VULNERABILITY ASSESSMENT

CITY OF FOUNTAIN VALLEY

MAY 2023

PREPARED BY: PLACEWORKS

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1. INTRODUCTION

REGULATORY FRAMEWORK

In accordance with California Government Code Section 65302(g)(4), all counties and incorporated communities in California must prepare a vulnerability assessment when updating its local hazard mitigation plan. The vulnerability assessment must assess the risks and associated impacts of climate change on local assets, populations, and resources using data and information made available by federal, state, regional, and local agencies.

CLIMATE CHANGE VULNERABILITY

Changes to the global climate system are expected to affect future occurrences of natural hazards in and around Fountain Valley. Many hazards are projected to become more frequent and more intense in coming years and decades, and in some cases, these trends have already begun. According to California's *Fourth Climate Change Assessment,*[1] Fountain Valley can expect to experience various changes to the patterns of climate-related hazard events.

- Both droughts and floods are expected to become more frequent as precipitation is expected to occur in fewer, more intense storms. Although Fountain Valley is likely to experience little change in overall annual precipitation levels from climate change, the region is expected to see an increase in the number of extreme precipitation events. As a result, floods are expected to occur more often in Fountain Valley, and climate change may expand the parts of the city that are considered flood prone. Climate change is expected to also increase the frequency and severity of droughts that cause soil to dry out and compact. When precipitation does return, more water runs off the impermeable surface rather than being absorbed into the ground, which can lead to flooding.

- Warming temperatures are projected to increase the number of extreme heat events. The number of extreme heat days, defined in Fountain Valley as a day when the high temperature is at least 93.9 degrees Fahrenheit (°F), is expected to rise from a historical annual average of 8 to 11 days by the middle of the century (2035 to 2064), and to an average of 12 to 25 days by the end of the century (2070 to 2099). In addition to the increases in extreme heat events, Fountain Valley is expected to see an increase in the average daily high temperatures.

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

Extreme heat poses a significant human health risk, especially to senior citizens, outdoor workers, and persons who do not have access to adequate cooling, including people experiencing homelessness. Some buildings and infrastructure systems may be damaged by very high temperatures, constraining their ability to meet community needs.

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

- Although there is no wildfire risk in Fountain Valley, hotter, drier weather is expected to lead to an increase in wildfires in the surrounding area and across Orange County. Across the region, more frequent and intense wildfires may lead to poor air quality in Fountain Valley.

- Increased air emissions from urban growth and development may also add to these air quality problems. Health impacts associated with air pollution are typically most severe for young children, senior citizens, and those already suffering from respiratory or cardiovascular disease. Outdoor workers, individuals experiencing homelessness, and others who may already be exposed to higher levels of air pollution are also vulnerable.

- Severe weather events, such as strong storms and high winds, may become more frequent and intense due to climate change. Climate change is expected to cause an increase in intense rainfall, which is usually associated with strong storm systems. As mentioned in the first bullet, heavy rainfall may contribute to an increased risk of flooding in and around Fountain Valley. In Orange County, severe storms are linked to high winds. The types of dangers posed by severe weather vary widely and include injuries or deaths, damage to buildings and structures, fallen trees, roads blocked by debris, and fires sparked by lightning.

2. HAZARDS AND VULNERABILITIES

AIR POLLUTION

Healthy air quality can be defined as the degree to which ambient air is pollution free. Air pollution can cause many serious health effects. For example, inhaling small particles called particulate matter can lead to asthma attacks and heart and lung disease with smaller particles capable of traveling farther into the lungs.

The specific pollutants of concern in Fountain Valley include diesel particulate, ozone, and $PM_{2.5}$. Diesel particulate, generated from the burning of diesel fuel, is considered a toxic air contaminant (TAC), which can cause serious health effects from exposure at extremely low levels. People exposed to diesel particulate at sufficient concentrations and durations may have an increased chance of getting cancer or experiencing other serious health effects. Health effects can include damage to the immune system as well as 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 diesel particulate matter 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.

Ozone is a key ingredient of "smog" and is a gas that is formed when volatile organic compounds (VOCs) and oxides of nitrogen (NO_X), both by-products of internal combustion engine exhaust, undergo photochemical reactions in sunlight. Ozone concentrations are generally highest during the summer months when direct sunlight, light winds, and warm temperatures create favorable conditions for its formation. Ozone poses a health threat to those who already suffer from respiratory diseases as well as to healthy people. Inhaling ozone can trigger a variety of health problems, including chest pain, coughing, throat irritation, and congestion. It can worsen bronchitis, emphysema, and asthma. Ground-level ozone also can reduce lung function and inflame the linings of the lungs. Repeated exposure may permanently scar lung tissue. Ozone also affects sensitive vegetation and ecosystems, including forests, parks, wildlife refuges, and wilderness areas.

$PM_{2.5}$ is a suspended particulate matter that consists of finely divided solids or liquids such as soot, dust, aerosols, fumes, and mists. Inhalable fine particles, or $PM_{2.5}$, have an aerodynamic diameter of 2.5 microns or less (i.e., ≤2.5 millionths of a meter or 0.0001 inch). Particulate discharge into the atmosphere results primarily from industrial, agricultural, construction, and transportation activities. $PM_{2.5}$ adversely affects the human respiratory system, especially in people who are naturally sensitive or

susceptible to breathing problems. The EPA's scientific review concluded that $PM_{2.5}$, which penetrates deeply into the lungs, is more likely than PM_{10} (particles with a diameter of 10 microns or less) to contribute to health effects and at far lower concentrations. These health effects include premature death in people with heart or lung disease, nonfatal heart attacks, irregular heartbeat, aggravated asthma, decreased lung function, and increased respiratory symptoms. Particulate matter can also cause environmental effects, such as visibility impairment, environmental damage, and aesthetic damage.

Sensitive groups in Fountain Valley face compounded health risk from exposure to elevated concentration levels of diesel particulate, ozone, and $PM_{2.5}$ and are exposed to multiple health risks from pollutants such as these. In some situations, sensitive groups may also concurrently experience unhealthy housing conditions and/or experiencing poverty and other socioeconomic stressors that are associated with negative health outcomes.

Although these conditions can occur anywhere throughout Fountain Valley, they are more often experienced by sensitive groups. During Orange County's wildfire season (historically August – October, although wildfires may now occur throughout most of the year), regional wildfire smoke is likely to impact Fountain Valley's air quality and exacerbate health conditions for its residents, especially sensitive groups. As regional wildfire increases in frequency, recurring air quality degradation events in Fountain Valley will likely occur resulting in respiratory health effects throughout the community.

DROUGHT

A drought is a long period when precipitation levels are well below normal. The City of Fountain Valley chronically experiences drought cycles. Drought impacts the city's water supply which ultimately makes less water available for people, businesses, and natural systems.

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

The U.S. Drought Monitor recognizes a five-point scale for drought events: D0 (abnormally dry), D1 (moderate drought), D2 (severe drought), D3 (extreme drought), and D4 (exceptional drought). According to the U.S. Drought Monitor, the most intensive

drought conditions in recent years occurred during most of 2007, when all of Orange County was classified as being in "extreme" drought. While Orange County was classified as being in "severe" drought in 2021, storm activity in 2022/2023 brought some relief and most of California, including Orange County, is no longer classified as experiencing a drought.

Fountain Valley's water supply comes from three main sources: groundwater, imported water, and recycled water. Groundwater accounts for approximately 60 percent of the city's water supply and comes from the Lower Santa Ana River Groundwater Basin. Imported water accounts for approximately 26 percent of the city's water supply and comes from the Colorado River via the Colorado River Aqueduct and the Sacramento River via the State Water Project. Recycled water (non-potable water) accounts for 14 percent of the city's water supply which is received through the Green Acres Project operated by the Orange County Water District (OCWD). Recycled water is used for outdoor irrigation at the Sports Park, Mile Square Park, golf courses, as well as other outdoor areas and businesses throughout the city.

Potential Changes to Drought in Future Years

Likelihood of Future Occurrence

Drought is different than many of the other natural hazards in that it is not a distinct event and usually has a slow onset. Drought can severely impact a region both physically and economically, affecting different sectors in different ways and with varying intensities. Adequate water is the most critical issue for commercial and domestic use. As the population in the city continues to grow, so will the demand for water.

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

Reduced winter precipitation levels and warmer temperatures have greatly decreased the size of the Colorado River Basin and Sierra Nevada snowpack (the volume of accumulated snow), which in turn makes less fresh water available for communities throughout California, including the imported water supply for Fountain Valley. Continued decline in the Sierra Nevada snowpack volume is expected, which may lead to lower volumes of available imported water. Groundwater supplies are usually buffered from shorter-term drought conditions, although long-term chronic drought conditions can cause a decline in groundwater levels. Local groundwater supplies are replenished

by natural processes as well as by the Groundwater Replenishment System operated by OCWD and the Orange County Sanitation District, providing additional resilience against groundwater decline.

Climate Change and Drought

Although droughts are a regular feature of California's climate, scientists expect that climate change will lead to more frequent and more 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. Locally, the Groundwater Replenishment System can help protect groundwater supplies against more frequent and severe droughts, although monitoring and improvements to the system may be needed to help maintain sustainable groundwater levels.

