normal. Increased wildfire frequency can destabilize hillsides due to loss of vegetation and change soil composition, which can contribute to greater runoff and erosion. The combination of a generally drier climate in the future, which will increase the chance of drought and wildfires, and the occasional extreme downpour, is likely to cause more mudslides and landslides. Impacts from these conditions would compound landslide potential for the most susceptible locations.

The vulnerability assessment finds that several groups might have difficulty securing stable and resilient housing, including households in poverty, low-resourced people of color, incarcerated individuals, and individuals experiencing homelessness. These groups may also experience heightened landslide exposure, as housing units in the western portion of the city and the California Medical Facility and State Prison are located in landslide hazard areas. Seniors, members of immigrant communities, those with chronic illnesses or disabilities, and those lacking lifelines such as phone service or a private vehicle may not receive timely emergency notifications and may encounter barriers to evacuating and accessing support and recovery services in the aftermath of a landslide, such as lack of adequate transportation and inability to connect with friends, family, employers, and medical and social service providers. Those living on single access roads may be cut off from the larger community if landslides damage or lead to closures of nearby roads, and outdoor workers may cut off from work.

Transportation and energy infrastructure could be damaged by a landslide. Major roads and highways in western Vacaville, such as I-80 and Alamo Drive are located in medium to high landslide susceptibility areas.[10] Thirty bridges, including those along I-80, I-505, and Alamo Drive are located within medium to high landslide potential areas.[11] Landslides can undermine the foundations of major roads, highways, or bridges or completely block them. These slides can prevent travel to and from Vacaville, affecting economic activities. Nearly four miles of electrical transmission lines are located in medium to high landslide hazard areas, creating a risk of power outages if the lines are disrupted.[12]

Many parks and community features, such as Pena Adobe Park and Vacaville Town Hall, are located within a medium to high landslide susceptibility areas, as are residential structures in hillside western Vacaville. Landslides could damage these structures, and older structures may be especially vulnerable.

Flooding and Storm Drainage

Flooding Hazards

Flooding is the rising and overflowing of a body of water onto normally dry land. Historically, floods are one of the most frequent natural hazards impacting communities in Solano County, including Vacaville. 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. Flooding can be extremely dangerous, and even six inches of moving water can knock a person over given a strong current. Floodwaters can transport large objects downstream, which can damage or remove stationary structures, such as dam spillways. Ground saturation can result in instability, collapse, or other damage. Objects can be buried or destroyed by sediment deposition. Floodwaters can also break utility lines and interrupt services. Standing water can cause damage to roads, foundations, and electrical circuits. Other problems connected with flooding and stormwater runoff include erosion, sedimentation, degradation of water quality, losses of environmental resources, and certain health hazards.

Floods are usually caused by large amounts of precipitation, either from a period of very intense precipitation or a long period of steady precipitation. Historically, Vacaville has been at risk of flooding primarily during the winter and spring months when streams swell with heavy rainfall. This type of flood results from prolonged, heavy rainfall and is characterized by high peak flows of moderate duration and by a large volume of runoff. Flooding is more severe when prior rainfall has resulted in saturated ground conditions.

Occasionally, flash flooding can result from short-duration, high-intensity precipitation events (often during thunderstorms), even during drought conditions. Flash floods can tear out trees, undermine buildings and bridges, and scour new channels. In urban areas, flash flooding is an increasingly serious problem due to removal of vegetation and replacement of ground cover with impermeable surfaces such as roads, driveways, and parking lots.

Developments create impermeable surfaces and reduce the total surface area that can absorb water. Stormwater runoff is augmented by water flows from development contributing to street flooding. Moreover, developed areas generate irrigation water runoff from landscaping, which may channel stormwater and other runoff flows into nearby underdeveloped areas and street gutters.

Storm Drainage

In general, creeks in Vacaville flow in an east-southeast and ultimately drain into the Sacramento River via Cache Slough. The southern portion of Vacaville drains to the Noonan Drain, which discharges ultimately to Barker Slough, or to Union Creek, which discharges to Suisun Bay. The major stream courses in the city include:

- Alamo Creek, including its tributaries Laguna Creek and Encinosa Creek
- Ulatis Creek
- Horse Creek, including its tributary Pine Tree Creek
- Gibson Canyon Creek

There are two existing reservoirs in Vacaville: Lagoon Valley Lake, which is a tributary to Laguna Creek and drains a portion of Lower Lagoon Valley, and the Basherini Reservoir on Vine Street, which is owned and operated by the Solano Irrigation District.

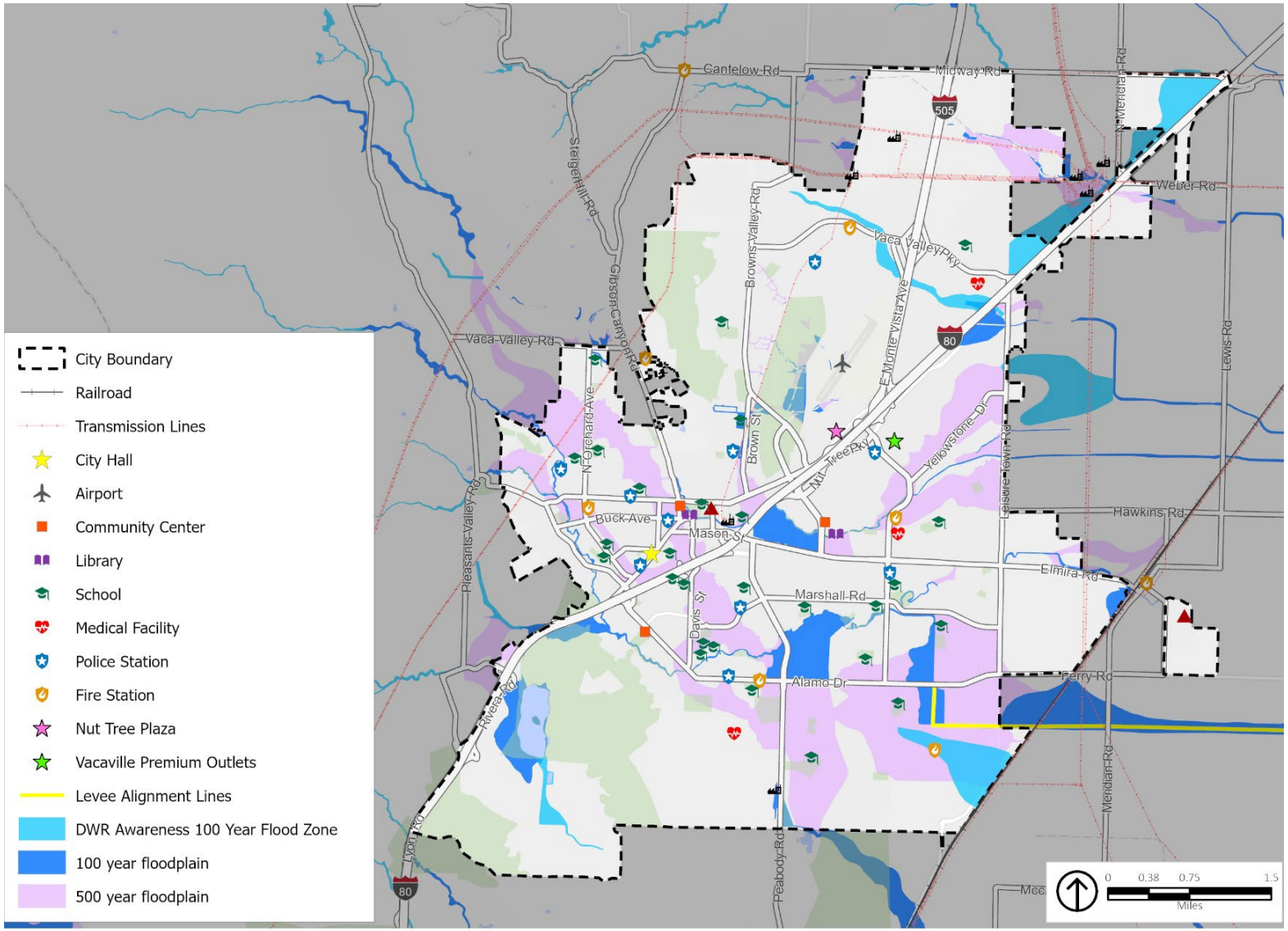
The major creeks that flow through Vacaville are largely in their natural state and alignment, except at the eastern edge of the city where flood control channels have been constructed. The natural, unaltered portions of the creeks generally do not have adequate flow capacity to convey a 100-year storm event, which is a storm that has a 1 percent chance of occurring in any given year.

Historically, flooding from creeks or streams overtopping their banks has occurred during 10-year or greater storms (i.e., a storm that has a 10 percent chance of occurring in any given year) in areas where channel and/or bridge capacities are exceeded, resulting in flooding of residential properties, blocking roads, and disrupting traffic. Areas susceptible to flooding include areas along Putah South between Foxboro Parkway and Marshall Road, the intersection of Putah South and Elmira Road, the environs of Lagoon Valley Park, the lower northwestern corner of the city in the vicinity of Alamo Creek and Ulatis Creek, and the northern tip of the city.

Flood Zones

A majority of the flood risk within Vacaville is specifically subject to inundation as a result of heavy rainfall and resulting stream and drainage canal overflows. The most recent mapping of areas subject to flooding, shown in **Figure SAF-8,** shows the boundaries of the 100- and 500-year floodplains. Approximately 1.70 square miles of Vacaville and 1,500 properties fall within the 100-year flood plain, and 5.07 square miles fall within the 500-year floodplain.

Figure SAF-8 FEMA Flood Zones



Source: DWR 2021, Solano County 2021, PlaceWorks 2022, ESRI

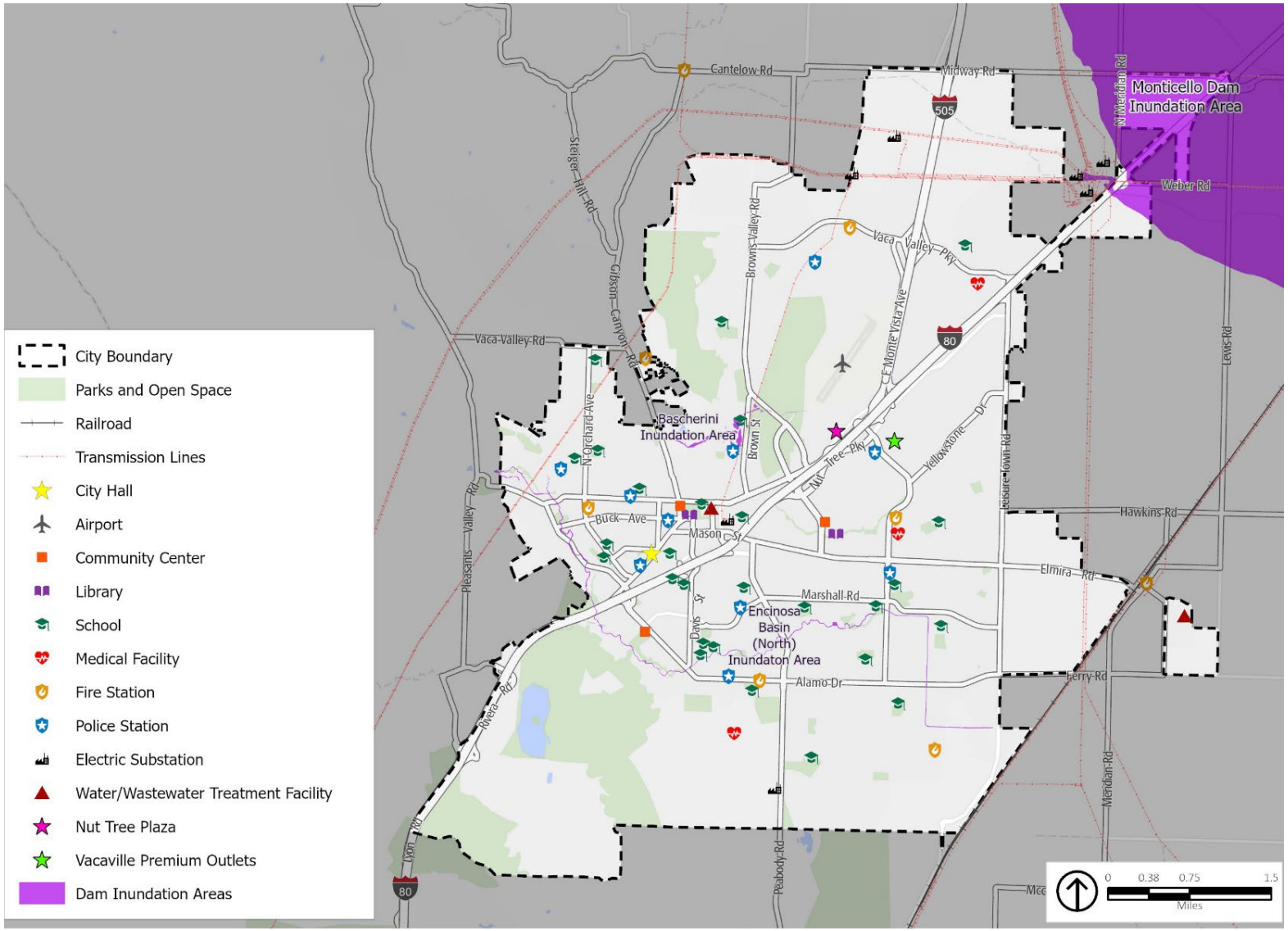
Dam Inundation

All dams pose the potential risk of failure, most likely from seismically induced ground shaking or a related seismic hazard, which threatens the area below the dam with inundation of water spilling from the dam. As illustrated in **Figure SAF-9,** the northeastern portion of Vacaville is subject to potential dam inundation by the Monticello Dam. The inundation map shows the area likely to flood should the dam fail. Constructed between 1953 and 1957 in Napa County, the Monticello Dam forms Lake Berryessa, which stores over 1.6 million acre-feet of water when full.

