Earth - Strata, Inc.

Geotechnical, Environmental and Materials Testing Consultants

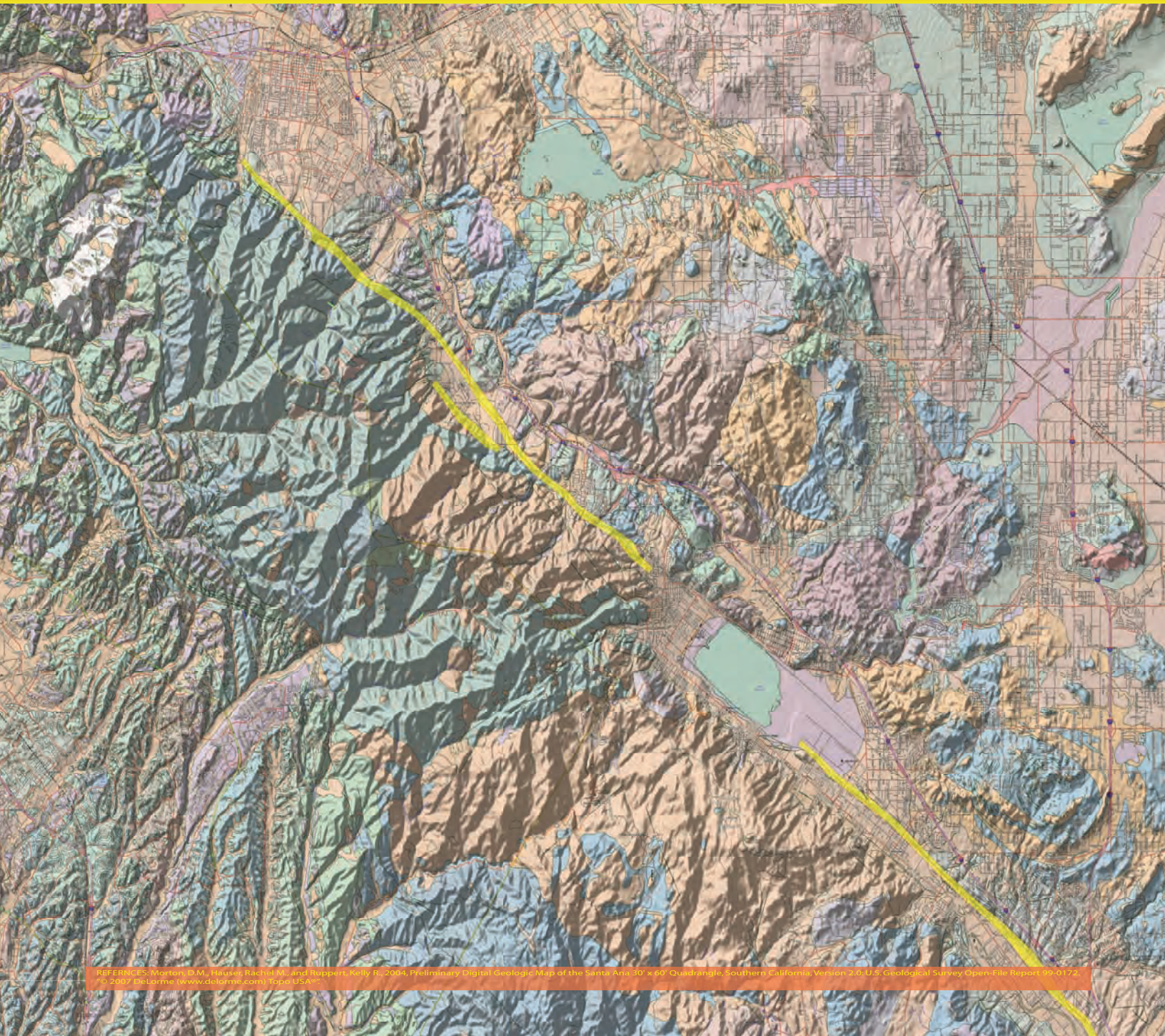
BETTER PEOPLE • BETTER SERVICE • BETTER RESULTS

PRELIMINARY GEOTECHNICAL INTERPRETIVE REPORT

PROPOSED THE PEARL DEVELOPMENT WITH UNDERGROUND PARKING, ASSESSOR'S PARCEL NUMBER 298-211-81, LOCATED ON SOUTH SIERRA AVENUE, CITY OF SOLANA BEACH, SAN DIEGO COUNTY, CALIFORNIA

PROJECT NO. 10814-10A

ISSUED: JANUARY 20, 2011



January 20, 2011

Project No. 10814-10A

OFFICE OF THE CITY ENGINEER
Attention: Mr. Jim Greenstine
635 South Highway 101
Solana Beach, CA 92075

Subject: **Preliminary Geotechnical Interpretive Report, Proposed The Pearl Development with Underground Parking, Assessor's Parcel Number 298-211-81, Located on South Sierra Avenue, City of Solana Beach, San Diego County, California**

Earth-Strata is pleased to present our preliminary geotechnical interpretive report for the proposed mixed-use development with underground parking, Assessor's Parcel Number 298-211-81, located on South Sierra Avenue, in the City of Solana Beach, San Diego County, California. This work was performed in accordance with the scope of work described in our proposal, dated September 10, 2010. The purpose of this study is to evaluate the nature, distribution, engineering properties, and geologic strata underlying the site with respect to the proposed development.

Earth-Strata appreciates the opportunity to offer our consultation and advice on this project. In the event that you have any questions, please do not hesitate to contact the undersigned at your earliest convenience.

Respectfully submitted,

EARTH-STRATA, Inc.

CERTIFIED ENGINEERING GEOLOGIST
CHAD E. WELKE
No. 2378
Exp. 2/28/11
STATE OF CALIFORNIA

Chad E. Welke, PG, CEG, PE
Principal Geologist/Engineer

REGISTERED PROFESSIONAL ENGINEER
STEPHEN MICHAEL POOLE
No. 692
Exp. 9/30/12
GEOTECHNICAL
STATE OF CALIFORNIA

Stephen M. Poole, PE, GE
Principal Engineer

CW/SMP/am

Distribution: (6) Addressee

TABLE OF CONTENTS

Section **Page**

Attachments:

INTRODUCTION

Earth-Strata is pleased to present our preliminary geotechnical interpretive report for the proposed development. The purpose of this study was to evaluate the nature, distribution, engineering properties, and geologic strata underlying the site with respect to the proposed development, and then provide preliminary grading and foundation design recommendations based on the plans you provided. The general location of the subject property is indicated on the Vicinity Map, Figure 1. The plans you provided were used as the base map to show geologic conditions within the subject site, see Geotechnical Map, Plate 1.

SITE DESCRIPTION

The subject property is located on the east side of South Sierra Avenue in the City of Solana Beach, San Diego County, California. The approximate location of the site is shown on the Vicinity Map, Figure 1.

The subject property is comprised of partially developed land that is being used as a public parking lot. The site has been graded. Topographic relief at the subject property is relatively low with the terrain being generally flat. Elevations at the site range from approximately 60 to 61 feet above mean sea level (msl), for a difference of about 1 ± feet across the entire site. Drainage within the subject property generally flows to the southwest.

The site is currently bordered by residential and commercial developments. Most of the vegetation on the site consists of moderate to dense amounts of landscaping with grasses, along with some scattered small to large trees.

PROPOSED DEVELOPMENT AND GRADING

The proposed residential and commercial development is expected to consist of a concrete, wood or steel framed one to three and one half story structure with up to one level of below grade parking. The current development plans include one multi-story building covering most of the site with underground parking varying in depth from 6 to 10 feet below existing grade with deeper levels for elevator and other ancillary facilities. We anticipate column loads of up to 60 kips.

The plans provided by you were utilized in our exploration and form the base for our Geotechnical Map, Plate 1. Retaining walls up to 12 feet high are planned to support level backslope conditions for the below grade parking levels.

Formal plans have not been prepared and await the conclusions and recommendations of this report.

Earth - Strata, Inc.
Geotechnical, Environmental and Materials Testing Consultants
BETTER PEOPLE • BETTER SERVICE • BETTER RESULTS

THE PEARL - SOLANA BEACH | 10814-10A

VICINITY MAP

SEE BAR SCALE

JAN. 2011 | FIGURE 1

FIELD EXPLORATION AND LABORATORY TESTING

Field Exploration

Subsurface exploration within the subject site was performed on December 13, 2010 for the exploratory excavations. A truck mounted hollow-stem-auger drill rig was utilized to drill 5 borings throughout the site to a maximum depth of 51.5 feet. An underground utilities clearance was obtained from Underground Service Alert of Southern California, prior to the subsurface exploration.

Earth materials encountered during exploration were classified and logged in general accordance with the Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) of ASTM D 2488. Upon completion of laboratory testing, exploratory logs and sample descriptions may have been reconciled to reflect laboratory test results with regard to ASTM D 2487.

Associated with the subsurface exploration was the collection of bulk (disturbed) samples and relatively undisturbed samples of earth materials for laboratory testing and analysis. The relatively undisturbed samples were obtained with a 3 inch outside diameter modified California split-spoon sampler lined with 1 inch high brass rings. Additional samples were retrieved using a Standard Penetration Test (N) split-spoon sampler. Samples obtained using a hollow stem auger drill rig, were mechanically driven with successive 30 inch drops of a 140-pound automatic trip safety hammer. The blow count per one foot increment was recorded in the boring logs. The central portions of the driven samples were placed in sealed containers and transported to our laboratory for testing and analysis. The approximate exploratory locations are shown on Plate 1 and descriptive logs are presented in Appendix B.

Laboratory Testing

Maximum dry density/optimum moisture content, Atterberg limits, expansion potential, shear strength, R-value, pH, resistivity, sulfate content, chloride content, and in-situ density/moisture content were determined for selected undisturbed and bulk samples of earth materials, considered representative of those encountered. An evaluation of the test data is reflected throughout the Conclusions and Recommendations section of this report. A brief description of laboratory test criteria and summaries of test data are presented in Appendix C.

FINDINGS

Regional Geology

Regionally, the site is located in the Peninsular Ranges Geomorphic Province of California. The Peninsular Ranges are characterized by northwest trending steep mountain ranges separated by sediment filled elongated valleys. The dominant structural geologic features reflect the northwest trend of the province. Associated with and subparallel to the San Andreas Fault are the San Jacinto Fault, Newport-Inglewood, and the Whittier-Elsinore Fault. The Santa Ana Mountains abut the west side of the Elsinore Fault while the Perris Block forms the other side of the fault zone to the east. The Perris Block is bounded to the east by the San Jacinto Fault. The northern perimeter of the Los Angeles basin forms part of a northerly dipping blind thrust fault at the boundary between the Peninsular Ranges Province and the Transverse Range Province.

The mountainous regions within the Peninsular Ranges Province are comprised of Pre-Cretaceous, metasedimentary, and metavolcanic rocks along with Cretaceous plutonic rocks of the Southern California Batholith. The low lying areas are primarily comprised of Tertiary and Quaternary non-marine alluvial sediments consisting of alluvial deposits, sandstones, claystones, siltstones, conglomerates, and occasional volcanic units. A map illustrating the regional geology is presented on the Regional Geologic Map, Figure 2.

Local Geology

The earth materials on the site are primarily comprised of Pleistocene Old Paralic Deposits. A general description of the dominant earth materials observed on the site is provided below:

- Quaternary Old Paralic Deposits (map symbol Qop): Quaternary old paralic deposits were encountered to the maximum depth explored. These deposits consist predominately of interlayered moderate yellowish brown to gray brown, silty sand. These deposits were generally noted to be in a slightly moist to very moist, medium dense to very dense state.

Geologic Structure

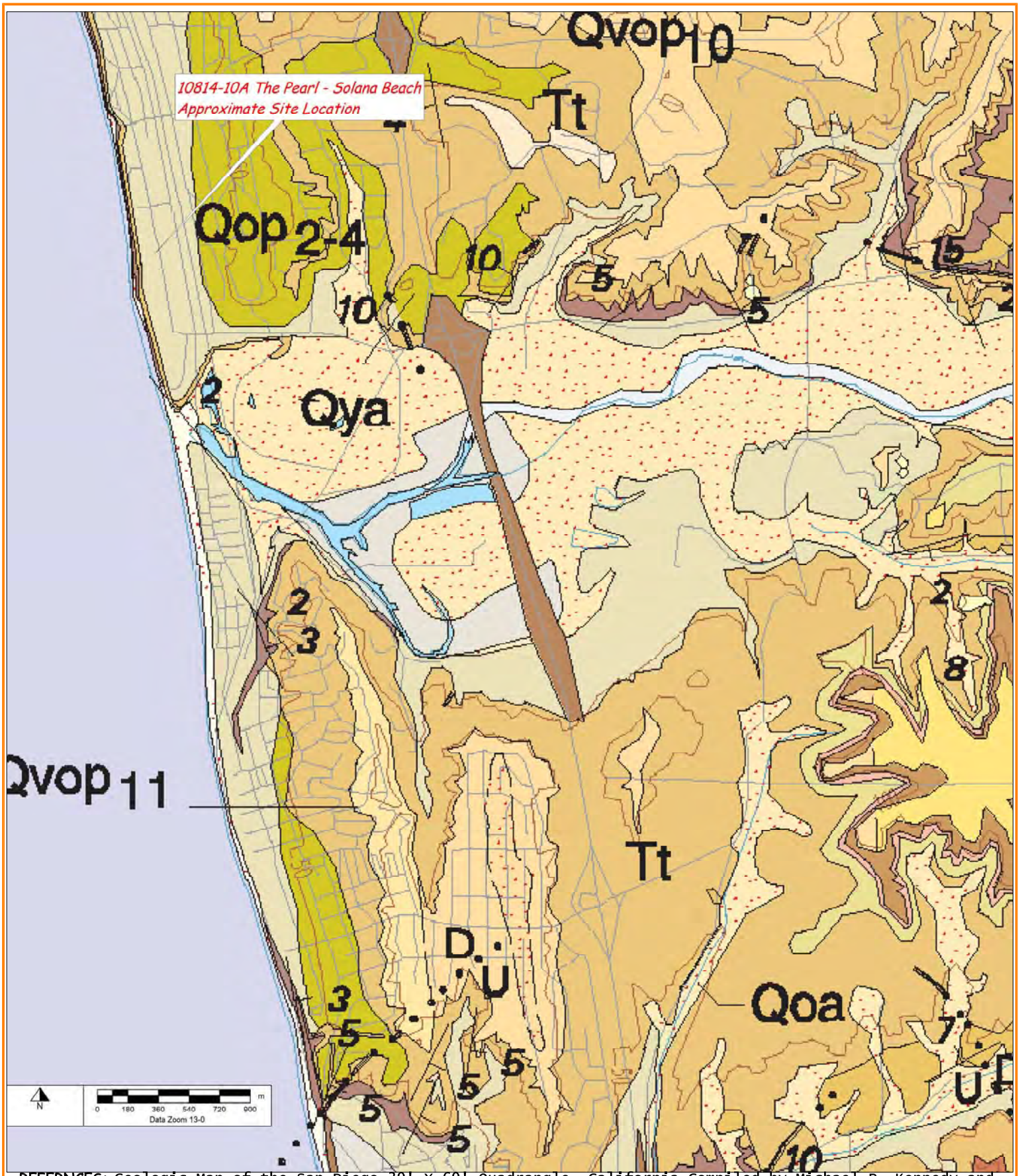
The paralic deposits described are common to this area and the geologic structure is generally massive to horizontally layered and lacks significant structural planes.

Faulting

The project is located in a seismically active region and as a result, significant ground shaking will likely impact the site within the design life of the proposed project. The geologic structure of the entire southern California area is dominated by northwest-trending faults associated with the San Andreas Fault system, which accommodates for most of the right lateral movement associated with the relative motion between the Pacific and North American tectonic plates. Known active faults within this system include the Newport-Inglewood, Whittier-Elsinore, San Jacinto and San Andreas Faults.

No active faults are known to project through the site and the site is not located within an Alquist-Priolo Earthquake Fault Zone, established by the State of California to restrict the construction of new habitable structures across identifiable traces of known active faults. An active fault is defined by the State of California as having surface displacement within the past 11,000 years or during the Holocene geologic time period.

Based on our review of regional geologic maps and the computer program (USGS 2002 Interactive Deaggregation), the Rose Canyon Fault with an approximate source to site distance of 3.8 kilometers is the closest known active fault anticipated to produce the highest ground accelerations, with an anticipated maximum modal magnitude of 7.0. Based on the data compiled during the preparation of this report, it is our interpretation that the potential for surface rupture to adversely impact the proposed structures is very low to remote.



REFERNCES: Geologic Map of the San Diego 30' X 60' Quadrangle, California Compiled by Michael P. Kennedy and Siang S. Tan 2005 Digital Preparation by Kelly R. Bovard1, Anne G. Garcia1 and Diane Burns1
1. U.S. Geological Survey, Department of Earth Sciences, University of California, Riverside.

Earth - Strata, Inc. Geotechnical, Environmental and Materials Testing Consultants BETTER PEOPLE • BETTER SERVICE • BETTER RESULTS	THE PEARL - SOLANA BEACH	10814-10A
	REGIONAL GEOLOGIC MAP	SEE BAR SCALE
		JAN. 2011 / FIGURE 2

Landslides

Landslide debris was not observed during our subsurface exploration and no ancient landslides are known to exist on the site.

CONCLUSIONS AND RECOMMENDATIONS

General

From geotechnical and engineering geologic points of view, the subject property is considered suitable for the proposed development, provided the following conclusions and recommendations are incorporated into the plans and are implemented during construction.

Earthwork

Earthwork and Grading

The provisions of the 2007 California Building Code (CBC), including Appendix J Grading, should be applied to all earthwork and grading operations, as well as in accordance with all applicable grading codes and requirements of the appropriate reviewing agency. Unless specifically revised or amended herein, grading operations should also be performed in accordance with applicable provisions of our General Earthwork and Grading Specifications within the last appendix of this report.

Clearing and Grubbing

Vegetation including trees, grasses, weeds, brush, shrubs, or any other debris should be stripped from the areas to be graded and properly disposed of offsite. In addition, laborers should be utilized to remove any roots, branches, or other deleterious materials during grading operations.

Earth-Strata should be notified at the appropriate times to provide observation and testing services during Clearing and Grubbing operations. Any buried structures or unanticipated conditions should be brought to our immediate attention.

Excavation Characteristics

Based on the results of our exploration and experience with similar projects in similar settings, the near surface earth materials, will be readily excavated with conventional earth moving equipment.

Groundwater

Groundwater was not observed during our subsurface exploration. It should be noted that localized groundwater could be encountered during grading due to the limited number of exploratory locations or other factors.

Ground Preparation For Fill Areas

For each area to receive compacted fill, the removal of low density, compressible earth materials, such as upper alluvial materials, and undocumented artificial fill, should continue until firm competent old paralic deposits are encountered. Removal excavations are subject to verification by the project engineer, geologist or their representative. Prior to placing compacted fills, the exposed bottom in each removal area should be scarified to a depth of 6 inches or more, watered or air dried as necessary to achieve near optimum moisture conditions and then compacted to a minimum of 90 percent of the maximum dry density determined by ASTM D 1557.

The intent of remedial grading is to diminish the potential for hydro-consolidation, slope instability, and/or settlement. Remedial grading should extend beyond the perimeter of the proposed structures a horizontal distance equal to the depth of excavation or a minimum of 5 feet, whichever is greater. For cursory purposes the anticipated removal depths are shown on the enclosed Geotechnical Map, Plate 1. In general, the anticipated removal depths should vary from 3 to 5 feet below existing grade. However, the proposed basement elevations should be at lower elevations than the proposed removal depths. Therefore, all foundations should be founded into competent old paralic deposits.

Wet Removals

Wet alluvial materials will probably not be encountered. If removals of wet alluvial materials are required, special grading equipment and procedures can greatly reduce overall costs. Careful planning by an experienced grading contractor can reduce the need for special equipment, such as swamp cats, draglines, excavators, pumps, and top loading earthmovers. Possible solutions may include the placement of imported angular rock and/or geotextile ground reinforcement. More specific recommendations can be provided based on the actual conditions encountered. Drying or mixing of wet materials with dry materials will be needed to bring the wet materials to near optimum moisture prior to placing wet materials into compacted fills.

