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February 11, 2014
P/W 1207-08
Report 1207-08-B-4

Attention: **Ms. Melissa Krause**

Subject: ***Preliminary Geotechnical Investigation, Bernardo Shores Residential Development, City of Imperial Beach, California***

References: See Appendix A

Gentleperson:

Pursuant to your request, presented herein are the results of Advanced Geotechnical Solutions, Inc.'s (AGS) Preliminary Geotechnical Investigation for the proposed Bernardo Shores multi-family residential development located northeast of the intersection of Palm Avenue and Highway 75 in Imperial Beach, California. The purpose of this geotechnical investigation is to evaluate the proposed design relative to on-site geologic and geotechnical conditions and provide conclusions and recommendations to aid in the development of the project. A 40-scale Tentative Map prepared by Pasco Laret Suiter and Associates was provided to AGS for preparation of this report. Geologic and geotechnical data is superimposed upon the Tentative Map and is included herewith as Plate 1. The site currently supports a 124-unit RV park with paved roads and concrete RV parking pads, along with an office/community building, pool, and recreation area. Current development plans call for the regrading of the site to support a 38 unit townhome development with associated recreation and bio-retention facilities. The geotechnical and geologic issues opined to be significant include:

- **Liquefaction**

  Portions of the underlying soil have been identified as potentially liquefiable. Given the relatively flat nature of the site, the primary concerns associated with liquefaction are loss of bearing, lateral spread in the northern portion of the site, dynamic settlement and surface manifestation. These issues can be mitigated through remedial grading, foundation design, and building setbacks.

- **Unsuitable Soil Removal Recommendations**

  The removal of all undocumented artificial fill and the upper weathered portions of the Old Paralic Deposits is recommended prior to placement of structural fills or where exposed in cuts. Unsuitable soil removals are anticipated to be on the order of 3 to 8 feet below original grade.

- **<u>Soil Properties and Preliminary Foundation Design Parameters</u>**

  Onsite soils are expected to range from "low" to "medium" in expansion potential. Once the recommended remedial grading as outlined herein is completed, it is anticipated that the proposed structures can be supported by a conventional foundation system.

AGS appreciates the opportunity to provide you with geotechnical consulting services on this project. If you have questions concerning this report, please do not hesitate to contact the undersigned at (619) 708-1649.

Respectfully submitted,

Advanced Geotechnical Solutions, Inc.

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APPENDIX A- REFERENCES
APPENDIX B- SUBSURFACE INVESTIGATION
APPENDIX C- LABORATORY TEST RESULTS
APPENDIX D- EARTHWORK SPECIFICATIONS AND GRADING DETAILS
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FIGURE 1- SITE LOCATION MAP
PLATE 1- GEOLOGIC MAP AND EXPLORATION LOCATION PLAN

Preliminary Geotechnical Investigation, Bernardo Shores Residential Development, City of Imperial Beach, California

1.0 INTRODUCTION

This study is aimed at providing geologic and geotechnical information and recommendations for the development of the proposed multi-family residential development relative to: 1) existing site soil and geologic conditions; 2) engineering characteristics of the onsite earth materials; 3) remedial grading; 4) earthwork recommendations; 5) subsurface drainage; 6) seismic design parameters for use in the geotechnical analysis; and 7) preliminary foundation and retaining wall design parameters.

1.1. Scope of Work

The scope of our study included the following tasks:

- Review of pertinent published and unpublished geologic and geotechnical literature, maps, and aerial photographs readily available to this firm.
- Review of the Geotechnical Due Diligence Investigation prepared for the project site *(AGS 2012).*
- Prepare a geotechnical and geologic map depicting the site conditions (Plate 1).
- Excavate, log, and sample four hollow-stem auger borings (B-1 through B-4) within the limits of the project. A Certified Engineering Geologist logged each boring. The logs of borings from AGS's subsurface exploration are presented in Appendix B.
- Advancement of five Cone Penetrometer Soundings (CPT-1 through CPT-5) within the limits of the project. The CPT data is presented in Appendix B.
- Conduct laboratory testing of samples of the onsite soils obtained during the subsurface investigation including: direct shear; consolidation; chemical/resistivity; sieve analyses; maximum density; and moisture/density. Results of laboratory testing are presented in Appendix C.
- Utilizing the 40-scale Tentative Map prepared by Pasco Laret Suiter and Associates (PLSA) AGS has compiled selected geologic and geotechnical information generated from this investigation onto Plate 1. The Tentative Map depicts existing grades, ultimate design grades, finish floor of the proposed structures and associated improvement locations, AGS has added geologic information and the approximate boring locations.
- Conduct a geotechnical engineering and geologic hazard analysis of the site.
- Conduct a limited seismicity analysis.
- Prepare a preliminary geotechnical investigation report with exhibits summarizing our findings, suitable for design and regulatory review.

1.2. Geotechnical Study Limitations

The conclusions and recommendations in this report are professional opinions based on the data developed during investigation. The conclusions presented herein are based upon the current design as reflected on the Site Plan. If significant changes to the existing site plan occur, further review by AGS may be necessary.

The materials immediately adjacent to or beneath those observed may have different characteristics than those observed. No representations are made as to the quality or extent of materials not observed. Any evaluation regarding the presence or absence of hazardous material is beyond the scope of this firm's services.

2.0 SITE LOCATION AND DESCRIPTION

2.1. Site Location

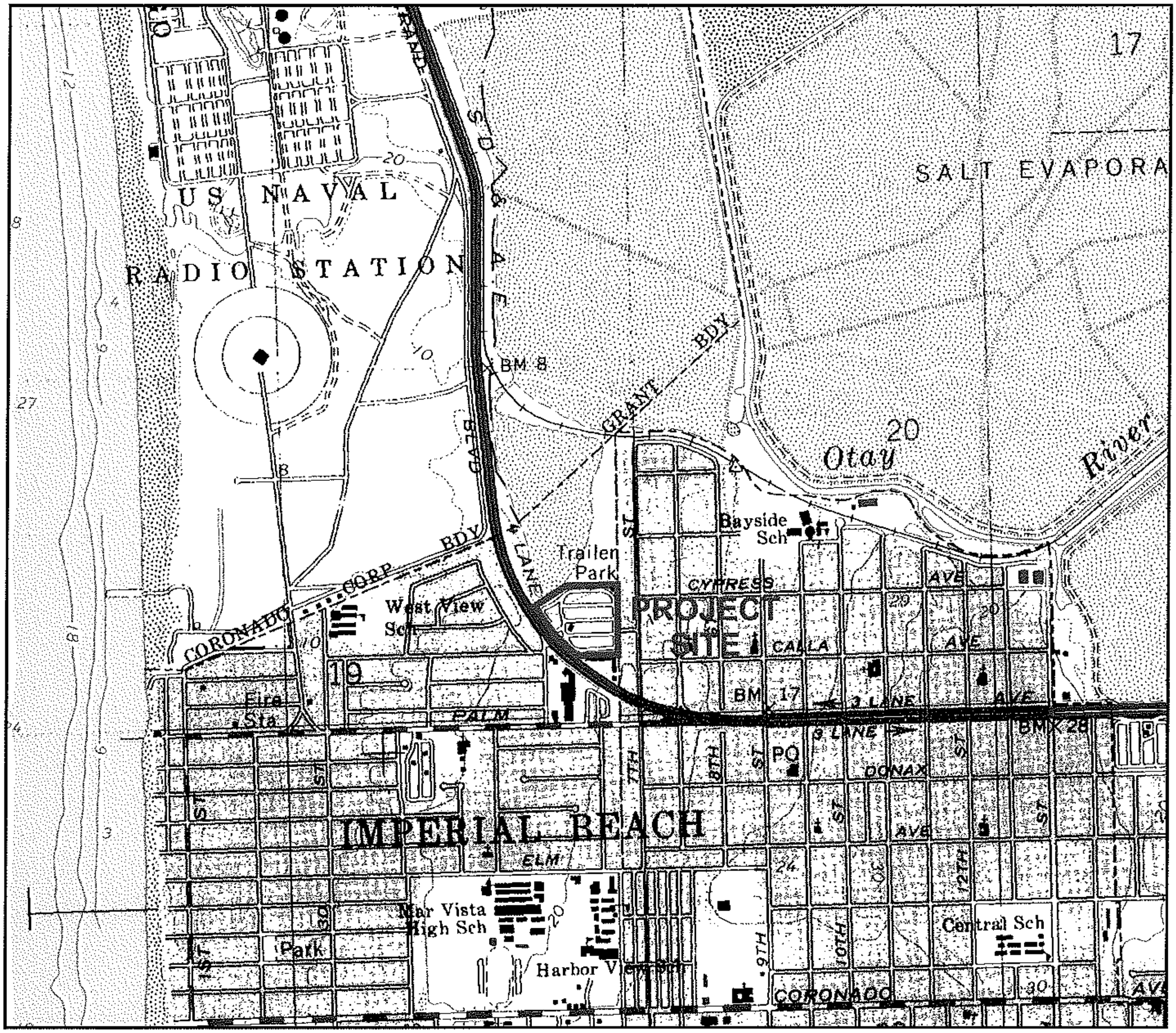
The site is located northeast of the intersection of Palm Avenue and Hwy 75 in the City of Imperial Beach, California. The site is bounded to the east by existing residential properties, to the south by commercial buildings, to the west by Hwy 75, and to the north by the tidal basin of San Diego Bay.

2.2. Site Description

The subject property encompasses approximately 10 acres of relatively level to gently sloping ground with approximate elevations ranging between 8 feet above MSL in the northwest portion of the site and 19 feet above MSL in the southeast portion of the site. Grades across the site are relatively flat and generally drain in a northerly direction into San Diego bay. The site currently supports a 124-unit RV park with paved roads and concrete RV parking pads, along with an office/community building, pool, and recreation area. The roads are paved with concrete pavement with the individual RV sites consisting of a concrete pad and a gravel pad (approximately 3 to 5 inches of ¾ inch gravel) founded upon approximately 3 to 6 inches of cement treated base. All of the existing RV-pads have sewer, water, electrical, and cable/phone. In addition, there are existing single story office and laundry structures.