EXTREME HEAT

While there is no universal definition of extreme heat, California guidance documents define extreme heat as temperatures that are hotter than 98 percent of the historical high temperatures for the area, as measured between April and October of 1961 to 1990. Days that reach this level are called extreme heat days. In Fountain Valley, the extreme heat threshold is 93.9 °F. An event with five extreme heat days in a row is called a heat wave.

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

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

thresholds are not necessarily at lower risk, as persons and community assets used to cooler temperatures may be less prepared for extreme heat events.

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

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

Potential Changes to Extreme Heat in Future Years

Likelihood of Future Occurrence

Extreme heat tends to occur on an annual basis and is likely to continue occurring annually. As Fountain Valley is located in western Orange County and at relatively low elevation, extremely high temperatures will continue to be a more common occurrence than cold temperatures.

Climate Change and Extreme Heat

The warmer temperatures brought on by climate change are likely to cause an increase in extreme heat events. Depending on the location and emissions levels, the state Cal-Adapt database indicates the number of extreme heat days is expected to rise from a historical annual average of 8 to 11 days by the middle of the century (2035 to 2064), and an average of 12 to 25 days by the end of the century (2070 to 2099).

Overall, Fountain Valley is expected to see an increase in the average daily high temperatures. 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. As temperatures increase, Fountain Valley will face increased risk of death from dehydration, heat stroke, heat exhaustion, heart attack, stroke, and respiratory distress caused by extreme heat.

FLOOD AND INUNDATION HAZARDS

Flooding is the rising and overflowing of a body of water onto normally dry land. History highlights floods as one of the most frequent natural hazards impacting communities in Orange County. Floods are among the costliest natural disasters in terms of human hardship and economic loss nationwide, causing substantial damage to structures, landscapes, and utilities, as well as life-safety issues. Flooding can be extremely dangerous, and even six inches of moving water can knock a person over given a strong current. Floodwaters can transport large objects downstream, which can damage or remove stationary structures, such as dam spillways. Ground saturation can result in instability, collapse, or other damage. Objects can also be buried or destroyed through sediment deposition. Floodwaters can also break utility lines and interrupt services. Standing water can cause damage to roads, foundations, and electrical circuits. Other problems connected with flooding and stormwater runoff include erosion, sedimentation, degradation of water quality, losses of environmental resources, and certain health hazards.

Floods are usually caused by large amounts of precipitation, either from a period of very intense precipitation or a long period of steady precipitation. Historically, Fountain Valley has been at risk of flooding primarily during the winter and spring months when stream systems swell with heavy rainfall. This type of flood results from prolonged, heavy rainfall and is characterized by high peak flows of moderate duration and by a large volume of runoff. Flooding is more severe when prior rainfall has resulted in saturated ground conditions. Flooding susceptibility in Fountain Valley is primarily associated with the Santa Ana River as well as smaller-scale and flash flood events.

Flash flooding is a common problem for Orange County and typically associated with short-duration, high-intensity precipitation events often during summer thunderstorms. Such events can occur even during a drought. Localized flooding also occurs in Fountain Valley at various times throughout the year, especially along the Santa Ana River. The Santa Ana River, which carries runoff from large portions of Orange, Riverside, and San Bernardino Counties, provides the greatest flood hazard potential for Fountain Valley. Areas directly adjacent to the Santa Ana River may be expected to be flooded by water ranging from 1 to 3 feet in depth in the event of a 100-year storm.

Historically, precipitation in and around Fountain Valley has been low to moderate. Precipitation occurs mainly in the fall, winter, and spring months, from November through April. Although Fountain Valley occasionally experiences periods of significant drought, the city can also experience periods of substantial rainfall. When Fountain Valley does experience heavy rain, or rain over a period of days or weeks, many areas of the city are subject to flooding. Runoff from rain drains into flood-control facilities.

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

Areas at an elevated risk of flooding are generally divided into 100- and 500-year flood zones. A 100-year flood zone has a 1-percent chance of experiencing a major flood in any given year and a 500-year flood zone has a 0.2-percent chance of flooding in any given year. Figure 1 shows the 100- and 500-year flood zones in and around Fountain Valley. The majority of the city is within Flood Zone X, and the northwestern portion of the city is within Flood Zone A. Zone X area is determined to be within the 500-year flood area, with 0.2% chance of flooding in a given year, but protected by levee from 100-year flood risks. Zone A represents areas within the 100-year flood areas that have a 1% annual chance of flooding. In Fountain Valley, flood damage is most likely to occur in the northwestern area of the city. During heavy rainfall events, a number of residential areas are subject to flooding, including the areas in the vicinity of Sandalwood Street, Walnut Street, and Heil Avenue.

Agencies responsible for flood control in Fountain Valley include the Unites States Army Corps of Engineers (USACE), OCFCD, FEMA, the Federal Insurance Administration (FIA), and the Department of Water Resources (DWR).

- **USACE:** The USACE identifies the need for and constructs major flood-control facilities. It also develops flood and dam inundation maps and reports. The USACE constructed the Santa Ana River 1 Levee System which protects the city along the right/west bank of the Santa Ana River.

- **OCFCD:** OCFCD coordinates floodplain management services with agencies such as FEMA throughout Orange County. OCFCD operates and maintains the Santa Ana River 1 Levee System, which borders the eastern boundary of the city.

- **FEMA:** FEMA manages the National Flood Insurance Program (NFIP), providing insurance to the public in communities that participate in the program. FEMA is the main federal government agency contact during natural disasters and publishes the Flood Insurance Rate Maps (FIRM), which identify the extent of flood potential in flood-prone communities based on a 100-year flood (or base flood) event.

- **FIA:** The FIA is the primary agency that delineates potential flood hazard areas and floodways through the FIRMs and the Flood Boundary and Floodway Map.

Flood insurance is required of all homeowners who have federally subsidized loans.

- **DWR:** DWR is responsible for managing and protecting California's water. DWR works with other agencies to benefit the state's people, and to protect, restore, and enhance the natural and human environments. DWR also works to prevent and respond to floods, droughts, and catastrophic events that would threaten public safety, water resources and management systems, the environment, and property.

Floodplains can change over time; the floodplain and watercourse of a stream can also be affected by anthropogenic (or human) influences, such as the development of land into residential or commercial structures and the resulting reduction of pervious land, resulting in increased stream flow, the construction of bridges or culverts, or the creation of levees or other impoundment structures that control the flow in the watercourse.

Dam break floods are usually associated with intense rainfall or prolonged flood conditions. A dam failure is an uncontrolled release of water from a reservoir through a dam as a result of structural failures or deficiencies in the dam. Dam failures can range from fairly minor to catastrophic and can potentially harm human life and property downstream from the failure. In addition, ecosystems and habitats are destroyed as a result of waters flooding them. Although dam failures are very rare, these events are not unprecedented. Additionally, the older that dams get, the more potential exists for catastrophic dam failures. There are four major causes of dam failures, which include the following:

- **Overtopping:** These failures occur when a reservoir fills too high with water, especially in times of heavy rainfall, leaving water to rush over the top of the dam. Other causes of this type of failure include settling of the crest of the dam or spillway blockage.

- **Foundation defects:** These failures occur as a result of settling in the foundation of the dam, instability of slopes surrounding the dam, uplift pressures, and seepage around the foundation. All of these failures result in structural instability and potential dam failure.

- **Piping and seepage failures**: These failures occur as a result of internal erosion caused by seepage and erosion along hydraulic structures such as the spillways. Erosion may also be caused by animal burrows and cracks in the dam structure.

- **Conduit and valve failure:** These failures occur as a result of problems with valves and conduits.

Other dam failures arise as a result of other miscellaneous causes. Many dam failures are also the secondary result of other natural disasters, such as earthquakes, landslides, extreme storms, or heavy snow-melt. Other causes include equipment malfunction, structural damage, and sabotage.

The Seven Oaks Dam and the Prado Dam present a downstream hazard to the City of Fountain Valley. The Seven Oaks Dam is located on the Santa Ana River in the upper Santa Ana Canyon about eight miles northeast of the City of Redlands in San Bernardino County. The Prado Dam is about 40 miles downstream of the Seven Oaks Dam. Approximately 47 billion gallons (145,600 acre-feet) of water can be stored in the Seven Oaks Reservoir and 61 billion gallons (187,600 acre-feet in the Prado reservoir). As illustrated in Figure 2, the entire city is at risk of inundation from these dams. In Fountain Valley, a major earthquake could cause a dam failure. Dams are constructed with safety features known as "spillways" that allow water to overtop the dam if the reservoir fills too quickly. Spillway overflow events, often referred to as "design failures," result in increased discharges downstream and increased flooding potential. In a dam failure scenario, the greatest threat to life and property typically occurs in those areas immediately below the dam since flood depths and discharges generally decrease as the flood wave moves downstream. The primary danger associated with dam failure is the high-velocity flooding downstream of the dam and limited warning times for evacuation.

