



4.6 GEOLOGY AND SOILS

<i>Would the project:</i>	Potentially Significant Impact	Less Than Significant Impact With Mitigation Incorporated	Less Than Significant Impact	No Impact
a. Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:				
1) 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? Refer to Division of Mines and Geology Special Publication 42.			✓	
2) Strong seismic ground shaking?			✓	
3) Seismic-related ground failure, including liquefaction?		✓		
4) Landslides?				✓
b. Result in substantial soil erosion or the loss of topsoil?			✓	
c. Be located on a 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?		✓		
d. Be located on expansive soil, as defined in Table 18-1-B of the California Building Code (2004), creating substantial risks to life or property?		✓		
e. 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?				✓

a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:

1) 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? Refer to Division of Mines and Geology Special Publication 42.

Less Than Significant Impact. For the purposes of the Alquist-Priolo Earthquake Fault Zoning Map Act, the State of California defines active faults as those that have historically produced earthquakes or shown evidence of movement within the past 11,000 years (during the Holocene Epoch).¹ Figure 4.4-2, *Regional Fault Map*, of the 2005 *General Plan Update FPEIR*, illustrates the locations of the faults located in the project region. As indicated in Figure 4.4-2, an Alquist-Priolo Earthquake Fault Zone does not traverse the project site. Therefore, project implementation would result in less than significant impacts associated with the exposure of people or structures to potential substantial adverse effects involving fault rupture.

¹ California Department of Conservation and California Geologic Survey. Potentially active faults have demonstrated displacement within the last 1.6 million years (during the Pleistocene Epoch), but do not displace Holocene Strata. Inactive faults do not exhibit displacement younger than 1.6 million years before the present.



Fire Access Road Alternative

Similar to the proposed project, the Fire Access Road Alternative would result in a less than significant impact, as the project site boundaries would remain similar to the proposed project.

Mitigation Measures: No mitigation measures are required.

2) Strong seismic ground shaking?

Less Than Significant Impact. Seismic activity in the vicinity of the Town is a result of continuing tectonic movement along the eastern front of the Sierra Nevada. Three historically-active faults, located in proximity to the area, have the greatest potential to create significant ground shaking in the Town. These faults include the Hilton Creek fault, Owens Valley fault, and Chalfant Valley Fractures. These three faults, as well as six other potentially active faults (i.e., Hartley Springs Fault, Laurel-Convict Fault, Long Valley Caldera Faults, Mono Craters Caldera Faults, Silver Lake Fault and Wheeler Crest Fault) have the potential for ground shaking in the Town.

The Town is anticipated to experience considerable seismic activity in the future. The California Division of Mines and Geology (CDMG) has included the Town within Seismic Zone III in their Urban Geology Master Plan with expected modified Mercalli Rating of "IX" or "X" at maximum earthquake intensities.² Although no known faults exist within the project boundaries, the project site could experience strong seismic ground shaking from faults located off-site in the region. The intensity of ground shaking at the project site would depend upon the magnitude of the earthquake, distance to the epicenter, and geology of the area between the epicenter and the project site. The project is subject to compliance with the California Department of Conservation, California Geologic Survey Special Publications 117, *Guidelines for Evaluating and Mitigating Seismic Hazards in California* (1997), which provides guidance for evaluation and mitigation of earthquake-related hazards. In addition, the project is subject to compliance with Code Section 15.24.020, *Seismic Design - Uniform Building Code - Section 2333(b)*, which requires that all structures within the boundaries of the Town be designed to the requirements of Seismic Zone 4, as defined in the Uniform Building Code. Adherence to standard engineering practices and Code requirements relative to seismic and geologic hazards would minimize potential impacts. Therefore, project implementation would result in less than significant impacts associated with the exposure of people or structures to potential substantial adverse effects involving strong seismic ground shaking.