3.0 PROPOSED DEVELOPMENT

Grading for the proposed development will consist of cuts and fills of less than five feet to develop the proposed multi-family building pads. The building pads will support two to eight unit condominium/townhome structures (approximately 38) and 4 single family town homes which will consist of parking at ground level and two stories of living above. In total approximately 203 townhome/condominium units are currently planned. It is anticipated that the condominiums will consist of three-story, wood framed structures supported by conventionally reinforced mat slabs foundation systems. In addition to the residential structures, a pool and recreation center along with other amenities (paseos and other open space areas) are proposed. A Bio-Retention Area is proposed along the northern boundary of the site south of San Diego Bay. The Bio-Retention is designed with an approximate subgrade elevation of 9.4MSL. The Bio-Retention basin will be separated from the development by an eight foot wide bike path.



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SITE LOCATION MAP
BERNARDO SHORES DEVELOPMENT
500 HIGHWAY 75
IMPERIAL BEACH, CALIFORNIA

P/W 1207-08

FIGURE 1

SOURCE MAP - TOPOGRAPHIC MAP OF THE IMPERIAL BEACH 7.5 MINUTE QUADRANGLE, SAN DIEGO COUNTY, CALIFORNIA

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4.0 FIELD AND LABORATORY INVESTIGATION

4.1. Current Investigation

Geologic mapping and the subsurface investigation presented herein were performed in January 2014. The current subsurface work consisted of excavating, logging and sampling of four (4) hollow-stem borings (B-1 through B-4). The approximate locations of the exploratory borings are shown on Plate 1.

Relatively "undisturbed" ring and bulk samples were obtained from the borings at predetermined intervals, as well as at significant lithologic changes. The ring and bulk samples were transported to AGS's approved laboratory for testing. The test results are presented in Appendix C.

4.2. Previous Investigation

The previous geologic mapping and the subsurface investigation was conducted during our Due Diligence Investigation (AGS 2012) in August 2012. The previous investigation consisted of the advancement of five CPT (CPT-1 through CPT-5) soundings and general geologic mapping of the site. The approximate locations of the CPT soundings are shown on Plate 1. Logs of the CPT soundings are presented in Appendix B.

5.0 ENGINEERING GEOLOGY

5.1. Regional Geologic and Geomorphic Setting

The subject site is situated within the western portion of the Peninsular Ranges Geomorphic Province. The Peninsular Ranges province occupies the southwestern portion of California, extending southward from the Transverse Ranges and Los Angeles Basin to the southern tip of Baja California. In general the province consists of young, steeply sloped, northwest trending mountain ranges underlain by metamorphosed Late Jurassic to Early Cretaceous-aged extrusive volcanic rock and Cretaceous-aged igneous plutonic rock of the Peninsular Ranges Batholith. The westernmost portion of the province is predominantly underlain by younger marine and non-marine sedimentary rocks. The Peninsular Ranges' dominant structural feature is northwest-southeast trending crustal blocks bounded by active faults of the San Andreas transform system.

5.2. Site Geology

A brief description of the earth materials encountered on this site is presented in the following sections. More detailed description of these materials is provided in the boring logs included in Appendix B. The site geology presented herein has been modified from the original *Due Diligence Investigation (AGS 2012)*. The modification to the site lithology is based upon our recent observations of undisturbed samples obtained from the borings, as opposed to our previous interpretation of the site lithology utilizing CPT sounding data.

5.2.1. Artificial Fill – Undocumented (afu)

Undocumented artificial fills were encountered in the four hollowstem borings excavated onsite and are anticipated to mantle the project site. As encountered, these soils were generally brown to red brown, slightly moist to saturated, stiff, sandy clays and loose to medium dense sands with varying amounts of silt and clay. Thickness of the artificial fill ranged from approximately 2 feet (B-4) to 10.5 feet (B-1), with locally deeper deposits possible. In its present state the existing fill is unsuitable for support of the proposed structures and could be potentially liquefiable in its present state.

5.2.2. Old Paralic Deposits ($Qvop_6$)

Late to middle Pleistocene-age Old Paralic Deposits (Unit 6), formerly called Bay Point Formation, were encountered beneath the undocumented artificial fill to the depths explored. These materials predominantly consist of brown to gray brown to red brown, interbedded silt, clay, and sand lenses with occasional gravel and cobble lenses. The deposits are generally slightly moist to saturated and in a relatively dense/stiff condition. Portions of the Old Paralic Deposits are weakly cemented with minor carbonate development.

5.3. Groundwater

Groundwater was encountered in all five CPT soundings at depths between 6 and 8 feet below existing ground surface which correlates to depths of approximately 2 to 5 feet above MSL. Groundwater was also encountered in three of four hollowstem borings (B-1 through B-3) at depths between 8 and 11 feet below existing ground surface which correlates to depths of approximately 0 to 3 feet above MSL. It is AGS's opinion that the closer you are to the bay the shallower groundwater will be. Further, groundwater elevations will likely fluctuate based upon the tides. For design and estimating purposes, AGS recommends that the groundwater elevations presented in the boring logs are more accurate than the inferred groundwater elevations utilizing pore pressure readings presented in the earlier CPT soundings.

5.4. Seismic Hazards

The site is located in the tectonically active Southern California area, and will therefore likely experience shaking effects from earthquakes. The type and severity of seismic hazards affecting the site are to a large degree dependent upon the distance to the causative fault, the intensity of the seismic event, and the underlying soil characteristics. The seismic hazard may be primary, such as surface rupture and/or ground shaking, or secondary, such as liquefaction or dynamic settlement. The following is a site-specific discussion of ground motion parameters, earthquake-induced landslide hazards, settlement, and liquefaction. The purpose of this analysis is to identify potential seismic hazards and propose mitigations, if necessary, to reduce the hazard to an acceptable level of risk. The following seismic hazards discussion is guided by the California Building Code (2013), CDMG (2008), and Martin and Lew (1998).

5.4.1. Surface Fault Rupture

No known active faults have been mapped within the project site. The nearest known active surface fault is the Silver Strand section of the Newport-Inglewood-Rose Canyon fault zone which is approximately 1.5 miles west of the project site. Accordingly, the potential for fault surface rupture on the subject site is very low. This conclusion is based on literature review and aerial photographic analysis.

5.4.2. Seismicity

As noted, the site is within the tectonically active southern California area, and is approximately 1.5 miles from an active fault, the Silver Strand section of the Newport-Inglewood-Rose Canyon fault zone. The potential exists for strong ground motion that may affect future improvements.

At this point in time, non-critical structures (commercial, residential, and industrial) are usnally designed according to the California Building Code (2013) and that of the controlling local agency.

5.4.3. Liquefaction

The lower, saturated portions of the undocumented fill located along the northerly boundary of the project in the vicinity of the proposed Bio-Retention Basin are considered to be potentially liquefiable when subject to the design site acceleration of 0.499g. Theoretically, unless mitigated, liquefaction in these areas could consist of dynamic settlement, surface manifestation (sand boils and ground cracking) and or lateral spread. The Old Paralic Deposits ($Qvop_6$) unit underlying the undocumented fill is not considered liquefiable.

5.4.4. Dynamic Settlement

Dynamic settlement occurs in response to an earthquake event in loose sandy earth materials. Theoretically, portions of the undocumented fill could be subject to dynamic settlement. Given the age and the density of the Old Paralic Deposits ($Qvop_6$) the potential for dynamic settlement in this geologic unit is considered to be remote.

5.4.5. Seismically Induced Landsliding

Given the absence of steep sloping ground onsite or immediately adjacent to the site, the potential for seismically induced land sliding is absent on site.

5.4.6. Lateral Spread

Lateral spread could occur in the bio retention basin if the undocumented fill soils are left in place in their present state. Lateral spread can be mitigated through grading of the undocumented fills and the installation of soil reiuforcement in the embankments as proposed herein.

6.0 GEOTECHNICAL ENGINEERING

Presented herein is a general discussion of the geotechnical properties of the various soil types and the analytic methods used in this report.

6.1. Material Properties

6.1.1. Excavation Characteristics

Based on our previous experience with similar projects near the subject site and the information gathered during our investigation for this report, it is our opinion that the upper unsaturated portions of the Artificial Fill and Old Paralic Deposits are excavatable with conventional earthmoving equipment. However, deeper saturated portions of the Artificial fill and the Old Paralic Deposits will require specialized grading equipment ("Swamp" Cats , Top loading with Large Excavators), and mixing with drier soils for efficient excavation.

6.1.2. Compressibility

Onsite the undocumented artificial fill soils are considered to be moderately to highly compressible and the weathered portion of the Old Paralic Deposits are considered to be low in their present condition. Dependent upon the final foundation loading, the unweathered portion of the Old Paralic Deposits are not considered to be compressible.

6.1.3. Collapse Potential/Hydro-Consolidation

Given the relatively thin veneer of undocumented fill soils (2 to 10.5 feet thick) on top of the dense formational materials, and the removals proposed herein, the potential for hydro-consolidation is considered to be very low.

6.1.4. Expansion Potential

Based upon prior experience in the area, it is anticipated that the onsite soils will exhibit expansion potentials ranging from "Low" to "Medium".

Foundation design recommendations presented in this report assume that the soils affecting the foundation could vary in expansion potential from "Low" to "Medium". Further testing should be conducted during and upon completion of the grading operations to verify the as-graded expansion potential onsite.

6.1.5. Shear Strength

Shear strength testing was conducted on "undisturbed" and re-molded samples of the onsite soils. Table 6.1.5 summarizes the recommended shear strengths for compacted fill soils and Very Old Paralic Deposits.

TABLE 6.1.5 SHEAR STRENGTHS USED FOR DESIGN			
Material	**Cohesion (psf)**	**Friction Angle (degrees)**	**Density (pcf)**
Artificial Fill Undocumented - (afu)	70	27	125
Artificial Fill - Compacted (afc)	125	30	125
Very Old Paralic Deposits (Qvop6)	250	30	130

6.1.6. Chemical and Resistivity Test Results

It is anticipated that the onsite soils will exhibit sulfate "Negligible" sulfate concentrations when classified in accordance with ACI 318-05 Table 4.3.1 (per 2013 CBC). Preliminary resistivity testing indicates that the onsite soils exhibit a "moderate to severe" corrosion potential to ferrous metals.