Oversize Rock

Oversize rock is not expected to be encountered during grading. Oversize rock that is encountered (i.e., rock exceeding a maximum dimension of 12 inches) should be disposed of offsite or stockpiled onsite and crushed for future use. The disposal of oversize rock is discussed in greater detail in General Earthwork and Grading Specifications within the last appendix of this report.

Compacted Fill Placement

Compacted fill materials should be placed in 6 to 8 inch maximum (uncompacted) lifts, watered or air dried as necessary to achieve uniform near optimum moisture content and then compacted to a minimum of 90 percent of the maximum dry density determined by ASTM D 1557-00.

Import Earth Materials

Should import earth materials be needed to achieve final design grades, all potential import materials should be free of deleterious/oversize materials, non-expansive, and approved by the project geotechnical consultant prior to delivery onsite.

Fill Slopes

Fill slopes are not anticipated.

Cut Slopes

Cut slopes are not anticipated.

Temporary Backcuts

It is the responsibility of the grading contractor to follow all Cal-OSHA requirements with regard to excavation safety. Where existing developments are upslope, adequate slope stability to protect those developments must be maintained. Temporary backcuts will be required to accomplish removals of unsuitable materials and possibly, to perform canyon removals, stabilization fills, and/or keyways. Backcuts should be excavated at a gradient of 1:1 (h:v) or flatter. Flatter backcuts may be required where geologic structure or earth materials are unfavorable. It is imperative that grading schedules minimize the exposure time of the unsupported excavations. All excavations should be stabilized within 30 days of initial excavation.

Slot Cuts

Vertical excavations removing support from the adjacent properties will require the use of slot cutting (ABC method).

The slot cutting method uses the earth as a buttress and allows the excavation to proceed in phases. The initial excavation is made at a slope of 1:1. Alternate slots up to 13 feet high and 35 feet in width may be worked. The retaining wall should be completed and backfilled in the slots before the "B" earth buttresses are excavated. In addition, alternate slots up to 8 feet high and 200 feet in width may be worked. Again, the retaining wall "C" earth buttresses may be excavated upon completion of the walls and backfilling of the "B" earth buttresses are excavated. The "C" earth buttresses may be excavated upon completion of the walls and backfilling of the "B" areas.

The geologist should be present during grading to see temporary slopes. It is imperative that grading schedules minimize the exposure time of the unsupported excavations. All excavations should be stabilized within 30 days of initial excavation. Water should not be allowed to pond on top of the excavations nor to flow toward it.

Geotechnical Observations

Clearing operations, removal of unsuitable materials, and general grading procedures should be observed by the project geotechnical consultant or his representative. No compacted fill should be placed without observations by the geotechnical consultant or his representative to verify the adequacy of the removals.

The project geotechnical consultant or his representative should be present to observe grading operations and to check that minimum compaction requirements and proper lift thicknesses are being met, as well as to verify compliance with the other recommendations presented herein.

Post Grading Considerations

Slope Landscaping and Maintenance

Adequate slope and building pad drainage is essential for the long term performance of the subject site. The gross stability of graded slopes should not be adversely affected, provided all drainage provisions are properly constructed and maintained. Engineered slopes should be landscaped with deep rooted, drought tolerant maintenance free plant species, as recommended by the project landscape architect.

Site Drainage

Control of site drainage is important for the performance of the proposed project. Roof gutters are recommended for the proposed structures. Pad and roof drainage should be collected and transferred to driveways, adjacent streets, storm-drain facilities, or other locations approved by the building official in non-erosive drainage devices. Drainage should not be allowed to pond on the pad or against any foundation or retaining wall. Drainage should not be allowed to flow uncontrolled over any descending slope. Planters located within retaining wall backfill should be sealed to prevent moisture intrusion into the backfill. Planters located next to structures should be sealed to the depth of the footings. Drainage control devices require periodic cleaning, testing and maintenance to remain effective.

At a minimum, pad drainage should be designed at the minimum gradients required by the CBC. To divert water away from foundations, the ground surface adjacent to foundations should also be graded at the minimum gradients required per the CBC.

Utility Trenches

All utility trench backfill should be compacted at near optimum moisture to a minimum of 90 percent of the maximum dry density determined by ASTM test method D 1557-00. For utility trench backfill within pavement areas the upper 6 inches of subgrade materials should be compacted to 95 percent of the maximum dry density determined by ASTM D 1557-00. This includes within the street right-of-ways, utility easements, under footings, sidewalks, driveways and building floor slabs, as well as within or adjacent to any slopes. Backfill should be placed in approximately 6 to 8 inch maximum loose lifts and then mechanically compacted with a hydro-hammer, rolling with a sheepsfoot, pneumatic tampers, or similar equipment. The utility trenches should be tested by the project geotechnical engineer or their representative to verify minimum compaction requirements are obtained.

In order to minimize the penetration of moisture below building slabs, all utility trenches should be backfilled with compacted fill, lean concrete or concrete slurry where they undercut the perimeter foundation. Utility trenches that are proposed parallel to any building footings (interior and/or exterior trenches), should not be located within a 1:1 (h:v) plane projected downward from the outside bottom edge of the footing.

SEISMIC DESIGN CONSIDERATIONS

Ground Motions

Structures are required to be designed and constructed to resist the effects of seismic ground motions as provided in the 2007 California Building Code Section 1613. The design is dependent on the site class, occupancy category I, II, III, or IV, mapped spectral accelerations for short periods (S_s), and mapped spectral acceleration for a 1-second period (S_1).

In order for structural design to comply with the 2007 CBC, a computer program, Earthquake Ground Motion Parameters, Version 5.0.9, dated October 6, 2008, was used to compile spectral accelerations for the subject property based on data and maps jointly compiled by the United States Geological Survey (USGS) and the California Geological Survey (CGS). The data found in the following table is based on the Maximum Considered Earthquake (MCE) with 5% damped ground motions having a 2% probability of being exceeded in 50 years (2,475 year return period).

The seismic design coefficients were determined by a combination of the site class, mapped spectral accelerations, and occupancy category. The following seismic design coefficients should be implemented during design of the proposed structures. Summaries of the Seismic Hazard Deaggregation graphs and test data are presented in Appendix D.

2007 CBC	FACTOR
Site Location	Latitude: 32.9849°(North) Longitude: -117.2712°(West)
Site Class	D
Mapped Spectral Accelerations for short periods, S_s	1.56
Mapped Spectral Accelerations for 1-Second Period, S_1	0.60
Site Coefficient, F_a	1.00
Site Coefficient, F_v	1.50
Maximum Considered Earthquake Spectral Response Acceleration for Short Periods, S_{ms}	1.56
Maximum Considered Earthquake Spectral Response Acceleration for 1-Second Period, S_{m1}	0.90
Design Spectral Response Acceleration for Short Periods, S_{DS}	1.04
Design Spectral Response Acceleration for 1-Second Period, S_{D1}	0.60
Seismic Design Category	D
Importance Factor Based on Occupancy Category	II

We performed the probabilistic seismic hazard assessment for the site in accordance with the 2007 CBC, Section 1802.2.7. The probabilistic seismic hazard maps and data files were jointly prepared by the United States Geological Survey (USGS) and the California Geological Survey (CGS) and can be found at the CGS Probabilistic Seismic Hazards Mapping Ground Motion Page. Actual ground shaking intensities at the site may be substantially higher or lower based on complex variables such as the near source directivity effects, depth and consistency of earth materials, topography, geologic structure, direction of

fault rupture, and seismic wave reflection, refraction, and attenuation rates. The anticipated horizontal ground acceleration for evaluating the potential for liquefaction at the subject property is 0.42 g (S_{DS}/2.5, per CBC Section 1802.2.7).

Secondary Seismic Hazards

Secondary effects of seismic shaking considered as potential hazards include several types of ground failure as well as induced flooding. Different types of ground failure, which could occur as a consequence of severe ground shaking at the site, include landslides, ground lurching, shallow ground rupture, and liquefaction/lateral spreading. The probability of occurrence of each type of ground failure depends on the severity of the earthquake, distance from faults, topography, the state of subsurface earth materials, groundwater conditions, and other factors. Based on our experience, subsurface exploration, and laboratory testing, all of the above secondary effects of seismic activity are considered unlikely.

Seismically induced flooding is normally a consequence of a tsunami (seismic sea wave), a seiche (i.e., a wave-like oscillation of surface water in an enclosed basin that may be initiated by a strong earthquake) or failure of a major reservoir or retention system up gradient of the site. Since the site is at an elevation of more than 60 feet above mean sea level and is located more than less than one mile inland from the nearest coastline of the Pacific Ocean, the potential for seismically induced flooding due to a tsunamis is considered remote. Since no enclosed bodies of water lie adjacent to or up gradient of the site, the likelihood for induced flooding due to a seiche overcoming the dams freeboard is considered nonexistent. It is considered remote that any major reservoir or retention system up gradient of the site would be compromised to a point of failure.

Liquefaction and Lateral Spreading

Liquefaction occurs as a result of a substantial loss of shear strength or shearing resistance in loose, saturated, cohesionless earth materials subjected to earthquake induced ground shaking. Potential impacts from liquefaction include loss of bearing capacity, liquefaction related settlement, lateral movements, and surface manifestation such as sand boils. Seismically induced settlement occurs when loose sandy soils become denser when subjected to shaking during an earthquake. The three factors determining whether a site is likely to be subject to liquefaction include seismic shaking, type and consistency of earth materials, and groundwater level. The proposed structures will be supported by competent bedrock, with groundwater at a depth of over 50 feet. As such, the potential for earthquake induced liquefaction and lateral spreading beneath the proposed structures is considered very low to remote due to the recommended compacted fill, relatively low groundwater level, and the dense nature of the deeper onsite earth materials.

Liquefaction analyses were performed for the existing conditions, using a conservative groundwater level of 10 feet to represent the historic high groundwater level. The analyses determined that no potentially liquefiable earth materials were encountered. We estimate that dynamic settlement of sands will be on the order of less than one inch. The liquefaction potential and dynamic settlement of sands analyses are included within the appendices of this report.

Ground Lurching

The physics of ground lurching are not well understood, but it is generally thought to effect lightly loaded structures such as pavement, pipelines, and sidewalks. Heavier structures typically resist damage from

ground lurching. Loose cohesionless earth materials near the surface are prone to ground lurching. Due to the recommendations herein and the lack of loose cohesionless earth materials near the surface, the potential for ground lurching is not expected to occur.

Ground Subsidence

Groundwater or oil withdrawal from sedimentary earth materials can cause the permanent collapse of pore space previously occupied by the fluid. The consolidation of subsurface sediments resulting from fluid withdrawal could cause the ground surface to subside. If sufficient differential subsidence occurs it can significantly damage engineered structures. Since no excessive withdrawal of fluids is planned in the vicinity of the proposed project, the potential for subsidence is considered low to remote.

TENTATIVE FOUNDATION DESIGN RECOMMENDATIONS

General

Provided grading is performed in accordance with the recommendations of this report, shallow foundations are considered feasible for support of the proposed structures. Tentative foundation recommendations are provided herein and graphic presentations of relevant recommendations may also be included on the enclosed map.

Allowable Bearing Values

An allowable bearing value of 2,000 pounds per square foot (psf) is recommended for design of 24 inch square pad footings and 12 inch wide continuous footings founded at a minimum depth of 12 inches below the lowest adjacent final grade. This value may be increased by 20 percent for each additional 1-foot of width and/or depth to a maximum value of 4,000 psf. Recommended allowable bearing values include both dead and frequently applied live loads and may be increased by one third when designing for short duration wind or seismic forces. The shallow foundations should be founded into competent old paralic deposits.

Settlement

Based on the settlement characteristics of the earth materials that underlie the building sites and the anticipated loading, we estimate that the maximum total settlement of the footings will be less than approximately ¾ inch. Differential settlement is expected to be about ½ inch over a horizontal distance of approximately 20 feet, for an angular distortion ratio of 1:480. It is anticipated that the majority of the settlement will occur during construction or shortly after the initial application of loading.

The above settlement estimates are based on the assumption that the grading and construction are performed in accordance with the recommendations presented in this report and that the project geotechnical consultant will observe or test the earth material conditions in the footing excavations.

Lateral Resistance

Passive earth pressure of 250 psf per foot of depth to a maximum value of 2,500 psf may be used to establish lateral bearing resistance for footings. A coefficient of friction of 0.36 times the dead load forces

may be used between concrete and the supporting earth materials to determine lateral sliding resistance. The above values may be increased by one-third when designing for short duration wind or seismic forces. When combining passive and friction for lateral resistance, the passive component should be reduced by one third. In no case shall the lateral sliding resistance exceed one-half the dead load for clay, sandy clay, sandy silty clay, silty clay, and clayey silt.

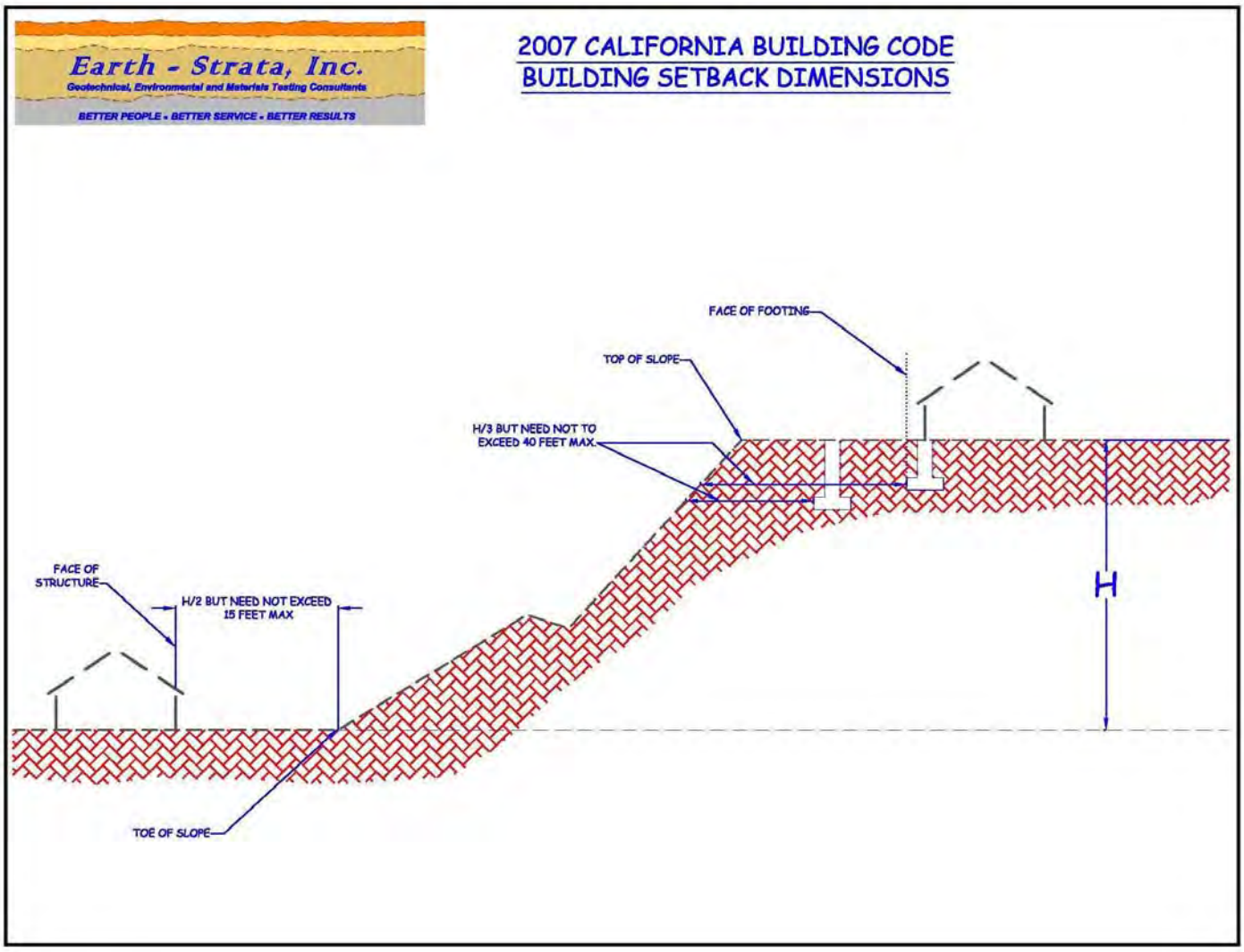
The above lateral resistance values are based on footings for an entire structure being placed directly against competent old paralic deposits.

Structural Setbacks and Building Clearance

Structural setbacks are required per the 2007 California Building Code (CBC). Additional structural setbacks are not required due to geologic or geotechnical conditions within the site. Improvements constructed in close proximity to natural or properly engineered and compacted slopes can, over time, be affected by natural processes including gravity forces, weathering, and long term secondary settlement. As a result, the CBC requires that buildings and structures be setback or footings deepened to resist the influence of these processes.

For structures that are planned near ascending and descending slopes, the footings should be embedded to satisfy the requirements presented in the CBC, Section 1805.3.1 as illustrated in the following Foundation Clearances From Slopes diagram.

FOUNDATION CLEARANCES FROM SLOPES



When determining the required clearance from ascending slopes with a retaining wall at the toe, the height of the slope shall be measured from the top of the wall to the top of the slope. The structural setback for pools may be reduced by one-half.

Foundation Observations

In accordance with the 2007 CBC and prior to the placement of forms, concrete, or steel, all foundation excavations should be observed by the geologist, engineer, or his representative to verify that they have been excavated into competent bearing materials. The excavations should be per the approved plans, moistened, cleaned of all loose materials, trimmed neat, level, and square. Any moisture softened earth materials should be removed prior to steel or concrete placement.

Earth materials from foundation excavations should not be placed in slab on grade areas unless the materials are tested for expansion potential and compacted to a minimum of 90 percent of the maximum dry density.

Expansive Soil Considerations

Preliminary laboratory test results indicate onsite earth materials exhibit an expansion potential of **VERY LOW** as classified in accordance with 2007 CBC Section 1802.3.2 and ASTM D4829-03. Additional, testing for expansive soil conditions should be conducted upon completion of rough grading. The following recommendations should be considered the very minimum requirements, for the earth materials tested. It is common practice for the project architect or structural engineer to require additional slab thickness, footing sizes, and/or reinforcement.

Very Low Expansion Potential (Expansion Index of 20 or Less)

Our laboratory test results indicate that the earth materials onsite exhibit a **VERY LOW** expansion potential as classified in accordance with 2007 CBC Section 1802.3.2 and ASTM D4829-03. Since the onsite earth materials exhibit expansion indices of 20 or less, the design of slab on ground foundations is exempt from the procedures outlined in Section 1805.8.1 or 1805.8.2.

Footings

- Exterior continuous footings may be founded at the minimum depths below the lowest adjacent final grade (i.e. 12 inch minimum depth for one-story, 18 inch minimum depth for two-story, and 24 inch minimum depth for three-story construction). Interior continuous footings for one-, two-, and three-story construction may be founded at a minimum depth of 12 inches below the lowest adjacent final grade. All continuous footings should have a minimum width of 12, 15, and 18 inches, for one-, two-, and three-story structures, respectively per Table 1805.4.2 of the 2007 CBC, and should be reinforced with a minimum of four (4) No. 4 bars, two (2) top and two (2) bottom.

- Exterior pad footings intended to support roof overhangs, such as second story decks, patio covers and similar construction should be a minimum of 24 inches square and founded at a minimum depth of 18 inches below the lowest adjacent final grade. No special reinforcement of the pad footings will be required.

Building Floor Slabs

- Building floor slabs should be a minimum of 5 inches thick and reinforced with a minimum of No. 4 bars spaced a maximum of 18 inches on center, each way. All floor slab reinforcement should be supported on concrete chairs or bricks to ensure the desired placement at mid-depth.

- Interior floor slabs, within living or moisture sensitive areas, should be underlain by a minimum 10-mil thick moisture/vapor barrier to help reduce the upward migration of moisture from the underlying earth materials. The moisture/vapor barrier used should meet the performance standards of an ASTM E 1745 Class A material, and be properly installed in accordance with ACI publication 318-05. It is the responsibility of the contractor to ensure that the moisture/vapor barriers are free of openings, rips, or punctures prior to placing concrete. As an option for additional moisture reduction, higher strength concrete, such as a minimum 28-day compressive strength of 5,000 pounds per square inch (psi) may be used.

