B. HEALTH AND SAFETY ELEMENT TECHNICAL APPENDIX

This is a technical appendix to the Health and Safety Element (Element), a State-mandated General Plan Element that must identify and plan for potential natural and human-created hazards that could affect Contra Costa County's residents, businesses, and services. This appendix provides additional technical details to augment the background information provided in the Health and Safety Element of the Contra Costa County 2045 General Plan. Figure references in this appendix are to the figures in the Health and Safety Element.

The Health and Safety Element contains the bulk of the General Plan's goals, policies, and actions to minimize hazardous situations and protect and improve public health in and around the county. Combined with the additional details provided in this technical appendix, 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, including efforts to minimize harm to people, buildings, and infrastructure and 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. However, the Health and Safety Element aims to reduce this risk by:

- Developing a framework for considering safety issues in the land use planning process.
- Facilitating identification and mitigation of hazards for new development and strengthening existing codes, project review, and permitting processes.
- Presenting policies directed at identifying and reducing hazards in existing development.
- Strengthening preparedness planning and post-disaster reconstruction policies for earthquakes, floods, dam inundation, wildfires, and other hazards.
- Identifying how natural and climate-related hazards are likely to increase in frequency and intensity in the future and providing policies to increase community resilience through preparedness and adaptation.

The Health and 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 Health and Safety Element contain background information and policies to address multiple natural hazards, analyze the vulnerabilities from climate change and establish policies to improve climate change resilience, and assess residential areas with evacuation constraints. The public safety issues in Contra Costa County include emergency preparedness and response, flood and inundation hazards, seismic and geologic hazards, fire hazards, hazardous waste and materials, and other climate-related hazards. The Health and Safety Element identifies goals, policies, and actions for each of these hazards.

RELATIONSHIP TO OTHER DOCUMENTS

The Health and Safety Element does not exist in a vacuum but is instead one of several plans that address community public safety and related topics. These other plans include the Contra Costa County Local Hazard Mitigation Plan (LHMP), Contra Costa County Emergency Operations Plan (EOP), and Contra Costa Countywide Community Wildfire Protection Plan (CWPP). The Health and Safety Element should be consistent with these other plans to ensure that the County has a unified strategy to address public safety issues. The Health and Safety Element incorporates information, technical analyses, and policies from these other documents where appropriate to help support this consistency.

The other Elements in the General Plan also provide policy guidance on related topics. The Health and Safety Element is consistent with and complementary to the other General Plan Elements.

Contra Costa County Local Hazard Mitigation Plan

The County prepared the most recent Multi-Jurisdictional Local Hazard Mitigation Plan (LHMP) in accordance with the federal Disaster Mitigation Act of 2000 and the Federal Emergency Management Agency's (FEMA) LHMP policy guidance. The County collaborated with local agencies, including 16 incorporated cities and towns and 25 special districts in the Contra Costa County planning area, to prepare the LHMP. Contra Costa County's LHMP process is one where hazards are identified and profiled, the people and facilities at risk are analyzed, and mitigation actions are developed to reduce or eliminate hazard risk. Implementation of these mitigation actions, which include short- and long-term strategies, involves planning, policy changes, programs, projects, and other activities. Local governments are required to develop a hazard mitigation plan as a condition for receiving certain types of non-emergency disaster assistance.

The LHMP and Health and Safety Element address similar issues, but the Health and Safety Element provides a higher-level framework and set of policies that pertain to the long-term safety of the county, while the LHMP focuses on more specific mitigation actions to enable jurisdictions to better protect lives, property, and natural systems. The LHMP, certified by FEMA, is incorporated into the Health and Safety Element by reference, as permitted by California Government Code Section 65302.6, and can be accessed at www.contracosta.ca.gov/6415/Local-Hazard-Mitigation-Plan.

Contra Costa County Emergency Operations Plan

The EOP describes the planned response to extraordinary emergency situations associated with natural disasters, technological (human-caused) emergencies, and war emergency operations in or affecting Contra Costa County. The EOP establishes an emergency management organization that will respond to any significant emergency or disaster affecting the county. The EOP is also the principal guide for the County and special districts who respond to and mitigate emergencies and disasters in the county. It is intended to facilitate multi-agency and multi-jurisdictional emergency operations and coordination, particularly between local governments in the operational area (i.e., county boundary), and addresses State and federal response upon request.

Contra Costa Countywide Community Wildfire Protection Plan

In collaboration with the Contra Costa County Fire Chiefs Association, Hills Emergency Forum, and stakeholder committee members, the Diablo Fire Safe Council prepared and published the 2019 Contra Costa CWPP. The goal of the plan is to reduce hazards through increased information and education about wildfires, hazardous fuels reduction, actions to reduce structure ignitability, and other recommendations to assist emergency preparedness and fire-suppression efforts. The Contra Costa CWPP complements local agreements and existing plans for wildfire protection for a coordinated effort in determining appropriate fire management actions.

CLIMATE CHANGE VULNERABILITY

Changes to the global climate system are expected to affect future occurrences of natural hazards in and around Contra Costa County. 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 Contra Costa County include increasing temperatures, changes in precipitation, and sea level rise. Overall, precipitation levels are expected to increase slightly; however, there are likely to be more years of extreme precipitation events and droughts that last longer and are more severe. According to California's Fourth Climate Change Assessment,[i] Contra Costa County can expect to experience the following climate-related hazard events:

- Sea level rise is a gradual process, taking place over years or decades. Along the Contra Costa County shoreline, sea levels are projected to rise approximately 24 inches by 2050 and 84 inches by 2100.[ii] However, it is possible that sea levels could rise faster than these projections.[iii] Rising sea levels can also cause the shoreline to flood more frequently and severely during storms or king tide events. Because ocean levels are higher during normal conditions due to sea level rise, shoreline floods can reach further onto land.

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. 2020. California Adaptation Planning Guide.

- Although Contra Costa County is likely to experience only a slight increase in overall annual precipitation levels from climate change, rainfall is expected to fall in fewer, more extreme precipitation events. 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 will run off the dry ground instead of being absorbed, potentially leading to more frequent flooding. Drought conditions will strain the water supplies derived from the Mokelumne River watershed and the Sacramento-San Joaquin Delta, causing water shortage contingency plans and demand reduction actions to go into effect more frequently.
- Severe weather events, such as lightning, hail, heavy rainfall, and high winds, may become more frequent and intense. Heavy rainfall may also contribute to an increased risk of landslides in the hills of Contra Costa County. Although the connection between climate change and severe weather is not as well established as it is for 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.

- Warmer temperatures are projected to cause an increase in extreme heat events. An extreme heat day is defined in Contra Costa County as a day when the high temperature is on average at least 96.6°F, although it varies by specific location. Extreme heat days are expected to rise from a historical annual average of 4 days per year to 20 days per year by the middle of the century (2035 to 2064) and to an average of 37 days per year by the end of the century (2070 to 2099). In addition to the increases in extreme heat events, Contra Costa County is expected to see an increase in warmer nights, which are defined in Contra Costa County as nights when the minimum temperatures stay above 63.2°F. The number of warm nights is expected to rise from a historical annual average of 5 nights per year to 36 nights per year by the middle of the century (2035 to 2064) and to an average of 88 nights per year by the end of the century (2070 to 2099).
- Wildfire risk in Contra Costa County is increasing, and hotter, drier weather resulting from climate change is expected to increase wildfires in the surrounding area and across the county. Continued dry conditions with above-normal temperatures through spring will leave fuel moisture levels lower than normal, increasing the potential for wildfire activity and an extended wildfire season. Across the region, more frequent and intense wildfires may also create poor air quality for Contra Costa County due to smoke.
- 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. For example, mosquitos are more active during warmer and rainier conditions, and therefore can more easily spread diseases such as West Nile virus and Zika virus. 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.
- Due to its location along the Bay and Delta shorelines, floodplains, wildfire prone areas, and steep topography, Contra Costa County is in an area that can experience multiple, simultaneous natural hazards. These can also be called compounding hazards or cascading hazards. Compounding hazards could include a flood event that is followed by an earthquake, which are unrelated events that could compound to increase liquefaction in soils near floodplains or shorelines. Cascading hazards, on the other hand, occur one after the other. For example, an increase in extreme heat events and drought can dry out forests, leading to more fuel for wildfires, which can lead to faster moving and higher burning wildfires. The burn scar of a wildfire could then experience heavy rainfall, which could lead to landslides or debris flows. These hazards are discussed separately above, but when combined, they can cause more devastating consequences for county residents, visitors, and businesses.

Vulnerability Assessment

Under California law, the Health and 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 County conducted a Vulnerability Assessment to analyze its susceptibility to hazards, including those related to climate change, in accordance with the most recent available guidance in the California Adaptation Planning Guide published by the California Governor's Office of Emergency Services (OES). The Vulnerability Assessment looks at how 13 different hazards—agricultural pests and diseases, air quality, coastal flooding, drought, extreme heat, human health hazards, flooding, fog, landslides, sea level rise, seismic

hazards, severe storms, and wildfire—may affect 64 different population groups and community assets. Each population or asset received a score of V1 (minimal vulnerability) to V5 (severe vulnerability) for each hazard.