Since grading is proposed, testing should be conducted during and upon completion of precise grading operations to further evaluate the sulfate content and potential corrosivity of the onsite soils.

6.1.7. Earthwork Adjustments

The following average earthwork adjustment factors are presented for use in evaluating earthwork quantities. These numbers are considered approximate and should be refined during grading when actual conditions are better defined.

TABLE 6.1.7 EARTHWORK ADJUSTMENTS	
Geologic Unit	**Approximate Range**
Undocumented Artificial Fill (afu)	10% to 12% Shrink
Very Old Paralic Deposits (Qvop6)	4% to 8% Bulk

6.1.8. Bearing Capacity and Lateral Earth Pressures

Ultimate bearing capacity values were obtained using the graphs and formulas presented in *NAVFAC DM-7.1*. Allowable bearing was determined by applying a factor of safety of at least three (3) to the ultimate bearing capacity.

Static lateral earth pressures were calculated using *Rankine* methods for active and passive cases. If it is desired to use *Coulomb* forces, a separate analysis specific to the application can be conducted.

6.1.9. Pavement Support Characteristics

One sample of the undocumented artificial fill was tested for Resistance "R" Value with a result of 29. For preliminary planning purposes, AGS has used an "R"-Value of 29 to design the roadway pavement sections.

7.0 GRADING RECOMMENDATIONS

Based on the information presented herein and our experience in the vicinity of the subject site, it is AGS's opinion that the proposed development of the multi-family residential site is feasible, from a geotechnical point of view, provided that the constraints discussed in this report are addressed in the design and construction of the proposed multi-family residential structures.

All grading shall be accomplished under the observation and testing of the project Geotechnical Engineer and Engineering Geologist in accordance with the recommendations contained herein, the current codes practiced by the City of San Diego and this firm's Earthwork Specifications (Appendix D).

7.1. Site Preparation and Removals/Overexcavation

Guidelines to determine the depth of removals are presented below; however, the exact extent of the removals must be determined in the field during grading, when observation and evaluation in greater detail afforded by those exposures can be performed by the Geotechnical Engineer and/or Engineering Geologist. In general, removed soils will be suitable for reuse as compacted fill when free of deleterious materials and after moisture conditioning.

Removal of unsuitable soils typically should be established at a 1:1 projection to suitable materials outside the proposed structures and embankment fills. Fore cuts should be made no steeper than 1:1, except where constrained by other factors. Removals should be initiated at a distance approximately equal to twice anticipated removal depth, outside the structures. The bottoms of all removal areas should be observed, mapped, and approved by the Engineering Geologist prior to fill placement. It is recommended the bottoms of removals be surveyed and documented by the project Civil Engineer or by the Engineering Technician utilizing available survey information.

7.1.1. Site Preparation

Existing vegetation, trash, debris, and other deleterious materials should be removed and wasted from the site prior to commencing removal of unsuitable soils and placement of compacted fill materials.

7.1.2. Undocumented Artificial Fill

Undocumented fill materials should be removed in cut and fill areas prior to the placement of compacted fill as it has unfavorable bearing characteristics and could be potentially liquefiable if left in place. Removal depths are expected to range from approximately 5 to 7 feet, with possibly localized areas requiring deeper removals. It is suggested that the inert debris (concrete, asphalt, etc) generated during the removals or demolition of the existing structure should be stockpiled for use in the stabilization of the wet subgrade soils once remedial grading is conducted. due to soft pumping and yielding soils that will likely be encountered at the removal bottoms it will be necessary to stabilize the base of the removal with a layer of rock (or inert construction debris such as concrete rubble, brick, etc) overlain by a geotextile fabric with similar properties to Mirafi 500X. The reinforcing fabric should extend horizontally a minimum of 5 to 7 feet from the limits of the building foot print. The oversize materials should have a maximum dimension no greater than 8 to 12-inches and any exposed steel reinforcement should be cut off or removed.

7.1.3. Very Old Paralic Deposits

The upper one (1) to three (3) feet of the Very Old Paralic Deposits should be removed and recompacted from building pad areas prior to fill placement and when exposed in cuts. In addition, the cut portion of the pad should be undercut to a sufficient depth to provide at least 3 feet of compacted fill on the building pad.

7.1.4. Overexcavation

Dependent upon removal depths and ultimate foundation design, cut/fill transitions could be created during the mass grading. Should a cut/fill transition occur across foundation elements, footings founded in cut should be overexcavated such that a minimum compacted fill section of three (3) feet is maintained below the bottom of the footings. This overexcavation should extend a minimum of five (5) feet outside of the foundation foot print, where possible.

7.1.5. Removals Along Grading Limits and Property Lines

Removals of unsuitable soils will be required prior to fill placement along the grading limit. A 1:1 projection, from toe of slope or grading limit, outward to competent materials should be established, where possible. Where removals are not possible due to grading limits, property line or easement restrictions, removals should be initiated at the grading boundary (property line, easement, grading limit or outside the improvement) at a 1:1 ratio inward to competent materials. Along theses edges specialized grading techniques may be required to conduct the necessary removals for support of the proposed structures and to facilitate foundation construction. These "specialized grading" techniques could range from temporary shoring to excavation and recompaction with trenching techniques. If removals cannot be conducted deepened foundations may be required. Where this reduced removal criteria is implemented, special maintenance zones may be necessary.

7.2. Slope Stability and Remediation

Proposed slope heights to be created during this phase of grading are on the order of five feet or less and are considered grossly stable when graded in accordance to the recommendations presented herein. Dependent upon field conditions it may be necessary to integrate geogrid (Mirafi 500X or equivalent) in the subgrade at the base of the removal and at mid-height of the slope for the detention basins to minimize the potential for long term slope softening caused by the repeated wetting and drying and to reduce the potential for seismically induced lateral spread. Final determination will be made in the field based upon field conditions.

7.3. Survey Control During Grading

Removal bottoms, stabilization fill keys, and backdrains should be surveyed by the Civil Engineer prior to final observation and approval by the geotechnical engineer/engineering geologist in order to verify locations and gradients.

7.4. Subsurface Drainage

Canyon subdrains are not anticipated for this project due to the relatively flat topography of the site.

7.5. Excavation and Temporary Cut Slopes

All excavations should be shored or laid back in accordance with applicable Cal-OSHA standards. Formational materials (Very Old Paralic Deposits) can be considered a Type "A" soil. Fill can be considered Type "B" soil. Any temporary excavation greater than 5 feet in height should be laid back with a 3/4:1 (horizontal: vertical) gradient in formational material or 1:1 in fill soils. These excavations should not become saturated or allowed to dry out. Surcharge loads should not be permitted within a distance equal to the height of the excavation from the top of the excavation. The top of the excavation should be a minimum of 10 feet from the edge of existing improvements. Excavations steeper than those recommended or closer than 10 feet from an existing surface improvement should be temporarily shored in accordance with applicable OSHA codes and regulations. Soil parameters for shoring and tieback design are presented in Section 7.6 below.

7.6. Earthwork Considerations

7.6.1. Compaction Standards

All fills should be compacted at least 90 percent of the maximum dry density as determined by ASTM D1557. All loose and or deleterious soils should be removed to expose firm older alluvium or bedrock. Prior to the placement of fill, the upper 6 to 8 inches should be ripped, moisture conditioned to optimum moisture or slightly above optimum, and compacted to a minimum of 90 percent of the maximum dry density (ASTM D1557). Fill should be placed in thin (6 to 8-inch) lifts, moisture conditioned to optimum moisture or slightly above, and compacted to 90 percent of the maximum dry density (ASTM D1557) until the desired grade is achieved.

7.6.2. Benching

Where the natural slope is steeper than 5-horizontal to 1-vertical and where determined by the project Geotechnical Engineer or Engineering Geologist, compacted fill material shall be keyed and benched into competent materials.

7.6.3. Mixing and Moisture Control

In order to prevent layering of different soil types and/or different moisture contents, mixing and moisture control of materials may be necessary. The preparation of the earth materials through mixing and moisture control should be accomplished prior to and as part of the compaction of each fill lift. Water trucks or other water delivery means may be necessary for moisture control. Discing may be required when either excessively dry or wet materials are encountered.

7.6.4. Haul Roads

All haul roads, ramp fills, and tailing areas shall be removed prior to engineered fill placement.

7.6.5. Import Soils

Import soils, if required, should consist of clean, structural quality, compactable materials similar to the on-site soils and should be free of trash, debris or other objectionable materials. Import soils should be tested and approved by the geotechnical consultant prior to importing. At least three working days should be allowed in order for the geotechnical consultant to sample and test the potential import material.

7.6.6. Oversize Rock

Oversize rocks are not anticipated to be encountered during onsite grading. If encountered, rocks or inert construction debris (brick, concrete rubble, asphalt, etc.) generated during the demolition of the site greater than 8 inches cannot be used in the compacted fill unless reduced in size to 8-inches (maximum) or disposed of in the deeper fill areas.

7.6.7. Utility Trench Excavation and Backfill

All utility trenches should be shored or laid back in accordance with applicable Cal/OSHA standards. Excavations in bedrock areas should be made in consideration of underlying geologic structure. The geotechnical consultant should be consulted on these issues during construction.

Mainline and lateral ntility trench backfill should be compacted to at least 90 percent of maximum dry density as determined by ASTM D 1557. Onsite soils will not be suitable for use as bedding material but will be suitable for use in backfill, provided oversized materials are removed. No surcharge loads should be imposed above excavations. This includes spoil piles, lumber, concrete trucks or other construction materials and equipment. Drainage above excavations should be directed away from the banks. Care should be taken to avoid saturation of the soils.

Compaction should be accomplished by mechanical means. Jetting of native soils will not be acceptable.