Flood Hazard Mitigation and Response

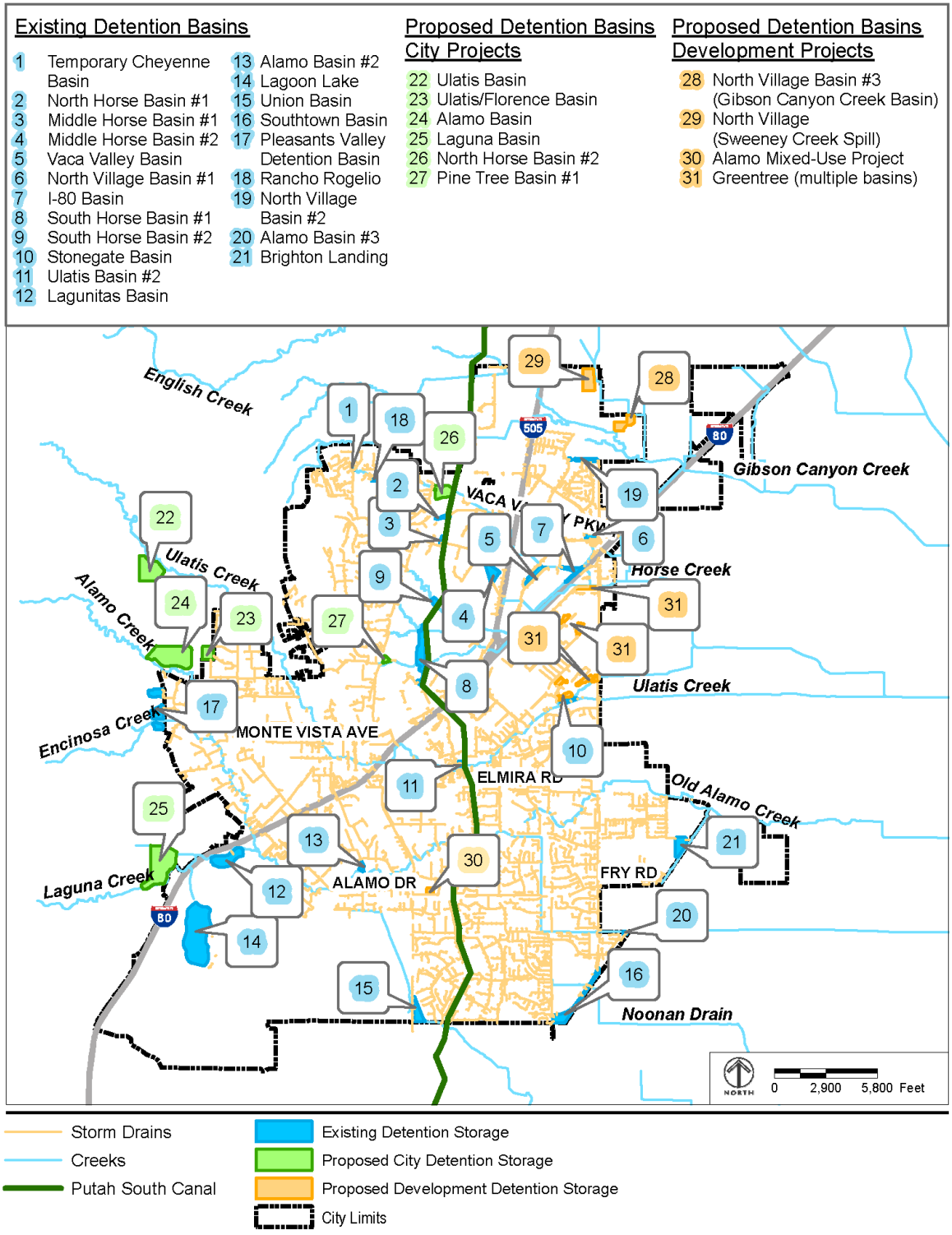
To address these flooding problems, Vacaville uses a variety of flood control facilities and measures. As shown in **Figure SAF-10,** the City has built several regional detention basins that reduce the flows from the Vaca Mountains before they reach the city and thus reduce urban flooding. There are currently 21 detention basins throughout Vacaville, primarily along the major creeks in the city, and 10 additional basins are currently proposed. The City also maintains a network of storm drains and works to keep channel flowlines free from debris and vegetation. As part of past flood control efforts, certain creekways have been engineered to handle larger volumes of stormwater than they would in their natural states. In addition, Vacaville's Residential Design Guidelines minimize the extent ofimpervious surfaces, which water cannot penetrate, such as a roof, road, sidewalk, or paved parking lot. Because impervious surfaces do not allow water to penetrate into the ground, they increase runoff volumes and contribute to flooding. Minimizing the amount of permitted impervious surfaces helps reduce flooding. The City maintains the Storm Drainage Master Plan that identifies storm drainage deficiencies and improvements needed to address local flooding problems. The Storm Drainage Master Plan identifies regional detention basins to mitigate the increase in runoff from new development. New development is required to provide 100-year-level flood protection within the proposed development area and ensure that developed areas are not adversely impacted.

Figure SAF-9 Dam Inundation Areas



Source: DWR DSOD 2021, PlaceWorks 2022, ESRI

Figure SAF-10 Existing and Proposed Drainage Facilities



Floodplain Development Regulations

Regulation of development in known flood-prone areas, based on FEMA mapping and other information, is a key tool in reducing flooding risks to life and property. The key development regulations in known flood-prone areas are:

- **Central Valley Flood Protection Plan**. According to California Government Code Sections 65302.9 and 65860.1, every jurisdiction in the Sacramento-San Joaquin Valley, which includes Vacaville, is required to update its general plan and zoning ordinance in a manner consistent with the Central Valley Flood Protection Plan (CVFPP) within 24 months after the CVFPP's adoption, which first occurred in 2012. In addition, the locations of the State and local flood management facilities, locations of flood hazard zones, and the properties in these areas must be mapped and consistent with the CVFPP. The planning area of the CVFPP is called the Systemwide Planning Area. Vacaville is not included in this area. The CVFPP also catalogs the State Plan of Flood Control, which is the collection of State and federal flood protection system in the Central Valley. None of the facilities in the State Plan of Flood Control are in Vacaville.

- **AB 5, SB 5, SB 17, and AB 162.** In 2007, several State laws were passed to address flooding risks in California. AB 5 (Wolk), SB 5 (Machado), SB 17 (Florez), and AB 162 (Wolk) require that urban and urbanizing areas in the Sacramento Valley and San Joaquin Valley, such as Vacaville, achieve, or make adequate progress toward achieving, 200-year protection to continue to approve development in the floodplain. Specifically, AB 162 requires that each local jurisdiction's Safety Element include 200-year floodplain maps. Maps must be based on the best available data on flood protection, including areas protected by State and federal project levees, and areas outside of these areas. As of June 2022, the 200-year floodplain for Vacaville has not yet been mapped.

State legislation also requires a jurisdiction's Safety Element to include a Levee Flood Protection Zone map and an Alluvial Fan Floodplain Evaluation and Delineation map. However, because Vacaville is not within a Levee Flood Protection Zone, this Safety Element does not include such a map. In addition, the Alluvial Fan Floodplain Evaluation and Delineation Map program only applies to counties in Southern California.

Vacaville has adopted a Floodplain Management Ordinance (Section 14.18 of the Municipal Code) that outlines the requirements for construction within a designated 100-year floodplain or areas prone to flooding. The Floodplain Management Ordinance contains provisions for anchoring, construction materials and methods, and elevation and floodproofing of new construction as well as provisions specific to nonresidential construction, utilities, subdivisions, manufactured housing, recreational vehicles, and floodway construction. Vacaville's Department of Public Works collaborates with the City's fire and police departments and Solano County's Office of Emergency Services to alert and help the community prepare for flooding.

State Awareness Mapping Program

The purpose of the State Awareness Mapping project is to show flood hazards that are not mapped under FEMA's National Flood Insurance Program to give property owners and residents additional information about potential flood hazards. The State has deemed the areas mapped under the Awareness Mapping project as prone to flooding. This designation is advisory only and is not subject to federal or State regulation.

Past Occurrences

The City of Vacaville has historically been subject to periodic flooding. Severe flooding occurred in 1937, 1940, 1941, 1943, 1948, 1952, 1955, 1958, 1962, 1963, 1964, 1965, 1967, 1969, and 1973. Since 1964, flooding has been reduced substantially by a National Resources Conservation Service project consisting of channel improvements and levees along selected stream reaches below I-80. The major floods of 1940, 1967, and 1973 resulted in the flooding of one or both of Alamo and Ulatis Creeks and flooded residential properties and streets, stranded residents, and deposited debris and garbage. Several families were forced to evacuate their homes or apartments when floodwaters covered the lower floors.

More recently, major regional flood occurrences include:

- **1986 Northern California and western Nevada floods.** A strong storm known as a Pineapple Express (a large flow of moisture-laden air from the waters near Hawaii) caused unprecedented amounts of rain and extensive flooding of the Napa and Russian Rivers. The nine-day storm brought half of the average annual rainfall for the year. Sacramento, Yuba, and Feather River levee breaks in Olivehurst and Linda forced thousands of residents to evacuate. On the San Joaquin River and in the Delta, levee breaks along the Mokelumne River caused flooding in Thornton and flooded four Delta islands. The event resulted in 13 deaths, 50,000 people evacuated, and over $400 million in property damage.

- **1996–7 New Year's Day Northern California flood**. A Pineapple Express storm hit northern California, making December one of wettest on record. The Klamath River experienced its worst flood since 1974 and permanently changed course in some areas. Dozens of levees failed and produced widespread flooding throughout the San Joaquin River Basin, including along the Cosumnes River and near Olivehurst, Arboga, Wilton, Manteca, and Modesto. Massive landslides occurred in El Dorado National Forest east of Sacramento, closing Hwy 50. Forty-eight counties in California were declared disaster areas. Over 23,000 homes and businesses, agricultural lands, bridges, roads, and flood management infrastructures—valued at about $2 billion—were damaged. Nine people were killed and 120,000 people were evacuated from their homes. Overall, the storms led to flooding across 300 square miles.

- **December 13–16, 2002.** A series of storms led to extensive flooding and damage to many homes, barns, and other structures in the Ulatis Creek Watershed. The peak rainfall for the December 2002 storm occurred on December 16 between 2 am and 4 am following several days of continuous rainfall that saturated the ground. A few hours after the peak rainfall, many creeks in Solano County crested, causing widespread flooding and damage to several homes, apartment buildings, and businesses. The storm is estimated to have been a 20-to 50-year event in the Vacaville area.

- **June 3, 2004**. The Upper Jones Tract levee near Woodward Island in Stockton failed, resulting in the flooding of both Upper and Lower Jones Tracts. More than a dozen homes were flooded, and many were forced to evacuate. The flood was responsible for $90 million in damages, much of it associated with lost or damaged crops.[13]

- **2005–6, Dec 31st Vacaville flooding**. Heavy rainfall resulted in extensive flooding and damage to many houses, barns, and other structures. Peak rainfall was preceded by several smaller storms that saturated the ground and contributed to the flooding on the 31st. Ulatis Creek experienced measured creek flows in excess of the FEMA 100-year flow rate at Leisure Town Road despite large amounts of water overtopping the creek banks upstream. Similarly, Alamo Creek at Vanden Road experienced creek flows just below the FEMA 50-year flow rate, despite the significant overflows identified upstream of I-80 and the overflows between Peabody Road and the Putah South Canal. Most flooding occurred in residential areas, with 3 percent of households (900 homes) experiencing flooding of their homes, garages, or cars. Four businesses experienced flooding, and one storm-related death occurred.[14] The Department of Water Resources declared emergency mobilization. High tides along Delta shorelines and continued wet weather throughout the State resulted in a federal disaster declaration. The governor declared a state of emergency due to the threat of major flooding in northern California and the San Joaquin Valley.

In addition to these flood events, Vacaville also experienced more recent, moderate flooding in the winters of 2017, 2019, and 2021. These floods closed roads and downed trees across the city.

Future Risk

Given Vacaville's extensive history of periodic flooding, managing and mitigating flood risk should be a high priority in future planning. As land uses and climate conditions shift and as improvements are made to flood-control channels, the size of existing flood zones is likely to change. The potential for a dam failure event in Vacaville is likely to remain a risk in future years, although the odds of such events are expected to remain very low.

Climate Change and Flooding

Climate change and attendant changes to the local and regional hydrological cycle may exacerbate flood risk. Historically, Vacaville has experienced annual precipitation levels of 22.6 inches per year. As climate change progresses, annual average rainfall levels may increase to between 25.6 and 26.1 inches per year by midcentury (2035–2064) and to between 25.7 and 29.8 inches by the end of this century (2070–2099). This increase in average rainfall is likely to occur in high-intensity storms, which are projected to become more intense and more frequent over the course of this century. These high-intensity storms will likely increase flood risk within Vacaville, meaning that flood events currently considered 100-year and 500-year floods will likely occur with greater frequency than they have historically.

The vulnerability assessment identified several population groups who may be vulnerable to flooding. Groups with limited financial resources, including low-income households, immigrant communities, individuals experiencing homelessness, and low-resourced people of color may be more likely to live in flood-prone areas, to live in structures that are less structurally resilient, and to lack access to financial or community resources to aide in flood recovery. Groups with limited resources, seniors, those with chronic illnesses or disabilities, and those lacking access to lifelines such as phone service or a private vehicle may experience either physical or logistical barriers to receiving emergency notifications and evacuating in the event of an emergency. Seniors and those with chronic illnesses or disabilities may be especially vulnerable to the health effects associated with exposure to floodwaters, as may pollution-burdened populations.

Components of Vacaville's transportation and flood control infrastructure networks could be damaged by flooding. Major routes and bridges, including sections of I-80, Alamo Drive, Nut Tree Road, Peabody Road, Elmira Road, and Orchard Avenue, are located within the 100-year or 500-year floodplain.[15] The Union Pacific railroad is within the 500-year floodplain, rendering Amtrak and freight trains vulnerable to flooding disruptions.[16] Flooding can damage or overwhelm storm drains and detention basins to overflow. The City has recently installed detention basins, which have helped with the flooding in the City, and additional repairs and retrofits to the storm drain and flood control infrastructure are planned. However, increased levels of floodwaters could still overwhelm the system.

Parks, residential structures, and public safety buildings are all vulnerable to flooding. Several parks are located partially or entirely within the 100-year flood zone.[17] Flooding can damage park structures and facilities, rendering the parks unusable until repaired. Although parks often absorb floodwaters and can protect surrounding structures from flooding, they are still vulnerable to damage from a major flood event. Households along Ulatis and Alamo Creeks and in neighborhoods along Alamo Drive and surrounding Nut Tree Plaza and the outlets are located within the 100-year or 500-year floodplain.[18] This puts them at risk of direct damage from flooding or mold or mildew growth from floodwaters, which can make the houses uninhabitable. Four fire stations and one police station are located in the 100-year or 500-year flood zone.[19] Floodwaters can damage these buildings and the resources housed in these buildings, preventing public safety buildings from supporting public safety services in the city.

