G. GEOLOGY, SEISMICITY, AND MINERAL RESOURCES

This section describes the existing geologic and seismic conditions, including mineral resources, for the City of Albany. Background information for this section is based on regional geologic reports and maps from the United States Geological Survey (USGS), the California Geological Survey (CGS), the U.S. Department of Agriculture (USDA), and other sources. The impacts and mitigation measures section defines the criteria of significance and identifies potential impacts and mitigation measures related to geology, seismicity, and mineral resources for future development in the City of Albany.

1. Setting

The setting section describes existing conditions in the City of Albany and pertinent federal, State, and local agency laws, regulations, and programs related to geology and seismicity.

a. Geologic Conditions. The City of Albany has an incorporated area of approximately 5.5 square miles (including land and water).[1] The majority of the land area is located on a gentle, westward-sloping alluvial plain on the eastern margin of San Francisco Bay.[2] The underlying Quaternary alluvial sediments mainly consist of unconsolidated gravel, sand, silt, and clay deposits that have been subject to redistribution by fluvial (stream) processes. These materials were shed from the Berkeley Hills which rise as a series of ridges east of the City. The westernmost portion of the City, bordering San Francisco Bay, is underlain by artificial fill which includes a heterogeneous mixture of clay, silt, sand, rock fragments, organic matter, and man-made debris.

Two isolated outcrops of Franciscan Complex sandstone (Late Cretaceous) are located in the western portion of the City near the boundary of San Francisco Bay. Albany Hill, a distinctive hilltop in the northwest corner of the City, and Fleming Point, located under and west of Golden Gate Fields, are underlain by this sandstone. Table IV.G-1 describes the geologic units in the City of Albany and Figure IV.G-1 shows the generalized geology and Figure IV.G-2 shows the location of earthquake faults.

Table IV.G-1: Geologic Units in the City of Albany

Symbol	Unit Name	Age	Description
Qhaf	Alluvium	Quaternary - Holocene	Young alluvial fan deposits: fine-grained sand and silt, minor gravel
Qpaf	Alluvium	Quaternary - Pleistocene	Young alluvial fan deposits: fine-grained sand and silt, minor gravel
Kfn	Franciscan Complex	Jurassic to Cretaceous	Sandstone with smaller amounts of shale, chert, limestone, and conglomerate
af	Artificial fill	Historic	Clay, silt, sand, rock fragments, organic matter, and man-made debris

Source: California Department of Conservation, 2001. *Oil, Gas, and Geothermal Fields in California.* Map S-1.

[1] United States Census Bureau, 2010. Albany, California. Website: quickfacts.census.gov/qfd/states/06/0600674.html.

[2] Graymer, R.W., et al., 2000. *Geologic Map and Map Database of the Oakland Metropolitan Area, Alameda, Contra Costa and San Francisco Counties, California*.

(1) Soils. Soil is generally defined as the unconsolidated mixture of mineral grains and organic material which mantles the land surfaces of the earth. Soils can develop on unconsolidated sediments, such as alluvium, and weathered bedrock. The characteristics of soil reflect the five major influences on their development: topography, climate, biological activity, parent material, and time.

Soil surveys from the USDA indicate that City soils consist of five basic soil mapping units that are summarized in Table IV.G-2, including the area of the individual soil units, their shrink-swell potential, and whether the soils are corrosive to steel or concrete. The extent of the soil units are shown on Figure IV.G-3.

Table IV.G-2: Soils in the City of Albany

Soil Association/Name	Approximate Acreage within Albany	Linear Extensibility (shrink-swell)	Corrosivity (uncoated steel)	Corrosivity (concrete)
Los Osos-Millsholm Complex[a]	106	Moderate to High	Moderate	Low
Millsholm Silt Loam	64	Low	Moderate	Low
Urban Land	312	N/A	N/A	N/A
Urban Land-Clearlake Complex	223	N/A	N/A	N/A
Urban Land-Tierra Complex[b]	167	Low to High	Moderate	Moderate
Clear Lake Clay	12	High to Very High	High	Moderate
Tierra Loam	251	Low to High	High	Moderate

[a] The Los Osos component makes up 60 percent of the map unit and is used to describe the shrink-swell and corrosivity potential.
[b] The Tierra component makes up 50 percent of the map unit and is used to describe the shrink-swell and corrosivity potential.

Source: U.S. Department of Agriculture, 2015. Natural Resources Conservation Service. *Web Soil Survey*. Website: websoilsurvey.sc.egov.usda.gov/App/HomePage.htm (accessed May 18, 2015).