Overall, populations in Contra Costa County tend to be most vulnerable to inland flooding, extreme heat and warm nights, wildfire and smoke, and human health hazards, which directly affect health outcomes. Climate change could affect the transportation network and associated economic activity by creating strain on transportation infrastructure, resulting in impacts to personal travel behavior and goods movement. Transportation infrastructure such as roadways, bridges, and railways are all potentially at increased risk due to inland and shoreline flooding, landslides, and severe weather events. Disruption of transportation infrastructure could significantly limit the movement of goods and services, economic vitality of the community, ability to evacuate during an emergency, and livelihood of many businesses.

Countywide, energy delivery is also vulnerable to multiple hazards, including severe weather, such as high winds that can trigger public safety power shutoff (PSPS) events, extreme heat that reduces capacity and strains the system, and wildfires that damage the system, ultimately disrupting energy service. In particular, extreme heat can cause mechanical failure of grid equipment and heat damage to power lines, while also creating a high demand for electricity to power air conditioners, all of which places stress on the network and can lead to rolling blackouts.

Climate change is also expected to affect parts of the county that are considered prone to both inland and shoreline flooding, mainly because of sea level rise and stronger storm systems. As a result, agricultural land, homes, and businesses throughout the county will likely experience an increase in the frequency and magnitude of inland and shoreline flood events in future years.

Ecosystems throughout the county will likely shift and change due to rising temperatures and changes in precipitation patterns. Extreme temperatures and drought conditions can weaken woodlands and forests in the county, causing wildfires to spark more easily. Frequent wildfires in these ecosystems can cause specific composition to change as more fire-adapted species outcompete other species. Sea level rise may cause a similar phenomenon in marshland habitat along the shorelines of the county. As sea levels rise, marshland habitat will likely be slowly inundated by elevated high tide levels, causing marshes to shift to mudflat habitat types.

PUBLIC SAFETY ISSUES

Among other topics, the Health and Safety Element addresses:

- Air quality
- Flood and inundation hazards (also addressed in the Public Facilities and Services Element)
- Fire hazards (also addressed in the Public Facilities and Services Element)
- Hazardous materials and waste
- Seismic and geologic hazards
- Emergency preparedness and response
- Agriculture and ecosystem hazards (also addressed in the Conservation, Open Space, and Working Lands Element)
- Additional climate-related hazards such as drought, extreme heat, and severe weather (also addressed in the Conservation, Open Space, and Working Lands Element and Public Facilities and Services Element)

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 Contra Costa County, agencies responsible for providing protection from these public safety issues, and other background information required by California Government Code Section 65302(g)(4). Goals, policies, and actions related to these hazards are provided in the Health and Safety Element.

The results of the Vulnerability Assessment are integrated into the discussions of hazards and other public safety issues.

Air Quality

Healthy air quality can be defined as the degree to which ambient air is pollution free. Although air pollution has been regulated for decades, California still has some of the worst air in the country. Air pollution can cause many serious health effects.

A significant pollutant of concern in Contra Costa County is diesel particulate matter (DPM), a toxic air contaminant (TAC). TACs are air pollutants that can cause serious health effects from exposure at extremely low levels—a safe level of exposure may not even exist. DPM is particulate matter from diesel-fueled engines, such as those in on-road vehicles like diesel trucks, off-road construction vehicles, diesel electrical generators, and various pieces of stationary construction equipment.

People exposed to DPM at sufficient concentrations and durations may have an increased chance of getting cancer or experiencing other serious health effects, including damage to the immune system and neurological, reproductive (e.g., reduced fertility), developmental, respiratory, and other health problems. Almost all diesel exhaust particles are 10 microns or less in diameter. Because of their extremely small size, these particles can be inhaled and eventually trapped in the bronchial and alveolar regions of the lungs. Long-term (chronic) inhalation of DPM is likely a lung cancer risk. Short-term (i.e., acute) exposure can cause irritation and inflammatory responses and may exacerbate existing allergies and asthma.

As illustrated in Figure HS-1, air pollution impacts from exposure to elevated concentrations of DPM is greatest in North Richmond, Montalvin Manor, Bayview, Tara Hills, Rollingwood, East Richmond Heights, El Sobrante, Rodeo, Crockett, Mountain View, Vine Hill, Pacheco, Baypoint, Contra Costa Centre, Saranap, Parkmead, and Castle Hill. In western and central Contra Costa County where these communities are located, major sources of DPM include I-80, SR-4, and I-680; the Richmond Parkway, which is a truck traffic thoroughfare; a bulk cargo port on Richmond Harbor; the Burlington Northern Santa Fe rail yard in Richmond; and petrochemical and other industrial complexes, many of which are near the Port of Richmond on Richmond Harbor. There are also several facilities emitting DPM along the northern waterfront areas of the county, including along the San Pablo Bay shoreline adjacent to Rodeo and the Suisun Bay shoreline adjacent to Vine Hill, Clyde, and Bay Point.

Air quality is a function of both the rate and location of pollutant emissions under the influence of meteorological conditions and topographic features. Atmospheric conditions such as wind speed, wind direction, and air temperature inversions interact with the physical features of the landscape to determine the movement and dispersal of air pollutant emissions and, consequently, their effect on air quality. Regardless, the impacts to local air quality from DPM will vary over time based on changes to the location and operation of emission sources as well as their overall contribution to emissions. As traffic increases in these areas, particularly along I-80, SR-4, I-680, and the Richmond Parkway, diesel emissions will increase. Operational increases in diesel-fueled engines, such as those in railyards and other industrial complexes, will also contribute to a greater concentration of DPM. Consequently, increases in DPM concentrations will lead to a greater health

risk for communities exposed to these emissions. Those most vulnerable from exposure to elevated concentrations of DPM include individuals with existing health conditions, children, and elderly populations.

Flood and Inundation Hazards

Flood and inundation hazards are addressed in the Public Facilities and Services Element, in addition to the Health and Safety Element.

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—even six inches of moving water with a strong current can sweep a person off their feet. Floodwaters can transport large objects downstream that can damage or even dislodge stationary structures, such as dam spillways. Saturated ground can lead to instability or collapse, and standing water can damage roads, building foundations, and electrical circuits. Floodwaters can also break utility lines and interrupt services. Other problems related to flooding and stormwater runoff include erosion, sedimentation, degradation of water quality, losses of environmental resources, and certain health hazards (e.g., mold growth).

Flood events in Contra Costa County can occur from a river, creek, or canal overtopping its banks, a flash flood from intense precipitation in a targeted area, water pooling in low-lying areas and overwhelming drain systems, levee or dam failure, or waves and high water along coastal areas.

A large portion of developed and undeveloped lands in the county are subject to flooding as a result of heavy seasonal rainfall, dam inundation, and canal or levee failure. A majority of these flood-prone lands are subject to inundation specifically from heavy rainfall and resulting stream overflows.

Climate change will likely enlarge the area of the county that is at risk of flooding.

Flood Hazards

Areas at an elevated risk of flooding are divided into 100-, 200-, and 500-year flood zones. A 100-year floodplain has a 1 percent chance of experiencing a flood in any given year; a 200-year floodplain has a 0.5 percent chance of flooding in a given year; and a 500-year flood plain has a 0.2 percent chance of flooding in any given year. Figure HS-2 shows the 100- and 500-year floodplains in Contra Costa County. There are no 200-year flood zone maps for Contra Costa County, but the 500-year flood zone can be used as a proxy in low-lying portions of East County (i.e., areas mainly at risk of flooding from the Delta).

The floodplains in Contra Costa County include the areas along the shorelines of the San Francisco Bay, San Pablo Bay, Carquinez Strait, Suisun Bay, San Joaquin River, and Old River; tracts in the eastern portion of the county; and areas adjacent to inland tributaries. Floodplains can change over time, including through land development and the resulting reduction of pervious land, construction of bridges or culverts, or through building levees or other impoundment structures that control the flow in the watercourse.

The Contra Costa Flood Control and Water Conservation District (CCFCWCD) is the primary local flood control agency for the county. It constructs and maintains regional flood control facilities, including approximately 79 miles of channels, creeks, and other drainages and 30 detention basins and dams. CCFCWCD works to reduce flood risk, promote stormwater quality, and restore and enhance natural resources in an environmentally sensitive manner for communities throughout Contra Costa County.

Other agencies responsible for flood control in Contra Costa County include the United States Army Corps of Engineers (USACE), the Federal Insurance Administration (FIA), and the California Department of Water Resources (DWR).

