### 3C.1 Summary

The following is a summary of the proposed project’s potential impacts to geology and soils, any necessary mitigation measures, and the level of significance after mitigation.

<table>
<thead>
<tr>
<th>Potential Impact</th>
<th>Mitigation Measure(s)</th>
<th>Significance after Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Potential Impact 3C-1.</strong> Exposure of People or Structures to Potential</td>
<td>2000 SEIR 1278 mitigation measures that continue to be applicable:</td>
<td>Less than significant</td>
</tr>
<tr>
<td>Substantial Adverse Effects Including the Risk of Loss, Injury, or Death</td>
<td><strong>MM G-1.</strong> All Grading Subject to City Grading Manual Regulations.</td>
<td></td>
</tr>
<tr>
<td>Involving Rupture of a Known Earthquake Fault; Strong Seismic Ground Shaking;</td>
<td><strong>MM G-2.</strong> Removal of Unsuitable Earth Materials.</td>
<td></td>
</tr>
<tr>
<td>Seismic-related Ground Failure, including Liquefaction; or Landslides</td>
<td><strong>MM G-3.</strong> Further Slope Stability Investigations.</td>
<td></td>
</tr>
<tr>
<td><strong>Potential Impact 3C-2.</strong> Location of Structures on a Geologic Unit or Soil</td>
<td><strong>MM G-4.</strong> Detailed Geotechnical and Soil Engineering Reports.</td>
<td></td>
</tr>
<tr>
<td>that is Unstable, or that Would Become Unstable as a Result of the Project and</td>
<td><strong>MM G-5.</strong> All Structures Designed and Constructed in Accordance with Seismic Safety Design Criteria.</td>
<td></td>
</tr>
<tr>
<td>Potentially Result in On- and Offsite Landslide, Lateral Spreading, Subsidence,</td>
<td><strong>MM 3C-6.</strong> Slopes Will Be Stabilized.</td>
<td></td>
</tr>
<tr>
<td>Liquefaction, or Collapse</td>
<td><strong>MM 3C-7.</strong> Standard Grading Codes Will Be Applied.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>MM 3C-8.</strong> Compressible Soils Will Be Identified.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>MM 3C-9.</strong> Compressible Soils Will Be Mitigated.</td>
<td></td>
</tr>
<tr>
<td><strong>Potential Impact 3C-3.</strong> Substantial Soil Erosion or Loss of Topsoil</td>
<td>No mitigation was included in 2000 SEIR 1278.</td>
<td>Less than significant</td>
</tr>
<tr>
<td></td>
<td><strong>MM 3C-6.</strong> Implement Sediment Transport Minimization Measures.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>MM 3C-7.</strong> Revegetation of Exposed Graded Slopes.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>MM 3C-8.</strong> Comply with Corps, CDFG, IRWD, and SCWD Requirements.</td>
<td></td>
</tr>
<tr>
<td><strong>Potential Impact 3C-4.</strong> Location of Structures on Expansive Soils, as Defined</td>
<td>No mitigation was included in 2000 SEIR 1278.</td>
<td>Less than significant</td>
</tr>
<tr>
<td>in Table 18-1-B of the Uniform Building Code</td>
<td><strong>MM 3C-9.</strong> Field Observations and Testing Will Be Conducted.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>MM 3C-10.</strong> Fill Materials Will Be Tested.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>MM 3C-11.</strong> Expansive Soils Will Be Mitigated.</td>
<td></td>
</tr>
<tr>
<td>Potential Impact</td>
<td>Mitigation Measure(s)</td>
<td>Significance after Mitigation</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td><strong>EAST ORANGE PLANNED COMMUNITY – AREA 1</strong></td>
<td><strong>Potential Impact 3C-1.</strong> Exposure of People or Structures to Potential Substantial Adverse Effects Including the Risk of Loss, Injury, or Death Involving Rupture of a Known Earthquake Fault; Strong Seismic Ground Shaking; Seismic-related Ground Failure, including Liquefaction; or Landslides <strong>Potential Impact 3C-2.</strong> Location of Structures 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- and Offsite Landslide, Lateral Spreading, Subsidence, Liquefaction, or Collapse</td>
<td><strong>Less than significant</strong></td>
</tr>
</tbody>
</table>
|                                                                                   | MM 3C-1. Slopes Will Be Limited to 2:1.  
MM 3C-4. Compressible Soils Will Be Identified.  
MM 3C-5. Compressible Soils Will Be Mitigated.  
MM 3C-12. Grading and Planting Plans Will Conform to City Guidelines.  
MM 3C-13. A Detailed Geotechnical Study Will Be Submitted.  
MM 3C-16. Remove Unstable Deposits.  
MM 3C-17. Submit Building Plans to the City.  
MM 3C-18. Stabilize All Cut Slopes.                                                                                     |                                                                           |
| **Potential Impact 3C-3.** Substantial Soil Erosion or Loss of Topsoil                                                                                                 | MM 3C-6. Implement Sediment Transport Minimization Measures.  
MM 3C-7. Revegetation of Exposed Graded Slopes.  
MM 3C-8. Comply with Corps, CDFG, IRWD, and SCWD Requirements.                                                                                                      | **Less than significant** |
| **Potential Impact 3C-4.** Location of Structures on Expansive Soils, as Defined in Table 18-1-B of the Uniform Building Code                                                                                              | MM 3C-9. Field Observations and Testing Will Be Conducted.  
MM 3C-10. Fill Materials Will Be Tested.  
MM 3C-11. Expansive Soils Will Be Mitigated.                                                                                              | **Less than significant** |
| **EAST ORANGE PLANNED COMMUNITY – AREAS 2 AND 3 AND REMAINING AREAS**                                                                                                 | **Potential Impact 3C-1.** Exposure of People or Structures to Potential Substantial Adverse Effects Including the Risk of Loss, Injury, or Death Involving Rupture of a Known Earthquake Fault; Strong Seismic Ground Shaking; Seismic-related Ground Failure, including Liquefaction; or Landslides **Potential Impact 3C-2.** Location of Structures 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- and Offsite Landslide, Lateral Spreading, Subsidence, Liquefaction, or Collapse | **Less than significant** |
|                                                                                   | MM 3C-1. Slopes Will Be Limited to 2:1.  
MM 3C-4. Compressible Soils Will Be Identified.  
MM 3C-5. Compressible Soils Will Be Mitigated.  
MM 3C-12. Grading and Planting Plans Will Conform to City Guidelines.  
MM 3C-13. A Detailed Geotechnical Study Will Be Submitted.  
MM 3C-16. Remove Unstable Deposits.  
MM 3C-17. Submit Building Plans to the City.  
MM 3C-18. Stabilize All Cut Slopes.  
MM 3C-19. Stabilize or Remove Lake Reclamation Fills in East Orange Planned Community Area 2, Sector 8.                                |                                                                           |
### 3C.2 Introduction

This section analyzes the impacts of the proposed project on geology and soils. The Santiago Hills II Planned Community development area—which is proposed to be developed with approximately the same land uses and densities at those described in 2000 SEIR 1278, but with changes to its circulation system—is analyzed here on a project-specific level. East Orange Planned Community Area 1 (primarily residential), which includes a tentative tract map, is also analyzed at a project-specific level. East Orange Planned Community Area 2 (primarily residential), East Orange Planned Community Area 3 (residential), and remaining areas (which include areas for a golf course, marina and trailhead, water quality basins, fire station site, and two pump station sites) are analyzed at a programmatic level because the project includes only general plan designations and zoning, but no site-specific development plans, for these areas.

Public and agency comments received during the review of the notice of preparation and scoping meetings were considered during the analysis of impacts to geology and soils. These comments included preventing silt and soil from plugging the storm drain adjacent to Jamboree Road across from Canyon View Avenue in the Santiago Hills II Planned Community site, and retaining the rural nature of the canyon hills and valleys in the East Orange Planned Community Area 2 site (see Appendix A-4).

The following discussion is based mainly on the 2000 SEIR 1278 and the Limited 500-Scale Preliminary Geotechnical Investigation, East Orange Planned Community and Santiago Hills II Planned Community, by GeoSoils, Inc., January 16, 2004. This report included the field exploration data (boring and test pit logs) and laboratory test results used for 2000 SEIR 1278 and supplemental data. The supplemental data included three approximately 100-foot-deep borings, seven test pits, geologic logging, and geophysical seismic surveys. The complete report is provided in Appendix D-1.

### 3C.3 Setting

#### 3C.3.1 Regional Geologic Setting

The Santiago Hills II and East Orange Planned Communities sites are within the northern Santa Ana Mountains that are a part of the Peninsular Range geomorphic province of Southern California. This province is bounded by the Whittier-Elsinore fault to the north (located approximately 5 miles northeast of the site) and by the Newport-Inglewood fault zone to the south (located approximately 17 miles southwest of the site). This area includes a variety of Cretaceous (66 to 144 million years before present) and Tertiary age (1.6 to 66 million years before present) sedimentary rocks on the southern limb of a

---

<table>
<thead>
<tr>
<th>Potential Impact</th>
<th>Mitigation Measure(s)</th>
<th>Significance after Mitigation</th>
</tr>
</thead>
</table>
regional anticline (i.e., an arch or upfold of stratified rock) at the margin of the Los Angeles depositional basin. The bedrock units have been folded and faulted during regional uplift of the Santa Ana Mountains. The resultant bedrock structure has formed a complex fault pattern with isolated structural blocks and broad synclinal (down-warps) and anticlinal folds.

The site location relative to earthquake faults is shown on Figure 3C-1.