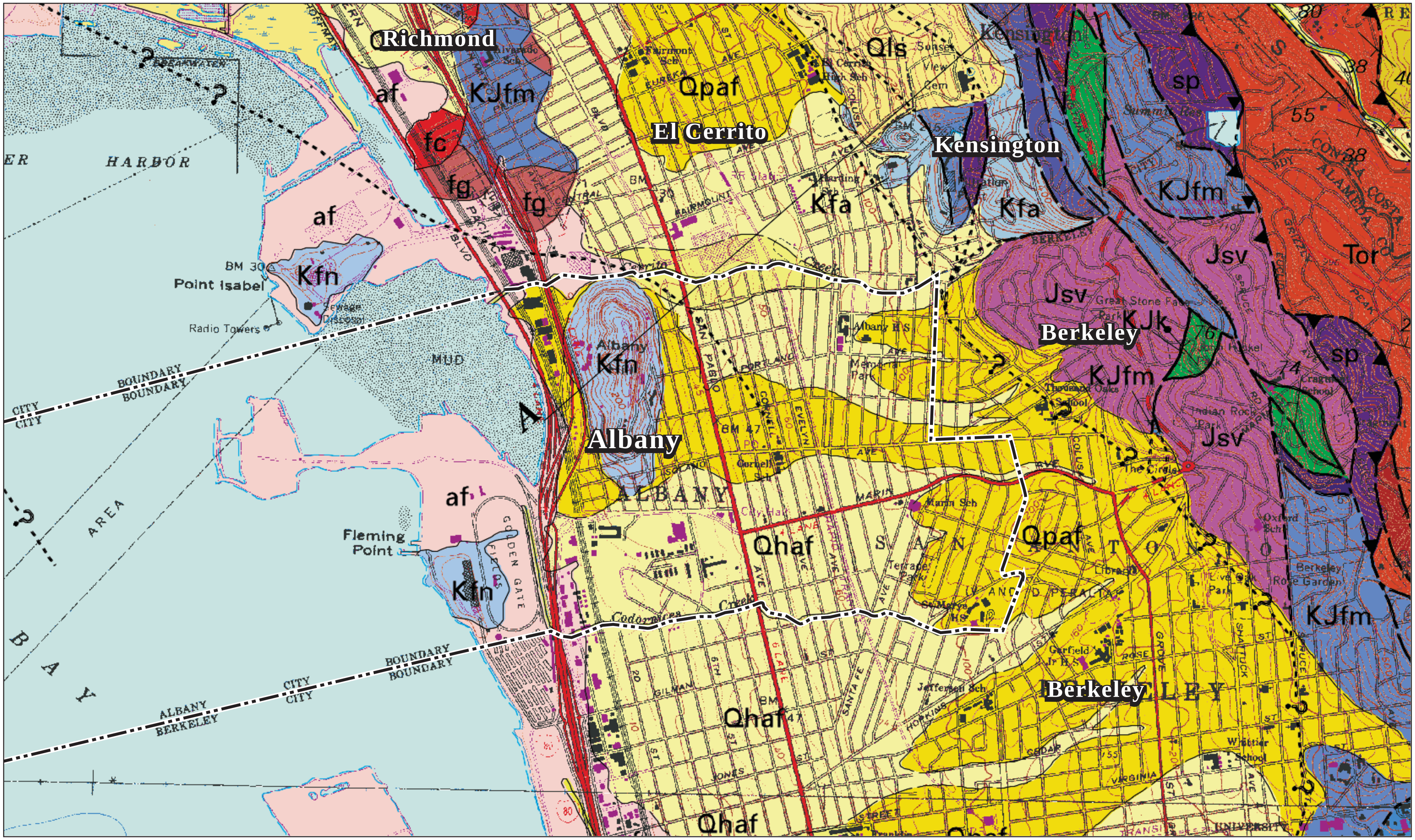
(2) Mineral Resources. Statewide mapping of mineral resources classified the majority of the City of Albany as MRZ-1, "areas where adequate information indicates that no significant mineral deposits are present, or where it is judged that little likelihood exists for the presence."[3] Albany Hill, composed of Franciscan Complex sandstone, is classified as MRZ-2, "areas where adequate information indicates that significant deposits are present, or where it is judged that high likelihood for the presence exists."[4] Historic mining of the sandstone has occurred at both Albany Hill and at Fleming Point; there are no active or permitted mining operations within the City. There have been no natural gas, oil, or geothermal resources identified in or adjacent to the City.[5,6]

[3] California Division of Mines and Geology, 1987. *Mineral Land Classification: Aggregate Materials in the San Francisco – Monterey Bay Area*. Special Report 146, part II.

[4] Ibid.

[5] California Department of Conservation, 2000. *Energy Map of California, Map S-2, 3rd Edition.*

[6] California Department of Conservation, 2001. *Oil, Gas, and Geothermal Fields in California.* Map S-1.



LSA

N

0 1250 2500
FEET

SOURCES: R.W. GRAYMER, 2000; BASELINE; LSA ASSOCIATES, INC., 2015.

Symbol	Description
af	Artificial Fill (Historic)
fc	Serpentinite blocks
fg	Greenstone blocks
sp	Chert blocks
Jsv	Keratophyre/Quartz Keratophyre (Late Jurassic)
Kfa	Sandstone of Alcatraz terrane of Blake & others (1984)(Cretaceous)
Kfn	Sandstone of Novato Quarry terrane of Blake & others (1984)(Late Cretaceous)
KJfm	Franciscan complex mélange (Cretaceous Late Jurassic), includes mapped locally: Graywacke & meta-graywacke blocks
KJsv	Volcanoclastic breccia
Qhaf	Alluvial fan and fluvial deposits (Holocene)
Qpaf	Alluvial fan and fluvial deposits (Pleistocene)
Qls	Landslide deposits (Pleistocene)
	Albany City Limits