Canal or Levee Failure

Canals and levees in Contra Costa County are maintained by CCFCWCD, USACE, 13 special reclamation districts, and private landowners. These levees and drainage systems protect agricultural and rural areas, critical infrastructure like highways, and important environmental resources. Levee or canal bank failures or overtopping can cause sudden and severe flooding in surrounding areas. There are over 1,100 miles of earthen levees and revetments managed by CCFCWCD and reclamation districts in the county. Rudimentary levees along many smaller streams and creeks also protect small areas of land. Many levees are old and were built under a different set of flood management goals and standards.

Using the best available data, DWR has identified areas in the Central Valley known as Levee Flood Protection Zones (LFPZ), which are places where flood waters would be three feet above base flood elevation or more if a levee were to fail. While there are no mapped LFPZs in Contra Costa County, FEMA has mapped areas in East County, such as Discovery Bay. that are at a reduced flood risk due to levees, as shown in Figure HS-2. Additionally, while not mapped, Bethel Island is below sea level and surrounded by levees. A levee failure would likely cause inundation of several feet throughout the island.

Dam Failure

A dam failure is an uncontrolled release of water from a reservoir through a dam because of structural failures or deficiencies in the dam, usually associated with intense rainfall or prolonged flooding, but it could also happen because of an earthquake, landslides, or equipment malfunction. Dam failures can range from minor to catastrophic and can potentially harm human life, property, ecosystems, and habitat downstream. Although dam failures are very rare, they are not unprecedented.

Dam inundation zones are based on the highly unlikely scenario of a total catastrophic dam failure in a very short period of time. According to the USACE's National Inventory of Dams, there are 21 dams of significant concern in Contra Costa County, and another 6 dams outside the county have inundation areas extending into the county.

The Federal Energy Regulatory Commission (FERC), as required by federal law, has reviewed and approved comprehensive emergency action plans (EAP) for each of these dams. The EAPs minimize the threat to public safety and the response time to an impending or actual sudden release of water from dams. The EAPs are also designed to provide emergency notifications when floodwater releases present the potential for major flooding.

As mandated by the National Dam Inspection Act, the USACE has the authority and responsibility for conducting inspections of all dams. The purpose of these inspections is to check the structural integrity of the dam and associated appurtenant structures, ensuring protection of human life and property. Periodic inspections disclose conditions that might disrupt operation or dam safety.

Figure HS-4 illustrates areas in the county that would be affected by inundation if any of these dams failed.

Tsunamis

Earthquakes can create tsunamis as a secondary hazard, and tsunamis have the potential to affect the shoreline areas of Contra Costa County. Tsunamis are typically caused by earthquakes generated in offshore subduction zones. The sudden movement displaces a large volume of water, creating a tsunami wave that can travel across the ocean at speeds up to 700 miles per hour. As the tsunami enters shallower water near coastal shorelines, it slows to about 20 to 30 miles per hour and the wave can increase to a height of 90 feet or more as it approaches the coastline and the water column compresses. Tsunamis can result in severe property damages and loss of life in affected areas near the coast. They can also disrupt emergency services and transportation routes. Tsunami waves can also diffract around land masses. Because tsunamis are not symmetrical, the waves may be much stronger in one direction than another, depending on the nature of the source and the surrounding geography.

Earthquakes of magnitudes below 6.5 are very unlikely to trigger a tsunami so it is a particularly rare phenomenon. The narrow opening of the Golden Gate Strait also protects much of the inner Bay Area shoreline from severe tsunami impacts. Nonetheless, the County considers susceptibility to tsunami when reviewing development proposals.

Figure HS-5 illustrates the areas that may be subject to inundation from tsunamis in Contra Costa County. The only areas of the county that are considered at risk from tsunamis are the shoreline areas along San Francisco Bay, San Pablo Bay, and a portion of the Carquinez Strait.

Seiche

A seiche is a wave that can occur in an enclosed or partially enclosed body of water, such as a reservoir, bay, or harbor. Seiches can be caused by a variety of factors, including changes in atmospheric pressure, wind, and seismic or geologic activity. When a seiche occurs, it can cause water levels to rise and fall rapidly, which poses a risk to boats, docks, and other structures in the affected area. Seiches can generate waves that can inundate areas around the affected water body, similar to a tsunami. Additionally, seiches occurring in a reservoir can cause overtopping of a dam and result in regional flooding. While seiches are a risk associated with earthquakes and tsunamis, it is unlikely that one would occur in the San Pablo or San Francisco Bays or in the reservoirs in Contra Costa County.

Sea Level Rise and Shoreline Flooding

Sea level rise is a gradual increase in the ocean's surface height over years or decades. Sea level rise is a direct result of climate change and affects coastal communities as well as those along the San Francisco Bay and into the Sacramento/San Joaquin Delta region. Sea level rise has the potential to inundate homes, businesses, and infrastructure near the shorelines as well as cause erosion of coastal lands over time. Rising seas increase the risk of coastal flooding, storm surge inundation, coastal erosion and shoreline retreat, and wetland loss. The communities and infrastructure that line many coasts are already vulnerable to damage from storms, which will likely increase as the sea level continues to rise and inundate areas further inland. Finally, rising tides may increase groundwater levels, inundating contaminated soil and pushing toxins toward the surface. Given that some contaminated sites in Contra Costa County sit near the shoreline, rising groundwater may cause contaminated soils to leach into previously unaffected areas.

Along the Contra Costa County shoreline, sea levels are projected to rise approximately 2 feet (24 inches) by 2050 and 7 feet (84 inches) by 2100. However, it is possible that sea levels could rise faster than these projections, which has happened historically. Projections for the expected

depth of water that would inundate dry land in the years 2050 and 2100 in Contra Costa County are shown in Figures HS-6 and HS-8, respectively. Land that is below sea level could be inundated by water deeper than the sea level rise (e.g., 2 feet of sea level rise could expose land 2 feet below sea level to 4 feet of water). Sea levels may increase enough by 2100 to permanently flood low-lying areas along the shorelines of the Carquinez Strait and Suisun Bay as well as large tracts of land in the eastern portion of the county adjacent to Old River.

Rising sea levels can cause the shoreline to flood more frequently and severely during storms or king tide events. For example, a storm that has a 1 in 5 chance of occurring in a given year (known as a 5-year storm) can create a temporary increase in sea levels of approximately 24 inches. Because ocean levels are higher during normal conditions due to sea level rise, shoreline floods can reach further onto land. This means that if sea levels rise by 24 inches during normal conditions, a 5-year storm event would create a temporary sea level rise of around 48 inches. Shoreline flooding projections for the years 2050 and 2100 in Contra Costa County are shown in Figures HS-7 and HS-9, respectively.

The San Francisco Bay Conservation and Development Commission (BCDC) requires that shoreline protection projects, such as levees and seawalls, be designed to withstand the effects of projected sea level rise and be integrated with adjacent shoreline protection.

Past Occurrences

Floods are a regular occurrence in California and cause the second-greatest number of disaster declarations in the state. Delta flooding has a long history in Contra Costa County and is a continuing hazard. Since construction of levees started in the early 1860s, every island in the Delta has been flooded at least once due to levee overtopping or failure. Approximately 110 levee failures have occurred since 1900, including about 12 since 1980. Since 1969, 10 flood events in Contra Costa County have been declared federal disasters. These 10 floods caused over $50 million in property damage.

There are several major floods in the county's history. In 1955, strong storms inundated almost 38,000 acres and caused about $3.3 million in damage. The Delta area suffered permanent damage to a sizeable amount of agricultural land. Concurrent strong onshore winds generated high waves that threatened many islands.

In January and February 1969, high tides and adverse wave action in the Delta combined with large river inflow and rain-soaked levees to cause flooding of several islands; approximately 11,400 acres were flooded, totaling $9.2 million in flood damage.

In mid-January 1980, severe rainstorms over central California precipitated high river outflow through the Delta that coincided with gale force winds and high tides, resulting in levee failure and flooding of two tracts, with approximately 9,600 acres under water. Continued high inflow to the Delta and wind-generated waves increased erosion on all Delta-area levees, necessitating temporary curtailment of boat traffic.

In June 2004, Jones Tract in San Joaquin County near the border with Contra Costa County experienced a levee breech. In August 2009, a bulk carrier ship stuck a levee at Bradford Island north of Bethel Island, also causing a serious breach.

More recently, communities in Contra Costa County report increased damage from king tide events, especially when paired with heavy rain, and community members are attributing these changes to sea level rise.

Potential Changes to Flood Risk in Future Years

Historically, extended heavy rains have resulted in floodwaters that exceed normal high-water boundaries and cause damage in Contra Costa County. Flooding has occurred within both the 100- and 500-year floodplains and in other localized areas. As land uses and climate conditions shift and as improvements are made to flood-control channels, the size of these flood zones is likely to change. Although climate change may not change average precipitation levels significantly, scientists expect that it will cause more events of extreme precipitation. That is, more years are likely to have particularly intense storm systems that drop enough precipitation over a short enough period to cause flooding. Because of this, floods are expected more often in Contra Costa County, and climate change may expand the parts of the county that are considered prone to flood. Climate change is also expected to increase the frequency and severity of droughts, which cause soil to dry out and harden. When precipitation does return, more water runs off the hardened surface than is absorbed into the ground, which can lead to floods.

