V.J. GEOLOGY AND SOILS

This section summarizes the findings presented Chapter V.J of the *Willow Road/Highway 101 Interchange Final Environmental Impact Report*, prepared by Douglas Wood & Associates, Inc. The topic of mineral resources has been included in this section consistent with the current County Initial Study Checklist issues to be addressed. (March 1999: pp. V164-V175)

1. Existing Conditions

Topography. The project area lies on a coastal plain, which slopes gradually from east to west. Most of the project site lies within the Nipomo Mesa, an area of dune deposits that form smoothly eroded hills and shallow linear valleys. As the project approaches Nipomo Creek, the topography slopes gently downward toward the creek.

Geology. The project area lies within the Coast Ranges Geomorphic Province. Fault-bounded mountain ranges, trending northwest to southeast, characterize this region. The tectonic bedrock underlies the project site, although it lies exposed at spots within the region. Thick marine and non-marine sedimentary rocks overlie the bedrock. Unconsolidated sediments typically occur at the surface. Dune sands are the most common of these sediments, although fluvial and other sediments are more common to the east of Nipomo Creek and US 101.

Soils. Dune sand deposits, ranging from 70 to 80 feet in thickness within the project area, underlie Nipomo Mesa. Oceano Series soils (0 to 9 percent slope and 9 to 30 percent slope) form on these deposits (see Figure V.H-1). These soils are excessively drained. Oceano Series (0 to 9 percent slope) have a slight to moderate erosion potential during wet years, forming gullies. Similarly, Oceano Series (9 to 30 percent slope) have a moderate to severe erosion potential during wet years. Vegetative cover reduces the risk of erosion.

Alluvial deposits occur adjacent to Nipomo Creek and its tributaries. Cropley Clay (0 to 2 percent slope) and Cropley Clay (2 to 9 percent slope) develop within these deposits, Cropley Clay (2 to 9 percent slope) occurring closer to Thompson Avenue (see Figure V.H-1). These soils develop on alluvial fans. They are very deep and moderately well drained. They exhibit clays that are approximately 36 inches thick. They have slow permeability, but surface runoff is slow to moderate, increasing with slope. Consequently, erosion potential is generally low. These soils are highly expansive.

Along the low stream terrace bordering Nipomo Creek on its northern side, Tierra Sandy Loam (2 to 9 percent slope) series soil occurs (see Figure V.H-1). This soil forms on hills and dissected terraces in old alluvium weathered from sedimentary rocks. Tierra soils are deep and moderately well drained. Soil permeability is very slow, but the available water capacity is low to moderate. It also has a moderate soil blowing hazard.

Gently sloping foothill areas with relatively shallow bedrock occur toward the southern end of Thompson Road. At this location, Undifferentiated Diablo Clay (9 to 15 percent slope) develops (see Figure V.H-1). This soil type is deep, well drained, and has slow permeability. Surface runoff is medium with a moderate erosion potential. This soil is highly expansive and prone to debris flow failure.

Hydrogeology. Ground water should occur at the depth of bedrock, which is as much as 70 to 80 feet beneath the ground surface locally. Local areas of shallow bedrock or perched water may occur, particularly near Nipomo Creek during and after the rainy season. Historically, springs and shallow groundwater existed within the alluvial deposits near Nipomo Creek.

Seismicity. The project area does not lie within any fault rupture zones Significant faults do occur within the region (Douglas Wood & Associates, Inc. 1999: V168), and could produce moderate to strong ground shaking at Nipomo Mesa. The potentially active Wilmar Avenue fault also crosses the project area as do structural benches related to the potentially active Oceano fault.

Mineral Resources. There are no existing mineral extraction operations in and adjacent to the project site.

2. Thresholds of Significance

Appendix G of the State CEQA guidelines and the County of San Luis Obispo Initial Study Checklist state that a project will have a substantial adverse effect, including the risk of loss, injury, or death if the project exposes people or structures to the following conditions.

- The project is within a California Department of Mines and Geology Earthquake Fault Zone;
- The project exposes people or structures to strong seismic ground shaking;
- The project exposes people or structures to seismic-related ground failure, including liquefaction;
- The project exposes people or structures to landslides;
- The project exposes people or structures to the results of substantial soil erosion or the loss of topsoil;
- The project would change rates of soil absorption, or amount or direction of surface runoff;
- The project lies on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating a substantial risk to life or property; or
- The project is inconsistent with the County's Safety Element related to Geologic and Seismic Hazards;
- The project lies within the 100-year flood zone;
- The project changes the drainage patterns where substantial on- or off-site sedimentation/erosion or flooding may occur;
- The project would preclude the future extraction of valuable mined resources.

