EIR–LEVEL
UPDATE GEOTECHNICAL REPORT

OTAY MESA
COMMUNITY PLAN UPDATE
SAN DIEGO, CALIFORNIA

GEOCON
INCORPORATED

GEOTECHNICAL
ENVIRONMENTAL
MATERIALS

PREPARED FOR

RECON ENVIRONMENTAL, INC.
SAN DIEGO, CALIFORNIA

OCTOBER 9, 2012
PROJECT NO. 07254-42-03

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October 9, 2012

Recon Environmental, Inc.
1927 Fifth Avenue
San Diego, California 92101

Attention: Ms. Stephanie Whitmore

Subject: EIR–LEVEL UPDATE GEOTECHNICAL REPORT
OTAY MESA COMMUNITY PLAN UPDATE
SAN DIEGO, CALIFORNIA

Reference:

1. *EIR Level Geotechnical Report, Otay Mesa Community Plan Update, San Diego, California* prepared by Geocon Incorporated dated July 9, 2004.

2. *EIR–Level Geotechnical Report Addendum, Otay Mesa Community Plan Update, San Diego, California,* prepared by Geocon Incorporated, dated December 5, 2006 (Project No. 07154-42-01).

3. *Hazardous Materials Technical Study; Otay Mesa Community Plan Update, San Diego, California,* prepared by Geocon Consultants Incorporated, dated July 27, 2007.

4. *Otay Mesa Community Plan Update,* April 6, 2011 Public Draft.

Dear Ms. Whitmore:

In accordance with your request, we have prepared this update to the above referenced report (Reference 2) to update soil and geologic information specific to the community plan developed by the City of San Diego Planning Department. This information is for purposes of augmenting the Environmental Impact Report (EIR) for the proposed Community Plan Update to the current land use map. Conclusions and recommendations of this study are based on review of available published geotechnical reports in our files, previous subsurface geotechnical exploration, site reconnaissance of existing conditions, and geological aspects with respect to development.

The Otay Mesa Community Plan Update considers the portion of Otay Mesa adjacent to State Highway 905 from Interstate 805 to the eastern edge of the City of San Diego limits. The study area is further defined as various areas of development types per the Otay Mesa Land Use Map. The accompanying report presents soil and geologic conditions superimposed over the land use map. This report also provides preliminary recommendations regarding the geotechnical aspects of development.

Should you have questions regarding this report, or if we may be of further service, please contact the undersigned at your convenience.

Very truly yours,

GEOCON INCORPORATED

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EIR–LEVEL UPDATE GEOTECHNICAL REPORT

1. PURPOSE AND SCOPE

This report provides soil and geologic information pertinent to the current Otay Land Use Map for the Otay Mesa Community Plan Amendment Update. The Community Plan Update area consists of the portion of Otay Mesa adjacent to Highway 905 (SR-905) from Interstate 805 (I-805) to the eastern edge of the City of San Diego (see *Vicinity Map*, Figure 1) and extends from Otay Mesa Road on the north to the U.S.A/Mexico border on the south. Within the community plan area, the proposed update is concerned mostly with remaining undeveloped land (although developed residential and industrial land exist in the overall area) and development types that will result in a variable-use area in the southeast portion of San Diego.

The purpose of this study was to identify site soil and geologic conditions, potential geotechnical constraints, and to provide preliminary recommendations pertaining to geotechnical aspects of development for use in providing the necessary geotechnical information for inclusion in the project Environmental Impact Report. More specifically, this addendum study included the following:

- Identification of site soil conditions and general site geology;
- Review of available published geologic literature and maps, and geotechnical reports prepared for developments in the study area that are in our files;
- Reconnaissance level geological mapping performed on November 20, 2006;
- Preparation of this addendum report.

A listing of published documents reviewed as part of this study is presented at the end of this report (see *List of References*). Geotechnical reports prepared by Geocon Incorporated for development of sites within Otay Mesa were also reviewed, but are not shown on the *List of References* due to the large volume of documents. The recommendations presented herein are based on an analysis of the data obtained from our geologic reconnaissance mapping, review of published reports and site-specific geotechnical reports available in our files and our understanding of planned development associated with the community plan update.

2. SITE DESCRIPTION AND PROPOSED PROJECT DEVELOPMENT

The community plan area is irregularly shaped with an elongated east-west orientation; geographically, it is generally flat mesa broken on the north by irregular bluffs and canyons that drain into the Otay River Valley. On the south, the mesa is drained southward by Spring Canyon into the Tijuana River. To the southwest and west, steep bluffs descend into river and coastal plains and the community of San Ysidro. Eastward, the flat mesa gradually rises into the foothills of the San Ysidro Mountains. Historically, Otay Mesa has been used for agriculture and livestock grazing purposes.

Otay Mesa is largely within the City of San Diego municipal boundary along its northern and eastern edges; however, the mesa extends southward across the United States and Mexico International Boundary on the south, but the International Boundary marks the southern extent of the Community Plan limits and I-805 approximately marks its western limits.

Overall, the community plan area consists of undeveloped property, agricultural lands, and developed areas with residential and commercial projects. Undeveloped areas support native grasses, herbs, and chaparral.

We understand proposed project is a comprehensive update of the Otay Mesa Community Plan. The current land use map shows general land use categories to include 1) open space, parks, and institutional; 2) commercial including community, regional, and heavy; 3) residential varying from very low to medium high; 4) village centers; and 5) industrial consisting of light to heavy industrial, business parks, and international business and trade.

Circulation components involve construction and realignment of Airway Road as a major arterial roadway to decrease east-west traffic volume on SR-905. Airway Road will essentially run south of and parallel to SR-905 and connect to State Route 125 (SR-125) at the east end of the community plan area. Dependent upon final alignment of Airway Road, bridges may be required to span open space canyon areas. Beyer Road will also be extended from the west end of the site to the mesa top to create a westerly connection with San Ysidro and a direct link to Interstate 5. Mass grading will be required to construct pads and additional residential connector streets. Infrastructure will likely include underground utilities, roadways, and bridges.

Locations and descriptions provided herein are based on our review of geotechnical reports available in our files, observations during our field reconnaissances, discussions with the design team, review of the draft scenarios and our understanding of the project. Geocon Incorporated should be contacted to review development plans once they become available to evaluate potential impacts and to determine the necessity of providing revised and/or additional recommendations based on planned site usage.

3. SOIL AND GEOLOGIC CONDITIONS

Based on review of published geologic documents and geotechnical reports in our files, soil, and geologic features observed during the field reconnaissance, the site is underlain by three surficial soil deposits and four geologic formations. The surficial soils include artificial fill (unmapped), topsoil/colluvium (unmapped), and alluvium. The geologic formations include Pleistocene Very Old Paralic Deposits (formerly Lindavista Formation), Upper Pliocene San Diego Formation, and Pliocene Otay Formation.

Large complex landslide deposits have been mapped along the southwest, west, and northwest edges of Otay Mesa, and on both sides of the International Border with Mexico. We have also mapped suspected landslides, inferred from topography, along canyon sidewalls during our field reconnaissance. The approximate limits of the surficial deposits, geologic formations and landslide deposits are shown on Figures 2 and 3 (*Geologic Maps*, map pocket).

Geology as shown on the maps is based on reported geology by Kennedy and Tan (DMG 1975, 1977 and 1999) and does not reflect recently developed areas: 1) residential areas north of SR-905, California Terraces, Dennery Ranch, and Robinhood Ridge; 2) commercial industrial, Oceanview Hills Corporate Center, Piper Ranch Business Park, and business parks south of SR-905. Landslides on these developed areas may have been mitigated during mass grading of the projects. Some landslides, however, may exist in open-space areas separating the developments.

The surficial soils and geologic formations are discussed below. Landslide deposits are discussed in Section 6, Geologic Hazards.

3.1 Undocumented Fill (Unmapped)

Undocumented fill was observed during our field reconnaissance in the central portion of the subject area south of SR-905. Undocumented fill was interpreted as loose soil with concrete debris, trash, and miscellaneous materials. The fills appear to have been placed for a variety of purposes including: access barriers, material disposal areas included household trash, and vegetation. Minor undocumented fills also were observed primarily as a result of agricultural pursuits; and possibly for control of surface water along the proposed extension of Airway Road. An artificial fill marked by signage to contain hazardous materials is on the west side of Cactus Road, south of SR-905 and may be in the vicinity of the possible extension of Airway Road.

Compacted fill soils were likely placed to construct facilities (water reservoirs, transmission towers, and associated roads, or runways on Brown Field) within the community plan area. However, we are unaware of an engineer’s record of compaction for these fill soils and, as a consequence, these fills are considered undocumented until the appropriate records are provided.

