# 4.6 GEOLOGIC AND SEISMIC HAZARDS

The purpose of this Section is to describe the geologic and seismic setting of the Bakersfield Metropolitan area, identify potential impacts associated with implementation of the General Plan Update, reference General Plan goals, policies, and standards, and, where necessary, recommends mitigation measures to reduce the significance of impacts. The issues addressed in this section include risks associated with: faults, strong seismic ground shaking, seismic related ground failure such as liquefaction, landslides, and unstable geologic units and/or soils.

## ENVIRONMENTAL SETTING

### GEOLOGY

#### Geologic Structure

The Metropolitan Bakersfield area is a part of the Great Valley Geomorphic Province of California which is an alluvial plain, about 50 miles wide and 400 miles long, between the Coast Ranges and Sierra Nevada. The Great Valley is drained by the Sacramento and San Joaquin rivers, which join and enter San Francisco Bay. The southern part of the Great Valley is the San Joaquin Valley. The Valley is a northwesterly trending trough (geocycline) filled with immense thickness of sediments (estimated at 40,000 feet at the axis) deposited from surrounding mountains. Streams flowing westerly from the Sierra Nevada have eroded and deposited materials into the trough, forming alluvial fans at the surface. The largest of these in the Plan area is the Kern River fan, covering about 300 square miles of the valley and made up of sand, silt and clay deposits. The Kern River flood plain is incised into the upper part of the fan, north of downtown Bakersfield, and spread out across the broad, flat lower fan to the southwest.

#### Soils

Refer to Section 4.7, *Soils and Agricultural Resources*, for a discussion of soil characteristics in the Plan area.

#### Seismicity

A fault is a fracture in the crust of the earth along which land on one side have moved relative to those on the other side. Most faults are the result of repeated displacements over a long period of time. A fault trace is the line on the earth's surface defining the fault.

There are numerous geologic fractures in the earth's crust within the San Joaquin Valley, with the San Andreas Fault being the most prominent. These fault systems are illustrated in Figure VIII-1 of the 1990 General Plan, *Major Active Faults*. Other fault systems occur in the Bakersfield region, as in most of California, due to the continual and historical convergence of the continental plates. The following discussion summarizes the characteristics of the four major fault systems:

**San Andreas Fault.** The San Andreas Fault is located approximately 38 miles southwest of downtown Bakersfield, outside of the Plan area. The Fault is approximately 650 miles long, reaching from the Mendocino Escarpment on the north, to the Imperial Valley on the south. Along this extent, the San Andreas is considered to be the boundary between the North American Plate and the Pacific Plate.

The segment of the San Andreas through Kern County is relatively short compared to its 650-mile length. However, it is important since this segment of the system breaks from its predominant 350 degrees trending direction between the San Luis Obispo and Los Angeles County lines. The last great earthquake on this segment was the 1857 Fort Tejon earthquake that is believed to have caused a rupture extending 200 miles or more. Geologists consider this fault as having the potential to generate an earthquake of magnitude 8.3 on the Richter scale, which is designated as the maximum credible earthquake.

This is an active fault capable of causing damage to the Planning area. Areas along this fault have been designated by the state as an Alquist-Priolo Special Studies Zone (refer to discussion below).

**Breckenridge-Kern Canyon Fault**. The Breckenridge-Kern Canyon fault is located in the southern Sierra Nevada, approximately 25 miles east of downtown Bakersfield, outside of the Planning area. It trends northerly from the north end of Walker Basin to north of Mount Whitney, a distance of approximately 100 miles. Uncertainty exists as to the degree of activity of this fault system and its classification as either one or two distinct faults. It is designated as active with a maximum credible earthquake of 8.0. This fault is capable of causing damage to the Planning area. Areas along this fault have been designated by the state as an Alquist-Priolo Special Studies Zone.

**Garlock Fault.** The Garlock fault extends easterly from its point of intersection with the San Andreas fault, near Lebec, for a distance of approximately 150 miles. The fault is located approximately 35 miles southeast of downtown Bakersfield, outside of the Planning area. The Garlock fault zone is one of the most obvious geologic features in southern California, clearly marking the northern boundary of the area known as the Mojave Block, as well as the southern ends of the Sierra Nevada and the valleys of the westernmost Basin and Range province. While no earthquake has produced surface rupture on the Garlock fault in historic times (although cracks opened along a short segment of the fault in 1952, due to the shaking of the Kern County earthquake, and groundwater removal has also triggered slip in the Fremont Valley area), there have been a few sizable quakes recorded along the Garlock fault zone. The most recent was a magnitude 5.7 near the town of Mojave on July 11, 1992. It is thought to have been triggered by the Landers earthquake, just two weeks earlier. At least one section of the fault has shown movement by creep in recent years. These facts, along with the freshness of scarps left behind from previous ruptures and the on-going seismicity associated with the fault zone, leave little doubt that the Garlock fault zone will rupture again in the future. This is an active fault capable of causing damage to the Planning area. Areas along this fault have been designated by the state as an Alquist-Priolo Special Studies Zone.

**White Wolf Fault.** The White Wolf fault is a southeast dipping left-lateral oblique reverse fault with a length of approximately 45 miles. This Fault is located approximately 19 miles south of downtown Bakersfield, outside of the Planning area. This fault traverses the southeast end of the San Joaquin Valley from Wheeler Ridge to northeast of Caliente. On July 21, 1952 the White Wolf fault ruptured, producing an earthquake of magnitude 7.5 and subsequently an extensive sequence of after shocks. Although surface rupture formed along only 17 miles of the surface trace of the fault, rupture probably occurred along most of its 45-mile length. A magnitude 7.5 is considered close to the earthquake of greatest magnitude for the White Wolf fault.