To reduce moisture penetration beneath the slab-on-grade areas, shallow utility trenches should be backfilled with lean concrete or concrete slurry where they intercept the foundation perimeter. As au alternative, such excavations can be backfilled with native soils, moisture-conditioned to over optimum, and compacted to a minimum of 90 percent relative compaction.

8.0 DESIGN RECOMMENDATIONS

From a geotechnical perspective, the proposed development is feasible provided the following recommendations are incorporated into the design and construction. Preliminary design recommendations are presented herein and are based on some of the general soils conditions encountered during our preliminary investigation. As such, recommendations provided herein are considered preliminary and subject to change based on the results of additional observation and testing that will occur during grading operations. Final design recommendations should be provided in a final rough/precise grading report. For preliminary design it is anticipated that the onsite soils will exhibit "Low" to "Medium" expansion potential.

8.1. Structural Design Recommendations

It is anticipated that the proposed multi-family residential structure can be supported with spread and continuous footings or through the use of a "Mat" slab. The design of these systems should be determined by the structural engineer the anticipated bearing values presented herein. Final design should be based on as-graded conditions once the remedial grading is completed

8.1.1. Foundation Design

8.1.1.1. Conventional Foundations

For preliminary design foundations may be designed using the values provided in the following table. These values may be increased as allowed by Code to resist transient loads such as wind or seismic. Building code and structural design considerations may govern depth and reinforcement requirements and should be evaluated once more detailed plans become available.

CONVENTIONAL FOUNDATION DESIGN PARAMETERS	
Allowable Bearing	3000 psf, based on a minimum width and depth
Lateral Bearing (Level Condition)	250 psf/foot of depth to a maximum of 3000 psf
Sliding Coefficient	0.35
Continuous Footings	
Footing Width*	18 inches
Footing Depth*	24 inches
Reinforcement	Per Structural Engineer
Spread Footings	
Footing Width*	24 inches
Footing Depth*	24 inches
Reinforcement	Per structural engineer
Slab-on-Grade	
Minimum Slab Thickness	4 inches (actual)
Minimum Slab Reinforcement	No. 3 rebar spaced 12 inches on center (maximum), each way
Moisture Barrier	An approved moisture and vapor barrier should be placed below all slabs-on-grade within living and moisture sensitive areas as discussed in Section 8.1.1.3
Slab Subgrade Moisture	Minimum of 110 percent of optimum moisture to a depth of 12 inches prior to placing concrete

Final foundation design should be provided by structural engineer.
***Indicates Minimums:** *Depth of embedment should be measured below lowest adjacent finish grade.*
Isolated Spread Footings: *Isolated spread footings outside the footprint of the proposed structures should be tied with grade beams to the structure in two orthogonal directions*
Footings Adjacent to Swales and Slopes: *If exterior footings adjacent to drainage swales are to exist within 5 feet horizontally of the swale, the footing should be embedded sufficiently to assure embedment below the swale bottom is maintained. Footings adjacent to slopes should be embedded such that at least 5 feet is provided horizontally from edge of the footing to the face of the slope.*

8.1.1.2. Mat Slab

For the design of a Mat slab foundation system the following values may be used:

k=135pci, where $K=k((b+1/(2b))^2$

where b=least width of the foundation

8.1.1.3. Settlement

Settlements are likely to be produced from structural loads and long-term settlement of the fill.

Static Settlement

For foundations designed based on the above values, total settlements under structural loads should be less than ½-inch total with differential settlement on the order of 3/8 inch in 20 feet.

Dynamic Settlement

Structures should also be designed to accommodate the potential for seismically-induced settlement in accordance with the guidelines presented in Special Publication 117A (CDMG 2008). Total dynamic settlement is anticipated to be on the order of 1-inch with dynamically induced differential settlement estimated to be 1/2-inch in 40 feet. Dynamic settlements can be considered independently from static settlements.

8.1.1.4. Footing Excavations

Footing excavations should be observed by the geotechnical consultant. Spoils from the footing excavations should not be placed on slab-on-grade areas unless the soils are properly compacted. The footing excavations should not be allowed to dry back and should be kept moist until concrete is poured. The excavations should be free of all loose and sloughed materials, be neatly trimmed, and moisture conditioned at the time of concrete placement.

8.1.1.5. Moisture and Vapor Barrier

A moisture and vapor retarding system should be placed below the slabs-on-grade in portions of the structure considered to be moisture sensitive. The retarder should be of suitable composition, thickness, strength and low permeance to effectively prevent the migration of water and reduce the transmission of water vapor to acceptable levels. Historically, a 10-mil plastic membrane, such as *Visqueen*, placed between one to four inches of clean sand, has been used for this purpose. More recently Stego® Wrap or similar underlayments have been used to lower permeance to effectively prevent the migration of water and reduce the transmission of water vapor to acceptable levels. The use of this system or other systems, materials or techniques can be considered, at the discretion of the designer, provided the system reduces the vapor transmission rates to acceptable levels.

8.1.2. Earth Pressures for Design of Buried Structures

The recommended active, passive and at rest earth Rankine earth pressures, which may be utilized for design of buried structures with level backfill are as follows:

Level Backfill	Rankine Coefficients	Equivalent Fluid Pressure (psf/lin.ft.)
Coefficient of Active Pressure:	$K_a = 0.29$	37
Coefficient of Passive Pressure:	$K_p = 3.39$	424
Coefficient of at Rest Pressure:	$K_o = 0.46$	57

2 : 1 Backfill	Rankine Coefficients	Equivalent Fluid Pressure (psf/lin.ft.)
Coefficient of Active Pressure:	$K_a = 0.44$	55
Coefficient of At Rest Pressure:	$K_o = 0.68$	85

For rigid restrained walls it is recommended that "At-Rest" values should be used. For cantilever retaining walls which can undergo minor rotations active pressures can be used.

The above values may be increased by 1/3 as allowed by Code to resist transient loads. Building Code and structural design considerations may govern.

In addition to the above static pressures, unrestrained retaining walls should be designed to resist seismic loading as required by the 2013 CBC. The seismic load can be modeled as a thrust load applied at a point 0.6H above the base of the wall, where H is equal to the height of the wall. This seismic load (in pounds per lineal foot of wall) is represented by the following equation:

$$Pe = \frac{3}{8} * \gamma * H^2 * k_h$$

Where:

Pe = Seismic thrust load

H = Height of the wall (feet)

γ = soil density = 125 pounds per cubic foot (pcf)

k_h = seismic pseudostatic coefficient = 0.4 * PGA_M (1)

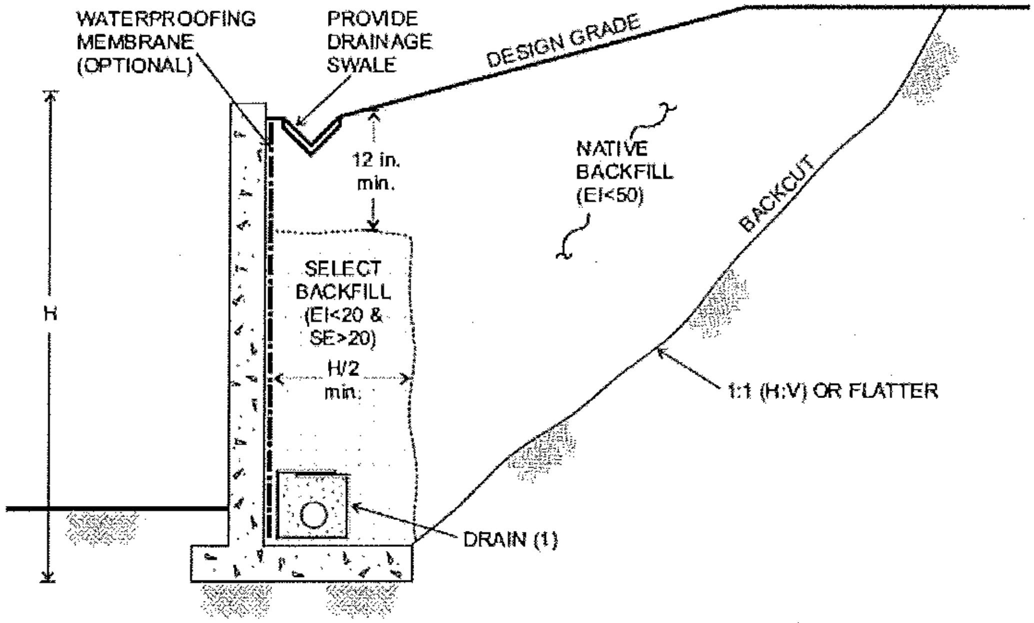
(1) see section 8.1.3 S_{D1}

Walls should be designed to resist the combined effects of static pressures and the above seismic thrust load.

Retaining walls should be provided with a drainage system adequate to prevent the buildup of hydrostatic pressures. To relieve the potential for hydrostatic pressure wall backfill should consist of a free draining backfill (sand equivalent "SE" >20) and a heel drain should be constructed (see Figure 2). The heel drain should be place at the heel of the wall and should consist of a 4-inch diameter perforated pipe (SDR35 or SCHD 40) surrounded by 4 cubic feet of crushed rock (3/4-inch) per lineal foot, wrapped in filter fabric (Mirafi® 140N or equivalent).

FIGURE 2

Retaining Wall Backfill and Drainage



NOTES: (1) DRAIN: 4-INCH PERFORATED ABS OR PVC PIPE OR APPROVED EQUIVALENT SUBSTITUTE PLACED PERFORATIONS DOWN AND SURROUNDED BY A MINIMUM OF 1 CUBIC FEET OF 3/4 INCH ROCK OR APPROVED EQUIVALENT SUBSTITUTE AND WRAPPED IN MIRAFI 140 FILTER FABRIC OR APPROVED EQUIVALENT SUBSTITUTE

Proper drainage devices should be installed along the top of the wall backfill, which should be properly sloped to prevent surface water ponding adjacent to the wall In addition to the wall drainage system, for building perimeter walls extending below the finished grade, the wall should be waterproofed and/or damp-proofed to effectively seal the wall from moisture infiltration through the wall section to the interior wall face.