Tsunamis depend on a seismic event. Major earthquakes are rare, but they are a possibility in the region and could generate tsunamis under some circumstances. A more likely instance is a tsunami triggered by a distant earthquake that could still be large enough to cause damage in Contra Costa County.

Sea levels have risen in San Francisco Bay and are expected to continue rising at an accelerated rate over the coming century. Sea level rise will occur slowly over time and increase impacts of other coastal hazards, such as shoreline erosion and the potential impact of tsunamis. Community assets and infrastructure that border the shoreline are vulnerable to damage from storms, which will likely increase as the sea level continues to rise and inundate areas further inland. As sea levels rise, the area and number of people at risk because of flooding will also increase.

The potential for a dam failure event affecting Contra Costa County will remain a risk in future years, although the likelihood of such events is expected to remain very low.

Fire Hazards

The combination of complex terrain, Mediterranean climate, and productive natural plant communities, along with ample natural ignition sources, has created conditions for extensive wildfires in and around Contra Costa County, making this a hazard of high concern. Historically, the fire season extended from early summer through late fall during the hottest, driest months of the year, but it is becoming a hazard that can occur year-round. Wildfire conditions arise from a combination of high temperatures, low-moisture content in the air and plant matter, an accumulation of vegetation, and high winds. They can be sparked by lightning, malfunctioning equipment, carelessness, and other causes There is also a risk of structural fires in Contra Costa County.

Three types of fires are of concern to Contra Costa County: (1) wildfires, (2) wildland-urban interface fires, and (3) structural fires.

Wildfires and Wildland-Urban Interface Fires

Wildfires occur on mountains, hillsides, and grasslands. Fuel, weather, and topography are primary factors that affect how wildland fires spread. In Contra Costa County, grassland and woodland habitat provide highly flammable fuel that is conducive to wildfires. These plant species are capable of regeneration after a fire, making periodic wildfires a natural part of the ecology of these areas. The climate of Contra Costa County keeps the grass

dry and more readily combustible during fire season. Seasonal drought conditions exacerbate fire hazards.

The wildfire potential for Contra Costa County is typically greatest when dry vegetation coexists with hot, dry winds, known as Diablo winds. Diablo winds come from the north and northeast, carrying extremely dry air at a high velocity, usually occurring in the San Francisco Bay Area. The name "Diablo wind" refers to the fact that the wind blows into the inner Bay Area from the direction of Mount Diablo in Contra Costa County. These hot, dry winds can quickly desiccate vegetation and other combustible materials and can push a fire down or up a slope at very high speeds. During these times, controlling a fire becomes far more difficult.

The wildland-urban interface (WUI) is an area where buildings and infrastructure mix with areas of flammable wildland vegetation. Wildfires are often most dangerous when they burn into this region because most people and structures in wildfire-prone areas are in the WUI. The WUI can be subdivided into the intermix zone (where houses and wildland vegetation directly mingle), the interface zone (housing adjacent to wildland vegetation, but not mingled with it), and the influence zone (areas of wildfire-susceptible vegetation surrounding the others). The interface and intermix zones are typically the areas of highest risk.

Increasing local and regional fire frequency can also create recurring air quality degradation events leading to respiratory health effects. Wildfire smoke consists of 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, including children, older adults, people with chronic respiratory or cardiovascular disease, people experiencing low socioeconomic status, or people who spend substantial time outdoors, such as agricultural workers..

Structural Fires

Contra Costa County is also at risk from structural fires. These fires occur in built-up environments, destroying buildings and other human-made structures. Structural fires are often due to faulty wiring or mechanical equipment, or human error, combined with combustible construction materials. Older buildings that lack modern fire safety features may face greater risk of damage from fires.

Fire Hazard Zones

The California Department of Forestry and Fire Protection (CAL FIRE) establishes Fire Hazard Severity Zones (FHSZ), designating moderate, high, or very high severity. Unincorporated areas are considered State Responsibility Areas (SRA). SRAs are areas where CAL FIRE has responsibility for fire protection. Local jurisdictions do not have financial responsibility for wildland fire protection in SRAs.

The highest areas at risk for fires are in western Contra Costa County and in the foothills and mountainous watershed areas around Mount Diablo and Los Vaqueros. Grassland areas, especially in eastern Contra Costa County, also face wildfire risk. Figure HS-10 shows the FHSZs in Contra Costa County, and Figure HS-11 identifies the WUI.

Water Pressure and Supply

Insufficient water pressure and supply also contribute to wildfire danger. Most of the higher-risk wildfire areas in the county are not served by public water systems. Fire districts serving these areas are typically equipped with

tank trucks. Properties designated for residential use in areas without public water service are required to maintain sufficient on-site water storage, and new development must have sufficient water pressure for firefighting purposes.

Fire Protection

Fire protection service is addressed in the Public Facilities and Services Element. Six fire protection districts (the Contra Costa Fire Protection District, San Ramon Valley Fire Protection District, Moraga-Orinda Fire Protection District, Rodeo-Hercules Fire Protection District, Crockett-Carquinez Fire Protection District, and Kensington Fire Protection District) and three city fire departments provide fire prevention and protection services that adequately cover the entire county except for Jersey Island, Bradford Island, Quimby Island, Webb Tract, and the Marathon Refinery near Martinez. Other service providers include CAL FIRE and the Federal Fire Department Concord-US Army.

All agencies, including CAL FIRE, participate in mutual and automatic aid agreements to provide services outside of their bounds. Mutual aid agreements help ensure adequate response times in outlying areas. The County also has a contract with the State Office of Emergency Services.

The jurisdictional boundaries for these fire protection districts are illustrated in Figure PFS-5 in the Public Facilities Element.

Past Occurrences

From 2010 to 2022, there were 24 wildfires in Contra Costa County, most burning over 100 acres. Some burned considerably more acreage, most notably the 2020 Santa Clara Unit (SCU) Complex Fire. These events are illustrated in Figure HS-12; fires over 100 acres in size are listed in Table C-1.

TABLE C-1: FIRE SIZES AND DATES (100+ ACRES, 2010–2021)

Date	Fire Name	Size in Acres
June 11, 2010	Vista Fire	186
July 2, 2010	Bradford Fire	510
August 24-26, 2010	Curry Fire	375
December 1-2, 2011	Collier Fire	198
July 1, 2013	Kirker Fire	492
July 1, 2013	Concord Fire	274
September 8-14, 2013	Morgan Fire	3,111
June 24-25, 2015	Loma Fire	533
July 30, 2015	Vasco Fire	195
July 25-August 3, 2018	Marsh Fire	247
August 1-8, 2019	Marsh 3 Fire	340
August 1-8, 2019	Marsh 5 Fire	227
August 1-8, 2019	Marsh 6 Fire	174
August 17-October 1, 2020	Santa Clara Unit Complex Fire	396,824*
July 11, 2021	Diablo Fire	128
June 23, 2022	Scenic Fire	120
September 5, 2022	Franklin Fire	125

Sources: Contra Costa 2018 LHMP; California Fire Incident Database.
* The SCU Complex Fire burned 3,305 acres within the borders of Contra Costa County.

The SCU Complex Fire, which started on August 17, 2020, is by far the largest fire to burn in Contra Costa County in recent years. The fire burned approximately 396,824 acres across Santa Clara, Alameda, Contra Costa, San Joaquin, Stanislaus, and Merced counties and lasted 44 days, with 3,305 of those acres in Contra Costa County. The fire consisted of three zones: the Deer Zone in Contra Costa County; the Canyon Zone in Alameda, Santa Clara, and parts of Stanislaus counties; and the Calaveras zone in parts of Stanislaus, San Joaquin, and Merced counties. The SCU Complex Fire was one of several fire complexes burning in California during August and September 2020. The fire destroyed 222 structures, damaged 26 structures,

and injured 6 people, although no fatalities were recorded. As of summer 2023, this fire was the fourth-largest wildfire in California's modern history.

Potential Changes to Fire Risk in Future Years

Wildfire is expected to continue being a high-risk hazard in Contra Costa County. Smoke impacts from local and regional wildfires are also likely to continue being problematic. Changing climate conditions are expected to increase the fire risk in and around Contra Costa County. 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 also 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 also increase disease and insect infestations, resulting in higher fuel loads. Higher wind speeds cause more erratic fire behavior, making fires harder to contain. Warmer temperatures are also expected to extend the wildfire season from earlier in the year to later than it has been historically. Wildfires later or earlier in the year are more likely during Diablo wind events, which cause wildfires to move more quickly and increase the likelihood of burning in the WUI areas.

Hazardous Materials and Waste

Types of Hazardous Materials

Hazardous materials are materials that pose a significant risk to public safety or human or environmental health. Hazardous materials come from a variety of sources within the county. Some common categories are briefly discussed below to provide a framework for the policies and actions in the Health and Safety Element.