Ultimately, the design of the moisture/vapor barrier system and recommendations for concrete placement and curing are the purview of the foundation engineer, taking into consideration the project requirements provided by the architect and owner.

- Garage floor slabs should be a minimum of 5 inches thick and should be reinforced in a similar manner as living area floor slabs. Garage floor slabs should be placed separately from adjacent wall footings with a positive separation maintained with ⅜ inch minimum felt expansion joint materials and quartered with weakened plane joints. A 12 inch wide turn down founded at the same depth as adjacent footings should be provided across garage entrances. The turn down should be reinforced with a minimum of two (2) No. 4 bars, one (1) top and one (1) bottom.

- The subgrade earth materials below all floor slabs should be pre-watered to promote uniform curing of the concrete and minimize the development of shrinkage cracks, prior to placing concrete. The pre-watering should be verified by Earth-Strata during construction.

Corrosivity

Corrosion is defined by the National Association of Corrosion Engineers (NACE) as "a deterioration of a substance or its properties because of a reaction with its environment." From a geotechnical viewpoint, the "substances" are the reinforced concrete foundations or buried metallic elements (not surrounded by concrete) and the "environment" is the prevailing earth materials in contact with them. Many factors can contribute to corrosivity, including the presence of chlorides, sulfates, salts, organic materials, different oxygen levels, poor drainage, different soil types, and moisture content. It is not considered practical or realistic to test for all of the factors which may contribute to corrosivity.

The potential for concrete exposure to chlorides is based upon the recognized Caltrans reference standard "Bridge Design Specifications", under Subsection 8.22.1 of that document, Caltrans has determined that "Corrosive water or soil contains more than 500 parts per million (ppm) of chlorides". Based on limited preliminary laboratory testing, the onsite earth materials have chloride contents *less* than 500 ppm. As such, specific requirements resulting from elevated chloride contents are not required.

Specific guidelines for concrete mix design are provided in 2007 CBC Section 1904.3 and ACI 318, Section 4.3 Table 4.3.1 when the soluble sulfate content of earth materials exceeds 0.1 percent by weight. Based on limited preliminary laboratory testing, the onsite earth materials are classified in accordance with Table 4.3.1 as having a *negligible* sulfate exposure condition. Therefore, structural concrete in contact with onsite earth materials should utilize Type I or II.

Based on our laboratory testing of resistivity, the onsite earth materials in contact with buried steel should be considered *mildly corrosive*. Additionally, pH values below 9.7 are recognized as being corrosive to most common metallic components including, copper, steel, iron, and aluminum. The pH values for the earth materials tested were *lower* than 9.7. Therefore, any steel or metallic materials that are exposed to the earth materials should be encased in concrete or other measures should be taken to provide corrosion protection.

The preliminary test results for corrosivity are based on limited samples, and the initiation of grading may blend various earth materials together. This blending or imported material could alter and increase the detrimental properties of the onsite earth materials. Accordingly, additional testing for chlorides and

sulfates along with testing for pH and resistivity should be performed upon completion of grading. Laboratory test results are presented in Appendix C.

RETAINING WALLS

Active and At-Rest Earth Pressures

Foundations may be designed in accordance with the recommendations provided in the Tentative Foundation Design Recommendation section of this report. The following table provides the minimum recommended equivalent fluid pressures for design of retaining walls a maximum of 12 feet high. The active earth pressure should be used for design of unrestrained retaining walls, which are free to tilt slightly. The at-rest earth pressure should be used for design of retaining walls that are restrained at the top, such as basement walls, curved walls with no joints, or walls restrained at corners. For curved walls, active pressure may be used if tilting is acceptable and construction joints are provided at each angle point and at a minimum of 15 foot intervals along the curved segments.

MINIMUM STATIC EQUIVALENT FLUID PRESSURES (pcf)		
PRESSURE TYPE	BACKSLOPE CONDITION	
	LEVEL	2:1 (h:v)
Active Earth Pressure	40	63
At-Rest Earth Pressure	60	95

The retaining wall parameters provided do not account for hydrostatic pressure behind the retaining walls. Therefore, the subdrain system is a very important part of the design. All retaining walls should be designed to resist surcharge loads imposed by other nearby walls, structures, or vehicles should be added to the above earth pressures, if the additional loads are being applied within a 1:1 plane projected up from the heel of the retaining wall footing. As a way of minimizing surcharge loads and the settlement potential of nearby buildings, the footings for the building can be deepened below the 1:1 plane projected up from the heel of the retaining wall footing. Retaining wall calculations have been included herein.

In general, properly constructed retaining walls without excessive pore water pressure perform well during earthquakes. Retaining walls less than 12 feet high are not required to be designed for earthquake loads for critical structures per Section 1806A of the 2007 CBC. As a result, it is our opinion that proposed retaining walls under 12 feet high do not need to be designed for earthquake motions.

Upon request and under a separate scope of work, more detailed analyses can be performed to address equivalent fluid pressures with regard to stepped retaining walls, actual retaining wall heights, actual backfill inclinations, specific backfill materials, higher retaining walls requiring earthquake design motions, etc.

Subdrain System

We recommend a perforated pipe and gravel subdrain system be provided behind all proposed retaining walls to prevent the buildup of hydrostatic pressure behind the proposed retaining walls. The perforated pipe should consist of 4 inch minimum diameter Schedule 40 PVC or ABS SDR-35, placed with the perforations facing down. The pipe should be surrounded by 1 cubic foot per foot of ¾- or 1½ inch open

graded gravel wrapped in filter fabric. The filter fabric should consist of Mirafi 140N or equivalent to prevent infiltration of fines and subsequent clogging of the subdrain system.

In lieu of a perforated pipe and gravel subdrain system, weep holes or open vertical masonry joints may be provided in the lowest row of block exposed to the air to prevent the buildup of hydrostatic pressure behind the proposed retaining walls. Weep holes should be a minimum of 3 inches in diameter and provided at intervals of at least every 6 feet along the wall. Open vertical masonry joints should be provided at a minimum of 32 inch intervals. A continuous gravel fill, a minimum of 1 cubic foot per foot, should be placed behind the weep holes or open masonry joints. The gravel should be wrapped in filter fabric consisting of Mirafi 140N or equivalent.

The retaining walls should be adequately coated on the backfilled side of the walls with a proven waterproofing compound by an experienced professional to inhibit infiltration of moisture through the walls.

Temporary Excavations

All excavations should be made in accordance with Cal-OSHA requirements. Earth-Strata is not responsible for job site safety.

Retaining Wall Backfill

Retaining wall backfill materials should be approved by the geotechnical engineer or his representative prior to placement as compacted fill. Retaining wall backfill should be placed in lifts no greater than 6 to 8 inches, watered or air dried as necessary to achieve near optimum moisture contents. All retaining wall backfill should be compacted to a minimum of 90 percent of the maximum dry density as determined by ASTM D 1557. Retaining wall backfill should be capped with a paved surface drain.

CONCRETE FLATWORK

Thickness and Joint Spacing

Concrete sidewalks and patio type slabs should be at least 3½ inches thick and provided with construction or expansion joints every 6 feet or less, to reduce the potential for excessive cracking. Concrete driveway slabs should be at least 5 inches thick and provided with construction or expansion joints every 10 feet or less.

Subgrade Preparation

In order to reduce the potential for unsightly cracking, subgrade earth materials underlying concrete flatwork should be compacted at near optimum moisture to a minimum of 90 percent of the maximum dry density determined by ASTM test method D 1557-00 and then moistened to at least optimum or slightly above optimum moisture content. This moisture should extend to a depth of at least 12 inches below subgrade and be maintained prior to placement of concrete. Pre-watering of the earth materials prior to placing concrete will promote uniform curing of the concrete and minimize the development of shrinkage cracks. The project geotechnical engineer or his representative should verify the density and moisture content of the earth materials and the depth of moisture penetration prior to placing concrete.

Cracking within concrete flatwork is often a result of factors such as the use of too high a water to cement ratio and/or inadequate steps taken to prevent moisture loss during the curing of the concrete. Concrete distress can be reduced by proper concrete mix design and proper placement and curing of the concrete. Minor cracking within concrete flatwork is normal and should be expected.

PRELIMINARY ASPHALTIC CONCRETE PAVEMENT DESIGN

Laboratory testing of representative earth materials indicate an R-value of 75 may be used for preliminary pavement design. The following table includes our minimum recommended asphaltic concrete pavement sections calculated in accordance with the State of California design procedures using assumed Traffic Indices. Final pavement design should be based on sampling and testing of post grading conditions. Alternative pavement sections and calculation sheets have been provided within the appendices of this report.

PRELIMINARY ASPHALTIC CONCRETE PAVEMENT DESIGN			
PARAMETERS	**AUTO PARKING**	**AUTO DRIVES**	**ENTRANCES/TRUCK DRIVES**
Assumed Traffic Index	4.0	5.0	6.0
Design R-Value	50	50	50
AC Thickness (inches)	3.0	3.0	3.0
AB Thickness (inches)	*4.0	*4.0	4.2

Notes: AC – Asphaltic Concrete
AB – Aggregate Base
* - Denotes Minimum

The subgrade earth materials immediately below the aggregate base (base) should be compacted to a minimum of 95 percent of the maximum dry density determined by ASTM D 1557 to a minimum depth of 12 inches. Base materials should be compacted to a minimum of 95 percent of the maximum dry density determined by ASTM D 1557.

PRELIMINARY PORTLAND CEMENT CONCRETE PAVEMENT DESIGN

PORTLAND CEMENT CONCRETE PAVEMENT			
Type	**Design R-Value**	**Traffic Index**	**Pavement Section**
Residential	50	6.0	6 inches PCC over 5 inches of AB

Note: PCC = Portland Cement Concrete
AB = Aggregate Base

The minimum requirements for the Portland cement concrete shall be a six-sack mix and 3,500 pounds per square inch at 28 days.

Base materials should consist of Class 2 aggregate base conforming to Section 26-1.02B of the State of California Standard Specifications or crushed aggregate base conforming to Section 200-2 of the Standard Specifications for Public Works Construction (Greenbook). Base materials should be compacted at or slightly below optimum moisture content. Asphaltic concrete materials and construction operations

should conform to Section 203 of the Greenbook. Portland cement concrete materials and construction should conform to Section 201 of Greenbook.

GRADING PLAN REVIEW AND CONSTRUCTION SERVICES

This report has been prepared for the exclusive use of **OFFICE OF THE CITY ENGINEER** and their authorized representative. It likely does not contain sufficient information for other parties or other uses. Earth-Strata should be engaged to review the final design plans and specifications prior to construction. This is to verify that the recommendations contained in this report have been properly incorporated into the project plans and specifications. Should Earth-Strata not be accorded the opportunity to review the project plans and specifications, we are not responsibility for misinterpretation of our recommendations.

We recommend that Earth-Strata be retained to provide geologic and geotechnical engineering services during grading and foundation excavation phases of the work. In order to allow for design changes in the event that the subsurface conditions differ from those anticipated prior to construction.

Earth-Strata should review any changes in the project and modify and approve in writing the conclusions and recommendations of this report. This report and the drawings contained within are intended for design input purposes only and are not intended to act as construction drawings or specifications. In the event that conditions encountered during grading or construction operations appear to be different than those indicated in this report, this office should be notified immediately, as revisions may be required.

REPORT LIMITATIONS

Our services were performed using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable soils engineers and geologists, practicing at the time and location this report was prepared. No other warranty, expressed or implied, is made as to the conclusions and professional advice included in this report.

Earth materials vary in type, strength, and other geotechnical properties between points of observation and exploration. Groundwater and moisture conditions can also vary due to natural processes or the works of man on this or adjacent properties. As a result, we do not and cannot have complete knowledge of the subsurface conditions beneath the subject property. No practical study can completely eliminate uncertainty with regard to the anticipated geotechnical conditions in connection with a subject property. The conclusions and recommendations within this report are based upon the findings at the points of observation and are subject to confirmation by Earth-Strata based on the conditions revealed during grading and construction.

This report was prepared with the understanding that it is the responsibility of the owner or their representative, to ensure that the conclusions and recommendations contained herein are brought to the attention of the other project consultants and are incorporated into the plans and specifications. The owners' contractor should properly implement the conclusions and recommendations during grading and construction, and notify the owner if they consider any of the recommendations presented herein to be unsafe or unsuitable.

APPENDIX A

REFERENCES

APPENDIX A

References

California Building Standards Commission, 2007, *2007 California Building Code, California Code of Regulations Title 24, Part 2, Volume 2 of 2,* Based on 2006 International Building Code.

DeLorme, 2004, (www.delorme.com) *Topo USA*®.

Hart, Earl W. and Bryant, William A., *1997, Fault Rupture Hazard Zones in California, CDMG Special Publication 42,* revised 2003.

Irvine Geotechnical, 2001, Mult Calc 2000, October 10.

National Association of Corrosion Engineers, 1984, *Corrosion Basics An Introduction*, page 191.

Southern California Earthquake Center (SCEC), 1999, *Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Liquefaction Hazards in California,* March.

APPENDIX B

EXPLORATORY LOGS

SYMBOLS AND TERMS USED ON LOGS

The No. 200 Standard Sieve is about the smallest particle visible to the naked eye.					
Coarse-grained Soils ≥½ of materials larger than #200 sieve	**GRAVELS** Higher percentage of coarse fraction is larger than #4 sieve	Clean Gravels (less than 5% fines)		**GW**	Well-graded gravels, little or no fines
				GP	Poorly-graded gravels, little or no fines
		5 – 12% fines		**GW-GM**	Well-graded gravel with silt
				GW-GC	Well-graded gravel with clay
				GP-GM	Poorly-graded gravel with silt
				GP-GC	Poorly-graded gravel with clay
		Gravels with fines	PI < 4	**GM**	Silty Gravels
			PI > 7	**GC**	Clayey Gravels
	SANDS Higher percentage of coarse fraction is smaller than #4 sieve	Clean Sands (less than 5% fines)		**SW**	Well-graded sands, little or no fines
				SP	Poorly-graded sands, little or no fines
		5 – 12% fines		**SW-SM**	Well-graded sand with silt
				SW-SC	Well-graded sand with clay
				SP-SM	Poorly-graded sand with silt
				SP-SC	Poorly-graded sand with clay
		Sands with fines	PI < 4	**SM**	Silty Sands
			PI > 7	**SC**	Clayey Sands
			PI 4-7	**SC-SM**	Silty clayey sands
Fine-grained Soils ≥½ of materials smaller than #200 sieve	**SILTS & CLAYS** Liquid Limit Less Than 50		PI < 4	**ML**	Inorganic silts & sandy silts
			PI > 7	**CL**	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, lean clays
			PI 4-7	**ML-CL**	Silts & clays of low plasticity, sandy silty clay, silty clay
	SILTS & CLAYS Liquid Limit Greater Than 50			**MH**	Inorganic silts, micaceous or diatomaceous silt, sandy silt
				CH	Inorganic clays of high plasticity, fat clays, sandy clays, gravelly clays
				OH	Organic silts and clays of medium-to-high plasticity
Highly Organic Soils				**PT**	Peat, humus swamp soils with higher organic content

Symbols	
	Ring Sample
	SPT Sample
NR	No Recovery
▽	Groundwater

Grain Size				
Description		Sieve Size	Grain Size	Approximate Size
Boulders		>12"	>12"	Larger than basketball-sized
Cobbles		3-12"	3-12"	Fist-sized to basketball-sized
Gravel	Coarse	¾-3"	¾-3"	Thumb-sized to fist-sized
	Fine	#4-¾"	0.19-0.75"	Pea-sized to thumb-sized
Sand	Coarse	#10-#4	0.079-0.19"	Rock salt-sized to pea-sized
	Medium	#40-#10	0.017-0.079"	Sugar-sized to rock salt-sized
	Fine	#200-#40	0.0029-0.017"	Flour-sized to sugar-sized
Fines		Passing #200	<0.0029"	Flour-sized and smaller

Moisture Content
Slightly Moist
Moist
Very Moist
Wet

Consistency – Fine Grained Soils			
Apparent Density	SPT (# blows/foot)	Modified CA Sampler (# blows/foot)	Field Test
Very Soft	<1	<2	Easily penetrated by thumb; exudes between thumb and fingers when squeezed in hand
Soft	2-3	3-6	Easily penetrated one inch by thumb; molded by light finger pressure
Medium Stiff	4-6	7-12	Penetrated over ½ inch by thumb with moderate effort; molded by strong finger pressure
Stiff	7-10	13-15	Indented about ½ inch by thumb but penetrated only with great effort
Very Stiff	11-20	16-30	Readily indented thumbnail
Hard	>20	>30	Indented with difficulty by thumbnail

Relative Density – Coarse Grained Soils			
Apparent Density	SPT (# blows/foot)	Modified CA Sampler (# blows/foot)	Field Test
Very Loose	<2	<4	Easily penetrated with ½ inch reinforcing rod pushed by hand
Loose	3-5	4-10	Easily penetrated with ½ inch reinforcing rod pushed by hand
Medium Dense	6-15	11-30	Easily penetrated 1-foot with ½ inch reinforcing rod driven with a 5-lb hammer
Dense	16-25	31-50	Difficult to penetrate 1-foot with ½ inch reinforcing rod driven with a 5-lb hammer
Very Dense	>25	>50	Penetrated only a few inches with ½ inch reinforcing rod driven with a 5-lb hammer

Geotechnical Boring Log B-1

Date: December 13, 2010	**Project Name: The Pearl - Solana Beach** **Page: 1 of 2**
Project Number: 10814-10A	**Logged By: CW**
Drilling Company: Cal Pac	**Type of Rig: Mobile B61**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft): 60	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	ASTM Symbol	MATERIAL DESCRIPTION
0						***6"AC, No Aggregate Base***
						Pleistocene Old Paralic Deposits (Qop):
					SM	Silty SAND; reddish brown, slightly moist, medium dense to dense
	35	R-1	122.5	3.8		
5	11	R-2	107.9	3.6		medium dense, fine to medium grained, oxidation zones
	38	R-3	115.6	4.1		orangish brown, dense
10	41	R-4				disturbed
15	45	R-5	102.6	3.8		light yellowish brown
20	62	R-6	104.6	1.8		whitish brown, very dense, fine grained
25	68	R-7	111.7	1.7		with gravel, fine to coarse grained
30						

Geotechnical Boring Log B-1

Date: December 13, 2010	**Project Name: The Pearl - Solana Beach** **Page: 2 of 2**
Project Number: 10814-10A	**Logged By: CW**
Drilling Company: Cal Pac	**Type of Rig: Mobile B61**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft): 60	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	ASTM Symbol	MATERIAL DESCRIPTION
30	76	R-8	102.4	2.5	SP	SAND; whitish brown, slightly moist, very dense, fine to coarse grained
35	52	N-1	-	2.4		
40	50-6"	R-9	107.6	2.8		
45	37	N-2	-	3.0		
50	75	R-10	111.2	3.1		
						Total Depth @ 51.5 feet
						No Groudnwater
55						**Backfilled with Hydro Plug Chips**
60						

Geotechnical Boring Log B-2

Date: December 13, 2010	**Project Name: The Pearl - Solana Beach** **Page: 1 of 1**
Project Number: 10814-10A	**Logged By: CW**
Drilling Company: Cal Pac	**Type of Rig: Mobile B61**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft): 60	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	ASTM Symbol	MATERIAL DESCRIPTION
0		Bag 1 @ 0-5'				***8" AC, No Aggreate Base***
						Pleistocene Old Paralic Deposits (Qop):
					SM	Silty SAND; orangish brown, slightly moist to moist, loose to medium dense
	20	R-1	116.4	2.9		medium dense, fine to medium grained
5	13	R-2	106.0	3.3		
	54	R-3	123.3	4.6		very dense
10	28	R-4	104.3	1.8		light tannish brown, medium dense
15	52	R-5	103.7	2.7		very dense
20	49	R-6	98.7	1.6		dense
						Total Depth @ 21.5 feet
						No Groundwater
25						
30						

26047 JEFFERSON AVENUE, SUITE C, MURRIETA, CA 92562

Earth - Strata, Inc.
Geotechnical, Environmental and Materials Testing Consultants
BETTER PEOPLE • BETTER SERVICE • BETTER RESULTS