The wall should be backfilled with granular soils placed in loose lifts no greater than 8-inches thick, at or near optimum moisture content, and mechanically compacted to a minimum 90 percent of the maximum dry density as determined by ASTM D1557. Flooding or jetting of backfill materials generally do not result in the required degree and uniformity of compaction and, therefore, is not recommended. No backfill should be placed against concrete until minimum design strengths are achieved as verified by compression tests of cylinders. The geotechnical consultant should observe the retaining wall footings, back drain installation, and be present during placement of the wall backfill to confirm that the walls are properly backfilled and compacted.

8.1.3. Seismic Design Parameters

The following seismic design parameters are presented to be code compliant to the California Building Code (2013). The project site is considered to be Site Class "D" in accordance with CBC, 2013, Section 1613.3.2 and ASCE 7, Chapter 20. The site is located at Latitude 32.5866° N and Longitude -117.1195° W. Utilizing this information, the United States Geological Survey (USGS) web tool (http://earthquake.usgs.gov/designmaps) and ASCE 7 criterion, the mapped seismic acceleration parameters S_S, for 0.2 seconds and S_1, for 1.0 second period (CBC, 2013, 1613.3.1) for Risk-Targeted Maximum Considered Earthquake (MCE_R) can be determined. The mapped acceleration parameters are provided for Site Class "B". Adjustments for other Site Classes are made, as needed, by utilizing Site Coefficients F_a and F_v for determination of MCE_R spectral response acceleration parameters S_{MS} for short periods and S_{M1} for 1.0 second period (CBC, 2013 1613.3.3). Five-percent damped design spectral response acceleration parameters S_{DS} for short periods and S_{D1} for 1.0 second period can be determined from the equations in CBC, 2013, Section 1613.3.4.

Seismic Design Criteria	
Mapped Spectral Acceleration (0.2 sec Period), S_S	1.140g
Mapped Spectral Acceleration (1.0 sec Period), S_1	0.434g
Site Coefficient, F_a (CBC, 2013, Table 1613.3.3(1))	1.044
Site Coefficient, F_v (CBC, 2013, Table 1613.3.3(2))	1.566
MCE_R Spectral Response Acceleration (0.2 sec Period), S_{MS}	1.190g
MCE_R Spectral Response Acceleration (1.0 sec Period), S_{M1}	0.679g
Design Spectral Response Acceleration (0.2 sec Period), S_{DS}	0.794g
Design Spectral Response Acceleration (1.0 sec Period), S_{D1}	0.453g

Utilizing a probabilistic approach, the CBC recommends that structural design be based on the peak horizontal ground acceleration (PGA) having of 2 percent probability of exceedance in 50 years (approximate return period of 2,475 years) which is defined as the Maximum Considered Earthquake (MCE). Using the United States Geological Survey (USGS) web-based ground motion calculator, the site class modified PGA_M (F_{PGA}*PGA) was determined to be 0.499g. This value does not include near-source factors that may be applicable to the design of structures on site.

8.2. Civil Design Recommendations

8.2.1. Drainage

Final site grading should assure positive drainage away from structures. Planter areas should be provided with area drains to transmit irrigation and rain water away from structures. The use of gutters and down spouts to carry roof drainage well away from structures is recommended. Raised planters should be provided with a positive means to remove water through the face of the containment wall.

8.2.2. Exterior Flatwork

8.2.2.1. Slab Thickness

Concrete flatwork should be designed utilizing 4-inch minimum thickness.

8.2.2.2. Control Joints

Weakened plane joints should be installed on walkways at intervals of approximately 6 to 8 feet. Exterior slabs should be designed to withstand shrinkage of the concrete.

8.2.2.3. Flatwork Reinforcement

Consideration should be given to reinforcing any exterior flatwork.

8.2.2.4. Thickened Edge

Consideration should be given to construct a thickened edge (scoop footing) at the perimeter of slabs and walkways adjacent to landscape areas to minimize moisture variation below these improvements. The thickened edge (scoop footing) should extend approximately 8 inches below concrete slabs and should be a minimum of 6 inches wide.

8.2.3. Preliminary Pavement Design

8.2.3.1. Asphaltic Concrete

For the design of asphaltic pavement, the following preliminary pavement design section is recommended based upon an R-value=29 and a traffic index of 5.5:

3-inches Asphaltic Concrete
Over
8-Class II-Base**
**Subgrade and base compacted to a minimum of 95% (per ASTM D 1557)

8.2.3.2. Concrete Pavement

For concrete paving the following pavement sections are presented assuming a modulus of subgrade reaction k=100pci and a modulus of rupture (MR) for the concrete of 550psi:

Location	Traffic Index	Recommended Section
Parking	5.0	6 inches Concrete over 4-inches Aggregate Base*
Driveway	6.0	6.5 inches AC over 4-inches Aggregate Base*

*Compacted to a minimum of 95% (per ASTM D1557)

Consideration should be given to a thickened edge where the pavement transitions from asphaltic concrete to concrete. To minimize unwanted cracking control joints should be placed at 8 to 10 foot centers both ways.

8.3. Plan review

Once foundation design plans become available, they should be reviewed by AGS to verify that the design recommendations presented are consistent with the proposed construction

9.0 CLOSURE

9.1. Geotechnical Review

As is the case in any grading project, multiple working hypotheses are established utilizing the available data, and the most probable model is used for the analysis. Information collected during the grading and construction operations is intended to evaluate the hypotheses, and some of the assumptions summarized herein may need to be changed as more information becomes available. Some modification of the grading and construction recommendations may become necessary, should the conditions encountered in the field differ significantly than those hypothesized to exist.

AGS should review the pertinent plans and sections of the project specifications, to evaluate conformance with the intent of the recommendations contained in this report.

If the project description or final design varies from that described in this report, AGS must be consulted regarding the applicability of, and the necessity for, any revisions to the recommendations presented herein. AGS accepts no liability for any use of its recommendations if the project description or final design varies and AGS is not consulted regarding the changes.

9.2. Limitations

This report is based on the project as described and the information obtained from referenced reports. The findings are based on the review of the field and laboratory data provided combined with an interpolation and extrapolation of conditions between and beyond the reviewed exploratory excavations and compaction test results. The results reflect an interpretation of the direct evidence obtained. Services performed by AGS have been conducted in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions. No other representation, either expressed or implied, and no warranty or guarantee is included or intended.

The recommendations presented in this report are based on the assumption that an appropriate level of field review will be provided by geotechnical engineers and engineering geologists who are familiar with the design and site geologic conditions. That field review shall be sufficient to confirm that geotechnical and geologic conditions exposed during grading are consistent with the geologic representations and corresponding recommendations presented in this report. AGS should be notified of any pertinent changes in the project plans or if subsurface conditions are found to vary from those described herein. Such changes or variations may require a re-evaluation of the recommendations contained in this report.

The data, opinions, and recommendations of this report are applicable to the specific design of this project as discussed in this report. They have no applicability to any other project or to any other location, and any and all subsequent users accept any and all liability resulting from any use or reuse of the data, opinions, and recommendations without the prior written consent of AGS.

AGS has no responsibility for construction means, methods, techniques, sequences, or procedures, or for safety precautious or programs in connection with the construction, for the acts or omissions of the CONTRACTOR, or any other person performing any of the construction, or for the failure of any of them to carry out the construction in accordance with the final design drawings and specifications.

APPENDIX A

REFERENCES

REFERENCES

Advanced Geotechnical Solutions, Inc (AGS 2012). *Geotechnical Due Diligence Investigation, Bernardo Shores Project, City of Imperial Beach, California,* dated September 6, 2012, Report No. 1207-08-B-2.

American Society of Civil Engineers, 2013, Minimnm Design Loads for Buildings and Other Structures (7-10, third printing).

California Division of Mines and Geology (CDMG 2008). *Guidelines for Evaluating and Mitigating Seismic Hazards in California, 2008, Special Publication 117A.*

California Building Standards Commission, 2013, *California Building Code*, Title 24, Part 2, Volumes 1 and 2.

Jennings, C.W., 1994, Fault Activity Map of California and Adjacent Areas: California Geological Survey, California Geologic Data Map No. 6, Scale 1:750,000.

Kennedy, M.P., 1975, Geology of the La Jolla Quadrangle, San Diego County, California, California Geological Survey, Bulletin 200, Scale 1:24,000

Kennedy, M.P., and Tan, S.S., 2008, Geologic Map of the San Diego 30' x 60' Quadrangle, California Regional Geologic Map Series, Scale 1:100,000, Map No. 3, Sheet 1 of 2.

Tan, S.S., 1995, Landslide Hazards in the Southern Part of the San Diego Metropolitan Area, San Diego County, California, Landslide Hazard Identification Map No. 33, Plate 33A, Division of Mines and Geology, Open File Report 95-03.

United States Geological Survey, U.S. Seismic Design Maps, World Wide Web, http://earthquake.usgs.gov/hazards/designmaps/.

APPENDIX B

SUBSURFACE EXPLORATION

ADVANCED GEOTECHNICAL SOLUTIONS, INC.

APPENDIX B

SUBSURFACE EXPLORATION

Four borings (B-1 through B-4) were excavated, logged and sampled utilizing a CME 75 Hollow-stem Continuous Flight Auger. The approximate locations of the exploratory borings are shown on the Site Plan (Plate 1) and the Geotechnical Boring Logs are attached.

Representative bulk soil samples were obtained from the borings at selected locations. Ring samples were obtained by driving a Modified California Sampler into the material a total of 12-inches or until refusal. The Modified California Sampler is a spoon-type sampler, which has an inside diameter of 2.42-inches and a tapered cutting tip at the lower end. The barrel is lined with thin brass rings, each 1-inch in length. Material is retained within the brass rings during the driving of the sampler. In addition to undisturbed sampling, Standard Penetration Testing (SPT) was conducted by driving a split-barrel sampler to obtain a representative disturbed soil sample for identification purposes, and measure the resistance of the soil to penetration of the sampler. The SPT testing was conducted in general conformance to ASTM D 1586-08. In addition to recording the blow counts, materials obtained from the SPT testing were retained for testing.