Hazardous materials include toxic chemicals, flammable or corrosive materials, petroleum products, and unstable or dangerously reactive materials. They can be released through human error, malfunctioning or broken equipment, or as an indirect consequence of other emergencies (e.g., if a flood damages a hazardous material storage tank). Hazardous materials can also be released accidentally during transportation (e.g., from vehicle accidents).

A release or spill of bulk hazardous materials could result in a fire, explosion, toxic cloud, or direct contamination of people, property, and the environment. The effects may involve a small site or many square miles. Health problems may be immediate, such as corrosive effects on skin and lungs, or gradual, such as development of cancer from a carcinogen. Damage to property could include immediate destruction by explosion or permanent contamination by a persistent hazardous material. Figure HS-14 shows the location of toxic release facilities and the toxic releases exposure rankings for census tracts in unincorporated Contra Costa County. As illustrated in Figure HS-14, exposure to toxic releases is greatest in Rodeo, Crockett, Mountain View, Vine Hill, Clyde, and Bay Point.

Transportation of Hazardous and Toxic Materials

Land use hazards associated with the transport of hazardous cargo exist in Contra Costa County. A number of major, interstate transportation routes pass through the county and a wide range of hazardous cargo is regularly transported along these routes by trucks, trains, and ships. The most vulnerable areas are considered freeway on-/off-ramps and interchanges. Types of hazardous cargo regularly transported out of, into, and through Contra Costa County include flammable liquids, corrosive materials, compressed and/or poisonous gases, explosives, and flammable solids.

Some potential exists for a highway, railway, or shipping mishap that could cause hazardous cargo to spill, contaminating surrounding areas. If flammable liquids were to ignite, they could quickly spread fire and poisonous fumes that could cause human casualties and/or property damage. Spilled liquids could also contaminate the Bay or nearby streams or drainage facilities, spreading the effects of an accident over a much larger area. Since 1970, 105 railway and 100 roadway hazardous materials incidents have occurred in Contra Costa County.

In addition, hundreds of miles of pipelines that transport natural gas, crude oil, and refined petroleum products traverse Contra Costa County, including through residential and commercial areas. Such pipelines cross areas with active fault lines, landslide deposits, unstable slopes, and areas underlain by soft mud and peat. Most pipelines containing flammable or hazardous materials are underground. Each type of pipeline operates under various pressures depending on the size of the pipe, material, and what is necessary to move the material through the pipes. Despite all precautionary measures, pipelines are at risk of leaking into the environment or releasing flammable material.

Agency Monitoring and Response

Hazardous materials and waste in Contra Costa County are managed by the Contra Costa Hazardous Materials Programs (CCHMP), which is the Certified Unified Program Agency (CUPA) for all of Contra Costa County. The CUPA consolidates, coordinates, and makes consistent the regulatory activities of several hazardous materials and hazardous waste programs, including Hazardous Materials Management, California Accidental Release Prevention, Hazardous Waste Management, Underground Storage Tanks, Aboveground Storage Tanks, and Emergency Response.

Several State agencies monitor hazardous materials and waste facilities. Figure HS-15 shows the location of hazardous waste generators and the hazardous waste exposure rankings for census tracts in unincorporated Contra Costa County. As illustrated on the figure, exposure to hazardous waste generators is greatest in North Richmond, Montalvin Manor, Bayview, Tara Hills, Rollingwood, El Sobrante, Rodeo, Crockett, Port Costa, Mountain View, Vine Hill, Clyde, Pacheco, Bay Point, Parkmead, Castle Hill, Alamo, Byron, Winter Island, and the Agriculture Core east of Brentwood.

Potential and known contamination sites are monitored and documented by the State Water Resources Control Board and the California Department of Toxic Substances Control (DTSC). Figure HS-16 shows the locations of cleanup sites and their ranking for census tracts in unincorporated Contra Costa County. As illustrated on the figure, exposure to cleanup sites is greatest in North Richmond, Montalvin Manor, Bayview, El Sobrante, Rodeo, Crockett, Port Costa, Vine Hill, Clyde, Bay Point, Contra Costa Centre, Knightsen, and Winter Island.

If a hazardous material spill poses an imminent public health threat, the County will support local regulating agencies in notifying the public. The transport of hazardous materials, wastes, and explosives through the county is regulated by the California Department of Transportation (Caltrans). I-80, I-580, I-680, SR-4, SR-24, SR-123, and SR-242 are open to vehicles carrying hazardous materials and wastes. Transporters of hazardous wastes are required to be certified by Caltrans, and manifests are required to track the hazardous material or waste during transport. The danger of hazardous materials and waste spills during transport does exist and can potentially increase as transportation of these materials increases on freeways and railways. The Contra Costa County Sheriff's Office, CAL FIRE, Contra Costa County Emergency Services Division, and Contra Costa County Division of Environmental Health are responsible for hazardous materials accidents at

all locations in the county. Depending on location, Contra Costa County fire protection districts will also respond to hazardous materials accidents.

Potential Changes to Hazardous Material Risk in Future Years

Although a hazardous material accident can occur almost anywhere, certain regions are more vulnerable. The potential for an accident increases in regions near roadways or railways that are frequently used for transporting hazardous material as well as those with agricultural or industrial facilities that use, store, handle, or dispose of hazardous material. Given that 205 hazardous materials incidents have happened in transport through the county in the past 50 years, it is likely a hazardous materials incident will occur in Contra Costa County every year. However, according to Caltrans, most incidents are related to releases of fluids from the transporting vehicles themselves and not the cargo; therefore, the likelihood of a significant hazardous materials release in the county is more limited and difficult to predict. Climate change is expected to cause increases in the frequency and intensity of natural hazards, such as floods, landslides, and severe storms. This may lead to a greater risk of hazardous materials releases during these events.

Seismic and Geologic Hazards

Seismic hazards include earthquakes and hazardous events caused by them. Geologic hazards are other hazards involving land movements that are not linked to seismic activity and are capable of inflicting harm to people or property.

Seismic Hazards

Seismic activity occurs along boundaries in the earth's crust, called faults. Pressure along the faults builds over time and is ultimately released, resulting in ground shaking. Earthquakes can also trigger other hazards, including surface rupture (cracks in the ground surface), liquefaction (causing loose soil to lose its strength), landslides, and subsidence (sinking of the ground surface). Earthquakes and other seismic hazards often damage or destroy property and public infrastructure, including utility lines, and falling objects or structures pose a risk of injury or death.

Earthquake risk is very high in Contra Costa County due to the presence of several active faults in the region: the Calaveras (North Central) Fault, Concord-Green Valley Fault, Greenville Fault, Hayward Fault, Mount Diablo Fault, and San Andreas Fault. Figure HS-17 shows the locations of regional faults.

- Calaveras (North Central) Fault: The Calaveras (North Central) Fault is a major branch of the San Andreas Fault. It extends 76 miles from the San Andreas Fault near Hollister to Danville at its northern end. The Calaveras (North Central) Fault is one of the most geologically active and complex faults in the Bay Area. According to the *2018 Contra Costa County LHMP*, the probability of experiencing a magnitude 6.7 or greater earthquake along the Calaveras (North Central) Fault in the next 30 years (beginning from 2018) is 26 percent.
- Concord-Green Valley Fault: The Concord-Green Valley Fault, so named because it is under the city of Concord, is connected to the main Green Valley Fault. The fault extends from Mount Diablo to the Carquinez Strait. It is under high stress and has a 16 percent probability of experiencing a magnitude 6.7 or greater earthquake in the next 30 years (beginning from 2018).

- Greenville Fault: The Greenville Fault extends from northwest of Livermore Valley along the Marsh Creek and Clayton faults toward Clayton Valley.
- Hayward Fault: The Hayward Fault is a 45-mile-long fault that runs through some of the Bay Area's most populated areas, including San Jose, Oakland, and Berkeley. The Hayward Fault is becoming a hazard priority throughout the Bay Area because of its increased chance for activity and its intersection with highly populated areas and critical infrastructure. The probability of experiencing a magnitude 6.7 or greater earthquake along the Hayward Fault in the next 30 years (beginning from 2018) is 33 percent.
- Mount Diablo Fault: The Mount Diablo thrust fault runs from Walnut Creek to Livermore. It plays a role in the continued uplift of Mount Diablo.
- San Andreas Fault: The San Andreas Fault is a major fault in the Bay Area region that has created devastating seismic activity, most notably in the 1906 San Francisco Earthquake and 1989 Loma Prieta Earthquake. This fault is approximately 15 miles to the west of the western edge of Contra Costa County. The probability of experiencing a magnitude 6.7 or greater earthquake along the San Andreas Fault by 2050 is 72 percent and a magnitude 7.5 or greater in that same timeframe is 20 percent.[iv]

Figure HS-17 shows the Alquist-Priolo Fault Zones in the county and the areas susceptible to shaking from a hypothetical major earthquake. The Alquist-Priolo Fault Zones are areas around active faults that are known to cause surface rupture, meaning that the surface of the ground is "pulled apart" during seismic activity. Structures within these zones are subject to specific building codes and regulations to ensure they can withstand the effects of earthquakes, as surface rupture can seriously damage buildings and other structures built on top of the fault.

