4.6 GEOLOGY AND SEISMICITY

SCOPE AND METHODOLOGY

This section identifies the potential for geologic and seismic hazards to occur in and near the City of Azusa. Issues of concern include soils and their suitability for development; geologic faults; direct and indirect seismic hazards; potential hazards such as subsidence, liquefaction, and landslides. Impact assessments were performed based on criteria established by the CEQA Guidelines (discussed below under "Significance Criteria"). The following documents and maps are referenced for this section:

- City of Azusa, *Analysis of Existing Conditions and Trends* report, December 2001
- United States Department of Agriculture Soil Conservation Service, "Report and General Soil Map, Los Angeles County, California," 1969
- Department of Conservation, Division of Mines and Geology, Special Publication 42, "Fault-Rupture Hazard Zones in California," 1997

GEOLOGIC SETTING

Topography

Existing topography in the City can be quite variable. The steep mountains have slopes commonly in the range of 50 to 60 percent. The foothills slopes are more moderate generally 5 to 10 percent, with the alluvial fan surface sloping away from the San Gabriel Mountains at a gradient of approximately 50 feet per mile (about one percent).[1] The open pit mines have also created local artificial topographical features.

The elevation of land surfaces in the city range from about 2,080 feet at the north edge of Azusa along the National Forest boundary to about 475 feet at Arrow Highway and Vicent Avenue. The Vulcan gravel pit has elevations below 350 feet, but occupies only a very small area of the City near its southwestern edge. The quarry wall slopes are mostly 45 degrees.

Soils

The City consists of soils of the Hanford, Ramona-Placentia (9 to 15 percent grade), Tujunga-Soboba, and Vista-Amargosa associations. Soils of the Ramona-Placentia, Tujunga-Soboba, and Vista-Amargosa associations are primarily located to the northern portion of the City. The area to the south of 11th Street contains soil of the Hanford association.

Soils of the Hanford association are located on gently sloping alluvial fans. Soils of the Ramona-Placentia (9 to 15 percent grade) are located on strongly sloping and rolling terraces. Soils of the Tujunga-Soboba association are located on nearly level and gently sloping alluvial fans. Soils of the Vista-Amargosa association are located on steep mountains.[2]

[1] Alluvial fan is a widespread bed of sand, gravel, cobbles, and boulders deposited by the river as it emerges from the south slopes of the San Gabriel Mountains.

[2] United States Department of Agriculture Soil Conservation Service, "Report and General Soil Map, Los Angeles County, California," 1969.

Geologic Materials

The geology of the City of Azusa can be thought of in three basic types of geologic groupings. The steeper mountains are made up of very old "basement" rocks that are generally very hard and resistant to erosion. Formations in the foothills are old "bedrock" formations and the oldest "alluvium" formations. South of the steep mountains and foothills are the intermediate-age and younger alluvium formations (often called alluvial fans because of their shape on a map), and man-made fill deposits.

The geologic units that are found in the City are shown in **Table 4.6-1**.

TABLE 4.6-1: GEOLOGIC UNITS IN AZUSA

Geologic Unit	Location
Artificial Fill	Found either as dams or in the quarries/pits where reclamation is underway.
Youngest Alluvium	Found in the San Gabriel River active channel and active floodplains, in the immediate vicinity of Little Dalton Wash, in a few small canyons along the foothills, and in the local talus deposits at the base of steep slopes (e.g., quarries). Talus is the wedge- or cone-shaped accumulation of material that moves under gravity from a slope face to the base of a slope.
Landslide Deposits	Found along steep-walled canyons in the foothills and in the steep mountainsides along San Gabriel Canyon Road and west of Fish Canyon Road. It is most abundant in the basement rock of the mountains.
Young Alluvial Fan Deposits	Located to the east of the active San Gabriel River floodplain extending to meet the intermediate-age alluvial fan deposits along a line connecting the intersection of Sierra Madre Boulevard and Azusa Avenue with Little Dalton Wash and Alosta Avenue.
Intermediate-Age Alluvial Fan Deposits	Occupies the flatter alluvial area bordering the foothills.
Older Alluvial Fan Deposits	Found in isolated patches along the flanks of San Gabriel Canyon (each side of San Gabriel Canyon Road) north of the central City area. Older alluvial fan deposits are also found in the foothills along the base on the mountains just northeast of the central City area.
Bedrock--Topanga Formation and Glendora Volcanics	Found throughout the flatter portions of the City. Bedrock exposures are known along the Sierra Madre and Duarte faults east of Azusa Avenue at the transition from a) the higher mountains to the foothills, and b) the foothills to the alluvial fans.