3. Project Impacts

Surface Fault Rupture. Faults may occasionally cause displacement of the ground surface. Within the project area, the Wilmar Avenue fault reaches the surface near Nipomo Creek and crosses the proposed extension of Willow Road (Douglas Wood & Associates, Inc. 1999: V168). This fault is a "blind" reverse fault, a type for which the potential for surface rupture is thought to be low. A major

earthquake on the fault in this area could, however, cause warping and fracturing of the ground surface. This fault is the only one within the project area likely to pose potential threat of surface rupture. Because of the low probability of rupture, potential impacts related to surface rupture along this fault are not significant. The proposed project design will nevertheless be required to meet all applicable County and State standards (see Mitigation Measures J-1 through J-3).

Regional Uplift and Tilting. Offset along faults within the eastern and western ends of the project could produce uplift and/or tilting of the roadway. The probability of such offset is quite low, and the effects of this tilting would be minor. Uplift and tilting could crack pavement and structural sections, creating a minor threat to public safety. These effects are easily repaired. The impacts attributable to uplift and tilting are therefore not significant.

Seismic Activity. Severe ground shaking will occur within the project area if an earthquake of great magnitude occurs on one of the nearby active or potentially active faults. The incidence of major earthquakes near the project area can not be reliably predicted. Nevertheless, a major earthquake is likely to occur within the life of the project. The effects of such an event include cracking of the roadway and structural sections and slumping of slopes near the US 101 interchange. These events occur infrequently, so they pose a minor threat to public safety. When seismic activity occurs, impacts resulting from it are potentially significant. The impacts can be mitigated to a level that is less than significant with the implementation of Mitigation Measures J-1 and J-2.

Differential Consolidation and Seismic Settlement. Seismic ground shaking can cause sediments to settle several inches. Such settlement particularly affects sands and silts of loose to medium density. Differential consolidation and seismic settlement may crack or warp roads. Differential settlement will be most evident in areas where soil characteristics vary greatly within relatively small areas. While Nipomo Mesa contains sandy soils, soil characteristics remain uniform throughout the portion of the Mesa located to the west of US 101. Soil characteristics vary more to the east of US 101 (see Figure V.H-1), where sandy Oceano and Tierra series soils lie adjacent to Cropley Clay soil. Consequently, differential consolidation is likely to be greater in this area. Such problems can be easily addressed through routine road maintenance, so this impact is not significant.

Liquefaction and Lateral Spreading. Saturated or nearly saturated soils may compress and lose shear strength when shaken during an earthquake. The loss of shear strength can cause the soil to behave as a viscous fluid rather than as a particulate solid, causing structures to sink or contort. Loss of shear strength can also create large fissures to occur along unsupported slopes, which can pull apart structures resting in the affected soils. Loose, fine or medium grained, well-sorted sands are particularly prone to such behavior when saturated, although other sediment types may also act in this fashion. Ground water likely occurs at depths of 70 feet or more throughout most of the project area, which obviates the potential for liquefaction. Liquefaction typically occurs only in places where the ground water exists within 50 feet of the ground surface. Localized areas of perched ground water do exist in some spots, however. The occurrence of these conditions within the project area must be determined from design-level geotechnical investigations. The potential impacts of liquefaction and lateral spreading can be reduced to a less than significant level with the implementation of Mitigation Measures J-1, J-3, and J-4.

Soils. Soil characteristics can affect the project in two different ways. Soil collapse, although unlikely given the nature of the local soils, can cause structures and roadway facilities to sink or

contort. Expansive soils may repeatedly expand and contract, damaging structures (and pavement) that rest on them. The only expansive soils within the project site are the Cropley Clay series soils (Figure V.H-1). The potential impacts of expansive soils can be mitigated to a less than significant level with the implementation of Mitigation Measures J-5 and J-6.

Landsliding. The Landslide Risk Map of the San Luis Obispo County Seismic Element characterizes the project area as one of "negligible risk". A geologic survey of the project area produced no evidence of landslides, and therefore, the potential for natural landslides is very low. Cut and fill slopes created during construction of the proposed project could, however, create conditions conducive to landslides. Landslides could temporarily block roads and destabilize road embankments, creating a possible minor threat to public safety. Impacts resulting from landslides can be mitigated to a less than significant level with the implementation of Mitigation Measure J-7.

Erosion. Dunes to the west of US 101 readily erode when their vegetative cover is disturbed, such as during construction. Sand blowing across the roads as a result of this erosion can reduce visibility to hazardous levels and require frequent clearing of the road. This impact is potentially significant, but can be reduced to a less than significant level with the implementation of Mitigation Measures J-8 and J-9.

Mineral Resources. Since no mineral extraction activities are currently operating in the immediate project area, and no commercially valuable mineral resources are known to exist in the project area, (the designated land uses along the project alignment are residential rural, recreation and agriculture per the General Plan), the proposed project would not preclude the future extraction of valuable mineral resources.