### 3C.3.2 Local Geology

Within the Santiago Hills II Planned Community area, the sedimentary bedrock sequence, in order of oldest to youngest, includes the Santiago, Sespe/Vaqueros, Topanga, and Puente Formations. Minor outcrops of El Modeno Volcanics of middle to late Miocene age conformably overlay the Topanga Formation. Within the East Orange Planned Community, the order is slightly different and includes Ladd, Williams, Silverado, Santiago, Sespe/Vaqueros, Topanga, and Puente Formations. These sedimentary rock units basically consist of interbedded sandstone and siltstone with minor shale, conglomerate, claystone, and siliceous shale.

#### 3C.3.2.1 Bedrock Units

The project site is underlain by a sequence of sedimentary bedrock units that range widely in age from upper Cretaceous (about 70 million years) to lower Pliocene (about 4 million years). The oldest units occur in the northern part of the site, with younger units progressively to the south. Their chief characteristics are briefly described below.

**Santiago Formation**

The Santiago Formation of Eocene age outcrops at the northern part of the project site and underlies the northernmost area of the Santiago Hills II Planned Community site. In the East Orange Planned Community development area, the Santiago Formation overlies the Silverado Formation at the northern part of the site. The northernmost East Orange Planned Community area would be partially underlain by this unit. This formation is characterized by massive, mainly marine, pale gray sandstone beds that reportedly contain concretions and fragments of silicified fossil logs.

**Sespe/Vaqueros Formation**

The late Eocene to Miocene age Sespe/Vaqueros Formation consists of interlensing strata of shallow marine and continental origin that are commonly combined as a single, undifferentiated geologic unit. A large part of the central area of the Santiago Hills II Planned Community site, north of Chapman Avenue, is underlain by this formation. This combined Sespe/Vaqueros unit forms the most widespread formation mapped within the East Orange Planned Community site and underlies most of the East Orange Planned Community Areas 1 and 2 sites. The lower Sespe unit consists predominantly of nonmarine, reddish brown sandstones and clayey sandstones. The overlying Vaqueros unit consists of relatively soft, yellow-brown marine sandstone and shale. The distinct yellow-brown and reddish hues of these deposits characterize this formation, and contrast sharply with the surrounding more subtle rock colors. Thin clay seam interbeds are present locally and have formed basal slip surfaces for landslides in this formation.
Figure 3C-1
Site Location Relative to UBC Active Fault Near-Source Zones

This map is intended to be used in conjunction with the 1997 Uniform Building Code, Tables 16-S and 16-T

California Department of Conservation
Division of Mines and Geology

LEGEND

Shaded zones are within 2 km of known seismic sources.

- A fault
- B fault

Contours of closest horizontal distance to known seismic sources:

- 5 km
- 10 km
- 15 km

1/4" is approximately equal to 1 km
August, 1997
Topanga Formation

The Topanga Formation of middle to late Miocene age consists predominantly of yellow-gray marine sandstone with some siltstone, shale, and conglomerate interbeds. Outcrops of this unit occur in fault contact with other formations in the Santiago Hills II Planned Community area, and in the south part of the East Orange Planned Community Area 1 site in apparent conformity with the underlying Sespe/Vaqueros Formation.

El Modeno Volcanics

The El Modeno Volcanics of middle Miocene age rest conformably upon strata of the Topanga Formation and are overlain by the La Vida member of the Puente Formation. This volcanic unit is composed of hard andesitic, tuffaceous, and basaltic rocks, which are limited to a small area in Santiago Hills II Planned Community site along Chapman Avenue.

Puente Formation

The Puente Formation of upper Miocene to lower Pliocene age is entirely of marine origin and is subdivided here into two members: 1) the lowermost La Vida member, which is mainly silty, diatomaceous, and clayey shales and 2) the Soquel member, which is chiefly yellow sandstone with minor gray shale beds. Both members of this formation mainly occur south of Chapman Avenue in the Santiago Hills II Planned Community area. The Puente Formation is the youngest bedrock unit mapped within that area. Clay-rich interbeds that commonly form landslide slip surfaces occur mainly within the La Vida member. This formation underlies large portions of the southern part of the East Orange Planned Community site beneath the planned development areas. The Puente Formation is the youngest bedrock unit mapped within the project area, and is unconformably overlain by the surficial soil units described below.

Ladd and Williams Formations

In the East Orange Planned Community area, the Ladd and Williams Formations of upper Cretaceous age are restricted in their occurrence to the extreme northern portion of the project area, well outside of the planned development areas. Both of these formations are divided into two subunits: the Ladd Formation contains the Baker Canyon member and Holz Shale member, and the Williams Formation is made up of the Schulz Ranch member and Pleasants Sandstone member. They consist mainly of relatively hard, resistant sandstone, conglomerate, and shale beds of marine origin.

Silverado Formation

In the East Orange Planned Community area, the Silverado Formation of Paleocene age is composed chiefly of massive, nonmarine sandstone, with siltstone and claystone interbeds, overlying a basal conglomerate. This unit outcrops south of the underlying Cretaceous age formations, but north of and outside the planned development areas.
3C.3.3 Faults and Seismicity

Geologic structure within the project area is varied and locally complex. In the Santiago Hills II Planned Community area, the terrain in general is transected by northeast- and northwest-trending faults that disrupt the uniformly southwest-dipping strata. The geotechnical investigation found that the western half of Santiago Hills II Planned Community area contains numerous intersecting faults that have produced a fault block complex of several formations in close juxtaposition. In the East Orange Planned Community area, the terrain in general is transected by north to northeast trending faults that disrupt the homoclinal, uniformly southwest-dipping strata. None of these faults within either area are known to be active. There are no through-going or seismically active faults that cross the proposed project site. The crosscutting fault patterns are believed to reflect past geologic episodes of tectonic deformation, unassociated with current stress fields.

As discussed in 2000 SEIR 1278, the closest major active faults are the Whittier-Elsinore fault to the northeast and the Newport-Inglewood fault to the southwest. Based on the computer program EQFAULT (Blake 1995), the closest active fault is the Whittier fault, approximately 5 miles northeast of the northern part of the project area. This section of the Whittier fault is also the state-designated earthquake fault zone closest to the property. The Peralta Hills thrust fault is 3 miles north of the Santiago Hill II and East Orange Planned Communities, and the El Modeno fault is located 0.5 mile west of the Santiago Hills II Planned Community site and 1.5 miles west of the East Orange Planned Community site. These latter faults are also thought to be seismically or potentially active by some geologists; however, they are relatively short, poorly defined, and have not been delineated as earthquake fault zones by the state (Southern California Earthquake Data Center 2004). No designated earthquake special studies fault zones occur within the site, nor are there any known active or potentially active faults in the project site. The site has been delineated within seismic hazard zones, as recently mapped by the state (Southern California Earthquake Data Center 2004), and thus requires investigations for liquefaction and earthquake-induced landslides. A report with recommended countermeasures must be completed before a permit is approved to construct buildings.

The Alquist-Priolo Earthquake Fault Zoning Act was adopted in 1972 by the State of California to mitigate the hazard of surface fault rupture along active faults. For the purpose of this act, the state has defined an active fault as having “had surface displacement during Holocene time” (i.e., during the previous 11,000 years). In accordance with the act, the state has delineated earthquake fault zones along active faults throughout the state. The designated zone closest to the property appears to be approximately 5 miles to the north along the Whittier-Elsinore fault zone. The proposed project site is not within a designated earthquake fault zone.

Numerous faults cut the rocks that outcrop on the proposed project site. In general, the majority of these faults trend to the north-northwest. None of these faults are considered active. The closest potentially active fault is the Whittier-Elsinore fault, located approximately 5 miles north of the site.

There are a number of faults in the Southern California area that are considered active and would have an effect on the proposed project areas in the form of moderate to strong shaking, should they be the source of an earthquake. These include: the San Andreas fault, the San Jacinto fault, the Elsinore fault, the Whittier-Elsinore fault, the Chino fault, and the Newport-Inglewood fault zones. The possibility of ground acceleration or shaking at the proposed project site may be considered as approximately similar to that for the Southern California region as a whole. The guidelines presented in Special Publication 117 by the State of California will be used when assessing the liquefaction potential. Minimum guidelines, as presented in the latest edition of the Uniform Building Code, will also be included in the project design recommendations.
Based on the seismic characteristics and history of the region, it is assumed that during a 50-year life, a structure in the proposed project area would be subjected to ground shaking from an earthquake of a Moment Magnitude 6.0 or greater, with ground accelerations in excess of 0.15g (gravitational force). The Whittier-Elsinore and Newport-Inglewood faults produce the highest maximum probable accelerations that would affect the project site in case of a severe earthquake. A major event on the nearby Whittier-Elsinore fault could produce peak bedrock accelerations of 0.48g to 0.52g, with repeatable ground accelerations of 0.31g to 0.34g. A major event on the Newport-Inglewood fault could generate peak bedrock accelerations of 0.22g to 0.26g, with repeatable ground accelerations of 0.10g to 0.17g. The El Modeno fault, located to the west of the site, is the closest known active fault, although evidence for its Holocene activity is poorly documented. However, bedrock accelerations from this smaller fault would probably not be as severe as from the larger previously mentioned fault systems.