Significant features caused by the fault are the valley at the junction of Highways 58 and 223 (sometimes called "White Wolf Valley"), and the Arvin cutoff along State Route 223. This is an active fault capable of causing damage to the Planning area. This Fault has been designated by the state as an Alquist-Priolo Special Studies Zone.

**Other Significant Fault Systems.** Other major fault systems in or near the Plan area include the Sierra Nevada, Edison, and Kern Front, and Pond-Poso Fault systems.

### Seismic Hazards

As discussed above, the southern end of the San Joaquin Valley is bordered by major, active fault systems, making Bakersfield a historically active seismic area. The faults which have been identified in the vicinity of Bakersfield capable of causing damage are outlined in Table 4.6-1, *Active Faults Capable of Causing Damage to the Bakersfield Area*. Table 4.6-1 outlines the recognized active faults, their closest distances to downtown Bakersfield, and the maximum credible earthquake and maximum credible causative bedrock acceleration along each fault. The locations of the major faults which could potentially produce significant ground shaking are illustrated in Figure VIII-1 of the General Plan.

An active fault is defined by the State Mining and Geology Board as one that has "had surface displacement within Holocene time (about the last 11,000 years)." This definition does not mean that faults lacking evidence for surface displacement within Holocene time are necessarily inactive. A fault may be presumed to be inactive based on satisfactory geologic evidence; however, the evidence necessary to prove inactivity is sometimes difficult to obtain and locally may not exist. A potentially active fault is a fault that shows evidence of surface displacement during Quaternary time (last 1.6 million years).

On July 21, 1952, the well-known Kern County earthquakes began as a result of movement along the White Wolf Fault. The initial shock was a 7.5 magnitude shake with the epicenter near Wheeler Ridge. Extensive damage occurred to older buildings in Bakersfield, as well as utility outages and ground rupture due to liquefaction south of the City of Bakersfield. Severe damage also occurred in the cities of Tehachapi and Arvin to the southeast of the Plan area.

Potential seismic hazards affecting the Plan area include the following: fault rupture; strong ground shaking; ground failure (such as collapse, landslides and liquefaction); and dam failure. The following analysis addresses the presence/ absence of these hazards along with their characteristics:

**Fault Rupture.** Surface rupture occurs when movement on a fault deep within the earth breaks through to the surface. Fault ruptures almost always follows preexisting faults which are zones of weakness. Rupture may occur suddenly during an earthquake or slowly in the form of fault creep. Sudden displacements are more damaging to structures because they are accompanied by shaking. Fault creep is the slow rupture of the earth's crust.

**TABLE 4.6-1**
**ACTIVE FAULTS CAPABLE OF CAUSING DAMAGE TO THE BAKERSFIELD AREA**

| Fault | Downtown Bakersfield (miles) | Maximum Credible Earthquake (RM)[1] | Maximum Credible Bedrock Acceleration (g)[2] |
|---|---|---|---|
| San Andreas | 38 | 8.0 – 8.3 | 0.2 – 0.25 |
| Sierra Nevada | 39 | 6.5 – 8.25 | 0.07 – 0.12 |
| Garlock | 35 | 7.5 – 8.0 | 0.17 – 0.18 |
| Breckenridge-Kern Canyon | 25 | 6.0 – 8.0 | 0.09 – 0.47 |
| White Wolf | 19 | 7.5 – 8.0 | 0.28 – 0.45 |
| Pond Poso | 08 | 7.0 | 0.31 – 0.48 |

Source: Metropolitan Bakersfield General Plan Update.

[1] Richter Magnitude.
[2] g = percent of gravity.

The Alquist-Priolo Earthquake Fault Zoning Act, passed in 1972, is primarily intended to prevent the construction of buildings used for human occupancy on the surface trace of active faults. The Act only addresses the hazard of surface fault rupture and is not directed toward other earthquake hazards. The law requires the State Geologist to establish regulatory zones known as “Earthquake Fault Zones” around the surface traces of active faults and to issue appropriate maps.

Local agencies are required to regulate most development Plans within these zones. Before a development can be permitted, the city/county must require a geologic investigation to demonstrate that proposed buildings would not be constructed across active faults. If an active fault is found, a structure for human occupancy cannot be placed over the trace of the fault and must be set back from the fault (generally 50 feet).

As illustrated in Figure VIII-2 of the 1990 General Plan, *Geologic Hazards*, Earthquake Fault Zones have been designated for the northeastern portion of the Plan area (i.e., locations of surface rupture during the 1952 White Wolf earthquake). However, active faults may potentially exist outside these zones.

**Strong Ground Shaking.** The Plan area is susceptible to moderate to extreme ground shaking from a number of seismic sources in the region.

The Modified Mercalli intensity scale measures the intensity of an earthquake's effects in a given locality, and is perhaps much more meaningful to the layman because it is based on actual observations of earthquake effects at specific places. On the Modified Mercalli intensity scale, values range from I to XII. The most commonly used adaptation covers the range of intensity from the conditions of "I -- not felt except by very few, favorably situated," to "XII –damage total, lines of sight disturbed, objects thrown into the air." While an earthquake has only one magnitude, it can have many intensities, which decrease with distance from the epicenter.