Surrounding agricultural lands and related industrial facilities are in flood-prone areas and may be disrupted by flooding.[20] Flooding can cause significant damage to crops and animals because floodwaters can damage plants, wash away topsoil nutrients, degrade essential microbial activity, damage animal facilities, injure animals, and increase vector-borne diseases in livestock. Flooding could then have ripple effects on the associated food processing and wholesale trade industries.

Wildland Fires

Fire Hazard Areas

Highly flammable vegetation and warm, dry summers create the potential for wildland fires in Vacaville. The risk of wildland fires is related to a combination of factors, including winds, temperatures, humidity levels, and fuel moisture content. Of these four factors, wind is the most crucial. Steep slopes also contribute to fire hazards by intensifying the effects of wind and making fire suppression difficult. Where there is easy public access to dry vegetation, fire hazards increase due to greater chance of human carelessness. High hazard areas in Vacaville include outlying residential parcels and open lands adjacent to residential areas.

The wildland-urban interface (WUI) is an area where buildings and infrastructure (e.g., cell towers, schools, water supply facilities) mix with areas of flammable wildland vegetation. The WUI is made up of three distinct zones. The intermix zone contains housing development or improved parcels interspersed in an area dominated by wildland vegetation subject to wildfire. The interface zone contains dense housing next to vegetation that can burn in a wildfire, but not dominated by wildland vegetation. The influence zone contains wildfire-susceptible vegetation within 1.5 miles of the wildland-urban interface or wildland-urban intermix zones. Hundreds of homes now border major forests and brush areas in California. With thousands of people living near and visiting wildland areas, the probability of human-caused fires is growing.

In the WUI, efforts to prevent ignitions and limit wildfire loss hinge on hardening structures and creating defensible space through a multi-faceted approach, which includes engineering, enforcement, education, emergency response, and economic incentive. Different strategies in the defense and threat zones of the WUI help to limit the spread of fire and reduce the risk to people and property.

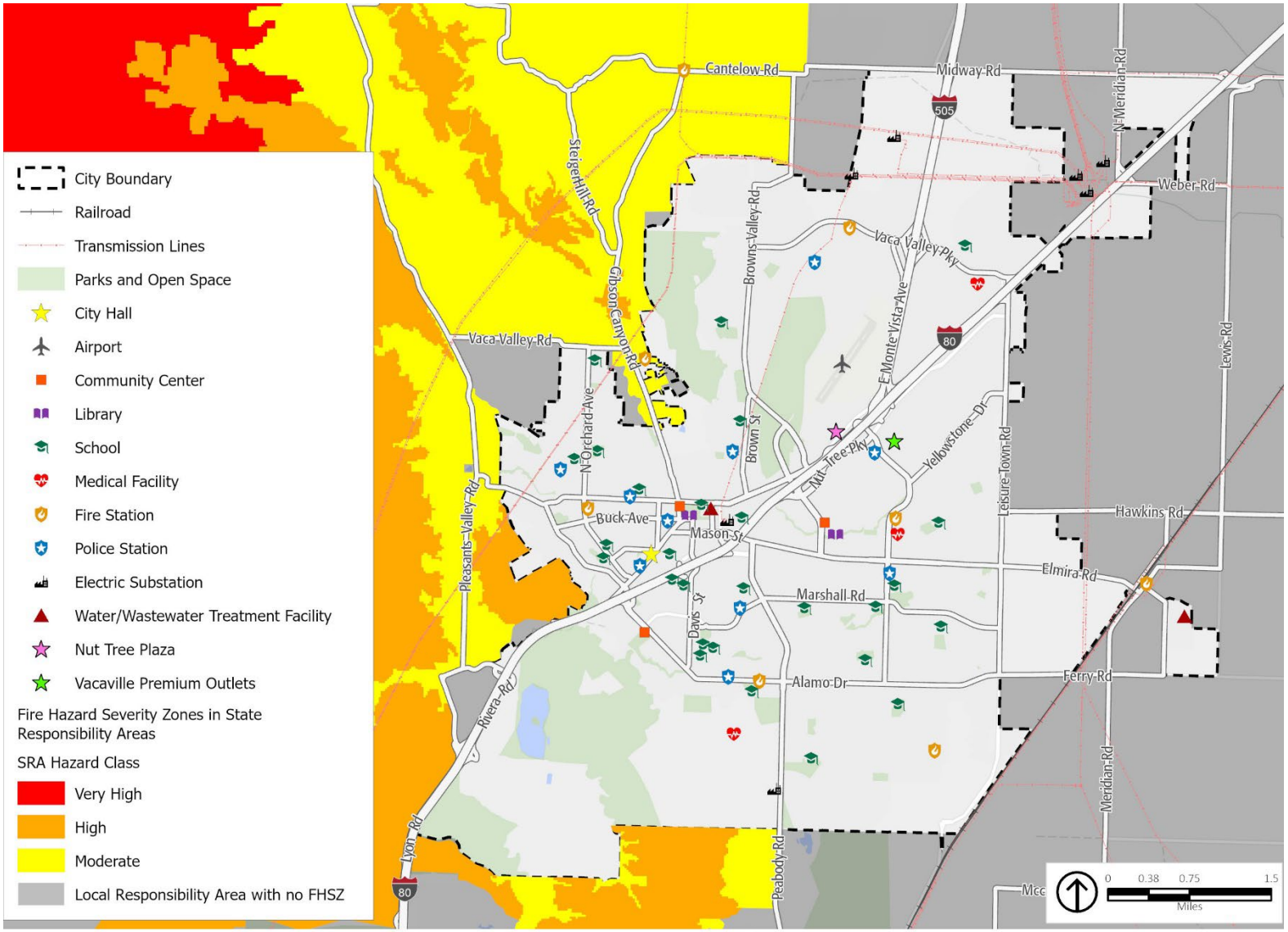
To quantify wildfire risk, the California Department of Forestry and Fire Protection (CAL FIRE) has developed a Fire Hazard Severity Scale that uses three criteria to evaluate and designate potential fire hazards in wildland areas: fuel loading (vegetation), fire weather (winds, temperatures, humidity levels, and fuel moisture contents), and topography (degree of slope). **Figure SAF-11** shows the Moderate, High, and Very High Fire Hazard Severity Zones as designated by CAL FIRE at time of writing, and **Figure SAF-12** shows the wildland urban interface (WUI) in and around the City of Vacaville. Users should consult the most recent available mapping, available from CAL FIRE's Fire and Resource Assessment Program (FRAP) at https://frap.fire.ca.gov/.

In addition to the Fire Hazard Severity Zones mapped by CAL FIRE in **Figure SAF-11** and the WUI in **Figure SAF-12,** open agricultural lands in eastern Vacaville pose a threat related to grass fires. Grass fires can travel very fast and threaten nearby residential areas. Grass fire threats in open agricultural lands are a significant concern in the growth areas in the eastern portion of the city.

Wildfire Smoke

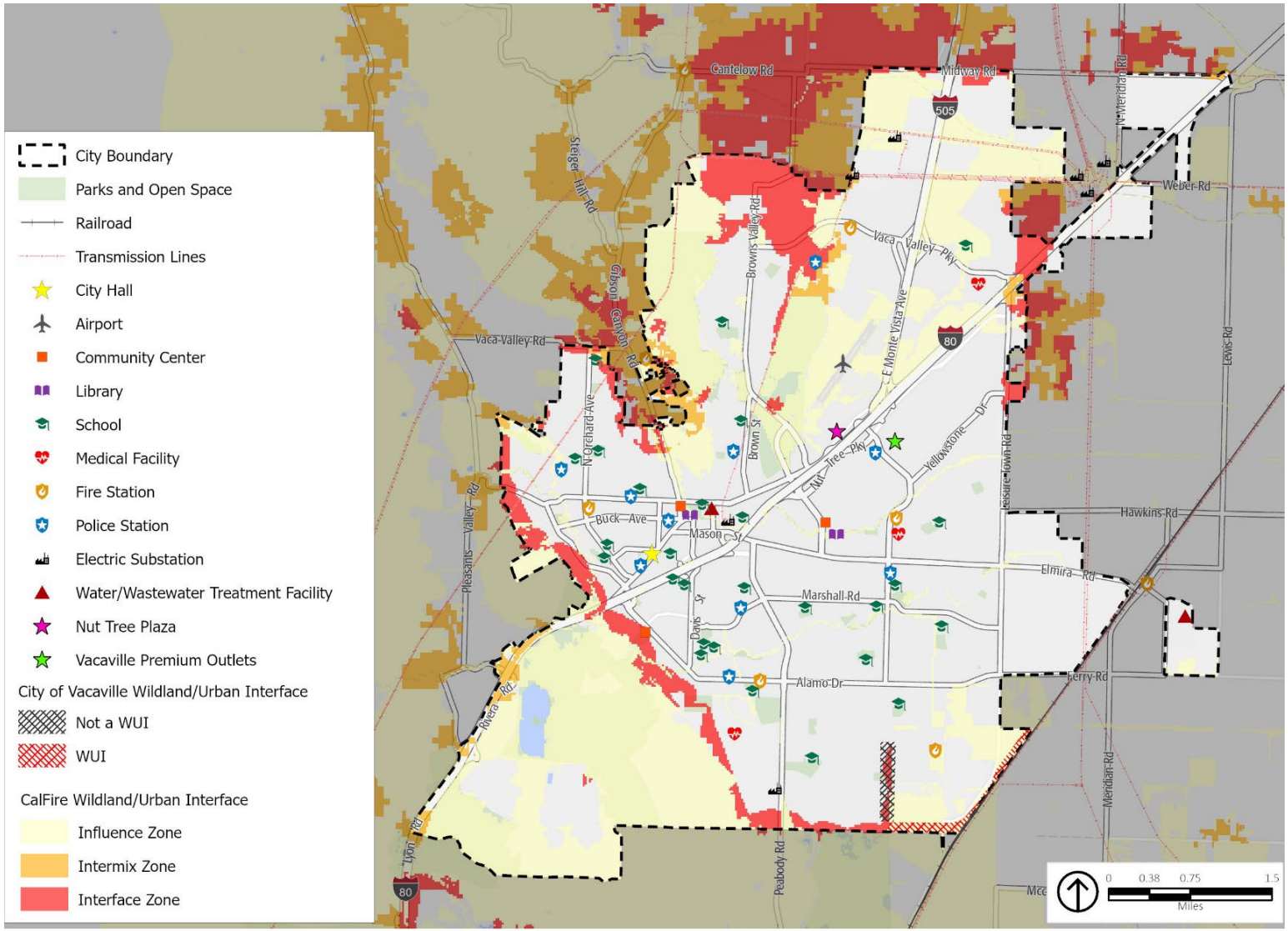
Wildfire smoke is a mix of gases and fine particulate matter from burning vegetation and materials. The pollutant of most concern from wildfire smoke is fine particulate matter ($PM_{2.5}$). $PM_{2.5}$ from wildfire smoke is damaging to human health due to its ability to deeply penetrate lung tissue and affect the heart and circulatory system. Although wildfire smoke presents a health risk to everyone, sensitive groups may experience more severe acute and chronic symptoms from exposure to wildfire smoke, such as children, older adults, people with chronic respiratory or cardiovascular disease, or people experiencing low socioeconomic status. Fires occurring locally or elsewhere in northern California can create dangerously high levels of air pollution in Vacaville.

Figure SAF-11 CALFIRE Fire Hazard Severity Zones



Source: Cal Fire 2007, Solano County, PlaceWorks 2022, ESRI

Figure SAF-12 WUI Zones



Source: CalFire 2015, PlaceWorks 2022, ESRI

Note: Due to recent development activity, the City of Vacaville believes that the WUI boundaries in southeast Vacaville are different from those mapped by CAL FIRE. The City believes that the area shown in black cross-hatching along Nut Tree Road is no longer a WUI area, and the area shown in red cross-hatching near Leisure Town Road is part of the Interface zone.

Fire Mitigation and Response

The Vacaville Fire Department (VFD) is responsible for fire response within the city. VFD is comprised of dedicated staff and volunteers and engages in building plan review, fire protection system inspections, fire safety building inspections, municipal code enforcement, neighborhood clean-up programs, new construction inspections, and weed abatement in order to help manage Vacaville's fire risk. VFD responded to 290 fire calls in 2021 and had an average response time six minutes and 53 seconds.[21]

To reduce risks from wildland fires, the City of Vacaville adopted Chapter 14.20.290 of the Municipal Code, Standards for New Construction Adjacent to Open Space Lands Where Wildfire Is a Threat. Chapter 14.20.290 provides development standards for new construction adjacent to permanent open or other open lands where no development is anticipated in the near future (as identified in the General Plan) and where wildfire is a threat. Some of the fire reduction strategies incorporated in the Municipal Code include providing for fire access roads, maintaining a defensible space of noncombustible vegetation around structures, and installing indoor sprinkler systems.

Fuel reduction and weed abatement play significant roles in the City's wildfire mitigation strategy. The City has used cow grazing to reduce weeds and other fuels to mitigate wildfire impacts. Cow grazing significantly slowed the forward movement of the 2020 LNU Lightning Complex fire as it spread into the city and allowed for successful containment efforts without the loss of homes within city limits. The City would like to expand the use of grazing efforts to include goat and sheep grazing. The City's strict weed abatement ordinance helps further reduce the accumulation of potential wildfire kindling, and the City manages a weed abatement program performed by both in-house City staff and outside contractors to abate over 2,000 acres of designated weed abatement parcels. Municipal Code Chapter 15.20. 271 establishes the City's weed abatement program.

Past Occurrences

Wildfires are of major concern to the city. Major past regional occurrences of wildfire are described here.

- **1954.** A grass fire with high winds burned 5,888 acres from California Medical Facility to Travis AFB.
- **1961 "Black Saturday".** Ninety-five fires reported, with the most severe in the Allendale area (95,008 acres and 10 homes destroyed). Burning from Elmira-Travis AFB to Collinsville (40,008 acres) and from Benicia-Cordelia Hills along I-80 to the Carquinez Bridge. Three days later, an arson fire in Miller Canyon burned 2,808 acres along Blue Ridge in 40 hours.
- **1965 "Black Thursday".** Fire between Dixon and Peabody-Vanden roads. A second fire was caused by power lines falling and igniting dry grass in the English Hills. Nearly 400 fire fighters fought the blaze north of Vacaville; 6,588 acres, 13 homes, and 45 other buildings were lost. Extensive damage at Travis AFB. Meanwhile the "Kaiser Fire" started in Napa County due to falling power lines, burning 25,888 acres from Soscol Ridge near Highway 29 to American Canyon Road and 1-88 to the south and into Green Valley to the east.

