SAFETY ELEMENT

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VI. SAFETY ELEMENT

I. INTRODUCTION

A. PURPOSE

The Safety Element is the primary document for linking land use decisions to local safety planning. The main focus of the element is to address the public safety concerns of the community. One of its ultimate purposes is to reduce harm to people and property resulting from natural hazards such as fire, flooding, geologic and seismic hazards. Safety issues outside of natural hazards may also be addressed.

The Safety Element addresses public safety through analysis of conditions and hazards that have the potential to cause loss of life, injury, property damage, economic loss, and social dislocation. For Hercules, these constraints include seismic and other geologic hazards, flooding, urban and wildland fires, and hazardous materials. (Hazardous materials are addressed in the Hazardous Waste Management Plan Element.) The city cannot be made hazard free, but the planning process can be used to minimize exposure to dangerous conditions. This is the concept of acceptable risk and it is an inherent part of the environmental planning process.

Every community must decide what public safety standards are acceptable and the actions needed to maintain those standards. For planning purposes, an acceptable level of risk is one at which a hazard is deemed to be a tolerable exposure to danger, given the expected benefits to be gained. For some types of risk, numerical measures have been defined to identify the threshold of acceptable risk. In the case of seismic or flooding hazards, for example, specific locations may be identified as unacceptable based on their distance from known faults or location within a designated flood zone.

Environmental impact review is frequently used to assist in the decision-making process. Each identifiable risk must be addressed with mitigation measures that eliminate or minimize potential hazards. The measures include limitation of use in locations which are prone to hazard, special construction techniques, and site planning programs to respond to hazardous conditions.

B. AUTHORITY

1. Safety

Government Code Section 65302: (g) A safety element for the protection of the community from any unreasonable risks associated with the effects of seismically induced surface rupture, ground shaking, ground failure, tsunami, seiche, and dam failure; slope instability leading to mudslides and landslides; subsidence, liquefaction and other seismic hazards identified pursuant to Chapter 7.8 (commencing with Section 2690) of the Public Resources Code, and other geologic hazards known to the legislative body; flooding; wild land fires, and urban fires. The safety element shall include mapping of known seismic and other geologic hazards. It shall also address evacuation routes, peakload water supply requirements, and minimum road widths and clearances around structures, as those items relate to identified fire and geologic hazards. Prior to the periodic review of its general plan and prior to preparing or revising its safety element, each city and county shall consult the Division of Mines and Geology of the Department of Conservation and the Office of Emergency Services for the purpose of including information known by and available to the department and the office required by this subdivision.

To the extent that a county's safety element is sufficiently detailed and contains appropriate policies and programs for adoption by a city, a city may adopt that portion of the county's safety element that pertains to the city's planning area in satisfaction of the requirement imposed by this subdivision.

At least 45 days prior to adoption or amendment of the safety element, each county and city shall submit to the Division of Mines and Geology of the Department of Conservation one copy of a draft of the safety element or amendment and any technical studies used for developing the safety element. The division may review drafts submitted to it to determine whether they incorporate known seismic and other geologic hazard information, and report its findings to the planning agency within 30 days of receipt of the draft of the safety element or amendment pursuant to this subdivision. The legislative body shall consider the division's findings prior to final adoption of the safety element or amendment unless the division's findings are not available within the above prescribed time limits or unless the division has indicated to the city or county that the division will not review the safety element. If the division's findings are not available within those prescribed time limits, the legislative body may take the division's findings into consideration at the time it considers future amendments to the safety element. Each county and city shall provide the division with a copy of its adopted safety element or amendments. The division may review adopted safety elements or amendments and report its findings. All findings made by the division shall be advisory to the planning agency and legislative body.

2. Seismic Safety

Public Resources Code Sections 2697 and 2699 require that seismic safety be addressed in the General Plan and through geotechnical reports.

Public Resources Code Section 2697:

(a) Cities and counties shall require, prior to the approval of a project located in a seismic hazard zone, a geotechnical report defining and delineating any seismic hazard. If the city or county finds that no undue hazard of this kind exists, based on information resulting from studies conducted on sites in the immediate vicinity of the project and of similar soil composition to the project site, the geotechnical report may be waived. After a report has been approved or a waiver granted, subsequent geotechnical reports shall not be required, provided that new geologic datum, or data, warranting further investigation is not recorded. Each city and county shall submit one copy of each approved geotechnical report, including the mitigation measures, if any, that are to be taken, to the State Geologist within 30 days of its approval of the report.

(b) In meeting the requirements of this section, cities and counties shall consider the policies and criteria established pursuant to this chapter. If a project's approval is not in accordance with the policies and criteria, the city or county shall explain the reasons for the differences in writing to the State Geologist, within 30 days of the project's approval.

Public Resources Code Section 2699:
Each city and county, in preparing the safety element to its general plan pursuant to subdivision (g) of Section 65302 of the Government Code, and in adopting or revising land use planning and permitting ordinances, shall take into account the information provided in available seismic hazard maps.