Ground motions, on the other hand, are often measured in percentage of gravity (percent g), where g = 32 feet per second (980 cm/sec$^2$) on the earth. One hundred percent of gravity (1g) is the acceleration a sky diver would experience during free-fall. An acceleration of 0.4 g is equivalent to accelerating from 0 to 60 miles (0-97 km) per hour in about 7 seconds. The force that one would feel during an earthquake with 0.4g acceleration would be similar to the force one would feel when standing in the back of a truck accelerating very rapidly onto a freeway. One difference between the earthquake and the ride in the truck is that in the earthquake one would accelerate backward and forward for many cycles. That is why it is difficult to stand during episodes of strong ground shaking.

Ground shaking accompanying earthquakes on any of the faults outlined in Table 4.6-1 could be expected to be felt within the Plan area. However, the intensity of ground shaking would depend upon the magnitude of the earthquake, the distance to the epicenter, and the geology of the area between the epicenter and the property.

During a seismic event, Bakersfield may be subjected to high levels of ground shaking. As a result, buildings within the community could sustain substantial damage. Tilt-up structures, unreinforced masonry buildings, older buildings, buildings over four stories, and mobile homes are particularly susceptible to earthquake damage.

The most vulnerable structures in an earthquake are the unreinforced masonry buildings in the Bakersfield area, which were built before seismic codes were first instituted in the city and county. Other building types that may pose substantial hazards in an earthquake include precast concrete tilt-up buildings, and predominantly multi-story buildings of non-ductile concrete frame and composite precast concrete construction of types.

Seismic design standards have been established to reduce many of the structural problems occurring as a result of major earthquakes. In 1998, the Uniform Building Code was revised as follows:

- Upgrade the level of ground motion used in the seismic design of buildings;
- Add site amplification factors based on local soils conditions; and
- Improve the way ground motion is applied in detailed design.

Additionally, SB547 required local jurisdictions to inventory existing unreinforced masonry buildings and develop structural hazards reduction programs for such buildings. The City's program for unreinforced masonry buildings has been very successful. A complete inventory of unreinforced masonry buildings was completed and the City conducted a very aggressive seismic retrofit construction program. Of those buildings identified as "unreinforced masonry structures," 85% are now up to

1993 seismic construction standards. The County has performed a similar inventory and notified owners of the status of their buildings.

**Seismically Induced Landslides.** A strong earthquake could trigger landslides or slope failures on steeper slopes in the foothills and along the Kern River Canyon and floodplain. The common types of landslides induced by earthquakes are bluff and streambank failures, rock falls and soil slips on steep slopes. Deep-seated landslides are not necessarily reactivated in an earthquake.

**Liquefaction.** Seismic ground shaking of relatively loose, granular soils that are saturated or submerged can cause the soils to liquefy and temporarily behave as a dense fluid. Liquefaction is caused by a sudden temporary increase in pore water pressure due to seismic densification or other displacement of submerged granular soils. Liquefaction more often occurs in areas underlain by young alluvium where the groundwater table is higher than 50 feet below the ground surface.

As illustrated in Figure VIII-2 of the 1990 General Plan, areas of high ground water (five to 15 feet below the surface) are present in the southeastern portion of the Plan area. This could result in local areas of liquefaction during a strong earthquake, with attendant ground rupture and potential sinking or tilting of large buildings. High groundwater is known to exist at depths of five to 15 feet below the ground surface on portions of the Lamont quadrangle (approximately between Brundage Lane and DiGiorgio Road). Areas of high groundwater are rare elsewhere in the Plan area.

**Dam Failure.** Isabella Dam, which is located approximately 40 miles northeast of Bakersfield, has a capacity to hold 570,000 acre feet of water. This dam, which is earth filled, is approximately 185 feet high and 1,725 feet long, and is built near a major earthquake fault.

If an earthquake were to occur in the vicinity, it could result in a break in the dam. This could, under certain conditions, cause the entire lake storage to be released, which would result in flooding 60 square miles of Metropolitan Bakersfield. Estimates of the time (hours) after dam failure when serious flooding may occur at given locations are illustrated in Figure VIII-2 of the 1990 General Plan. The chances of the dam failing entirely, with the lake at capacity, was judged as one day in 10,000 years.

The objective of the existing Flood Evacuation Plan for the Metropolitan area is to provide for the protection of life and property through evacuation of areas that would be inundated. The major evacuation routes identified within the Plan area are illustrated in Figure VIII-3 of the 1990 General Plan, Flood Evacuation Routes. Generally, the evacuation routes run east or west to the nearest major thoroughfares then proceed to the south, except the areas north of 24th Street which proceed to the north in the direction of Oildale.

### Other Hazards

Other geologic hazards existing in the Plan area include flooding, landslides, and subsidence. The following analysis addresses the presence/absence of these hazards along with their characteristics:

**Flooding.** Areas within the 100-year flood zone have been delineated by the Federal Emergency Management Agency's National Flood Insurance Program and are illustrated in Figure VIII-2 of the 1990 General Plan. As is evidenced by this Figure, non-seismic-related flood hazards to the Plan area relate primarily to the Kern River floodplain (i.e., the southwestern portion of the Plan area). A second major area within a flood zone which derives from Caliente Creek is situated in the southeastern portion of the Plan area. For a complete discussion of the magnitude of this flood hazard, refer to Section 4.8 of this EIR, *Hydrology and Drainage*.

**Landslides.** Slopes subject to failure within the Bakersfield area are predominantly found along the river terraces, bluffs and foothills to the northeast and east of the City. Investigations to date have documented two landslides in the foothills northeast of the City. The approximate locations and directions of movement of these landslides are illustrated in Figure VIII-2 of the 1990 General Plan.