3C.3.4 Groundwater and Liquefaction

Groundwater was encountered in boreholes at various depths within surficial soil and bedrock units. Water occurs as perched groundwater at variable depths that depend in large part on local bedrock stratigraphy and seasonal rainfall. Seepage as shallow as 17 feet was encountered in alluvial materials in GeoSoils Boring B-1), at the eastern portion of the Santiago Hills II Planned Community site. The shallowest bedrock seepage was at a depth of 30 feet in John A. Sayers and Associates Boring B-20. These borings were drilled during 2000 and 1988, respectively, both years of below-average rainfall. A Geohyrdelic Review of Groundwater Issues Related to the Santiago Hills II and East Orange Planned Communities was prepared by GeoSciences Support Services Inc. in November 2003 (Appendix D-2). This information, in conjunction with the Limited 500-Scale Preliminary Geotechnical Investigation, East Orange Planned Community and Santiago Hills II Planned Community, prepared by GeoSoils, Inc., is incorporated herein and can be referenced in Appendix D. For the East Orange Planned Community area, groundwater was encountered in alluvial materials at a depth of 33 feet in GeoSoils Boring B-37 in the East Orange Planned Community Area 2 site, and at 20 feet in GeoSoils Boring B-9 in Limestone Canyon, adjacent to the East Orange Planned Community Area 3 site (see Appendix D-1). The shallowest bedrock seepage in the proposed development portions of the East Orange Planned Community Areas 1 and 2 sites were at depths of 38 feet (GeoSoils Boring B-1-01) and 28 feet (GeoSoils Boring B-16), respectively. All of these borings were drilled during 2000 and 2001, years of below-average rainfall (Appendix D-1).

Liquefaction occurs when saturated, loose cohesionless materials (e.g., sand or silty sand) lose shear strength and are transformed from a solid to a near-liquid state due to pore water pressure increase caused by strong earthquake ground motion. Site susceptibility to liquefaction is a function of depth, density, and groundwater level, along with the magnitude of earthquakes. Liquefaction-related phenomena can include lateral spreading, ground oscillation, flow failures, loss of bearing strength, subsidence, and buoyancy effects (Youd and Perkins 1978).

Saturated, unconsolidated silts, sands, and silty sands within 40 feet of the ground surface are most susceptible to liquefaction. Several such areas were found within the Santiago Hills II Planned Community site along the main drainages, and between the East Orange Planned Community Areas 2 and 3 sites in low-lying areas around Irvine Lake and along Limestone Canyon.
3C.3.5 Soils

Surficial soils in the Santiago Hills II Planned Community area are classified into five mappable units (from oldest to youngest): terrace deposits, landslide masses, alluvium, slopewash, and manmade (artificial) fill. No new soils information for this area is available. Surficial soils in the East Orange Planned Community area are classified into six mappable units: terrace deposits, landslide masses, alluvium, slopewash, pond deposits, and manmade (artificial) fill. The main characteristics of these units are presented below.

Terrace Deposits

Nonmarine stream terrace deposits of late Pleistocene age are present along the flanks of active drainages along portions of the slopes north of Chapman Avenue. They formed as a result of ancient stream activity, and were subsequently uplifted with respect to the present drainage levels. These relatively dense, old alluvial deposits range from yellow-brown to dull red-brown and are composed largely of interlensing cobbles, gravel, sand, and silt.

Landslide Masses

Landslides in the Santiago Hills II and East Orange Planned Communities area consist of relatively unstable bedrock that has moved downslope under the influence of gravity, probably aided by seepage and possibly by earthquakes. Their characteristics are similar to bedrock, and they are classed as a surficial soil unit because they have been redeposited in the Quaternary landslides in the Santiago Hills II Planned Community area. In the East Orange Planned Community area are numerous small to large landslides, some more than 1,000 feet wide (Appendix D-2). Two of these large landslides, depicted on published geologic maps, occur within the East Orange Planned Community Area 2 site. Some landslides are mapped as queried where studies are ongoing. Most of the slope movement can be classified as translational bedrock or block sliding, where a rock mass progresses out and down along a planar or slightly irregular bedding surface. Geologic units that contain inclined, clay-rich planar bedding surfaces are most susceptible to block sliding. Potentially unstable landslide masses with these characteristics are most prevalent within the East Orange Planned Community areas in the following formations, in order of decreasing abundance: the Puente Formation (La Vida and Soquel members, respectively), the Sespe/Vaqueros Formation, and the Topanga Formation.

Alluvium

In the Santiago Hills II Planned Community area, thick alluvium deposits occur within the major drainages and low-lying areas. These materials are transported by intermittent stream flow and consist chiefly of beds and lenses of sand, silt, and clay mixtures. GeoSoils Boring B-41, at the northeast part of the subject site, encountered alluvium to 21 feet, the maximum depth drilled in that borehole. GeoSoils Borings HA-1, -2, -6, and -12, which were drilled along the western portion of the Santiago Hills II Planned Community area, penetrated between 38 and 58 feet of alluvial deposits. In the East Orange Planned Community area, thick alluvial deposits occur within the major drainages and low-lying areas of Santiago Creek and Limestone Canyon. GeoSoils Borings B-9, -10, -11, and -37, which were drilled along Limestone Canyon near the boundary of the East Orange Planned Community Areas 2 and 3 sites, encountered between 28 and 40 feet of alluvium, the maximum depths drilled. These deposits are transported by intermittent stream flow and consist chiefly of beds and lenses of sand, silt, and gravel, with minor clay. A portion of Santiago Creek above Irvine Lake has been modified by past alluvial sand and gravel mining operations.
**Slopewash**

Slopewash (also termed colluvium) consists of a loose mixture of soil and rock fragments deposited by rain-wash and slow, downslope creep in response to gravity. These deposits are composed chiefly of soil-like sand, silt, and clay mixtures, with scattered rock fragments that accumulate mainly along the base of slopes and swales to depths usually less than about 10 feet throughout the proposed project area.

**Lake/Pond Deposits**

Lake/pond deposits are only present in the East Orange Planned Community area and surround Irvine Lake. These deposits are a result of deposition of generally fine-grained soils in the reservoir from when the reservoir was larger. These fine clay-silt and clay-sand mixtures interfinger with alluvial deposits near the present shore. GeoSoils Boring B-37, which was drilled at the north side of the East Orange Planned Community Area 2 site at the reservoir, encountered clayey pond deposits interbedded with alluvium to a depth of about 36 feet. Silt sediment ponds were part of the commercial sand and gravel operation previously located near the reservoir.

**Manmade Fill**

Throughout the Santiago Hills II Planned Community area, uncompacted (nonengineered) artificial or manmade fills are present at various locations as a result of road grading, recreational facilities, and ranches. Fill composition varies widely because it is generally composed of a heterogeneous mixture of nearby soil and rock materials. Compacted, engineered fills are present in association with freeway and highway construction. A maximum fill thickness of 42 feet was encountered in GeoSoils Boring HA-12, which was drilled at the southwest part of the area adjacent to the freeway.

In the East Orange Planned Community area, uncompacted (nonengineered) artificial or manmade fills are a result of road grading, sand and gravel quarries in Santiago Canyon, recreational facilities, ranches, and the closed Santiago Canyon Landfill. The maximum depth of uncompacted fill was encountered in John A. Sayers and Associates Boring B-24 to 29 feet. The fill was underlain by porous topsoil that had formed at the original ground surface.

In an effort to restore and maintain adequate water storage capacity within the Irvine Lake reservoir, local water districts initiated a desilting project in the mid-1990s to remove excess silts (i.e., sand, gravel, and other alluvial [pond] deposits) that were, and continue to be, naturally deposited by Santiago and Limestone Creeks into the reservoir.

In connection with the desilting project, the water districts contracted an aggregate mining company to remove the silts, which in turn were used for commercial sale. The contractor gained approval of a reclamation plan from the County in July 1989. In 2002, the County approved a changed plan, including reclamation fill areas to be used for disposal of noncommercial fine-grained material excavation. Reclamation fill is to be compacted only to a density provided by the effort of the equipment used and as such is considered uncompacted fill for development purposes. Fill placed within the plant site was to be compacted to 90 percent relative density. The commercial desilting operation conducted by the contractor ceased in late 2003, and the reclamation of areas impacted by the commercial operation are to be completed in accordance with the approved reclamation plan and its modifications. Reclamation has been completed. Notwithstanding cessation of commercial aggregate mining activities, future reservoir operations will continue to include dredging/desilting the reservoir as needed to ensure sufficient capacity for water storage. It is not certain if, in the future, the spoils of these desilting reservoir maintenance operations would be placed in the Irvine Lake reservoir.
operations would be used as a source material for aggregate mining or other commercial extraction operations. There currently are no plans for commercial use of the dredged spoils. Continual desilting is expected to be a necessary element of reservoir operations.

**Landfill**

The closed Santiago Canyon Landfill is located to the north and east of the East Orange Planned Community Area 1 site. The proximity of the existing landfill to the north and east of the East Orange Planned Community Area 1 site does not appear to present any structural geotechnical concerns due to the distance from currently proposed development (the closest proposed development/cut slope is roughly 600 feet away). Adverse effects of groundwater potentially affected by the landfill and migrating toward proposed development are considered negligible. This conclusion is based on the general absence of groundwater encountered in exploratory excavations within the East Orange Planned Community Area 1 site (with the exception of some locally perched groundwater). The area of particular concern would be to the south of the landfill, where there is no natural drainage divide (although there is a bedrock barrier) separating the landfill from proposed development areas, and where regional bedrock structure would appear to direct groundwater toward proposed development (despite the presence of the bedrock ridgeline). Due to the absence of any groundwater encountered in deep borings to the south of the landfill (including in deep alluvial areas to be reported on in future studies of this area), in addition to the more regional groundwater gradient direction (toward the northwest), it is concluded that negligible potential exists for migration of groundwater from the landfill toward proposed development.