SOURCE: City of Azusa, "Analysis of Existing Conditions and Trends," December 2001.

Earthquake Faults

Earthquakes generally occur on faults, which are the planar features within the earth. Numerous regional and local faults are capable of producing severe earthquakes, those of magnitude (M) of 6.0 or greater. Historic earthquakes have occurred on numerous faults in southern California which have been felt in the City of Azusa, but which have caused no damage or injury. **Figure 4.6-1** identifies the faults within 100 kilometers of the City.

Figure 4.6-1 (Regional Faults and Earthquake Epicenters)

Table 4.6-2 shows the four most critical faults near the City, their approximate distance from the City, and the magnitude of the worst-case earthquake recorded near the site. Usually, the effect of an earthquake originating from any given fault will depend upon its distance from the City and the size of the earthquake the fault generates. The more distant the fault or the smaller the earthquake, the less the effect.

TABLE 4.6-2: CRITICAL FAULTS WITHIN A 100-KILOMETER RADIUS OF AZUSA

Fault Name	Approximate Distance from Site	Magnitude
Sierra	1	7.2
Raymond	11	6.5
Whittier	19	7.5
San Andreas Central	33	8.3

SOURCE: City of Azusa, "Azusa General Plan Update: Analysis of Existing Conditions and Trends," December 2001

No state-designated special studies zones for fault rupture hazard (so-called Earthquake Fault Zone) exist within the City. The City is not located within an Alquist-Priolo Earthquake Hazard Zone.[3] However, previous geologic studies have identified seven faults that may traverse the City. Description of these faults and their hazards follows below.

Sierra Madre Fault

The Sierra Madre Fault extends from San Fernando on the west to San Dimas-Claremont on the east. It is considered the "master" fault responsible for thousands of feet of vertical and significant left-lateral offset thrusting the San Gabriel Mountains southward up and over the San Gabriel Basin. In Azusa, the fault is concealed at its western end where it crosses the mouth of Van Tassel Canyon and extends in an arcuate path across the San Gabriel River floodplain. It is exposed in the hill above Clearhaven Drive where Wilson Diorite is thrust over Topanga Formation. The fault dips about 40 to 90 degrees into the mountain and is intermittently exposed as it continues eastward. It exits the study area about 500 feet north of the intersection of Sierra Madre Boulevard and Citrus Avenue. The County of Los Angeles and the State consider the Sierra Madre Fault potentially active. The Sierra Madre Fault is considered capable of surface rupture within the City.

Fault "C"

Fault "C" lies about 1,400 feet south of, and trends subparallel to, the Sierra Madre Fault. The fault extends east-southeast from the intersection of Azusa Avenue north and San Gabriel Canyon Road across Sierra Madre Boulevard. The Fault "C" is not delineated by the County of Los Angeles or the State of California.

Upper Duarte Fault

The fault enters the City from Duarte on the west at Encanto Parkway trending to the east-southeast. The active buried section passes to the north of the Vulcan (formerly Azusa Largo) quarry along the SPT CO railroad spur associated with the plant production. This segment passes on an easterly trend through the intersection of West 10th Street and Todd Avenue in Azusa. From here, the fault trends east-northeast through Northside Park and the north end of Old Mill Road. It exits the City just south of the approximate location of where Citrus Avenue would extend to intersect Leadora Avenue. The Upper

[3] Special Publication 42, "Fault-Rupture Hazard Zones in California," Department of Conservation, Division of Mines and Geology, 1997.

Duarte fault is delineated as active by the County of Los Angeles and potentially active or active by the State.

Raymond Fault

The Raymond Fault projects to the east/northeast across the northern San Gabriel (groundwater) Sub-basin separating it from the Raymond Sub-basin, further to the north. Tectonically, the fault is related to the Sierra Madre Fault system, which has been responsible for the uplift of the San Gabriel Mountains. The fault has a length of 22 km and dips steeply northward.