FIGURE IV.G-1

City of Albany General Plan EIR
City of Albany Geology

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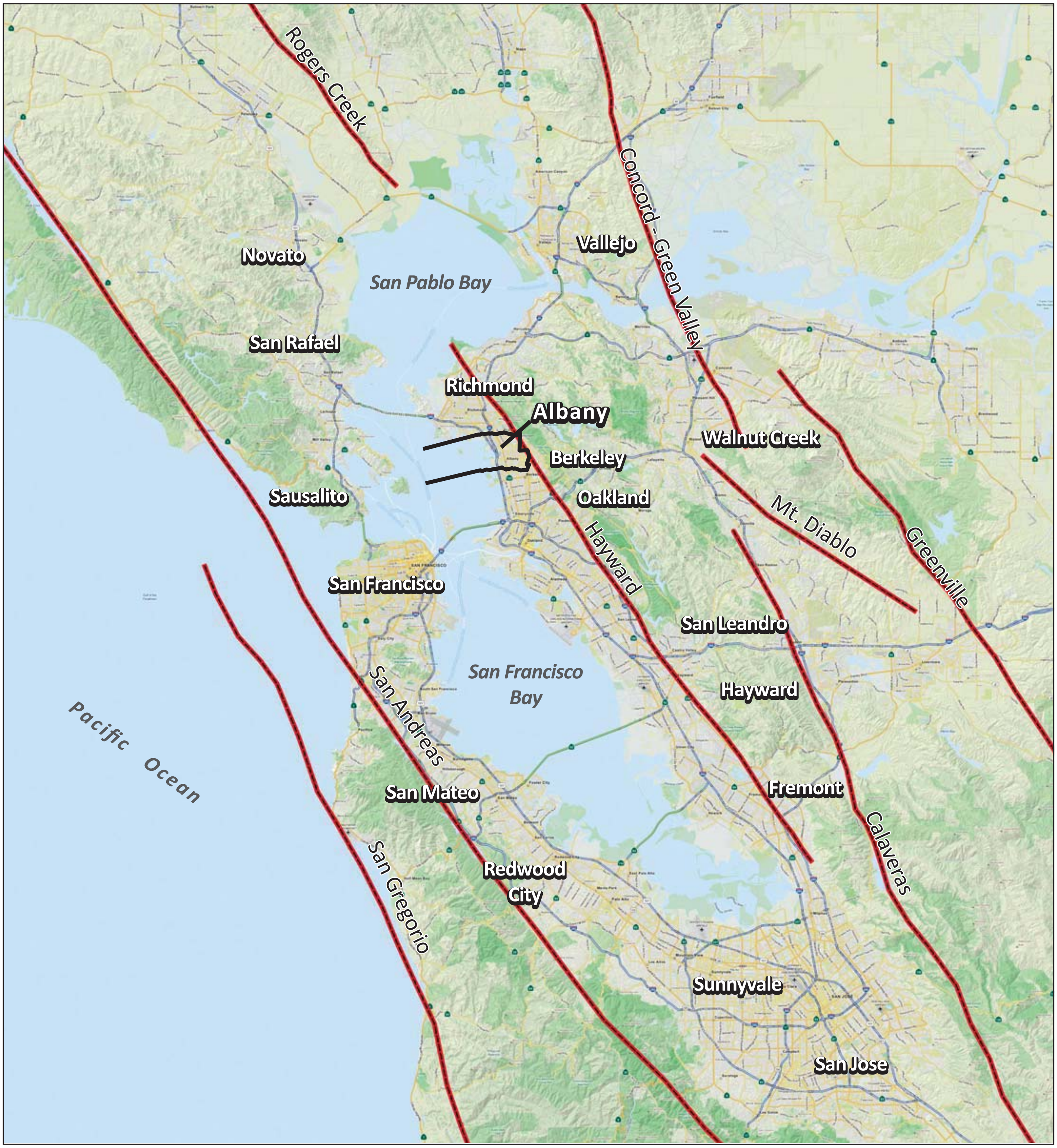

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FIGURE IV.G-2

Albany City Limits

Fault Lines

0 5 10
MILES

City of Albany General Plan EIR

San Francisco Bay Area Fault Map

SOURCES: MAPQUEST; UNITED STATES GEOLOGICAL SURVEY, 2015.

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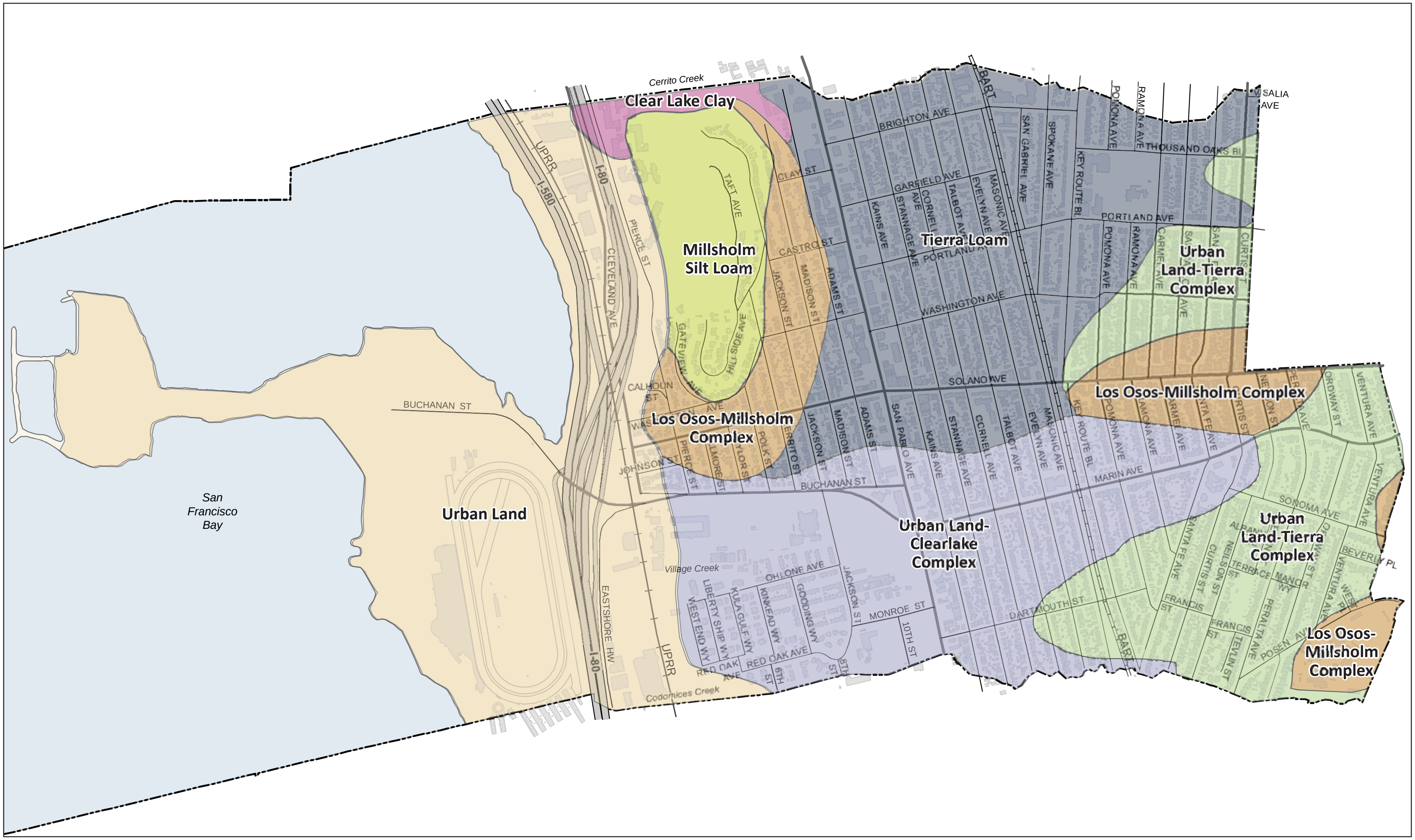