**Subsidence.** Land subsidence is a type of ground failure caused by extraction of oil and gas, withdrawal of groundwater in quantities much larger than replacement can occur, and by hydrocompaction of moisture-deficient alluvial deposits. Groundwater withdrawal south of the Bakersfield City limits (within the Plan area) is thought to be responsible for gradual subsidence in the southern portion of the Plan area. Subsidence records due to groundwater withdrawal from 1926 to 1970 indicate land subsidence up to four feet in the Plan area.

## STANDARDS OF SIGNIFICANCE

### SIGNIFICANCE CRITERIA

In accordance with CEQA, the effects of a Plan are evaluated to determine if they will result in a significant adverse impact on the environment. An EIR is required to focus on these effects and offer mitigation measures to reduce or avoid any significant impacts that are identified. The criteria, or standards, used to determine the significance of impacts may vary depending on the nature of the Plan. Geologic and seismic impacts resulting from the implementation of the General Plan Update could be considered significant if they cause any of the following results:

- Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving;
    - Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault;
    - Strong seismic ground shaking;
    - Seismic-related ground failure, including liquefaction; and
    - Landslides.
- Exposure of people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam.

- Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the Plan, and potentially result in on- or off-site landslides, lateral spreading, subsidence, liquefaction or collapse.

Based on these standards, the effects of Plan implementation have been categorized as either a “less than significant impact” or a “potentially significant impact.” If a potentially significant impact cannot be reduced to a less than significant level through the application of goals, policies, standards or mitigation, it is categorized as a significant and unavoidable impact.

## IMPACTS AND MITIGATION MEASURES

### FAULT RUPTURE

- **BUILDOUT IN ACCORDANCE WITH THE GENERAL PLAN UPDATE MAY INCREASE THE NUMBER OF PEOPLE/STRUCTURES EXPOSED TO ADVERSE EFFECTS ASSOCIATED WITH RUPTURE OF A KNOWN EARTHQUAKE FAULT.**

**Level of Significance Before Policies/Mitigation:** Potentially Significant Impact.

**Impact Analysis:** Active or potentially active faults are located within the Plan area. The south end of the San Joaquin Valley is bordered by four major fault systems, all of which are considered to be active: San Andreas, Breckenridge-Kern Canyon, Garlock and White Wolf faults. It is probable that these faults will move in the future. As a result, it is anticipated that buildout of the General Plan Update would expose an increased number of people/structures to potential substantial adverse effects associated with rupture of a known earthquake fault.

Alquist-Priolo Special Studies Zones have been designated for portions of the Plan area to indicate the presence of faults which showed surface breakage during the 1952 White Wolf earthquake. These Zones mark the areas where faults are considered to have been recently active (during the last 10,000 years) and to have a relatively high potential for surface rupture. Alquist-Priolo Special Studies Zone maps are on file with the City of Bakersfield and the County of Kern.

Structures constructed over these active faults would be unable to withstand the direct impact of surface rupture and even small surface cracks can cause severe structural damage to them. In compliance with the Alquist-Priolo Earthquake Fault Zoning Act and in order to reduce the level of significance of this potential impact, any development proposals within Special Studies Zones would be subject to special geologic investigation requirements. More specifically, these developments would be required to comply with the following minimum specific criteria:

- No structure for human occupancy, public or private, shall be permitted to placed across the trace of an active fault. Furthermore, the area within fifty (50) feet of an active fault shall be assumed to be underlain by active branches of that fault unless and until proven otherwise by an appropriate geologic investigation and submission of a report by a geologist registered in the State of California. This 50-foot standard is intended to represent minimum criteria only for all structures.

- Application for a development permit (as defined in Division 2, Chapter 7.5, section 2621.6(a) of the Alquist-Priolo Special Studies Zones Act) within a special studies zone shall be accompanied by a geologic report prepared by a geologist registered in the State of California, and directed to the problem of potential surface fault displacement through the Plan site, unless such report is waived pursuant to Section 2623.

The Safety Element has identified various implementation programs with respect to fault rupture. These programs specify various requirements including: detailed geologic investigations are to be conducted, in conformance with guidelines of the California Division of Mines and Geology, for all construction designed for human occupancy in an Alquist-Priolo Fault Study Zone; construction of buildings for human occupancy within 50 feet of the trace of an active fault is prohibited; plans and permits for installation of major lifeline components such as for highways, utilities and petroleum or chemical pipelines are to incorporate design features to accommodate potential fault movement in areas of active faults without prolonged disruption of an essential service or threat to health and safety; and field information is to be developed as part of any CEQA investigations and geologic reports by the city/county geologists should be kept current and accessible for use in report preparation, geologic reviews and policy development.

It should be noted that active faults may potentially exist outside of the Special Studies Zones. As a result, development of critical and important facilities proposed outside of these zones would require additional fault investigation. The Safety Element has specified a policy which requires that the development of critical facilities be supported by documentation of thorough hazard investigation. Critical facilities are defined by the California Seismic Safety Commission as the following three basic types of facilities:

- “Essential facilities,” whose continued functioning is necessary to maintain public health and safety following a disaster. These facilities include fire and police stations, communication facilities, emergency operation centers, hospitals, administrative buildings, and schools designated as mass care shelters. Also included are key transportation facilities and utility “lifeline” facilities such as water supply, sewage disposal, oil and gas storage facilities and transmission lines, and electric generation stations and transmission lines.