Potential shaking in Figure HS-17 is rated from very strong shaking to violent shaking. As illustrated on the figure, the western portions of the county are most susceptible to violent shaking; the communities of North Richmond, Montalvin Manor, Bayview, Tara Hills, Rollingwood, El Sobrante, East Richmond Heights, Kensington, and Canyon are most vulnerable.

Earthquakes have secondary effects and can cause urban fires, dam failures, tsunamis, seiches, and toxic chemical releases. A major earthquake along any fault could result in substantial casualties and damage from collapsed buildings; damaged roads, railroads, 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, in Contra Costa County, structures built prior to enactment of these improved building codes have generally not been upgraded to current standards and are vulnerable in earthquakes. In Contra Costa County, approximately 36,050 homes, or 57 percent of all housing in the unincorporated areas of county, were constructed prior to 1980.[v]

Liquefaction

In addition to the direct physical damage that can result from the motion of an earthquake, damage can result from liquefaction. Liquefaction occurs where water-logged soils near the ground surface lose compaction during strong ground motion, causing the soils to lose strength and behave as liquid. This can cause building foundations to shift and can result in significant structural damage. Soils susceptible to liquefaction are typically

found in areas of low-lying current or former floodplains. Areas with high liquefaction potential are shown on Figure HS-18.

Geologic Hazards

Other geologic hazards also exist within the county. These hazards, which include landslides and erosion, depend on the geologic composition of the area. Landslides and rock falls may occur in sloped areas, especially areas with steep slopes, and usually in areas of loose and fragmented soil. Landslides, rockfalls, and debris flows can be very slow, while others occur very suddenly, often with disastrous results. There are predictable relationships between local geology and landslides, rockfalls, and debris flows. Slope stability is dependent on many factors and interrelationships, including rock type, pore water pressure, slope steepness, and natural or human-made undercutting.

Landslides are usually triggered by other natural hazards like earthquakes, heavy rain, floods, or wildfires, so landslide frequency is often related to the frequency of these other hazards. The many types of landslides are categorized based on form and type of movement. They range from slow-moving rotational slumps and earth flows, which can distress structures over time but are less threatening to personal safety, to fast-moving rock avalanches and debris flows that are a serious threat to structures and have been responsible for most fatalities during landslide events. Many large landslides are complex and include a combination of more than one landslide type.

In Contra Costa County, landslides typically occur during and after severe storms, so the potential for landslides largely coincides with the potential for sequential severe storms that saturate steep, vulnerable soils. Landslides and mudslides are a common occurrence and have caused damage to homes, public facilities, roads, parks, and sewer lines.

Upland areas of the county are susceptible to landslides, land slips, mudflows, and debris flows. Triggered by an earthquake, heavy rainfall, or changes in ground conditions caused by development activity, these events can send large volumes of land cascading down hillsides, destroying property along the way. Figure HS-19 illustrates areas in Contra Costa County that are most susceptible to landslides.

Contra Costa County is also susceptible to hazards related to erosion, the geological process in which earthen materials are worn away and transported by natural forces such as water or wind, causing the soil to deteriorate. Eroded topsoil can be transported into streams and other waterways. Water erosion is the removal of soil by water and transport of the eroded materials away from the point of removal. The severity of water erosion is influenced by slope, soil type, the soil's capacity for water storage, nature of the underlying rock, vegetation cover, and rainfall intensity and duration. The impact of soil erosion on water quality can be significant, particularly with soil surface runoff. Highly erosive soils can damage roads, bridges, buildings, and other structures.

Past Occurrences

Contra Costa County is in a region of high seismicity with numerous local faults. A number of significant earthquakes (i.e., more than magnitude 5.0) have occurred in and near Contra Costa County over the last 35 years. The South Napa earthquake on August 24, 2014, was the most recent notable earthquake near Contra Costa County. It was on the West Napa Fault, and its epicenter was near the Napa Valley Marina. With a recorded magnitude of 6.0, it was the largest in the Bay Area in about 25 years. The South Napa Earthquake caused extensive damage through ground shaking and surface cracking. This earthquake resulted in one death and approximately 200 injuries in the affected region. Ground shaking was felt in Contra Costa County.

The magnitude 6.9 1989 Loma Prieta earthquake was on the San Andreas fault roughly 48 miles southwest of Contra Costa County and 10 miles northeast of Santa Cruz, near Mt. Loma Prieta in the Santa Cruz Mountains. Statewide, 18,306 houses were damaged and 963 were destroyed, and 2,575 businesses were damaged and 147 were destroyed. The most notable damage included the collapse of the elevated Cypress Structure section of I-880 in Oakland, the collapse of a section of roadbed on the Bay Bridge, and extensive damage to downtown Santa Cruz and San Francisco's Marina District. The Bay Bridge was unusable for a month. This earthquake resulted in an economic loss of approximately $10 billion; 63 people died, 3,757 were reported injured, and 12,053 were displaced.

Though major earthquakes are rare in Contra Costa County, minor earthquakes occur more often. Small landslides are a common occurrence, generally on hillsides and in winter during high precipitation years.

Earthquake Magnitude Scale

Magnitude 3.0 or less: Usually not felt, but can be recorded by a seismograph.

Magnitude 3.0 to 4.0: Minor earthquake felt by humans.

Magnitude 4.0 to 5.0: Light earthquake with some property damage.

Magnitude 5.0 to 6.0: Moderate earthquake with property damage.

Magnitude 6.0 to 7.0: Strong earthquake with damage in the billions of dollars and loss of life.

Magnitude 7.0 to 8.0: Great earthquake with severe economic impact and large loss of life.

Magnitude 8.0 or greater: Largest recorded earthquakes, destruction over vast area, massive loss of life.

Source: Gavin Hayes and David Wald, USGS, Earthquake Magnitude, Energy Release, and Shaking Intensity, https://www.usgs.gov/programs/earthquake-hazards/earthquake-magnitude-energy-release-and-shaking-intensity, accessed June 9, 2023.

Potential Changes to Geologic and Seismic Risk in Future Years

Earthquakes are likely to continue on an occasional basis and are likely to be small in most instances. Most are expected to cause no substantive damage and may not even be felt by most people. According to the California State Hazard Mitigation Plan, earthquakes large enough to cause moderate damage to structures—those of magnitude 5.5 or larger—occur three to four times a year statewide. Strong earthquakes of magnitude 6 to 6.9 strike an average of once every two to three years. Major earthquakes of magnitude 7 to 7.9 occur in California about once every 10 years.

A major earthquake along any regional fault could result in substantial casualties and damage, although the greatest risk in Contra Costa County is from the Hayward-Rodger's Creek Fault and the Concord-Green Valley Fault due to their location and high potential to cause a severe earthquake. A major earthquake on the Hayward Fault could damage or destroy primary evacuation routes and bridges, limiting access in and out of the community. Underground utility lines are also susceptible where they lack sufficient flexibility to accommodate the seismic ground motion.

Geologic risks, such as small landslides, are common occurrences in Contra Costa County. With significant rainfall, additional slope failures are likely in the community's landslide hazard areas, and minor to moderate landslides will likely continue to impact the area after heavy precipitation, as they have in the past. Heavy rainfall, which is expected to increase due to climate change, could cause an increase in the number of landslides or make landslides larger than in the past. Increased wildfire frequency can destabilize hillsides due to loss of vegetation and change in 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.

Emergency Preparedness and Response

Community Warning Systems

The County uses the Contra Costa County Community Warning System (CWS) to notify residents and businesses within Contra Costa County that are impacted by, or are in danger of being impacted by, an emergency. The system provides basic information about incidents and what specific protective actions (e.g., shelter in place, lockdown, evacuate, or avoid the area) are necessary to protect life and health. The CWS is a partnership of the Contra Costa County Office of the Sheriff, Contra Costa Health Services, other government agencies, industry, news media, and the non-profit Community Awareness and Emergency Response organization. CWS notifications may include:

- Sirens in special safety zones
- Emergency Alert System (EAS) alerts on television and radio (KCBS 740 AM)
- Use of the Telephone Emergency Notification System
- Cell phone alerts
- National Oceanic and Atmospheric Administration (NOAA) weather radios
- Notices posted on Twitter and Facebook

Alerts are distributed via voice, text, and email messages through the CWS Telephone Emergency Notification System. This computerized system makes telephone calls to the known telephone numbers in the vicinity of the hazard based on the incident-specific issues.