Geotechnical Boring Log B-3

Date: December 13, 2010	**Project Name: The Pearl - Solana Beach** **Page: 1 of 1**
Project Number: 10814-10A	**Logged By: CW**
Drilling Company: Cal Pac	**Type of Rig: Mobile B61**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft): 60	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	ASTM Symbol	MATERIAL DESCRIPTION
0		Bag 1 @ 0-5'				***6" AC, No Aggreate Base***
						Pleistocene Old Paralic Deposits (Qop):
					SM	Silty SAND; orangish brown, loose to medium dense, fine to medium grained
	26	R-1	116.0	2.7		medium dense, well sorted, poorly graded
5	13	R-2	108.8	3.5		moist
	24	R-3	117.2	2.9		light orangish brown, slightly moist
10	36	R-4	112.6	5.1		dense
15	55	R-5	115.6	4.1		very dense
20	40	R-6	99.8	1.6		dense
						Total Depth @ 21.5 feet
						No Groundwater
25						
30						

Geotechnical Boring Log B-4

Date: December 13, 2010	**Project Name: The Pearl - Solana Beach** **Page: 1 of 1**
Project Number: 10814-10A	**Logged By: CW**
Drilling Company: Cal Pac	**Type of Rig: Mobile B61**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft): 60	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	ASTM Symbol	MATERIAL DESCRIPTION
0						***7" AC, No Aggreate Base***
						Pleistocene Old Paralic Deposits (Qop):
					SM	Silty SAND; reddish brown, moist, loose to medium dense, fine to medium grained
	33	R-1	117.2	4.2		dense
5	8	R-2	108.1	5.9		dark reddish brown, loose, very moist to wet
	12	R-3	110.9	4.6		light orangish brown, slightly moist, medium dense
10	28	R-4	110.8	5.0		
15	56	R-5	116.2	3.2		very dense, medium to coarse grained
20	45	R-6	97.9	2.5		whitish brown, slightly moist, dense, fine grained
						Total Depth @ 21.5 feet
						No Groundwater
25						
30						

Geotechnical Boring Log B-5

Date: December 13, 2010	**Project Name: The Pearl - Solana Beach** **Page: 1 of 1**
Project Number: 10814-10A	**Logged By: CW**
Drilling Company: Cal Pac	**Type of Rig: Mobile B61**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft): 60	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	ASTM Symbol	MATERIAL DESCRIPTION
0						***6" AC, No Aggregate Base***
						Pleistocene Old Paralic Deposits (Qop):
					SM	Silty SAND; reddish brown, moist, loose to medium dense
	11	R-1	113.3	4.7		
5	14	R-2	113.9	4.0		orangish brown, medium dense
	31	R-3				dense
10	39	R-4	115.7	3.9		slightly moist
15	42	R-5	106.6	5.7		yellowish brown
20	44	R-6	99.5	4.8		whitish brown, slightly moist, fine grained
25	45	R-7	97.7	4.7	SP	SAND; whitish brown, slightly moist to moist, dense, medium to coarse grained
30						

Geotechnical Boring Log B-5

Date: December 13, 2010	**Project Name: The Pearl - Solana Beach** **Page: 2 of 2**
Project Number: 10814-10A	**Logged By: CW**
Drilling Company: Cal Pac	**Type of Rig: Mobile B61**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft): 60	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	ASTM Symbol	MATERIAL DESCRIPTION
30	64	R-8	104.0	3.4		
						Total Depth @ 31.5 feet
						No Groundwater
						Backfilled with Hydro Plug Chips
35						
40						
45						
50						
55						
60						

APPENDIX C

LABORATORY PROCEDURES AND TEST RESULTS

APPENDIX C

Laboratory Procedures and Test Results

Laboratory testing provided quantitative and qualitative data involving the relevant engineering properties of the representative earth materials selected for testing. The representative samples were tested in general accordance with American Society for Testing and Materials (ASTM) procedures and/or California Test Methods (CTM).

Soil Classification: Earth materials encountered during exploration were classified and logged in general accordance with the Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) of ASTM D 2488. Upon completion of laboratory testing, exploratory logs and sample descriptions were reconciled to reflect laboratory test results with regard to ASTM D 2487.

Atterberg Limits: The Atterberg limits of select samples were determined using the guidelines of ASTM D 4318 for engineering classification of fine materials. The test results are presented in the table below.

SAMPLE LOCATION	MATERIAL DESCRIPTION	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	ASTM SYMBOL
B-3 @ 0-5 feet	Silty Sand	NP	NP	NP	SM

Note: NP=Non-Plastic

Moisture and Density Tests: For select samples moisture content was determined using the guidelines of ASTM D 2216 and dry density determinations were made using the guidelines of ASTM D 2937. These tests were performed on relatively undisturbed samples and the test results are presented on the exploratory logs.

Maximum Density Tests: The maximum dry density and optimum moisture content of representative samples were determined using the guidelines of ASTM D 1557. The test results are presented in the table below.

SAMPLE LOCATION	MATERIAL DESCRIPTION	MAXIMUM DRY DENSITY (pcf)	OPTIMUM MOISTURE CONTENT (%)
B-2 @ 0-5 feet	Silty Sand	127.0	8.5

Expansion Index: The expansion potential of representative samples was evaluated using the guidelines of ASTM D 4829. The test results are presented in the table below.

SAMPLE LOCATION	MATERIAL DESCRIPTION	EXPANSION INDEX	EXPANSION POTENTIAL
B-2 @ 0-5 feet	Silty Sand	4	Very Low

Direct Shear: Direct shear tests were performed on representative remolded and/or undisturbed samples using the guidelines of ASTM D 3080. The test results are presented in the table below and/or on the Direct Shear Plots on Sheets S-1 through S-3.

SAMPLE LOCATION	MATERIAL DESCRIPTION	*FRICTION ANGLE (degrees)	*APPARENT COHESION (psf)
B-1 @ 10 feet	Silty Sand	28.7	629
B-5 @ 7.5 feet	Silty Sand	31.4	375

* Peak values.

R-Value: The R-value of representative samples was determined using the guidelines of CTM 301. The test results are presented in the table below.

SAMPLE LOCATION	MATERIAL DESCRIPTION	R-VALUE
B-3 @ 0-5 feet	Silty Sand	75

Minimum Resistivity and pH Tests: Minimum resistivity and pH Tests of select samples were performed using the guidelines of CTM 643. The test results are presented in the table below.

SAMPLE LOCATION	MATERIAL DESCRIPTION	pH	MINIMUM RESISTIVITY (ohm-cm)
B-2 @ 0-5 feet	Silty Sand	8.1	2,900

Soluble Sulfate: The soluble sulfate content of select samples was determined using the guidelines of CTM 417. The test results are presented in the table below.

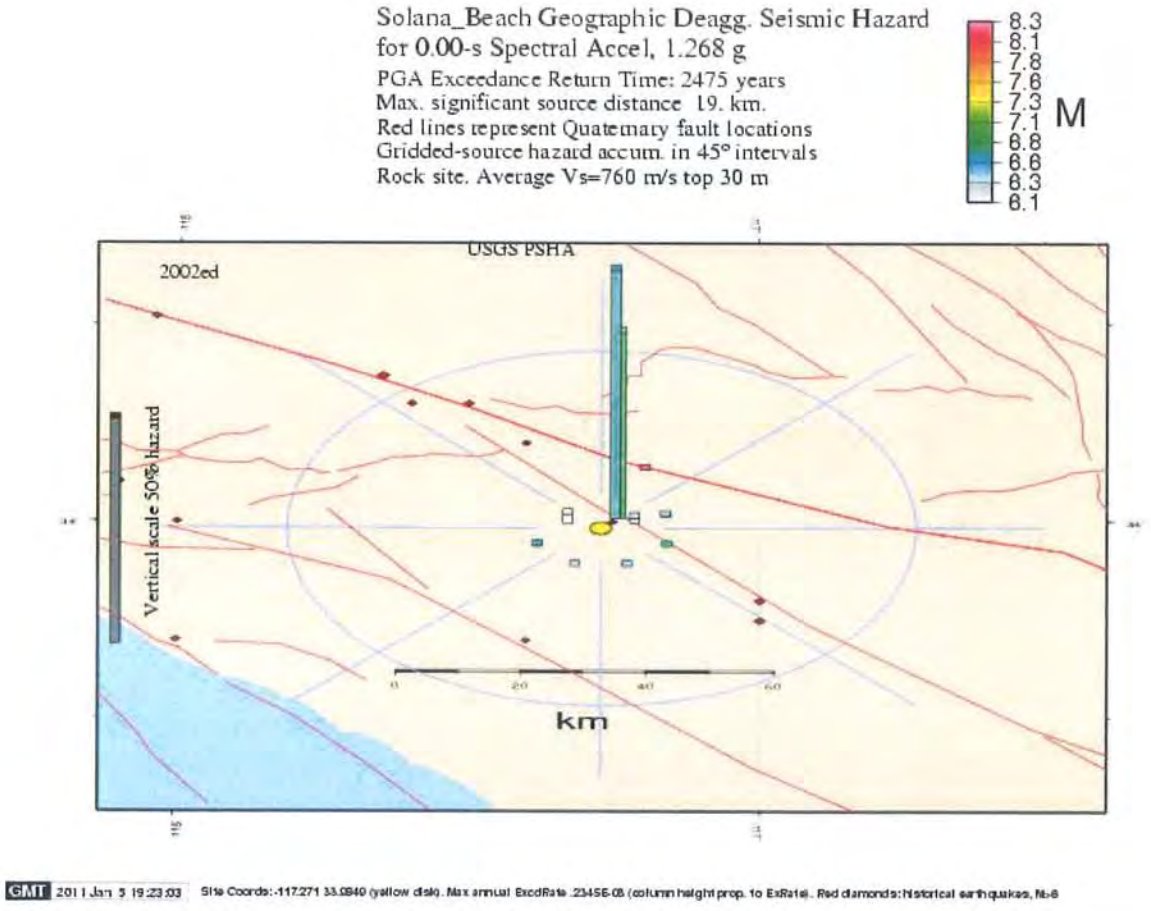
SAMPLE LOCATION	MATERIAL DESCRIPTION	SULFATE CONTENT (% by weight)	SULFATE EXPOSURE
B-2 @ 0-5 feet	Silty Sand	0.061	Negigible

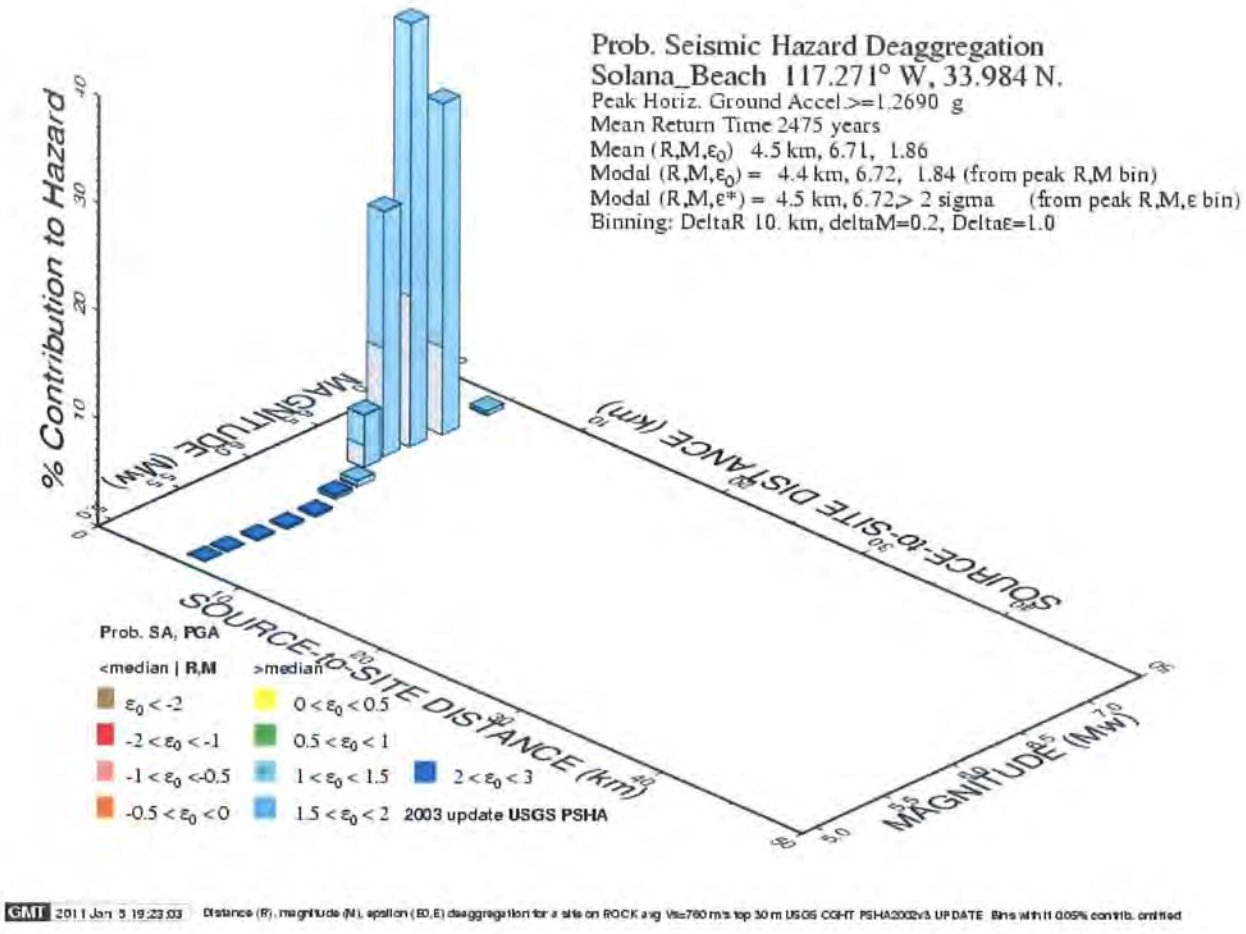
Chloride Content: Chloride content of select samples was determined using the guidelines of CTM 422. The test results are presented in the table below.

SAMPLE LOCATION	MATERIAL DESCRIPTION	CHLORIDE CONTENT (ppm)
B-2 @ 0-5 feet	Silty Sand	370

APPENDIX D

SEISMICITY


Solana_Beach Geographic Deagg. Seismic Hazard
for 0.00-s Spectral Accel, 1.268 g
PGA Exceedance Return Time: 2475 years
Max. significant source distance 19. km.
Red lines represent Quaternary fault locations
Gridded-source hazard accum. in 45° intervals
Rock site. Average Vs=760 m/s top 30 m
8.3
8.1
7.8
7.6
7.3
7.1
6.8
6.6
6.3
6.1
M
USGS PSHA
2002ed
Vertical scale 50% hazard
0
20
40
60
km
GMT 2011 Jan 5 19:23:03
Site Coords: -117.271 33.0840 (yellow disk). Max annual ExcdRate .23456-05 (column height prop. to ExRate). Red diamonds: historical earthquakes, M>6



GMT 2011 Jan 5 19:23:03 Distance (R), magnitude (M), epsilon (E0,E) deaggregation for a site on ROCK avg Vs=760 m/s top 30 m USGS CGHT PSHA2002v3 UPDATE Bins with it 0.05% contrib. omitted

*** Deaggregation of Seismic Hazard for PGA & 2 Periods of Spectral Accel. ***
*** Data from U.S.G.S. National Seismic Hazards Mapping Project, 2002 version ***
PSHA Deaggregation. %contributions. site: SolanaBeach long: 117.271 W., lat: 32.984 N.
USGS 2002-03 update files and programs. dM=0.2. Site descr:ROCK
Return period: 2475 yrs. Exceedance PGA =0.6287 g.
#Pr[at least one eq with median motion>=PGA in 50 yrs]=0.00262

DIST(KM)	MAG(MW)	ALL_EPS	EPSILON>2	1<EPS<2	0<EPS<1	-1<EPS<0	-2<EPS<-1	EPS<-2
6.7	5.05	0.559	0.418	0.141	0.000	0.000	0.000	0.000
11.7	5.05	0.073	0.073	0.000	0.000	0.000	0.000	0.000
6.7	5.20	1.111	0.703	0.408	0.000	0.000	0.000	0.000
12.0	5.20	0.181	0.181	0.000	0.000	0.000	0.000	0.000
6.7	5.40	1.105	0.518	0.587	0.000	0.000	0.000	0.000
12.3	5.40	0.232	0.232	0.000	0.000	0.000	0.000	0.000
6.7	5.60	1.101	0.391	0.710	0.000	0.000	0.000	0.000
12.6	5.60	0.292	0.281	0.010	0.000	0.000	0.000	0.000
6.7	5.80	1.084	0.304	0.740	0.040	0.000	0.000	0.000
12.9	5.80	0.351	0.307	0.044	0.000	0.000	0.000	0.000
6.2	6.01	1.388	0.279	0.910	0.199	0.000	0.000	0.000
12.7	6.01	0.479	0.358	0.121	0.000	0.000	0.000	0.000
5.8	6.20	1.911	0.280	1.155	0.476	0.000	0.000	0.000
12.6	6.20	0.612	0.389	0.224	0.000	0.000	0.000	0.000
6.0	6.40	2.068	0.263	1.129	0.675	0.000	0.000	0.000
12.9	6.40	0.638	0.351	0.287	0.000	0.000	0.000	0.000
4.3	6.64	19.792	1.635	8.778	9.379	0.000	0.000	0.000
12.6	6.62	0.975	0.507	0.468	0.000	0.000	0.000	0.000
4.8	6.77	8.812	1.072	4.775	2.964	0.001	0.000	0.000
13.1	6.81	0.727	0.414	0.313	0.000	0.000	0.000	0.000
3.9	6.94	32.019	2.429	13.596	15.905	0.088	0.000	0.000
12.8	6.94	0.313	0.144	0.169	0.000	0.000	0.000	0.000
3.9	7.17	23.030	1.436	9.122	11.897	0.575	0.000	0.000
3.8	7.49	0.720	0.040	0.252	0.387	0.041	0.000	0.000
26.1	7.60	0.202	0.202	0.000	0.000	0.000	0.000	0.000
26.1	7.80	0.095	0.095	0.000	0.000	0.000	0.000	0.000

Summary statistics for above PSHA PGA deaggregation, R=distance, e=epsilon:
Mean src-site R= 4.8 km; M= 6.78; eps0= 0.56. Mean calculated for all sources.
Modal src-site R= 3.9 km; M= 6.94; eps0= 0.37 from peak (R,M) bin
Gridded source distance metrics: Rseis Rrup and Rjb
MODE R*= 3.8km; M*= 6.93; EPS.INTERVAL: 0 to 1 sigma % CONTRIB.= 15.905

Principal sources (faults, subduction, random seismicity having >10% contribution)

Source Category:	% contr.	R(km)	M	epsilon0 (mean values)
California shallow gridded	19.11	7.8	6.15	1.22
Calif b, SS or Thrust	80.89	4.1	6.93	0.40
Individual fault hazard details if contrib.>1%:				
2 Rose Canyon	46.49	3.8	7.03	0.33
2 Rose Canyon GR M-distrib	34.08	4.3	6.78	0.48

********** Southern California **********
PSHA Deaggregation. %contributions. ROCK site: SolanaBeach long: 117.271 d W., lat: 32.984 N.
USGS 2002-2003 update files and programs. Analysis on DaMoYr:05/01/2011
Return period: 2475 yrs. 1.00 s. PSA =0.5529 g.
#Pr[at least one eq with median motion>=PSA in 50 yrs]=0.00030

DIST(km)	MAG(Mw)	ALL_EPS	EPSILON>2	1<EPS<2	0<EPS<1	-1<EPS<0	-2<EPS<-1	EPS<-2
6.7	5.41	0.076	0.076	0.000	0.000	0.000	0.000	0.000
6.7	5.61	0.145	0.139	0.006	0.000	0.000	0.000	0.000
6.6	5.80	0.233	0.179	0.054	0.000	0.000	0.000	0.000
12.9	5.81	0.080	0.080	0.000	0.000	0.000	0.000	0.000
5.8	6.02	0.468	0.232	0.236	0.000	0.000	0.000	0.000
13.1	6.02	0.187	0.187	0.001	0.000	0.000	0.000	0.000
5.3	6.21	0.894	0.260	0.634	0.000	0.000	0.000	0.000
13.1	6.20	0.327	0.297	0.030	0.000	0.000	0.000	0.000
5.6	6.41	1.241	0.255	0.938	0.047	0.000	0.000	0.000
13.5	6.40	0.474	0.343	0.131	0.000	0.000	0.000	0.000
23.4	6.41	0.083	0.083	0.000	0.000	0.000	0.000	0.000
4.3	6.63	12.404	1.560	7.744	3.100	0.000	0.000	0.000
13.7	6.62	1.126	0.668	0.458	0.000	0.000	0.000	0.000
24.5	6.62	0.254	0.254	0.000	0.000	0.000	0.000	0.000
4.5	6.79	14.909	1.555	8.894	4.461	0.000	0.000	0.000