Undocumented fills are unsuitable for support of structural fill or settlement-sensitive structures, and where placed on slopes are subject to downslope movement (creep, sliding or shallow debris flows). Undocumented fill will require removal and replacement by compacted fill. The undocumented fill soil is suitable for reuse as compacted fill provided deleterious material including construction debris, vegetation, and trash is removed.

3.2 Topsoil and Slopewash (unmapped)

Topsoil typically blankets the level portions site and consists of brown sandy clay to sandy silt. Topsoil is estimated to be approximately 3 feet thick, but localized areas with greater thicknesses may exist. Slopewash is present on sloping areas of the site and consists of light brown to gray sandy clay to sandy silt. It is typically a minimum of 3 feet thick but can locally be significantly thicker. Topsoil and slopewash materials are soft, loose, and/or expansive in their present condition and will require removal and recompaction in areas to receive additional fill and/or support for structures and improvements.

3.3 Alluvium (Qal)

Alluvial soils are mapped at the floor of canyon drainages. It is anticipated the alluvial soils consist of soft sandy to silty clay and interfingers or grades with topsoil and slopewash along the outer edges of canyons. Depth of alluvial materials is anticipated to range from approximately 5 feet in smaller drainages to in excess of 20 feet in Spring Canyon and other major drainages. The alluvial soils are typically compressible, medium to highly expansive, and will require removal and recompaction to provide suitable support for fill placement and/or structural support.

3.4 Very Old Paralic Deposits (Qvop)

Pleistocene age Very Old Paralic Deposits (formerly Lindavista Formation) is present across Otay Mesa. The Very Old Paralic Deposits in the project area consist of clay (mudstone) overlying sandstone which grades to a gravel and cobble conglomerate. Thickness of the mudstone unit ranges from approximately 4 feet to 20 feet. Thickness of the sandstone and conglomerate unit is generally less than 30 feet. Cobbles of the conglomerate are commonly exposed on slopes. Geotechnical tests performed for projects in the study area indicate the mudstone is highly expansive. The presence of these highly expansive materials, especially if near finish proposed grades requires special foundations for buildings and mitigation to prevent excessive soil heave that can damage surface improvements such as sidewalks and pavements.

3.5 San Diego Formation (Tsd)

The sandstone member of the Pliocene-age San Diego Formation is exposed on slopes of drainages primarily in the western and northwestern portion of the community plan area. The San Diego Formation consists of dense, yellow-brown, fine- to medium-grained, poorly indurated micaceous sandstone. It is readily eroded and forms uniform slopes along the sides of narrow canyons in the study area. The San Diego Formation is typically massive, and is considered to be flat lying, which is a favorable geologic structure for gross stability. Materials derived from this formation are low expansive and have relatively good shear strength characteristics and as such, can provide good capping materials for pads and higher strength soils for construction of fill slopes. Portions of the San Diego Formation are cohesionless and erode readily. Landscape planting and maintenance should be implemented soon after construction of slopes to minimize potential erosion.

3.6 Otay Formation (To)

Pliocene age Otay Formation underlies the San Diego Formation. It is older than the San Diego Formation and is generally distinguished from the San Diego Formation by an increase in clay content within the deposit and isolated bentonite claystone beds. The bentonite beds are waxy and composed almost entirely of montmorillinitic clay. The bentonitic materials are very highly expansive and have very low shear strength and are considered to be the main cause of the large landslide complex (San Ysidro Landslide) along the western edge of the plan area. The Otay Formation consists of a dense to very dense upper sandstone unit that has a light gray color. A coarser grained gritstone member underlies the sandstone at depth. The Otay Formation is generally flat-lying or nearly horizontally bedded which is favorable for overall stability.

4. GROUNDWATER

No indications of natural springs or seeps were observed during the field reconnaissance or encountered in previous geotechnical subsurface studies conducted by Geocon Incorporated. Near surface groundwater (less than 20 feet deep) is unlikely in geologic formations at the site. Subsurface water may be present at depth in alluvial soils deposited in drainage channels. However, it is anticipated the subsurface water is relatively shallow in drainages and has intermittent response to seasonal rainfalls. Ponded water was observed west of Heritage Road and south of Otay Mesa Road and is believed to be impounded surface run off.

Groundwater is not anticipated to be an adverse geologic condition with respect to proposed development as planned new development is generally on the top of Otay Mesa. Perched groundwater in canyon bottoms in planned areas of development may require special grading techniques to enable removal and recompaction of alluvium. Placement of canyon subdrains may also be required to prevent groundwater buildup in fills and to collect moisture migration along the contact between natural ground and compacted fill surfaces.

5. GEOLOGIC HAZARDS

5.1 Landslides (Qls)

A complex of deep seated landslides mapped by Tan (1995) and the City of San Diego Seismic Safety Study (2008, Sheets 2 and 3) known as the San Ysidro Landslide is present in the western and southern edges Otay Mesa (*Geologic Map,* Figure 2). At this location there are a series of landslides that have increased in size and complexity with refined mapping with the most recent document utilized for this preliminary geotechnical report being prepared by the City of San Diego (2008). Geotechnical exploration by Geocon Incorporated at the San Diego Trolley rail tracks near Beyer Boulevard encountered apparent landslide debris to at least 100 feet below the ground surface, placing the bottom of the landslides below present sea level, indicating an ancient and complex history of movement. Based on subsurface exploration (conducted for other projects) Geocon Incorporated believes these deep landslides moved on a very weak, thick bentonite clay bed that had a regional dip that varied from horizontal to less than 10 degrees to the south and west.

Landslides on the *Geologic Map* (Figures 2 and 3, map pocket) are based on published sources or inferred using topography. The corroborated landslides are based on reference to multiple sources that are not consistent between their findings (some sources show landslides where others would not). The shallow suspected landslides are mainly based on reconnaissance mapping conducted for this report or the City of San Diego Seismic Safety Study, and are not verified by published sources or subsurface exploration. As such, the mapped expression of suspected landslides may not be relied upon as definitive of their existence. In addition, construction and development in recent years (especially in the northwestern quadrant of the Otay Mesa) has mitigated a number of large, previously documented landslides. They are still shown on our maps for reference.

Numerous smaller landslides are present on steep drainage slopes. These landslides likely vary in depth from less than 10 feet to more than 80 feet. It is anticipated the landslides occurred in clay beds of the Otay Formation or oversteepened slopes at inclinations greater than the angle of repose for site formational materials. The landslides are expected to have an incoherent broken internal structure, and are susceptible to continued movement, particularly where destabilized by undercutting, placement of additional (fill) loads, or introduction of soil moisture. Engineered stabilization fills (earthwork or retaining devices) are typically utilized to stabilize landslides. A structure/improvement setback from landslide areas is an alternative to engineered stabilization in areas of large landslides where engineered stabilization is not practical.

5.2 Faulting

Review of published geologic literature indicates the community plan area is located on the east margin of the La Nacion fault zone (LNFZ). Several faults are mapped to traverse the subject area including discontinuous faults that cross areas in the headwaters of Spring Canyon (see Figures 2 and 3). The LNFZ is characterized by north trending faults. The presence and existence of faults in this zone and an intersecting conjectural northwest-trending fault zone (not shown) named the San Ysidro Fault Zone (Kennedy and Tan, 1977) has been refined through published literature and specific geotechnical investigations. Faults shown on the *Geologic Map* are faults that have been presented in published literature that may not have been confirmed by all referenced sources (i.e., faults may be shown on one referenced source but not another). The presence of faults forming the San Ysidro Fault Zone as it trends through the area is particularly unclear. Because of site observations and recent drilling by Geocon Incorporated, the bulk of evidence points to landslide-scarps, rather than fault-scarps for this feature. Fault strands of the north-striking La Nación Fault Zone, however, are considered to be potentially active.

The nearest known active fault is the Rose Canyon Fault Zone, located approximately 14 miles to the west. Major earthquakes occurring on the Rose Canyon Fault Zone, or other regional active faults located in the southern California area, could subject the site to moderate to severe ground shaking.

5.3 Seismicity-Deterministic Analysis

According to the computer program *EZ-FRISK* (Version 7.62), seven known active faults are located within a search radius of 50 miles from the property. We used acceleration attenuation relationships developed by Boore-Atkinson (2008) NGA USGS2008, Campbell-Bozorgnia (2008) NGA USGS, and Chiou-Youngs (2008) NGA in our analysis. The nearest known active fault is the Newport-Inglewood/Rose Canyon Fault, located approximately 14 miles west of the site and is the dominant source of potential ground motion. Table 5.3.1 lists the estimated maximum earthquake magnitude and peak ground acceleration for faults in relationship to the site location.