Whittier Fault

The Whittier fault is at the north end of a zone of major northwest-trending faults that extend for more than 120 miles. The zone begins near Montebello, from the southwestern boundary of the Puente Hills, and merges with the Elsinore fault zone near Corona. The fault zone is seismically active. Historically, primarily small earthquakes are associated with this zone, with the largest being a 4.2 in 1976. The nearest segment of the Whittier Fault Zone is located within 19 kilometers (about 12 miles) south of the City center.

Fault "D"

The fault beginning at Pasadena Avenue just north of 10th Street that extends east and then northeast to intersect the Upper Duarte Fault at roughly Baldy Vista and Leadora Avenues. The location of the fault is inferred based on the presence of bedrock and older alluvium fan deposits at the topographic scarp north of the intermediate-age alluvium. Fault "D" is not delineated by the County of Los Angeles and the State.

Duarte Fault

The Duarte Fault is the southernmost known significant fault within the City. The fault enters the City from Duarte within the southern portion of the Rancho Duarte Golf Course and extends through the Vulcan mine east-southeast to about Slauson School (near 5th Street and Azusa Avenue). From here, it extends approximately northeast through Lee School, exiting the City near Citrus Avenue and West Foothill Boulevard through a portion of Citrus College. The Duarte fault is delineated as active by the County of Los Angeles and potentially active by the State.

Landslides

A landslide is the descent of earth and rock down a slope. Some areas near the mountainous portions of Azusa are at higher risk for landslides due to inherent instability. This instability is generally caused by a steep slope or unstable soil composition. Heavy rainfall, flooding, or ground movements such as earthquakes can induce landslides. Seismically induced landslides could occur in the mountainous portion of the City.

Landslides are present in the higher hills and along the boundaries of some steep canyons. These landslides indicate slope instability that may have taken place in the past in historic time or several thousand years ago. The landslide masses range in size from a few hundred feet across to over 2,000 feet wide. The potential for future movement of any given landslide mass will be specific to the current conditions at the given location.

Liquefaction

Liquefaction is essentially the transformation of soil to a liquid state. Liquefaction is a phenomenon in which the strength and stiffness of a soil are reduced by earthquake shaking or other rapid loading. Liquefaction potential has been found to be the greatest where the groundwater level is shallow, and loose, fine sands occur at a depth of about 50 feet or less. Factors that affect liquefaction include water level, soil type, particle size distribution and gradation, relative density, confining pressure, intensity of shaking and duration of shaking. Three key factors that indicate whether an area is potentially susceptible to liquefaction are severe groundshaking, shallow groundwater, and cohesionless sand. In addition to having groundshaking parameters, quantitative estimates of liquefaction potential require specific data from geotechnical borings and groundwater level information.

A groundwater depth of less than 50 feet below ground surface is important when assessing liquefaction. The majority of the City is either underlain by bedrock area with no aerially continuous groundwater surface) or by alluvium with groundwater greater than 100 feet deep. This includes the steep mountainous areas and the areas generally south of Foothill Boulevard. An area generally bounded by Sierra Madre Avenue on the north, 5th Avenue on the south, Orange Avenue on the west, and Cerritos Avenue on the east has groundwater depths between 50 and 100 feet. On the eastern side of the City, groundwater depth is between 30 to 50 feet deep in the area east of Cerritos Avenue, west of Citrus Avenue, south of 10th Street, and north of 6th Street. North and east of these previous two areas, groundwater may be predominately less than 30 feet deep.

In the northwest portion of the City, in the San Gabriel River floodplain, groundwater is, in general, less than 50 feet deep. This area is roughly defined by the mountains on the north, east and west, by Azusa Avenue on the east, the Southern Pacific-Santa Fe right-of-way on the south, and the city limits on the west.

The State Seismic Hazards map (Figure 4.6-2) shows the area of the City that is subject to liquefaction. Generally, these areas are located to the north of 2nd Street.

SIGNIFICANCE CRITERIA

The proposed project would result in a significant adverse impact with regard to geology and seismicity if it:

- Exposes people or structures to potential substantial adverse effects, including 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 based on other substantial evidence of a known fault, strong seismic ground shaking, and seismic-related ground failure, including liquefaction and landslides;
- Results in substantial soil erosion or the loss of topsoil;
- Would be located on a geologic unit or soil that is unstable, or would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse;
- Would be located on expansive soil, as defined in Table 18-1-B on the Uniform Building Code (1994), creating substantial risks to life or property; or
- Would have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water.