The Federal Energy Regulatory Commission, as required by federal law, has reviewed and approved comprehensive emergency action plans (EAPs) for each of these dams. The EAP minimizes the threat to public safety and the response time to an impending or actual sudden release of water from project dams. The EAP is also designed to provide emergency notification when flood water releases may 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 1. FLOOD HAZARD ZONES

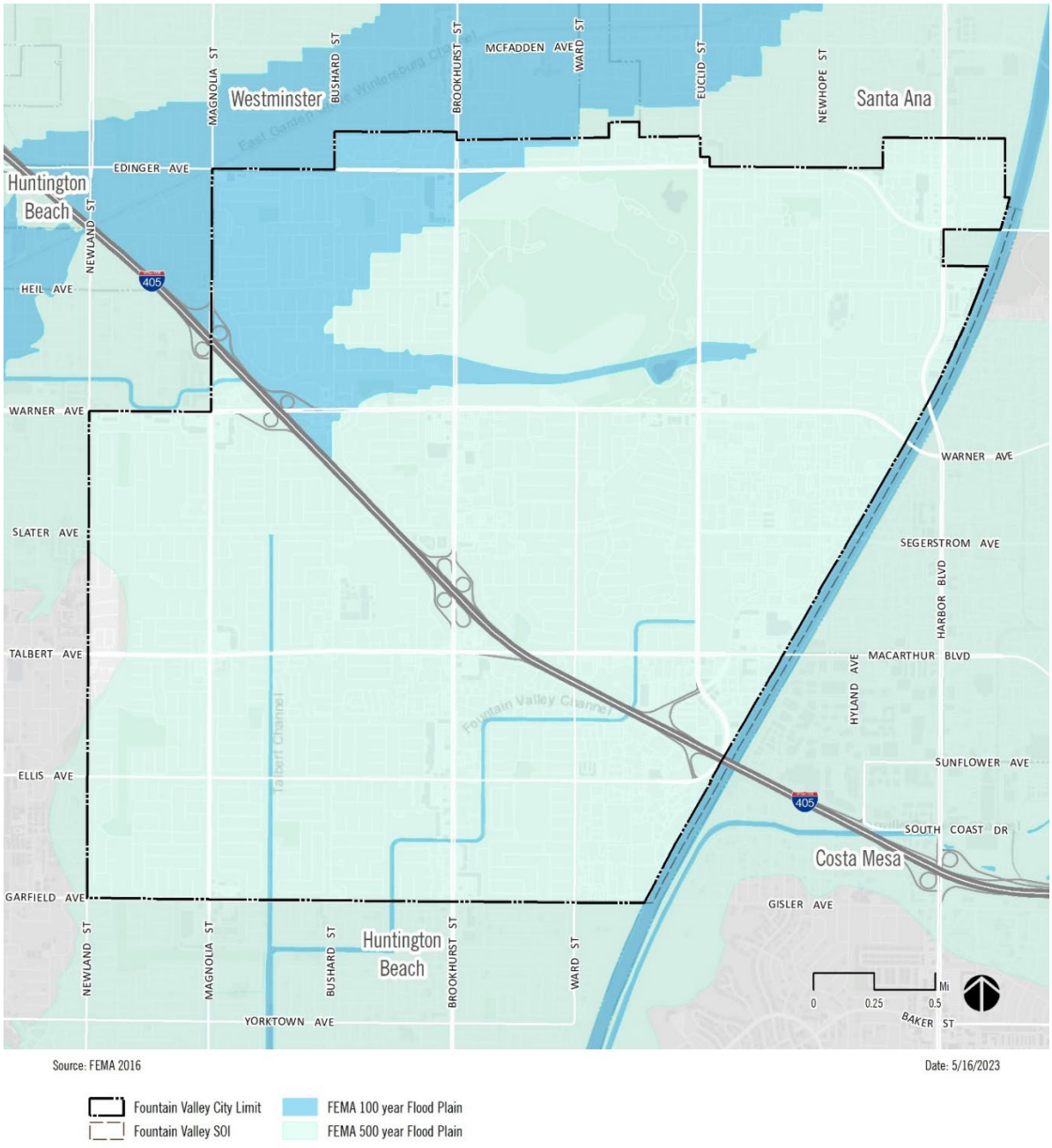
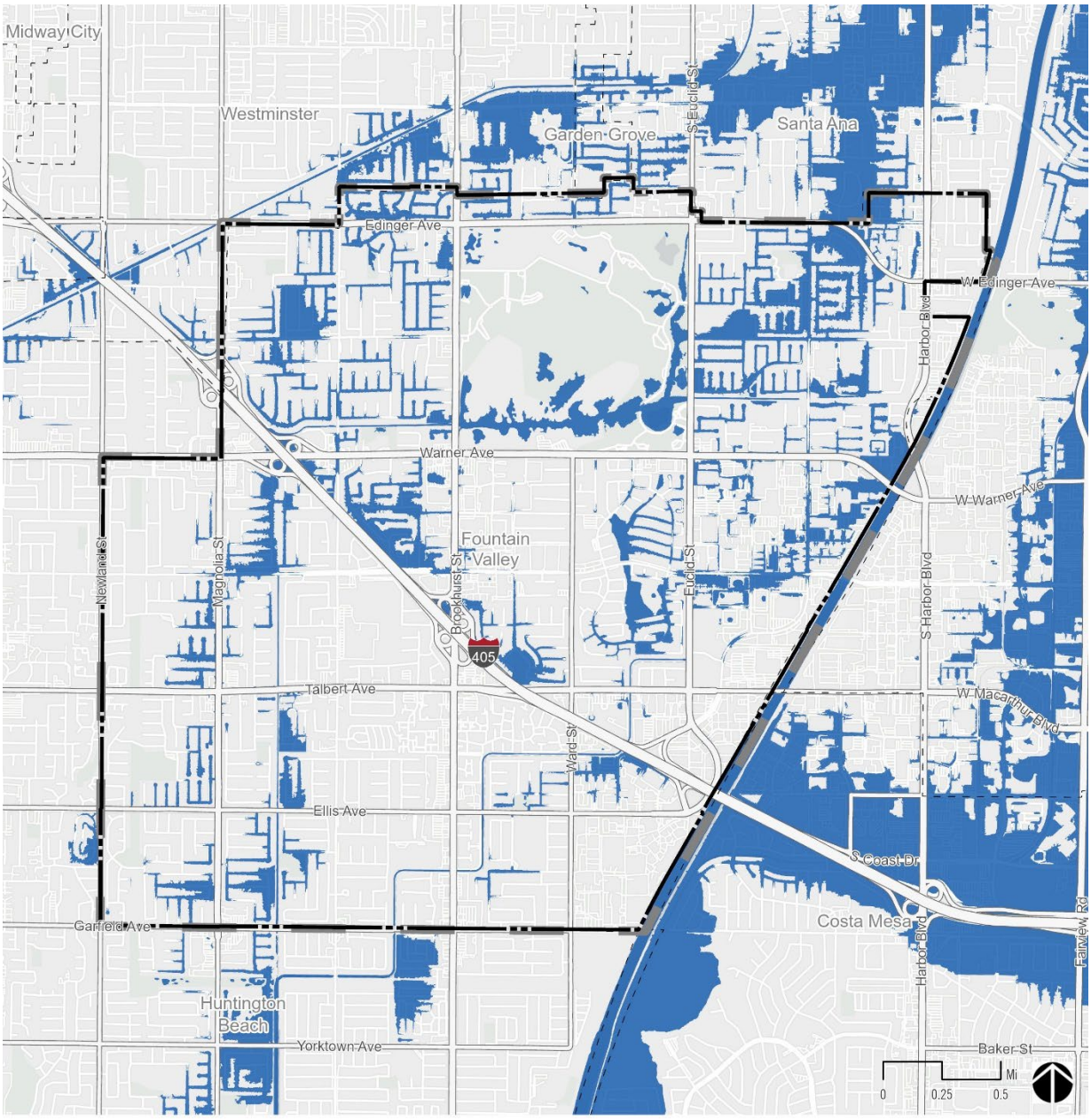


FIGURE 2. DAM INUNDATION



Source: OES, PlaceWorks 2021

Date: 5/17/2023

Fountain Valley City Limits (incorporated)

Dam Inundation Areas

Fountain Valley Sphere of Influence

POTENTIAL CHANGES TO FLOOD RISK IN FUTURE YEARS

Likelihood of Future Occurrence

Historically, extended heavy rains have resulted in floodwaters that exceed normal high-water boundaries and cause damage in Fountain Valley. Flooding has occurred both within 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. The potential for a levee failure or dam failure event in Fountain Valley is likely to remain a risk in future years, although the odds of such events are expected to remain low.

Climate Change and Flooding

Floods are among the most damaging natural hazards in Orange County, and climate change is expected to make flood events worse. Although climate change may not change average precipitation levels significantly, scientists expect that it will cause more years with extreme precipitation events. This means that more years are likely to see particularly intense storm systems that drop enough precipitation over a short enough period to cause flooding. Although Southern California is likely to experience a decrease in overall precipitation levels from climate change, the region is also expected to see an increase in the number of extreme precipitation events. A meteorological phenomenon known as the "atmospheric river," a narrow stream of extremely moist air, is frequently responsible for the more intense storms that strike California. Atmospheric rivers generally deliver high levels of precipitation, up to 50 percent of the state's total precipitation in any given year.