- **2015, July 4.** Officials said fireworks were suspected in starting a 325-acre fire that prompted about 125 people to evacuate their homes. City officials said no structures were lost in that blaze, which was contained, and no immediate reports of injuries. The fire affected the hills between Keating Park and the Pena Adobe/Lagoon Valley Park area.
- **2017 Atlas Fire.** The Atlas Fire burned 51,624 acres across Solano and Napa counties and resulted in the destruction of 781 structures and six deaths.
- **2020 Lightning Complex Fire.** The LNU Lightning Complex was a large complex of wildfires that burned during the 2020 California wildfire season across much of the wine country area of Northern California—Lake, Napa, Sonoma, Solano, and Yolo counties—from August 17 to October 2, 2020. The complex consisted of numerous lightning-sparked fires, most of which were small. The Hennessey Fire eventually grew to merge with the Gamble, Green, Markley, Spanish, and Morgan fires, scorching 192,000 acres by itself, for a total burn area of 363,220 acres in the complex. The fire, which burned in the hills surrounding Vacaville, Fairfield, and Napa, destroyed 1,491 structures and damaged a further 232. Six people were killed and another five injured. As of spring 2022, the LNU Lightning Complex was the sixth-largest, eleventh-most destructive, and sixteenth-deadliest fire in California's recorded history.

Future Risk

Given the complex relationships between climate, vegetation, hydrology, and human behavior that contribute to fire risk, fire severity can fluctuate from year to year. Overall, fire risks are expected to continue in and around Vacaville. This includes direct threats to the community from active burn areas, as well as risks from poor air pollution caused by smoke from fires elsewhere in northern California.

Climate Change and Wildfire

Changing climate conditions are expected to increase the fire risk in and around Vacaville. Warmer temperatures brought on by climate change can exacerbate drought conditions. Droughts can kill or dry out plants, creating more fuel for wildfires. Warmer temperatures are expected to increase the number of pest outbreaks, such as the pine beetle, creating more dead trees and increasing the fuel load. Hot, dry spells may increase disease and insect infestations, resulting in higher fuel loads. Increased winds may result in more erratic fire behavior, making fires harder to contain. Warmer temperatures are also expected to occur later in the year, extending the wildfire season, which is likely to begin earlier in the year and extend later than it has historically.[22] Therefore, even in years in which wildfire does not occur within Vacaville, the city may still suffer public health and safety impacts of wildfire smoke from wildfire throughout the region.

Low resourced communities and those with underlying physiological conditions are more vulnerable to wildfires due to increased risk of harm from smoke exposure, a limited ability to prepare for wildfires or to protect their homes against fires, or to evacuate if the situation calls for it. Outdoor workers and individuals experiencing homelessness are more likely than the general population to experience direct and prolonged smoke exposure, and immigrant communities and incarcerated individuals may also experience elevated exposure levels depending on the specifics of their working and housing conditions. Outdoor work may also be halted during a fire, creating a risk of economic harm. Nearly all mobile home parks in Vacaville are located in medium and high fire hazard areas, placing mobile home residents at an elevated risk of wildfires.[23]

Parts of several major roads and highways, along with 44 bridges, are located within high or very high wildfire hazard zones.[24] Wildfires could block these routes, preventing passenger or freight traffic. Additionally, three substations and over 20 miles of transmission lines in Vacaville are located in wildfire prone areas.[25] Electrical transmission lines and the poles that support them can be damaged or destroyed by the flames and high temperatures created by wildfires, which can cause Vacaville residents, businesses, and community services to lose power.

Key community features, structures, and services such as parks and recreation, historic buildings, residential structures, and water treatment and delivery could be impacted by wildfire. The majority of Vacaville's parks, the Pena Adobe, and homes in western Vacaville are located in medium to high wildfire hazard areas and could be damaged by a fire. Wildfires in the region could impact the Solano Project and the Sacramento River Watershed, which Vacaville relies on for water services. Water quality can be degraded due to ash content or fire retardants present in surface water storage. Although contaminated water supplies can be filtered to and treatment plants can be upgraded, this process may be expensive and may take weeks or months to complete after a fire occurs.

Agricultural land surrounding Vacaville is located in wildfire prone areas. Smoke and ash can damage crops and soil,[26] causing plants to die or reduce productivity. Although wildfires naturally occur in chaparral ecosystems surrounding Vacaville, fires more than every 20 years can reduce the biodiversity of chaparral habitat and cause the ecosystem system to convert to a grassland or scrub habitat, harming native chaparral species.[27]

Hazardous Materials and Waste

Hazardous Materials in Vacaville

Products as diverse as gasoline, paint solvents, film-processing chemicals, household cleaning products, refrigerants, and radioactive substances are categorized as hazardous materials. What remains of a hazardous material after use or processing is considered hazardous waste. The handling, transportation, and disposal of such waste is a concern to all communities. Improper handling of hazardous materials or waste may result in significant impacts on human health and the environment. Many businesses and residents in Vacaville use hazardous materials and generate some amount of hazardous waste. Common hazardous waste is generated from gasoline service stations, dry cleaners, automotive mechanics, auto body repair shops, machine shops, printers and photo processors, and agriculture. Most of these wastes are petroleum-based or hydrocarbon hazardous waste and include cleaning and paint solvents, lubricants, and oils. However, medical wastes, defined as potential infectious waste from sources such as laboratories, clinics, and hospitals, are also among the hazardous wastes in Vacaville.

The State Water Resources Control Board's GeoTracker database (https://geotracker.waterboards.ca.gov/) tracks the status of sites that impact, or have the potential to impact, water quality in California, with emphasis on groundwater. GeoTracker contains records for sites that require cleanup, such as Leaking Underground Storage Tank (LUST) Sites, Department of Defense Sites, and Cleanup Program Sites. As of November 9, 2022, the database identifies 99 sites in Vacaville, consisting of both LUST and military sites. Cleanup has been completed at 82 of the sites.

The Department of Toxic Substances Control's hazardous waste EnviroStor database (https://www.envirostor.dtsc.ca.gov/public/) tracks the cleanup, permitting, enforcement, and investigation

of hazardous waste facilities and sites with known contamination or sites where there may be reason to investigate further. As of November 9, 2022, the EnviroStor database shows 12 hazardous materials sites within Vacaville, 9 of which are closed or inactive. The city contains 6 plugged oil wells. Hazardous materials sites are subject to state and federal cleanup requirements.

Hazardous materials are mapped on **Figure SAF-13** and summarized in **Table SAF-1**.

TABLE SAF-1: HAZARDOUS MATERIALS SITES

Site Name	Address	Site Type	Status
1119 East Monte Vista Avenue	1119 East Monte Vista Avenue	Lust Cleanup Site	Completed - Case Closed
5057 & 5065 Quinn Road	5065 Quinn Road	Lust Cleanup Site	Completed - Case Closed
7-11 Store #2211-24248	1091-1097 Monte Vista Ave E	Lust Cleanup Site	Completed - Case Closed
7-11 Store #22837	2490 Nut Tree Road	Lust Cleanup Site	Completed - Case Closed
Alamo Laundromat	1460 Alamo Drive	Cleanup Program Site	Open - Site Assessment
American Home Food	500 Crocker Dr	Lust Cleanup Site	Completed - Case Closed
Arco #2067	310 Orange Dr	Lust Cleanup Site	Completed - Case Closed
Arco #5368	2500 Nut Tree Pkwy	Lust Cleanup Site	Completed - Case Closed
Arco #5368	2500 Nut Tree Road	Lust Cleanup Site	Completed - Case Closed
Arco #5630	1470 Alamo Dr	Lust Cleanup Site	Completed - Case Closed
Autocraft Collision	1275 Callen Street	Lust Cleanup Site	Completed - Case Closed
Basic American Foods	411 Davis St	Lust Cleanup Site	Completed - Case Closed
Basic Vegetable Products	619 Davis Street	Cleanup Program Site	Completed - Case Closed
Beacon Nut Tree Station	1501 East Monte Vista Avenue	Lust Cleanup Site	Open - Site Assessment
Beacon Ss #522	800 Merchant St	Lust Cleanup Site	Completed - Case Closed
Beacon Ss #699	921 Merchant St	Lust Cleanup Site	Completed - Case Closed
Big-O Distribution Center	877 Cotting Ct	Lust Cleanup Site	Completed - Case Closed
Bp #11244	817 Leisure Town Rd	Lust Cleanup Site	Completed - Case Closed
Ca Medical Facility	1600 California Dr	Lust Cleanup Site	Completed - Case Closed
California Medical Facility	1600 California	Cleanup Program Site	Completed - Case Closed
Cardlock	917 Cotting Lane	Lust Cleanup Site	Completed - Case Closed
Carone Property (Former Bray)	7297 Chevron Way	Lust Cleanup Site	Completed - Case Closed
Chandler's Home Appliance	218 Dobbins St	Lust Cleanup Site	Completed - Case Closed
Chevrolet Dealership (Former)	1250 Monte Vista Ave E	Lust Cleanup Site	Completed - Case Closed
Chevron	1615 Monte Vista Ave E	Lust Cleanup Site	Completed - Case Closed
Chevron #9-1668	501 Peabody Rd	Lust Cleanup Site	Completed - Case Closed
Chevron #9-2610	200 Monte Vista Ave E	Lust Cleanup Site	Completed - Case Closed
Chevron #9-5959	300 Orange Dr	Lust Cleanup Site	Completed - Case Closed
Chevron #9-6738	970 Merchant St	Lust Cleanup Site	Completed - Case Closed

Site Name	Address	Site Type	Status
Chevron (Abandoned Shell)	299 Orange Dr	Lust Cleanup Site	Completed - Case Closed
Darpetro	401 Merchant St	Lust Cleanup Site	Completed - Case Closed
Darpetro #4 (Exxon)	199 Orchard St	Lust Cleanup Site	Completed - Case Closed
Darpetro (Morre's Ss)	937 Monte Vista Ave E	Lust Cleanup Site	Completed - Case Closed
Dependable Sheet Metal	1330 Callen St	Lust Cleanup Site	Completed - Case Closed
Dick Lewis Ford	148 Peabody Rd	Lust Cleanup Site	Completed - Case Closed
Eric's Cable Car Wash	977 Merchant St	Lust Cleanup Site	Completed - Case Closed
Fashion Cleaners	613 Elmira Road	Cleanup Program Site	Completed - Case Closed
Firestone Store #3680	1200 Monte Vista Ave E	Lust Cleanup Site	Completed - Case Closed
Flying J	177 Peabody Rd	Lust Cleanup Site	Completed - Case Closed
Food & Liquor #38	1193 Monte Vista Ave E	Lust Cleanup Site	Completed - Case Closed
Former Robert's Homes	1416 Midway Rd	Lust Cleanup Site	Completed - Case Closed
Johnson & Johnson Facility	700 Eubanks Drive	Cleanup Program Site	Open - Remediation
K Mart	130 Brown Valley Pkwy	Lust Cleanup Site	Completed - Case Closed
Kabota's (Vaughn Used Cars)	270 Nut Tree Pkwy	Lust Cleanup Site	Completed - Case Closed
Kelly Company	1076 Monte Vista Ave E	Lust Cleanup Site	Completed - Case Closed
Ken's Tires (Former)	650 Davis St	Lust Cleanup Site	Completed - Case Closed
Kmep Elmira Booster Station	Leisure Town Road	Cleanup Program Site	Completed - Case Closed
Kmep Fry/Meridian Rd Rrxing	1500 Feet West Of Fry Road Where Fry Crosses	Cleanup Program Site	Completed - Case Closed
Lucky's Distribution Center	700 Crocker Dr	Lust Cleanup Site	Completed - Case Closed
Maint Dept (Vacaville Usd) Case #1	353 Brown St	Lust Cleanup Site	Completed - Case Closed
Mason Plaza	900 Mason St	Lust Cleanup Site	Completed - Case Closed
Oats Country Store	4819 Midway Rd	Lust Cleanup Site	Completed - Case Closed
Pacific Spectrum Glass	909 Aldridge Rd	Lust Cleanup Site	Completed - Case Closed
Peabody Road Apartments	148 Peabody Road	Cleanup Program Site	Open - Site Assessment
Pg&E Vacaville Service Center	158 Peabody Rd	Lust Cleanup Site	Completed - Case Closed
Pombo Lane	6630 Pombo Lane	Cleanup Program Site	Completed - Case Closed
Private Residence	Private Residence	Military Privatized Site	Completed - Case Closed
Private Residence	Private Residence	Military Privatized Site	Completed - Case Closed
Private Residence	Private Residence	Military Privatized Site	Completed - Case Closed

Site Name	Address	Site Type	Status
Private Residence	Private Residence	Military Privatized Site	Completed - Case Closed
Private Residence	Private Residence	Lust Cleanup Site	Completed - Case Closed
Private Residence	Private Residence	Military Ust Site	Open - Site Assessment
Private Residence	Private Residence	Military Ust Site	Open - Site Assessment
Private Residence	Private Residence	Lust Cleanup Site	Completed - Case Closed
Private Residence	Private Residence	Cleanup Program Site	Completed - Case Closed
Private Residence	Private Residence	Lust Cleanup Site	Completed - Case Closed
Quik Stop Market #102	807-A Davis St	Lust Cleanup Site	Completed - Case Closed
Red Carpet Car Wash	108 Elmira Rd	Lust Cleanup Site	Completed - Case Closed
Shell	101 Peabody Rd	Lust Cleanup Site	Completed - Case Closed
Shell	1611 Monte Vista Ave E	Lust Cleanup Site	Completed - Case Closed
Shell Case #2	1611 E. Monte Vista	Lust Cleanup Site	Completed - Case Closed
Shell Ss	950 Merchant St	Lust Cleanup Site	Completed - Case Closed
Solano County Community College District	1600 California Drive	Cleanup Program Site	Open - Site Assessment
Solano Irr. Dist. Garage	508 Elmira Rd	Lust Cleanup Site	Completed - Case Closed
Texaco (Former)	190 Hickory Ln	Lust Cleanup Site	Completed - Case Closed
The Goodyear Tire & Rubber Company	1146 East Monte Vista	Lust Cleanup Site	Completed - Case Closed
Thrifty (Bp)	1491 Monte Vista Ave E	Lust Cleanup Site	Completed - Case Closed
Town Square, Vacaville	501 Main	Lust Cleanup Site	Completed - Case Closed
Travis Air Force Base Nike Battery 10 - Aoi-3 Administrative Area	5887 Hay Road	Military Ust Site	Open - Site Assessment
Travis Air Force Base Nike Battery 10 - Aoi-4 Administrative Area	5887 Hay Road	Military Ust Site	Open - Site Assessment
Travis Air Force Base Nike Battery 10 - Aoi-5 Administrative Area	5887 Hay Road	Military Ust Site	Open - Site Assessment
Travis Air Force Base Nike Battery 10 - Aoi-6 Administrative Area	5887 Hay Road	Military Ust Site	Open - Site Assessment
Travis Air Force Base Nike Battery 10 - Aoi-7 Control Area	Hay Road	Military Ust Site	Open - Site Assessment
Travis Air Force Base Nike Battery 10 - Flammable Materials Storehouse	5887 Hay Road	Military Privatized Site	Completed - Case Closed