Fire Access Road Alternative

Similar to the proposed project, the Fire Access Road Alternative would result in a less than significant impact, as the project site boundaries would remain similar to the proposed project. As with the proposed project, the Fire Access Road Alternative would be required to adhere to standard engineering practices and Code

² The "IX" Mercalli rating indicates that heavy damage to un-reinforced structures would result and some structures would collapse. The "X" rating indicates that most masonry structures would be destroyed, and some well built wooden structures would be destroyed and public facilities would be damaged.



requirements relative to seismic and geologic hazards, which would minimize potential impacts. Therefore, implementation of the Fire Access Road Alternative would result in less than significant impacts in this regard.

Mitigation Measures: No mitigation measures are required.

3) Seismic-related ground failure, including liquefaction?

Less Than Significant Impact With Mitigation Incorporated. Liquefaction of cohesionless soils can be caused by strong vibratory motion due to earthquakes. Liquefaction is characterized by a loss of shear strength in the affected soil layers, thereby causing the soils to behave as a viscous liquid.

Based on the character of surface and subsurface soil and depth to groundwater, there appears to be little potential for liquefaction in the Town.³ Within Mammoth Lakes, areas of alluvium and moraine material with shallow groundwater have the potential for liquefaction. According to the *Sierra Star Master Plan Draft SEIR*, soils in the project area consist of alluvium and glacial till in the topsoils and medium dense to dense nature bearing soil.

Given that site conditions are anticipated to have a lack of groundwater and the presence of medium dense to dense nature bearing soil, the conditions that are conducive to liquefaction are not anticipated to be present on the project site. However, up to 5.5 feet of alluvial deposits consisting of loose sand and silty sand may be present at the site. In addition, perched water may develop at the site. Therefore, during construction activities at the Project site, the topsoils that consist of loose alluvium would be required to be excavated and removed from the site as it is considered unsuitable for reuse as structural fill (Mitigation Measure GEO-1). Permanent perimeter subsurface drains would be installed to intercept perched groundwater associated with snowmelts (GEO-2).

Based on these anticipated site conditions, the potential for liquefaction to occur is considered very low due to the lack of groundwater and the presence of medium dense to dense nature bearing soil at the site. However, in areas where loose alluvial soil is left in place and subsurface drainage is not added, a small potential for soil liquefaction would remain. In order for liquefaction to occur at these locations, perched groundwater would need to saturate the loose sandy alluvial soil and a large earthquake would need to occur on a nearby portion of one of the active faults. In general, only critical structures or very important site improvements would need to consider this potential hazard. Therefore, with implementation of Mitigation Measure GEO-1, the project would require a soils report to identify the potential for liquefaction, expansive soils, ground settlement, slope failure, and groundwater. Verification of potential liquefaction under critical structures would be analyzed and recommendations to reduce these impacts would occur.

Additionally, the project is subject to compliance with the minimum standards for structural design and construction provided in Code Chapter 15.04. Therefore, with

³ Town of Mammoth Lakes, *Town of Mammoth Lakes 2005 General Plan Update Final Program EIR*, May 2007, Page 4-107.



implementation of Mitigation Measures GEO-1 and GEO-2 as well as compliance with Code Chapter 15.04, impacts in this regard would be reduced to less than significant levels.

Fire Access Road Alternative

Similar to the proposed project, the Fire Access Road Alternative would result in a less than significant impact, as the proposed boundaries would remain the same as the proposed project. As with the proposed project, during construction activities the topsoils consisting of loose alluvium would be required to be excavated and removed from the site as it is considered unsuitable for reuse as structural fill (Mitigation Measure GEO-1). Permanent perimeter subsurface drains would be installed to intercept perched groundwater associated with snowmelts (GEO-2).

Additionally, with implementation of GEO-1, the Fire Access Road would be required to prepare a soils report to identify the potential for liquefaction, expansive soils, ground settlement, slope failure, and groundwater. Verification of potential liquefaction under critical structures would be analyzed and recommendations to reduce these impacts would occur. Therefore, similar to the proposed project, implementation of the Fire Access Road Alternative would result in less than significant impacts after implementation of Mitigation Measures GEO-1 and GEO-2.