Figure 4.6-2 (Liquefaction Potential)

ENVIRONMENTAL IMPACTS

Earthquake Faults

As discussed above, the City is not in an Earthquake Fault Zone or Alquist-Priolo Earthquake Hazard Zone. The closest active fault zone to the site is the Sierra Madre Fault Zone (approximately 1.2 miles north of the center of the center of the City). The City would be subject to groundshaking consistent with other areas of Southern California located in close proximity to active or potentially active faults.

One of the goals of the General Plan is to "minimize to the greatest extent feasible the loss of life, serious injuries, and major social and economic disruption caused by the collapse of, or severe damage to, vulnerable structures (e.g., buildings, bridges, water storage facilities, key railroad components) resulting from an earthquake" (Geologic Hazards Goal 2). The General Plan provides policies that would protect people and structures from earthquake fault, strong seismic ground shaking, and seismic-related ground failure, including liquefaction and landslides. These Geologic Hazards policies are as follows:

1.2 Require that proposed essential facilities apply the most current professional standards for seismic design and be subject to seismic review, including detailed site investigations for faulting, liquefaction, ground motion characteristics, and slope stability.

1.3 Prohibit the location of Critical Facilities within an identified active fault zone or potentially active fault zone of concern (or future Alquist-Priolo Earthquake Fault Zone), unless it is determined by a qualified geologic engineer that a closer location will not result in undue risks based on detailed site investigations.

1.4 Prohibit the location of Sensitive and High-Occupancy facilities within 100 feet of the identified active fault zone or potentially active fault zone of concern, unless it is determined by a qualified geologic engineer that a closer location will not result in undue risks based on detailed site investigations.

1.5 Attempt to locate Critical and Sensitive structures in areas with continuous road access where utility services can be maintained in the event of an earthquake.

1.6 Encourage owners of existing Critical and Sensitive Facilities with significant seismic vulnerabilities to upgrade, relocate or phase out the facilities as appropriate.

1.7 Incorporate planning for potential seismic incidents affecting Critical, Sensitive and High-Occupancy Facilities into the City's contingency plans for disaster response and recovery.

1.8 Require that all existing essential facilities located in areas of potential geologic, seismic and soils hazards maintain emergency response plans, with contingencies for all appropriate hazards.

2.1 Re-evaluate the seismic review procedures for tilt-up structures and other potentially hazardous buildings in the City at appropriate points in the structures' history to ensure their seismic integrity.

2.2 Establish incentives for owners of potentially hazardous buildings that would serve to encourage the seismic retrofitting of vulnerable structures.

The following General Plan implementation programs would minimize the exposure of people or structures to potential substantial adverse effects associated with earthquakes:

Geo1 The building, development and grading codes shall be amended, where appropriate, to:

- reflect standards modified by the policies herein. Specifically, they shall incorporate standards for a) the siting, seismic design, and review of Critical, Sensitive and High-Occupancy Facilities; and b) the review of slope stability and soil hazards for new developments prior to discretionary review; and

- prohibit construction on slopes exceeding 50 percent and mass grading on slopes exceeding 25 percent. The codes shall also require the clustering of units and the reduction of density for proposed developments sited on a 15—25 percent grade.

Development regulations shall be amended to prevent Critical Facilities from being located within 150 feet of an identified active fault or potentially active fault of concern found in the City's database or from field investigation. This distance may be modified if it is determined by a qualified geologic consultant that no adverse risk would occur based on field surveys, borings, and other relevant data and analysis. Any building intended for human occupancy shall be constructed at least fifty feet from either side of an active or potentially active fault.

Geo2 Sensitive and High-Occupancy Facilities shall require the discretionary approval of the Planning Commission if they are to be sited within 150 feet of an identified active fault or potentially active fault of concern. In any case Sensitive and High Occupancy Facilities shall not be allowed within 100 feet of either side of an active or potentially active fault. This distance may be modified if it is determined by a qualified geologic consultant that no adverse risk would occur based on field surveys, borings, and other relevant data and analysis.