TABLE 5.3.1
DETERMINISTIC SPECTRA SITE PARAMETERS

Fault Name	Distance from Site (miles)	Maximum Earthquake Magnitude (Mw)	Peak Ground Acceleration		
			Boore-Atkinson 2008 (g)	Campbell-Bozorgnia 2008 (g)	Chiou-Youngs 2008 (g)
Newport-Inglewood/Rose Canyon	14	7.5	0.23	0.17	0.22
Rose Canyon	14	6.9	0.19	0.15	0.16
Coronado Bank	26	7.4	0.16	0.11	0.13
Palos Verde Connected	26	7.7	0.18	0.12	0.15
Elsinore	29	7.85	0.18	0.12	0.15
Earthquake Valley	33	6.8	0.11	0.07	0.07
San Jacinto	50	7.88	0.12	0.08	0.10

It is our opinion that the site could be subject to moderate to severe ground shaking in the event of an earthquake along any of the faults listed in Table 5.3.1 or other faults in the Southern California/Northern Baja California region. However, we do not consider the site to possess any greater seismic risk than that of the surrounding developments.

We used the computer program *EZ-FRISK* to perform a probabilistic seismic hazard analysis. The computer program *EZ-FRISK* operates under the assumption that the occurrence rate of earthquakes on each mapped Quaternary fault is proportional to the faults slip rate. The program accounts for earthquake magnitude as a function of fault length, and site acceleration estimates are made using the earthquake magnitude and distance from the site to the rupture zone. The program also accounts for uncertainty in each of following: (1) earthquake magnitude, (2) rupture length for a given magnitude, (3) location of the rupture zone, (4) maximum possible magnitude of a given earthquake, and (5) acceleration at the site from a given earthquake along each fault. By calculating the expected accelerations from considered earthquake sources, the program calculates the total average annual expected number of occurrences of site acceleration greater than a specified value. We utilized acceleration-attenuation relationships suggested by Boore-Atkinson (2008) NGA USGS, Campbell-Bozorgnia (2008) NGA USGS, and Chiou-Youngs (2008) in the analysis. Table 5.3.2 presents the site-specific probabilistic seismic hazard parameters including acceleration-attenuation relationships and the probability of exceedence.

TABLE 5.3.2
PROBABILISTIC SEISMIC HAZARD PARAMETERS

Probability of Exceedence	**Peak Ground Acceleration**		
	Boore-Atkinson, 2008 (g)	**Campbell-Bozorgnia, 2008 (g)**	**Chiou-Youngs, 2008 (g)**
2% in a 50-Year Period	0.43	0.35	0.40
5% in a 50-Year Period	0.33	0.27	0.29
10% in a 50-Year Period	0.26	0.21	0.22

The California Geologic Survey (CGS) provides a program that calculates the ground motion for a 10 percent of probability of exceedence in 50 years based on an average of several attenuation relationships. Table 5.3.3 presents the calculated results from the *Probabilistic Seismic Hazards Mapping Ground Motion* Page from the CGS website.

TABLE 5.3.3
PROBABILISTIC SITE PARAMETERS FOR SELECTED FAULTS
CALIFORNIA GEOLOGIC SURVEY

Calculated Acceleration (g) Firm Rock	Calculated Acceleration (g) Soft Rock	Calculated Acceleration (g) Alluvium
0.22	0.24	0.28

While listing peak accelerations is useful for comparison of potential effects of fault activity in a region, other considerations are important in seismic design, including frequency and duration of motion and soil conditions underlying the site. Seismic design of the structures should be evaluated in accordance with the 2010 California Building Code (CBC) guidelines or those currently adopted by the City of El Cajon.

5.4 Liquefaction Potential

Liquefaction typically occurs when a site is located in a zone with seismic activity, onsite soils are relatively cohesionless, groundwater is encountered within 50 feet of the surface, and soil relative densities are less than about 70 percent. If all four previous criteria are met, a seismic event could result in a rapid pore-water pressure increase from earthquake-generated ground accelerations thereby resulting in soil liquefaction. The potential for liquefaction and seismically-induced settlement occurring for the mesa top areas is considered very low due to the very dense cemented condition of the geologic formations and lack of groundwater. Potentially liquefiable deposits exist in deeper alluvium areas such as the Otay River Valley or the Tijuana River Valley, typically some distance, respectively, to the north and south (with exception to a narrow area in the extreme northwestern quadrant) outside of the Community Plan map. Subsurface exploration and laboratory testing will be necessary to evaluate liquefaction potential of the alluvium if planned development extends into those areas, or where any other deep alluvial deposits are encountered.

5.5 Tsunamis and Seiches

The site is not located near the ocean or downstream of any large bodies of water. Therefore, the risk associated with inundation by tsunamis or seiches is low.

5.6 Subsidence

Based on the subsurface soil conditions encountered during our field investigation and the lack of groundwater extraction (pumping), the risk associated with ground subsidence hazard is low.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 General

6.1.1 This report has been prepared to identify site soil and geologic conditions within the Otay Mesa Community Plan Update boundaries and potential geologic constraints for inclusion in the project Environmental Impact report. Based on our study, development as shown on the land use map is feasible provided adverse geotechnical conditions identified herein are mitigated. Additional site-specific geotechnical studies should be performed during planning and/or preparation of grading plans.

6.1.2 Soil and/or geologic conditions identified during this study that may impact development include compressible surficial soils (undocumented fill, alluvium, colluvium and topsoil), the San Ysidro Landslide along the south and west side of Otay Mesa, suspected landslides along canyon drainages, and highly expansive clays in the upper portion of the Very Old Paralic Deposits.

6.1.3 Suspected landslides are likely present on the steep slopes of natural drainages. These landslides are inferred based on topographic expression and are not confirmed by subsurface exploration or detailed mapping. If present, their depths are generally considered to range from 5 feet to 15 feet; however, larger slides could extend to depths exceeding 50 feet. If development is planned within these suspected landslide zones, subsurface studies should be performed to establish their geometry and depth. If confirmed, stabilization will be required. Engineered stabilization (buttress embankments, partial and/or complete removal and replacement with compacted fill) is typically utilized to mitigate landslides. A structure/improvement setback from landslide areas is an alternative to engineered stabilization in areas of large landslides where engineered stabilization is not practical.

6.1.4 Confirmed landslides (Qls) at the west and southwest margins of Otay Mesa have been identified on multiple regional geologic maps and have been confirmed by Geocon Incorporated through subsurface exploration. The landslides are expected to have an incoherent broken internal structure, and are susceptible to continued movement, particularly where destabilized by undercutting, placement of additional (fill) loads, or introduction of soil moisture from precipitation or irrigation. Given the large area and estimated depth of the landslides in the western and southwestern properties, mitigation is likely unfeasible due to the extensive amount of regrading and impacts to environmentally sensitive habitat that would be necessary.

6.1.5 The clay mudstone strata within the Very Old Paralic Deposits exhibits high to very high expansion potential. The mudstone unit occurs near existing grade over the majority of Otay Mesa. The presence of the highly expansive soil near grade should be taken into consideration for future development. Typical mitigation measures may include placing a minimum 5-foot cap of low expansive (Expansion Index [EI] of 50 or less) over the clays, design of foundations and surface improvements to account for expansive soil movement or lime stabilization. Clays exposed at grade in streets may result in relatively thick pavement sections.

6.1.6 Portions of the project area are underlain by undocumented fill, colluvium/topsoil, and alluvium. These soils are typically loose, dry, and contain rubble, and are unsuitable for support of settlement-sensitive structures. Undocumented fill, colluvium/topsoil, and alluvium should be removed to firm ground, cleaned of deleterious material, properly moisture conditioned, and compacted in order to provide suitable foundation support.

6.1.7 The La Nación Fault Zone crosses the subject area. Faults in this zone are considered potentially active. It has been common practice in the City of San Diego for the geologic community to establish a 25-foot setback from each side of the main strand of the La Nación Fault. Should development be planned across this fault subsurface studies may be required to accurately locate the main strand.

6.2 Grading

6.2.1 The following grading recommendations are preliminary and intended to provide general criteria to assist in overall land planning. Detailed recommendations for each development area should be provided in site-specific geotechnical reports based on subsurface explorations and laboratory testing programs.

6.2.2 Grading should be performed in conjunction with the observation and compaction testing services of a geotechnical consultant. Fill soils should be observed continuously during placement and tested to verify proper compaction.

6.2.3 General grading specifications are provided in the *Recommended Grading Specifications* contained in Appendix A. **Where the recommendations of this section conflict with those of Appendix A the recommendations of this section take precedence**.

6.2.4 Prior to commencing grading, a pre-construction conference should be held at the site with the owner or developer, grading contractor, civil engineer, geotechnical engineer, and City of San Diego officials in attendance. Special soil handling and/or grading plans can be discussed at that time.

6.2.5 The site should be cleared of any deleterious material, vegetation, concrete or debris prior to commencing grading. All materials from demolition should be exported from the site. Any organic or unsuitable material generated should also be exported from the site.