Because of this, floods are expected to occur more often in Fountain Valley and climate change may expand the parts of the city that are considered flood prone. Although there are no specific flooding projections for the city, flood events are expected to become more frequent, and it is possible that the areas subject to flooding will expand. There are some indirect effects of climate change that may also increase flooding in the city. Climate change is expected to increase the frequency and severity of droughts that cause soil to dry out and become hard. When precipitation does return, more water runs off the surface than is absorbed into the ground, which can lead to floods.

While the risk and associated short- and long-term impacts of climate change are uncertain, experts in this field tend to agree that among the most significant impacts include those resulting from increased heat and precipitation events that cause increased frequency and magnitude of flooding. Increases in damaging flood events will cause greater property damage, public health and safety concerns, displacement, and loss of life. Displacement of residents can include both temporary and long-term displacement, increase in insurance rates, or restriction of insurance coverage in vulnerable areas.

FIRE HAZARDS

Fire hazards include both wildfires and urban fires. California is recognized as one of the most fire-prone and consequently fire-adapted landscapes in the world. The combination of complex terrain, Mediterranean climate, and productive natural plant communities, along with ample natural ignition sources, has created conditions for extensive wildfires. Wildfire is a low concern for the City of Fountain Valley. Generally, the fire season extends from early spring through late fall of each year during the hotter, dryer months. Fire conditions arise from a combination of high temperatures, low-moisture content in the air and plant matter, an accumulation of vegetation, and high winds.

Areas at risk of wildfire are labeled as Fire Hazard Severity Zones (FHSZs). In unincorporated areas where state agencies provide fire protection services (known as State Responsibility Areas or SRAs), the state has identified Moderate, High, and Very High FHSZs. In areas where local agencies provide fire protection services (Local Responsibility Areas or LRAs), the state has identified Very High FHSZs. There are no Very High Fire Hazard Severity Zones in Fountain Valley or adjacent communities, as the city is in an urban environment and surrounded by communities that are built out. Furthermore, the city is not within a wildland urban interface. The wildland-urban interface is an area where buildings and infrastructure (e.g., cell towers, schools, water supply facilities) mix with areas of flammable wildland vegetation. This interface is sometimes divided into the defense zone (areas in close proximity to communities, usually about a quarter mile thick) and threat zones (an approximately one-and-a-quarter-mile buffer around the defense zone). The nearest identified High and Very High FHSZs are in the San Joaquin Hills to the south, and Loma Ridge and Limestone Canyon Regional Park to the east. Consequently, the primary type of fire that is of concern to Fountain Valley is structural fires.

Wildfire potential for Orange County is typically greatest in the months of August, September, and October, when dry vegetation coexists with hot, dry Santa Ana winds. However, fires with conflagration potential can occur at any time of the year. Seasonal drought conditions exacerbate fire hazards. Areas adjacent to the city that are susceptible to wildfires are also of concern as these conditions could exacerbate vulnerabilities within the city.

Wildfire Smoke

While Fountain Valley itself is not at direct risk to wildfire, increasing regional fire frequency can 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 such as children, older adults, people with chronic respiratory or cardiovascular disease, or people experiencing low socioeconomic status. Impacts from $PM_{2.5}$ are discussed further in the Air Pollution section.

Structural Fires

As mentioned above, the primary fire risk in Fountain Valley is from structural fires. These fires occur in built-up environments, destroying buildings and other human-made structures. These disasters are often due to faulty wiring or mechanical equipment, combustible construction materials, or the absence of fire alarms and fire sprinkler systems. Structural fires are largely from human accidents, although deliberate fires (arson) may be a cause of some events. Older buildings that lack modern fire safety features may face greater risk of damage from fires. To minimize fire damage and loss, the City's Fire and Building Codes, based on the California Fire and Building Codes, sets standards for building and construction. It requires the provision of adequate water supply for firefighting, fire-retardant construction, and minimum street widths, among other things. Fire prevention awareness programs and fire drills are conducted to train residents to respond quickly and correctly to reduce injury and losses during fires.

Fire Protection

Fire protection in Fountain Valley is provided by the City of Fountain Valley Fire Department. The Fountain Valley Fire Department coordinates the city's emergency preparedness program to plan and train for disaster situations, such as earthquakes. The City of Fountain Valley also maintains a comprehensive Automatic Aid Agreement for fire protection and emergency medical aid services with the contiguous cities of Santa Ana, Costa Mesa, Newport Beach, Huntington Beach, Westminster, and the County of Orange. This agreement provides the shortest possible emergency response time, and includes training, arson investigation, communications, and weekly administrative coordination between all entities. The City of Fountain Valley is a signatory to the California Mutual Aid Fire Protection System. This agreement was established to aid with major emergency incidents anywhere in the state.

The Fountain Valley Fire Department provides fire protection, emergency medical services, and disaster preparedness and response. Fountain Valley has two fire stations located at 17737 Bushard Street (Fire Station #1:) and 16767 Newhope Street (Fire Station #2).

Potential Changes to Fire Risk in Future Years

Likelihood of Future Occurrence

The wildfire season in Orange County typically lasts from August through October. Extreme weather conditions during periods of low humidity, low fuel moisture, and high winds also contribute to the severity of any potential wildfires. Extreme weather conditions during periods of low humidity, low fuel moisture, and high winds also contribute to the severity of any potential wildfires. Fires occurring during these times typically burn hot and fast and are difficult to control unless initial suppression occurs immediately. However, wildfire for the Fountain Valley is not a great concern since the city is not within a FHSZ; the nearest identified High and Very High FHSZs are in the San Joaquin Hills to the south, and Loma Ridge and Limestone Canyon Regional Park to the east. Wildfire will continue to be a low-risk hazard for property damage in Fountain Valley, although smoke impacts from regional wildfires are likely to continue to be problematic. Structural fires are the primary risk for Fountain Valley given the city's built-up environment and proximity to FHSZs. However, the likelihood of structural fires occurring in the city is low since these fires are usually the result of human accidents or mechanical issues in buildings.

Climate Change and Wildfire

Changing climate conditions are expected to increase the fire risk in and around Fountain Valley. 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 shot hole borer, creating more dead trees and increasing the fuel load. Warmer temperatures are also expected to occur later in the year, extending the wildfire season, which is likely to begin earlier in the year and extend later than it has historically. Wildfire occurring later or earlier in the year are more likely to occur during Santa Ana wind events, which can cause wildfires to move more quickly and increase the likelihood to burning in the wildland-urban interface areas. According to the California Fourth Climate Change Assessment, overall burned area may increase by as much as 60 percent during Santa Ana wind events (typically October to March), and 75 percent during periods without Santa Ana winds (typically April to September).

SEVERE WEATHER

Severe weather is generally any destructive weather event, but usually occurs in Fountain Valley as localized storms that bring heavy rain, hail, lightning, and strong winds. Severe weather is usually caused by intense storm systems, although types of strong winds can occur without a storm. The types of dangers posed by severe weather vary widely and may include injuries or deaths, damage to buildings and structures, fallen trees, roads and railways blocked by debris, and fires sparked by lightning. Severe

weather often produces high winds and lightning that can damage structures and cause power outages. Lightning from these storms can ignite wildfires and structure fires that can cause damage to buildings and endanger people. Objects such as vehicles, unprotected structures (e.g., bus stops, car ports), fences, telephone poles, or trees can also be struck directly by lightning, which may result in an explosion or fire. In Orange County, most severe weather is linked to high winds. 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.

Santa Ana winds have caused large amounts of damage and increased the fire damage level dramatically. Santa Ana winds are generally defined as warm, dry winds that blow from the east or northeast (offshore). These winds occur below the passes and canyons of the coastal ranges of Southern California. Santa Ana winds often blow with exceptional speed in the Santa Ana Canyon. The complex topography of Southern California, combined with various atmospheric conditions, creates numerous scenarios that may cause widespread or isolated Santa Ana events. Commonly, Santa Ana winds develop when a region of high pressure builds over the Great Basin (the high plateau east of the Sierra Nevada and west of the Rocky Mountains, including most of Nevada and Utah). Santa Ana winds commonly occur between October and April with December having the highest frequency of events. Summer events are rare. Wind speeds are typically north to east at 40 miles per hour (mph) through and below passes and canyons with gusts to 58 mph. Stronger Santa Ana winds can have gusts greater than 69 mph over widespread areas and, in rare instances, gusts greater than 115 mph in specific areas. Frequently, the strongest winds in the basin occur during the night and morning hours due to the absence of a sea breeze.

All wind events, including Santa Ana winds, 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 breathing problems. The winds can blow roofs off buildings and cause tree limbs to fall on structures. High winds also increase the threat of wildfires. Winds may dry out brush and forest areas, increasing the fuel load in fire-prone areas. Winds may spark wildfires by knocking down power lines or causing them to arc. If wildfires do start, high winds can push flames quickly into new areas, contributing to the rapid spread of wildfires and making them harder to control. This can affect the air quality in Fountain Valley and may disrupt regional infrastructure networks.