- Those facilities where damage or failure could pose hazards to life and property well beyond their immediate vicinity. This category includes such facilities as dams and reservoirs, petroleum storage facilities, nuclear waste processing and storage facilities.

- Public or private structures for housing or assembly of large populations, where failure could pose hazards to life and property within the structures and in their immediate vicinity. These high-occupancy facilities include schools, prisons, coliseums, theaters, conference and convention facilities, high-rise buildings, and similar facilities used by large numbers of people.

Further, the Safety Element has identified various implementation programs to be carried out by the City and County affecting seismic safety of critical facilities. These programs include: detailed site studies for fault rupture potential are to be conducted

as background to the design process for critical facilities under city and county discretionary approval; existing critical facilities are to be reviewed for any significant siting, design or construction problems that would make them vulnerable in an earthquake. The findings shall be incorporated into emergency operations plans as well as addressed in longer-term programs of facilities upgrading or relocation; and construction of Critical Facilities is prohibited within 300 feet of the trace of an active fault.

Numerous controls would be imposed on development proposals through the permitting process. In general, the development would be regulated (and potential geologic impacts reduced) under the requirements of the California Building Code, the Alquist-Priolo Special Studies Zone Act, City/County land use policies and zoning, and Plan-specific mitigation measures. Future development would be subject to compliance with Title 15 of the Bakersfield Municipal Code, Building and Construction, including but not limited to Chapter 15.12, Uniform Building Code, which states that the Uniform Building Code and the 1998 Edition of the California Building Standards Code are the building code of the City for the purpose of regulating buildings and construction.

Although a relatively high potential for surface rupture exists in certain portions of the Plan area, implementation of the General Plan Update would not result in any impacts related to fault rupture beyond those that may presently exist within the Plan area. Further, the Safety Element identifies seismicity as a key safety issue and contains specific goals, policies, and implementation programs to reduce seismic hazards within the City. Therefore, implementation of the General Plan Update would result in less than significant impacts in this regard.

**Goals and Policies in the General Plan Update:** The Safety Element contains the following goals and policies:

SAF/SEI-G-6 Provide a continuously improving data base and reference source for evaluation of seismic and geologic hazards.

SAF/SEI-P-10 Prohibit development designed for human occupancy within 50 feet of a known active fault and prohibit any building from being placed astride an active fault.

SAF/SEI-P-11 Require site-specific studies to locate and characterize specific fault traces within an Alquist-Priolo Earthquake Fault Zone for all construction designed for human occupancy.

SAF/SEI-P-12 Design significant lifeline installations such as highways, utilities and petrochemical pipelines which cross an active fault, to accommodate potential fault movement without prolonged disruption of an essential service or creating threat to health and safety.

SAF/SEI-P-15 Compile information on areas of potential hazards and field information developed as part of CEQA investigations and geologic reports and keep geologic reviews and policy development current and accessible for use in report preparation.

SAF/SEI-P-17 Require known geologic and seismic hazards within the area of a proposed subdivision to be referenced on the final subdivision map.

**Mitigation Measures:** No mitigation measures beyond the goals, policies and implementation measures identified in the General Plan Update are proposed.

**Level of Significance After Policies/Mitigation:** Less Than Significant Impact.

**STRONG SEISMIC GROUND SHAKING**

- **BUILDOUT IN ACCORDANCE WITH THE GENERAL PLAN UPDATE MAY EXPOSE A GREATER NUMBER OF PEOPLE OR STRUCTURES TO STRONG SEISMIC GROUND SHAKING DURING A SEISMIC EVENT.**

**Level of Significance Before Policies/Mitigation:** Potentially Significant Impact.

**Impact Analysis:** Given the highly seismic character of the Plan area, moderate to severe groundshaking associated with earthquakes on the nearby faults can be expected within all of the Plan area. This has the potential to result in substantial damage to some buildings within the Plan area even though the epicenters may be many miles away. Several buildings, especially those constructed prior to the City's first seismic codes, could suffer severe damage or collapse in the event of any earthquake that produces moderate to strong ground motion in the Plan area. Some structures, including tilt-ups, unreinforced masonry buildings, older buildings, buildings over four stories, and mobile homes would be particularly susceptible to earthquake damage.

Senate Bill 547 (enacted in 1986) required local jurisdictions to inventory existing unreinforced masonry buildings and develop structural hazards reduction programs for such buildings by January 1, 1990. In response to this requirement, the City conducted a complete inventory of unreinforced masonry buildings and an aggressive seismic retrofit construction program. This program for unreinforced masonry buildings was proven very successful. Of those buildings identified as “unreinforced masonry structures”, 85 percent are presently up to 1993 seismic construction standards. The County has performed a similar inventory and notified owners of the status of their buildings.

Plan implementation would increase the Plan area's population, thus, exposing a greater number of people to ground shaking hazards. Therefore, impacts associated with seismically induced ground shaking would be considered significant unless mitigated. Specific goals, policies, and implementation measures have been included in the Safety Element to minimize potential seismic hazards in the City. Additionally, it should be noted that as a part of the City’s discretionary review process, detailed site-specific studies regarding ground shaking characteristics (and other geologic hazards) are required for critical facilities, as opposed to all future development. Therefore, mitigation has been specified which requires that the database of geologic hazards be continuously improved by means of site-specific studies conducted for all future development.

Adherence to/compliance with the Safety Element, as well as compliance with the City and County Development Codes and the California Building Code, would reduce impacts associated with ground shaking to a less than significant level. It should be noted that the Uniform Building Code was revised in 1998 to:

- Upgrade the level of ground motion used in the seismic design of buildings;
- Add site amplification factors based on local soils conditions; and
- Improve the way ground motion is applied in detailed design.