6.2.6 Undocumented fills within areas of planned grading or improvements should be removed, cleaned of deleterious matter and construction debris, properly moisture conditioned, and compacted.

6.2.7 Topsoil, colluvium, and alluvium within areas of planned grading should be removed to firm ground and replaced as compacted fill. The limits of removal should extend horizontally at least 5 feet beyond the planned development limits or a distance equal to the depth of excavation (whichever is greater).

6.2.8 Prior to placing fill, the existing ground surface or base of overexcavations should be scarified to a depth of at least 12 inches, moisture conditioned as necessary, and compacted. Fill soils may then be placed and compacted in layers to the design finish-grade elevations. The layers should be no thicker than will allow for adequate bonding and compaction. All fill (including scarified ground surfaces and wall and utility trench backfill) should be compacted to at least 90 percent of maximum dry density at optimum moisture content or slightly above as determined by the current version of ASTM D 1557. A representative of Geocon Incorporated should observed and test the placement of fill soil.

6.2.9 The upper 5 feet of soil below proposed finish pad and street subgrade elevations should consist of granular, low expansive (EI of 50 or less) soil. This may require mining of the underlying sandy/cobble portion of the Very Old Paralic Deposits or importing select granular fill soil.

6.2.10 Cut and/or fill slopes should be constructed at an inclination of 2:1 (horizontal to vertical) or flatter. Fill slopes should be constructed of granular material and compacted out to the face of the finish slope. Engineering analyses should be performed to evaluate the maximum height of cut and fill slopes that possess an adequate safety factor.

6.3 Bio-Retention Basin and Bio-Swale Recommendations

6.3.1 The clay mudstone unit that overlies the sandstone across the mesa is fine grained and expansive. Based on our experience with this geologic unit, the soils have a very low permeability and very low infiltration characteristics. As such, the native surface soils are expected to be unsuitable for infiltration of storm-water runoff.

6.3.2 Any bio-retention basins, bioswales and bio-remediation areas should be designed by the project civil engineer and reviewed by the geotechnical engineer. Typically, bioswales consist of a surface layer of vegetation underlain by clean sand. A subdrain should be provided beneath the sand layer.

6.3.3 Distress may be caused to planned improvements and properties located hydrologically downstream or adjacent to these devices. The distress depends on the amount of water to be detained, its residence time, soil permeability, and other factors. We have not performed a hydrogeology study at the site. Downstream and adjacent properties may be subjected to seeps, springs, slope instability, raised groundwater, movement of foundations and slabs, or other impacts as a result of water infiltration. Because of on-site soils that generally blanket the mesa, permanent bio-retention swales or basins should be lined with an impermeable barrier, such as a thick visqueen.

6.3.4 The landscape architect should be consulted to provide the appropriate plant recommendations.

6.4 Site Drainage and Moisture Protection

6.4.1 Adequate site drainage is critical to reduce the potential for differential soil movement, erosion and subsurface seepage. Under no circumstances should water be allowed to pond adjacent to footings. The site should be graded and maintained such that surface drainage is directed away from structures in accordance with 2010 CBC section 1803.3 or other applicable standards. In addition, surface drainage should be directed away from the top of slopes into swales or other controlled drainage devices. Roof and pavement drainage should be directed into conduits that carry runoff away from the proposed structure.

6.4.2 In the case of basement walls or building walls retaining landscaping areas, a water-proofing system should be used on the wall and joints, and a Miradrain drainage panel (or similar) should be placed over the waterproofing. The project architect or civil engineer should provide detailed specifications on the plans for all waterproofing and drainage.

6.4.3 Underground utilities should be leak free. Utility and irrigation lines should be checked periodically for leaks, and detected leaks should be repaired promptly. Detrimental soil movement could occur if water is allowed to infiltrate the soil for prolonged periods of time.

6.4.4 Landscaping planters adjacent to paved areas are not recommended due to the potential for surface or irrigation water to infiltrate the pavement's subgrade and base course. We recommend that subdrains to collect excess irrigation water and transmit it to drainage structures, or impervious above-grade planter boxes be used. In addition, where landscaping is planned adjacent to the pavement, we recommend construction of a cutoff wall along the edge of the pavement that extends at least 6 inches below the bottom of the base material.

6.5 Grading and Foundation Plan Review

6.5.1 The soil engineer and engineering geologist should review the grading and foundation plans prior to finalization to verify their compliance with the recommendations of this report and to determine the need for additional comments, recommendations and/or analysis.

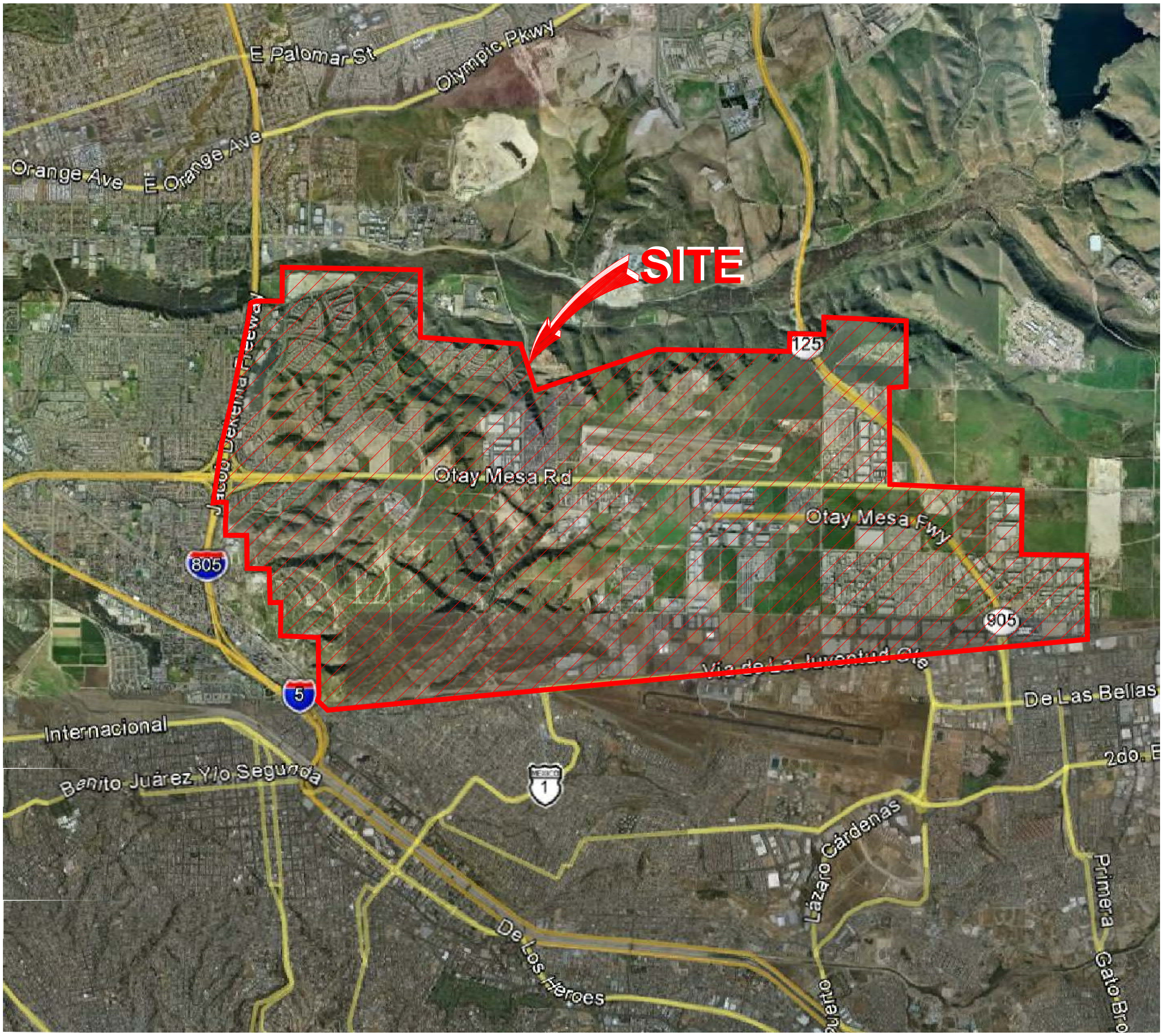
LIMITATIONS AND UNIFORMITY OF CONDITIONS

1. The firm that performed the geotechnical investigation for the project should be retained to provide testing and observation services during construction to provide continuity of geotechnical interpretation and to check that the recommendations presented for geotechnical aspects of site development are incorporated during site grading, construction of improvements, and excavation of foundations. If another geotechnical firm is selected to perform the testing and observation services during construction operations, that firm should prepare a letter indicating their intent to assume the responsibilities of project geotechnical engineer of record. A copy of the letter should be provided to the regulatory agency for their records. In addition, that firm should provide revised recommendations concerning the geotechnical aspects of the proposed development, or a written acknowledgement of their concurrence with the recommendations presented in our report. They should also perform additional analyses deemed necessary to assume the role of Geotechnical Engineer of Record.