The ring samples and bulk samples were transported to AGS's approved laboratory for testing. Laboratory testing procedures and test results are presented in Appendix C of this report.

BORING NUMBER B-1

AGS
ADVANCED GEOTECHNICAL SOLUTIONS, INC.

CLIENT Integral Communities	PROJECT NAME Bernardo Shores
PROJECT NUMBER 1207-08	PROJECT LOCATION Imperial Beach, CA
DATE STARTED 1/22/14 COMPLETED 1/22/14	GROUND ELEVATION ___ HOLE SIZE 8
DRILLING CONTRACTOR Baja Exploration	GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger	▽ AT TIME OF DRILLING 8.00 ft
LOGGED BY PJD CHECKED BY PJD	AT END OF DRILLING ---
NOTES	AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	USCS	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	SATURATION (%)	OTHER TESTS	ATTERBERG LIMITS: LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	FINES CONTENT (%)
0		GW	**4 inches Cement Treated Base**										
		CL	**Artificial Fill** Red brown, moist, stiff, sandy CLAY with silt										
				SPT	8-5-6 (11)								76
5		SC	Red brown, moist to wet, medium dense, clayey fine- to medium-grained SAND	MC	20-7-10 (17)	112	19.9						
		SP	▽ Brown to red brown, wet to saturated, loose, fine- to medium-grained SAND with silt and clay	SPT	2-3-3 (6)								
10		SM	**Old Paralic Deposits** Brown to red brown to orange brown, saturated, medium dense, silty fine- to medium-grained SAND with clay	MC	6-16-16 (32)	112	19.7						
15		SP	Brown to red brown, saturated, medium dense, fine- to medium-grained SAND with silt; trace clay	SPT	17-7-11 (18)								
20			-Same; brown to orange brown	MC	16-18-20 (38)	112	17.9						
25		SM-SC	Brown to gray brown, saturated, medium dense, silty to clayey fine-grained SAND	SPT	5-5-6 (11)								

BORING TERMINATED AT 26.5 FEET
GROUNDWATER ENCOUNTERED AT 8 FEET
BORING BACKFILLED WITH ~8 CU. FT. OF BENTONITE GROUT

AGS
ADVANCED GEOTECHNICAL SOLUTIONS, INC.

BORING NUMBER B-2

CLIENT Integral Communities
PROJECT NAME Bernardo Shores
PROJECT NUMBER 1207-08
PROJECT LOCATION Imperial Beach, CA
DATE STARTED 1/22/14 COMPLETED 1/22/14
GROUND ELEVATION HOLE SIZE 8
DRILLING CONTRACTOR Baja Exploration
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
AT TIME OF DRILLING 11.00 ft
LOGGED BY PJD CHECKED BY PJD
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	USCS	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	SATURATION (%)	OTHER TESTS	ATTERBERG LIMITS: LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	FINES CONTENT (%)
0		GW	**4 inches Cement Treated Base**										
		SM	**Artificial Fill** Red brown, slightly moist, medium dense, silty fine- to medium-grained SAND	MC	6-10-15 (25)	114	16.5						
5		SM	**Old Paralic Deposits** Red brown, moist, medium dense, silty fine-grained SAND										
			-Same; dense, weakly cemented	SPT	24-28-21 (49)								
			-Same; micaceous, minor carbonate development	MC	16-27-41 (68)	105	21.5						
10		SM-SC	∇ Brown to gray brown, moist to wet, medium dense, silty to clayey fine-grained SAND	SPT	8-12-14 (26)								50
15		CL	Brown to gray brown, wet, stiff, silty CLAY with fine-grained sand	MC	10-13-17 (30)	97	27.9						
20		SW	Brown, saturated, medium dense, fine- to coarse-grained SAND with silt	SPT	8-18-22 (40)								
25			-Same	SPT	8-18-20 (38)								

BORING TERMINATED AT 26.5 FEET
GROUNDWATER ENCOUNTERED AT 11 FEET
BORING BACKFILLED WITH ~8 CU. FT. OF BENTONITE GROUT

BORING NUMBER B-3

AGS
ADVANCED GEOTECHNICAL SOLUTIONS, INC.

CLIENT Integral Communities		**PROJECT NAME** Bernardo Shores	
PROJECT NUMBER 1207-08		**PROJECT LOCATION** Imperial Beach, CA	
DATE STARTED 1/22/14	**COMPLETED** 1/22/14	**GROUND ELEVATION**	**HOLE SIZE** 8
DRILLING CONTRACTOR Baja Exploration		**GROUND WATER LEVELS:**	
DRILLING METHOD Hollow Stem Auger		▽ **AT TIME OF DRILLING** 11.00 ft	
LOGGED BY PJD	**CHECKED BY** PJD	**AT END OF DRILLING** ---	
NOTES		**AFTER DRILLING** ---	

DEPTH (ft)	GRAPHIC LOG	USCS	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	SATURATION (%)	OTHER TESTS	ATTERBERG LIMITS: LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	FINES CONTENT (%)
0		GW	**4 inches Cement Treated Base**										
		SM	**Artificial Fill** Red brown, moist, medium dense, silty fine-grained SAND	SPT	3-5-8 (13)								
5		SM	**Old Paralic Deposits** Red brown, slightly moist, medium dense, silty fine- to medium-grained SAND	MC	8-10-10 (20)	106	8.6						
		SP	Orange brown, slightly moist, medium dense, fine- to medium-grained SAND with silt	SPT	5-6-6 (12)								
10		SM-SC	▽ Red brown, wet to saturated, medium dense, silty to clayey fine- to medium-grained SAND	MC	7-16-21 (37)	104	6.1						
15		SP	Brown, saturated, medium dense, fine- to medium-grained SAND with silt; trace clay	SPT	7-16-19 (35)								9
20		SM	Brown to gray brown, saturated, medium dense, silty fine-grained SAND with clay	SPT	8-11-13 (24)								

BORING TERMINATED AT 21.5 FEET
GROUNDWATER ENCOUNTERED AT 11 FEET
BORING BACKFILLED WITH ~6 CU. FT. OF BENTONITE GROUT

BORING NUMBER B-4

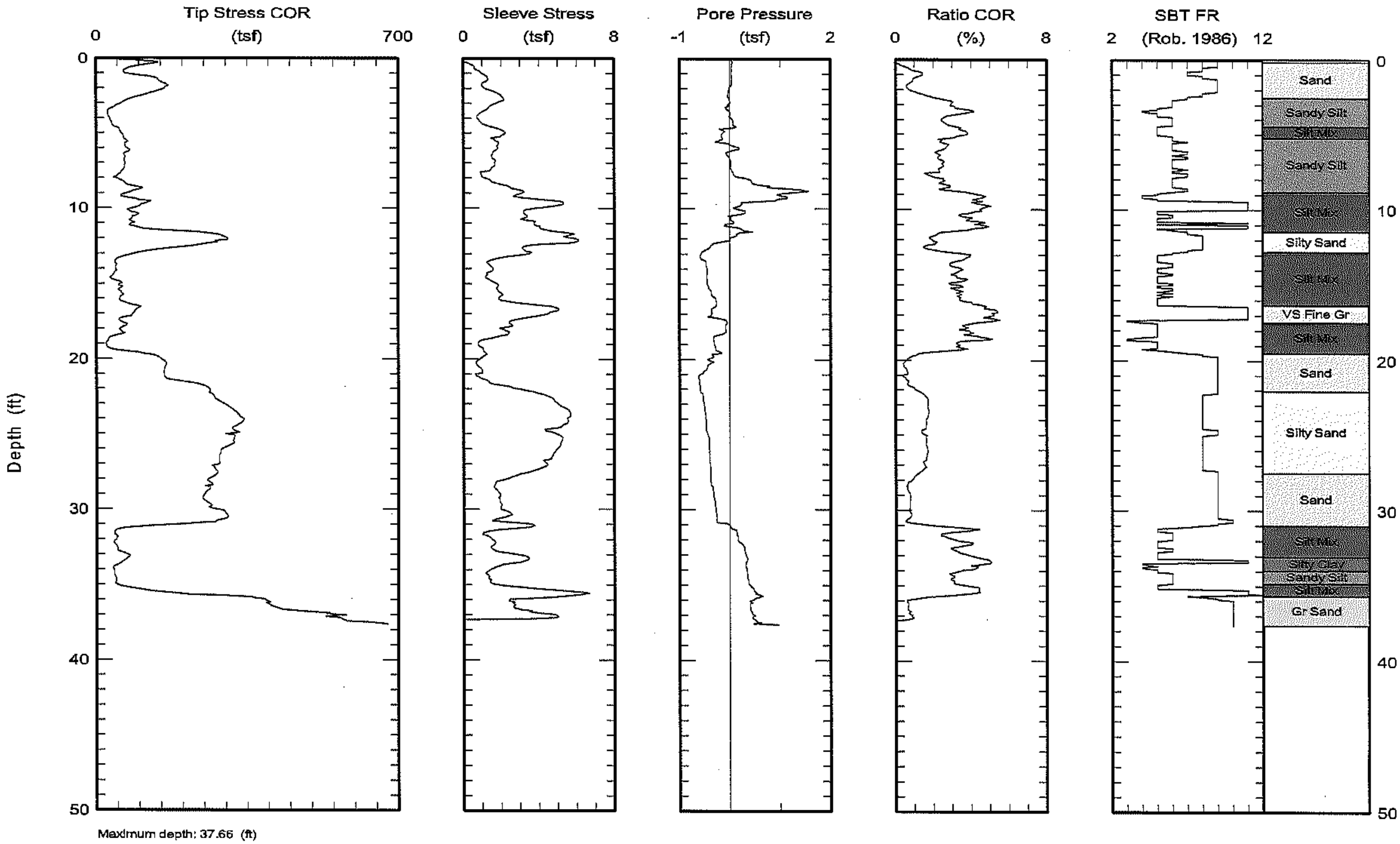
AGS
ADVANCED GEOTECHNICAL SOLUTIONS, INC.