LSA

LEGEND

- Albany City Limit
- Freeway
- BART Tracks
- Railroad Tracks
- Building
- Urban Land
- Urban Land: Clearlake Complex
- Urban Land: Tierra Complex
- Millsholm Silt Loam
- Tierra Loam
- Los Osos-Millsholm Complex
- Clear Lake Clay

0 0.125 0.25
MILES

FIGURE IV.G-3

City of Albany General Plan EIR

Soil Classifications

SOURCE: SOIL CLASSIFICATIONS (USDA, NATURAL RESOURCES CONSERVATION SERVICE, 2015)

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(3) Topography. The City of Albany is in an area with relatively modest topographic relief with an elevation of zero feet NGVD[7] along the shores of San Francisco Bay and rising to approximately 200 feet NGVD 1.5 miles to the east, at the eastern edge of the City near the corner of Ventura and Sonoma Avenues. A relatively large physical landmark, Albany Hill, is located near the northwest boundary of the City and rises more than 250 feet above the surrounding grade and covers an area of over 40 acres.[8]

(4) Slope Stability. Slope failure can occur as either rapid movement of large masses of soil ("landslide") or slow, continuous movement ("creep"). The primary factors influencing the stability of a slope are: 1) the nature of the underlying soil or bedrock; 2) the geometry of the slope (height and steepness); 3) rainfall; and 4) the presence of previous landslide deposits. Landslides are commonly triggered by unusually high rainfall and the resulting soil saturation, earthquakes, or a combination of these conditions.

Based on old debris flow (i.e., mudslide) deposits, CGS has mapped the side slopes of Albany Hill as a seismic hazard zone for earthquake-induced landslides.[9] The flatland areas located west of San Pablo Avenue and adjacent to the Bay have gentle slopes with little or no potential for landslides. Few landslides, if any, have be mapped on the east side of the City.[10] Overall, the City has a relatively low susceptibility to landslides and creep due to the low to moderate relief of the local topography, with the exception of localized areas around Albany Hill.

(5) Expansive Soils. Expansion and contraction of volume can occur when expansive soils undergo alternating cycles of wetting (swelling) and drying (shrinking). During these cycles, the volume of the soil changes markedly. The most commonly referenced measure of expansion potential is linear extensibility. As a consequence of such soil volume changes, structural damage to building and infrastructure may occur if the potentially expansive soils were not considered in building design and during construction. The soils of the City range from low to very high shrink-swell potential (i.e., low to very high linear extensibility) (Table IV.G-2). Moderate to very high shrink-swell potential soils are classified as expansive soils, which can pose geotechnical hazards to subsurface utilities and building foundations.[11]

(6) Subsidence. Subsidence is the lowering of the land-surface elevation. The mechanism for subsidence is generally related to groundwater pumping and subsequent consolidation of loose aquifer sediments. The primary hazards associated with subsidence are increased flooding hazards and damage to underground utilities as well as above-ground structures. Other effects of subsidence include changes in the gradients of stormwater and sanitary sewer drainage systems in which the flow is gravity-driven. The City is very nearly built out and water is provided via the water supply utility,

[7] National Geodetic Vertical Datum of 1929, which is roughly equivalent to mean sea level.

[8] United States Geological Survey, 2012. *Richmond Quadrangle 7.5' series Topographic Map*.

[9] California Geological Survey, 2003. *State of California Seismic Hazard Zones; Richmond Quadrangle*. February 14.

[10] United States Geological Survey, 1998. *San Francisco Bay Region Landslide Information: Summary Distribution of Slides and Earth Flows. USGS Open-File Report 97-745*.

[11] U.S. Department of Agriculture, 2015. Natural Resources Conservation Service. *Web Soil Survey*. Website: websoilsurvey.sc.egov.usda.gov/App/HomePage.htm (accessed May 18, 2015).

East Bay Municipal Utility District. There are no significant agricultural or industrial activities that result in the substantial pumping withdrawal of water from the underlying aquifer that would contribute to subsidence in the City.

(7) Settlement and Differential Settlement. Differential settlement could occur if buildings or other improvements were built on low-strength foundation materials (including imported fill) or if improvements straddle the boundary between different types of subsurface materials (i.e., a boundary between native material and fill or between bedrock and unconsolidated sediments). Although differential settlement generally occurs slowly enough that its effects are not dangerous to inhabitants, it can cause significant building damage over time. Portions of the City that contain loose or uncontrolled (non-engineered) fill or recent alluvial sediments may be susceptible to differential settlement.

b. Seismic Conditions. The City of Albany is located in the seismically active San Francisco Bay Area. The main geologic condition which generates the seismic activity in the region is movement along the tectonic plate boundary between the North American and Pacific plates. Locally, this boundary is referred to as the San Andreas Fault Zone (SAFZ) and includes numerous active faults found by the California Geological Survey under the Alquist-Priolo Earthquake Fault Zoning Act to be "active" (i.e., to have evidence of fault rupture in the past 11,000 years). Albany City Hall is located approximately 1.6 miles west of the Hayward Fault, approximately 13.8 miles west of the northern terminus of the Mt. Diablo Fault, and 16.7 miles east of the San Andreas Fault (Figure IV.G-2).[12]

(1) Fault Rupture Damage. Surface rupture occurs when the ground surface is broken due to fault movement during an earthquake. Regional faults identified by the CGS are shown in Figure IV.G-2. The location of surface rupture generally can be assumed to be along an active major fault trace. CGS has mapped areas susceptible to surface fault rupture by delineating Alquist-Priolo Earthquake Fault Zones, which have up to an approximately 0.25-mile buffer around surface traces of active faults. The nearest Alquist-Priolo Earthquake Fault Zone to the City of Albany is mapped along the northern section of the Hayward Fault, which generally follows along the base of the foothills of the Berkeley Hills. No known active faults are present within the City and therefore hazards associated with surface fault rupture in the City are considered negligible.[13]