4. Cumulative Impacts

The proposed project accommodates planned development. The cumulative projects study area comprises Nipomo Mesa and Nipomo Valley, which possess distinctive geologic features. Most of the projects on the cumulative projects list presented in Chapter IV occur on Nipomo Mesa. The projects on this list face potential hazards resulting from seismic activity, such as seismic ground shaking, since the projects on the list would be affected by the same faults as affect the proposed project. Similarly, the projects on the cumulative projects list may create wind blown sand or expose people and structures to the risks of soil expansion, depending on whether the projects occur on Nipomo Mesa or in clay soils to the east of the Mesa. Because planned development will occur in these areas regardless of the presence of the proposed project, the proposed project does not affect the likelihood that people or structures experience such geologic hazards. The proposed project thus does not significantly contribute to the cumulative impacts resulting from geologic hazards. These impacts are project-specific and can be mitigated to less than significant levels on a project -by- project basis.

5. Mitigation Measures

J-1, Conformance to Applicable Standards. Project design and grading plans prepared by the Project Engineer shall conform to applicable County and State Construction Standards for roads and bridges. These standards must be implemented in the plans prior to County approval of the final plans, specifications, and estimates (PS&E).

J-2, Project Design Assumptions. Project design shall assume that project facilities will be exposed to ground shaking commensurate with a Maximum Credible Earthquake. These design specifications shall be incorporated in the design plan prepared by the Project Engineer prior to County approval of the PS&E.

J-3, Recommendations of the Geotechnical Engineer. The recommendations of a design-level geotechnical investigation performed by a qualified Geotechnical Engineer shall be implemented in the design plan prepared by the Project Engineer prior to County approval of the final PS&E. These recommendations will include detailed geologic investigations related to liquefaction, lateral spreading, and collapsible/expansive soils.

J-4, Mitigation of Potentially Liquefiable Soils. If areas of potentially liquefiable soils are identified during design-level geotechnical investigations, appropriate design measures shall be implemented in the design plan prepared by the Project Engineer prior to County approval of the final PS&E. These design measures will include:

- Realign interchange to avoid liquefiable soil;
- Elevate the roadway on a compacted fill embankment; or
- Densify liquefiable soils by accepted ground improvement methods including deep dynamic compaction or installation of stone columns.

Any project design modifications that expand the physical area of effect beyond the project limits as defined in this EIR will require subsequent environmental review and analysis by the County to conform to the requirements of CEQA.

J-5, **Mitigation of Potentially Collapsible Soils.** If any potentially collapsible soil is identified during design-level geotechnical investigations, the affected area shall be temporarily flooded with water by the Project Engineer or Project Contractor to induce collapse before construction. This requirement shall be shown on all applicable construction plans.

J-6, Mitigation of Potentially Expansive Soils. If any potentially expansive soil is identified during design-level geotechnical investigations, appropriate measures shall be implemented in the design plan prepared by the Project Engineer prior to County approval of the final PS&E. These measures will include:

- Remove and replace any excessively expansive material identified;
- Water, condition, and control compaction of fill; and
- Establish positive drainage to suitable points in a controlled manner without ponding.

J-7, Mitigation of Landslides. Land sliding potential of cut/fill slopes associated with the US 101 interchange can be reduced by implementing the following measures in the design plan prepared by the Project Engineer prior to County approval of the final PS&E:

- Design the freeway structures to withstand the maximum credible earthquake;

- Construct fill and/or cut slopes no steeper than 2:1 (horizontal: vertical);
- Establish vegetation along slopes immediately after construction pursuant to County requirements;
- If required vegetation is not fully established by the beginning of the rainy season, additional erosion control measures shall be installed along slopes prior to the season and any rain events pursuant to County requirements; and
- Plant native drought-resistant vegetation which requires limited irrigation pursuant to County requirements.

J-8, Mitigation of Potential Erosion. To control potential erosion, all slopes and areas disturbed by grading for any proposed project facilities shall be planted with native drought resistant vegetation by the County's designated landscape contractor immediately following each applicable phase of construction.

J-9, **Erosion Control Maintenance.** Periodic maintenance of areas disturbed by construction of project facilities shall be conducted during and after project construction by the Project Contractor in order to control erosion gullying and wind erosion.

6. Residual Impacts

After implementation of Mitigation Measures J-1 through J-9, the project poses no significant, unavoidable impacts resulting from geologic hazards. Potentially significant impacts within the project area could be caused by seismic ground shaking, blowing sand and erosion, liquefaction, landslides, and collapsible or expansive soils. Implementation of the foregoing mitigation measures will reduce these potentially significant impacts to a less than significant level. Impacts resulting from surface fault rupture, lateral spreading, regional uplift and tilting, and differential consolidation/seismic settlement would not be significant.