**3C.3.6 Slope Stability**

Three basic geologic factors govern bedrock slope stability in the project area: 1) bedding orientation, 2) the presence of clay-rich interbeds, and 3) groundwater. Out-of-slope bedding plane orientations are present in some areas of the Santiago Hills II Planned Community site, and actual or potential out-of-slope bedding orientations are present in some portions of the East Orange Planned Community Areas 1 and 2 sites. Out-of-slope bedding plane orientations occur where the tilt of the strata is downward toward unsupported natural or cut slope surface, causing a potential for landsliding. Clay-rich interbeds and groundwater have been encountered at various depths in borings within the Santiago Hills II Planned Community and East Orange Planned Community Areas 1 and 2 sites. However, bedding orientations and depths of clayey interbeds and groundwater in the Santiago Hills II Planned Community site were found to vary considerably. The extreme variability of these factors is a result of the complexly folded and faulted bedrock conditions that occurred during past geologic ages. Rather detailed, closely spaced subsurface explorations would be needed to properly evaluate these variable, localized conditions. In the East Orange Planned Community area, the number of mapped landslides of various sizes within the project area attests to the relatively unstable natural slope conditions. A comprehensive subsurface investigation is presently ongoing to assess slope stability.

The stability of both natural and manmade (cut and fill) slopes can be adversely affected by strong seismic ground shaking. Based on geologic mapping by the State of California, there are a few areas of potential earthquake-induced landslides within the Santiago Hills II and East Orange Planned Communities site.
3C.3.7 Regulatory Setting

There are a number of existing codes and policies, implemented through the regular subdivision process, that would serve to mitigate the impacts of the proposed project. Current codes and policies relating to geology and soils are as follows:

- the City Manual of Grading and Standard Plans and Specifications, which governs the grading for the proposed development;
- the City General Plan and Environmental Hazards Element regarding actions to minimize loss from nonseismic geologic hazards and earthquakes;
- the most recent version of the Uniform Building Code for Seismic Zone 4;
- the California Building Code, which is certified in the CCR, Title 24, Part 2, and is a portion of the California Building Standards Code (Title 24 is assigned to the California Building Standards Commission, which by law is responsible for coordinating all building standards);
- CEQA, which defines a significant effect on the environment as a substantial, or potentially substantial, adverse change in the physical conditions within the area affected by the project;
- the Alquist-Priolo Earthquake Fault Zoning Act of 1972, which requires that special geologic studies be conducted to locate and assess any active fault traces in and around known active fault areas before development of structures for human occupancy (the proposed project is not within any of the required special studies zones);
- the Seismic Hazards Mapping Act of 1990, which addresses nonsurface fault rupture earthquake hazards, including liquefaction and seismically induced landslides;

The Los Angeles District of the Corps has jurisdiction around Irvine Lake to the ordinary high water mark elevation of 765 feet above mean sea level. CDFG has jurisdiction around Irvine Lake up to an elevation of 800 feet above mean sea level.

3C.4 Impacts and Mitigation

3C.4.1 Methodology

Potential significant impacts associated with the proposed development and mitigation measures were developed based on a site reconnaissance, experience, and the review of the following documents:

- Final EIR 1278;
- 2000 SEIR 1278;
- Limited 500-Scale Preliminary Geotechnical Investigation of East Orange Planned Community and Santiago Hills II Planned Community, prepared by GeoSoils, Inc. in October 2004;
- Geohydrolic Review of Groundwater Issues Related to the East Orange and Santiago Hills II Planned Communities, prepared by GeoSciences Support Services Inc. in November 2003; and
- a plan for the reclamation of Irvine Lake Desilting Project in July 1987, and reclamation plan conceptual reclamation grades on April 12, 2001.
The impacts analysis for the project was considered using three distinct approaches. For Santiago Hills II Planned Community, which has a previously certified environmental document (2000 SEIR 1278), the analysis addresses only substantial changes in the revised Santiago Hills II Planned Community from that previously approved, substantial changes in the setting or regulatory setting related to the Santiago Hills II Planned Community study area, or new information related to the Santiago Hills II Planned Community study area that was not known at the time that 2000 SEIR 1278. Such changes are addressed in the impacts analysis, and mitigation is included if necessary. In addition, mitigation measures from the 2000 SEIR 1278 are considered, with a determination as to whether these mitigation measures would be applicable to the revised project or no longer applicable (because the impact would not occur or because the previous mitigation has already been implemented).

For the proposed East Orange Planned Community Area 1 activities, a project-level impact analysis related is included in this environmental document because tentative tract maps have been submitted, allowing for this level of analysis. For the proposed East Orange Planned Community Areas 2 and 3 activities along with remaining areas, a program level of analysis of potential impacts was undertaken, reflecting the conceptual level of planning that has occurred to date.

### 3C.4.2 Thresholds of Significance

This analysis applies the following criteria, according to Appendix G of the State CEQA Guidelines, to determine whether or not the proposed project would result in significant geotechnical impacts. Geotechnical impacts are deemed to be significant if the project would result in any of the following:

- exposure of people or structures to potential substantial adverse effects (including the risk of loss, injury, or death involving rupture of a known earthquake fault; strong seismic ground shaking; seismic-related ground failure, including liquefaction; or landslides);
- location of structures 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 offsite landslide, lateral spreading, subsidence, liquefaction, or collapse;
- substantial soil erosion or the loss of topsoil; or
- location of structures on expansive soils, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property.

### 3C.4.3 Potential Impacts of the Proposed Project

#### 3C.4.3.1 Santiago Hills II Planned Community

_Potential Impact 3C-1 Exposure of People or Structures to Potential Substantial Adverse Effects Including the Risk of Loss, Injury, or Death Involving Rupture of a Known Earthquake Fault; Strong Seismic Ground Shaking; Seismic-related Ground Failure, including Liquefaction; or Landslides_
**Potential Impact 3C-2  Location of Structures 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- and Offsite Landslide, Lateral Spreading, Subsidence, Liquefaction, or Collapse**

Potential Impacts 3C-1 and 3C-2 are considered together.

**2000 SEIR 1278**

There are unavoidable inherent seismic impacts associated with urban development in Southern California due to the region’s exposure to seismic events and earthquakes. However, the 2000 SEIR 1278 determined that, with the implementation of Uniform Building Code requirements and proposed mitigation measures, all potential geotechnical impacts would be considered less than significant.

Approximate estimates of the total grading quantities in the 2000 SEIR 1278 Santiago Hills II Planned Community, north and south, were 6,000,000 and 2,000,000 cubic yards, respectively.

The project actions and geologic hazards potentially affecting the site are related to: mass grading of slopes and ridges; slope stability of natural, cut, and fill slopes; earthquake (seismic) activity; and soil conditions. Mass grading would disturb the natural rock and soils, with displacements and compaction causing a change in the morphology and density of the ground surface. Slope stability impacts may be related to the presence of landslides and unstable bedrock formations, and to high cut and fill slopes. Potential earthquake-related effects include strong ground shaking and liquefaction of saturated alluvial materials. Potential soil-related hazards are expansiveness and fill/natural soil consolidation/settlement.

The mitigation measures identified in 2000 SEIR 1278 are listed below.

**MM G-1. All grading for development areas within the project site will be subject to the regulations included in the City Grading Manual.**

**MM G-2. Removal of colluvium, alluvium, topsoil, landslide debris, and uncompacted artificial fill down to an elevation where suitable foundation earth materials exist will be required prior to placement of fill in areas where these deposits occur. Specific grading recommendations for removal depths will be determined as part of future, more detailed geotechnical studies and will be subject to the approval of the City. Most importantly, the actual required removal depths will be confirmed by field observation during construction.**

**MM G-3. Further slope stability investigations will be conducted pursuant to required future geotechnical studies for the areas of potential slope instability within the proposed limits of development. The level of detail will vary with the local geologic conditions and planned grading. In most cases, a subsurface geologic investigation will be required to evaluate critical lithologic and structural geological interpretations. In general, conclusions pertaining to slope stability in these preliminary studies should be clearly presented and supported by adequate geologic maps, cross sections, and supporting engineering data. Technical review for adequacy of all such reports should be accomplished in accordance with current practices. Reviewing agencies have found that compliance with Chapter 70 of the Uniform Building Code, which regulates earthwork and grading, is important in the mitigation of slope instability during the actual grading phase of development. Should unfavorable slide conditions be encountered, they may be removed during grading or stabilized by means of buttressing or modification of slope orientation, geometry, or inclination.**
**MM G-4.** Detailed geotechnical and soil engineering reports will be prepared subsequent to development of preliminary design layouts and final grading plans (e.g., at the tentative tract map preparation stages). The reports will provide more detailed measures for treatment of excavation (ripping) difficulties, surficial material removals, cut and fill slopes, expansive soils, and liquefaction hazards, as well as measures to avoid rockfall and mudflows, as appropriate. The geotechnical analyses will be subject to technical review and approval of the City or other agencies, as appropriate.

**MM G-5.** All structures within the project site shall be designed and constructed in accordance with seismic safety design criteria specified in the latest building code or as otherwise recommended by a qualified, registered structural engineer. Building plans will be subject to review and approval by the City Building Department to provide an additional level of safety.

**Revised Santiago Hills II Planned Community**

A Limited 500-Scale Preliminary Geotechnical Investigation of Santiago Hills II Planned Community was prepared in 2004 to support the project-level analysis presented in this SEIR/EIR for the Santiago Hills II Planned Community portion of the project (Appendix D-1). As noted above, the report confirms that overall geologic and soil conditions of the project site have not changed since 2000 SEIR 1278. However, additional information and additional mitigation measures beyond those adopted in the 2000 SEIR 1278 are set forth below.

In general, the site condition elements remain essentially unchanged since 2000 SEIR 1278. There would be no substantial changes in the Santiago Hills II Planned Community component of the proposed project, and there is no new information of substantial importance that would change the conclusions as to existence or significance of impacts and available mitigation with respect to geology and soils. Mitigation measures MM G-1 through MM G-5 from 2000 SEIR 1278 would continue to apply.