Potential Changes to Severe Weather in Future Years

Likelihood of Future Occurrence

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

Climate Change and Severe Weather

Climate change is expected to cause an increase in intense rainfall and strong storm systems, which is usually associated with strong storm systems. This means that Fountain Valley 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.

SEISMIC AND GEOLOGIC HAZARDS

Seismic and geologic hazards are risks caused by the movement of different parts of the Earth's crust, or surface. 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 build over time and is ultimately released, resulting in ground shaking that we refer to as an earthquake. 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.

While Fountain Valley is at risk from many natural and human-caused hazards, the event with the greatest potential for loss of life or property and economic damage is an earthquake. This is true for most of Southern California, since damaging earthquakes affect widespread areas, trigger many secondary effects that can overwhelm the ability of local jurisdictions to respond. In Fountain Valley, earthquake effects include ground shaking, fault rupture, landslides, liquefaction, subsidence, and seiches. Earthquakes can also cause human-caused hazards such as urban fires, dam failures, and toxic chemical releases.

Earthquake risk is very high in West Orange County, including the City of Fountain Valley, due to the presence of several active faults in the region, the San Andreas Fault, Newport-Inglewood Fault, Whittier-Elsinore Fault, El Modina Fault, San Jacinto Fault, Norwalk Fault, Santa Monica-Raymond Hill Fault, Cristianos Fault, San Joaquin Hills Thrust Fault, Peralta Uplift Fault, and Palos Verdes Fault, and San Clemente Fault. These faults are all capable of producing earthquakes in the magnitude 4.5 – 8+ range. However, the five active faults which could potentially cause serious damage to the city are the San Andreas Fault, Newport-Inglewood Fault, San Joaquin Hills Thrust Fault, Palos Verdes Fault and San Clemente Fault. A major earthquake along any of these five faults could result in substantial casualties and damage resulting from collapsed buildings, damaged roads and bridges, fires, flooding, and other threats to life and property.

Most of the loss of life and injuries from earthquakes are due to damage and collapse of buildings and structures. Building codes for new construction have generally been made more stringent following damaging earthquakes. However, in Fountain Valley, structures built prior to the enactment of these improved building codes have generally not been upgraded to current standards and are vulnerable to earthquakes. Comprehensive hazard mitigation programs that include the identification and mapping of hazards, prudent planning and enforcement of building codes, and expedient retrofitting and rehabilitation of weak structures can significantly reduce the scope of an earthquake disaster.

Earthquake shaking at a particular site is a function of both distance to the fault and site geology. Fountain Valley has a high potential of ground failure including liquefaction and settlement due to the high content of ground water, especially in the areas adjacent to the Santa Ana River and south of Interstate 405 (I-405). The city could suffer shocks strong enough to cause severe structural damage.

Fountain Valley is fortunate not to have any known faults within the City's boundaries although liquefaction could cause a major threat to the area should a significant seismic event occur. Most of these events have been attributed to the two faults located nearest to the planning area; the Newport-Inglewood Fault, which angles from offshore near

Dana Point inland through the City of Newport Beach, on into Los Angeles County through Long Beach, and into Torrance, and the Whittier-Elsinore Fault, which follows a general line easterly of the Santa Ana Mountains into Mexico, as shown on Figure 3 Regional Fault Lines.

In the event of an earthquake, the location of the epicenter, as well as the time of day and season of the year, would have a profound effect on the number of deaths and casualties, as well as property damage. There are a number of small-scale earthquakes that happen weekly, but larger scale or catastrophe shaking is less likely. Property and human life in Fountain Valley are at risk for a significant earthquake causing catastrophic damage and strains on response and mitigation resources.

The county experiences hundreds of minor quakes and tremblers each month from the myriad of faults in the area. Other faults, both in and outside Orange County, may also be capable of generating significant earthquakes with damaging effects in the county. A major quake could happen at any time. Figure 3 shows the known fault lines in and around Fountain Valley.

Portions of the city are susceptible to liquefaction, which is a potentially destructive secondary effect of strong seismic shaking. Liquefaction occurs primarily in saturated, loose, fine- to medium-grained soils in areas where the groundwater table is within approximately 50 feet of the surface. Shaking causes the soil to lose strength and behave as liquid. Excess water pressure is vented upward through fissures and soil cracks and can result in a water-soil slurry flowing onto the ground surface. This subsurface process can lead to near-surface or surface ground failure that can result in property damage and structural failure. Ground water which is less than ten feet to the surface can cause the highest liquefaction susceptibility. Groundwater ten to thirty feet below the surface can create a moderately high to moderate susceptibility. Groundwater thirty to fifty feet deep can create a moderate to low susceptibility.

Liquefaction-related effects include loss of bearing strength, ground oscillations, lateral spreading, and flow failures or slumping. Site-specific geotechnical studies are the only practical and reliable way of determining the specific liquefaction potential of a site; however, a determination of general risk potential can be provided based on soil type and depth of groundwater. Fountain Valley has delineated areas of known and potential liquefaction hazard. As illustrated in Figure 4, all of the community with the exception of an isolated area along Newland Street in the western portion of the city is susceptible to liquefaction.

Areas are susceptible to liquefaction based on a combination of known factors in some areas and the absence of known factors in other areas. Additionally, these potential

hazard zones are not an absolute indication that the hazard truly exists nor are they an indicator of the extent of damage that may or may not occur at a given site. Ground water in Fountain Valley is less than ten feet from the surface probably due to the swampland that existed within the planning area in the early 1900s; therefore, there is a very high potential for liquefaction in Fountain Valley.

In most cases, proper design and construction of subgrade soils and building foundations provides a mechanism to mitigate the risk of seismic hazards to an acceptable level in conformance with the California Building Code. The representation of areas having a liquefaction potential is only intended as notification to seek further site-specific information and analysis of this potential hazard as part of future site development. It should not be solely relied upon, without site-specific information and analysis, for design or decision-making purposes.

Seismic seiches are waves which can occur in a body of water because of seismic shaking. Seiching has been known to occur within storage tanks located near a fault, as it did in the 1971 San Fernando earthquake. In extreme cases, such waves can rupture a water tank. Fountain Valley has a large wastewater treatment facility located within its city limits that could be damaged and/or shutdown during a seiche event within the tanks, although this is considered unlikely.

Geologic Hazards

Geologic hazards, such as 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 occur continuously on all slopes; some processes act very slowly, while others occur very suddenly, often with disastrous results. They often occur as a consequence of seismic activity or heavy rainfall, either of which may cause slopes to lose structural integrity and slide. 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. Due to the level or nearly level terrain of the city, landslides are not a hazard of significant concern in Fountain Valley. In Fountain Valley, landslides would be minor and limited to small hillside areas.

Fountain Valley is susceptible to hazards related to erosion, or 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 transportation of the eroded materials away from the point of removal. The severity of water erosion is influenced by slope, soil type, soil water storage capacity, nature of the underlying rock,

vegetation cover, and rainfall intensity and period. The impact of soil erosion on water quality becomes significant, particularly as soil surface runoff. Highly erosive soils can damage roads, bridges, buildings, and other structures.

Hydroconsolidation, or soil collapse, typically occurs in recently deposited, Holocene (less than 10,000 years old) soils that were deposited in an arid or semi-arid environment. Soils prone to collapse are commonly associated with human-made fill, wind-laid sands and silts, and alluvial fan and mudflow sediments deposited during flash floods. When saturated, collapsible soils undergo a rearrangement of their grains, and the water removes the cohesive (or cementing) material. Rapid, substantial settlement results. In Fountain Valley, collapsible soils occur predominantly at the base of the mountains, where Holocene-age alluvial fan and wash sediments have been deposited during rapid runoff events. Typically, differential settlement of structures occurs when lawns or plantings are heavily irrigated near the structure's foundation. Forensic indications of collapsible soils include tilting or sagging floors, cracking or separating structures, and windows and doors that cannot open due to shifts in the building.

Subsidence refers to the sudden sinking or gradual downward settling and compaction of soil and other surface material with little or no horizontal motion. It may be caused by a variety of human and natural activities, including earthquakes and water saturation. Subsidence typically occurs throughout a susceptible valley. In addition, differential displacement and fissures occur at or near the valley margin and along faults. Land subsidence and related issues have been well-documented in the county. Most early documented cases of subsidence affected only agricultural land or open space. As urban areas expanded, impacts of subsidence increased on structures for human occupancy. Alluvial valley regions are especially susceptible. Ground subsidence resulted from changes to groundwater tables throughout the city and surrounding region. Figure 4 shows the subsidence zones in and around Fountain Valley.

POTENTIAL CHANGES TO GEOLOGIC AND SEISMIC RISK IN FUTURE YEARS

Likelihood of Future Occurrence

Seismic Risk

Earthquakes are likely to continue to occur on an occasional basis and are likely to be small. Most are expected to cause no substantive damage and may not even be felt by most people. Major earthquakes are rare, but a possibility in the region. However, earthquakes are the highest concern for the city given the proximity to the Newport-Inglewood Fault and liquefaction potential. Due to the structure of the subsurface soils and a high-water table, the city has a high liquefaction potential in the areas adjacent to the Santa Ana River and south of I-405. No major earthquakes have been recorded with

epicenters within the city, although the city has felt strong ground shaking from earthquakes with epicenters located elsewhere. Large earthquakes from faults such as the San Andreas Fault may cause significant damage to homes and businesses in the city. Based on historical data and the location of Fountain Valley relative to active and potentially active faults, the city will likely experience a significantly damaging earthquake.