Site Name	Address	Site Type	Status
Travis Air Force Base Nike Battery 10 - Hazardous, Toxic, And Radioactive Waste (Htrw) Sites	Hay Road	Military Cleanup Site	Open - Remediation
Travis Air Force Base Nike Battery 10 - Nike Battery 10 (J09ca097)	Hay Road	Military Cleanup Site	Open - Site Assessment
Travis Air Force Base Nike Battery 10 - Removed Pole-Mounted Transformer	5887 Hay Road	Military Privatized Site	Open - Site Assessment
Travis Air Force Base Nike Battery 10 - Removed Transformers	5887 Hay Road	Military Privatized Site	Open - Eligible For Closure
Union Pacific (Former Sprr)	Mason & Depot St	Lust Cleanup Site	Completed - Case Closed
Unocal #4882	390 Monte Vista Ave E	Lust Cleanup Site	Completed - Case Closed
Unocal #5264	167 Bella Vista Rd	Lust Cleanup Site	Completed - Case Closed
Vacaville (Former Tesoro #67114)	800 Merchant Street	Lust Cleanup Site	Completed - Case Closed
Vacaville Cardlock	536 Merchant St	Lust Cleanup Site	Completed - Case Closed
Vacaville City	630 Merchant St	Lust Cleanup Site	Completed - Case Closed
Vacaville Fruit Company	855 Davis Street	Lust Cleanup Site	Completed - Case Closed
Vacaville Sanitary Service	855-1/2 Davis St	Lust Cleanup Site	Completed - Case Closed
Vacaville Usd Yard Case #2	353 Brown St	Lust Cleanup Site	Completed - Case Closed
Vanden Ii	5714 Vanden Road	Lust Cleanup Site	Completed - Case Closed
Zadnick Property	410 Kendal St	Lust Cleanup Site	Completed - Case Closed
Cdcr - California Medical Facility	1600 California Dr	Non-Operating	Closed
Court Galvanizing, Inc.	4937 Allison Parkway	Tiered Permit	Inactive - Needs Evaluation
Fairmont School Site	1355 Marshall Road	School Investigation	Inactive - Needs Evaluation
High School B	Leisure Town Road/El Mira Road	School Investigation	No Further Action
North Village Elementary	Vaca Valley Parkway/Leisure Town Road	School Investigation	No Action Required
Proposed New Science Bldg. Will C. Wood High School	998 Marshall Road	School Investigation	No Action Required
Recology Hay Road	6426 Hay Rd	Non-Operating	Closed
Sprig Circuits, Inc.	765 Eubanks Drive #B	Tiered Permit	Inactive - Needs Evaluation
Vacaville Elementary School #1	West Of Leisure Town Rd./South Of Midway Rd.	School Investigation	No Further Action

Hazardous Materials Incidents Mitigation and Response

Hazardous materials and hazardous wastes in Vacaville are heavily regulated by a range of federal, State, and local agencies. One of the primary hazardous materials regulatory agencies is the California Environmental Protection Agency, Department of Toxic Substances Control, which is authorized by the US Environmental Protection Agency to enforce and implement federal hazardous materials laws and regulations. Solano County has taken the lead in preparing and adopting a hazardous waste management plan for all waste projected to be generated in the county. State law requires all businesses to prepare an inventory of hazardous materials they use and store. The County's Department of Environmental Management receives this information and distributes it to local fire protection agencies. The Solano County Inter-Agency Hazardous Materials Team, part of Solano County's Office of Emergency Services, has responsibility for responding to hazardous materials incidents.

In Vacaville, limited quantities of household hazardous waste may be transported to and dropped off at a recycling center. Local small businesses may also contract with the waste collection service provider to regularly dispose of larger quantities of waste.

Past Occurrences

Major hazardous materials incidents have not occurred on a regular basis in Vacaville. In June 2019, a chemical spill occurred at the intersection of Alamo Drive and Peabody Road, necessitating the closing of the intersection. The chemical was later identified as muriatic acid and was turned over to Vacaville public works for proper disposal.

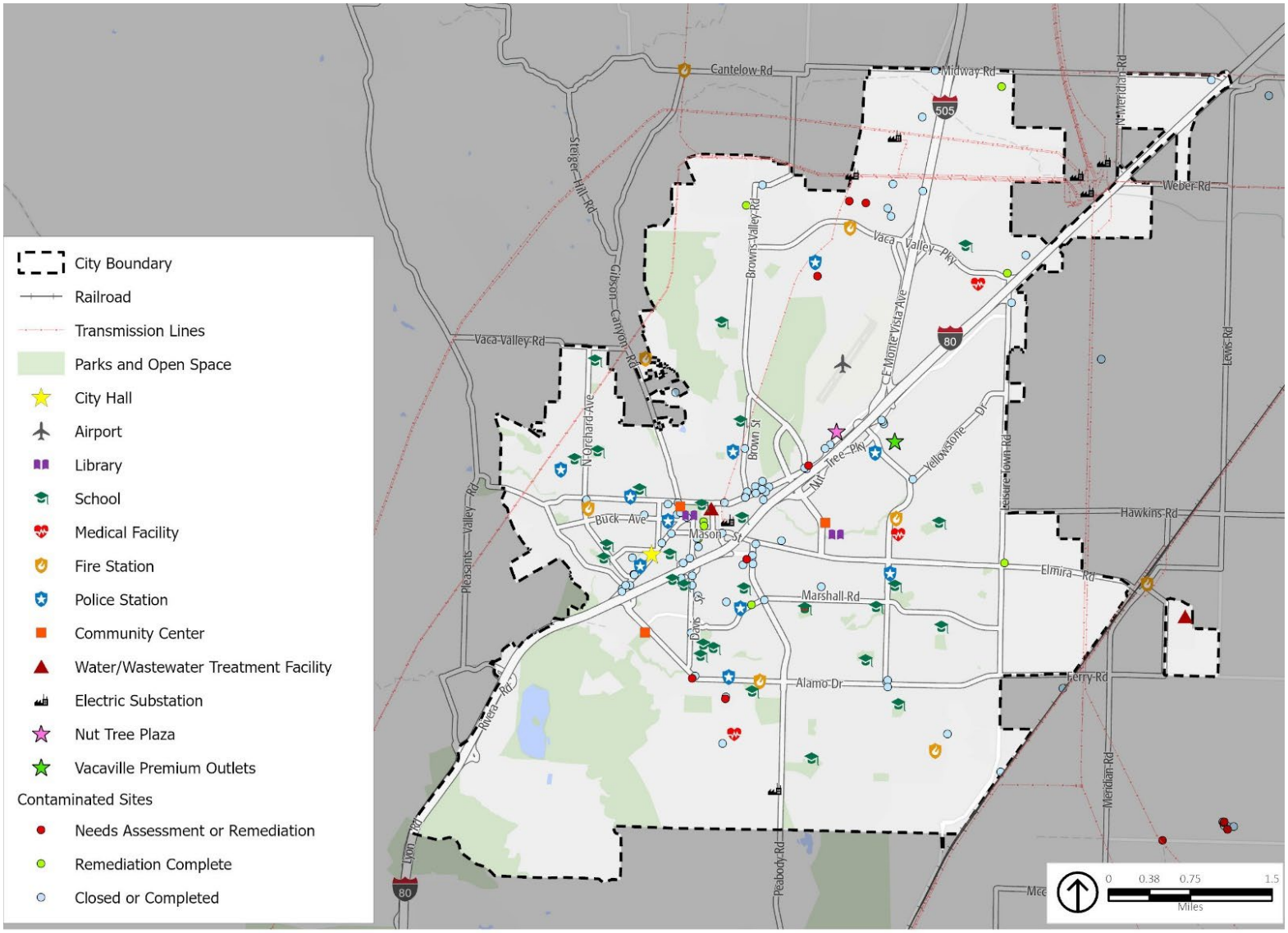
Future Risk

Given Vacaville's limited history of major hazardous materials incidents, it is unlikely a hazardous materials incident will occur in Vacaville on a frequent basis.

Climate Change and Hazardous Materials and Waste

Climate change is unlikely to substantially affect hazardous materials transportation incidents. However, increases in the frequency and intensity of hazards, such as floods, landslides, and severe storms, may create a greater risk of hazardous materials releases during these events.

Figure SAF-13 Hazardous Materials Sites



Source: CalOES 2021, Solano County 2021, PlaceWorks 2022, ESRI

Disaster and Emergency Preparedness

Vacaville Disaster and Emergency Response

The Vacaville Police Department (VPD) and VFD can help the community prepare for and respond to disasters and emergencies. VPD responsibilities include a 24-hour-a-day, 7-day-a-week communication center, crime suppression and prevention, investigations, traffic patrol, and emergency service. VPD participates in a regional Office of Emergency Services mutual aid agreement. This mutual aid agreement is administered through the State of California Office of Emergency Services and is managed at a local level through Solano County. By participating in this mutual aid agreement, VPD commits staff and other resources to assist with disasters throughout the state. In return, VPD receives assistance from outside entities should a significant emergency occur in Vacaville. For emergency medical service, VFD provides Advanced Life Support first responder and ALS transport services. These services include responding to minor injury and major traumatic injury incidents as well as to general and major medical incidents. VFD responds to mass casualty incidents within its larger response area as part of a countywide mutual aid system for ambulances. VFD is actively involved in formal agreements with Dixon, Fairfield, and the Vacaville Fire Protection District to provide automatic aid responses in designated areas. In addition to these automatic aid agreements, VFD also participates in a mutual aid plan with other fire departments in Solano County. Together, the departments have developed a shared alarm matrix that identifies which agencies and units should respond, depending on the size and nature of the incident. VFD also participates in the Statewide Mutual Aid Program.

Vacaville works with the Solano County Office of Emergency Services (OES) to help prevent and respond to emergency events. Solano County OES operates Get Ready Solano, an online clearinghouse of emergency preparedness resources and programs for responding to floods, fires, hazardous materials, terrorist incidents, community warning, and emergency preparedness, response, and recovery. Solano County OES maintains the Solano County Emergency Operations Plan and the Solano County Multi-Jurisdictional Hazard Mitigation Plan, which has an annex for Vacaville-specific hazards. Vacaville uses Alert Solano to notify residents and businesses within Solano County that are impacted by or in danger of being impacted by an emergency. Alert Solano provides basic information about incidents and what specific protective actions are necessary to protect life and health (shelter in place, lockdown, evacuate, avoid the area, etc.).

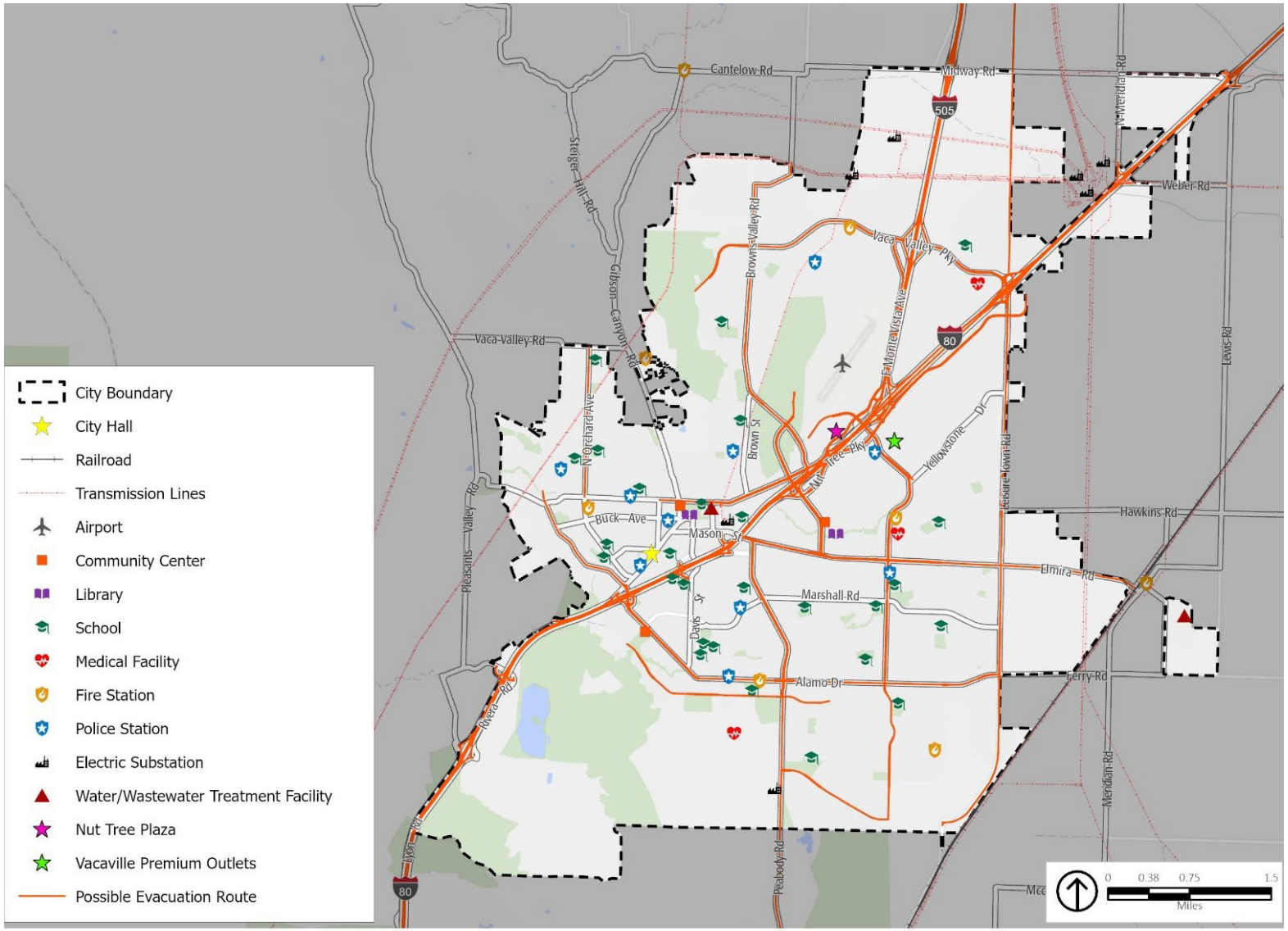
Alert Solano enables agencies within Solano County to provide residents with critical information quickly in a variety of situations, such as severe weather, unexpected road closures, missing persons, and evacuations of buildings or neighborhoods. In the event of an emergency, public safety officials, including local police and fire, send out a message directly to those who have registered for Alert Solano. The Alert Solano emergency notification system allows users to provide customized information to allow the most efficient delivery of emergency information. Alerts can be sent to all devices registered with Alert Solano, maximizing the chances of alerting users in a timely manner. Emergency alerts are also issued on Vacaville's Channel 26. In addition, the City adopted the CAL FIRE program "Ready, Set, Go" that helps educate the community on how to plan, prepare, and stay aware of fire danger.