2. The recommendations of this report pertain only to the site investigated and are based upon the assumption that the soil conditions do not deviate from those disclosed in the investigation. If any variations or undesirable conditions are encountered during construction, or if the proposed construction will differ from that anticipated herein, Geocon Incorporated should be notified so that supplemental recommendations can be given. The evaluation or identification of the potential presence of hazardous or corrosive materials was not part of the scope of services provided by Geocon Incorporated.

3. This report is issued with the understanding that it is the responsibility of the owner or his representative to ensure that the information and recommendations contained herein are brought to the attention of the architect and engineer for the project and incorporated into the plans, and the necessary steps are taken to see that the contractor and subcontractors carry out such recommendations in the field.

4. The findings of this report are valid as of the present date. However, changes in the conditions of a property can occur with the passage of time, whether they be due to natural processes or the works of man on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and should not be relied upon after a period of three years.



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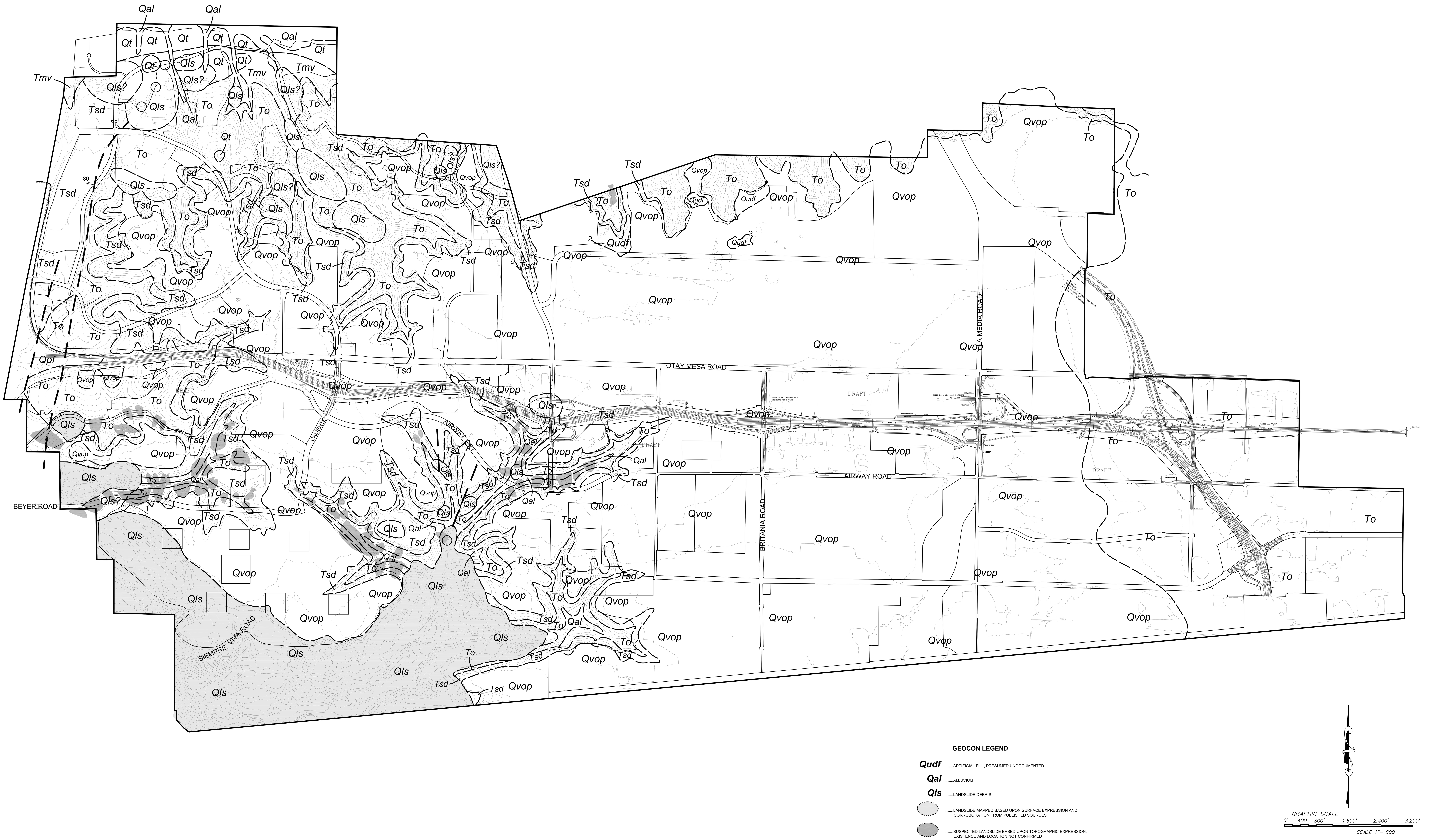
VICINITY MAP

OTAY MESA COMMUNITY PLAN UPDATE
SAN DIEGO COUNTY, CALIFORNIA

RG / RA		DSK/GTYPD	DATE 10 - 09 - 2012	PROJECT NO. 07254 - 42 - 03	FIG. 1



GEOCON LEGEND

Qudf ....ARTIFICIAL FILL, PRESUMED UNDOCUMENTED

Qal ....ALLUVIUM

Qls ....LANDSLIDE DEBRIS

........LANDSLIDE MAPPED BASED UPON SURFACE EXPRESSION AND CORROBORATION FROM PUBLISHED SOURCES

........SUSPECTED LANDSLIDE BASED UPON TOPOGRAPHIC EXPRESSION, EXISTENCE AND LOCATION NOT CONFIRMED

Qvop ....VERY OLD PARALIC DEPOSITS (Also Known as Linda Vista Formation, ***Qln***)

To ....OTAY FORMATION

Tsdss ....SAN DIEGO FORMATION / SANDSTONE MEMBER

........APPROX. LOCATION OF GEOLOGIC CONTACT

70 ....APPROX. LOCATION OF FAULT (Dotted Where Concealed, Arrow Showing Dip In Degrees)
REFERENCES.... KENNEDY AND TAN, 1977
TRIEMAN, 1993
CITY OF SAN DIEGO SEISMIC SAFETY STUDY MAP, 1996

GEOLOGIC MAP

OTAY MESA COMMUNITY PLAN
OTAY MESA AREA
SAN DIEGO, CALIFORNIA

GEOCON INCORPORATED
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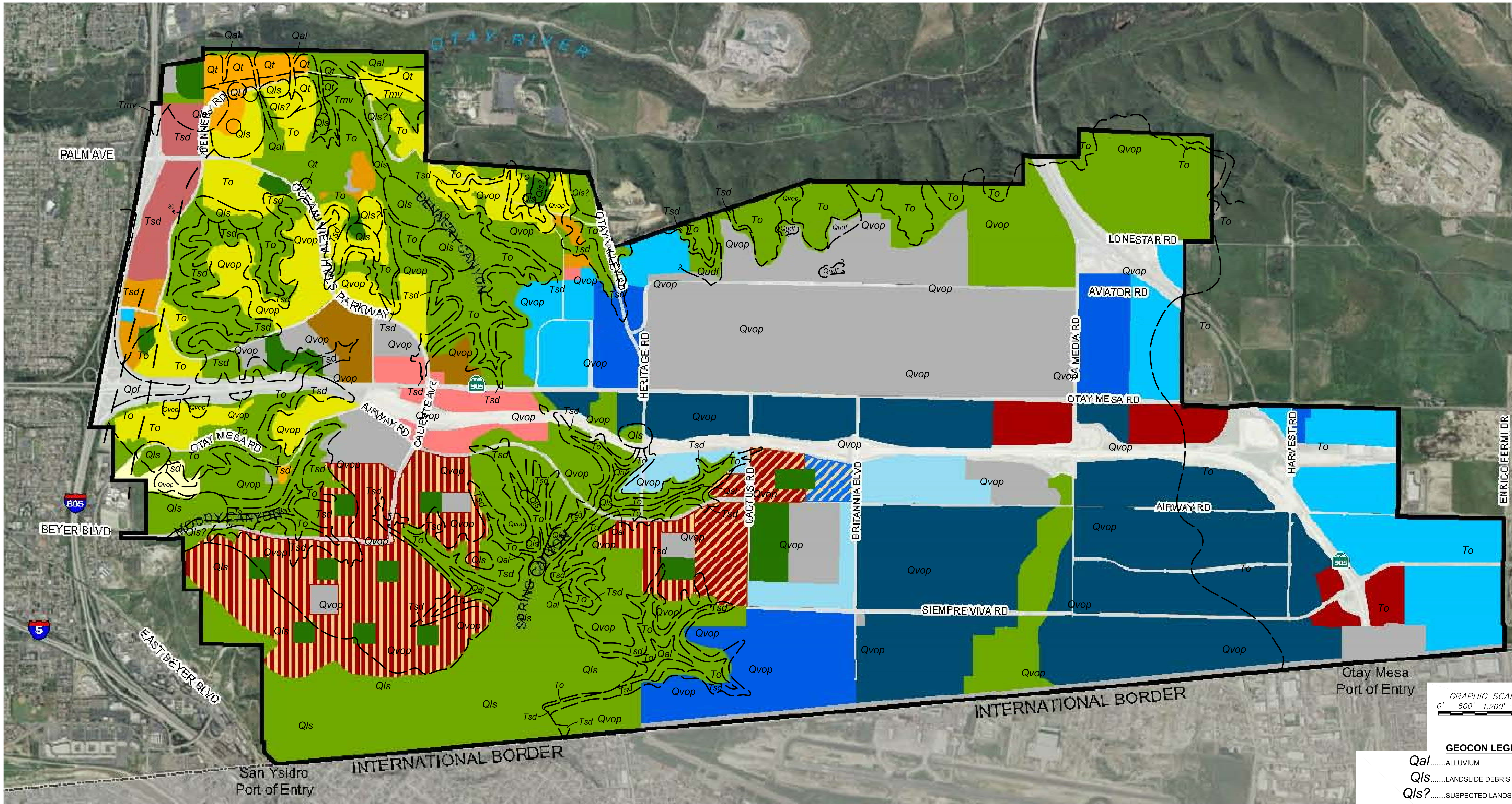
6960 FLANDERS DRIVE - SAN DIEGO, CALIFORNIA 92121 - 2974
PHONE 858 558-6900 - FAX 858 558-6159