As part of the proposed project, the applicant has submitted a detailed tentative tract map for the area. The following analysis reflects the additional information provided by the tentative tract map.

The current estimates of the total grading quantities based on the actual grading plan are 6,340,000 and 2,446,000 cubic yards, respectively, slightly more than estimated in the 2000 SEIR 1278.

**Slope Stability**

Two types of cut slopes would be involved in site development: temporary cut slopes (backcuts), which would be filled against to stabilize the in-place bedrock, and permanent cut slopes, which would remain exposed following the grading process. Temporary cut slopes for Santiago Hills II Planned Community may approach 100 feet high. Bedrock in these areas is inherently unstable due to out-of-slope bedding or weak, at times saturated, clayey bedding planes. Failure of a temporary cut slope can have impacts ranging from a nuisance (e.g., slope repair, debris cleanup, and lost time-effort) to a hazard to workers. It is anticipated that the proposed cut slopes along the northern boundary of the project would exhibit adverse geologic conditions (e.g., out-of-slope bedding, highly erosive material, and landslide bedrock) that would require stabilization or buttress fill. Such areas are shown on Figure 3C-2. Failure of permanent cut slopes could result in damage to structures, hazards to people, or a nuisance. This potentially significant new impact would be reduced to a less-than-significant level by the following additional mitigation measures.

**Consolidation and Settlement**

Settlement occurs when compressible soils consolidate under their own weight or due to new imposed loads, such as from fills or foundations. For the proposed project, the primary sources of settlement would be consolidation of alluvial soils in canyons under the fill loads and settlement of deep fills.
Figure 3C-2
Santiago Hills II Planned Community and East Orange Planned Community Area 1
Special Grading Considerations
(particularly deeper than 20 to 30 feet) under their own weight and due to hydro consolidation. The areas of fills greater than 30 feet are shown on Figure 3C-2. Settlement causes distress in improvements and buildings when there is differential settlement across the building or improvement over a short distance. Differential settlement is typically caused by variable soil conditions, such as variation in the thickness of a compressible material or a transition between materials of different compressibility (such as from cut to fill).

Consolidation and settlement impacts would be reduced to less-than-significant levels using established geotechnical engineering practice identified in MM G-4 from 2000 SEIR 1278 and the additional mitigation presented below. The choice and extent of the mitigation measures should consider the thickness and distribution of the compressible materials, anticipated depth of moisture variation, the anticipated amounts of total and differential settlement, the time available before building construction is planned to begin, and the tolerance of the structure for displacement. Based on these factors, the engineers would select the most appropriate methods of mitigation.

**Mitigation Measures**

- **MM 3C-1**  
  **Slopes Will Be Limited to 2:1.** As part of the grading plans and during grading activities, all cut and fill slopes will not exceed slope ratios of 2:1 (horizontal to vertical).

- **MM 3C-2**  
  **Slopes Will Be Stabilized.** As part of the grading plans and during grading activities, cut slopes along the northern boundary of Santiago Hills II Planned Community will be stabilized (through stabilization and/or buttress fills) to avoid the effects of adverse geologic conditions (e.g., out-of-slope bedding or highly erosive materials and landslides).

- **MM 3C-3**  
  **Standard Grading Codes Will Be Applied.** The grading plans and grading activities will comply with all standard grading codes, including:
  - All graded and natural slopes will have a minimum static factor of safety of 1.5 and a minimum pseudostatic (seismic) factor of safety of 1.1.
  - All temporary construction cut slopes will only be left exposed for as short a time as practical prior to filling to reduce the potential for slope failure.
  - All cut slopes will be evaluated and mapped, as they are graded, by a qualified geologist and geotechnical engineer to identify adverse bedding, weak zones, or other features that could affect the stability. If cut slopes are found to expose adverse geologic conditions, then buttresses will be constructed or the slope geometry modified. If cut slopes are found to expose fractured/faulted bedrock and surficial instability, then stabilization fills will be required.
  - All fill slopes will be evaluated for stability by a qualified engineer and/or geologist.

- **MM 3C-4**  
  **Compressible Soils Will Be Identified.** Before submission of final grading plans, the developer will retain a qualified geotechnical engineer and engineering geologist. The geologist/engineer will conduct field observations and testing of onsite soils and formations to identify and define the limits of compressible soils. A final report will be prepared and submitted to the City. This report will identify:
  - thickness and distribution of the compressible materials,
  - anticipated depth of moisture variation,
anticipated amounts of total and differential settlement,
tolerance of the structure for displacement, and
confirmation or modification of mitigation measures for compressible materials.

MM 3C-5 Compressible Soils Will Be Mitigated. Following identification and delineation of compressible materials, the engineers will identify the most appropriate methods of mitigation. Mitigation measures will include one or more of the following.

- removal and/or compaction of compressible natural soils (e.g., alluvium, colluvium, and deeply weathered bedrock) and non-compact fills before placing fill;
- provision of gradual transitions between cuts and fills;
- location of structures away from abrupt transitions;
- location of structures on soils that are relatively uniform;
- compaction of deep fills to at least 95 percent relative compaction, and at high moisture content;
- delay of construction for site improvements and buildings until after until settlement has essentially stopped;
- construction of a drainage system that provides complete control of flows and control landscape watering to preclude water from ponding and/or penetrating the deep fills; and
- where required, foundations designed to span across areas of potential differential settlement, or utilize deep foundations that gain support in similar materials below the settlement zones.

Residual Impacts
Residual impacts would be less than significant.

Potential Impact 3C-3 Substantial Soil Erosion or Loss of Topsoil

2000 SEIR 1278 Analysis of this impact in 2000 SEIR 1278 was included in the general geotechnical evaluation discussed under Potential Impacts 3C-1 and 3C-2, above.

Revised Santiago Hills II Planned Community
Mass grading requires removal of vegetation, stripping of topsoil, and temporary excavations and haul roads to construct stable finished graded areas. Until the project is complete and permanent vegetation and controlled drainage is established, the exposed areas are subject to runoff and erosion. This impact would be reduced to a less-than-significant level with implementation of the following mitigation measures.

Mitigation Measures

MM 3C-6 Implement Sediment Transport Minimization Measures. Grading and construction activities will utilize standard practices—such as dust control, impoundment dikes, erosion control, and revegetation—to minimize potential for
increases in sediment transport. Such measures will be subject to approval of a notice of intent and SWWPP consistent with SWRCB criteria for construction sites.

- **MM 3C-7** Revegetation of Exposed Graded Slopes. All graded slopes (cut and fill), including roadsidess, will undergo permanent revegetation as feasible and appropriate to minimize the potential for erosion and siltation.

- **MM 3C-8** Comply with Corps, CDFG, IRWD, and SCWD Requirements. The grading plans and grading activities will comply with requirements of the water districts, Corps, and CDFG for areas that are close to or drain into Irvine Lake.

**Residual Impacts**

Residual impacts would be less than significant.

**Potential Impact 3C-4  Location of Structures on Expansive Soils, as Defined in Table 18-1-B of the Uniform Building Code**

2000 SEIR 1278

Analysis of this impact in 2000 SEIR 1278 was included in the general geotechnical evaluation discussed under Potential Impacts 3C-1 and 3C-2, above.

**Revised Santiago Hills II Planned Community**

The expansion potential of soils within Santiago Hills II Planned Community, similar to that for surrounding areas, ranges from low to high. These soils can cause distress to structures built directly on them from soil volume change caused by moisture variation, such as seasonal wetting and drying.

Expansive rock behavior is similar to that of expansive soils. The expansiveness is usually related to clayey and shale strata, which expand when wetted. In addition, since expansive strata are tightly confined in the formation, they tend to rebound when the confinement is released by excavation (i.e., removing the overlying weight [overburden] of the cut materials); the greater the depth of excavation, the greater the rebound. Differential rebound/expansion is most severe when adjacent expansive and nonexpansive strata are exposed. This commonly occurs where steeply dipping formations are cut, exposing alternating strata at the surface.

Using established geotechnical engineering practice identified in MM G-4 in 2000 SEIR 1278 and further defined in the following additional mitigation measures, potential significant impacts would be reduced to less-than-significant levels. The following mitigation measures for expansive soils are similar to those for expansive rock. The choice and extent of the mitigation measures should be confirmed by field observations and testing and should consider the thickness and distribution of the expansive materials, anticipated depth of moisture variation, the expansiveness of the materials, the time available before building construction is planned to begin, and the tolerance of the structure for displacement.

**Mitigation Measures**

- **MM 3C-9** Field Observations and Testing Will Be Conducted. Before submission of final grading plans, the developer will retain a qualified geotechnical engineer and engineering geologist. The geologist/engineer will conduct field observations and testing of onsite soils and formations to identify and define the limits of expansive
materials. A final report will be prepared and submitted to the City. This report will include identification of:

- thickness and distribution of the expansive materials,
- anticipated depth of moisture variation,
- expansiveness of the earth materials,
- the tolerance of the structure for displacement, and
- confirmation or modification of mitigation measures for expansive materials.

**MM 3C-10 Fill Materials Will Be Tested.** Upon completion of rough grading and before final grading begins, a qualified geotechnical engineer and/or engineering geologist will:

- obtain representative samples of near-surface soils and formations exposed in cut areas,
- identify expansion potential, and
- locate and define the limits of the expansive soils.

**MM 3C-11 Expansive Soils Will Be Mitigated.** Following identification and delineation of expansive materials, the engineers will identify the most appropriate methods of mitigation. Mitigation measures will include one or more of the following.