Emergency Evacuation

With advanced warning, evacuation can be effective in reducing injury and loss of life during a catastrophic event. The primary evacuation routes serving Vacaville include I-80 and Leisure Town Road. Leisure Town Road is identified as a reliever road for I-80 because I-80 may become backed up during a large evacuation. **Figure SAF-14** shows the major roadways serving Vacaville—I-80, I-505, Vaca Valley Parkway, Browns Valley Parkway, Nut Tree Parkway, Orange Drive, North Orchard Avenue, East Monte Vista Avenue, Allison Drive, Elmira Road, Alamo Drive, California Drive, and Peabody Road.

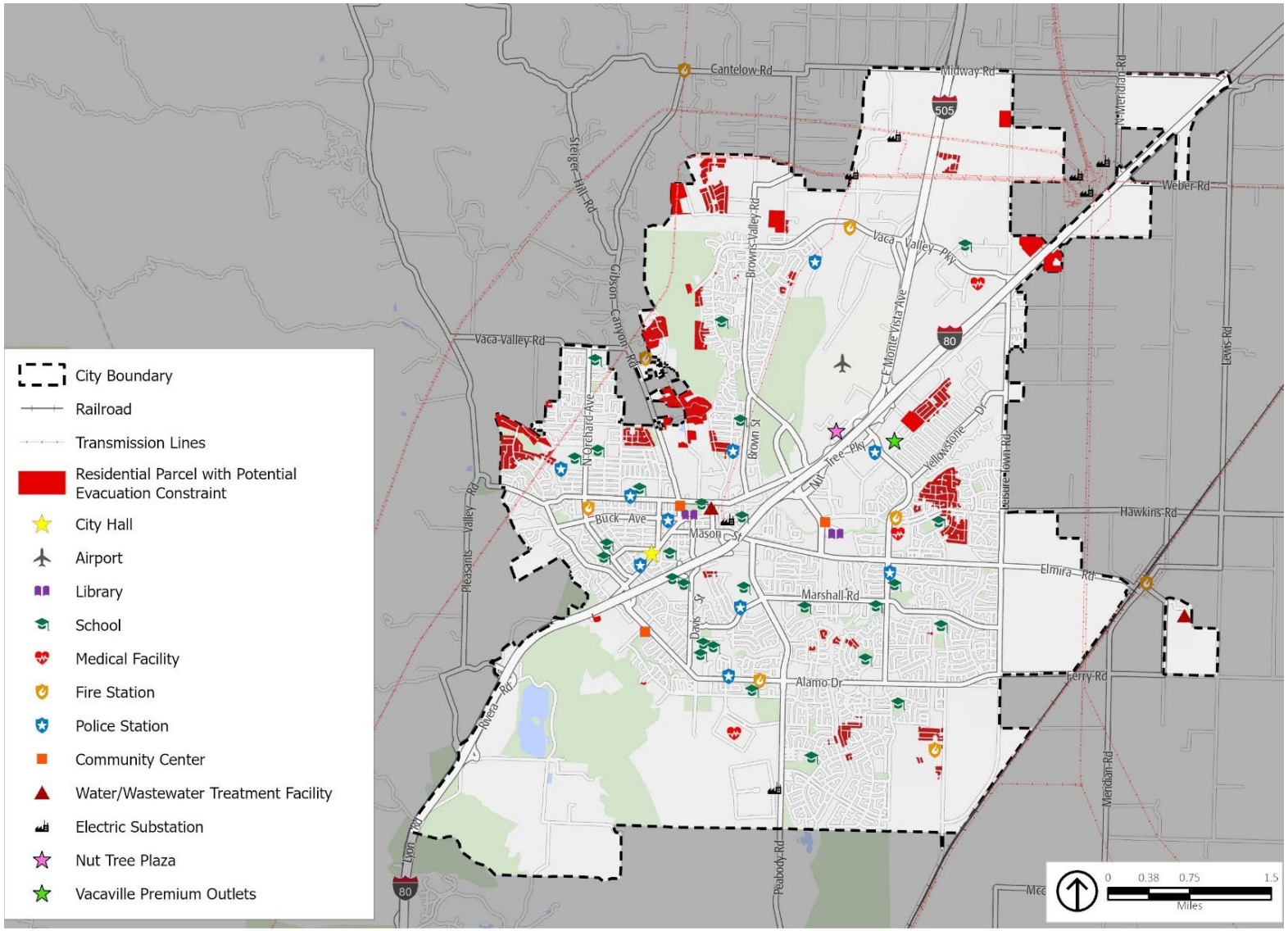
Figure SAF-15 shows residential parcels with evacuation constraints, meaning that these parcels are at least half a mile from a major roadway. Limited points of access may create bottlenecks and further complicate evacuation efforts. The city is currently working to improve evacuation conditions via the Jepson Parkway Concept, which is designed to provide a four-lane roadway from the I-80/Leisure Town Road interchange in Vacaville to the State Route 12/Walters Road intersection in Suisun City.[28]

Figure SAF-14 Evacuation Routes



Source: Solano County 2021, PlaceWorks 2022, ESRI

Figure SAF-15 Evacuation Constrained Parcels



Source: Solano County, PlaceWorks 2022, ESRI

Climate Change and Disaster and Emergency Preparedness

Climate change-related changes in wildfire, flooding, extreme heat, and severe weather patterns will likely make natural-hazards-related emergencies both more frequent and more intense. Given the ability of wildfires, floods, extreme heat, and severe weather to damage structures and infrastructure and to harm human health, increased frequency of these natural hazards will likely raise demand for evacuation routes and evacuation and disaster preparation and recovery assistance.

Additional Climate-Related Hazards

Agricultural and Ecosystem Pests

According to the Solano County Crop and Livestock Report, agriculture and livestock production had a value of $357 million in 2020.[29] In 2020, top agricultural commodities were almonds, tomatoes, nursery products, cattle and calves, and walnuts. These commodities are vulnerable to agricultural pests and diseases, which can affect crop plants, orchards, and nurseries in and around Vacaville.

Major pests of concern in Solano County include Asian Citrus Psyllid, European Grapevine Moth, Glassy-Winged Sharpshooter, Gypsy Moth, Japanese Beetle, Light Brown Apple, Mediterranean Fruit Fly, Melon Fly, Oriental Fruit Fly, Asian Gypsy Moth, Rosy Moth, Nun Moth, and Siberian Silk Moth, along with various plants and microbes.[30] Pesticides and herbicides can help crops resist pests and diseases and new crop varietals may be pest-resistant; however, quickly evolving pests may make it difficult for some plant species to survive; changing crop varietals can also be expensive for farm owners.

Past Occurrences

Two major instances of agricultural pests and diseases have occurred in the area in recent years. False yellowhead (*Dittrichia viscosa)* is a State-listed noxious weed originating from the south Mediterranean, first found in western Solano County in 2014. This was the first documented sighting in California. *D. viscosa* is a world-wide weed of concern that proliferates in disturbed landscapes such as roadsides and burn sites. It is a threat to Solano County's unique biodiversity and is toxic to livestock. The Solano County Agricultural Department, in cooperation with Caltrans, has established an eradication project area between Vallejo and Fairfield.[31]

In 2017, a quarantine was initiated in response to the Mediterranean fruit fly (*Ceratitis capitata*). This quarantine encompassed 108 square miles of Solano County and was declared eradicated in August 2018 by the California Department of Food and Agriculture and the Solano County Agricultural Commissioner's Office. Eradication efforts included fruit removal from trees in hot spot areas, organic insecticidal bait treatments, and the release of over 100 million sterile Mediterranean fruit flies to disrupt the reproduction cycle of the pest.[32] Along with these two instances, there are numerous agricultural and ecosystem pests and diseases that occur in limited instances in and around Vacaville.

Agricultural and Ecosystem Pest Reduction and Response

Pest exclusion is the first line of defense to prevent detrimental, non-native pests from entering the county. In 2020, a total of 457 premise visits occurred at shipping terminals, nurseries, and residences in the county. During these visits, 2,002 shipments of plant material, seed, and household goods were inspected. A total of 17 shipments were rejected for live pests, material not properly certified, or improper container markings. County staff inspected 11 production nurseries, encompassing 1,572 acres, for pests and diseases.

Pest detection is Solano County's second line of defense against the introduction and spread of insect pests of concern. Insect traps are placed throughout the county and monitored for early detection of pests. In 2020, 22,320 inspections were conducted on a total of 2,712 traps.

The County also implements the following programs to address agricultural and ecosystem pests and diseases:

- The Pierce's Disease Control Program works to prevent the spread of the glassy-winged sharpshooter into Solano County, which is the main insect vector of Pierce's Disease. In 2020, Department personnel inspected 533 shipments of nursery stock arriving from infested counties in California.
- The Sudden Oak Death program prevents the spread of the disease caused by the pathogen *Phytophthora ramorum*. Department personnel conducted 46 inspections at 9 production shipping nurseries.
- The Phytosanitary Certification Program ensures that plants and plant communities shipped to other states or foreign countries are free from injurious pests. Solano County personnel performed 812 phytosanitary field inspections on 7,137 acres of seed crops.[33]

Potential Changes to Agricultural and Ecosystem Pests in Future Years

Likelihood of Future Occurrence

Agricultural and ecosystem pests will likely maintain an ongoing presence in Solano County and Vacaville, though their activity can be at least partially managed via the County's pest-control initiatives.

Climate Change and Agricultural and Ecosystem Pests

Pest and diseases activity is likely to increase as higher temperatures caused by global warming allow insects to reproduce more rapidly and increase the activity window for pests and diseases. Row crops can be affected by fungal pathogens and invasive disease vectors as temperatures continue to rise, affecting the quality and viability of crops.

Due to the severe vulnerability of agriculture to pests and diseases, outdoor workers and immigrant communities are also highly vulnerable. Persons working in these industries may experience economic harm during significant outbreaks. Damage to agricultural assets can reduce work opportunities, create economic hardships for some workers, and cause employees to be let go from their jobs when farms experience economic hardships.

The agricultural and livestock industries could be impacted by pests and diseases, which harm the quality or viability of agricultural products Pesticides and herbicides can help crops resist pests and diseases, and new varietals of crops can be planted that may be pest resistant. The County does have several pest exclusion and detection programs that could help detect and eradicate pests and diseases.[34] However, if the pests and diseases evolve quickly, this may not be possible for all plant species. Similarly, livestock operators can use medicine and other methods to prevent or slow the spread of animal pathogens. However, this may become more difficult to do as pests and diseases worsen and combined with drought and extreme heat.

Oak savanna and oak woodland ecosystems are particularly susceptible to sudden oak death. Due to the spread-out nature of oak savannas and absence of other species that can carry sudden oak death, oak savannas may not be harmed as severely as oak woodlands. Increases in drought conditions and more severe winds can cause

rapid spreading of this disease, overwhelming natural disaster and recovery activities.[35] Urban trees can also be harmed by sudden oak death or other tree pathogens, especially when trees are weakened by extreme heat, drought, and severe weather.

Drought

A drought is an extended period when precipitation levels are well below normal. Drought is a normal part of the climate cycle. Drought may cause losses to agriculture; affect domestic water supply, energy production, public health, and wildlife; or contribute to wildfire. Like most of California and the western United States, Vacaville chronically experiences drought cycles. Drought impacts the city's water supply, which may, in severe instances, ultimately makes less water available for people, businesses, and natural systems.

Local ecosystems that are not well adapted to drought conditions can be easily harmed. During drought events, the flow of water in creeks and streams is reduced, creating more slow-moving or standing water. This can concentrate sediment and toxins in the low water levels, causing harm to plants and animals. Droughts can also indirectly lead to more wildfires, and the stress caused by water shortages can weaken plants, making them more susceptible to pests and diseases.

The U.S. Drought Monitor recognizes a five-point scale for drought events: D0 (abnormally dry), D1 (moderate drought), D2 (severe drought), D3 (extreme drought), and D4 (exceptional drought). During severe drought conditions, water shortages are common and water restrictions may be imposed to meet essential community needs.

Vacaville relies of a variety of sources to fulfill its water needs. The City uses Solano Project water from Lake Berryessa, State Water Project and Settlement Water from the North Bay Aqueduct, and groundwater from local wells.

Water from Lake Berryessa is diverted through the Putah Diversion Dam to the Putah South Canal, which transports water to the eight Solano County Water Agency (SCWA)-member agencies for Solano Project water. SCWA, acting as a water wholesaler, has entered into agreements with cities, districts, and other agencies, including the City of Vacaville, to provide water from the Solano Project. In addition to its entitlement from SCWA, the City maintains a Master Water Agreement with the Solano Irrigation District (SID), in which the City receives an increasing supply of water through the year 2039 and a consistent supply thereafter until the year 2050.