**Goals and Policies in the General Plan Update:** The Safety Element contains the following goals and policies:

SAF/SEI-G-1 Substantially reduce the level of death, injury, property damage, economic and social dislocation and disruption of vital services that would result from earthquake damage.

SAF/SEI-G-2 Ensure the availability and effective response of emergency services following an earthquake.

SAF/SEI-G-3 Prepare the Planning area for effective response to, and rapid, beneficial recovery from, an earthquake.

SAF/SEI-G-4 Prevent loss of life from the failure of critical facilities in an earthquake and ensure the continued functioning of essential facilities following a disaster.

SAF/SEI-G-6 Provide a continuously improving data base and reference source for evaluation of seismic and geologic hazards.

SAF/SEI-P-1 Ensure that earthquake survival and efficient post-disaster functions are a primary objective in the siting, design and construction standards for discretionary essential facilities or for expansion of such existing facilities.

SAF/SEI-P-2 Require that the siting and development of critical facilities under discretionary approval by the City Council and Board of Supervisors be supported by documentation of thorough hazard investigations relating to site selection, pre-construction site investigations and application of the most current professional standards for seismic design.

SAF/SEI-P-3 Encourage existing critical facilities with significant seismic vulnerabilities to be upgraded or relocated as appropriate.

SAF/SEI-P-4 Encourage critical facilities in dam inundation areas to develop and maintain plans for safe shut-down and efficient evacuation from their facilities, as appropriate to the degree of flood hazard for each facility.

SAF/SEI-P-5 Incorporate planning for incidents affecting critical facilities into contingency plans for disaster response and recovery.

SAF/SEI-P-6 Inventory all unreinforced masonry buildings in the Planning area for conformance with state legislation and guidelines (i.e., SB 547, enacted in 1986).

SAF/SEI-P-7 Continue to address seismically hazardous buildings pursuant to Chapter 12.2 (8875 et Seq.), Division 1 of Title 2 of the Government Code.

SAF/SEI-P-8 Require seismic review of other potentially hazardous buildings upon any change in their use or occupancy status.

SAF/SEI-P-9 Adopt and maintain high standards for seismic performance of buildings, through prompt adoption and careful enforcement of the most current seismic standards of the Uniform Building Code.

SAF/SEI-P-15 Compile information on areas of potential hazards and field information developed as part of CEQA investigations and geologic reports and keep geologic reviews and policy development current and accessible for use in report preparation.

SAF/SEI-P-16 Encourage and support local, state and federal research program for delineation of geologic and seismic hazards so that acceptable risk may be continually reevaluated and kept current with state-of-the-art information and contemporary values.

SAF/SEI-P-17 Require known geologic and seismic hazards within the area of a proposed subdivision to be referenced on the final subdivision map.

SAF/SEI-P-22 Require local agencies to coordinate with the business community to reduce seismic hazards.

SAF/SEI-P-23 Increase the public awareness of seismic hazards in residents of the city and county.

SAF/SEI-P-24 Require the city's and county's emergency preparedness programs to have a three-fold emphasis: hazard mitigation, disaster response and self-sufficiency of residents, business and industry.

SAF/SEI-P-25 Require the emergency management program to include effective plans for disaster/earthquake response, training of responsible personnel, mutual aid agreements for all appropriate functions, and exercises conducted at least annually to test and evaluate plan capabilities.

**Mitigation Measures:** No mitigation measures beyond the goals, policies and implementation measures identified in the General Plan Update are proposed.

**Level of Significance After Policies/Mitigation:** Less Than Significant Impact.

## LIQUEFACTION

- **BUILDOUT IN ACCORDANCE WITH THE GENERAL PLAN UPDATE MAY EXPOSE PEOPLE OR STRUCTURES TO POTENTIAL SUBSTANTIAL ADVERSE EFFECTS ASSOCIATED WITH LIQUEFACTION.**

**Level of Significance Before Policies/Mitigation:** Potentially Significant Impact.

**Impact Analysis:** The area of high ground water which exists in the southeastern portion of the Plan area (refer to Figure VIII-2 of the 1990 General Plan) may be subject to liquefaction in an earthquake, with attendant ground rupture and potential sinking or tilting of large buildings. According to the General Plan Land Use Map, this area is designated primarily for public and agricultural land uses.

Areas of high groundwater are rare elsewhere in the Plan area and not all soil types are susceptible to liquefaction. However, additional information is necessary to determine the geographic extent of high groundwater. The Safety Element has identified various implementation programs to be carried out by the City and County with respect to potential liquefaction. These programs specify various requirements including detailed site studies which are to be conducted for liquefaction potential as background to the design process for critical facilities under city and county discretionary approval. Liquefaction investigations also are to be conducted in all areas of high groundwater potential. Appropriate foundation designs are to be identified to mitigate potential damage to buildings on sites with liquefaction potential.

Specific goals, policies, and implementation programs have been included in the Safety Element to minimize potential liquefaction hazards in the Planning area. These would serve to mitigate potential liquefaction problems for future uses. With implementation of the goals and policies outlined below, impacts to future uses associated with liquefaction would be reduced to a less than significant level.

**Goals and Policies in the General Plan Update:** The Safety Element contains the following goals and policies:

SAF/SEI-G-5 Protect essential lifelines and prevent casualties and major social and economic disruption due to liquefaction in an earthquake.