13.4	6.81	0.970	0.446	0.524	0.000	0.000	0.000	0.000
24.2	6.77	0.344	0.341	0.002	0.000	0.000	0.000	0.000
33.6	6.81	0.080	0.080	0.000	0.000	0.000	0.000	0.000
4.0	6.96	30.104	2.211	14.002	13.889	0.002	0.000	0.000
13.2	6.93	0.668	0.215	0.453	0.000	0.000	0.000	0.000
24.8	6.93	0.729	0.721	0.008	0.000	0.000	0.000	0.000
33.2	7.01	0.070	0.070	0.000	0.000	0.000	0.000	0.000
3.7	7.17	23.804	1.281	8.135	14.388	0.000	0.000	0.000
25.4	7.14	1.073	1.057	0.016	0.000	0.000	0.000	0.000
49.3	7.20	0.175	0.175	0.000	0.000	0.000	0.000	0.000
3.8	7.43	1.725	0.075	0.474	1.125	0.051	0.000	0.000
25.9	7.38	1.515	1.217	0.298	0.000	0.000	0.000	0.000
26.1	7.54	2.512	1.194	1.318	0.000	0.000	0.000	0.000
26.1	7.74	2.717	0.931	1.787	0.000	0.000	0.000	0.000
124.7	7.98	0.088	0.088	0.000	0.000	0.000	0.000	0.000
120.7	8.19	0.171	0.171	0.000	0.000	0.000	0.000	0.000

Summary statistics for above 1.0s PSA deaggregation, R=distance, e=epsilon:
Mean src-site R= 7.1 km; M= 6.96; eps0= 0.73. Mean calculated for all sources.
Modal src-site R= 4.0 km; M= 6.96; eps0= 0.51 from peak (R,M) bin
Gridded source distance metrics: Rseis Rrup and Rjb
MODE R*= 3.7km; M*= 7.17; EPS.INTERVAL: 0 to 1 sigma % CONTRIB.= 14.388

Principal sources (faults, subduction, random seismicity having >10% contribution)

Source Category:	% contr.	R(km)	M	epsilon0 (mean values)
California shallow gridded	10.46	8.9	6.53	1.33
Calif b, SS or Thrust	89.00	6.3	7.00	0.64
Individual fault hazard details if contrib.>1%:				
2 Rose Canyon	49.06	3.9	7.05	0.40
2 Newport-Inglewood offshore	1.33	24.5	7.07	2.15
2 Coronado Bank	5.51	26.1	7.61	1.62
2 Rose Canyon GR M-distrib	31.10	4.6	6.81	0.70
2 Coronado Bank GR M-distrib	1.87	27.1	7.30	1.99

********** Southern California **********
PSHA Deaggregation. %contributions. ROCK site: SolanaBeach long: 117.271 d W., lat: 32.984 N.
USGS 2002-2003 update files and programs. Analysis on DaMoYr:05/01/2011
Return period: 2475 yrs. 0.20 s. PSA =1.4676 g.
#Pr[at least one eq with median motion>=PSA in 50 yrs]=0.00339

DIST(km)	MAG(Mw)	ALL_EPS	EPSILON>2	1<EPS<2	0<EPS<1	-1<EPS<0	-2<EPS<-1	EPS<-2
6.8	5.05	0.627	0.444	0.183	0.000	0.000	0.000	0.000
11.8	5.05	0.097	0.097	0.000	0.000	0.000	0.000	0.000
6.8	5.20	1.230	0.745	0.485	0.000	0.000	0.000	0.000
12.1	5.20	0.246	0.246	0.000	0.000	0.000	0.000	0.000
6.8	5.40	1.200	0.548	0.651	0.000	0.000	0.000	0.000
12.5	5.40	0.322	0.322	0.000	0.000	0.000	0.000	0.000
6.8	5.60	1.176	0.400	0.776	0.000	0.000	0.000	0.000
12.9	5.60	0.404	0.385	0.019	0.000	0.000	0.000	0.000
6.8	5.80	1.145	0.307	0.802	0.036	0.000	0.000	0.000
13.2	5.80	0.479	0.412	0.067	0.000	0.000	0.000	0.000
6.3	6.01	1.436	0.287	0.960	0.189	0.000	0.000	0.000
13.0	6.01	0.643	0.471	0.172	0.000	0.000	0.000	0.000
5.8	6.20	1.939	0.291	1.198	0.449	0.000	0.000	0.000
12.8	6.20	0.814	0.497	0.317	0.000	0.000	0.000	0.000
21.9	6.21	0.057	0.057	0.000	0.000	0.000	0.000	0.000
6.0	6.40	2.099	0.276	1.209	0.613	0.000	0.000	0.000
13.2	6.40	0.851	0.445	0.406	0.000	0.000	0.000	0.000
22.8	6.40	0.066	0.066	0.000	0.000	0.000	0.000	0.000
4.3	6.64	20.973	2.030	9.780	9.162	0.000	0.000	0.000
12.8	6.62	1.328	0.623	0.705	0.000	0.000	0.000	0.000
22.6	6.61	0.099	0.099	0.000	0.000	0.000	0.000	0.000
4.0	6.85	21.365	1.377	8.013	11.975	0.000	0.000	0.000
13.6	6.81	0.945	0.515	0.430	0.000	0.000	0.000	0.000
22.6	6.78	0.082	0.082	0.000	0.000	0.000	0.000	0.000
4.1	6.97	16.693	1.668	8.945	5.964	0.117	0.000	0.000
12.9	6.94	0.482	0.181	0.300	0.001	0.000	0.000	0.000
24.0	6.93	0.081	0.081	0.000	0.000	0.000	0.000	0.000
3.8	7.16	21.658	1.499	8.970	10.552	0.637	0.000	0.000
24.9	7.12	0.066	0.066	0.000	0.000	0.000	0.000	0.000

3.8	7.49	0.634	0.040	0.240	0.313	0.042	0.000	0.000
25.9	7.35	0.121	0.121	0.000	0.000	0.000	0.000	0.000
26.1	7.54	0.303	0.303	0.000	0.000	0.000	0.000	0.000
26.1	7.74	0.290	0.290	0.000	0.000	0.000	0.000	0.000

Summary statistics for above 0.2s PSA deaggregation, R=distance, e=epsilon:
Mean src-site R= 5.2 km; M= 6.76; eps0= 0.61. Mean calculated for all sources.
Modal src-site R= 3.8 km; M= 7.16; eps0= 0.29 from peak (R,M) bin
Gridded source distance metrics: Rseis Rrup and Rjb
MODE R*= 3.9km; M*= 6.86; EPS.INTERVAL: 0 to 1 sigma % CONTRIB.= 11.975

Principal sources (faults, subduction, random seismicity having >10% contribution)

Source Category:	% contr.	R(km)	M	epsilon0 (mean values)
California shallow gridded	21.30	8.3	6.14	1.29
Calif b, SS or Thrust	78.71	4.3	6.92	0.43

Individual fault hazard details if contrib.>1%:

2	Rose Canyon	44.11	3.8	7.02	0.33
2	Rose Canyon GR M-distrib	33.75	4.4	6.78	0.50

********** Southern California **********

APPENDIX E

LIQUEFACTION ANALYSIS

LIQUEFACTION & SETTLEMENT OF SANDS ANALYSIS

Project Name: The Pearl - Solana Beach
Project Number: 10814-10A
Boring Number: B-1

Horizontal Ground Acceleration (% g)	0.42	Energy Ratio C_E (Auto-hammer)	1.50
Analyzed Groundwater Depth (feet)	10.0	Borehole Diameter C_B (6 - 8 inches)	1.00
Average Wet Unit Weight (pcf)	110.0	Groundwater Depth in Boring (feet)	362.0
Design Magnitude Earthquake	7.0		
Magnitude Scaling Factor (MSF)	1.2		

Depth (feet)	Blow Count SPT	Blow Count Cal. Mod.	SPT N_m	Total Stress (tons/ft2)	Effective Stress (tons/ft2)	Fines Content FC(%)	C_R	Overburden C_N	rd	Sampler Type C_S	$(N_1)_{60}$	$(N_1)_{60cs}$	NCEER 1998 CSR	NCEER 1998 CRR*MSF	Liquefaction Safety Factor	Layer Thickness t (ft)	Layer Thickness t (inches)	Percent Volumetric Strain	Settlement Per Sand Layer (inches)
4		35	26.460	0.220	0.220	25	0.75	1.55	0.99	1.00	46	56	0.27	---	Corrected SPT >30*	4.00	48.00	0.00	0.00
7		11	8.316	0.385	0.385	25	0.75	1.39	0.98	1.00	13	19	0.27	0.2393	Above GW, Not Liquifiable	3.00	36.00	2.30	0.83
9		38	28.728	0.495	0.495	25	0.75	1.30	0.98	1.00	42	51	0.27	---	Corrected SPT >30*	2.00	24.00	0.00	0.00
13		41	30.996	0.715	0.621	25	0.85	1.15	0.97	1.00	45	55	0.30	---	Corrected SPT >30*	4.00	48.00	0.00	0.00
18		45	34.020	0.990	0.740	25	0.95	1.00	0.96	1.00	49	59	0.35	---	Corrected SPT >30*	5.00	60.00	0.00	0.00
23		62	46.872	1.265	0.859	25	0.95	0.89	0.95	1.00	60	71	0.38	---	Corrected SPT >30*	5.00	60.00	0.00	0.00
28		68	51.408	1.540	0.978	25	0.95	0.80	0.93	1.00	59	70	0.40	---	Corrected SPT >30*	5.00	60.00	0.00	0.00
33		75	56.700	1.815	1.097	25	1.00	0.73	0.91	1.00	62	73	0.41	---	Corrected SPT >30*	5.00	60.00	0.00	0.00
38	52		52.000	2.090	1.216	25	1.00	0.67	0.86	1.20	63	74	0.41	---	Corrected SPT >30*	5.00	60.00	0.00	0.00
43		100	75.600	2.365	1.335	25	1.00	0.62	0.82	1.00	70	82	0.40	---	Corrected SPT >30*	5.00	60.00	0.00	0.00
48	37		37.000	2.640	1.454	25	1.00	0.57	0.78	1.20	38	47	0.39	---	Corrected SPT >30*	5.00	60.00	0.00	0.00
51		75	56.700	2.805	1.526	25	1.00	0.55	0.76	1.00	47	56	0.38	---	Corrected SPT >30*	3.00	36.00	0.00	0.00
																	Total Settlement (inches):		0.8

Procedure established by T.L. Youd and I.M. Idriss, et. al., 1996 NCEER-96-0022 Workshop & S.C.E.C. SP117
Evaluation of settlements in sand due to earthquake shaking, Tokimatsu and Seed, 1987

3 Extension of rod above boring (feet)

* CRR 7.5 is not defined for $(N_1)60cs$ greater than 30. Soils with (N1)60cs > 30 are considered too dense to liquefy (NCEER Workshop)

$(N_1)_{60} = N_M C_N C_E C_B C_R C_S$ $(N_1)_{60CS} = K_S(N_1)_{60}$

APPENDIX F

RETAINING WALL AND SLOT CUT CALCULATIONS

RETAINING WALL

Earth - Strata, Inc.
Geotechnical, Environmental and Materials Testing Consultants
BETTER PEOPLE • BETTER SERVICE • BETTER RESULTS

JN: **10814-10** CONSULT: **CW**
PROJECT: **The Pearl - Solana Beach**

CALCULATION SHEET # **1**

CALCULATE THE DESIGN MINIMUM EQUIVALENT FLUID PRESSURE (EFP) FOR PROPOSED RETAINING WALLS. THE WALL HEIGHT AND BACKSLOPE AND SURCHARGE CONDITIONS ARE LISTED BELOW. ASSUME THE BACKFILL IS SATURATED WITH NO EXCESS HYDROSTATIC PRESSURE. USE THE MONONOBE-OKABE METHOD FOR SEISMIC FORCES.

CALCULATION PARAMETERS

EARTH MATERIAL:	Old Paralic Deposits	WALL HEIGHT	12 feet
SHEAR DIAGRAM:	1	BACKSLOPE ANGLE:	0 degrees
COHESION:	375 psf	SURCHARGE:	0 pounds
PHI ANGLE:	31 degrees	SURCHARGE TYPE:	U Uniform
DENSITY	125 pcf	INITIAL FAILURE ANGLE:	35 degrees
SAFETY FACTOR:	1.5	FINAL FAILURE ANGLE:	70 degrees
WALL FRICTION	0 degrees	INITIAL TENSION CRACK:	5 feet
CD (C/FS):	250.0 psf	FINAL TENSION CRACK:	100 feet

PHID = ATAN(TAN(PHI)/FS) = 21.8 degrees

HORIZONTAL PSEUDO STATIC SEISMIC COEFFICIENT (k_h) 0 %g

VERTICAL PSEUDO STATIC SEISMIC COEFFICIENT (k_v) 0 %g

CALCULATED RESULTS

CRITICAL FAILURE ANGLE	54 degrees
AREA OF TRIAL FAILURE WEDGE	42.8 square feet
TOTAL EXTERNAL SURCHARGE	0.0 pounds
WEIGHT OF TRIAL FAILURE WEDGE	5349.4 pounds
NUMBER OF TRIAL WEDGES ANALYZED	3456 trials
LENGTH OF FAILURE PLANE	8.5 feet
DEPTH OF TENSION CRACK	5.1 feet
HORIZONTAL DISTANCE TO UPSLOPE TENSION CRACK	5.0 feet
CALCULATED HORIZONTAL THRUST ON WALL	**1032.6 pounds**
CALCULATED EQUIVALENT FLUID PRESSURE	**14.3 pcf**
DESIGN EQUIVALENT FLUID PRESSURE	**40.0 pcf**

THE CALCULATION INDICATES THAT THE PROPOSED RETAINING WALL MAY BE DESIGNED FOR AN EQUIVALENT FLUID PRESSURE OF 40 POUNDS PER CUBIC FOOT.

RETAINING WALL

Earth - Strata, Inc.
Geotechnical, Environmental and Materials Testing Consultants
BETTER PEOPLE • BETTER SERVICE • BETTER RESULTS

JN: **10814-10** CONSULT: **CW**
PROJECT: **The Pearl - Solana Beach**

CALCULATION SHEET # **2**

CALCULATE THE DESIGN MINIMUM EQUIVALENT FLUID PRESSURE (EFP) FOR PROPOSED RETAINING WALLS. THE WALL HEIGHT AND BACKSLOPE AND SURCHARGE CONDITIONS ARE LISTED BELOW. ASSUME THE BACKFILL IS SATURATED WITH NO EXCESS HYDROSTATIC PRESSURE. USE THE MONONOBE-OKABE METHOD FOR SEISMIC FORCES.

CALCULATION PARAMETERS

EARTH MATERIAL:	Old Paralic Deposits	WALL HEIGHT	12 feet
SHEAR DIAGRAM:	1	BACKSLOPE ANGLE:	27 degrees
COHESION:	375 psf	SURCHARGE:	0 pounds
PHI ANGLE:	31 degrees	SURCHARGE TYPE:	U Uniform
DENSITY	125 pcf	INITIAL FAILURE ANGLE:	35 degrees
SAFETY FACTOR:	1.5	FINAL FAILURE ANGLE:	70 degrees
WALL FRICTION	0 degrees	INITIAL TENSION CRACK:	5 feet
CD (C/FS):	250.0 psf	FINAL TENSION CRACK:	100 feet

PHID = ATAN(TAN(PHI)/FS) = 21.8 degrees

HORIZONTAL PSEUDO STATIC SEISMIC COEFFICIENT (k_h) 0 %g

VERTICAL PSEUDO STATIC SEISMIC COEFFICIENT (k_v) 0 %g

CALCULATED RESULTS

CRITICAL FAILURE ANGLE	51 degrees
AREA OF TRIAL FAILURE WEDGE	72.8 square feet
TOTAL EXTERNAL SURCHARGE	0.0 pounds
WEIGHT OF TRIAL FAILURE WEDGE	9098.5 pounds
NUMBER OF TRIAL WEDGES ANALYZED	3456 trials
LENGTH OF FAILURE PLANE	12.7 feet
DEPTH OF TENSION CRACK	6.2 feet
HORIZONTAL DISTANCE TO UPSLOPE TENSION CRACK	8.0 feet
CALCULATED HORIZONTAL THRUST ON WALL	**1700.2 pounds**
CALCULATED EQUIVALENT FLUID PRESSURE	**23.6 pcf**
DESIGN EQUIVALENT FLUID PRESSURE	**63.0 pcf**

THE CALCULATION INDICATES THAT THE PROPOSED RETAINING WALL MAY BE DESIGNED FOR AN EQUIVALENT FLUID PRESSURE OF 63 POUNDS PER CUBIC FOOT.

SLOT CUT ANALYSIS

Earth - Strata, Inc.
Geotechnical, Environmental and Materials Testing Consultants
BETTER PEOPLE • BETTER SERVICE • BETTER RESULTS

JN: **10814-10** CONSULT: **CW**
PROJECT: **The Pearl - Solana Beach**

CALCULATION SHEET # **1**

CALCULATE THE FACTOR OF SAFETY OF SLOT CUT EXCAVATIONS. ASSUME COHESIVE AND FRICTIONAL RESISTANCE ALONG THE SIDES OF SLOTS AS WELL AS THE FAILURE SURFACE. THE HORIZONTAL PRESSURE ON THE SIDES OF THE SLOTS IS THE AT-REST PRESSURE (1-SIN(phi)).

CALCULATION PARAMETERS

EARTH MATERIAL:	Old Paralic Deposits	EXCAVATION HEIGHT:	13 feet
SHEAR DIAGRAM:	1	BACKSLOPE ANGLE:	0 degrees
COHESION:	375 psf	SURCHARGE:	0 pounds
PHI ANGLE:	31 degrees	SURCHARGE TYPE:	U Uniform
DENSITY:	125 pcf	INITIAL FAILURE ANGLE:	17 degrees
SLOT BOUNDARY CONDITIONS		FINAL FAILURE ANGLE:	70 degrees
SLOT CUT WIDTH:	35 feet	INITIAL TENSION CRACK:	5 feet
COHESION:	300 psf	FINAL TENSION CRACK:	20 feet
PHI ANGLE:	30 degrees		

CALCULATED RESULTS

CRITICAL FAILURE ANGLE	55	degrees
HORIZONTAL DISTANCE TO UPSLOPE TENSION CRACK	5.0	feet
DEPTH OF TENSION CRACK	5.9	feet
TOTAL EXTERNAL SURCHARGE	0.0	pounds
VOLUME OF FAILURE WEDGE	1650.2	ft^3
WEIGHT OF FAILURE WEDGE	206273.2	pounds
LENGTH OF FAILURE PLANE	8.7	feet
SURFACE AREA OF FAILURE PLANE	305	ft^2
SURFACE AREA OF SIDES OF SLOTS	47.1	ft^2
NUMBER OF TRIAL WEDGES ANALYZED	5544	trials
TOTAL RESISTING FORCE ALONG WEDGE BASE (FrB)	90804.5	pounds
TOTAL RESISTING FORCE ALONG WEDGE SIDES (FrS)	22759.1	pounds
RESULTANT HORIZONTAL COMPONENT OF FORCE	**-1052.8**	**pounds**
CALCULATED FACTOR OF SAFETY	**1.26**	

CONCLUSIONS:

THE CALCULATION INDICATES THAT SLOTS CUTS UP TO 35 FEET WIDE AND 13 FEET HIGH IN THE OLD PARALIC DEPOSITS HAVE A SAFETY FACTOR GREATER THAN 1.25 AND ARE TEMPORARILY STABLE.