Surface water the City receives from the State Water Project is delivered through the North Bay Aqueduct. SCWA acts as the contractor for all State Water Project allocations within Solano County, so all the City's water from the State Water Project is supplied through the SCWA. The water supply from the State Water Project is less reliable than the water supply from the Solano Project because of the large scale of the State Water Project; shortages occurring anywhere in the State Water Project impact the City's supply.

Vacaville overlies portions of two groundwater basins. The City primarily overlies the northwestern portion of the Solano Subbasin, one of the southern subbasins of the greater Sacramento Valley Basin. A small part of the southern portion of Vacaville overlies the Suisun-Fairfield Valley Basin, but the City does not own or operate any wells within that area. The City currently operates eleven wells to pump groundwater from the basin underlying the City.

Past Occurrences

Major droughts have occurred periodically in the Solano County region. Recent major droughts include:

- **1975 to 1977.** The two driest years (1976 and 1977) in the State of California's history resulted in severe drought conditions in Solano County. The drought was declared an emergency (FEMA-EM-3023) on January 20, 1977, and a state disaster in Solano County in February 1976. Total crop damages statewide totaled $2.67 billion dollars for both years ($888.5 million in 1976 and $1.8 billion in 1977).

- **1991.** A drought emergency was declared for Solano County. The US Department of Agriculture provided $995 million for crop losses in 1990–1991 nationwide, and an additional $775 million in emergency funds for 1990–1992 crop losses.

- **2004:** The Small Business Administration declared an Economic Injury Disaster in Solano County (Declaration #10073) for drought conditions, which occurred March 1 through September 23, 2004. Small, nonfarm businesses in Solano County were able to apply for Economic Injury Disaster Loans to cover working capital needs. The declaration covered the impact of reduced revenue caused by the drought. These loans were available to offset the economic losses caused by reduced revenue from farmers and ranchers whose crop production suffered.

- **2006 to 2009.** A California State–declared three-year drought of below-average rainfall, low snowmelt runoff, and the largest court-ordered water restricting in the state's history. The dry conditions damaged crops, deteriorated water quality, and caused extreme wildfire danger. Approximately $300 million in agricultural revenue loss, and a potential $3 billion in economic losses over time.

- **2012 to 2015.** The State of California imposed water conservation standards throughout the state, which required that the City of Vacaville reduce its water use by 32 percent. This regulation triggered the City to implement its Urban Water Shortage Contingency Plan Stage 3 response, wherein the City Council established residential household allocations; specified watering days for residential and commercial, industrial, and institutional customers; and implemented penalties for water use in excess of established allocations. The dry conditions damaged park, setback, and private landscaping that relies upon potable water. Dry conditions in the surrounding open space areas increased wildfire danger.

More recently, in 2021, from April through the end of the year, the county was also classified as being in "extreme" drought. As of May 2022, western Solano County, including Vacaville, was classified as being in "severe" drought and eastern Solano County was classified as being in "extreme" drought.

Drought Mitigation and Response

The City is able to manage its water supply based on water availability from each of its primary sources, using more surface water in wet years and more groundwater in dry years. Groundwater conditions are consistently monitored, and levels have been stable for over a decade. The City is also planning to develop recycled water as a future supply for irrigation and industrial uses.

The City of Vacaville has adopted Municipal Code Chapters 13.20 (Water Conservation in Normal, Drought, and Emergency Conditions) and 14.27 (Water Efficient Landscaping) to promote water conservation and mitigate the severity of drought conditions. The City of Vacaville's 2020 Urban Water Shortage Contingency Plan contains actions to implement and enforce regulations and restrictions for managing a water shortage when it declares a water shortage emergency under the authority of the Water Code.

Potential Changes to Drought in Future Years

Likelihood of Future Occurrence

Drought is different than many of the other natural hazards in that it is not a distinct event and usually has a slow onset. Drought can severely impact a region both physically and economically, affecting different sectors in different ways and with varying intensities.

The city has a high level of redundancy in its water supply sources, with surface water from the Solano Project and State Water Project, and groundwater from local production wells. This diversity increases the city's resilience to the impacts of climate change. Though long-duration, severe drought conditions would stress all three sources of water, groundwater and surface water supplies are projected to meet or exceed projected water demands even during extended drought conditions.

Based on historical information, the occurrence of drought in California, including Vacaville, is cyclical, driven by weather patterns. Drought has occurred in the past and will occur in the future. Periods of actual drought with adverse impacts can vary in duration, and the period between droughts is often extended. Although an area may be under an extended dry period, determining when it becomes a drought is based on comparing observed precipitation with what is normal (climatologic), comparing soil moisture and crop conditions with what is normal (agricultural), or by looking at how much water is contained in snow, the level or flow rate of moving water, water in reservoirs, or groundwater levels (hydrologic). However, how individuals recognize drought depends on the ways in which it affects them. The impacts from drought include reduction in water supply and an increase in dry fuels.

Climate Change and Drought

Although droughts are a regular feature of California's climate, scientists expect that climate change will lead to more frequent and intense droughts statewide. Overall, average annual precipitation levels are expected to increase slightly in Vacaville. However, the state's current data say that there will be more years with extreme levels of precipitation, both high and low, as a result of climate change. This is expected to cause more frequent and intense droughts—compared to historical norms—that cause soil to dry out and become hard. When precipitation does return, more water runs off the surface than is absorbed into the ground, which can lead to floods. Higher air temperatures are expected to increase evaporation, causing more water loss from lakes and reservoirs, exacerbating drought conditions.

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 the imported water supply for Vacaville.

Under future climate change conditions, more precipitation is likely to fall as rain instead of snow, and the snow that does fall is expected to melt earlier, reducing the Sierra Nevada spring snowpack by as much as 70 to 90 percent. Depending on the location and emissions levels, the state Cal-Adapt database indicates the snowpack (i.e., snow water equivalent) for the Tahoe-Sierra Integrated Regional Water Management Region in the spring is expected to decline from a historical average of 16.1 inches to an average of 7.8 inches (a 52 percent decrease) by the middle of the century (2035 to 2064), and an average of 2.9 inches (an 82 percent decrease) by the end of the century (2070 to 2099). How much snowpack will be lost depends in part on future precipitation patterns, the projections for which remain uncertain. However, even under wetter climate projections, the loss of snowpack would pose challenges to water managers and hamper hydropower generation.

The state Cal-Adapt database of climate projections indicate that snowpack (i.e., snow water equivalent) for the Westside (Yolo, Solano, Napa, Lake Colusa) Integrated Regional Water Management Region may decrease from a historical baseline of 10.5 inches to 0.2 inches under a late-century drought scenario (2051 to 2070) and may disappear completely under an early-century drought scenario (2023 to 2042). Baseflows within the Westside region may decline from a historical average of 6.1 inches to 3.1 inches under a late-century drought scenario (2051 to 2070) and may cease completely under an early-century drought scenario (2023 to 2042).

Drought may stress the Solano Project and Sacramento watershed supplies[36] and increase reliance on groundwater. The Solano Subbasin may be drawn down and groundwater quality may decline, and residents and businesses may see water restrictions and financial hardships.

Communities most vulnerable to drought include those whose financial resources may be strained by increased in water prices, those whose work depends on continued water availability, and those who already have reduced access to high-quality water. This includes households in poverty and low-resourced people of color may have to constrain water use in response to drought pricing, and outdoor workers and immigrant communities who are more likely than the general population to experience work stoppages during drought.

Drought conditions can decrease the availability of ground and surface water for irrigation and animal husbandry. Major crops, such as almonds, tomatoes, and nursery products, are highly dependent on irrigation from groundwater wells or the Solano County Water Agency. Similarly, many livestock species, especially cattle, require large amounts of water. The problem is particularly significant for animals raised on feed, as feed crops themselves require large amounts of water. Insufficient access to water can cause livestock growth to slow or stop and may increase the risk of sickness or animal mortality.[37] Negative impacts to the agricultural industry may have ripple effects on the associated food processing and wholesale trade industries.

Drought could reduce water inflow into riparian and wetland habitats, which can impact water quality and harm the plants and animals that rely on these ecosystems.

Extreme Temperatures

Extreme Heat

While there is no universal definition of extreme heat, California guidance documents define extreme heat as temperatures that are hotter than 98 percent of the historical high temperatures for the area, as measured between April and October of 1961 to 1990. Days that reach this level are called extreme heat days. In Vacaville, the extreme heat threshold is 102.5°F. An event with five extreme heat days in a row is called a heat wave.

Health impacts are the primary concern with this hazard, though economic impacts are also an issue. The Centers for Disease Control and Prevention recognize extreme heat as a substantial public health concern. Historically, data from the National Oceanic and Atmospheric Administration indicate that about 175 Americans die from summer heat, although this number has increased in recent years. From 2004 to 2018, studies by the U.S. Department of Health and Human Services indicate that there is an average of 702 deaths annually that are directly or indirectly linked to extreme heat.

Extreme heat events are dangerous because people exposed to extreme heat can suffer a number of heat-related illnesses, including heat cramps, heat exhaustion, and (most severely) heat stroke. As reflected in the Vulnerability Assessment, elderly persons, small children, chronic invalids, those on certain medications or drugs, and persons with weight and alcohol problems are particularly susceptible to heat reactions. The elderly and individuals below the poverty level are the most vulnerable to extreme heat. Nursing homes and elder-care facilities are especially vulnerable to extreme heat events if power outages occur and air conditioning is not available. In addition, individuals below the poverty level may be at increased risk to extreme heat if use of air conditioning is not affordable. Areas with lower extreme heat thresholds are not necessarily at lower risk, because persons and community assets used to cooler temperatures may be less prepared for extreme heat events.

Vacaville experiences the urban heat island effect, meaning that temperatures within the city are often significantly higher than those within outlying, less developed areas. Urban heat islands often occur in areas that lack open space and shade and are heavily built up with heat-absorbing materials such as asphalt. During high heat events, demand for air conditioning and other types of cooling services will likely be elevated with urban heat islands, and the health effects of high heat may be especially severe. While areas affected by the urban heat island effect occur throughout the city, the northern half of the city is especially vulnerable.[38] Residents of older homes, which are more likely to lack air conditioning and effective insulation, are also vulnerable to high heat. Approximately 42 percent of Vacaville's housing stock was constructed prior to 1980.[39]

Very high temperatures can harm plants and animals that are not well adapted to them, including natural ecosystems. Extreme heat can increase the temperature of water in lakes, streams, creeks, and other water bodies, especially during drought events when water levels are lower. In some cases, water temperatures may exceed comfortable levels for several plants and animals, causing ecological harm. Outdoor workers in construction or landscaping are also much more exposed to the elements than most people, so they are more susceptible to extreme heat conditions and the potential illnesses associated with very high temperatures.

Indirectly, extreme heat puts more stress on power lines, causing them to run less efficiently. The heat also causes more demand for electricity (usually to run air conditioning units), and in combination with the stress on the power lines, may lead to brownouts and blackouts.

Past Occurrences

High temperatures occur on a near-annual basis in Vacaville and the greater Solano County area. In June 2000, very hot weather persisted across interior Northern California for three days. Sixteen people were treated for heat stroke in Sacramento and Solano counties and one, a 16-year-old male in West Sacramento, died. A heavily used portion of I-80 between Sacramento and San Francisco was closed for several hours to repair three lanes in which the asphalt had buckled due to the sustained heat. Power outages were suffered by more than 100,000 customers during the event. In June 2013, strong high pressure built across the Solano County region, which

resulted in very hot temperatures on June 7th and 8th, accompanied by warm overnight temperatures. The heat sickened at least 15 people, 2 critically. Many of those stricken suffered heat exhaustion and heat stroke and ranged in age from 15 to more than 80 years of age.

Extreme Heat Mitigation and Response

The City of Vacaville has helped the public cope with previous extreme heat events by operating cooling centers. Cooling center locations have included Three Oaks Community Center, McBride Center, and the Ulatis Community Center. Solano County libraries have also served as cooling centers.

Extreme Cold

When winter temperatures drop significantly below normal, staying safe and warm can become a challenge. Cold temperatures can lead to injury or death from hypothermia, freeze pipes and sprinklers, and harm agricultural products. Residents who face excessive exposure to cold outdoor temperatures are especially vulnerable —including outdoor workers and those experiencing homelessness. Those living in housing with insufficient insulation may struggle to keep their homes adequately warm, potentially suffering from discomfort and elevated energy costs. Use of space heaters and fireplaces to stay warm can increase the risk of household fires and carbon monoxide poisoning.[40]

Past Occurrences

Cold winter temperatures are a fairly regular occurrence in Vacaville. Within Solano County, noteworthy cold weather events occurred in 1996, 1998, 2005, 2006, 2007, 2008, 2009, 2018, and 2022. Damage to crops and burst pipes were reported in conjunction with some of these events; no fatalities were reported.

Extreme Cold Mitigation and Response

The City of Vacaville and community partners operate warming centers during extreme cold events. Past warming center locations have included Three Oaks Community Center, Opportunity House, and various Vacaville churches.

Potential Changes to Extreme Temperatures in Future Years

Likelihood of Future Occurrence

Extreme heat and cold winter temperatures both tend to occur on an annual basis and are likely to continue occurring annually. Due to Vacaville's inland location and low elevation, high temperatures will continue to be a more common occurrence than cold temperatures.

Climate Change and Extreme Temperatures

The warmer temperatures brought on by climate change are likely to cause an increase in extreme heat events. Depending on the location and emissions levels, the state Cal-Adapt database indicates the number of extreme heat days is expected to rise from a historical annual average of 5 to 28 by the middle of the century (2035 to 2064), and an average of 49 by the end of the century (2070 to 2099).

Overall, Vacaville is expected to see an increase in the average daily high temperatures. Depending on the future severity of climate change, the state Cal-Adapt database indicates the annual average maximum temperature is expected to increase from a historical annual average of 74.2°F to an average of up to 79.6°F by the middle of the century (2035 to 2064), and an average of up to 82.9°F by the end of the century (2070 to 2099). As

temperatures increase, Vacaville residents will face increased risk of death from dehydration, heat stroke, heat exhaustion, heart attack, stroke, and respiratory distress caused by extreme heat.