- excavation and replacement with nonexpansive fill materials;
- moisture conditioning of the expansive material to a high moisture content to cause preswelling, then capping with nonexpansive fill;
- compliance with the Uniform Building Code, which specifies special foundation/slab design for residential construction on soils having an expansion potential of “low” or greater;
- designing foundations to span across areas of potential differential expansion; and
- submission of special foundation and slab design by the geotechnical and structural engineers and approval of this design by the building official.

**Residual Impacts**

Residual impacts would be less than significant.

**3C.4.3.2 East Orange Planned Community Area 1**

**Potential Impact 3C-1 Exposure of People or Structures to Potential Substantial Adverse Effects Including the Risk of Loss, Injury, or Death Involving Rupture of a Known Earthquake Fault; Strong Seismic Ground Shaking; Seismic-related Ground Failure, including Liquefaction; or Landslides**
Potential Impact 3C-2  Location of Structures 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- and Offsite Landslide, Lateral Spreading, Subsidence, Liquefaction, or Collapse

Potential Impacts 3C-1 and 3C-2 are considered together.

The project actions and geologic hazards potentially affecting East Orange Planned Community Area 1 are related to: mass grading of slopes and ridges; slope stability of natural, cut, and fill slopes; earthquake (seismic) activity; and soil conditions. Mass grading would disturb the natural rock and soils, with displacements and compaction causing a change in the morphology and density of the ground surface. Slope stability impacts may be related to the presence of landslides and unstable bedrock formations, and to high cut and fill slopes. The potential earthquake-related effects include strong ground shaking and liquefaction of saturated alluvial materials. Potential soil-related hazards are expansiveness and fill consolidation/settlement. These factors are addressed below.

Bedrock Units
Development would be subject to the engineering characteristics of the onsite bedrock units. Older bedrock units that occur at the extreme northeast portion of the project site, namely, the Williams and Ladd Formations, are not addressed below, as they do not occur within any of the areas of planned development and would have no known impact on the project.

East Orange Planned Community Area 1 is generally underlain by soft to moderately hard bedrock that is expected to require easy to difficult ripping; no blasting is anticipated. Development areas that would require engineering for poor slope stability characteristics (e.g., La Vida member of the Puente Formation and the Sespe/Vaqueros Formation) occur throughout most of the project site. Development areas that would require engineering for highly expansive bedrock and soils (e.g., La Vida member of the Puente Formation) occur locally in the southern part of the project site. Where encountered, diatomaceous earth would require special compaction quality control procedures. Though more difficult to work with, these geotechnical considerations would not preclude or limit onsite development. Implementation of standard engineering practices, as outlined in the City Grading Manual and the City’s Guidelines for Landform Grading and Planting, is required as part of the project. The following mitigation measures would reduce impacts to less-than-significant levels.

Faulting and Seismicity

Regional Seismicity
The Alquist-Priolo Earthquake Fault Zoning Act was adopted to mitigate the hazard of surface fault rupture along active faults. For the purpose of this act, the state has defined an active fault as having “had surface displacement during Holocene time” (i.e., during the previous 11,000 years). In accordance with the act, the state has delineated earthquake fault zones along active faults throughout the state. The designated zone closest to the property appears to be located about 5 miles to the north along the Whittier-Elsinore fault zone. The subject site is not located within a designated earthquake fault zone.

The possibility of ground acceleration or shaking at the site may be considered as approximately similar to the Southern California region as a whole. The guidelines presented in Special Publication 117 (state of California) would be utilized when assessing liquefaction potential. Minimum guidelines, as presented in the latest edition of the Uniform Building Code, would also be included in the project design recommendations.
The potential for surface fault rupture on the proposed project property is considered less than significant due to the absence of any known active or potentially active faults on or in the immediate vicinity of the project site. Experience has demonstrated that, with proper consideration of probable earthquake shaking, proper application of current design standards for buildings, grading, landslide stabilization, and ground improvement together with proper inspection can minimize the potential for severe damage to proposed structures.

Secondary Ground Effects
The potential for secondary ground effects from strong seismic shaking, such as liquefaction, lurching, localized lateral spreading, and sudden soil settlement, is considered negligible for East Orange Planned Community Area 1 since alluvium and colluvial soils are shallow and would be completely removed during site grading associated with development. Furthermore, no significant zones of saturated materials have been encountered or are anticipated within the planned development area. Impacts would be less than significant.

For each aspect of faulting and seismicity noted in the preceding paragraphs, impacts would be less than significant.

Grading and Soils
Development of East Orange Planned Community Area 1 as planned would involve mass grading of approximately 84 percent of that area. The remaining 16% would be open space. Natural slopes would be altered by cutting and placement of compacted fill, and low-lying areas would have surficial soils removed and replaced with compacted fill. Deep fills are planned at the northern part of the site, along SR-241. In general, the highest elevations along the easterly ridgelines and adjacent to the transportation corridors would remain in their natural state. Maximum cuts and fills would be 140 and 175 feet, respectively.

Development would also require engineered surficial units, specifically for the treatment of landslide materials and expansive soils. Several small- to moderate-size landslides are present within the planned development areas. Landslide mitigation measures would consist chiefly of complete removal of all landslide material. Where complete removals are not practical, landslides may be stabilized by buttressing with an earth fill.

Areas of special grading considerations are shown on Figure 3C-2.

The project would have a less-than-significant impact with the implementation of mitigation measures listed below.

Fill Materials
Onsite materials are suitable for use as compacted fills. Oversized material (generally greater than 8 inches in diameter) may be generated from bedrock excavations in deeper cut areas, or where well-indurated beds (i.e., beds hardened by heat or pressure) are encountered, that would require special handling for use in fills. In addition, terrace deposits in areas of cut may also generate oversized material requiring special handling for use in fills. Special handling may include the use of rock trucks, and/or rock burial techniques (i.e., isolated rock, rock blankets, or rock windrows).

The project would have a less-than-significant impact with the implementation of the mitigation measures listed below.
Slope Stability
Cut and fill slopes should be planned with slope ratios of 2:1 (horizontal to vertical) or flatter and have a calculated factor of safety of 1.5 and 1.1 for static and pseudo-static conditions, respectively. It is anticipated that the proposed cut slopes along the northern boundary of the project would exhibit adverse geologic conditions (i.e., out-of-slope bedding, highly erosive materials, and landslides) that would require stabilization (i.e., stabilization and/or buttress fills). Such areas are shown on Figure 3C-2.

Two types of cut slopes would be involved in site development: temporary cut slopes (backcuts), which would be filled against to stabilize the in-place bedrock, and temporary cut slopes, which may approach 100 feet high. Bedrock in these areas is inherently unstable due to out-of-slope bedding or weak, at times saturated, clayey bedding planes. Failure of a temporary cut slope can have impacts ranging from a nuisance (e.g., slope repair, debris cleanup, and lost time-effort) to a hazard to workers. The other type is a permanent cut slope, which would remain exposed following the grading process. Failure of permanent cut slopes could result in damage to structures, hazards to people, or a nuisance. This impact would be reduced to a less-than-significant level by the mitigation measures listed below.

Rippability
The majority of the bedrock units in East Orange Planned Community Area 1 are expected to be excavatable to moderate depths (i.e., planned depths). Excavation difficulties would be expected where relatively deep cuts are planned and localized hard rock areas would occur even at relatively shallow depths. These localized areas may require special excavation techniques and produce oversized material

Preliminary discussions with engineers and contractors familiar with construction of SR-241—which separates Santiago Hills II Planned Community from the East Orange Planned Community and cuts through some of the same formations to similar depths—indicate that no blasting was required south of Santiago Creek. Also, borings drilled into the volcanics were accomplished with auger equipment and coring was not required, indicating that even these materials are rippable and blasting would not be required. Blasting is not currently anticipated. Accordingly, the impact of rippability would be less than significant. However, blasting cannot be entirely ruled out. If blasting were required, following the standard safety and control procedures and any that would be imposed by the blasting permit process would reduce the impact to a less-than-significant level.

Subdrainage
Subdrains would be constructed beneath planned canyon fills and cut slope and landslide stabilizations. The location depths and extent of subdrains should be confirmed by inground observations and recommendations by the project geotechnical engineer and engineering geologist. Commonly, subdrains are placed in canyon fill areas subsequent to removal of alluvial soils, and prior to fill placement. In stabilization fills, the subdrains are placed at the back of the stabilization fill, against the bedrock contact. The purpose of these subdrains is to provide an outlet for groundwater, reducing the likelihood of potential adverse effects of groundwater buildup (e.g., increased settlement, hydrostatic pressures, and nuisance occurrences). This impact would be less than significant.

Consolidation and Settlement
Settlement occurs when compressible soils consolidate under their own weight or due to new imposed loads, such as from fills or foundations. For the proposed project, the primary sources of settlement are consolidation of alluvial soils in canyons under the fill loads and settlement of deep fills (particularly deeper than 20 to 30 feet) under their own weight and due to hydro consolidation. The areas of fills greater than 30 feet are shown on Figure 3C-2. Settlement causes distress in improvements and buildings when there is differential settlement across the building or improvement over a short distance. Differential settlement is typically caused by variable soil conditions, such as variation in thickness of a
compressible material or a transition between materials of different compressibility (such as from cut to fill).

The mitigation measures identified below would reduce the potential impacts due to consolidation to less-than-significant levels.

**Mitigation Measures**

Implementation of MM 3C-1, MM 3C-3, MM 3C-4, and MM 3C-5, as well as the following.

- **MM 3C-12** *Grading and Planting Plans Will Conform to City Guidelines.* Prior to obtaining grading permits, the developer will ensure that grading and planting plans comply with the City Grading Manual and the City’s Guidelines for Landform Grading and Planting. During construction, the contractor will ensure that all grading and landscape work complies with the regulations included in the City Grading Manual and the City’s Guidelines for Landform Grading and Planting.