Mitigation Measures:

- GEO-1 Prior to grading operations, a soils report shall be prepared for the proposed development to identify the potential for liquefaction, expansive soils, ground settlement, and slope failure. The report shall also:
- Specify loose alluvium that shall be excavated and removed from the site as it is considered unsuitable for reuse as structural fill.
 - Specify remedial measures that could be feasible implemented to minimize potential impact.
 - Analyze the potential for groundwater within the study area and recommend measures to remediate associated conditions.
 - Determine the potential for groundwater seepage that may occur where excavation would be the greatest.
 - Determine the need for dewatering of areas during parking garage construction to remove all water within the excavation perimeter and recommend appropriate method of dewatering.
- GEO-2 Permanent perimeter subsurface drains shall be installed to intercept perched groundwater associated with snowmelts.



4) Landslides?

No Impact. Landslides are caused when the stability of a slope changes from a stable to an unstable condition. Although the action of gravity is the primary driving force for a landslide to occur, there are other contributing factors that may affect the original slope stability. Landslides are primarily limited to areas with a combination of poorly consolidated material and slopes that exceed 30 percent. The slope of the project site averages five percent.⁴ Therefore, project implementation would result in less than significant impacts associated with the exposure of people or structures to potential substantial adverse effects involving landslide.

Fire Access Road Alternative

Similar to the proposed project, the Fire Access Road Alternative would result in a less than significant impact, as the site boundaries would remain the same as the proposed project.

Mitigation Measures: No mitigation measures are required.

b) Result in substantial soil erosion or the loss of topsoil?

Less Than Significant Impact. Soils throughout the project area are sensitive to disturbance from development and exhibit moderate to high erosion potential, depending on the grade of the slope.⁵ Clearing, grading, and excavation of the project site would expose soils to short-term erosion by wind and water. Based on the proposed grading, grading activities would include 1,000 cubic yards of excavation and embankment, 45,000 cubic yards of excavation and export, and 1,100 cubic yards of cut and fill. The 45,000 cubic yards of unusable materials would be exported off-site and deposited at the Mammoth-Yosemite Airport Pit. The proposed project would not require any import fill.

The project would be subject to compliance with the drainage and erosion design standards specified in the Municipal Code Section 12.08.090. Further, the project would be subject to compliance with the requirements set forth in the National Pollutant Discharge Elimination System (NPDES) Storm Water General Construction Permit for construction activities; refer to Response 4.8(a). Following compliance with the requirements for erosion control specified in Code Section 12.08.090 and NPDES permit, project implementation would result in a less than significant impact regarding soil erosion.

Fire Access Road Alternative

Similar to the proposed project, the Fire Access Road Alternative would result in a less than significant impact, as the project site boundaries would remain the same as the proposed project. Additionally, although the area of site disturbance would be slightly larger in order to accommodate the fire access road on-site; this disturbance would be minimal.

⁴ Triad/Holmes Associates, *Holiday Haus Preliminary Drainage Study*, dated February 2008.

⁵ Town of Mammoth Lakes, *Town of Mammoth Lakes 2005 General Plan Update Final Program EIR*, May 2007, Page 4-111.



Therefore, similar to the proposed project, following compliance with the requirements for erosion control specified in Code Section 12.08.090 and NPDES permit, implementation of the Fire Access Road Alternative would result in a less than significant impact pertaining to soil erosion.

Mitigation Measures: No mitigation measures are required.

- c) ***Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in an on-site or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?***

Less Than Significant Impact With Mitigation Incorporated.

Volcanic Activity

According to the 2005 General Plan Update FPEIR geotechnical hazards related to volcanic activity are possible in the project area. This possibility of volcanic related hazards in the Mono-Long Valley area has resulted in increased monitoring of seismic and non-eruptive volcanic activity. A comprehensive daily monitoring program of activity helps scientists to assess the volcanic hazards and to recognize the early signs of possible eruptions. The United States Geological Survey (USGS) has established procedures to promptly alert the public to a possible eruption. Implementation of the proposed project would not increase the risk of such volcanic activity affecting either existing or proposed development in the vicinity of the project site. The project would also be required to comply with the Town's Emergency Operations Plan, which was adopted in 2001 and is updated regularly. Therefore, with compliance of the Town's Emergency Operations Plan, project impacts pertaining to volcanic activity are less than significant.