SCALE 1" = 800'	DATE 10 - 09 - 2012
PROJECT NO. 07254 - 42 - 03	FIGURE 2
SHEET 1 OF 1	

Y:\PROJECTS\07254-42-03 OTAY MESA COMMUNITY PLAN UPDATE\SHEETS\07254-42-03 GEO-MAP (UPD-09-20-2012).dwg



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Land Use Plan

Open Space, Parks, Institutional

- OPEN SPACE
- PARKS
- INSTITUTIONAL

Commercial

- COMMUNITY COMMERCIAL - NO RESIDENTIAL
- REGIONAL COMMERCIAL - NO RESIDENTIAL
- HEAVY COMMERCIAL

Residential

- VERY LOW
- LOW
- LOW MEDIUM
- MEDIUM
- MEDIUM HIGH

Village Centers

- NEIGHBORHOOD VILLAGE
- COMMUNITY VILLAGE

Industrial - Residential Permitted

- BUSINESS PARK - RESIDENTIAL

Indistrial - Residential Prohibited

- BUSINESS PARK
- LIGHT INDUSTRIAL
- HEAVY INDUSTRIAL
- INTERNATIONAL BUSINESS AND TRADE

GEOCON LEGEND

Qal........ALLUVIUM
Qls........LANDSLIDE DEBRIS
Qls?........SUSPECTED LANDSLIDE DEBRIS
Qvop........VERY OLD PARALIC DEPOSITS (Also Known as Linda Vista Formation, ***Qln***)
Tsd........SAN DIEGO FORMATION (SANDSTONE MEMBER)
To........OTAY FORMATION
........APPROX. LOCATION OF GEOLOGIC CONTACT
........APPROX. LOCATION OF FAULT (Dotted Where Concealed, Arrow Showing Dip in Degrees)

REFERENCE: Kennedy and Tan, 1977
Triema,, 1993
City of San Diego Seismic Safety Study Map, 1996

GEOLOGIC MAP

OTAY MESA COMMUNITY PLAN
OTAY MESA AREA
SAN DIEGO, CALIFORNIA

GEOCON INCORPORATED
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS
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SCALE 1" = 800'	DATE 10 - 09 - 2012	
PROJECT NO. 07254 - 42 - 03		FIGURE 3
SHEET 1 OF 1		

Y:\PROJECTS\07254-42-03 OTAY MESA COMMUNITY PLAN UPDATE\SHEETS\07254-42-03 OtayMesaCommunityPlanUpdate(LandUseConcept).dwg

APPENDIX A

APPENDIX A

RECOMMENDED GRADING SPECIFICATIONS

FOR

OTAY MESA COMMUNITY PLAN UPDATE
SAN DIEGO, CALIFORNIA

PROJECT NO. 07254-42-03

RECOMMENDED GRADING SPECIFICATIONS

1. GENERAL

1.1 These Recommended Grading Specifications shall be used in conjunction with the Geotechnical Report for the project prepared by Geocon Incorporated. The recommendations contained in the text of the Geotechnical Report are a part of the earthwork and grading specifications and shall supersede the provisions contained hereinafter in the case of conflict.

1.2 Prior to the commencement of grading, a geotechnical consultant (Consultant) shall be employed for the purpose of observing earthwork procedures and testing the fills for substantial conformance with the recommendations of the Geotechnical Report and these specifications. The Consultant should provide adequate testing and observation services so that they may assess whether, in their opinion, the work was performed in substantial conformance with these specifications. It shall be the responsibility of the Contractor to assist the Consultant and keep them apprised of work schedules and changes so that personnel may be scheduled accordingly.

1.3 It shall be the sole responsibility of the Contractor to provide adequate equipment and methods to accomplish the work in accordance with applicable grading codes or agency ordinances, these specifications and the approved grading plans. If, in the opinion of the Consultant, unsatisfactory conditions such as questionable soil materials, poor moisture condition, inadequate compaction, adverse weather, result in a quality of work not in conformance with these specifications, the Consultant will be empowered to reject the work and recommend to the Owner that grading be stopped until the unacceptable conditions are corrected.

2. DEFINITIONS

2.1 **Owner** shall refer to the owner of the property or the entity on whose behalf the grading work is being performed and who has contracted with the Contractor to have grading performed.

2.2 **Contractor** shall refer to the Contractor performing the site grading work.

2.3 **Civil Engineer** or **Engineer of Work** shall refer to the California licensed Civil Engineer or consulting firm responsible for preparation of the grading plans, surveying and verifying as-graded topography.

2.4 **Consultant** shall refer to the soil engineering and engineering geology consulting firm retained to provide geotechnical services for the project.

2.5 **Soil Engineer** shall refer to a California licensed Civil Engineer retained by the Owner, who is experienced in the practice of geotechnical engineering. The Soil Engineer shall be responsible for having qualified representatives on-site to observe and test the Contractor's work for conformance with these specifications.

2.6 **Engineering Geologist** shall refer to a California licensed Engineering Geologist retained by the Owner to provide geologic observations and recommendations during the site grading.

2.7 **Geotechnical Report** shall refer to a soil report (including all addenda) which may include a geologic reconnaissance or geologic investigation that was prepared specifically for the development of the project for which these Recommended Grading Specifications are intended to apply.

3. MATERIALS

3.1 Materials for compacted fill shall consist of any soil excavated from the cut areas or imported to the site that, in the opinion of the Consultant, is suitable for use in construction of fills. In general, fill materials can be classified as *soil* fills, *soil-rock* fills or *rock* fills, as defined below.

3.1.1 **Soil fills** are defined as fills containing no rocks or hard lumps greater than 12 inches in maximum dimension and containing at least 40 percent by weight of material smaller than ¾ inch in size.

3.1.2 **Soil-rock fills** are defined as fills containing no rocks or hard lumps larger than 4 feet in maximum dimension and containing a sufficient matrix of soil fill to allow for proper compaction of soil fill around the rock fragments or hard lumps as specified in Paragraph 6.2. **Oversize rock** is defined as material greater than 12 inches.

3.1.3 **Rock fills** are defined as fills containing no rocks or hard lumps larger than 3 feet in maximum dimension and containing little or no fines. Fines are defined as material smaller than ¾ inch in maximum dimension. The quantity of fines shall be less than approximately 20 percent of the rock fill quantity.

3.2 Material of a perishable, spongy, or otherwise unsuitable nature as determined by the Consultant shall not be used in fills.

3.3 Materials used for fill, either imported or on-site, shall not contain hazardous materials as defined by the California Code of Regulations, Title 22, Division 4, Chapter 30, Articles 9 and 10; 40CFR; and any other applicable local, state or federal laws. The Consultant shall not be responsible for the identification or analysis of the potential presence of hazardous materials. However, if observations, odors or soil discoloration cause Consultant to suspect the presence of hazardous materials, the Consultant may request from the Owner the termination of grading operations within the affected area. Prior to resuming grading operations, the Owner shall provide a written report to the Consultant indicating that the suspected materials are not hazardous as defined by applicable laws and regulations.