CLIENT Integral Communities
PROJECT NAME Bernardo Shores
PROJECT NUMBER 1207-08
PROJECT LOCATION Imperial Beach, CA
DATE STARTED 1/22/14 **COMPLETED** 1/22/14
GROUND ELEVATION **HOLE SIZE** 8
DRILLING CONTRACTOR Baja Exploration
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
AT TIME OF DRILLING ---
LOGGED BY PJD **CHECKED BY** PJD
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

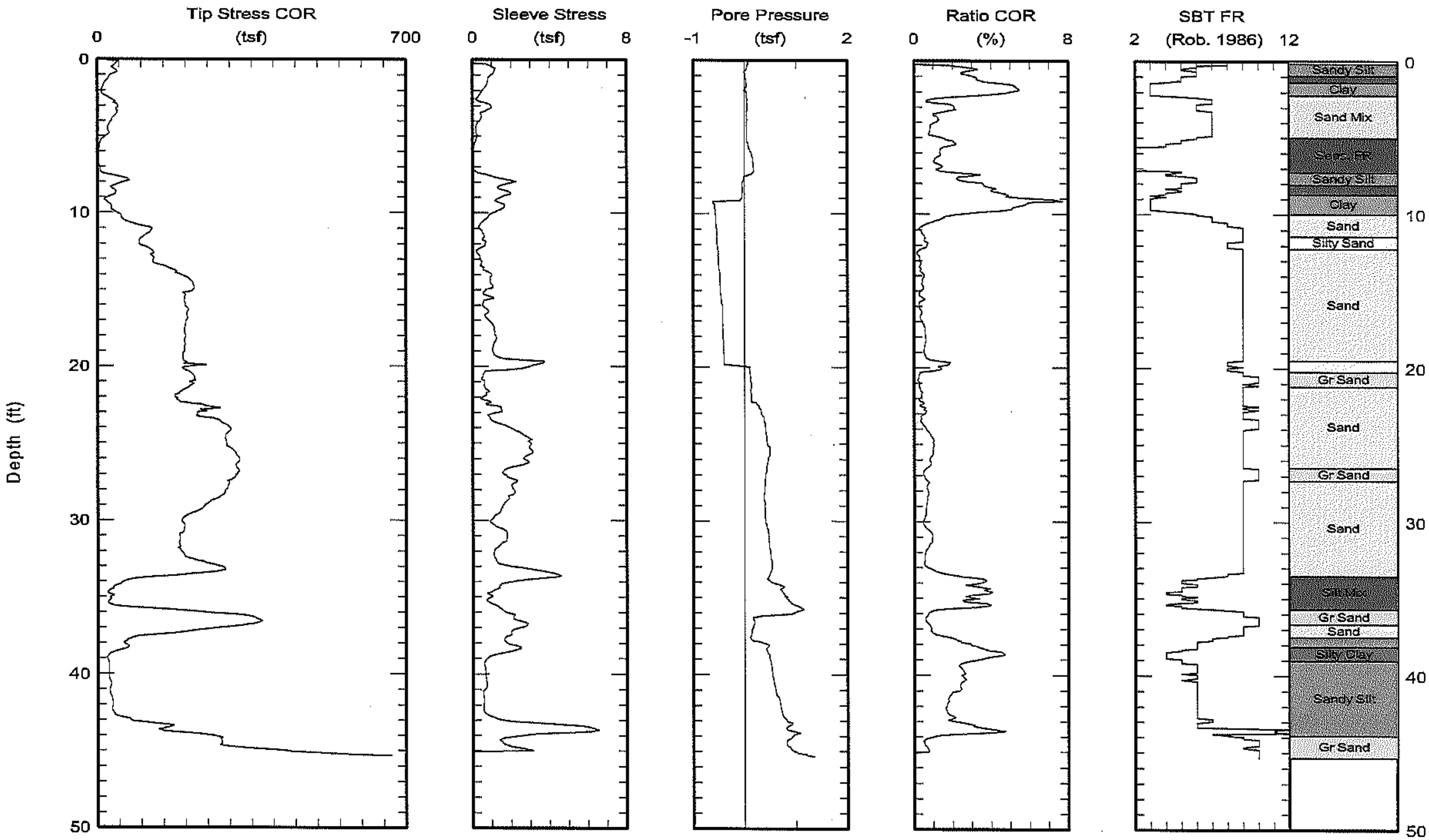
DEPTH (ft)	GRAPHIC LOG	USCS	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	SATURATION (%)	OTHER TESTS	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		SM	**Artificial Fill** Red brown, moist, medium dense, silty to clayey fine-grained SAND										
		SM	**Old Paralic Deposits** Red brown, moist, medium dense, silty fine- to medium-grained SAND with clay	SPT	8-10-9 (19)								
5			Red brown, slightly moist, medium dense, silty fine- to medium-grained SAND; trace gravel	MC	10-12-13 (25)	101	4.4						
			@ 6.5 ft. small cobble and large gravel lense encountered; difficult drilling										
			Limited Recovery: Red brown, moist, medium dense to dense, silty fine- to coarse-grained SAND with gravel	SPT	20-18-20 (38)								16
10		SP-SM	Red brown to orange brown, slightly moist to moist, medium dense, fine to medium-grained SAND with silt	SPT	22-6-8 (14)								11
15			No Recovery	MC	50/4"								

BORING TERMINATED AT 15.5 FEET
NO GROUNDWATER ENCOUNTERED
BORING BACKFILLED WITH ~4.5 CU. FT. OF BENTONITE GROUT

Kehoe Testing & Engineering Office: (714) 901-7270 Fax: (714) 901-7289 rich@kehoetesting.com www.kehoetesting.com	CPT Data 30 ton rig	Date: 30/Aug/2012 Test ID: CPT-1 Project: ImperialBeach
	Customer: Advanced Geotechnical Solutions Job Site: Bernardo Shores 1207-08	

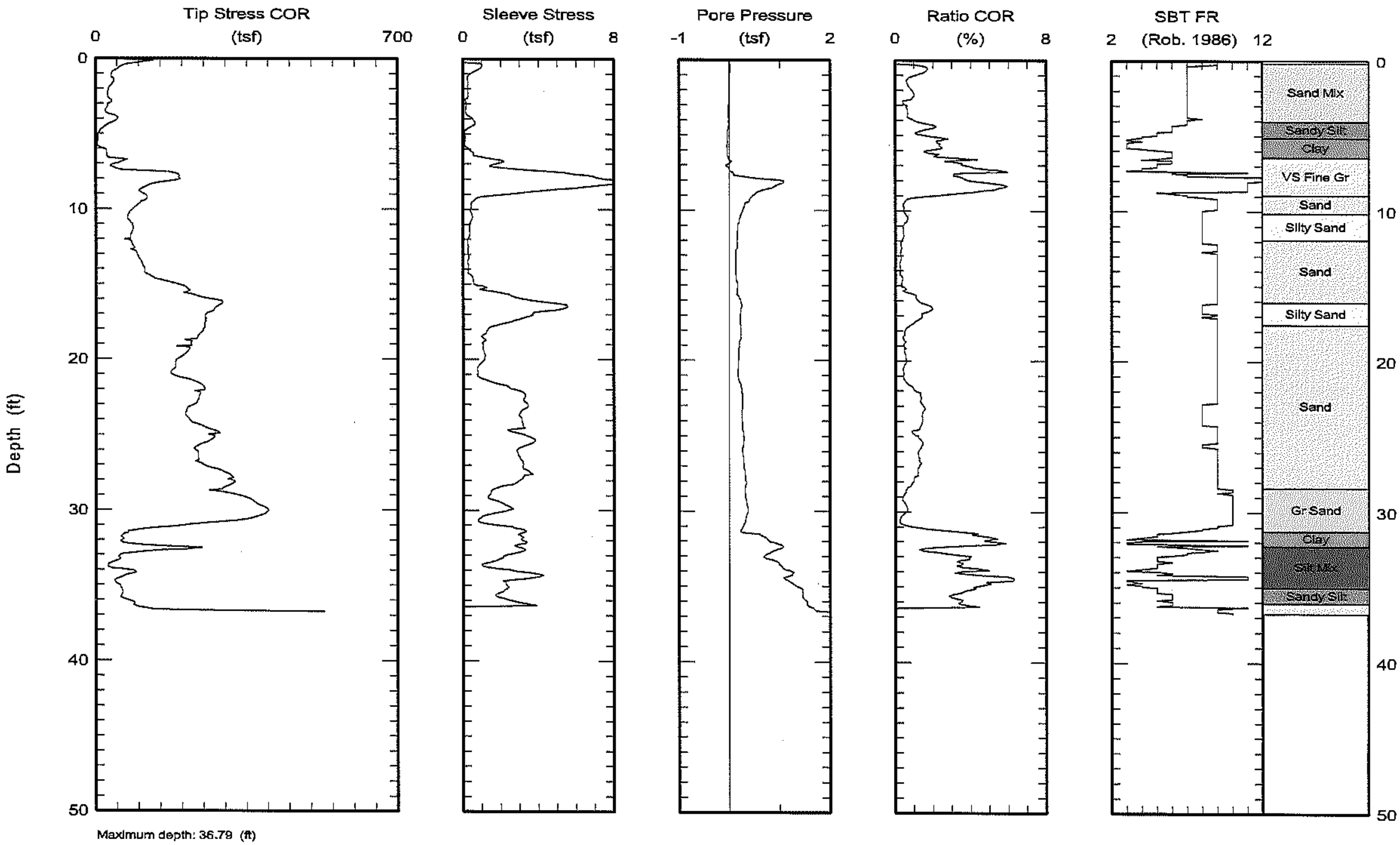


Kehoe Testing & Engineering Office: (714) 901-7270 Fax: (714) 901-7289 rich@kehoetesting.com www.kehoetesting.com	CPT Data 30 ton rig	Date: 30/Aug/2012 Test ID: CPT-2 Project: ImperialBeach
	Customer: Advanced Geotechnical Solutions Job Site: Bernardo Shores 1207-08	