Geo4 Consider the adoption of an ordinance, which includes incentives, for the upgrading of seismically hazardous structures that would include priorities for the sequence of enforcement; structural standards for seismic upgrading; options or requirements for early anchoring of buildings to provide an initial level of reinforcement at an early stage of seismic retrofit; incorporation of concepts and provisions of the State Code for historic buildings to provide additional flexibility for preservation of historic buildings while protecting them from significant earthquake damage; a time schedule for enforcement; and procedures for the posting and maintenance of warning signs on hazardous structures.

Maintain an awareness of other types of structures that may be considered by engineers, over time and through the use of state-of-the-art techniques, to be seismically hazardous and develop programs for the reduction of these seismic hazards. For example, the City may consider the modification of the current ordinance to require concrete tilt-up and concrete frame buildings built before enactment of the current seismic codes to meet basic seismic standards before a change in use or occupancy level is approved, or when significant alteration or repair is proposed.

Geo6 Seismic revisions to the State Uniform Building Code shall be reviewed and implemented in the City's Building Code.

Geo8 Review the current building code enforcement procedures for concrete tilt-up and composite pre-stressed concrete construction for consistency with effective principles of seismic design, and revise as appropriate to maintain the seismic integrity of new construction.

Geo11 Require the preparation of a site-specific geological report for all proposed development within an identified active fault or potentially active fault of concern (also an Alquist-Priolo Earthquake Fault Zone, if identified in the future) to ascertain the precise location of, and appropriate setbacks from, these active or potentially active faults.

Geo20 Detailed site specific studies for ground shaking characteristics, liquefaction potential, and fault rupture potential shall be required prior to discretionary review as background to the development/approval process for Critical, Sensitive and High-Occupancy Facilities.

Existing City-owned, City-leased or City-rented Critical, Sensitive and High-Occupancy facilities, including the Azusa Fire Department, the City Hall, Light and Water, and the Police Department, shall 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.

Geo21 Fault activity investigation reports shall have a standard format developed through consultation among the California Division of Mines and Geology, the City's Engineering Geology Consultant and relevant City Departments (e.g., Planning, Public Works). An agreed upon design shall be formulated by this group for the Sierra Madre, Upper Duarte, and Duarte faults, and unnamed Faults "C" and "D", and utilized in the reports to determine ground shaking potential. The City's Engineering Geology Consultant shall review reports for adequacy. At such time that the City's Sphere of Influence or other lands within the Planning Area are annexed, the City (Planning Department) shall require that areas planned for development within 500 feet of the these faults be studied to document age of last movement.

Geo22 All construction excavations and trenches of five feet or deeper, created in conjunction with human occupancy structures and public works infrastructure, shall be inspected by the City's Engineering Geology Consultant for any evidence of faulting if the subject property is identified as lying within 500 feet of an identified active fault or potentially active fault of concern in pervious soils, or geologic reports conducted for subject site.

Geo23 At the earliest opportunity, a database shall be compiled of all structural building types in the City that may be considered potential seismic hazards, including tilt-up structures and non-ductile concrete frame buildings.

Geo27 Seismic design for proposed Critical, Sensitive and High Occupancy Facilities and other select structures that have more than four stories and are of a size determined by City staff using criteria established by the City Engineer shall be handled by City-retained structural engineers. Alternatively, seismic design may be conducted through a third-party review process, whereby qualified engineers report to the City Engineer and are paid directly by the developer.

Geo28 A central repository shall be established in the Engineering Division, for the collection and compilation of geologic and soils engineering information related to identified active fault or potentially active fault of concern and fault zone studies, groundwater levels, soils characteristics, susceptibility to landslides and liquefaction, and other data as appropriate. This information shall be used to increase the knowledge and insights of City reviewers and applicants alike, in support of hazard mitigation. To the extent possible this information should be in a GIS-database and available in summary form on the City website.

Geo29 Special structural reviews shall be conducted on any multi-story or concrete buildings receiving significant damage in an earthquake, prior to their re-occupancy, repair or demolition. Review shall be conducted in accordance with Applied Technology council publications ATC-20, 1989, Procedures for Post Earthquake Safety Evaluation of Buildings and ATC-20-2, 1995, Addendum to the ATC-20 Post Earthquake Building Safety Evaluation Procedures. Such information as type of construction and occupancy, and damage evidence such as collapse or partial collapse, leaning walls, cracked or displaced foundations, distressed columns and beams, soil movement/slippage, etc. Structural review would be the responsibility of the owner.