SLOT CUT ANALYSIS

Earth - Strata, Inc.
Geotechnical, Environmental and Materials Testing Consultants
BETTER PEOPLE • BETTER SERVICE • BETTER RESULTS

JN: **10814-10** CONSULT: **CW**
PROJECT: **The Pearl - Solana Beach**

CALCULATION SHEET # **2**

CALCULATE THE FACTOR OF SAFETY OF SLOT CUT EXCAVATIONS. ASSUME COHESIVE AND FRICTIONAL RESISTANCE ALONG THE SIDES OF SLOTS AS WELL AS THE FAILURE SURFACE. THE HORIZONTAL PRESSURE ON THE SIDES OF THE SLOTS IS THE AT-REST PRESSURE (1-SIN(phi)).

CALCULATION PARAMETERS

EARTH MATERIAL:	Old Paralic Deposits		EXCAVATION HEIGHT:	8	feet
SHEAR DIAGRAM:	1		BACKSLOPE ANGLE:	0	degrees
COHESION:	375	psf	SURCHARGE:	0	pounds
PHI ANGLE:	31	degrees	SURCHARGE TYPE:	U	Uniform
DENSITY:	125	pcf	INITIAL FAILURE ANGLE:	17	degrees
SLOT BOUNDARY CONDITIONS			FINAL FAILURE ANGLE:	70	degrees
SLOT CUT WIDTH:	200	feet	INITIAL TENSION CRACK:	5	feet
COHESION:	300	psf	FINAL TENSION CRACK:	20	feet
PHI ANGLE:	30	degrees			

CALCULATED RESULTS

CRITICAL FAILURE ANGLE	46	degrees
HORIZONTAL DISTANCE TO UPSLOPE TENSION CRACK	5.0	feet
DEPTH OF TENSION CRACK	2.8	feet
TOTAL EXTERNAL SURCHARGE	0.0	pounds
VOLUME OF FAILURE WEDGE	5411.2	ft^3
WEIGHT OF FAILURE WEDGE	676396.8	pounds
LENGTH OF FAILURE PLANE	7.2	feet
SURFACE AREA OF FAILURE PLANE	1440	ft^2
SURFACE AREA OF SIDES OF SLOTS	27.1	ft^2
NUMBER OF TRIAL WEDGES ANALYZED	2700	trials
TOTAL RESISTING FORCE ALONG WEDGE BASE (FrB)	317549.2	pounds
TOTAL RESISTING FORCE ALONG WEDGE SIDES (FrS)	9702.3	pounds
RESULTANT HORIZONTAL COMPONENT OF FORCE	**-7129.1**	**pounds**
CALCULATED FACTOR OF SAFETY	**1.70**	

CONCLUSIONS:

THE CALCULATION INDICATES THAT SLOTS CUTS UP TO 200 FEET WIDE AND 8 FEET HIGH IN THE OLD PARALIC DEPOSITS HAVE A SAFETY FACTOR GREATER THAN 1.25 AND ARE TEMPORARILY STABLE.

APPENDIX G

ASPHALTIC CONCRETE PAVEMENT CALCULATIONS

PAVING DESIGN

Earth - Strata, Inc.
Geotechnical, Environmental and Materials Testing Consultants
BETTER PEOPLE • BETTER SERVICE • BETTER RESULTS

JN: **10814-10** CONSULT: **CW**
PROJECT: **The Pearl - Solana Beach**

CALCULATION SHEET # **1**

CALTRANS METHOD FOR DESIGN OF FLEXIBLE PAVEMENT

Input "R" value or "CBR" of native soil	50	
Type of Index Property - "R" value or "CBR" (C or R)	R	R Value
R Value used for Caltrans Method	50	
Input Traffic Index (TI)	4	
Calculated Total Gravel Equivalent (GE)	0.64	feet
Calculated Total Gravel Equivalent (GE)	7.68	inches
Calculated Gravel Factor (Gf) for A/C paving	2.83	
Gravel Factor for Base Course (Gf)	1.1	

Pavement sections provided below are considered equal; but, do not reflect reviewing agency minimums.

Gravel Equivalent GE (feet)	GE (inches)	Delta (inches)	INCHES A/C Section Thickness (inches)	INCHES Minimum Base (inches)	FEET A/C Section Thickness (feet)	FEET Minimum Base (feet)
0.71	8.50	-0.82	3.0		0.25	
0.83	9.92	-2.24	3.5		0.29	
0.99	11.90	-4.22	4.2		0.35	
1.13	13.60	-5.92	4.8		0.40	
1.42	17.00	-9.32	6.0		0.50	
1.65	19.84	-12.16	7.0		0.58	
1.89	22.67	-14.99	8.0		0.67	
2.13	25.51	-17.83	9.0		0.75	
2.36	28.34	-20.66	10.0		0.83	
2.60	31.17	-23.49	11.0		0.92	
2.83	34.01	-26.33	12.0		1.00	

PAVING DESIGN

Earth - Strata, Inc.
Geotechnical, Environmental and Materials Testing Consultants
BETTER PEOPLE • BETTER SERVICE • BETTER RESULTS

JN: **10814-10** CONSULT: **CW**
PROJECT: **The Pearl - Solana Beach**

CALCULATION SHEET # **2**

CALTRANS METHOD FOR DESIGN OF FLEXIBLE PAVEMENT

Input "R" value or "CBR" of native soil	50	
Type of Index Property - "R" value or "CBR" (C or R)	R	R Value
R Value used for Caltrans Method	50	
Input Traffic Index (TI)	5	
Calculated Total Gravel Equivalent (GE)	0.8	feet
Calculated Total Gravel Equivalent (GE)	9.6	inches
Calculated Gravel Factor (Gf) for A/C paving	2.53	
Gravel Factor for Base Course (Gf)	1.1	

Pavement sections provided below are considered equal; but, do not reflect reviewing agency minimums.

Gravel Equivalent GE (feet)	GE (inches)	Delta (inches)	INCHES A/C Section Thickness (inches)	Minimum Base (inches)	FEET A/C Section Thickness (feet)	Minimum Base (feet)
0.63	7.60	2.00	3.0	1.8	0.25	0.15
0.74	8.87	0.73	3.5	0.6	0.29	0.05
0.89	10.65	-1.05	4.2		0.35	
1.01	12.17	-2.57	4.8		0.40	
1.27	15.21	-5.61	6.0		0.50	
1.48	17.74	-8.14	7.0		0.58	
1.69	20.28	-10.68	8.0		0.67	
1.90	22.81	-13.21	9.0		0.75	
2.11	25.35	-15.75	10.0		0.83	
2.32	27.88	-18.28	11.0		0.92	
2.53	30.42	-20.82	12.0		1.00	

PAVING DESIGN

Earth - Strata, Inc.
Geotechnical, Environmental and Materials Testing Consultants
BETTER PEOPLE • BETTER SERVICE • BETTER RESULTS

JN: **10814-10** CONSULT: **CW**
PROJECT: **The Pearl - Solana Beach**

CALCULATION SHEET # **3**

CALTRANS METHOD FOR DESIGN OF FLEXIBLE PAVEMENT

Input "R" value or "CBR" of native soil	50	
Type of Index Property - "R" value or "CBR" (C or R)	R	R Value
R Value used for Caltrans Method	50	
Input Traffic Index (TI)	6	
Calculated Total Gravel Equivalent (GE)	0.96	feet
Calculated Total Gravel Equivalent (GE)	11.52	inches
Calculated Gravel Factor (Gf) for A/C paving	2.31	
Gravel Factor for Base Course (Gf)	1.1	

Pavement sections provided below are considered equal; but, do not reflect reviewing agency minimums.

Gravel Equivalent GE (feet)	GE (inches)	Delta (inches)	INCHES A/C Section Thickness (inches)	Minimum Base (inches)	FEET A/C Section Thickness (feet)	Minimum Base (feet)
0.58	6.94	4.58	3.0	4.2	0.25	0.35
0.67	8.10	3.42	3.5	3.0	0.29	0.25
0.81	9.72	1.80	4.2	1.8	0.35	0.15
0.93	11.11	0.41	4.8	0.6	0.40	0.05
1.16	13.88	-2.36	6.0		0.50	
1.35	16.20	-4.68	7.0		0.58	
1.54	18.51	-6.99	8.0		0.67	
1.74	20.83	-9.31	9.0		0.75	
1.93	23.14	-11.62	10.0		0.83	
2.12	25.45	-13.93	11.0		0.92	
2.31	27.77	-16.25	12.0		1.00	

APPENDIX H

GENERAL EARTHWORK AND GRADING SPECIFICATIONS

EARTH-STRATA

General Earthwork and Grading Specifications

General

Intent: These General Earthwork and Grading Specifications are intended to be the minimum requirements for the grading and earthwork shown on the approved grading plan(s) and/or indicated in the geotechnical report(s). These General Earthwork and Grading Specifications should be considered a part of the recommendations contained in the geotechnical report(s) and if they are in conflict with the geotechnical report(s), the specific recommendations in the geotechnical report shall supersede these more general specifications. Observations made during earthwork operations by the project Geotechnical Consultant may result in new or revised recommendations that may supersede these specifications and/or the recommendations in the geotechnical report(s).

The Geotechnical Consultant of Record: The Owner shall employ a qualified Geotechnical Consultant of Record (Geotechnical Consultant), prior to commencement of grading or construction. The Geotechnical Consultant shall be responsible for reviewing the approved geotechnical report(s) and accepting the adequacy of the preliminary geotechnical findings, conclusions, and recommendations prior to the commencement of the grading or construction.

Prior to commencement of grading or construction, the Owner shall coordinate with the Geotechnical Consultant, and Earthwork Contractor (Contractor) to schedule sufficient personnel for the appropriate level of observation, mapping, and compaction testing.

During earthwork and grading operations, the Geotechnical Consultant shall observe, map, and document the subsurface conditions to confirm assumptions made during the geotechnical design phase of the project. Should the observed conditions differ significantly from the interpretive assumptions made during the design phase, the Geotechnical Consultant shall recommend appropriate changes to accommodate the observed conditions, and notify the reviewing agency where required.

The Geotechnical Consultant shall observe the moisture conditioning and processing of the excavations and fill materials. The Geotechnical Consultant should perform periodic relative density testing of fill materials to verify that the attained level of compaction is being accomplished as specified.

The Earthwork Contractor: The Earthwork Contractor (Contractor) shall be qualified, experienced, and knowledgeable in earthwork logistics, preparation and processing of earth materials to receive compacted fill, moisture-conditioning and processing of fill, and compacting fill. The Contractor shall be provided with the approved grading plans and geotechnical report(s) for his review and acceptance of responsibilities, prior to commencement of grading. The Contractor shall be solely responsible for performing the grading in accordance with the approved grading plans and geotechnical report(s). Prior to commencement of grading, the Contractor shall prepare and submit to the Owner and the Geotechnical Consultant a work plan that indicates the sequence of earthwork grading, the number of "equipment" of work and the estimated quantities of daily earthwork contemplated for the site. The Contractor shall inform the Owner and the Geotechnical Consultant of work schedule changes and revisions to the work plan at least 24 hours in advance of such changes so that appropriate personnel will be available for observation and testing. No assumptions shall be made by the Contractor with regard to whether the Geotechnical Consultant is aware of all grading operations.

It is the sole responsibility of the Contractor to provide adequate equipment and methods to accomplish the earthwork operations in accordance with the applicable grading codes and agency ordinances, these specifications, and the recommendations in the approved geotechnical report(s) and grading plan(s). At the sole discretion of the Geotechnical Consultant, any unsatisfactory conditions, such as unsuitable earth materials, improper moisture conditioning, inadequate compaction, insufficient buttress keyway size, adverse weather conditions, etc., resulting in a quality of work less than required in the approved grading plans and geotechnical report(s), the Geotechnical Consultant shall reject the work and may recommend to the Owner that grading be stopped until conditions are corrected.

Preparation of Areas for Compacted Fill

Clearing and Grubbing: Vegetation, such as brush, grass, roots, and other deleterious material shall be sufficiently removed and properly disposed in a method acceptable to the Owner, Geotechnical Consultant, and governing agencies.

The Geotechnical Consultant shall evaluate the extent of these removals on a site by site basis. Earth materials to be placed as compacted fill shall not contain more than 1 percent organic materials (by volume). No compacted fill lift shall contain more than 10 percent organic matter.

Should potentially hazardous materials be encountered, the Contractor shall stop work in the affected area, and a hazardous materials specialist shall immediately be consulted to evaluate the potentially hazardous materials, prior to continuing to work in that area.

It is our understanding that the State of California defines most refined petroleum products (gasoline, diesel fuel, motor oil, grease, coolant, etc.) as hazardous waste. As such, indiscriminate dumping or spillage of these fluids may constitute a misdemeanor, punishable by fines and/or imprisonment, and shall be prohibited. The contractor is responsible for all hazardous waste related to his operations. The Geotechnical Consultant does not have expertise in this area. If hazardous waste is a concern, then the Owner should contract the services of a qualified environmental assessor.

Processing: Exposed earth materials that have been observed to be satisfactory for support of compacted fill by the Geotechnical Consultant shall be scarified to a minimum depth of 6 inches. Exposed earth materials that are not observed to be satisfactory shall be removed or alternative recommendations may be provided by the Geotechnical Consultant. Scarification shall continue until the exposed earth materials are broken down and free of oversize material and the working surface is reasonably uniform, flat, and free of uneven features that would inhibit uniform compaction. The earth materials should be moistened or air dried to near optimum moisture content, prior to compaction.

Overexcavation: The Cut Lot Typical Detail and Cut/Fill Transition Lot Typical Detail, included herein provides a graphic illustration that depicts typical overexcavation recommendations made in the approved geotechnical report(s) and/or grading plan(s).

Keyways and Benching: Where fills are to be placed on slopes steeper than 5:1 (horizontal to vertical units), the ground shall be thoroughly benched as compacted fill is placed. Please see the three Keyway and Benching Typical Details with subtitles Cut Over Fill Slope, Fill Over Cut Slope, and Fill Slope for a graphic illustration. The lowest bench or smallest keyway shall be a minimum of 15 feet wide (or ½ the proposed slope height) and at least 2 feet into competent earth materials as advised by the Geotechnical Consultant. Typical benches shall be excavated a minimum height of 4 feet into competent earth materials or as recommended by the Geotechnical Consultant. Fill placed on slopes steeper than 5:1 should be thoroughly benched or otherwise excavated to provide a flat subgrade for the compacted fill.

Evaluation/Acceptance of Bottom Excavations: All areas to receive compacted fill (bottom excavations), including removal excavations, processed areas, keyways, and benching, shall be observed, mapped, general elevations recorded, and/or tested prior to being accepted by the Geotechnical Consultant as suitable to receive compacted fill. The Contractor shall obtain a written acceptance from the Geotechnical Consultant prior to placing compacted fill. A licensed surveyor shall provide the survey control for determining elevations of bottom excavations, processed areas, keyways, and

benching. The Geotechnical Consultant is not responsible for erroneously located, fills, subdrain systems, or excavations.

Fill Materials

General: Earth material to be used as compacted fill should to a large extent be free of organic matter and other deleterious substances as evaluated and accepted by the Geotechnical Consultant.

Oversize: Oversize material is rock that does not break down into smaller pieces and has a maximum diameter greater than 8 inches. Oversize rock shall not be included within compacted fill unless specific methods and guidelines acceptable to the Geotechnical Consultant are followed. For examples of methods and guidelines of oversize rock placement see the enclosed Oversize Rock Disposal Detail. The inclusion of oversize materials in the compacted fill shall only be acceptable if the oversize material is completely surrounded by compacted fill or thoroughly jetted granular materials. No oversize material shall be placed within 10 vertical feet of finish grade or within 2 feet of proposed utilities or underground improvements.

Import: Should imported earth materials be required, the proposed import materials shall meet the requirements of the Geotechnical Consultant. Well graded, very low expansion potential earth materials free of organic matter and other deleterious substances are usually sought after as import materials. However, it is generally in the Owners best interest that potential import earth materials are provided to the Geotechnical Consultant to determine their suitability for the intended purpose. At least 48 hours should be allotted for the appropriate laboratory testing to be performed, prior to starting the import operations.

Fill Placement and Compaction Procedures

Fill Layers: Fill materials shall be placed in areas prepared to receive fill in nearly horizontal layers not exceeding 8 inches in loose thickness. Thicker layers may be accepted by the Geotechnical Consultant, provided field density testing indicates that the grading procedures can adequately compact the thicker layers. Each layer of fill shall be spread evenly and thoroughly mixed to obtain uniformity within the earth materials and consistent moisture throughout the fill.

Moisture Conditioning of Fill: Earth materials to be placed as compacted fill shall be watered, dried, blended, and/or mixed, as needed to obtain relatively uniform moisture contents that are at or slightly above optimum. The maximum density and optimum moisture content tests should be performed in accordance with the American Society of Testing and Materials (ASTM test method D1557-00).

Compaction of Fill: After each layer has been moisture-conditioned, mixed, and evenly spread, it should be uniformly compacted to a minimum of 90 percent of maximum dry density as determined by ASTM test method D1557-00. Compaction equipment shall be adequately sized and be either specifically designed for compaction of earth materials or be proven to consistently achieve the required level of compaction.

Compaction of Fill Slopes: In addition to normal compaction procedures specified above, additional effort to obtain compaction on slopes is needed. This may be accomplished by backrolling of slopes with sheepsfoot rollers as the fill is being placed, by overbuilding the fill slopes, or by other methods producing results that are satisfactory to the Geotechnical Consultant. Upon completion of grading, relative compaction of the fill and the slope face shall be a minimum of 90 percent of maximum density per ASTM test method D1557-00.

Compaction Testing of Fill: Field tests for moisture content and relative density of the compacted fill earth materials shall be periodically performed by the Geotechnical Consultant. The location and frequency of tests shall be at the Geotechnical Consultant's discretion based on field observations. Compaction test locations will not necessarily be random. The test locations may or may not be selected to verify minimum compaction requirements in areas that are typically prone to inadequate compaction, such as close to slope faces and near benching.

Frequency of Compaction Testing: Compaction tests shall be taken at minimum intervals of every 2 vertical feet and/or per 1,000 cubic yards of compacted materials placed. Additionally, as a guideline, at least one (1) test shall be taken on slope faces for each 5,000 square feet of slope face and/or for each 10 vertical feet of slope. The Contractor shall assure that fill placement is such that the testing schedule described herein can be accomplished by the Geotechnical Consultant. The Contractor shall stop or slow down the earthwork operations to a safe level so that these minimum standards can be obtained.

Compaction Test Locations: The approximate elevation and horizontal coordinates of each test location shall be documented by the Geotechnical Consultant. The Contractor shall coordinate with the Surveyor to assure that sufficient grade stakes are established. This will provide the Geotechnical Consultant with sufficient accuracy to determine the approximate test locations and elevations. The Geotechnical Consultant can not be responsible for staking erroneously located by the Surveyor or Contractor. A minimum of two grade stakes should be provided at a maximum horizontal distance of 100 feet and vertical difference of less than 5 feet.

Subdrain System Installation

Subdrain systems shall be installed in accordance with the approved geotechnical report(s), the approved grading plan, and the typical details provided herein. The Geotechnical Consultant may recommend additional subdrain systems and/or changes to the subdrain systems described herein, with regard to the extent, location, grade, or material depending on conditions encountered during grading or other factors. All subdrain systems shall be surveyed by a licensed land surveyor (except for retaining wall subdrain systems) to verify line and grade after installation and prior to burial. Adequate time should be allowed by the Contractor to complete these surveys.

Excavation

All excavations and over-excavations for remedial purposes shall be evaluated by the Geotechnical Consultant during grading operations. Remedial removal depths indicated on the geotechnical plans are estimates only. The actual removal depths and extent shall be determined by the Geotechnical Consultant based on the field evaluation of exposed conditions during grading operations. Where fill over cut slopes are planned, the cut portion of the slope shall be excavated, evaluated, and accepted by the Geotechnical Consultant prior to placement of the fill portion of the proposed slope, unless specifically addressed by the Geotechnical Consultant. Typical details for cut over fill slopes and fill over cut slopes are provided herein.

Trench Backfill

1) The Contractor shall follow all OHSA and Cal/OSHA requirements for trench excavation safety.

2) Bedding and backfill of utility trenches shall be done in accordance with the applicable provisions in the Standard Specifications of Public Works Construction. Bedding materials shall have a Sand Equivalency more than 30 (SE>30). The bedding shall be placed to 1 foot over the conduit and thoroughly jetting to provide densification. Backfill should be compacted to a minimum of 90 percent of maximum dry density, from 1 foot above the top of the conduit to the surface.

3) Jetting of the bedding materials around the conduits shall be observed by the Geotechnical Consultant.