3.4 The outer 15 feet of *soil-rock* fill slopes, measured horizontally, should be composed of properly compacted *soil* fill materials approved by the Consultant. *Rock* fill may extend to the slope face, provided that the slope is not steeper than 2:1 (horizontal:vertical) and a soil layer no thicker than 12 inches is track-walked onto the face for landscaping purposes. This procedure may be utilized provided it is acceptable to the governing agency, Owner and Consultant.

3.5 Samples of soil materials to be used for fill should be tested in the laboratory by the Consultant to determine the maximum density, optimum moisture content, and, where appropriate, shear strength, expansion, and gradation characteristics of the soil.

3.6 During grading, soil or groundwater conditions other than those identified in the Geotechnical Report may be encountered by the Contractor. The Consultant shall be notified immediately to evaluate the significance of the unanticipated condition

4. CLEARING AND PREPARING AREAS TO BE FILLED

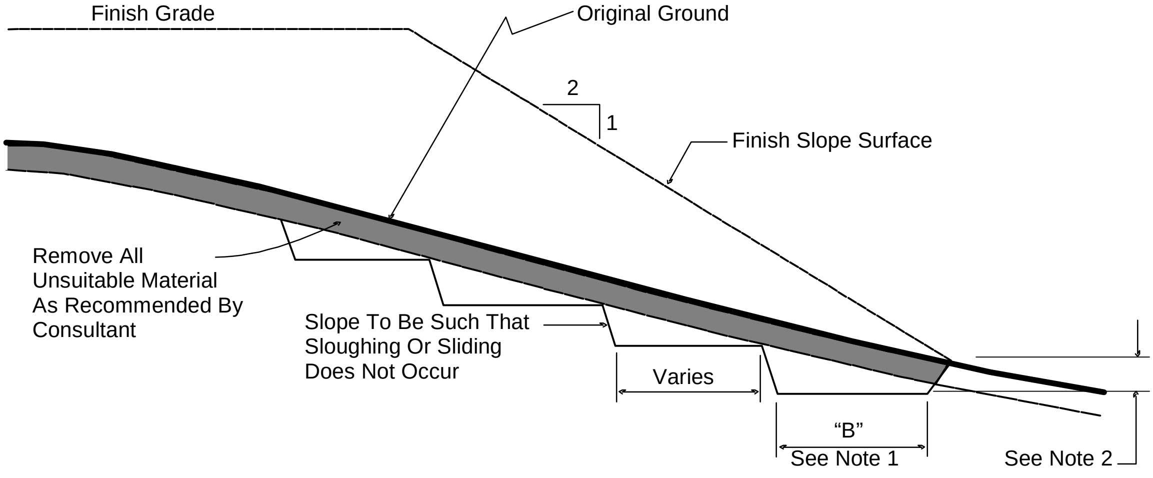
4.1 Areas to be excavated and filled shall be cleared and grubbed. Clearing shall consist of complete removal above the ground surface of trees, stumps, brush, vegetation, man-made structures, and similar debris. Grubbing shall consist of removal of stumps, roots, buried logs and other unsuitable material and shall be performed in areas to be graded. Roots and other projections exceeding 1½ inches in diameter shall be removed to a depth of 3 feet below the surface of the ground. Borrow areas shall be grubbed to the extent necessary to provide suitable fill materials.

4.2 Any asphalt pavement material removed during clearing operations should be properly disposed at an approved off-site facility. Concrete fragments that are free of reinforcing steel may be placed in fills, provided they are placed in accordance with Section 6.2 or 6.3 of this document.

4.3 After clearing and grubbing of organic matter and other unsuitable material, loose or porous soils shall be removed to the depth recommended in the Geotechnical Report. The depth of removal and compaction should be observed and approved by a representative of the Consultant. The exposed surface shall then be plowed or scarified to a minimum depth of 6 inches and until the surface is free from uneven features that would tend to prevent uniform compaction by the equipment to be used.

4.4 Where the slope ratio of the original ground is steeper than 5:1 (horizontal:vertical), or where recommended by the Consultant, the original ground should be benched in accordance with the following illustration.

TYPICAL BENCHING DETAIL



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DETAIL NOTES: (1) Key width "B" should be a minimum of 10 feet, or sufficiently wide to permit complete coverage with the compaction equipment used. The base of the key should be graded horizontal, or inclined slightly into the natural slope.

(2) The outside of the key should be below the topsoil or unsuitable surficial material and at least 2 feet into dense formational material. Where hard rock is exposed in the bottom of the key, the depth and configuration of the key may be modified as approved by the Consultant.

4.5 After areas to receive fill have been cleared and scarified, the surface should be moisture conditioned to achieve the proper moisture content, and compacted as recommended in Section 6 of these specifications.

5. COMPACTION EQUIPMENT

5.1 Compaction of *soil* or *soil-rock* fill shall be accomplished by sheepsfoot or segmented-steel wheeled rollers, vibratory rollers, multiple-wheel pneumatic-tired rollers, or other types of acceptable compaction equipment. Equipment shall be of such a design that it will be capable of compacting the *soil* or *soil-rock* fill to the specified relative compaction at the specified moisture content.

5.2 Compaction of *rock* fills shall be performed in accordance with Section 6.3.

6. PLACING, SPREADING AND COMPACTION OF FILL MATERIAL

6.1 *Soil* fill, as defined in Paragraph 3.1.1, shall be placed by the Contractor in accordance with the following recommendations:

6.1.1 *Soil* fill shall be placed by the Contractor in layers that, when compacted, should generally not exceed 8 inches. Each layer shall be spread evenly and shall be thoroughly mixed during spreading to obtain uniformity of material and moisture in each layer. The entire fill shall be constructed as a unit in nearly level lifts. Rock materials greater than 12 inches in maximum dimension shall be placed in accordance with Section 6.2 or 6.3 of these specifications.

6.1.2 In general, the *soil* fill shall be compacted at a moisture content at or above the optimum moisture content as determined by ASTM D 1557-02.

6.1.3 When the moisture content of *soil* fill is below that specified by the Consultant, water shall be added by the Contractor until the moisture content is in the range specified.

6.1.4 When the moisture content of the *soil* fill is above the range specified by the Consultant or too wet to achieve proper compaction, the *soil* fill shall be aerated by the Contractor by blading/mixing, or other satisfactory methods until the moisture content is within the range specified.

6.1.5 After each layer has been placed, mixed, and spread evenly, it shall be thoroughly compacted by the Contractor to a relative compaction of at least 90 percent. Relative compaction is defined as the ratio (expressed in percent) of the in-place dry density of the compacted fill to the maximum laboratory dry density as determined in accordance with ASTM D 1557-02. Compaction shall be continuous over the entire area, and compaction equipment shall make sufficient passes so that the specified minimum relative compaction has been achieved throughout the entire fill.

6.1.6 Where practical, soils having an Expansion Index greater than 50 should be placed at least 3 feet below finish pad grade and should be compacted at a moisture content generally 2 to 4 percent greater than the optimum moisture content for the material.

6.1.7 Properly compacted *soil* fill shall extend to the design surface of fill slopes. To achieve proper compaction, it is recommended that fill slopes be over-built by at least 3 feet and then cut to the design grade. This procedure is considered preferable to track-walking of slopes, as described in the following paragraph.

6.1.8 As an alternative to over-building of slopes, slope faces may be back-rolled with a heavy-duty loaded sheepsfoot or vibratory roller at maximum 4-foot fill height intervals. Upon completion, slopes should then be track-walked with a D-8 dozer or similar equipment, such that a dozer track covers all slope surfaces at least twice.

6.2 *Soil-rock* fill, as defined in Paragraph 3.1.2, shall be placed by the Contractor in accordance with the following recommendations:

6.2.1 Rocks larger than 12 inches but less than 4 feet in maximum dimension may be incorporated into the compacted *soil* fill, but shall be limited to the area measured 15 feet minimum horizontally from the slope face and 5 feet below finish grade or 3 feet below the deepest utility, whichever is deeper.

6.2.2 Rocks or rock fragments up to 4 feet in maximum dimension may either be individually placed or placed in windrows. Under certain conditions, rocks or rock fragments up to 10 feet in maximum dimension may be placed using similar methods. The acceptability of placing rock materials greater than 4 feet in maximum dimension shall be evaluated during grading as specific cases arise and shall be approved by the Consultant prior to placement.

6.2.3 For individual placement, sufficient space shall be provided between rocks to allow for passage of compaction equipment.