Implementation of the above policies, codes, and ordinances would protect people and structures from adverse effects associated with rupture of a known earthquake fault, strong seismic ground shaking, and seismic-related ground failure. Thus, less-than-significant impact is anticipated.

Liquefaction

A majority of the City is located within a liquefaction zone. Development within this area would be subjected to liquefaction. The General Plan contains implementation programs that would minimize impacts associated with liquefaction. These programs are as follow:

Geo5 Require development applicants to prepare a liquefaction report for proposed projects located in liquefaction susceptibility zones (Figure Geo-3). Liquefaction reports shall be prepared prior to the preparation of development plans or tentative tract maps. These reports will be utilized to help assure that adequate liquefaction mitigation is possible, and that the proposed mitigation is built into the initial project layout and design.

Geo7 The City's building and grading codes shall be modified to reflect investigation requirements for designated potential liquefaction zones. A liquefaction susceptibility investigation shall be required for Critical Facilities, Sensitive Facilities, High-Occupancy Facilities, and other select structures that have more than three stories and are of a size that shall be determined by City staff using criteria established by the City Engineer. Studies for all other human occupancy buildings should be at the discretion of the City Engineer and the City's Engineering Geology Consultant.

Geo9 Require public service agencies to prepare a Utilities Report for proposed projects located in liquefaction susceptibility zones. Utilities Reports will be used to help ensure that natural gas, electric, water, sewer and communication systems are designed to mitigate potential hazards arising from their location in liquefaction zones.

Geo20 Detailed site specific studies for ground shaking characteristics, liquefaction potential, and fault rupture potential shall be required prior to discretionary review as background to the development/approval process for Critical, Sensitive and High-Occupancy Facilities.

Geo24 Request the California Division of Mines and Geology or the U.S. Geological Survey to perform an initial study to re-define the groundwater levels in areas where liquefaction potential is estimated to be high. For areas of very high groundwater (within 30 feet of the ground surface), the City shall consider the appropriateness of requiring potential developers in these areas to investigate means of lowering the groundwater level, and consider appropriate programs to that end.

Geo25 Ensure the community has an adequate information base on the level and extent of the City's water table. Require project proponents to conduct water resource analysis should data prove to be insufficient.

Geo26 Liquefaction susceptibility and fault zone designations and related land use and construction policies shall be reviewed and updated periodically to reflect current information and technology.

Geo28 All geologic and soils reports submitted to the City shall be reviewed for their adequacy and completeness by a qualified, Certified Engineering Geologist and/or Registered Soils Engineer.

A central repository shall be established in the Engineering Division, for the collection and compilation of geologic and soils engineering information related to identified active fault or potentially active fault of concern and fault zone studies, groundwater levels, soils characteristics, susceptibility to landslides and liquefaction, and other data as appropriate. This information shall be used to increase the knowledge and insights of City reviewers and applicants alike, in support of hazard mitigation. To the extent possible this information should be in a GIS-database and available in summary form on the City website.

The General Plan policies listed above would ensure the safety of people and structures from liquefaction. Thus, less-than-significant impacts are anticipated.

Soils

Soil Erosion. Some portions of the City contain soil that have erosion potential and may not be suitable for construction. As mentioned previously, the City consists of soils of the Hanford, Ramona-Placentia (9 to 15 percent grade), Tujunga-Soboba, and Vista-Amargosa associations. Soils of the Ramona-Placentia, Tujunga-Soboba, and Vista-Amargosa associations are primarily located to the northern portion of the City. The area to the south of 11th Street contains soil of the Hanford association. Soils of the Hanford association have slight erosion potential. Soils of the Tujunga-Soboba association have erosion potential from slight to moderate. Soils of the Ramona-Placentia (9 to 15 percent grade) and Vista-Amargosa associations have high erosion potential.[4] The General Plan Land Use designates the northeastern portion of the city as Residential and Hotel/Conference center. These areas have soils of Tujunga-Soboba, Ramona-Placentia (9 to 15 percent grade), and Vista-Amargosa associations, where erosion potentials range from slight to high. Thus, some portions of this area may not be suitable for construction. On a project-by-project basis, a geotechnical investigation would be conducted to evaluate soil erosion potential on the site that is subject to development. Developments would be designed and constructed in conformance to the specific recommendations provided in the geotechnical report for each proposed structure. Thus, less-than-significant impact is anticipated.