- **MM 3C-13** *A Detailed Geotechnical Study Will Be Submitted.* Prior to approval of grading plans, a detailed geotechnical study will be prepared and submitted to the City for review. The study will include:
  - specific grading recommendations for colluvium, alluvium, topsoil, landslide debris, and uncompacted artificial fill;
  - slope stability investigations for the areas of potential slope instability within the proposed limits of development (Based on local geologic conditions and planned grading areas, a subsurface geologic investigation will be required to evaluate critical lithologic and structural geological interpretations. Conclusions pertaining to slope stability will be clearly presented and supported by geologic maps, cross sections, and supporting engineering data. Technical review for adequacy of all such reports will be accomplished in accordance with current practices);
  - outline of compliance with Chapter 70 of the Uniform Building Code for slope instability during the actual grading phase of development; and
  - measures to avoid unfavorable slide conditions identified in the study (Measures related to soil removal during grading or stabilization would include buttressing or modification of slope orientation, geometry, or inclination).

- **MM 3C-14** *A Detailed Geotechnical and Soils Report Will Be Submitted.* After development of preliminary design layouts and final grading plans (e.g., at the tentative tract map preparation stages), a detailed geotechnical report and a soil engineering report will be prepared and submitted to the City for technical review and approval by the City or other agencies, as appropriate. The reports will provide detailed measures for treatment of excavation (ripping) difficulties, surficial material removals, cut and fill slopes, expansive soils, and liquefaction hazards, as well as measures to avoid rockfall and mudflows.

- **MM 3C-15** *Removal Depths Will Be Verified.* Prior to final grading, a qualified geotechnical engineer and/or engineering geologist will confirm actual required removal depths for colluvium, alluvium, topsoil, landslide debris, and uncompacted artificial fill.
- **MM 3C-16**  **Remove Unstable Deposits.** Prior to placement of fill in areas where these unstable deposits occur, the contractor will remove colluvium, alluvium, topsoil, landslide debris, and uncompacted artificial fill down to suitable foundation earth materials.

- **MM 3C-17**  **Submit Building Plans to the City.** Prior to construction, building plans will be prepared and submitted to the City Building Department for review and approval. Plans will show that all structures within the project site have been designed, and will be constructed, in accordance with seismic safety design criteria specified in the latest building code, or as otherwise recommended by a qualified, registered structural engineer.

- **MM 3C-18**  **Stabilize All Cut Slopes.** As part of the grading plans and during grading activities, cut will be stabilized (through stabilization and/or buttress fills) to avoid the effects of adverse geologic conditions (e.g., out-of-slope bedding, highly erosive materials, and landslides).

**Residual Impacts**
Residual impacts would be less than significant.

**Potential Impact 3C-3  Substantial Soil Erosion or Loss of Topsoil**
Mass grading requires removal of vegetation, stripping of topsoil, and temporary excavations and haul roads to construct stable finished graded areas. Until the project is complete and permanent vegetation and controlled drainage is established, the exposed areas are subject to runoff and erosion. This impact would be reduced to a less-than-significant level with implementation of the following mitigation measures.

**Mitigation Measures**
Implementation of MM 3C-6, MM 3C-7, and MM 3C-8.

**Residual Impacts**
Residual impacts would be less than significant.

**Potential Impact 3C-4  Location of Structures on Expansive Soils, as Defined in Table 18-1-B of the Uniform Building Code**
The expansion potential of soils within East Orange Planned Community Area 1 is similar to that for surrounding areas, and ranges from low to high. These soils can cause distress to structures built directly on them due to soil volume change caused by moisture variation, such as seasonal wetting and drying.

Expansive rock behavior is similar to that of expansive soils. The expansiveness is usually related to clayey and shale strata, which expand when wetted. In addition, since expansive strata are tightly confined in the formation, they tend to rebound when the confinement is released by excavation (i.e., removing the overlying weight [overburden] of the cut materials); the greater the depth of excavation, the greater the rebound. Differential rebound/expansion is most severe when adjacent expansive and
nonexpansive strata are exposed. This commonly occurs where steeply dipping formations are cut, exposing alternating strata at the surface.

With mitigation, the potential impacts due to expansive material would be reduced to less-than-significant levels using established geotechnical engineering practice. The following mitigation measures for expansive soil are similar to those for expansive rock.

**Mitigation Measures**

Implementation of MM 3C-9 through MM 3C-11.

**Residual Impacts**

Residual impacts would be less than significant.

### 3C.4.3.3 East Orange Planned Community Areas 2 and 3 and Remaining Areas

**Potential Impact 3C-1** Exposure of People or Structures to Potential Substantial Adverse Effects Including the Risk of Loss, Injury, or Death Involving Rupture of a Known Earthquake Fault; Strong Seismic Ground Shaking; Seismic-related Ground Failure, including Liquefaction; or Landslides

**Potential Impact 3C-2** Location of Structures 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- and Offsite Landslide, Lateral Spreading, Subsidence, Liquefaction, or Collapse

Potential Impacts 3C-1 and 3C-2 are considered together.

The project actions and geologic hazards potentially affecting East Orange Planned Community Areas 2 and 3 and remaining areas are related to: mass grading of slopes and ridges; slope stability of natural, cut, and fill slopes; earthquake (seismic) activity; and soil conditions. Mass grading would disturb the natural rock and soils, with displacements and compaction causing a change in the morphology and density of the ground surface. Slope stability impacts may be related to the presence of landslides and unstable bedrock formations, and to high cut and fill slopes. The potential earthquake-related effects include strong ground shaking and liquefaction of saturated alluvial materials. Potential soil-related hazards are expansiveness and fill consolidation/settlement. These factors are addressed below.

**Bedrock Units**

Development would be subject to the engineering characteristics of the onsite bedrock units. East Orange Planned Community Areas 2 and 3 and remaining areas are generally underlain by soft to hard bedrock that is expected to require easy to difficult ripping; no blasting is anticipated. Development areas that would require engineering for poor slope stability characteristics (e.g., La Vida member of the Puente
Formation and the Sespe/Vaqueros Formation) occur throughout most of the project site. Development areas that would require engineering for highly expansive bedrock and soils (e.g., La Vida member of the Puente Formation) occur locally adjacent to Limestone Canyon. Where encountered, diatomaceous earth would require special compaction quality control procedures. Though more difficult to work with, these geotechnical considerations would not preclude or limit onsite development. Implementation of standard engineering practices, as outlined in the City Grading Manual and the City’s Guidelines for Landform Grading and Planting, would reduce the potential impacts to a less-than-significant level.

The project would have a less-than-significant impact with the implementation of MM 3C-12 through MM 3C-17.

**Faulting and Seismicity**

**Regional Seismicity**

The potential for surface fault rupture on the proposed project property is considered less than significant due to the absence of any known active or potentially active faults on or in the immediate vicinity of the project site.

The potential for severe damage to the proposed structures can be minimized with proper consideration of probable earthquake shaking; proper application of the current design standards for buildings, grading, landslide stabilization, and ground improvement; and proper inspection. The guidelines, presented in the State of California’s Special Publication 117, would be utilized when assessing liquefaction potential. Minimum guidelines, as presented in the latest edition of the Uniform Building Code, would also be included in the project design recommendations. Earthquake fault impacts would be less than significant.

**Secondary Ground Effects**

Secondary ground effects from strong seismic shaking include liquefaction, lurching, localized lateral spreading, ground cracking, landsliding, and sudden soil settlement. These effects could be expected to occur to a limited degree within the project site. The current extent of near-surface native cohesionless soils and depths to groundwater combine to create the potential for liquefaction along Limestone Canyon and around Irvine Lake. However, remedial grading proposed includes complete or partial removal of liquefiable soils, in conjunction with more robust foundation recommendations, to accommodate the potential effects of liquefaction. Such project design would reduce impacts to less-than-significant level.

**Grading and Soils**

Planning for the development of East Orange Planned Community Areas 2 and 3 and remaining areas is in the programmatic stage. The project proposes only general plan and zoning designations for East Orange Planned Communities Commercial Recreation Sector 9 and Commercial Recreation Sector 8. Only program-level conceptual planning studies are available for analysis, and no tentative maps or grading plans have been prepared for these areas (with the exception of the proposed fire station).

Grading within the reservoir boundary property would occur in connection with the East Orange Planned Community Area 2 residential, golf course, and commercial recreational developments. This grading would primarily consist of construction of fill slopes to support an access roadway across the Limestone Creek, residential development within East Orange Planned Community Area 2, and commercial recreational and golf course/marina/lodge development adjacent to Irvine Lake within Sectors 8 and 9. In addition, remedial grading in connection with the necessary fill slopes would be required to provide competent soil foundation for the proposed development. Remedial grading requirements depend on the type of development (structural or nonstructural) proposed to be supported by the fill slopes encroaching into the reclaimed reservoir area. In addition, some excavation would occur below an elevation of 760 feet to create compensating capacity in the reservoir to offset areas of fill.
Excavation would be implemented in accordance with measures that are designed to ensure that reservoir water levels are controlled at elevations that are sufficiently low, so as to allow for creation of compensating capacity using dry land excavation techniques. These measures may include one or more of the following:

- scheduling excavation activities to coincide with low reservoir levels;
- water district release and use of reservoir water to lower reservoir water elevations; and/or
- creation of temporary berms or similar temporary barriers to prevent inundation of the excavation area.