Unstable Soils

Topsoil, consisting of alluvial deposits (loose sand and silty sand), may be present at the site. In addition, perched water may develop at the site. Therefore, during construction activities, the upper portions of loose alluvium would be required to be excavated and removed from the site as it is considered unsuitable for reuse as structural fill (Mitigation Measure GEO-1). Permanent perimeter subsurface drains would be installed to intercept perched groundwater associated with snowmelts (Mitigation Measure GEO-2).

Further, no expansive soils have been mapped or encountered in the project area.⁶ Notwithstanding, the project would require a soils report to identify the potential for liquefaction, expansive soils, ground settlement, slope failure, and groundwater (Mitigation Measure GEO-1). The report would be required to identify remedial measures that could be feasibly implemented to reduce potential impacts to less than significant. With implementation of the recommended mitigation, which requires adherence to the recommendations of the soils report (Mitigation Measure GEO-1),

⁶ Town of Mammoth Lakes, *Town of Mammoth Lakes 2005 General Plan Update Final Program EIR*, May 2007, Page 4-113.



potential impacts associated with unstable soils would be reduced to less than significant levels.

Fire Access Road Alternative

Similar to the proposed project, the Fire Access Road Alternative would result in a less than significant impact, as the project site boundaries would remain the same as the proposed project. With compliance of the Town's Emergency Operations Plan, the Fire Access Road Alternative impacts pertaining to volcanic activity would be less than significant.

As with the proposed project, during construction activities the topmost portions of loose alluvium would be required to be excavated and removed from the site as it is considered unsuitable for reuse as structural fill (Mitigation Measure GEO-1). Permanent perimeter subsurface drains would be installed to intercept perched groundwater associated with snowmelts (GEO-2).

Additionally, with implementation of GEO-1, the Fire Access Road Alternative would be required to prepare a soils report to identify the potential for liquefaction, expansive soils, ground settlement, slope failure, and groundwater. At this time, verification of potential liquefaction under critical structures would be analyzed and recommendations to reduce these impacts would occur. Therefore, similar to the proposed project, with implementation of the Mitigation Measures GEO-1 and GEO-2, the Fire Access Road Alternative would adhere to the recommendations of the required soils report, and potential impacts associated with unstable soils would be reduced to less than significant levels.

Mitigation Measures: Refer to Mitigation Measures GEO-1 and GEO-2.

- d) ***Be located on expansive soil, as defined in Table 18-1-B of the California Building Code (2004), creating substantial risks to life or property?***

Less Than Significant Impact With Mitigation Incorporated. Refer to Response 4.6(c).

Fire Access Road Alternative

Refer to Response 4.6(c).

Mitigation Measures: Refer to Mitigation Measures GEO-1 and GEO-2.

- e) ***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?***

No Impact. The project involves the demolition of the existing Holiday Haus Motel and the construction of a new Hotel Condominium structure. The new structure would increase the density at the site; therefore, increasing the generation of wastewater. However, the project site currently uses the Town's sewer system, and would continue to do so upon implementation of the proposed project. The project



would not involve the use of septic tanks or alternative wastewater disposal systems, since the Town maintains infrastructure for disposal and treatment of wastewater. Additionally, the project would not remove any existing septic tanks or alternative wastewater disposal systems, as the existing Holiday Haus Motel is currently connected to the Towns' sewer and storm drain system. Therefore, no impact would occur in this regard.

Fire Access Road Alternative

Similar to the proposed project, the Fire Access Road Alternative would result in no impact, as the Fire Access Road Alternative would continue to utilize the Town's sewer system.

Mitigation Measures: No mitigation measures are required.