6.2.4 For windrow placement, the rocks should be placed in trenches excavated in properly compacted *soil* fill. Trenches should be approximately 5 feet wide and 4 feet deep in maximum dimension. The voids around and beneath rocks should be filled with approved granular soil having a Sand Equivalent of 30 or greater and should be compacted by flooding. Windrows may also be placed utilizing an "open-face" method in lieu of the trench procedure, however, this method should first be approved by the Consultant.

6.2.5 Windrows should generally be parallel to each other and may be placed either parallel to or perpendicular to the face of the slope depending on the site geometry. The minimum horizontal spacing for windrows shall be 12 feet center-to-center with a 5-foot stagger or offset from lower courses to next overlying course. The minimum vertical spacing between windrow courses shall be 2 feet from the top of a lower windrow to the bottom of the next higher windrow.

6.2.6 Rock placement, fill placement and flooding of approved granular soil in the windrows should be continuously observed by the Consultant.

6.3 *Rock* fills, as defined in Section 3.1.3, shall be placed by the Contractor in accordance with the following recommendations:

6.3.1 The base of the *rock* fill shall be placed on a sloping surface (minimum slope of 2 percent). The surface shall slope toward suitable subdrainage outlet facilities. The *rock* fills shall be provided with subdrains during construction so that a hydrostatic pressure buildup does not develop. The subdrains shall be permanently connected to controlled drainage facilities to control post-construction infiltration of water.

6.3.2 *Rock* fills shall be placed in lifts not exceeding 3 feet. Placement shall be by rock trucks traversing previously placed lifts and dumping at the edge of the currently placed lift. Spreading of the *rock* fill shall be by dozer to facilitate *seating* of the rock. The *rock* fill shall be watered heavily during placement. Watering shall consist of water trucks traversing in front of the current rock lift face and spraying water continuously during rock placement. Compaction equipment with compactive energy comparable to or greater than that of a 20-ton steel vibratory roller or other compaction equipment providing suitable energy to achieve the required compaction or deflection as recommended in Paragraph 6.3.3 shall be utilized. The number of passes to be made should be determined as described in Paragraph 6.3.3. Once a *rock* fill lift has been covered with *soil* fill, no additional *rock* fill lifts will be permitted over the *soil* fill.

6.3.3 Plate bearing tests, in accordance with ASTM D 1196-93, may be performed in both the compacted *soil* fill and in the *rock* fill to aid in determining the required minimum number of passes of the compaction equipment. If performed, a minimum of three plate bearing tests should be performed in the properly compacted *soil* fill (minimum relative compaction of 90 percent). Plate bearing tests shall then be performed on areas of *rock* fill having two passes, four passes and six passes of the compaction equipment, respectively. The number of passes required for the *rock* fill shall be determined by comparing the results of the plate bearing tests for the *soil* fill and the *rock* fill and by evaluating the deflection variation with number of passes. The required number of passes of the compaction equipment will be performed as necessary until the plate bearing deflections are equal to or less than that determined for the properly compacted *soil* fill. In no case will the required number of passes be less than two.

6.3.4 A representative of the Consultant should be present during *rock* fill operations to observe that the minimum number of “passes” have been obtained, that water is being properly applied and that specified procedures are being followed. The actual number of plate bearing tests will be determined by the Consultant during grading.

6.3.5 Test pits shall be excavated by the Contractor so that the Consultant can state that, in their opinion, sufficient water is present and that voids between large rocks are properly filled with smaller rock material. In-place density testing will not be required in the *rock* fills.

6.3.6 To reduce the potential for “piping” of fines into the *rock* fill from overlying *soil* fill material, a 2-foot layer of graded filter material shall be placed above the uppermost lift of *rock* fill. The need to place graded filter material below the *rock* should be determined by the Consultant prior to commencing grading. The gradation of the graded filter material will be determined at the time the *rock* fill is being excavated. Materials typical of the *rock* fill should be submitted to the Consultant in a timely manner, to allow design of the graded filter prior to the commencement of *rock* fill placement.

6.3.7 *Rock* fill placement should be continuously observed during placement by the Consultant.

7. OBSERVATION AND TESTING

7.1 The Consultant shall be the Owner's representative to observe and perform tests during clearing, grubbing, filling, and compaction operations. In general, no more than 2 feet in vertical elevation of *soil* or *soil-rock* fill should be placed without at least one field density test being performed within that interval. In addition, a minimum of one field density test should be performed for every 2,000 cubic yards of *soil* or *soil-rock* fill placed and compacted.

7.2 The Consultant should perform a sufficient distribution of field density tests of the compacted *soil* or *soil-rock* fill to provide a basis for expressing an opinion whether the fill material is compacted as specified. Density tests shall be performed in the compacted materials below any disturbed surface. When these tests indicate that the density of any layer of fill or portion thereof is below that specified, the particular layer or areas represented by the test shall be reworked until the specified density has been achieved.

7.3 During placement of *rock* fill, the Consultant should observe that the minimum number of passes have been obtained per the criteria discussed in Section 6.3.3. The Consultant should request the excavation of observation pits and may perform plate bearing tests on the placed *rock* fills. The observation pits will be excavated to provide a basis for expressing an opinion as to whether the *rock* fill is properly seated and sufficient moisture has been applied to the material. When observations indicate that a layer of *rock* fill or any portion thereof is below that specified, the affected layer or area shall be reworked until the *rock* fill has been adequately seated and sufficient moisture applied.

7.4 A settlement monitoring program designed by the Consultant may be conducted in areas of *rock* fill placement. The specific design of the monitoring program shall be as recommended in the Conclusions and Recommendations section of the project Geotechnical Report or in the final report of testing and observation services performed during grading.

7.5 The Consultant should observe the placement of subdrains, to verify that the drainage devices have been placed and constructed in substantial conformance with project specifications.

7.6 Testing procedures shall conform to the following Standards as appropriate:

7.6.1 Soil and Soil-Rock Fills:

7.6.1.1 Field Density Test, ASTM D 1556-02, *Density of Soil In-Place By the Sand-Cone Method.*

7.6.1.2 Field Density Test, Nuclear Method, ASTM D 6938-08A, *Density of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth).*

7.6.1.3 Laboratory Compaction Test, ASTM D 1557-02, *Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-Pound Hammer and 18-Inch Drop*.

7.6.1.4. Expansion Index Test, ASTM D 4829-03, *Expansion Index Test*.

7.6.2 Rock Fills

7.6.2.1 Field Plate Bearing Test, ASTM D 1196-93 (Reapproved 1997) *Standard Method for Nonreparative Static Plate Load Tests of Soils and Flexible Pavement Components, For Use in Evaluation and Design of Airport and Highway Pavements.*

8. PROTECTION OF WORK

8.1 During construction, the Contractor shall properly grade all excavated surfaces to provide positive drainage and prevent ponding of water. Drainage of surface water shall be controlled to avoid damage to adjoining properties or to finished work on the site. The Contractor shall take remedial measures to prevent erosion of freshly graded areas until such time as permanent drainage and erosion control features have been installed. Areas subjected to erosion or sedimentation shall be properly prepared in accordance with the Specifications prior to placing additional fill or structures.

8.2 After completion of grading as observed and tested by the Consultant, no further excavation or filling shall be conducted except in conjunction with the services of the Consultant.

9. CERTIFICATIONS AND FINAL REPORTS

9.1 Upon completion of the work, Contractor shall furnish Owner a certification by the Civil Engineer stating that the lots and/or building pads are graded to within 0.1 foot vertically of elevations shown on the grading plan and that all tops and toes of slopes are within 0.5 foot horizontally of the positions shown on the grading plans. After installation of a section of subdrain, the project Civil Engineer should survey its location and prepare an *as-built* plan of the subdrain location. The project Civil Engineer should verify the proper outlet for the subdrains and the Contractor should ensure that the drain system is free of obstructions.

9.2 The Owner is responsible for furnishing a final as-graded soil and geologic report satisfactory to the appropriate governing or accepting agencies. The as-graded report should be prepared and signed by a California licensed Civil Engineer experienced in geotechnical engineering and by a California Certified Engineering Geologist, indicating that the geotechnical aspects of the grading were performed in substantial conformance with the Specifications or approved changes to the Specifications.

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5. *Guidelines for Evaluating and Mitigating Seismic Hazards in California*, California Department of Conservation, Division of Mines and Geology, Special Publication 117, adopted March 13, 1997.

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7. Jennings, C. W., *Fault Activity Map of California and Adjacent Areas*, DMG Geologic Data Map No. 6, scale 1:750,000, 1994.

8. Kennedy, M. P., and S. H. Clarke, *Analysis of Late Quaternary Faulting in San Diego Bay and Hazard to the Coronado Bridge*, DMG Open File Report 97-10A, 1999.

9. Kennedy, M. P., and Tan, S.S., *Geology of the San Diego 30'x60' Quadrangle, California*, CGS Regional Geologic Map No. 3, 2008.

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