Grading improvements would include slope protection in Sectors 9a, 9b, and 8 as well as in East Orange Planned Community Area 2 where they would come into contact with the reservoir water surface. Fill slope protection features would be extended to the maximum anticipated wave action height, and would be selected to protect the slopes and development areas from wave action, changing reservoir water levels, and saturation and/or continuous wetting and drying action. Slope protection features that may be implemented with construction activities include any one, or a combination of, the following: riprap, geofabric, armorflex, concrete aprons, and soil cement. Riprap may be buried, and soil cement may be covered with a layer of native soil material to enhance habitat value after stabilization. The impacts to the reservoir and any resources within the reservoir as a result of this activity are discussed in the Section 3D, Biological Resources.

The water districts and their subcontractors are concluding extraction activities in this area and have started reclamation in accordance with the SMARA, County grading permits, and the mining subcontractors’ SMARA reclamation plan approved by the County. These reclamation activities were completed in June 2004. As part of these reclamation activities, reclaimed land was created and the shoreline for the reservoir was recontoured. This reclaimed land is within the area proposed by the project for general plan and zoning designations consistent with use as a golf course and marina. Additional project grading, including fill and stabilization measures, would be needed in the area of reclamation and within the reclaimed reservoir area to complete the golf course and marina.

As part of project development in East Orange Planned Community Area 2, Sectors 8, 9a, and 9b, natural slopes would be altered by cutting and placement of compacted fill. Low-lying areas would have surficial soils removed and replaced with compacted fill. High cut slopes are planned along ridges and along the flanks of the dominant northern ridgeline. Extensive fills are proposed adjacent to and within Irvine Lake property. These fills may recontour the reservoir shoreline. In general, the highest elevations along the main east-west ridgeline trending would remain at or near their natural state. All slopes, both cut and fill, would have drainage benches every 30 feet of vertical change.

Development would also require engineered surficial units, specifically for the treatment of landslide materials and expansive soils. Several small- to moderate-sized landslides are present within the planned development areas. Areas of special grading considerations are shown on Figure 3C-3.

Onsite materials are suitable for use as compacted fills. Oversized material (generally greater than 8 inches in diameter) may be generated from bedrock excavations in deeper cut areas, or where well-indurated beds are encountered, that would require special handling for use in fills. In addition, terrace deposits in areas of cut may also generate oversized material requiring special handling for use in fills. Special handling may include the use of rock trucks, and/or rock burial techniques (e.g., isolated rock, rock blankets, or rock windrows).
The project would have a less-than-significant impact with the implementation of the assumed grading design discussed above and the mitigation measures listed below.

**Fill Materials**
Onsite materials are suitable for use as compacted fills. Oversized material (generally greater than 8 inches in diameter) may be generated from bedrock excavations in deeper cut areas, or where well-indurated beds are encountered, and would require special handling for use in fills. In addition, terrace deposits in areas of cut may also generate oversized material requiring special handling for use in fills. Special handling may include the use of rock trucks and/or rock burial techniques (e.g., isolated rock, rock blankets, or rock windrows).

The project would have a less-than-significant impact with the implementation of MM 3C-14 through MM 3C-16.

**Slope Stability**
Cut and fill slopes should be planned with slope ratios of 2:1 (horizontal to vertical) or flatter and have a calculated factor of safety of 1.5 and 1.1 for static and pseudo-static conditions, respectively. It is anticipated that the proposed cut slopes would exhibit adverse geologic conditions (e.g., out-of-slope bedding, highly erosive materials, and landslides) that would require stabilization or buttress fill. Such areas are shown on Figure 3C-3.

Two types of cut slopes would be involved in site development: temporary cut slopes (backcuts), which would be filled against to stabilize the in-place bedrock, and temporary cut slopes, which may approach 100 feet high. Bedrock in these areas is inherently unstable due to out-of-slope bedding or weak, at times saturated, clayey bedding planes. Failure of a temporary cut slope can have impacts ranging from a nuisance (e.g., slope repair, debris cleanup, and lost time-effort) to a hazard to workers. The other type is permanent cut slopes, which would remain exposed following the grading process. Failure of permanent cut slopes could result in damage to structures, hazards to people, or a nuisance. This impact would be less than significant with the mitigation measures below.

**Rippability**
The majority of the bedrock units in East Orange Planned Community Areas 2 and 3 and remaining areas are expected to be excavatable to moderate depths (i.e., planned depths). Excavation difficulties would be expected where relatively deep cuts are planned and localized hard rock areas would occur even at relatively shallow depths. These localized areas may require special excavation techniques and produce oversized material.

Preliminary discussions with engineers and contractors familiar with construction of SR-241, which separates Santiago Hills II Planned Community from the East Orange Planned Community and cuts through some of the same formations to similar depths, indicate that no blasting was required south of Santiago Creek. Blasting is not currently anticipated. Accordingly, the impact of rippability would be less than significant.

However, blasting cannot be entirely ruled out. If blasting were required, the impact would be reduced to a less-than-significant level if standard safety and control procedures and procedures imposed by the blasting permit process were followed. If blasting were required, blasting noise and vibration would be considered a nuisance by people in the project area (see Section 3L, Noise). Issues of hazardous materials and human health are discussed in Section 3O, Hazards and Hazardous Materials. No significant impact on geology and soils would occur, and impacts would be less than significant.
Subdrainage
Subdrains would be constructed beneath planned canyon fills and cut slope and landslide stabilizations. The location depths and extent of subdrains should be confirmed by ingrating observations and recommendations by the project geotechnical engineer and engineering geologist. Commonly, subdrains are placed in canyon fill areas subsequent to removal of alluvial soils, and prior to fill placement. In stabilization fills, the subdrains are placed at the back of the stabilization fill, against the bedrock contact. The purpose of these subdrains is to provide an outlet for groundwater, reducing the likelihood of potential adverse effects of groundwater buildup (e.g., increased settlement, hydrostatic pressures, and nuisance occurrences). This impact would be less than significant.

Consolidation and Settlement
Settlement occurs when compressible soils consolidate under their own weight or due to new imposed loads, such as from fills or foundations. For the proposed project, the primary sources of settlement are 1) consolidation of alluvial soils in canyons under the fill loads and 2) settlement of deep fills (particularly deeper than 20 to 30 feet) under their own weight and due to hydro-consolidation. The grading plans have not been developed yet for this area, so the locations of deep fill areas are not known. Settlement causes distress in improvements and buildings when there is differential settlement across the building or improvement over a short distance. Differential settlement is typically caused by variable soil conditions, such as variation in thickness of a compressible material or a transition between materials of different compressibility (such as from cut to fill).

After proper mitigation, the potential impacts due to consolidation and settlement could be reduced to less-than-significant levels using established geotechnical engineering practice.

Mitigation Measures
Implementation of MM 3C-1, MM 3C-3 through MM 3C-5, and MM 3C-12 through 3C-18, as well as the following mitigation measure.

- **MM 3C-19  Stabilize or Remove Lake Reclamation Fills in East Orange Planned Community Area 2, Sector 8.** As part of the grading plans and activities for Sector 8, some uncompacted (non-engineered) reservoir reclamation fills will be removed or stabilized in areas where Sector 8 permanent fills are to be placed to accommodate construction of permanent, structural improvements.

Residual Impacts
Residual impacts would be less than significant.

Potential Impact 3C-3  Substantial Soil Erosion or Loss of Topsoil
Mass grading requires removal of vegetation, stripping of topsoil, and temporary excavations and haul roads to construct stable finished graded areas. Until the project is complete and permanent vegetation and controlled drainage is established, the exposed areas are subject to runoff and erosion. Mitigation measures would consist chiefly of developing and implementing temporary drainage and erosion control plans. The plans should follow the guidelines established by the grading ordinances. For areas that are close to or drain into Irvine Lake, additional procedures may be necessary to meet the requirements of the water districts, the Corps, and CDFG. The plans should be implemented before the start of grading. The plans and implementation should be updated and modified to accommodate changes as the grading continues.
progresses. This impact would be reduced to a less-than-significant level with implementation of the following mitigation measures.

**Mitigation Measures**
Implementation of MM 3C-6 through MM 3C-8.

**Residual Impacts**
Residual impacts would be less than significant.

**Potential Impact 3C-9  Location of Structures on Expansive Soils, as Defined in Table 18-1-B of the Uniform Building Code**
The expansion potential of soils within East Orange Planned Community Areas 2 and 3 and remaining areas is similar to that for surrounding areas, and ranges from low to high. These soils can cause distress to structures built directly on them due to soil volume change caused by moisture variation, such as seasonal wetting and drying.

Expansive rock behavior is similar to that of expansive soils. The expansiveness is usually related to clayey and shale strata, which expand when wetted. In addition, since expansive strata are tightly confined in the formation, they tend to rebound when the confinement is released by excavation (i.e., removing the overlying weight [overburden] of the cut materials); the greater the depth of excavation, the greater the rebound. Differential rebound/expansion is most severe when adjacent expansive and nonexpansive strata are exposed. This commonly occurs where steeply dipping formations are cut, exposing alternating strata at the surface.

After proper mitigation, the potential impacts due to expansive material could be reduced to a less-than-significant level using established geotechnical engineering practice.

**Mitigation Measures**
Implementation of MM 3C-9 through MM 3C-11.

**Residual Impacts**
Residual impacts would be less than significant.

**3C.4.3.4  MPAH Amendments**
The proposed MPAH amendments would delete and downgrade roads in the MPAH. They would not have an impact on geology and soils.
3C.4.3.5 Cumulative Impacts

Contemporary construction techniques and regulations, as described in this section, ensure that the impacts of individual projects do not result in a significant cumulative effect. Other projects in the region may result in impacts similar to those described for the proposed project. Most of the potential impacts raised in this section, including those related to seismic safety, landslide, soil erosion, and construction on unstable soils, are typically avoided through site-specific engineering and construction techniques. Furthermore, the mitigation measures described above for this project would ensure that it would not result in a significant cumulative impact in these issue areas.