Soil Instability. The General Plan contains implementation programs that would help maintain the stability of soil in the City.

Geo1 The building, development and grading codes shall be amended, where appropriate, to:

- reflect standards modified by the policies herein. Specifically, they shall incorporate standards for a) the siting, seismic design, and review of Critical, Sensitive and High-Occupancy Facilities; and b) the review of slope stability and soil hazards for new developments prior to discretionary review; and

- prohibit construction on slopes exceeding 50 percent and mass grading on slopes exceeding 25 percent. The codes shall also require the clustering of units and the reduction of density for proposed developments sited on a 15—25 percent grade.

[4]U.S. Department of Agriculture Soil Conservation Service, "Report and General Soil Map: Los Angeles County, California," 1969.

Amend the building and development codes to ensure that proposed developments incorporate drainage systems and appropriate landscape materials designed to prevent geologic and soils instability, including bedrock and soil slippage.

Geo3 Developers shall be responsible for supplying a preventative maintenance program for all manufactured (cut and fill) slopes. Additionally, the City shall consider the creation of slope maintenance districts as well as the implementation of a developer-sponsored 10-year slope failure warranty requirement. Inspection and maintenance of slopes during this period, including grading, planting and irrigation, will be provided for by association fees and CC&Rs.

Geo10 Amend the development and building codes to require the preparation of a landslide report by a qualified geologist or civil engineer for any proposed development located in a landslide hazard area. These landslide reports shall be written prior to the preparation of development plans or tentative tract maps.

Geo28 All geologic and soils reports submitted to the City shall be reviewed for their adequacy and completeness by a qualified, Certified Engineering Geologist and/or Registered Soils Engineer.

A central repository shall be established in the Engineering Division, for the collection and compilation of geologic and soils engineering information related to identified active fault or potentially active fault of concern and fault zone studies, groundwater levels, soils characteristics, susceptibility to landslides and liquefaction, and other data as appropriate. This information shall be used to increase the knowledge and insights of City reviewers and applicants alike, in support of hazard mitigation. To the extent possible this information should be in a GIS-database and available in summary form on the City website.

The above General Plan implementation programs would help maintain soil stability. Thus, no significant impact is anticipated.

Expansive Soils. Soils of the Hanford, Tujunga-Soboba, and Vista-Amargosa associations have low shrink-swell behavior. However, soils of the Ramona-Placentia association have high shrink-swell behavior. The area that has soils of the Ramona-Placentia association is located to the east of San Gabriel Canyon Road, in the northeastern portion of the City. The General Plan Land Use map designates a portion of the area with soils of the Ramona-Placentia association for residential uses. Expansive materials, if left untreated, can cause damage to structures, including cracking, heaving, and buckling of foundations. On a project-by-project basis, a geotechnical investigation would be conducted to evaluate the expansion potential of the materials on the site that is subject to development. Developments would be designed and constructed in conformance to the specific recommendations provided in the geotechnical report for each proposed structure. Compressible materials would be removed and replaced as compacted fill (with the exception of peat, which would be removed from the fills). The criteria for leaving surficial soils in place would be consistent with the grading specifications of the City. Additionally, if soils underlying a proposed development are found to be high expansive, they would be mitigated by special foundations, such as post-tensioned slab foundations, raft foundations, or caissons. Thus, no significant impact would occur.

Soils for Supporting Septic Tanks or Waste Water Disposal Systems. The City has been developed with urban uses for many years and a sewer system has been integrated into the infrastructure of the surrounding area. Additionally, the General Plan requires that all new development connect to the existing sewer system. Therefore, soils capable of supporting septic tanks or alternative waste water disposal systems are not required. No significant impact is anticipated.

MITIGATION MEASURES

No significant impacts are anticipated. Thus, no mitigation measures are required.

LEVEL OF IMPACT AFTER MITIGATION

No significant impacts to geology and seismicity are anticipated.