II. EXISTING CONDITIONS AND HAZARDS

A. GEOLOGY

Regional geology in the City of Hercules consists of alluvial (stream-related) deposits of Quaternary age (less than two million years old) on the floor of the Refugio Valley, surrounded by marine sedimentary rocks of Miocene age (between five and 23 million years old) in the adjacent uplands. The bedrock units exposed on the hills above the valley floor consist of Rodeo Shale and Hambre Sandstone to the south, and Briones Sandstone and Cierbo Sandstone to the north. In many places, the bedrock is overlain by colluvium (loose soil and rock fragments that have moved downslope).

Alluvium in the Refugio Valley varies from about 12 feet in thickness in the southeast portion of the valley to about 80 feet in thickness near the valley floor. Near San Pablo Bay, a few feet of fine-grained flood plain alluvium cap weak and highly compressible bay mud deposits. The bay mud has an estimated thickness of 35 to 40 feet along the western edge of the valley, thinning out in an upvalley direction.

Much of the older valley floor deposits are covered by loose, artificial fill. Fill materials were placed during operation of the Hercules Powder Company, and consist of soils and bedrock excavated from adjacent hillside areas; in some places the fill includes rubble consisting of bricks, asphalt, concrete, glass, and wood.

Most of Hercules lies within the lower portion of the Refugio Valley, adjacent to San Pablo Bay. The valley floor is fairly level. Most slopes on the uplands surrounding the valley floor are fairly gentle (less than 15 percent), although some slopes are between 15 and 30 percent, and exceed 30 percent in very limited areas. Landslides and soil creep have occurred in the past in the steeper portions of areas with unstable soils.

Clear Lake Clay lies on top of the alluvial deposits on the valley floor. The clay is a poorly drained soil with low erosion potential, low strength, high shrink-swell potential, and high corrosivity. Soils in the upland areas primarily consist of Tierra Loam, a moderately-well drained soil with moderate to high erosion potential, low strength, high shrink-swell potential and high corrosivity. Other soils in the upland areas consist of Los Osos Clay Loam and Sehorn Clay, both of which are well-drained soils with moderate to high erosion potential, low strength, high shrinkswell potential, and high corrosivity.

B. SEISMIC HAZARDS

On the basis of past history, all of the San Francisco Bay Area is considered seismically active. There is no method by which the location, magnitude or time of future seismic occurrences can be predicted. However, it is possible to identify certain types of seismic hazards and foretell which areas of the City will be particularly subject to damage by earthquakes. The following discussion summarizes the potential damaging effects of earthquakes in the City including ground shaking, ground failure, surface ruptures and tsunamis.

1. Faults

The Hercules area, as part of the San Francisco Bay Area, is in one of the most seismically active regions in the United States. The study area could be affected by ground shaking due to movement along any one of a number of active faults in the region. The San Andreas Fault lies about 21 miles to the southwest of the City, the Hayward Fault lies about two and a half miles southwest of the city, and the Concord-Green Valley Fault lies about 11 miles to the east. The Calaveras Fault lies approximately 40 miles to the southeast. The Rodgers Creek Fault, which connects with the Hayward Fault beneath San Pablo Bay, is another major fault only about 10 miles away to the west. The area within Hercules would be subject to strong ground motion in the event of a moderate to severe earthquake in the Bay Area. The U.S. Geological Survey has estimated that there is a 67 percent probability that there will be one or more earthquakes of magnitude 7.0 or greater (comparable to the 1989 Loma Prieta earthquake) in the Bay Area in the next 30 years. Ground shaking, rather than surface fault rupture, is the cause of the most damage during earthquakes.

In addition to the active faults noted above, two inactive faults are located in the Hercules vicinity. Two traces of the Pinole Fault pass immediately southwest of Hercules and the Franklin Fault lies about three miles to the northeast. Neither of these two faults shows evidence of surface displacement in Quaternary time (the last two million years), and future movement along them is much more unlikely than along the active faults associated with the Pinole fault.

The Alquist-Priolo Special Studies Zones Act requires the state to identify zones around "active" faults (those having evidence of surface displacement within about the last 11,000 years) in order to manage development near possible surface rupture sites. There are no Special Studies Zones within Hercules (the closest Special Studies Zone is along the Hayward Fault, about two and one half to four miles to the southwest). The northern end of the Pinole Fault was originally included in a Special Studies Zone, but was removed from the active category after further analysis.

2. Earthquake Hazards

There are four major hazards associated with earthquakes. These are fault surface rupture, ground shaking, ground failure, and flooding due to earthquake-generated waves or dam failures.

Fault Surface Rupture. In major earthquakes, fault displacement can cause rupture along the surface trace of the fault, leading to severe damage to any structures or other improvements located on the fault trace.