SAF/SEI-G-6 Provide a continuously improving database and reference source for evaluation of seismic and geologic hazards.

SAF/SEI-P-5 Incorporate planning for incidents affecting critical facilities into contingency plans for disaster response and recovery.

SAF/SEI-P-13 Determine the liquefaction potential at sites in areas of high groundwater prior to development and determine specific mitigation to be incorporated into the foundation design, as necessary to prevent or reduce damage from liquefaction in an earthquake.

SAF/SEI-P-14 Route major lifeline installations around potential liquefaction areas or otherwise protect them against significant damage from liquefaction in an earthquake.

**Mitigation Measures:** No mitigation measures beyond the goals, policies and implementation measures identified in the General Plan Update are proposed.

**Level of Significance After Policies/Mitigation:** Less Than Significant Impact.

**LANDSLIDES (SEISMICALLY-INDUCED)**

- **BUILDOUT IN ACCORDANCE WITH THE GENERAL PLAN UPDATE MAY EXPOSE PEOPLE OR STRUCTURES TO POTENTIAL SUBSTANTIAL ADVERSE EFFECTS ASSOCIATED WITH SEISMICALLY INDUCED LANDSLIDES.**

**Level of Significance Before Policies/Mitigation:** Potentially Significant Impact.

**Impact Analysis:** As previously noted, a strong earthquake could trigger landslides or slope failures on steeper slopes in the foothills and along the Kern River Canyon and floodplain. As illustrated on the General Plan Land Use Map, these areas are designated primarily for agriculture and open space use. Therefore, it is not anticipated that significant development would occur in these areas as a result of Plan implementation and people or structures would not be significantly exposed to substantial adverse effects involving seismically-induced landslides. The Safety Element has identified the goal of providing a continuously improving database and reference source for evaluation of seismic and geologic hazards, which would include areas with the potential for seismically-induced landslides. In addition, the Safety Element has identified implementation-programs with respect to seismically-induced landslides. Implementation programs require that maps be compiled showing the location of all geologic hazards, including earthquake-induced landslides.

Specific goals, policies and implementation programs have been included in the Safety Element to minimize potential landslide hazards in the Planning area. With implementation of the goals and policies outlined below, impacts to future uses associated with landslides would be reduced to a less than significant level.

**Goals and Policies in the General Plan Update:** The Safety Element contains the following goals and policies:

SAF/SEI-G-6 Provide a continuously improving database and reference source for evaluation of seismic and geologic hazards.

SAF/SEI-P-15 Compile information on areas of potential hazards and field information developed as part of CEQA investigations and geologic reports and keep geologic reviews and policy development current and accessible for use in report preparation.

SAF/SEI-P-16 Encourage and support local, state and federal research program for delineation of geologic and seismic hazards so that acceptable risk may be continually reevaluated and kept current with state-of-the-art information and contemporary values.

SAF/SEI-P-17 Require known geologic and seismic hazards within the area of a proposed subdivision to be referenced on the final subdivision map.

**Mitigation Measures:** No mitigation measures beyond the goals, policies and implementation measures identified in the General Plan Update are proposed.

**Level of Significance After Policies/Mitigation:** Less Than Significant Impact.

**LANDSLIDES (REGULAR)**

- **BUILDOUT IN ACCORDANCE WITH THE GENERAL PLAN UPDATE MAY EXPOSE PEOPLE OR STRUCTURES TO POTENTIAL SUBSTANTIAL ADVERSE EFFECTS ASSOCIATED WITH LANDSLIDES.**

**Level of Significance Before Policies/Mitigation:** Potentially Significant Impact.

**Impact Analysis:** Slopes subject to failure within the Metropolitan Bakersfield area are predominantly found along the river terraces, bluffs and foothills to the northeast and east of the City. Investigations to date have documented two landslides in the foothills northeast of the City. The approximate locations and directions of movement of these landslides are illustrated in Figure VIII-2 of the 1990 General Plan. It is not anticipated that significant development would occur in these areas as a result of Plan implementation and people or structures would not be significantly exposed to substantial adverse effects involving landslides. Additionally, this impact would be further reduced after compliance with the Safety Element's goal of providing a continuously improving database and reference source for evaluation of seismic and geologic hazards, including areas with the potential for landslides.

**Goals and Policies in the General Plan Update:** The Safety Element contains the following goals and policies:

SAF/SEI-G-6 Provide a continuously improving database and reference source for evaluation of seismic and geologic hazards.

SAF/SEI-P-15 Compile information on areas of potential hazards and field information developed as part of CEQA investigations and geologic reports and keep geologic reviews and policy development current and accessible for use in report preparation.

SAF/SEI-P-16 Encourage and support local, state and federal research program for delineation of geologic and seismic hazards so that acceptable risk may be continually reevaluated and kept current with state-of-the-art information and contemporary values.

SAF/SEI-P-17 Require known geologic and seismic hazards within the area of a proposed subdivision to be referenced on the final subdivision map.

**Mitigation Measures:** No mitigation measures beyond the goals, policies and implementation measures identified in the General Plan Update are proposed.