If serious shaking does occur, newer construction is in general more earthquake resistant than older construction because of improved building codes. Manufactured housing is very susceptible to damage because the foundation systems are rarely braced for earthquake motions.

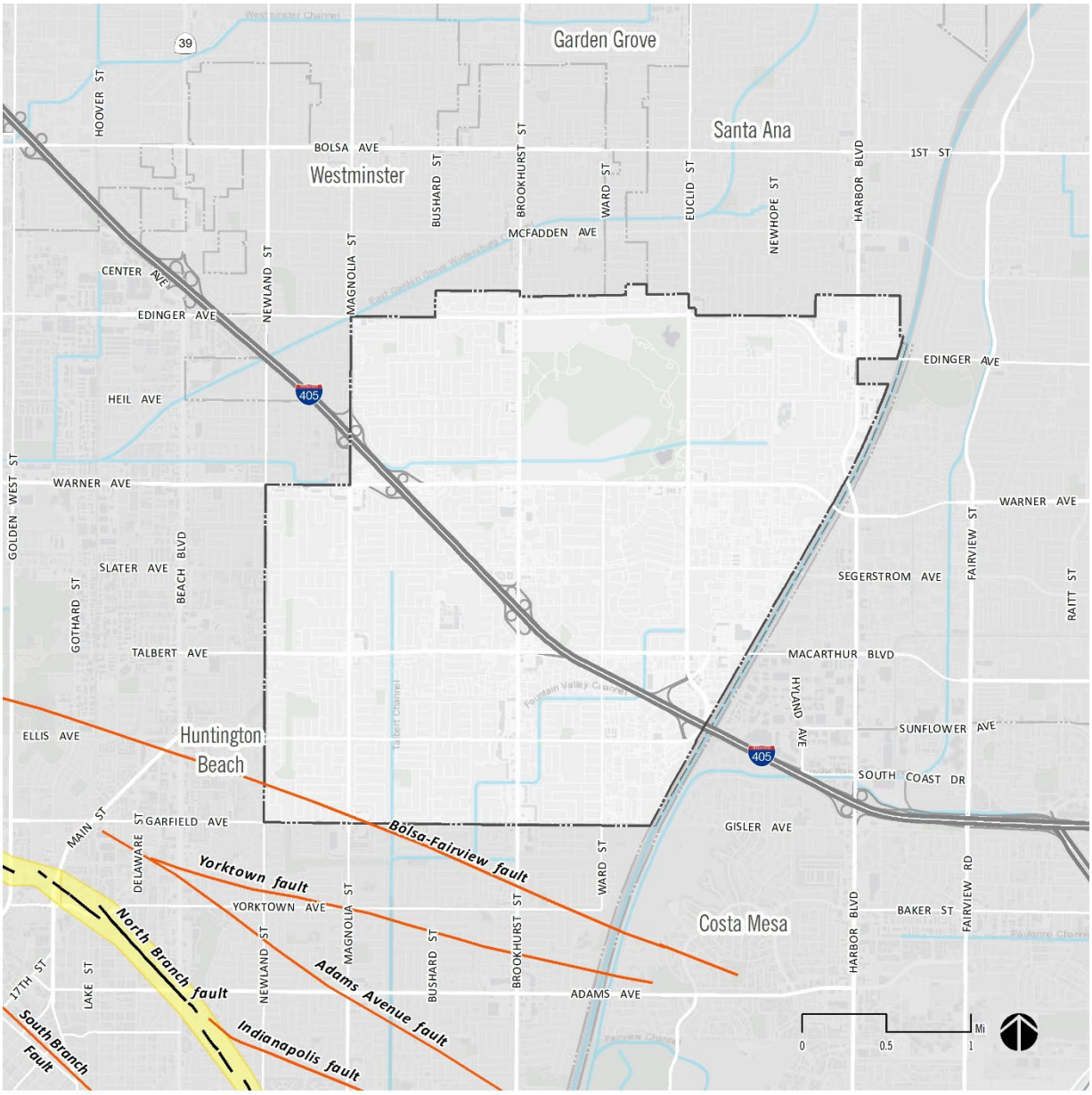
Geologic Risk

Minor landslides have occurred in the past, probably over the last several hundred years, as evidenced by both past deposits exposed in erosion gullies and recent landslide events. Orange County has a history of landslides during seasons of high precipitation. Geologic risks, such as landslides, are rare occurrences in Fountain Valley. With significant rainfall, additional failures are likely in the community's limited landslide hazard areas and minor landslides will likely continue to impact the area when heavy precipitation occurs, as they have in the past.

Climate Change and Geologic and Seismic Hazards

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

FIGURE 3. REGIONAL FAULT LINES

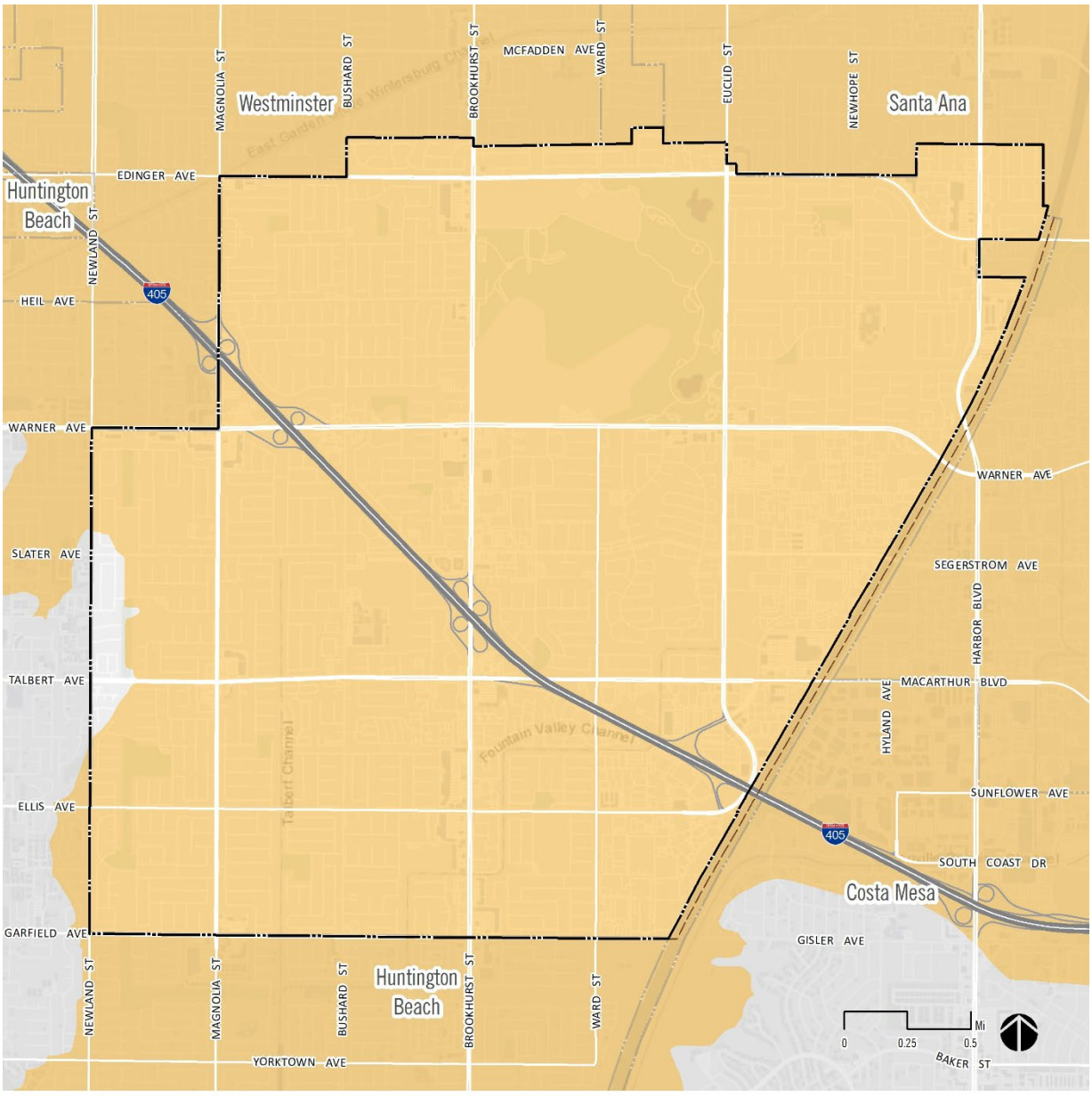


Source: CGS 2022

Date: 5/16/2023

Fountain Valley City Limit
Fountain Valley SOI
Alquist Priolo Fault Traces
Other Quaternary Faults
Alquist Priolo Fault Zone

FIGURE 4. LIQUEFACTION ZONE



HAZARDOUS WASTE AND MATERIALS

Hazardous materials are materials that pose a significant risk to public safety or human or environmental health. These 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, as a consequence of vehicle accidents.