(2) Seismic Shaking. Seismic shaking (or ground shaking) is a general term referring to all aspects of motion of the earth's surface resulting from an earthquake, and is normally the major cause of damage in seismic events. The extent of ground shaking is controlled by the magnitude and intensity of the earthquake, distance from the epicenter, and local geologic conditions. Magnitude is a measure of the energy released by an earthquake; it is assessed by seismographs that measure the amplitude of seismic waves. Intensity is a subjective measure of the perceptible effects of seismic energy at a given point and varies with distance from the epicenter and local geologic conditions. The Modified Mercalli Intensity Scale (MMI) is the most commonly used scale for measurement of the subjective effects of earthquake intensity and is further described in Table IV.G-3.

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[12] California Division of Mines and Geology, 1988. *Fault Map of California, with locations of Volcanoes, Thermal Springs, and Thermal Wells, California Department of Conservation.*

[13] California Geological Survey, 1982. *State of California Special Study Zones; Richmond.* January 1.

Table IV.G-3: Modified Mercalli Scale

M[a]	Category	Definition
	I	Not felt except by a very few under especially favorable circumstances.
3	II	Felt only by a few persons at rest, especially on upper floors of buildings. Delicately suspended objects may swing.
	III	Felt quite noticeably indoors, especially on upper floors of buildings, but many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibration like passing of truck. Duration estimated.
4	IV	During the day felt indoors by many, outdoors by few. At night some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
	V	Felt by nearly everyone, many awaken. Some dishes, windows, etc., broken; a few instances of cracked plaster; unstable objects overturned. Disturbances of trees, poles, and other tall objects sometimes noticed. Pendulum clocks may stop.
5	VI	Felt by all, many frightened and run outdoors. Some heavy furniture moved; a few instances of fallen plaster or damaged chimneys. Damage slight.
6	VII	Everybody runs outdoors. Damage negligible in building of good design and construction; slight to moderate in well-built ordinary structures; considerable in poorly built or badly designed structures; some chimneys broken. Noticed by persons driving motor cars.
	VIII	Damage slight in specially designed structures; considerable in ordinary substantial buildings, with partial collapse; great in poorly built structures. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. Sand and mud ejected in small amounts. Changes in well water. Persons driving motor cars disturbed.
7	IX	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb; great in substantial buildings, with partial collapse. Buildings shifted off foundations. Ground cracked conspicuously. Underground pipes broken.
8	X	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations; ground badly cracked. Rails bent. Landslides considerable from river banks and steep slopes. Shifted sand and mud. Water splashed (slopped) over banks.
	XI	Few, if any, (masonry) structures remain standing. Bridges destroyed. Broad fissures in ground. Underground pipelines completely out of service. Earth slumps and land slips in soft ground. Rails bent greatly.
	XII	Damage total. Practically all works of construction are damaged greatly or destroyed. Waves seen on ground surface. Lines of sight and level are distorted.

[a] Richter magnitude correlation.

Source: California Geological Survey, 2002. How Earthquakes and Their Effects are Measured.

Geologic and soil conditions in an area can influence the shaking effects of an earthquake. The Association of Bay Area Governments (ABAG) earthquake hazard mapping indicates a magnitude 7.0 event on the Hayward Fault would result in very strong to violent (MMI-VIII to MMI-IX, see Table IV.G-3) shaking in the City. This level of ground shaking could cause considerable damage to structures constructed in accordance with CBC standards (including seismically retrofitted unreinforced masonry buildings) and great damage in ordinary buildings that have not been built to CBC standards (e.g., soft-story residential buildings). Strong to very strong ground shaking would also be felt during large seismic events from the San Andreas Fault, Concord-Green Valley Fault, Calaveras Fault, and San Gregorio Fault (Figure IV.G-1).[14]

(3) Liquefaction and Lateral Spreading. Liquefaction is the rapid transformation of saturated, loose, fine-grained sediment to a fluid-like state because of high pore-water pressure developed in the sediment usually caused by earthquake ground shaking. In the process, the soil undergoes transient loss of strength, which commonly causes ground displacement or ground failure to occur. Since saturated soils are a necessary condition for liquefaction, soil layers in areas where the groundwater table is near the surface have higher liquefaction potential than those in which the water table is located at greater depths. Liquefaction potential increases in the vicinity of the San Francisco Bay and locally near creeks where loose, granular recently deposited sediments have accumulated as a result of stream processes. The potential for liquefaction also depends on soil conditions and groundwater levels, which may fluctuate.

Liquefaction has resulted in substantial loss of life, injury, and damage to property. In addition, liquefaction increases the hazard of fires because of explosions induced when underground gas lines break, and because the breakage of water mains substantially reduces fire suppression capability. In general, where there is any potential for liquefaction, site-specific studies are needed to determine the extent of the hazard if development were to occur in the area.

Lateral spreading is a form of horizontal displacement of soil toward an open channel or other “free” face, such as an excavation boundary. Lateral spreading can result from either the slump of low cohesion unconsolidated material or more commonly by liquefaction of either the soil layer or a subsurface layer underlying soil material on a slope, resulting in gravitationally driven movement.[15] Lateral spreading (lurching) may also occur where open banks and unsupported cut slopes provide a free face. Ground shaking, especially when inducing liquefaction, may cause lateral spreading toward unsupported slopes. Areas most prone to lateral spreading are those that consist of fill material that has been improperly engineered, that have steep, unstable banks, and that have high groundwater tables. Damage caused by liquefaction and lateral spreading is generally most severe when liquefaction occurs within 15 to 20 feet of the ground surface.