**Level of Significance After Policies/Mitigation:** Less Than Significant Impact.

**DAM INUNDATION**

- **BUILDOUT IN ACCORDANCE WITH THE GENERAL PLAN UPDATE MAY EXPOSE PEOPLE OR STRUCTURES TO A SIGNIFICANT RISK RESULTING FROM A SEISMICALLY-INDUCED FAILURE OF ISABELLA DAM.**

**Level of Significance Before Policies/Mitigation:** Potentially Significant Impact.

**Impact Analysis:** As illustrated in Figure VIII-2 of the 1990 General Plan, a break in Isabella Dam caused by an earthquake would result in flooding 60 square miles of the Metropolitan Bakersfield area. According to the Land Use Map, a growth in population and additional development resulting from Plan implementation would occur throughout this area. Therefore, an increased number of people and structures would be exposed to this potential risk. This would in turn require the evacuation of a substantial portion of the Plan area. If communications are intact, the City and County may have from two to six hours to complete the evacuation.

The Safety Element has identified policies including a response plan for dam failure as well as the maintenance of disaster response plans, development of discretionary approval procedures for critical facilities, and the review of zoning designations, street widths, and circulation patterns for compatibility with evacuation plans. These policies and review procedures are necessary to mitigate this potential hazard to a less than significant level.

With implementation of the following goals and policies, impacts regarding dam inundation hazards would be reduced to a less than significant level.

**Goals and Policies in the General Plan Update:** The Safety Element contains the following goal and policies:

SAF/SEI-G-7 Protect land uses from the risk of dam failure inundation including the assurances that: the functional capabilities of essential facilities are available in the event of a flood; hazardous materials[1] are not released; effective measures for mitigation of dam failure inundation are incorporated into the design of critical facilities; and the rapid and orderly evacuation of populations in the inundation area will occur.

SAF/SEI-P-1 Ensure that earthquake survival and efficient post-disaster functions are a primary objective in the siting, design and construction standards for discretionary essential facilities or for expansion of such existing facilities.

SAF/SEI-P-2 Require that the siting and development of critical facilities under discretionary approval by the City Council and Board of Supervisors be supported by documentation of thorough hazard investigations relating to site selection, pre-construction site

[1] Hazardous materials are defined as injurious substances, including pesticides, herbicides, toxic metals and chemicals, liquefied natural gas, explosives, volatile chemicals, and nuclear fuels.

investigations and application of the most current professional standards for seismic design.

SAF/SEI-P-3 Encourage existing critical facilities with significant seismic vulnerabilities to be upgraded or relocated as appropriate.

SAF/SEI-P-4 Encourage critical facilities in dam inundation areas to develop and maintain plans for safe shut-down and efficient evacuation from their facilities, as appropriate to the degree of flood hazard for each facility.

SAF/SEI-P-5 Incorporate planning for incidents affecting critical facilities into contingency plans for disaster response and recovery.

SAF/SEI-P-18 Design discretionary critical facilities located within the potential inundation area for dam failure in order to: mitigate the effects of inundation on the facility; promote orderly shut-down and evacuation (as appropriate); and, prevent on-site hazards from affecting building occupants and the surrounding communities in the event of dam failure.

SAF/SEI-P-19 Design discretionary facilities in the potential dam inundation area used for the manufacture, storage or use of hazardous materials to prevent on-site hazards from affecting surrounding communities in the event of inundation.

SAF/SEI-P-20 Require emergency response plans for the Planning area to include specific procedures for the sequential and orderly evacuation of the potential dam inundation area.

SAF/SEI-P-21 Encourage critical and high-occupancy facilities as well as facilities for elderly, handicapped and other special care occupants located in the potential inundation area below the dam to develop and maintain plans for the orderly evacuation of their occupants.

**Mitigation Measures:** No mitigation measures beyond the goals, policies and implementation measures identified in the General Plan Update are proposed.

**Level of Significance After Policies/Mitigation:** Less Than Significant Impact.

**SUBSIDENCE**

- **PORTIONS OF THE PLAN AREA ARE LOCATED ON GEOLOGIC UNITS THAT ARE CONSIDERED UNSTABLE AND COULD POTENTIALLY RESULT IN SUBSIDENCE.**

**Level of Significance Before Policies/Mitigation:** Less Than Significant Impact.

**Impact Analysis:** As previously noted, gradual subsidence (up to four feet in certain areas) has been identified in the southern portion of the Plan area. As illustrated on the General Plan Land Use Map, the southern area is designated primarily for

agriculture use. Therefore, it is not anticipated that significant development would occur in these areas as a result of Plan implementation and people or structures would not be significantly exposed to substantial adverse effects involving subsidence. Nonetheless, although subsidence is not a significant hazard, damage to wells, foundations and underground utilities could occur. This potential impact would be considered a less than significant with the site-specific studies conducted as a part of the discretionary review process. These studies would document the presence/absence of this potential hazard and identify the necessary mitigation.

**Goals and Policies in the General Plan Update:** The Safety Element contains the following policies:

SAF/SEI-P-15 Compile information on areas of potential hazards and field information developed as part of CEQA investigations and geologic reports and keep geologic reviews and policy development current and accessible for use in report preparation.

SAF/SEI-P-16 Encourage and support local, state and federal research program for delineation of geologic and seismic hazards so that acceptable risk may be continually reevaluated and kept current with state-of-the-art information and contemporary values.

SAF/SEI-P-17 Require known geologic and seismic hazards within the area of a proposed subdivision to be referenced on the final subdivision map.

**Mitigation Measures:** No mitigation measures beyond the goals, policies and implementation measures identified in the General Plan Update are proposed.

**Level of Significance After Policies/Mitigation:** Less Than Significant Impact.

## UNAVOIDABLE SIGNIFICANT IMPACTS

All geologic and seismic impacts associated with implementation of the General Plan Update would be considered less than significant with adherence to/compliance with goals, policies and implementation measures in the General Plan Update and conditions of approval.