The release or spill of bulk hazardous materials could result in fire, explosion, toxic cloud, or direct contamination of water, people, and property. The effects may involve a local site or many square miles. Health problems may be immediate, such as corrosive effects on skin and lungs, or gradual, such as the development of cancer from a carcinogen. Damage to property could range from immediate destruction by explosion to permanent contamination by a persistent hazardous material.

Most hazardous materials in the region are being transported on truck routes along major roadways, such as I-405, that pass through Fountain Valley. The most vulnerable areas along this route are considered the on-/off-ramps and interchanges. Since 1970, there has been one reported roadway hazardous materials incident.

Industrial and commercial businesses are located throughout the city and process, store and/or manufacture a wide variety of hazardous materials. The most vulnerable area of the city is the east side, from Warner Avenue, south to Garfield Avenue and along the Santa Ana River. Radiological materials are also used in hospitals and industrial applications. Some transportation of radioactive materials occurs on various routes throughout the city.

Hazardous materials and waste within Fountain Valley are managed by the Certified Unified Program Agency (CUPA), a local administrative agency within the County of Orange Environmental Health Division. 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/waste facilities. Potential and known contamination sites are monitored and documented by the Regional Water Quality Control Board (RWQCB) and the Department of Toxic Substances and Controls (DTSC). A review of the leaking underground storage tank list produced by the RWQCB and the DTSC EnviroStor database indicates two school investigation cleanup sites at 17816

Bushard Street; four voluntary cleanup sites at 18888 Brookhurst Street, 10130 Warner Avenue, Suite B; 18155 – 18191 Euclid Street and 11045 Condor Avenue, and 9790 Finch Avenue; one school cleanup site at 15872 Harbor Boulevard; and two military evaluation cleanup sites (addresses not available).

If a hazardous material spill poses an imminent public health threat, the City will support local regulating agencies in notifying the public. The transport of hazardous materials/wastes and explosives through the city is regulated by the California Department of Transportation (Caltrans). I-405 is open to vehicles carrying hazardous materials/wastes. Transporters of hazardous wastes are required to be certified by the United States Department of Transportation (DOT) and manifests are required to track the hazardous waste during transport. The danger of hazardous materials/waste spills during transport does exist and will potentially increase as transportation of these materials increase on I-405. The Fountain Valley Fire Department, Orange County Emergency Management Division, and Orange County Division of Environmental Health are responsible for hazardous materials accidents at all locations within the city.

Potential Changes to Hazardous Materials in Future Years

Likelihood of Future Occurrence

Given that there has been one hazardous materials incident in transport through the city in the past 50 years, it is unlikely a hazardous materials incident will occur in Fountain Valley on a frequent basis. Moreover, according to Caltrans, most incidents are related to releases of fluids from the transporting vehicles themselves and not the cargo, thus the likelihood of a significant hazardous materials release within the city is more limited and difficult to predict.

Climate Change and Hazardous Materials

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

3. EMERGENCY PREPARATION AND RESPONSE

The Fountain Valley Fire Department and Police Department conduct emergency preparedness activities in Fountain Valley. The City is prepared to meet emergency situations, such as all types of fire, medical, or hazardous situations. A multi-hazard functional plan includes an evacuation plan with traffic control points at every major arterial intersection. The Evacuation Plan provides guidance for the conduct of evacuation, dispersal or relocation operations during natural disasters, technological incidents, and nuclear defense emergencies. It also describes the organization and responsibilities for conducting evacuation operations.

The Emergency Operations Center (EOC) provides a centralized focus of emergency management in the event of a major emergency or disaster within the city. The EOC operations are directed by the City Manager, emergency management staff (City Department heads), and representatives from organizations who are assigned emergency responsibilities (Red Cross, schools, hospitals, etc.). The EOC has three potential operations centers ranked in order of priority: the police station at 10200 Slater Avenue, the City Yard at 18240 Ward Street, and the Fountain Valley Recreation Center at 16400 Brookhurst Street.

In addition to "fixed" facilities, the City has a mobile command vehicle capable of serving as a limited use EOC in a field environment. This vehicle is radio equipped, operational 24 hours and parked at the City Yard. The primary EOC is located within the Police Department Squad Room and has 24-hour security. Strict control of non-departmental personnel is maintained at the lobby entrance by a sworn police representative. The EOC is equipped with essential administrative supplies to sustain operations for an extended period. In addition, all necessary forms, i.e., communications message forms, separate journals for each emergency service, shelter registration cards, volunteer registration forms, emergency requisition forms, damage assessment survey sheets for all possible contingencies are stocked in the EOC.

The City of Fountain Valley uses Alert Orange County, a mass notification system, to notify the community and distribute emergency information and instructions before, during, and after a disaster. Other systems include the Emergency Alert Systems (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, such as weather and AMBER alerts, to affected communities. EAS participants – radio and television broadcasters, cable systems, satellite radio and television providers, and wireline video providers. FEMA, the Federal Communications System, and the National Oceanic and Atmospheric Administration’s (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 State of California Governor's Office of Emergency Services and is an enhancement to the EAS. These systems are available in multiple languages.

With advanced warning, evacuation can be effective in reducing injury and loss of life during a catastrophic event. Figure 5 shows residential parcels with evacuation constraints. All parcels within an evacuation constraint are located in at least one hazard-prone area and may have only one emergency evacuation route. The lack of multiple emergency access points limits roadway access for these properties, which may create difficulties if there is a need to evacuate. Figure 5 shows the evacuation routes throughout the city. Primary emergency access and evacuation routes include I-405 which intersects the city from northwest to southeast; Edinger Avenue, Warner Avenue, Slater Avenue, and Talbert Avenue (east-west roadways); and Magnolia Street, Brookhurst Street, Euclid Street, and Harbor Boulevard (north-south roadways). All evacuation routes in Fountain Valley face a potential disruption from a flooding or earthquake event, which 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 the community or specific neighborhoods. This issue may be compounded since evacuation routes for Fountain Valley will also likely serve as evacuation routes for surrounding communities, and so potential disruptions may have regional effects.

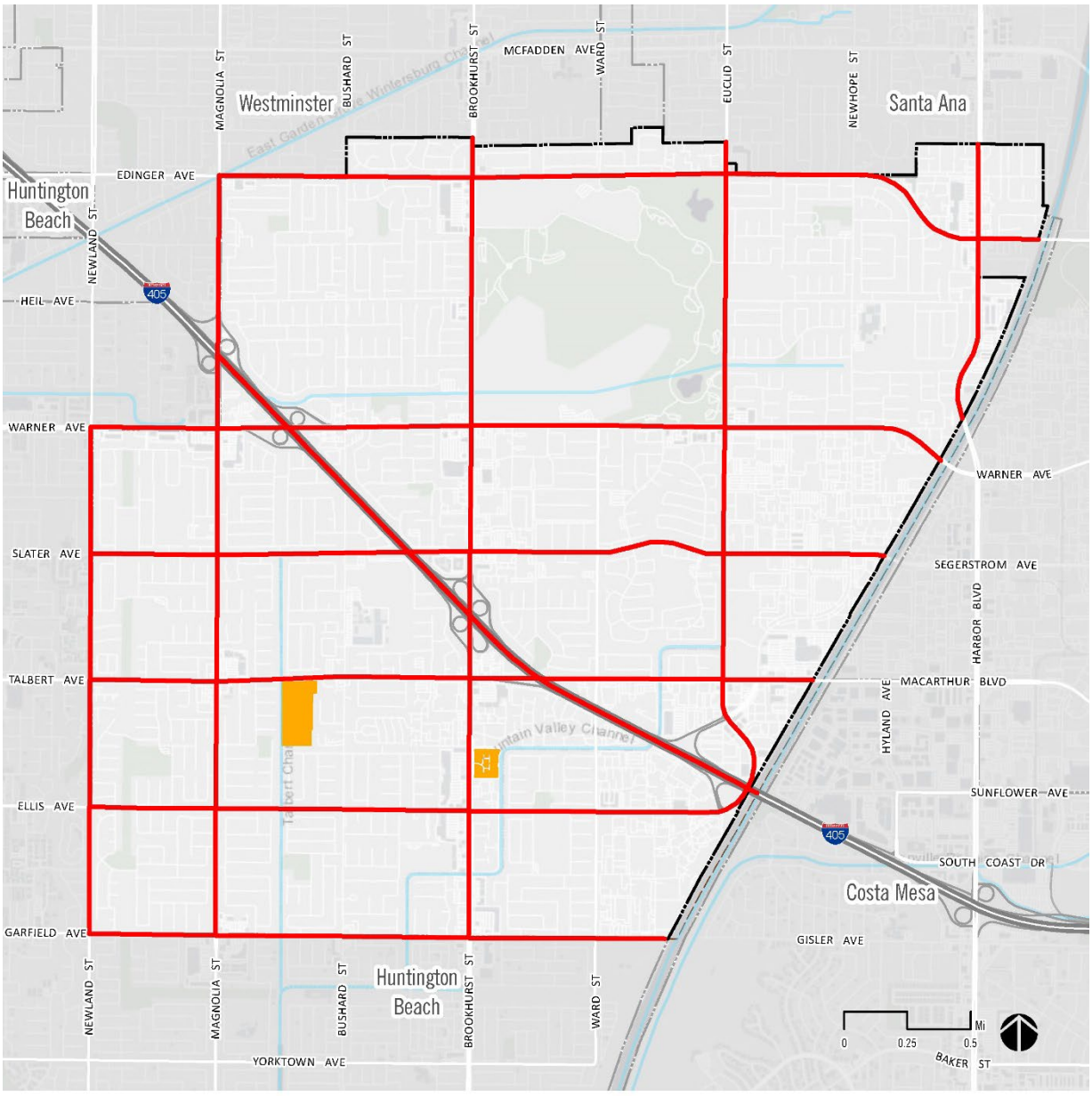
In recent years, the County of Orange has expanded its emergency preparedness planning. The County of Orange is required under state law to prepare and maintain a Standardized Emergency Management System (SEMS) Multi-hazard Functional Plan. The California Governor's Office of Emergency Services has extensive guidelines outlining the requirements of the Orange County SEMS.