In the City of Albany, CGS has mapped a seismic hazard zone for liquefaction that requires additional investigation to determine the extent and magnitude of potential ground failure. The zone extends from the banks of Codornices Creek along the south boundary of the City to the lowlands area adjacent the San Francisco Bay (including the area west of San Pablo Avenue and south of Buchanan Street).[16] Specifically, the zone shows an area “where historic occurrence of liquefaction, or local geological, geotechnical and groundwater conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693 (c) would be required.”

[14] Association of Bay Area Governments, 2015. *Future Earthquake Shaking Scenarios*. Website: resilience.abag.ca.gov/earthquakes (accessed May 18, 2015).

[15] Rauch, Alan F., 1997. *EPOLLS: An Empirical Method for Predicting Surface Displacements due to Liquefaction-Induced Lateral Spreading in Earthquakes*, Ph. D. Dissertation, Virginia Tech, Blacksburg, VA.

[16] California Geological Survey, 2003, op. cit.

c. Regulatory Framework. This section describes the applicable federal, State and local regulations that pertain to the City of Albany.

(1) Federal Regulations. The National Earthquake Hazards Reduction Program (NEHRP) was established by the U.S. Congress when it passed the Earthquake Hazards Reduction Act of 1977, Public Law (PL) 95–124. In establishing NEHRP, Congress recognized that earthquake-related losses could be reduced through improved design and construction methods and practices, land use controls and redevelopment, prediction techniques and early-warning systems, coordinated emergency preparedness plans, and public education and involvement programs. The four basic NEHRP goals remain unchanged:

1. Develop effective practices and policies for earthquake loss reduction and accelerate their implementation.
2. Improve techniques for reducing earthquake vulnerabilities of facilities and systems.
3. Improve earthquake hazards identification and risk assessment methods, and their use.
4. Improve the understanding of earthquakes and their effects.

Several key federal agencies contribute to earthquake mitigation efforts. There are four primary NEHRP agencies:

1. National Institute of Standards and Technology of the Department of Commerce
2. National Science Foundation
3. USGS of the Department of the Interior
4. Federal Emergency Management Agency (FEMA) of the Department of Homeland Security

Implementation of NEHRP priorities is accomplished primarily through original research, publications, and recommendations to assist and guide State, regional, and local agencies in the development of plans and policies to promote safety and emergency planning.

(2) State Regulations. State regulations described below include the California Building Code, earthquake protections laws, Alquist-Priolo Earthquake Fault Zoning Act, Seismic Hazards Mapping Act, regulations pertaining to oil, gas, and geothermal wells, and the Surface Mining and Reclamation Act of 1975.

California Building Code. The 2013 California Building Code (CBC), which refers to Part 2 of the California Building Standards Code in Title 24 of the California Code of Regulations, is based on the 2012 International Building Code. The 2013 CBC covers grading and other geotechnical issues, building specifications, and non-building structures. The CBC requires that a site-specific geotechnical investigation report be prepared by a licensed professional for proposed developments of one or more buildings greater than 4,000 square feet to evaluate geologic and seismic hazards. Buildings less than or equal to 4,000 square feet also are required to prepare a geologic engineering report, except for one-story, wood-frame and light-steel-frame buildings of Type V construction that are located outside of the Alquist-Priolo Earthquake Faults Zones.

The purpose of a site-specific geotechnical investigation is to identify seismic and geologic conditions that require project mitigation, such as surface fault ruptures, ground shaking, liquefaction, differential settlement, lateral spreading, expansive soils, and slope stability. Requirements for the geotechnical investigation are presented in Chapter 16 "Structural Design" and Chapter 18 "Soils and Foundation" of the 2013 CBC.

Earthquake Protection Laws. There are two State laws that address buildings and their resistance to earthquakes. The first is known as the Earthquake Protection Law, the portion of the Health and Safety Code in Division 13, Part 3 commencing with Section 19100. The law establishes the requirement that all buildings be designed to resist lateral forces from seismic motion, and allows local government to enact local requirements to mitigate the risk from existing buildings, such as unreinforced masonry buildings and others not designed in consideration of seismic motion.

The other State law regarding earthquake safety is in Government Code, Title 2, Chapter 12.2, commencing with Section 8875. This law requires cities and counties to identify potentially hazardous buildings, as defined, and establish a local mitigation program. Further, the owner of a building identified as a potentially hazardous building must post a written notice in a conspicuous location to warn the public as to the potential hazard during an earthquake.

Alquist-Priolo Earthquake Fault Zoning Act. Surface rupture is the most easily avoided seismic hazard. The Alquist-Priolo Earthquake Fault Zoning Act (APEFZA) was passed in December 1972 to mitigate the hazard of surface faulting to structures for human occupancy. As required by the Act, the CGS has delineated Earthquake Fault Zones along known active faults in California. There are no Earthquake Fault Zones located within the City.

Seismic Hazards Mapping Act. In 1990, following the 1989 Loma Prieta earthquake, the California Legislature enacted the Seismic Hazards Mapping Act (SHMA) to protect the public from the effects of strong ground shaking, liquefaction, landslides and other seismic hazards. The SHMA established a State-wide mapping program to identify areas subject to violent shaking and ground failure; the program is intended to assist cities and counties in protecting public health and safety. The SHMA requires the State Geologist to delineate various seismic hazard zones and requires cities, counties, and other local permitting agencies to regulate certain development projects within these zones. As described above, CGS has mapped seismic hazard zones for liquefaction and earthquake-induced landslides within the City of Albany.

Surface Mining and Reclamation Act of 1975. The principal legislation addressing mineral resources in California is the State Surface Mining and Reclamation Act of 1975 (SMARA) (Public Resources Code Sections 2710–2719), which was enacted in response to land use conflicts between urban growth and essential mineral production.[17] SMARA specifies that lead agencies require financial assurances of each mining operation to ensure reclamation is performed in accordance with the approved reclamation plan. The financial assurances may take the form of surety bonds, irrevocable letters of credit, trust funds, or similar mechanism.

[17] California Geological Survey, 2008. *Mineral Resources and Mineral Hazards Mapping Program*. Website: www.consrv.ca.gov/cgs/minerals/Pages/Index.aspx.