Other systems include the EAS and the Emergency Digital Information System (EDIS). The EAS is a national public warning system commonly used by State and local authorities to deliver important emergency information to affected communities, such as weather and AMBER alerts. EAS participants include radio and television broadcasters, cable systems, satellite radio and television providers, and wireline video providers. FEMA, the Federal Communications System, and NOAA's National Weather Service (NWS) work collaboratively to maintain the EAS and Wireless Emergency Alerts, which are the two main components of the national public warning system and enable authorities at all levels of government to send urgent emergency information to the public. The EDIS is a wireless emergency and disaster information service operated by the Governor's Office of Emergency Services (OES) and is an enhancement to the EAS. These systems are available in multiple languages.

Emergency Evacuation

With advanced warning, evacuation can be effective in reducing injury and loss of life during a catastrophic event. Figure HS-20 shows the potential evacuation routes throughout the county, including highways and major surface streets, although the preferred evacuation routes in any individual evacuation order will depend on the emergency.

Some parts of the county may face challenges evacuating, particularly those far from major roadways. Additionally, some areas have only one viable route of evacuation, which could become blocked or congested. Figure HS-21 shows residential parcels with evacuation constraints. All parcels identified

as having evacuation constraints are at least a half mile from a major roadway and/or have access to only one emergency evacuation route. In most cases, it is not feasible to retrofit existing neighborhoods to eliminate physical evacuation constraints such as lack of evacuation routes or insufficient roadway capacity. The County will nonetheless strive to improve evacuation from these constrained areas.

All evacuation routes in Contra Costa County face a potential disruption from flooding, earthquake, wildfire, landslide, or hazardous materials release. An emergency event may block roadways, damage the roadway surface, or collapse bridges and overpasses. In the event of widespread disruption to local evacuation routes, remaining evacuation routes may become congested, slowing down evacuation of a community or specific neighborhoods. This issue may be compounded if the county's evacuation routes are also the evacuation routes for surrounding areas, and so potential disruptions may have regional effects.

In preparation for wildfires and other disasters, the County uses Zonehaven Aware, which is a comprehensive evacuation support system of the Contra Costa County CWS. Zonehaven Aware provides the community with critical evacuation updates, resources, and information on active incidents. In the event of an emergency, the Contra Costa County Sheriff's Office and Contra Costa County fire districts can issue evacuation warnings or evacuation orders for affected areas. The County's website has an interactive evacuation map lookup tool that enables residents to find possible evacuation routes based on their address and respective zone.

Disaster Preparedness

Disaster preparedness refers to coordinated efforts to respond to both natural and human-caused disasters. In recent years, Contra Costa County has expanded its emergency preparedness planning. The County is required under State law to prepare and maintain a Standardized Emergency Management System (SEMS) Multi-hazard Functional Plan. OES has extensive guidelines outlining the requirements of the Contra Costa County SEMS.

Contra Costa County also participates in the California Disaster and Civil Defense Master Mutual-Aid Agreement, under which the State and local governments will work together to respond to emergencies. The Governor's Office of Emergency Services Coastal Region (Mutual Aid Region II) serves the counties on the coast from Del Norte to Monterey and the counties surrounding San Francisco Bay. The County has its own Contra Costa County Emergency Operations Plan developed by the Sheriff's Office of Emergency Services in collaboration with emergency management partners (e.g., fire districts, law enforcement agencies,), and has prepared additional plans addressing earthquake response, disaster debris management, and airport emergencies. The County maintains an Emergency Operations Center, which is activated as needed to communicate with emergency management partners and coordinate responses to incidents.

Contra Costa County OES offers Community Emergency Response Team (CERT) training to residents and members of the business community to increase disaster awareness and emergency response capability through its CERT Coalition. The primary goal of the Contra Costa CERT Coalition is to promote the development, coordination, and advancement of all CERT programs in Contra Costa County, progressively improving the quality of CERT programs across jurisdictions. The CERT program educates volunteers about disaster preparedness for the hazards that may impact their area and trains them in basic disaster response skills, such as fire safety, light search and rescue, team organization, and disaster medical operations. CERT offers consistent volunteer training and organization that professional responders can rely on during disaster situations, allowing them to focus on more complex tasks.

Agriculture and Ecosystem Hazards

Agriculture and ecosystem hazards are addressed in the Conservation, Open Space, and Working Lands Element, in addition to the Health and Safety Element.

Agricultural Pests

Agriculture in Contra Costa County encompasses approximately 34 percent of the land area. Thirteen crop categories exceeded $1 million in value in 2020. These categories in descending order are cattle and calves, sweet corn, tomatoes, grapes, cherries, miscellaneous vegetable crops, miscellaneous field crops, rangeland, alfalfa hay, irrigated pasture, apricots, walnuts, and apiary (bee) products. Crop values vary from year to year due to factors like production, weather, and market conditions. Eighteen of the farms in Contra Costa County used organic production methods in 2020.

Contra Costa County is threatened by several insect pests that, under the right circumstances, can cause severe economic and environmental harm. Insects of concern to plants and crops include the Asian gypsy moth, rosy moth, nun moth, Siberian silk moth, Asian citrus psyllid, European grapevine moth, glassy-winged sharpshooter, Japanese beetle, Mediterranean fruit fly, melon fly, and Oriental fruit fly.

Aquatic Invasive Species

Introduction of nonnative species into county waters can cause significant and enduring economic and environmental impacts. One of the most widespread mechanisms of introductions is transport of ballast water in ships. Ballast water is taken on and released by a vessel during cargo loading and discharging operations to maintain the vessel's trim and stability.

Ships discharge ballast water that has been obtained from waters throughout the state, country, or world. This water might include nonnative organisms, untreated sewage, and other contaminants. Invasive species of concern in Contra Costa County include the New Zealand mud snail, zebra mussel, and quagga mussel. Once introduced, invasive species are likely to become a permanent part of an ecosystem and may flourish, creating environmental imbalances and wreaking economic havoc. The New Zealand mud snail can displace native aquatic insects that fish eat, but pass through the fish without being digested. Ultimately, this can result in reduced growth rates and lower populations of fish. Zebra and quagga mussels can also kill native freshwater mussels by either attaching to the shells of native species or by outcompeting them and other filter-feeding invertebrates for food.

Potential Changes to Agriculture and Ecosystems in Future Years

As long as severe weather events continue to be a concern for Contra Costa County, the potential for ecosystem and agricultural losses remains. The primary causes of agricultural losses are severe weather events, such as droughts, freezes, and insect infestations. These factors can also contribute to significant ecosystem loss, as can wildfire events. Many pests and organisms that carry diseases are most active during warmer months. Given that temperatures are expected to get warmer earlier in the year and remain warmer until later in the year due to climate change, there will be a wider window for pests and diseases to be active.

Climate change can also indirectly create a greater risk of agriculture and ecosystem pests and diseases. Many crop plants, trees, and livestock may be weakened by warmer temperatures and changes in precipitation. These weaker plants and animals may not be able to fend off infestations or infections as well as stronger plants or animals, causing pests and diseases

to affect more of the agricultural area or ecosystem. These pests and diseases can inhibit plant and animal growth, damage plants and animals such that their products are less appealing and harder to sell, or lead to mortality.

The rate of aquatic invasive species discoveries continues to increase. Due to the high number of incidents of invasive species in the Sacramento-San Joaquin Delta, it is likely that future infestations of aquatic pests will occur in Contra Costa County. The risks associated with aquatic invasive species exist, and if a breakout occurs, there may be potentially large economic impacts.

In aquatic ecosystems, climate change is expected to result in warmer water temperatures, altered streamflow patterns, increased salinization, and increased demand for water storage and conveyance structures. Due to these patterns, invasive aquatic species are expected to flourish, since cold temperatures or winter hypoxic conditions are what have traditionally prevented the establishment and survival of these species in this climate.

Drought

Drought is addressed in the Conservation, Open Space, and Working Lands Element and Public Facilities and Services Element, in addition to the Health and Safety Element.

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, Contra Costa County chronically experiences drought cycles. Drought impacts the county's water supply, which may in severe instances make less water available for people, businesses, and natural systems.

Less snow falling in mountainous areas causes water levels in lakes and reservoirs to drop. 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, slowing water flow or creating standing water, which can concentrate sediment and toxins, harming 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. Drought conditions can also increase the salinity of the Delta, threatening wildlife habitat.

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). According to the U.S. Drought Monitor, the most intensive drought conditions in recent years were during most of 2014 and 2021, when all of Contra Costa County was classified in "extreme" drought. During severe drought conditions, water shortages are common and water restrictions may be imposed to meet essential community needs. When the County declares a water shortage emergency under the authority of the Water Code, the County will implement actions in the Contra Costa County 2020 Water Shortage Contingency Plan to implement and enforce regulations and restrictions for managing a water shortage.

The county has a diverse set of water supply options, including surface water and groundwater wells, to ensure that the community has adequate water, even after a period of dry years, through a combination of water supplies and water conservation measures.