The California Master Mutual-Aid Agreement has been adopted by the Standardized Emergency Management System and is designed to ensure that adequate resources, facilities, and other support are provided to jurisdictions whenever their own resources are insufficient to cope with the needs of a given emergency. The City of Fountain Valley participates in the California Master Mutual-Aid Agreement. The State Office of Emergency Services Southern Region (Mutual Aid Region I) serves the mutual-aid region that encompasses Orange County.

Automatic aid pacts with the Orange County Fire Authority (OCFA) and local fire departments provide additional emergency management and response services in

Fountain Valley. OCFA has established automatic aid and mutual aid with all fire agencies in Orange County, as well as adjacent counties. OCFA provides a variety of public safety services, including fire protection, medical aid, rescue, hazardous materials response, and educational safety programs. Fountain Valley Fire Department participates with the three fire departments which border Fountain Valley (Costa Mesa Fire Department, Huntington Beach Fire Department, and OCFA) in automatic aid pacts, which provide for the response of the closest fire and paramedic units regardless of jurisdictional boundaries. Other services consist of fire code enforcement and regulation, plan reviews, home and business inspections, and fire code permits.

FIGURE 5. EVACUATION ROUTES AND CONSTRAINED AREAS



4. VULNERABILITY ASSESSMENT

VULNERABILITY ASSESSMENT RESULTS

Under California law, the Public Safety Element is required to include a vulnerability assessment that looks at how people, buildings, infrastructure, and other key community assets may be affected by climate change. The City conducted a Climate Change Vulnerability Assessment in the summer of 2021 to analyze Fountain Valley's susceptibility to climate-related hazards. The City of Fountain Valley's vulnerability assessment, prepared in accordance with the most recent available guidance in the *California Adaptation Planning Guide*, assesses how seven different climate-related hazards (air quality, drought, extreme heat, flooding, human health hazards, landslides, and severe weather) may affect 50 different population groups and community assets. Each population or asset received a score of V1 (minimal vulnerability) to V5 (severe vulnerability) for each climate-related hazard. The Climate Change Vulnerability Assessment indicates that Fountain Valley's populations and assets are most vulnerable to extreme heat, severe weather, and flooding.

Populations in Fountain Valley tend to be vulnerable to extreme heat, human health hazards, air quality, and flooding, which directly affect health outcomes. As discussed previously, the most vulnerable communities include households in poverty, outdoor workers, and persons experiencing homelessness.

Citywide, energy delivery is vulnerable to multiple hazards, including severe weather, such as high winds that could disrupt energy service. These conditions can damage communication infrastructure, decreasing network capacity. There may be a higher demand for communication services during severe weather, potentially putting stress on the network and increasing the risk of service interruptions. Furthermore, energy delivery services, specifically electricity delivery, are subject to harm during extreme heat events. Extreme heat can lead to power outages by causing mechanical failure of grid equipment, heat damage to power lines, and by creating a high demand for electricity to power air conditioners, all of which place stress on the network. This is likely to lead to greater service disruptions.

The Public Safety Element includes goals, policies, and implementation measures to increase community resilience and help lower vulnerability scores, particularly for the populations and assets that received a score of V4 or V5 in the Vulnerability Assessment. A full list of the Vulnerability Assessment results can be found in **Appendix A**.

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APPENDIX A. VULNERABILITY ASSESSMENT RESULTS TABLE

The table below shows the results of the Vulnerability Assessment prepared for Fountain Valley, in accordance with the requirements of Senate Bill 379. For each population or asset that may be vulnerable to each climate-related hazard, the population or asset is scored on a scale of zero to five:

0: Not vulnerable

V1: Minimal vulnerability

V2: Low vulnerability

V3: Moderate vulnerability

V4: High vulnerability

V5: Severe vulnerability

The vulnerability scores reflect both the severity of climate-related impacts and the ability of populations and assets to resist and recover from these effects. Refer to the "Climate Change" and "Vulnerable Populations and Assets" sections of the Public Safety Element for additional details on the Vulnerability Assessment method.

Population or Asset		Hazard						
		Air Quality	Drought	Extreme Heat & Warm Nights	Flooding	Human Health Hazards	Landslides	Severe Weather
Populations	Children (Under 10)	V4	-	V5	V3	V3	V3	V3
	Cost burdened households	V3	V3	V3	V3	V2	V2	V2
	Households in poverty	V4	V4	V5	V4	V5	V3	V5
	Immigrants and refugees	V5	-	V4	V4	V5	V3	V4
	Linguistically isolated populations	V3	-	V3	V3	V3	V3	V4

	Population or Asset	Hazard						
		Air Quality	Drought	Extreme Heat & Warm Nights	Flooding	Human Health Hazards	Landslides	Severe Weather
	Low-Income Households	V3	V3	V4	V3	V2	V3	V3
	Outdoor Workers	V5	V4	V5	V4	V5	V2	V5
	Overcrowded households	V3	V2	V5	V3	V4	V3	V2
	Persons experiencing homelessness	V5	-	V5	V5	V5	V4	V5
	Persons with chronic illness	V4	-	V5	V4	V4	V2	V4
	Persons with disabilities	V3	-	V3	V4	V3	V3	V3
	Persons without access to lifelines	V3	-	V4	V3	V3	V3	V4
	Renters	V3	V3	V3	V2	V2	V2	V2
	Seniors (65+)	V4	-	V4	V4	V4	V3	V3
	Undocumented Persons	V5	-	V5	V5	V5	V3	V5
Infrastructure	Bicycle facilities	-	-	-	V3	-	-	V2
	Bridges	-	-	V3	V4	-	V3	V3
	Communication facilities (e.g., cell phone towers)	-	-	V3	-	-	-	V2
	Electrical substations and transmission lines	-	-	V4	V4	-	V4	V4
	Electric vehicle charging stations	-	-	V3	V3	-	-	V4
	Flood control infrastructure	-	-	-	V5	-	V3	V4
	Major Roads and Highways	-	-	V3	V4	-	V3	V3
	Natural gas pipelines	-	-	V3	V2	-	V3	-
	Parks and open space	-	V3	V2	V2	-	V4	V2
	Transit stops	-	-	-	V3	-	-	V2
	Solid waste facilities and closed landfills	-	-	-	-	-	-	-
	Water and wastewater infrastructure	-	V3	-	V3	-	V4	-
Buildings	Commercial buildings	-	-	V3	V3	-	-	-
	Community center	-	-	V3	V3	-	-	V1
	Government buildings	-	-	V2	V3	-	-	V1

Population or Asset		Hazard						
		Air Quality	Drought	Extreme Heat & Warm Nights	Flooding	Human Health Hazards	Landslides	Severe Weather
	Homes and residential structures	-	-	V3	-	-	V4	V4
	Libraries	-	-	V3	-	-	-	-
	Medical and care facilities	-	-	V1	-	-	-	-
	Public safety buildings	-	-	V1	-	-	-	-
	Schools	-	-	-	-	-	-	-
Important Economic Assets	Major Employers	V3	-	-	-	-	-	-
	Outdoor recreation	V4	V2	-	-	V3	V3	-
	Retail	V3	-	-	-	V3	-	-
	Educational services	V2	-	-	-	V3	-	-
	Healthcare and social services	V3	-	-	-	V3	-	-
	Professional, scientific, management, administrative and services	V1	-	-	-	V2	-	-
Key Community Services	Communication services	-	-	-	-	-	-	-
	Emergency medical response	V1	-	-	-	V4	-	-
	Energy delivery	V1	V1	-	-	-	-	-
	Government administration and community services	V1	-	-	-	V1	-	-
	Public health	V2	-	-	-	V3	-	-
	Public safety response	V2	-	-	-	V3	-	-
	Public transit access	V3	-	-	-	V2	-	-
	Solid waste removal	V3	-	-	-	V2	-	-
	Water and wastewater	-	V4	-	-	-	-	-