(3) Local Regulations. Applicable local regulations are described below.

City of Albany 1992 General Plan. The following policies from the 1992 General Plan address geology, seismicity, and minerals.

- **Policy CHS 1.2**: Review and revise City Codes and regulations to ensure that future construction of critical facilities (schools, police stations, fire stations, etc.) in Albany will be able to resist the effects of an earthquake of M7.5 on the Hayward Fault and sustain minor structural damage, remain operative, safe, and quickly be able to be restored to service.
- **Policy CHS 1.3**: Develop a seismic safety structural inventory and assessment program which reviews the structural integrity of all existing critical facilities and identifies what reconstruction would be necessary to meet a seismic safety standard. After this survey is completed, the City should evaluate the safest places to locate critical services and facilities.
- **Policy CHS 1.4**: Require that a geological investigation be conducted on new construction of critical facilities in areas identified on the Environmental Hazards Map as having medium-high to high susceptibility to ground failure during an earthquake.
- **Policy CHS 1.6**: Require review of the Environmental Hazards Map at the time a development is proposed. Assure implementation of appropriate mitigation measures if hazards are identified.

These policies will soon be superseded by a more robust set of policies and action programs in the Draft General Plan. The new policies carry forward the same basic principles, with the goal of protecting life and property from damage associated with geological events such as earthquakes and landslides.

2. Impacts and Mitigation Measures

This section provides an assessment of the potential geology, seismicity, and mineral resources impacts related to implementation of the Draft General Plan. This section begins with the criteria of significance, which establishes the thresholds for determining whether an impact is significant. The latter part of this section identifies potential impacts and evaluates how they relate to policies and actions of the Draft General Plan. Where potentially significant impacts are identified, mitigation measures are recommended.

a. Criteria of Significance. Implementation of the Draft General Plan would result in a significant geology, soils or seismicity impact if it would:

- Expose people or structures to potential substantial 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 or Seismic Hazards 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; or
    - Landslides;
- Result in substantial soil erosion or the loss of top soil;

- Be located on geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse; or
- Be located on expansive or corrosive soil, creating substantial risks to life or property.

b. Impact Analysis. The growth and changes to land use in Albany resulting from implementation of the Draft General Plan could result in increased development and population in the City of Albany. Implementation of the Draft General Plan would therefore result in additional people and structures being exposed to geohazards, including seismic risks, liquefaction, slope instability, soil settlement or compaction, and adverse soil conditions (e.g., expansive soils, corrosive soils). Some of these geohazards, particularly those related to seismic shaking, could result in injuries and/or fatalities; all of the geohazards discussed could result in damage to structures and property. The following section provides an evaluation and analysis for the potential impacts of the Draft General Plan for each of the criteria of significance listed above.

(1) Adverse Effects from Seismic Events. The State Geologist has not mapped any Earthquake Fault Zones within the City; therefore future developments under the Draft General Plan would not expose people to adverse effects associated with surface fault rupture. However, the major regional faults located near Albany are capable of producing strong to violent ground shaking in the City; these faults include the San Andres Fault, the Hayward Fault, the San Gregorio Fault, the Calaveras Fault, and the Concord-Green Valley Fault (shown in Figure IV.G-2). Strong to violent seismic shaking could cause considerable damage in specially designed structures and great damage in ordinary buildings that have not be built to comply with the current CBC, and could cause extensive non-structural damage to buildings in the City of Albany. CGS has also mapped seismic hazard zones where ground shaking from a seismic event could trigger liquefaction and/or landslides.

Existing federal and State regulations, programs, and standards, including the NEHRP, APEFZA, SHMA, and CBC, are designed to provide current information detailing seismic hazards, impose regulatory requirements regarding geotechnical and soils investigations, provide limitations on the locations of structures for human habitation, impose requirements for hazard notices to potential users, and establish structural standards and/or requirements for buildings and grading projects. The following policies and actions of the Draft General Plan would guide new development and reduce impacts relative to seismic hazards:

- **Policy EH-1.1: Hazard-Sensitive Planning**. Ensure that future development is sited, designed, and constructed to minimize risks associated with earthquakes, flooding, landslides, and other natural hazards. Appropriate mitigation measures should be required to reduce hazard risks.
- **Policy EH-1.3: Retrofits**. Strongly encourage the retrofitting of existing structures to reduce the risk of collapse and/or major damage and injury in an earthquake. As appropriate, the City may require seismic upgrading of structures when they are substantially rehabilitated or remodeled.
- **Policy EH-1.5: Building Codes**. Periodically update local building codes and regulations to incorporate emerging technologies and methods which reduce earthquake-related hazards.
- **Action EH-1.A: Soil and Geological Reports**. Require soils and/or geologic reports for proposed development in areas with high susceptibility to ground failure during an earthquake, and in other areas with the potential risk of slope failure, landslides, liquefaction, or other geologic hazards.

- **Action EH-1.B: Unreinforced Masonry Buildings**. Continue efforts to retrofit the remaining Unreinforced Masonry Buildings in Albany. Various financing options and programs should be explored to assist private property owners in meeting current Building Code requirements.
- **Action EH-1.C: Soft-Story Buildings**. Prepare an updated inventory of Albany's soft-story buildings and develop incentives and other programs to assist owners in retrofitting such structures to improve their performance in a major earthquake.
- **Action EH-1.D: Assessing Critical Facilities**. As part of the City's emergency preparedness planning, assess the structural integrity of critical public facilities and identify what additional measures might be needed to meet current seismic safety standards.
- **Action EH-1.F: Building Code Enforcement**. Require review of all development and construction proposals by the City of Albany to ensure conformance to current and applicable building code standards.

Soft-story buildings, as described in Action EH-1.C, are typically two to three story multi-family buildings with ground floor carports and other ground floor openings which require additional stability to withstand a major earthquake. Such structures have been identified as a vulnerable component of the City's building stock and would benefit from the installation of shear walls and other improvements to reduce the risk of collapse.

Compliance with federal and State requirements and the Draft General Plan policies and actions would reduce potential impacts related to seismic events to a less-than-significant level and no further mitigation would be required.