Ground Shaking. Because it affects a much broader area, ground shaking, rather than fault surface rupture, is the cause of the most damage during earthquakes. Three major factors affect the severity (intensity) of ground shaking at a site in an earthquake: the size (magnitude) of the earthquake, the distance to the fault that generated the earthquake, and the geologic materials that underlie the site. Larger magnitude earthquakes cause the ground to shake harder and longer, and affect larger areas. Given similar subsurface conditions, the intensity of ground shaking decreases with distance from the causative fault. Thick, loose soils, such as uncompacted alluvium and artificial fill, tend to amplify and prolong the ground shaking, while bedrock is less susceptible to ground shaking.

The Association of Bay Area Governments (ABAG) has mapped portions of the City area's susceptibility to ground shaking as "extremely high" (the highest rating). These areas generally coincide with the bay mud underlying a portion of the valley floor and the bayfront. This map is on file at the City offices. The bay muds are generally located along the bay shore with larger extending inland from the bay at the mouths of creeks. The risk of ground shaking damage in the areas underlain by bay mud is rated as "extremely high" (6.1 percent expected damage and above) for tilt-up concrete buildings, "high" (4.1-5.0 percent damage) for concrete and steel buildings, and "moderate" (2.1-3.0 percent damage) to "moderately high" (3 -4 percent damage) for wood frame dwellings (ABAG, 1987). The risk of ground shaking damage is much lower for areas not underlain by bay mud, although areas underlain largely by alluvium are expected to endure strong ground shaking as well. See Figure 1.

Ground Failure. Earthquakes can cause secondary ground failures, such as landslides, liquefaction, lurch, and settlement. All of these involve a displacement of the ground surface due to loss of strength, failure, or compaction of the underlying materials due to ground shaking.
An earthquake could trigger landslides, particularly upon steeper slopes where slide activity has already occurred. The amount of sliding would be intensified if an earthquake were to occur during wet winter months when the slopes were in a saturated, weakened condition.

Liquefaction is the sudden loss of strength in loose, saturated materials (predominantly sands) during an earthquake, which results in the temporary fluid-like behavior of those materials (much like quicksand). Liquefaction typically occurs in areas where groundwater is shallow, and materials consist of clean, poorly consolidated, fine sands. The upland areas surrounding the valley floor are underlain by bedrock and would not be subject to liquefaction. Bay mud underlying the western portion of the valley floor is not likely to liquefy, although sand seams occasionally contained within the bay mud or fine-grained alluvium or artificial fill on top of the bay mud could be susceptible to liquefaction. The liquefaction potential in the area of the rest of the valley floor generally is not known, although there is no indication that materials susceptible to liquefaction are present.

Lurch, or lurch cracking, is the cracking of the ground surface in soft, saturated material as a result of earthquake-induced ground shaking. Lurch cracking is likely to occur in areas of bay mud and fill in moderate to large earthquakes. Lurch cracking can occur in water-saturated sediments, soils, and alluvium at distances of up to 75 miles from the earthquake epicenter. The probability of lurching in the valley floor areas is unknown, but its occurrence is possible.

Differential settlement (where adjoining areas settle different amounts) most commonly occurs in loose, uncompacted materials of variable density and strength. Artificial fills are likely to be most susceptible to differential settlement. Transition areas between bedrock and alluvial deposits would also be subject to differential settlement.

Earthquake-Induced Inundation. Seismic activity off the coast of California could induce a tsunami, commonly but incorrectly referred to as a "tidal wave," that could enter San Francisco Bay through the Golden Gate. Tsunamis are waves that increase in size with distance traveled, and can cause destruction when they pile up at shallow shoreline areas. There is no evidence that any portion of Contra Costa County that is exposed to potential tsunami inundation has experienced significant damage from this phenomenon, and the likelihood of damage to the City of Hercules from one is small.

A major earthquake could theoretically create a seiche, a type of oscillating wave that sloshes around in an enclosed basin and can cause severe damage at the shoreline. No such wave has ever been recorded in San Francisco Bay or San Pablo Bay within historic time, however. A large earthquake could induce a landslide adjacent to a nearby reservoir, creating the geologic hazard known as landslide splash, an overtopping of water resulting from earth sliding into the reservoir. Additionally, failure of reservoir dams themselves could directly result from a major earthquake. However, the City of Hercules does not lie in the path of inundation from any reservoirs.

C. GEOLOGICAL HAZARDS

Potential geological hazards in the City include:

a. Landslides and soil creep
b. Valley Alluvium
c. Existing fills
d. Ground water, seepage and ponding
e. Erosion

The City has recently adopted a Grading Ordinance establishing standards for grading operations, requiring the issuance of grading permits, providing for the approval of grading plans, and inspection of grading construction. The Grading Ordinance provides for testing where there are potential geologic hazards.

1. Landslides and Soil Creep

Numerous shallow landslides of various sizes are present, particularly in the southeastern part of the City.

In addition to the landslides, soil creep movements are occurring on certain slopes within the City. Creep movement is generally most active and widespread on the steeper slopes. Rates and depths of creep movement are much slower and shallower than those associated with active landslides.