4) The Geotechnical Consultant shall test trench backfill for the minimum compaction requirements recommended herein. At least one test should be conducted for every 300 linear feet of trench and for each 2 vertical feet of backfill.

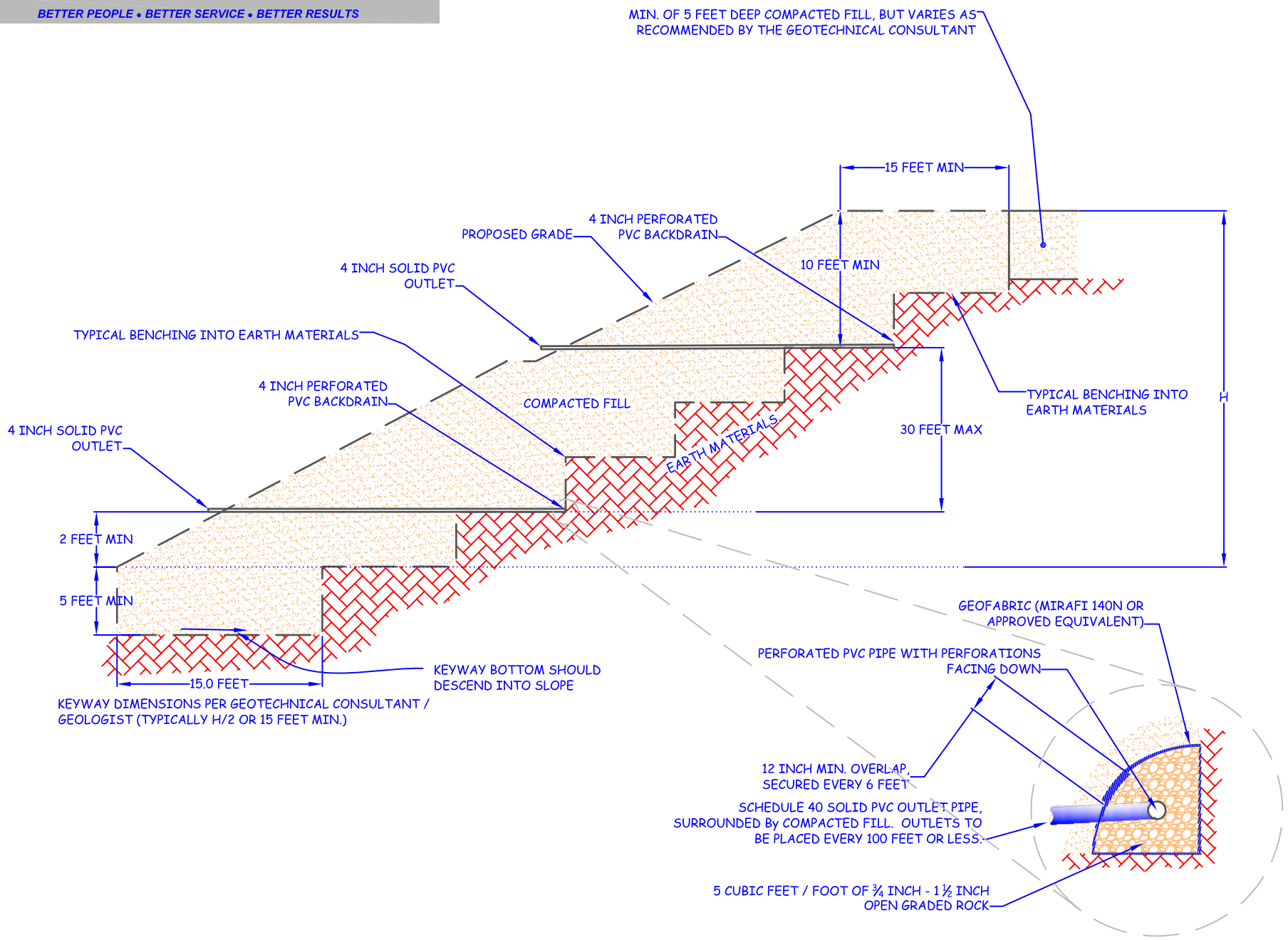
5) For trench backfill the lift thicknesses shall not exceed those allowed in the Standard Specifications of Public Works Construction, unless the Contractor can demonstrate to the Geotechnical Consultant that the fill lift can be compacted to the minimum relative compaction by his alternative equipment or method.

Earth - Strata, Inc.

Geotechnical, Environmental and Materials Testing Consultants

BETTER PEOPLE • BETTER SERVICE • BETTER RESULTS

STABILIZATION FILL TYPICAL DETAIL

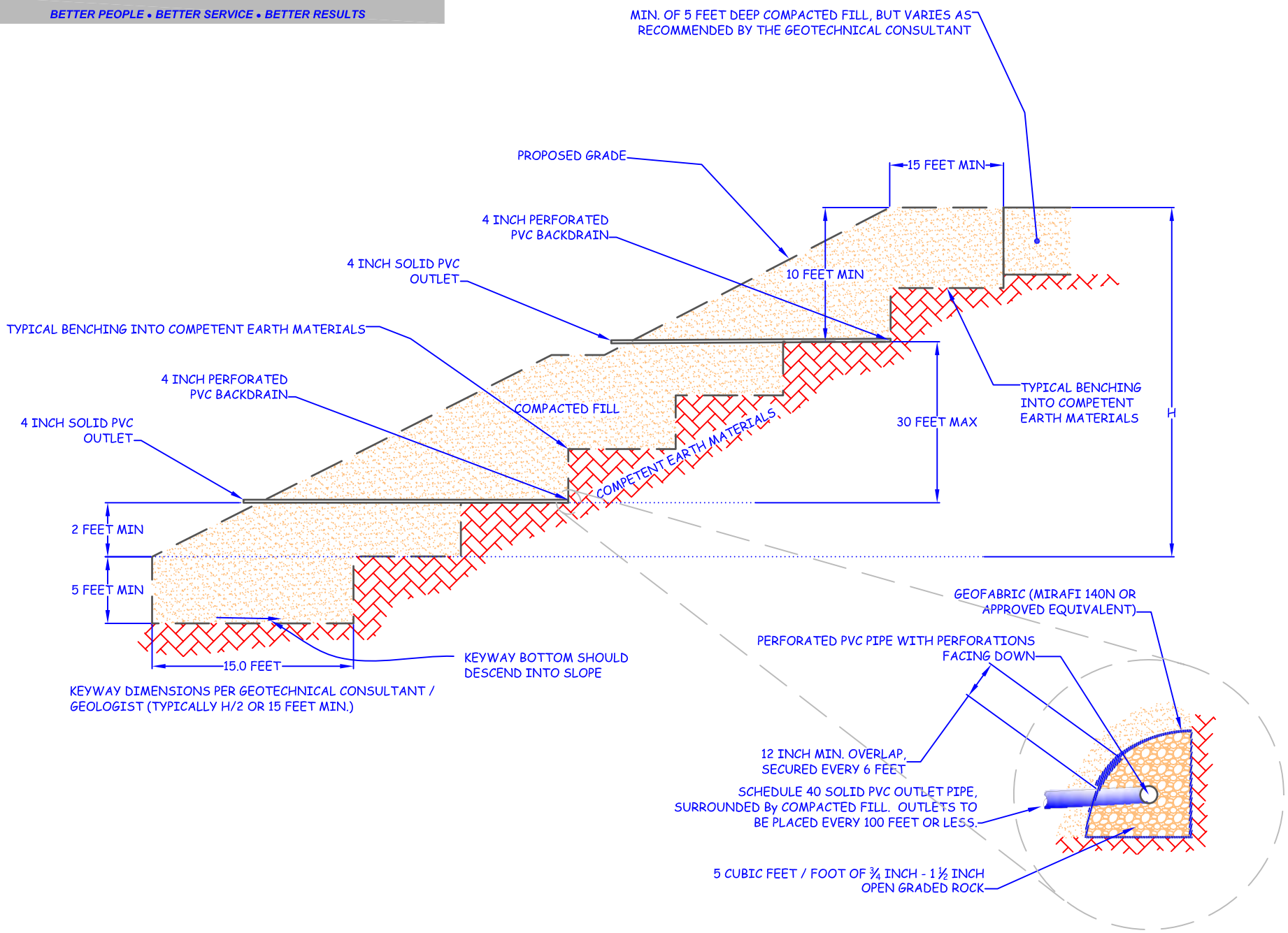


Earth - Strata, Inc.

Geotechnical, Environmental and Materials Testing Consultants

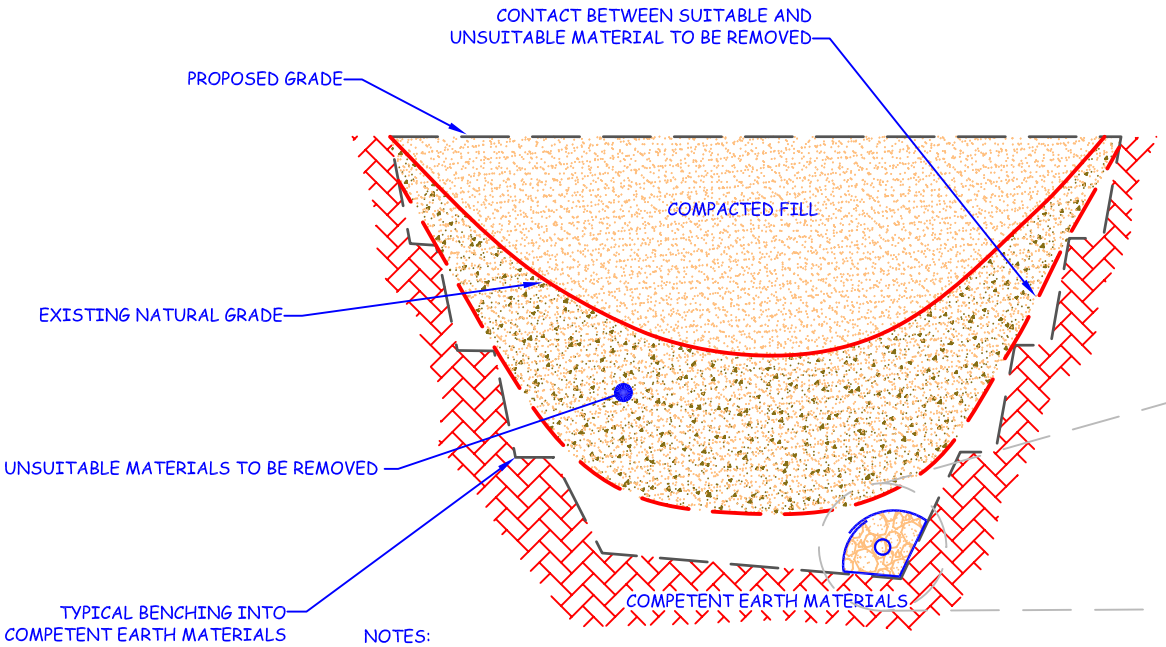
BETTER PEOPLE • BETTER SERVICE • BETTER RESULTS

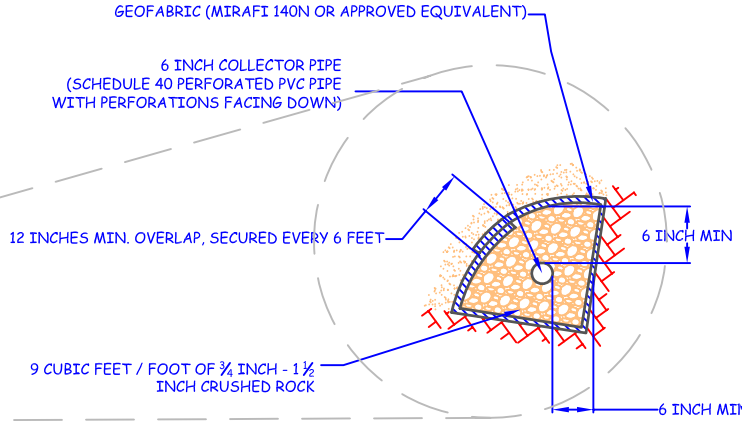
BUTTRESS TYPICAL DETAIL



Earth + Strata, Inc.
Geotechnical, Environmental and Materials Testing Consultants
BETTER PEOPLE • BETTER SERVICE • BETTER RESULTS

CANYON SUBDRAIN SYSTEM TYPICAL DETAIL

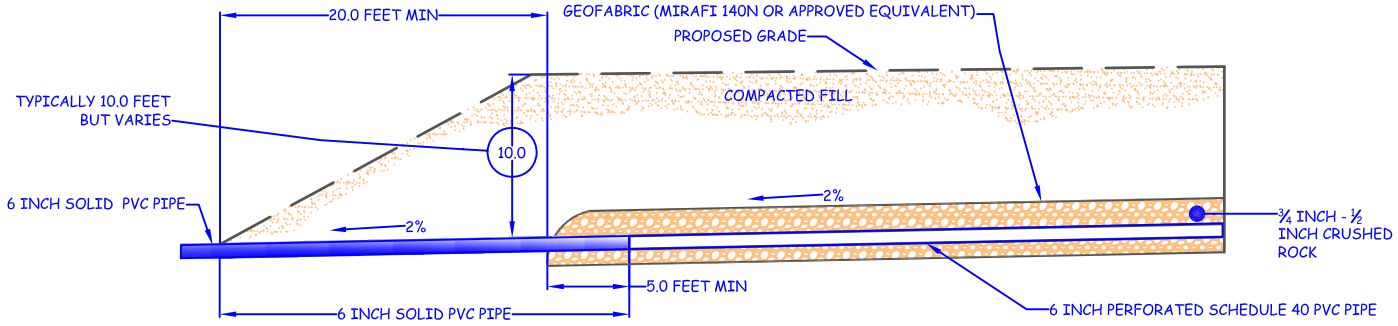




NOTES:
1 - CONTINUOUS RUNS IN EXCESS OF 500 FEET LONG WILL REQUIRE AN 8 INCH DIAMETER PIPE.

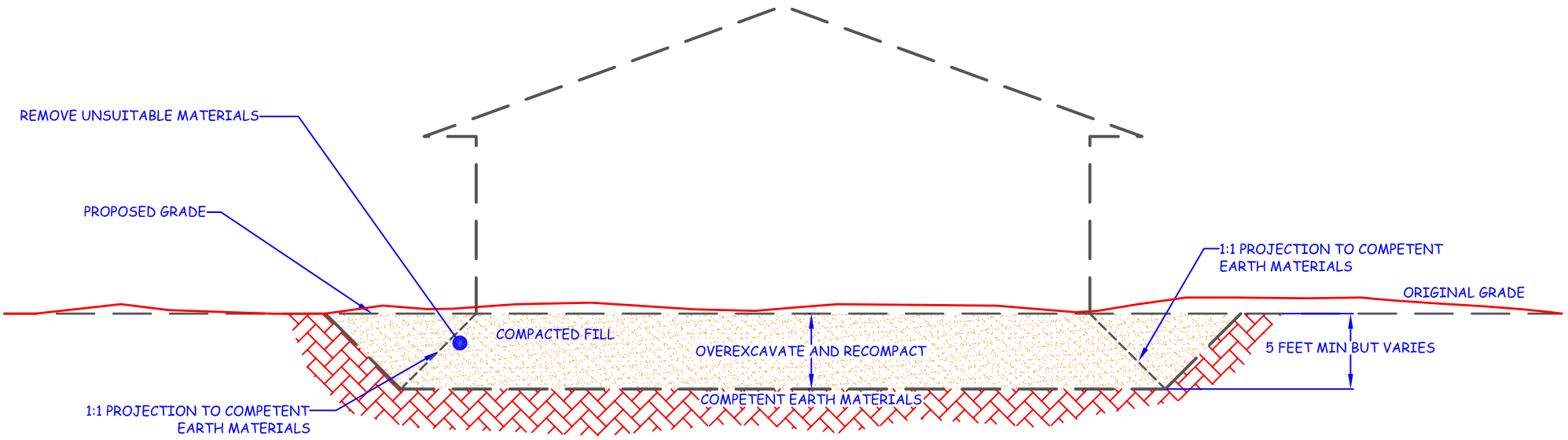
2 - FINAL 20 FEET OF PIPE AT OUTLET WILL BE SOLID AND BACKFILLED WITH COMPACTED FINE-GRAINED EARTH MATERIALS.

CANYON SUBDRAIN TYPICAL OUTLET



Earth = Strata, Inc.
Geotechnical, Environmental and Materials Testing Consultants
BETTER PEOPLE • BETTER SERVICE • BETTER RESULTS

CUT LOT TYPICAL DETAIL

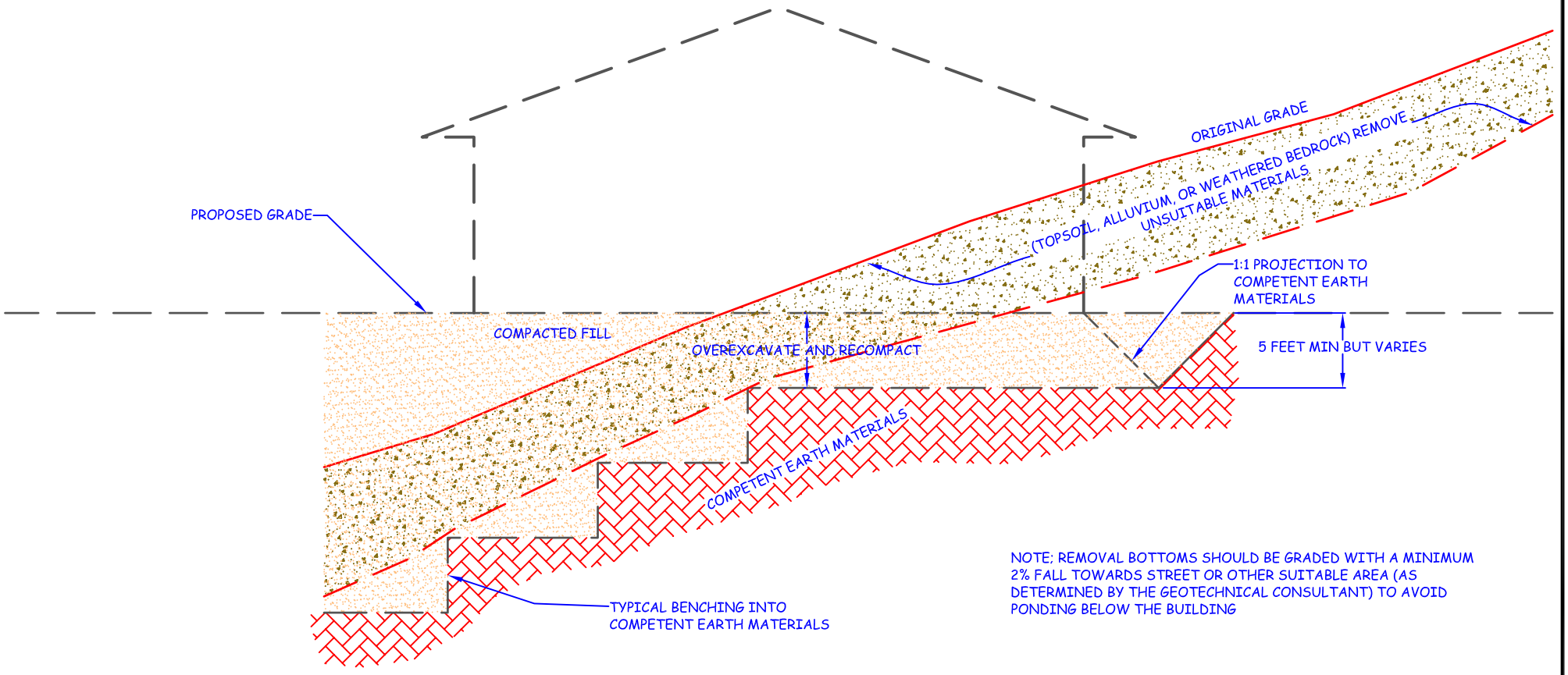


NOTE: REMOVAL BOTTOMS SHOULD BE GRADED WITH A MINIMUM 2% FALL TOWARDS STREET OR OTHER SUITABLE AREA (AS DETERMINED BY THE GEOTECHNICAL CONSULTANT) TO AVOID PONDING BELOW THE BUILDING