(2) Substantial Soil Erosion or the Loss of Top Soil. Development or redevelopment under the Draft General Plan would include construction activities that could potentially result in substantial erosion. Soil erosion could affect stormwater quality and the quality of receiving waters.

As discussed in Section IV.H, Hydrology and Water Quality, the State Board adopted an NPDES General Permit for Stormwater Discharges Associated with Construction and Land Disturbance Activities, Order No. 2009-0009-DWQ, NPDES No. CAS000002, as amended in 2011 (Construction General Permit). To obtain coverage under the Construction General Permit, a project applicant must submit various documents, including a Notice of Intent and a SWPPP. Activities subject to the Construction General Permit include clearing, grading, and disturbances to the ground, such as grubbing or excavation. The purpose of the SWPPP is to identify the sources of sediment and other pollutants that could affect the quality of stormwater discharges and to describe and ensure the implementation of Best Management Practices to reduce or eliminate sediment and other pollutants in stormwater, as well as non-stormwater, discharges resulting from construction activity.

The following policies of the Draft General Plan would also reduce impacts relative to soil erosion:

- **Policy CON-1.2: Erosion and Soil Management**. Require that construction, grading, retaining walls, infrastructure maintenance, and other earth moving activities use best management practices to reduce erosion, sedimentation, and soil loss.
- **Policy W-1.9: Hazard Remediation**. Remediate environmental hazards which may be present as park areas are improved for public access and use. This could include mitigation of geologic hazards, such as settlement, slope stability, and erosion. Additional testing and geotechnical studies may be warranted prior to excavation, grading, removal or reuse of filled soils, and other construction activities.

- **Policy EH-1.4: Soil-Related Hazards**. Use best management practices to reduce risks to structures, roads, and utilities associated with erosion, shrink-swell potential, subsidence, and other soil-related hazards.

Compliance with the Draft General Plan policies and State requirements would reduce erosion and topsoil impacts from the Draft General Plan to a less-than significant level and no further mitigation would be required.

(3) Unstable Geologic Unit or Soil. This section discusses potential impacts of the Draft General Plan related to unstable soils, landslides, lateral spreading, liquefaction, or collapse.

Landslides. Earthquake induced slope failure is generally not an issue in Albany due to the low relief of the local topography, with the exception of localized areas around Albany Hill. CGS has mapped the soils around Albany Hill as a seismic hazard zone susceptible to earthquake-induced landslides.

The following policies and action of the Draft General Plan would guide new development and reduce impacts relative to landslide hazards:

- **Policy EH-1.1: Hazard-Sensitive Planning**. Ensure that future development is sited, designed, and constructed to minimize risks associated with earthquakes, flooding, landslides, and other natural hazards. Appropriate mitigation measures should be required to reduce hazard risks.
- **Action EH-1.A: Soil and Geological Reports**. Require soils and/or geologic reports for proposed development in areas with high susceptibility to ground failure during an earthquake, and in other areas with the potential risk of slope failure, landslides, liquefaction, or other geologic hazards.
- **Policy W-1.9: Hazard Remediation**. Remediate environmental hazards which may be present as park areas are improved for public access and use. This could include mitigation of geologic hazards, such as settlement, slope stability, and erosion. Additional testing and geotechnical studies may be warranted prior to excavation, grading, removal or reuse of filled soils, and other construction activities.

Compliance with the Draft General Plan policies and action would reduce potential impacts related to landslides to a less-than-significant level and no further mitigation is required.

Subsidence. Groundwater removal is not proposed as a component of the Draft General Plan. Therefore, subsidence under the Draft General Plan would have no impact and further mitigation would not be required.

Liquefaction and Lateral Spreading. CGS has mapped a seismic hazard zone for liquefaction that extends from the banks of Codornices Creek along the south boundary of the City to the lowland areas adjacent the San Francisco Bay (including the area west of San Pablo Avenue and south of Buchanan Street). Lateral spreading toward unsupported slopes can be caused by ground shaking and resulting liquefaction. The following action of the Draft General Plan would guide new development and reduce impacts relative to liquefaction and lateral spreading:

- **Action EH-1.A: Soil and Geological Reports**. Require soils and/or geologic reports for proposed development in areas with high susceptibility to ground failure during an earthquake, and in other areas with the potential risk of slope failure, landslides, liquefaction, or other geologic hazards.

Compliance with the Draft General Plan action would reduce potential impacts related to liquefaction and lateral spreading to a less-than-significant level and no further mitigation is required.

(4) Soil-Related Hazards. Soils within the City of Albany have been identified as having a low to very high shrink/swell potential as well as low to high corrosion potential. Structural damage of buildings or rupture of utilities may occur if the potentially expansive and corrosive soils are not considered in the design and construction of future redevelopment projects. The following policies of the Draft General Plan would guide new development and reduce impacts relative to expansive and corrosive soils:

- **Policy EH-1.4: Soil-Related Hazards**. Use best management practices to reduce risks to structures, roads, and utilities associated with erosion, shrink-swell potential, subsidence, and other soil-related hazards.
- **Policy W-1.9: Hazard Remediation**. Remediate environmental hazards which may be present as park areas are improved for public access and use. This could include mitigation of geologic hazards, such as settlement, slope stability, and erosion. Additional testing and geotechnical studies may be warranted prior to excavation, grading, removal or reuse of filled soils, and other construction activities.

Compliance with the Draft General Plan policies would reduce potential soil-related impacts to a less-than-significant level and no further mitigation is required.

c. Cumulative Impacts. Implementation of the Draft General Plan would not affect the seismic or geologic environment in the vicinity of the City. However, the seismic and geologic conditions in the City of Albany could affect future development; such effects are related to site-specific hazards and would be mitigated on a development-by-development basis. The site-specific impacts from geologic and seismic hazards on developments are not transferable to other sites. Therefore, the Draft General Plan would not contribute to a cumulative impact that would be considerable, since other developments on the vicinity of the City would similarly be affected by site-specific geologic and seismic conditions.

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