The county is serviced by 11 purveyors of domestic and industrial water, most of which is through surface water supplies from the East Bay Municipal Utility District (EBMUD) and the Contra Costa Water District (CCWD). EBMUD provides drinking water for 1.4 million customers in Contra Costa and

Alameda counties over a 331-square-mile area. The EBMUD service area for drinking water in Contra Costa County covers western and central portions of the county, as shown on Figure PFS-2 in the Public Facilities and Services Element. CCWD provides treated and untreated water to a population of 500,000 in central and eastern Contra Costa County. In addition to EBMUD and CCWD, several smaller water providers serve the county, including incorporated communities, community services districts, and private suppliers.

Approximately 90 percent of EBMUD's water supply begins at the Mokelumne River watershed in the Sierra Nevada and extends 90 miles to the East Bay, passing through the Central Valley and Sacramento-San Joaquin Delta. The Mokelumne Aqueducts convey the Mokelumne River supply to local storage and treatment facilities in Contra Costa and Alameda counties. After treatment, water is distributed to the incorporated cities and unincorporated communities in the East Bay that EBMUD serves.

The primary source of water for CCWD is the Central Valley Project (CVP), a federally owned system of reservoirs and canals. The water supplied by the CVP originates from rivers in the Sierra Nevada and Klamath Mountains, primarily the American, Sacramento, Stanislaus, and Trinity Rivers. The water from these rivers flows into the Sacramento and San Joaquin Rivers, eventually finding its way into the Delta.

Other water providers in Contra Costa County purchase water from EBMUD or CCWD, source water from the Delta or other surface supplies using their own water rights, or pump groundwater.

Potential Changes to Drought in Future Years

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. Based on historical information, the occurrence of drought in California, including Contra Costa County, is cyclical, driven by weather patterns. Drought has occurred in the past and will occur in the future.

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, precipitation levels are expected to stay similar, and may even increase in some places. 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. 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 (i.e., the volume of accumulated snow), which in turn makes less fresh water available for communities throughout California, including the imported water supply for EBMUD and CCWD. Continued decline in the Sierra Nevada snowpack volume is expected, which may lead to lower volumes of available imported water. More precipitation is expected to fall as rain instead of snow, and the snow that does fall will melt earlier, reducing the Sierra Nevada spring snowpack by as much as 70 to 90 percent. 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 potential water shortage issues and exacerbate drought conditions.

As the population in the county continues to grow, so will the demand for water. However, EBMUD and CCWD both consider their water supplies adequate to meet projected water needs through the year 2045.

Extreme Heat

Extreme heat occurs when temperatures rise significantly above normal levels; it is defined as a daytime temperature that exceeds the 90th percentile of the historic average temperature for that date. Extreme heat is a relative term, and different temperatures in different parts of Contra Costa County qualify as extreme heat events because people and buildings accustomed to cooler average temperatures may be less prepared for extreme heat events. For example, an extreme heat day in Rodeo is when temperatures reach 93 degrees Fahrenheit (°F), while in Alamo it is 97°F, and in Knightsen it is 102°F.

Health impacts are the primary concern with this hazard, though economic impacts are also an issue. The Centers for Disease Control and Prevention (CDC) recognize extreme heat as a substantial public health concern. Historically, NOAA data indicate that about 175 Americans die from summer heat each year, 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. Following a record-breaking heat wave in 2006, over 16,000 emergency room visits, more than 1,100 hospitalizations, and at least 140 deaths were reported. As heat events are projected to become more frequent and last longer, preparing for the public health challenges they pose is critical.

In 2019, Contra Costa County reported an extreme heat event from June 9th to 11th. The combination of high pressure and strong offshore flow resulted in an early season heat wave across the Bay Area. Multiple daily records were broken across the region due to the heat. Three fatalities were reported: one person died as a direct result of heat-related illness, and two others drowned while attempting to cool down during the heat wave. In 2021, Contra Costa County reported an extreme heat event from July 9th to 11th. Daytime highs rose above 100°F, with locations across the East Bay up to 110°F. Overnight lows remained warm, particularly across higher elevations, where temperatures were between 70°F and 80°F in the early mornings. There were no reported fatalities from this heat event.

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, seniors, small children, persons with chronic illnesses and disabilities, and those with limited mobility are particularly susceptible to heat. Seniors 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 from 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 accustomed to cooler temperatures may be less prepared for extreme heat events. 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.

Very high temperatures can harm plants and animals that are not well adapted to them. 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. Trees and other vegetation in the natural and urban environment help to lower surface and air temperatures by 2°F to 9°F.[vi, vii]

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 and associated health and economic impacts. Wildfire risk increases as vegetation dries out. Damage to roadways, bridges, and other transportation infrastructure may also occur. An example occurred in Contra Costa County in June 2022, when extreme heat buckled BART tracks, causing a derailment.

Over 36,000 homes, or 57 percent of the housing stock in the unincorporated county, were constructed prior to 1980; they are unlikely to have air conditioning and may lack effective insulation. Therefore, people living in these homes, especially vulnerable populations, are at higher risk for heat-related illnesses from extreme heat events. To help provide relief from the heat, the County opens public libraries during extreme heat days and heat waves. These air-conditioned community spaces provide essential cool spaces for vulnerable populations.

Potential Changes to Extreme Heat in Future Years

Extreme heat tends to occur on an annual basis and is likely to continue occurring annually. While the western portions of Contra Costa County close to San Francisco Bay generally experience cooler temperatures than the eastern portions of the county, high temperatures throughout the county will continue to be a common occurrence.

Overall, Contra Costa County is expected to see an increase in average daily high temperatures. Depending on the future severity of climate change, the State's Cal-Adapt database indicates the annual average maximum temperature is expected to increase from a historical annual average of 71.1°F to an average of up to 75.8°F by the middle of the century (2035 to 2064), and an average of up to 79.0°F by the end of the century (2070 to 2099). Figure HS-13 shows the average temperature forecast in Contra Costa County for the end of the century.

Although the temperature increases may appear modest, the projected high temperatures are substantially greater than historical norms. These increases also make it more likely that an above-average high temperature will cross the extreme heat threshold. The warmer temperatures brought on by climate change are likely to cause an increase in extreme heat events, increasing the risk of death from dehydration, heat stroke, heat exhaustion, heart attack, stroke, and respiratory distress. By the end of the century, the county is projected to experience an annual average of 18 to 30 extreme heat days per year.

Severe Weather

Severe weather is generally any destructive weather event, but usually occurs in Contra Costa County as localized storms that bring heavy rain, hail, thunderstorms, and strong winds. Severe weather is usually caused by intense storm systems, although certain 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, power outages, fallen trees, and roads and railways blocked by debris. In addition, lightning from these storms can strike objects and ignite wildfires and structure fires that can damage buildings and endanger people. Severe weather may also include tornadoes, although they are uncommon in Contra Costa County; only four have been recorded in the county since 1950.

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, causing heavy rains that can lead to flooding and mudslide events.

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 miles per hour (mph) or higher lasting one hour or longer, or wind gusts of 58 mph or higher 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. Contra Costa County experiences high wind on an annual basis, although some high wind events have been particularly severe. On January 4, 2008, Contra Costa County reported 110 mph winds in the East Bay Hills and Diablo Range. During this high wind event, a very strong cyclone slammed into the San Francisco and Monterey Bay areas, bringing rain, high winds, record high surf, and coastal flooding. Hundreds of thousands of residences and businesses were without power, some for several days, due to high winds toppling power lines. The storm caused millions of dollars in property damage due to falling trees hitting cars and structures as well as damage to roads due to heavy rain. In another event on December 11, 2014, Contra Costa County reported 83 mph winds. This atmospheric river event brought heavy rain and gusty winds with a strong winter storm that impacted the Bay Area for several days. Contra Costa County and the greater Bay Area experienced a series of atmospheric rivers in winter 2023. Flooding was widespread throughout the county, with landslides in several steeper sloped areas of the county.

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 county. Dust and plant pollen blown by the wind can create respiratory problems. The winds can blow roofs off buildings and cause tree limbs to fall on people and property. 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 and making them harder to control. This can also affect the air quality in Contra Costa County and may disrupt regional infrastructure networks.

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. These events, 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, but they usually occur during high wind events and dry conditions. PSPS events may be limited to specific communities or they may affect broad swaths of the state. In October 2019, PG&E conducted one large-scale PSPS event, shutting off power to approximately 740,000 customers in 35 counties across the state, including customers in Contra Costa County. Several PSPS events also occurred in 2020. While smaller, these events still affected thousands of PG&E customers across the county.

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 evacuation 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

According to historical hazard data, severe weather is an annual occurrence in Contra Costa County. Damage and disaster declarations related to severe weather have occurred and will continue to occur in the future. Heavy rain and thunderstorms are the most frequent type of severe weather 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 has been limited. It is the secondary hazards, such as floods and fire, that have had the greatest impact on the county. Thunderstorms, high winds, and lightning can each have localized impacts on infrastructure, properties, and public safety. Transportation, including freight movement, faces increased congestion when severe storms occur.

Climate change is expected to cause an increase in intense rainfall and strong storm systems. This means that Contra Costa County 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.

Endnotes

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