NOTE: WHERE DESIGN CUT LOTS ARE EXCAVATED ENTIRELY INTO COMPETENT EARTH MATERIALS, OVEREXCAVATION MAY STILL BY NEEDED FOR HARD-ROCK CONDITIONS OR MATERIALS WITH VARIABLE EXPANSION POTENTIALS

Earth = Strata, Inc.
Geotechnical, Environmental and Materials Testing Consultants
BETTER PEOPLE • BETTER SERVICE • BETTER RESULTS

CUT / FILL TRANSITION LOT TYPICAL DETAIL

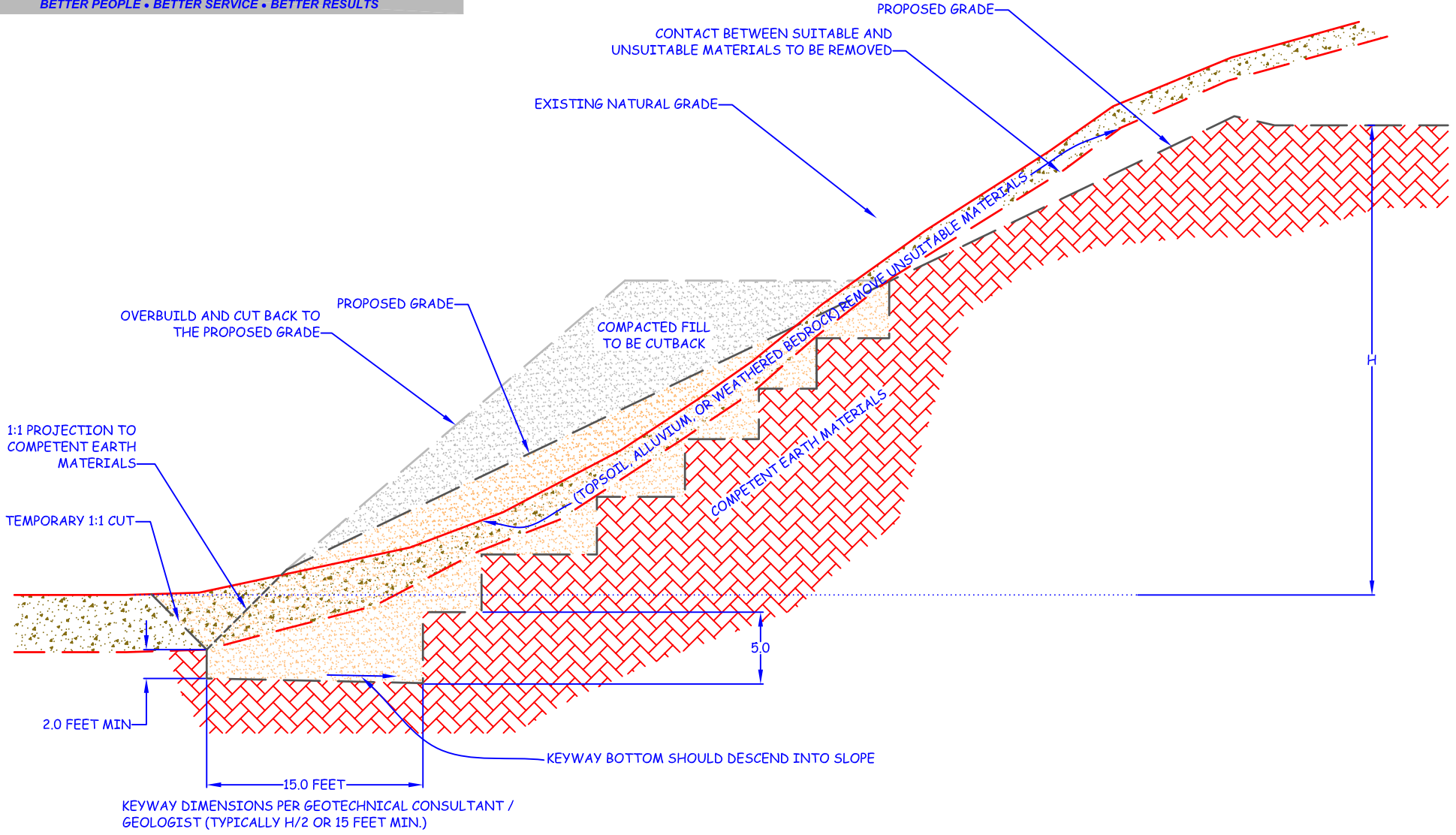


NOTE; REMOVAL BOTTOMS SHOULD BE GRADED WITH A MINIMUM 2% FALL TOWARDS STREET OR OTHER SUITABLE AREA (AS DETERMINED BY THE GEOTECHNICAL CONSULTANT) TO AVOID PONDING BELOW THE BUILDING

NOTE: WHERE DESIGN CUT LOTS ARE EXCAVATED ENTIRELY INTO COMPETENT EARTH MATERIALS, OVEREXCAVATION MAY STILL BY NEEDED FOR HARD-ROCK CONDITIONS OR MATERIALS WITH VARIABLE EXPANSION POTENTIALS

Earth + Strata, Inc.
Geotechnical, Environmental and Materials Testing Consultants
BETTER PEOPLE • BETTER SERVICE • BETTER RESULTS

KEYWAY & BENCHING TYPICAL DETAILS
CUT OVER FILL SLOPE

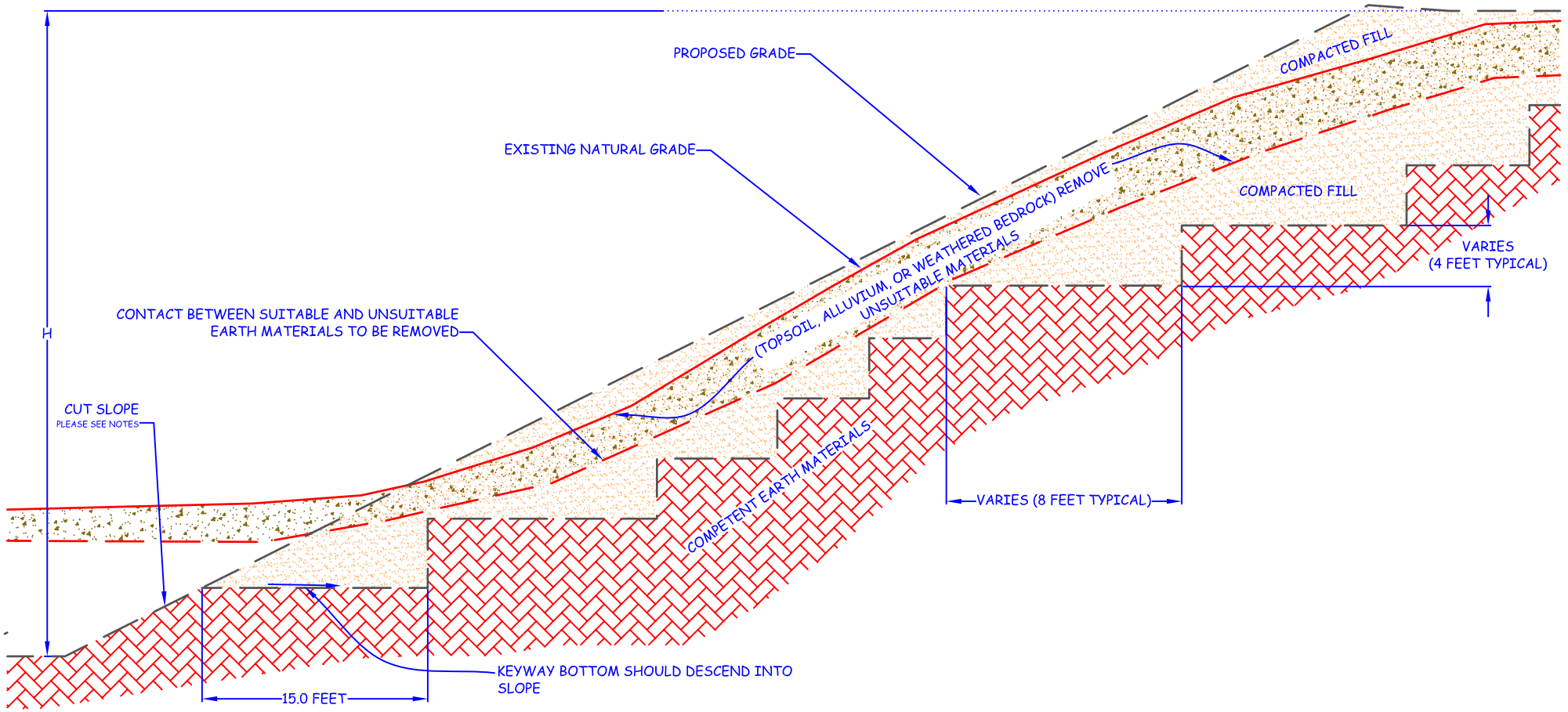


NOTE:

NATURAL SLOPES STEEPER THAN 5:1 (H:V) MUST BE BENCHED INTO COMPETENT EARTH MATERIALS

Earth + Strata, Inc.
Geotechnical, Environmental and Materials Testing Consultants
BETTER PEOPLE • BETTER SERVICE • BETTER RESULTS

KEYWAY & BENCHING TYPICAL DETAILS
FILL OVER CUT SLOPE



KEYWAY DIMENSIONS PER GEOTECHNICAL CONSULTANT / GEOLOGIST (TYPICALLY H/2 OR 15 FEET MIN.)

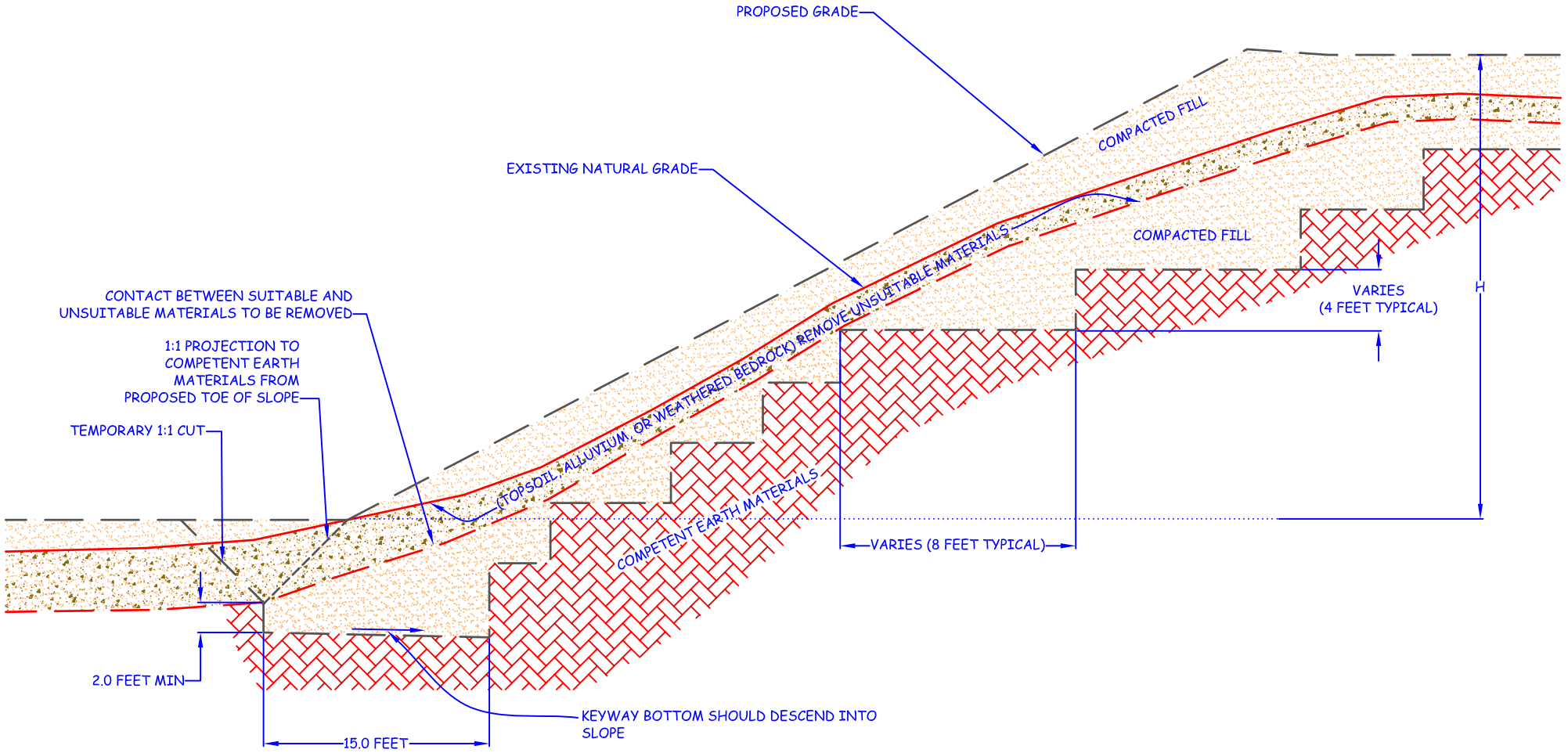
NOTES:

NATURAL SLOPES STEEPER THAN 5:1 (H:V) MUST BE BENCHED INTO COMPETENT EARTH MATERIALS

THE CUT SLOPE MUST BE CONSTRUCTED FIRST

Earth - Strata, Inc.
Geotechnical, Environmental and Materials Testing Consultants
BETTER PEOPLE • BETTER SERVICE • BETTER RESULTS

KEYWAY & BENCHING TYPICAL DETAILS
FILL SLOPE



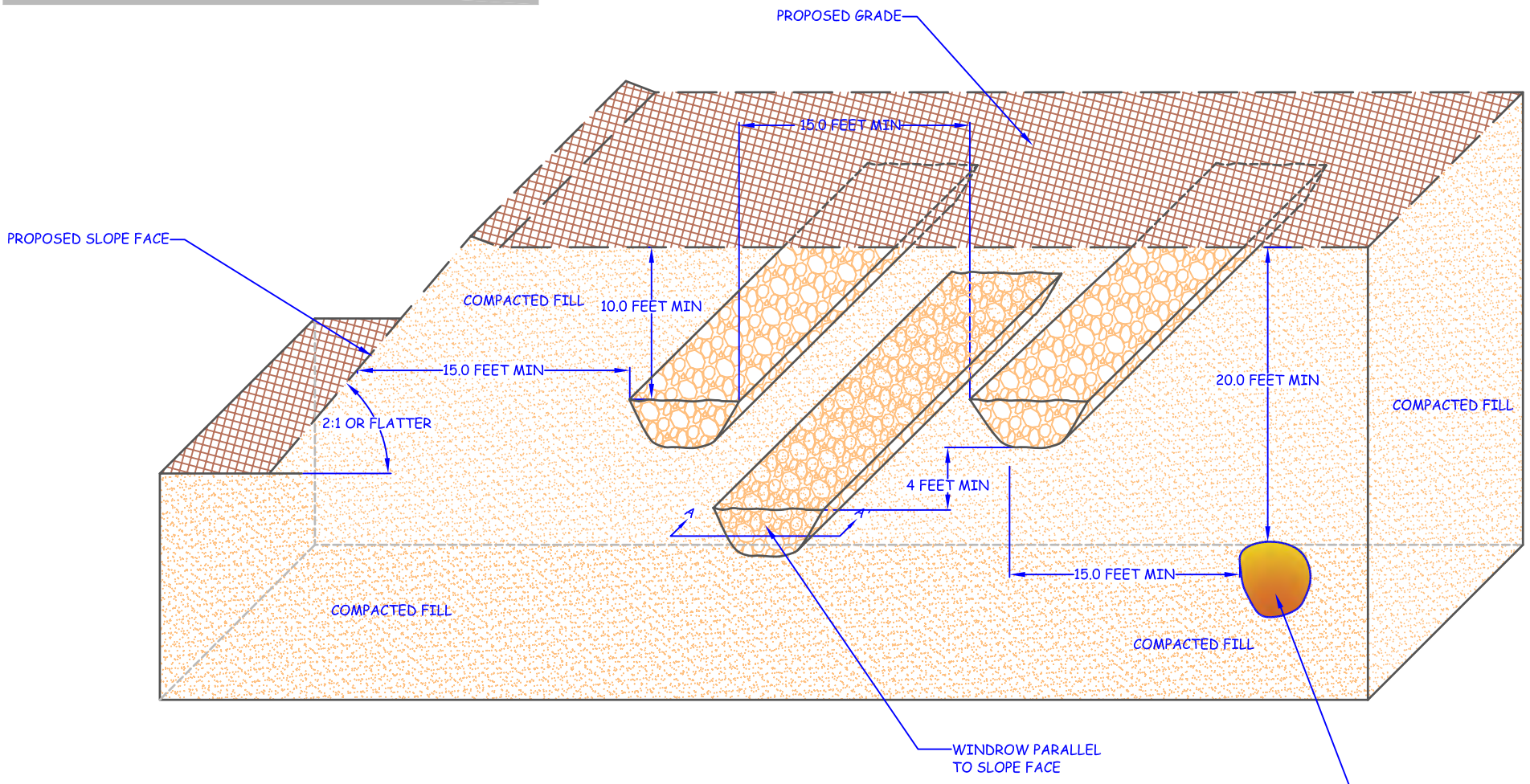
KEYWAY DIMENSIONS PER GEOTECHNICAL CONSULTANT / GEOLOGIST (TYPICALLY H/2 OR 15 FEET MIN.)

NOTES:

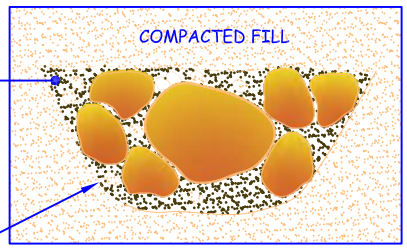
NATURAL SLOPES STEEPER THAN 5:1 (H:V) MUST BE BENCHED INTO COMPETENT EARTH MATERIALS

Earth + Strata, Inc.
Geotechnical, Environmental and Materials Testing Consultants
BETTER PEOPLE • BETTER SERVICE • BETTER RESULTS

OVERSIZE ROCK TYPICAL DETAIL



CROSS SECTION A-A'



NOTES:

OVERSIZE ROCK IS LARGER THAN
8 INCHES IN MAX DIAMETER

LEGEND

Locations are Approximate

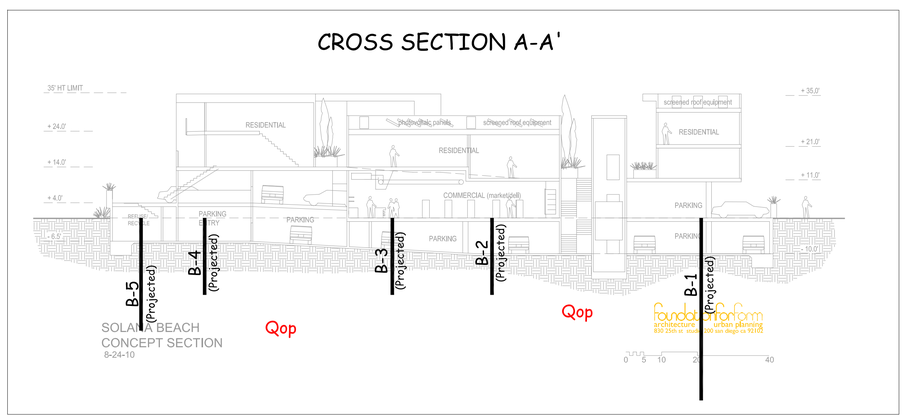
Geologic Units

Qop - Quaternary Old Paralic Deposits

Symbols

- Limits of Report
- B-5 T.D. = 31.5' NO G.W. - Boring Location, Including Total Depth and Depth to Groundwater
- 3-5' - Recommended Removal Depth
- A A' - Cross Section Location

CROSS SECTION A-A'



GEOTECHNICAL MAP

511 SOUTH SIERRA AVENUE, SOLANA BEACH
SAN DIEGO COUNTY, CALIFORNIA
APN 298-211-81-00

PROJECT	THE PEARL - SOLANA BEACH		
CLIENT	CITY OF SOLANA BEACH		
PROJECT NO.	10814-10A		
DATE	JANUARY 2011		
SCALE	1:20		
DWG XREFS	XREF		
REVISION			
DRAWN BY	GWG	PLATE	1

Earth - Strata, Inc.
Geotechnical, Environmental and Materials Testing Consultants
BETTER PEOPLE • BETTER SERVICE • BETTER RESULTS