Generally, climate change is associated with an increase in average annual temperature. Vacaville's average minimum temperature is projected to increase from a historical average of 46.6°F to between 50.5°F and 51.4°F by midcentury (2035 to 2064) and between 51.7°F and 55°F by the end of the century (2070 to 2099). However, though average winter temperatures may generally increase slightly, this does not preclude the possibility to extreme cold weather events. Residents may become increasingly sensitive to the effects of cold weather as it becomes less frequent. Reduced chilling hours may also interfere with crop production, especially for fruit and nut trees.[41]

According to the vulnerability assessment, the communities most vulnerable to extreme heat are those who face particularly high levels of heat exposure, those who lack the financial or social resources to improve their resiliency to heat or recover from the impacts of high heat events, and those who are physiologically more sensitive to the health effects of heat exposure. These at-risk populations include outdoor workers, incarcerated persons, low-income persons, people without lifelines, and those experiencing homelessness, who face especially high levels of heat exposure and may have limited resources available to increase their adaptive capacity or otherwise protect themselves. for protecting themselves from the impacts of heat or seeking medical care in the event of exposure. Children, seniors, pollution-burdened populations, and those with chronic illnesses or disabilities are especially sensitive to the health impacts of heat.

Extreme heat could interfere with energy and transportation infrastructure and services in Vacaville. Extreme heat can damage energy infrastructure and cause an increase in air conditioning use, which can stress and overload the grid, subsequently causing rolling power outages and damage to the lines. Extreme heat can also lead to thermal expansion of railroad tracks and cause warping or buckling of the tracks and damage to pavement on roadways.[42] This can subsequently cause train accidents, slowing of rail and freight services, or suspension of all rail traffic. Extreme heat may also cause fewer people to use public transit or active transportation since it may be made uncomfortable in the heat, increasing demand for private vehicle transportation and further straining transportation infrastructure.

Extreme heat could imperil the agricultural and livestock industries by altering the variety of crops that can be grown in the region and diminish productivity of some crops, while increasing the productivity of others. Warmer temperatures may also increase water demands for agriculture and reduce plant growth.[43,44] Extreme heat is also highly harmful to livestock animals. Temperatures above 100 degrees can create heat stress, increasing the risk of infection, reducing milk production and fertility, and may lead to death, particularly among animals that are already stressed by illness. Groundwater may be pumped more rapidly during extreme heat and higher air temperatures because farmers will likely have to use more water to maintain crops and livestock. This can cause overdraft of the groundwater basin.

Human Health Hazards

Human health hazards are bacteria, viruses, parasites, and other organisms that can cause diseases and illness in people. Some of these diseases may cause only mild inconvenience, but others are potentially life threatening. In the context of this Safety Element, human health hazards refer to diseases carried by animals such as mice and rats, ticks, and mosquitos. Warmer temperatures and high levels of precipitation can lead to increased populations of disease-carrying animals, creating a greater risk of disease and increased rates of infection.

Past Occurrences

Isolated incidents of West Nile Virus and Lyme Disease have been a perennial concern within Solano County. However, there are no records of recent widespread disease incidents in Vacaville associated with human health hazards.

Potential Changes to Human Health Hazards in Future Years

Likelihood of Future Occurrence

Human health hazards of various scales and levels of severity are likely to occur in the future, given that such hazards have occurred in the past and all expectations are that these hazards are likely to remain.

Climate Change and Human Health Hazards

Increases in average temperature and changes in precipitation patterns favoring larger precipitation events may facilitate the growth and activity of disease-carrying vectors. Overall risk of human health hazards is thus expected to increase.

Communities most likely to be impacted by human health hazards include those who are already physiologically sensitive to illness, those who lack access to adequate medical care, and those who live or work in conditions that increase their risk of disease exposure. Those who are especially sensitive to illness include those with chronic illnesses or disabilities, pollution-burdened populations, and seniors. Seniors may encounter transportation and financial barriers to seeking medical care, as might low-resourced households, incarcerated and formerly incarcerated individuals, outdoor workers, individuals experiencing homelessness, and those without access to lifelines such as phone service or a private vehicle. Many low-resourced households are also more likely than the general population to live or work in conditions that increase their risk of disease exposure.

Widespread public health events could have ripple effects across industries as businesses are forced to curtail operations or close due to public health orders or large numbers of employees falling ill, creating economic harm. Likewise, increased demand for medical care could strain Vacaville's emergency medical response resources.

Severe Weather

Severe weather is generally any destructive weather event and can occur in the form of heavy rain, hail, thunderstorms, and strong winds. 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 vary widely and may include injuries or deaths, damage to buildings and structures, fallen trees, roads and railways 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 (e.g., bus stops, carports), fences, telephone poles, or trees can also be struck directly by lightning, which may result in an explosion or fire.

A relatively common weather pattern that brings southwest winds and heavy rain to California is often referred to as an atmospheric river. Atmospheric rivers are long, narrow regions in the atmosphere that transport most of the water vapor carried away from the tropics. These columns of vapor move with the weather, carrying large amounts of water vapor and strong winds. When the atmospheric rivers make landfall, they often release

this water vapor in the form of rain or snow, often causing heavy rains that can lead to flooding and mudslide events.

A thunderstorm is a rain event that includes thunder and lightning. A thunderstorm is classified as "severe" when it contains one or more of the following: hail with a diameter of three-quarter inch or greater, winds gusting in excess of 57.5 miles per hour (mph), or tornado. However, tornadoes are uncommon in Solano County; only four have been recorded in the county since 1950.

High winds, often accompanying severe storms, can cause significant property damage, threaten public safety, and have adverse economic impacts from business closures and power loss. High winds, as defined by the National Weather Service, are sustained wind speeds of 40 mph or greater lasting one hour or longer, or wind gusts of 58 mph or greater for any duration. These winds may occur as part of a seasonal climate pattern or in relation to other severe weather events, such as thunderstorms.

All wind events pose several different types of threats. By themselves, the winds pose a threat to the health of people and structures in the city. Dust and plant pollen blown by the wind can create breathing problems. The winds can blow roofs off buildings and cause tree limbs to fall on structures. High winds also increase the threat of wildfires. Winds may dry out brush and forest areas, increasing the fuel load in fire-prone areas. Winds may spark wildfires by knocking down power lines or causing them to arc. If wildfires do start, high winds can push flames quickly into new areas, contributing to rapid spread of wildfires and making them harder to control. This can affect the air quality in Vacaville and may disrupt regional infrastructure networks.

Past Occurrences

The greater Solano County area is subject to extreme weather events, most frequently in the form of heavy rain, high wind, thunderstorms, and fog. In December 1997, dense fog contributed to a chain reaction collision on I-5 near Lambert, 17 miles south of downtown Sacramento, where 5 were killed and 26 were injured. In December 1998, one person was killed and ten injured during a dense fog event that resulted in a vehicle pileup ten miles northwest of downtown Sacramento on I-5.

In June 2000, one person was killed during a high wind event. Sustained winds of 30 to 40 miles per hour blew through Carquinez Strait, pushing a motorcyclist on I-680 off the highway near Marshview Road.

In January 2021, an atmospheric river event caused heavy rain and high winds across Northern California. Thousands of Vacaville residents lost power, and rockslides, flooding, road closures, and downed trees occurred across the region.[45] Heavy rains also occurred in October 2021, triggering road closures, downed trees, and flooding across Solano County, including Vacaville.[46]

Public Safety Power Shutoff Events

Electricity utilities throughout California, including Pacific Gas and Electric Company (PG&E), have begun to occasionally "de-energize", or turn off the electricity for power lines that run through areas where there is an elevated fire risk. This is intended to reduce the risk of power lines sparking or being damaged and starting a wildfire. As previously described, these activities, called Public Safety Power Shutoff (PSPS) events, result in a loss of power for customers served by the affected power lines. A PSPS event may occur at any time of the year, usually during high wind events and dry conditions. PSPS events may be limited to specific communities, or they may affect broad swaths of the state.

Four PSPS events affected Solano County in 2019, affecting more than 25,000 customers. Vacaville was affected by a PSPS in October 2021, which affected approximately 2,500 customers in the City of Vacaville, 4,700 customers across Solano County, and 24,000 customers across Northern California.[47,48] Two additional PSPS events affected Solano County in August and September of 2021. Both events were triggered by concerns over high wind and dry vegetative conditions.

PSPS events can impact emergency management activities. A loss of power can make it more difficult for homes or businesses to receive emergency notifications if needed. PSPS events can also create vulnerabilities for community members that lack backup power supplies and depend on electricity for heating or cooling homes and buildings, lighting, and internet. PSPS events may also be harmful to people who depend on electrically powered medical devices. Additionally, community members may be faced with economic hardships and be deprived of important services, such as grocery stores, gas stations, and banks/ATMs. Traffic lights and other traffic-control systems may not work, which can complicate any evacuation needs and may hinder emergency response. Although critical public health and safety facilities often have backup generators, the loss of power may also disable other key infrastructure systems.

Potential Changes to Severe Weather in Future Years

Likelihood of Future Occurrence

According to historical hazard data, severe weather is an annual occurrence in Solano County. Damage related to severe weather has occurred and will continue to occur in the future. Strong winds are the most frequent type of severe weather occurrences in the county. Wind and lightning often accompany these storms and have caused damage in the past. However, actual damage associated with the primary effects of severe weather have been limited. It is the secondary hazards caused by severe weather, such as floods and fire, which have had the greatest impact on the county. In general, any severe storm that affects Solano County has local effects in Vacaville as well. Thunderstorms, high winds, and lightning can each have localized impacts on infrastructure, properties, and public safety. Transportation, including freight shipping, faces increased congestion when severe storms occur.

Climate Change and Severe Weather

Climate change is expected to cause an increase in intense rainfall and strong storm systems, which is usually associated with strong storm systems. This means that Vacaville could see more intense weather resulting from these storms in the coming years and decades, although such an increase may not affect all forms of severe weather. While average annual rainfall may increase only slightly, 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 flooding.

The communities most vulnerable to severe weather include those whose living or employment situation increases their exposure to severe weather, those who lack the financial or social resources to recover from damages caused by severe weather, and those who may encounter barriers to evacuation. These groups are more likely than the general population to live or work in conditions that expose them to the effects of severe weather. Several of these groups may also lack financial or social resources to improve the resiliency of their structures, seek medical care, or recover from the effects of lost or damaged property or lost work due to severe weather in a timely manner. Individuals with chronic illnesses or disabilities, seniors, individuals lacking access to lifelines such as phone service or a private vehicle, and those living on single access roads may face challenges

evacuating, receiving emergency weather alerts, or reaching emergency services, and could also suffer health effects due to loss of power or loss of connectivity to the larger community.

Transportation, communication, and energy infrastructure and services could all be damaged or interrupted by severe weather, particularly severe wind and heavy rainfall. Damage to bridges, roadways, and railways could isolate communities that rely on these structures and disrupt regional commuting patterns and economic activity. Damage to communication facilities could cause the communication facilities to be turned off and not able to meet the demand of the community. Damage to electricity transmission and distribution lines cause secondary impacts, such as power outages, which would impact Vacaville residents and businesses. As seen from 2019 to present through PG&E public safety power shut-offs, residents may not have adequate time to prepare if the power is shut off for multiple days. Likewise, hazardous materials sites can be damaged or essential functions disrupted due to high winds, heavy rainfall, lightning, and Public Safety Power Shutoff (PSPS) events. This can cause fires and the release of hazardous materials into the surrounding air, water, and soils.

Older buildings, including historic structures such as Vacaville Town Hall, Pena Adobe, Will Buck House, and homes constructed prior to 1980 can be damaged by severe wind, heavy rainfall, and debris carried by severe weather events.

Severe weather can harm agricultural land and ecosystems. High winds, hail, and thunderstorms can damage agricultural operations. Crops can be flattened by high velocity winds and damaged by hail.[49] This can severely damage the agricultural economy in the areas surrounding Vacaville and bring economic hardship to farm owners and employees. Oak savannas and woodland can be harmed by sudden oak death, which can more easily spread through high velocity winds and heavy rainfall.[50] Severe storms can cause trees to fall in riparian areas, which can disrupt the flow of water through the systems and impact aquatic wildlife in the streams.

[1] Bedsworth, Louise, Dan Cayan, Guido Franco, Leah Fisher, Sonya Ziaja. (California Governor's Office of Planning and Research, Scripps Institution of Oceanography, California Energy Commission, California Public Utilities Commission). 2018. *Statewide Summary Report. California's Fourth Climate Change Assessment.* Publication number: SUMCCCA4-2018-013.

[2] RCPs are scenarios that include time series of emissions and concentrations of the full suite of greenhouse gases, aerosols, chemically active gases, and land use/land cover. RCP 4.5 is considered an intermediate stabilizing pathway; RCP 8.5 is considered a high-emissions pathway.

[3] Community populations are groups of people that may be uniquely vulnerable to climate change hazards due to existing stressors such as financial instability, health conditions, mobility challenges, and housing conditions.

[4] University of California Berkeley Seismology Lab. "Hayward Fault: Hazards and Preparedness." https://seismo.berkeley.edu/hayward/hayward_hazards.html, accessed May 27, 2022.

[5] USGS. 2018. "The Hayward Fault – Is It Due for a Repeat of the Powerful 1868 Earthquake?" https://www.usgs.gov/news/featured-story/hayward-fault-it-due-repeat-powerful-1868-earthquake, accessed May 27, 2022.

[6] Solano Subbasin Groundwater Sustainability Agency. 2021. Solano Subbasin Groundwater Sustainability Plan. https://www.solanogsp.com/viewgsp/

[7] USGS, 2015. https://www.usgs.gov/news/featured-story/south-napa-earthquake-one-year-later, accessed May 27, 2022.

[8] Watt, J., Ponce, D., Parsons, T., Hart, P. 2016. "Missing link between the Hayward and Rodgers Creek faults." Science Advances 2(10). https://www.science.org/doi/10.1126/sciadv.1601441

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[10] Dynamic Planning Solutions. 2022. Solano County Multi-Jurisdictional Hazard Mitigation Plan, Vacaville Annex. https://www.dropbox.com/s/zabnvb4tqajqkfg/Solano-MJHMP-ANNEX-Vacaville.pdf?dl=0.

[11] Dynamic Planning Solutions. 2022. Solano County Multi-Jurisdictional Hazard Mitigation Plan, Vacaville Annex. https://www.dropbox.com/s/zabnvb4tqajqkfg/Solano-MJHMP-ANNEX-Vacaville.pdf?dl=0.

[12] Dynamic Planning Solutions. 2022. Solano County Multi-Jurisdictional Hazard Mitigation Plan, Vacaville Annex. https://www.dropbox.com/s/zabnvb4tqajqkfg/Solano-MJHMP-ANNEX-Vacaville.pdf?dl=0.

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