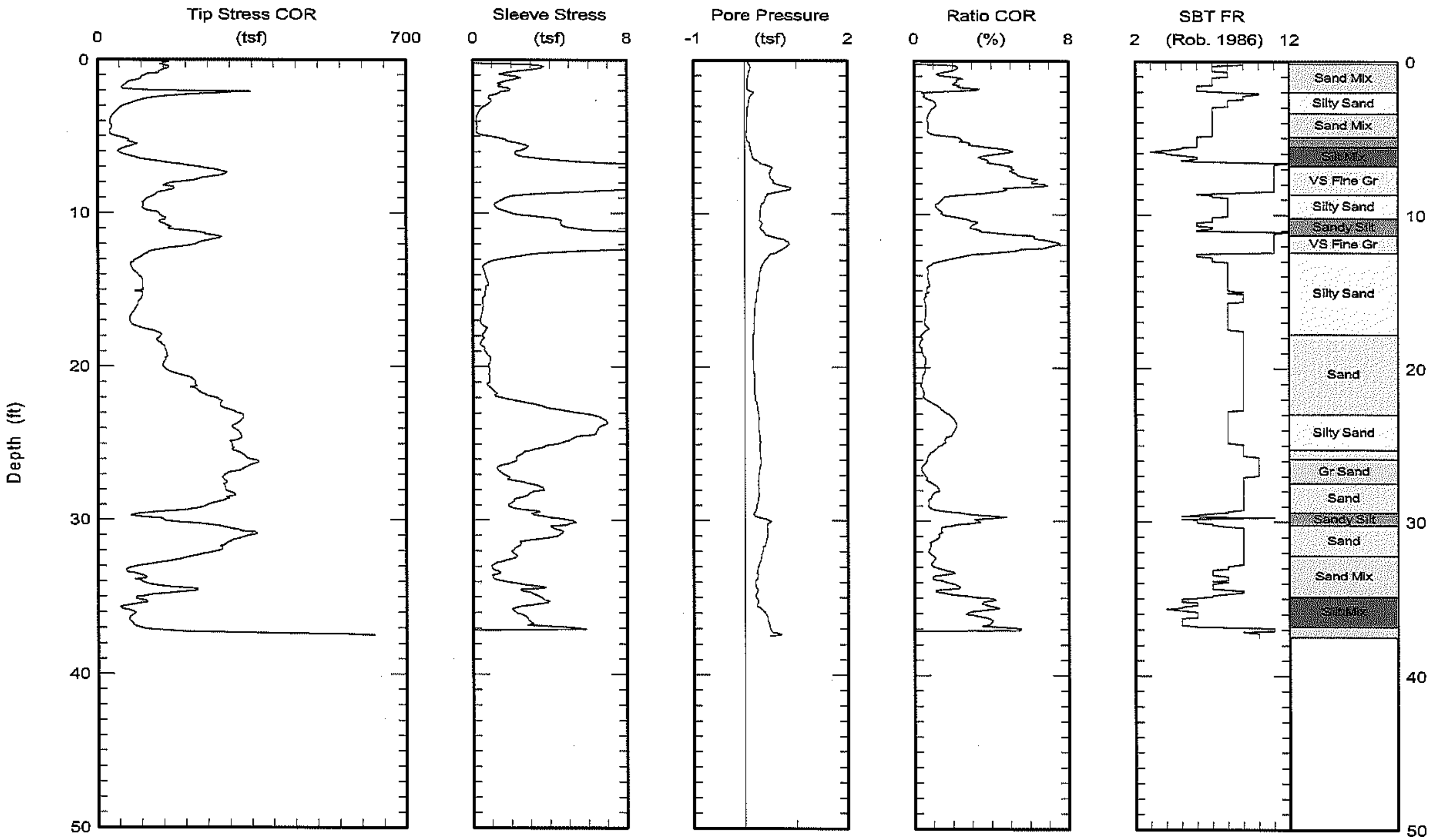


Maximum depth: 45.36 (ft)

Kehoe Testing & Engineering Office: (714) 901-7270 Fax: (714) 901-7289 rich@kehoetesting.com www.kehoetesting.com	CPT Data 30 ton rig	Date: 30/Aug/2012 Test ID: CPT-3 Project: ImperialBeach
	Customer: Advanced Geotechnical Solutions Job Site: Bernardo Shores 1207-08	

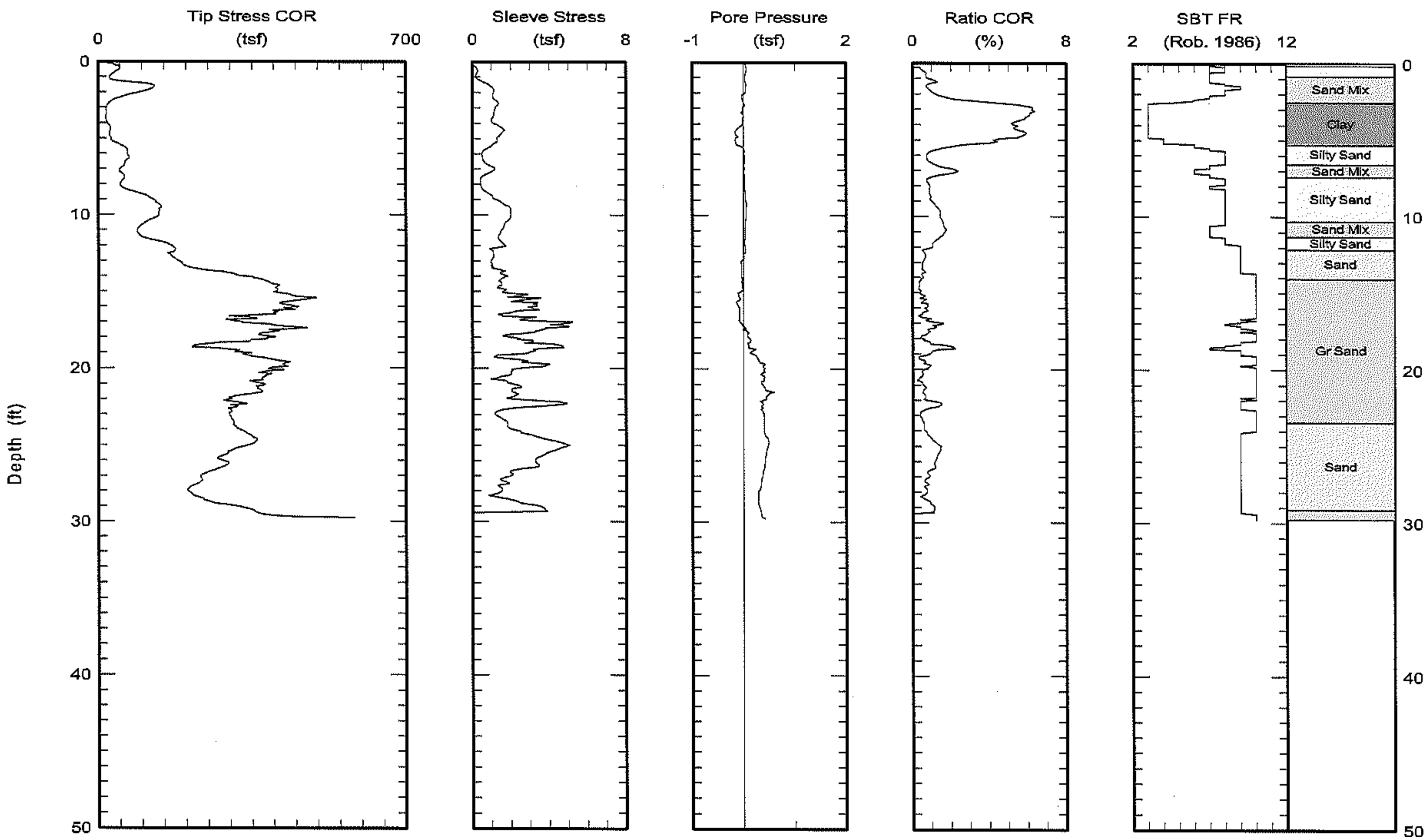


Kehoe Testing & Engineering Office: (714) 901-7270 Fax: (714) 901-7289 rich@kehoetesting.com www.kehoetesting.com	CPT Data 30 ton rig	Date: 30/Aug/2012 Test ID: CPT-4 Project: ImperialBeach
	Customer: Advanced Geotechnical Solutions Job Site: Bernardo Shores 1207-08	



Maximum depth: 37.48 (ft)

Kehoe Testing & Engineering Office: (714) 901-7270 Fax: (714) 901-7289 rich@kehoetesting.com www.kehoetesting.com	CPT Data 30 ton rig	Date: 30/Aug/2012 Test ID: CPT-5 Project: ImperialBeach
	Customer: Advanced Geotechnical Solutions Job Site: Bernardo Shores 1207-08	



Maximum depth: 29.79 (ft)

APPENDIX C

LABORATORY TESTING RESULTS

APPENDIX C

LABORATORY TESTING RESULTS

The results of laboratory testing performed during this study are enclosed within this Appendix.

Classification

Soils were classified with respect to the Unified Soil Classification System (USCS) in accordance with ASTM D-2487 and D-2488 and are summarized on the logs of the borings (B-1 through B-4, Appendix B).

Maximum Density/Optimum Moisture

The maximum dry densities and optimum moisture contents of representative bulk samples were evaluated in accordance with ASTM D-1557/Method A. Results are presented in this Appendix. In addition several moisture and density determinations were made on "undisturbed" ring samples. The results are presented on the logs of the borings (Appendix B).

Direct Shear Tests

Direct shear tests were performed on undisturbed ring samples and on remolded samples (remolded to 90 percent of the maximum dry density). Samples were saturated overnight in a confined condition prior to testing. The apparatus used is in conformance with the requirements outlined in ASTM Test Method: D-3080. The test specimens (1-inch in height and 2.42-inches in diameter) were subjected to simple shear along a plane at mid-height.

The samples were sheared under various normal loads, a different specimen being used for each normal load. A strain of 0.050-inches per minute was used to evaluate shear strength values.

The specimens were sheared until the shear stress reached a constant value or until the sample deformation had reached approximately 10 percent of the original diameter.

The shear stress values obtained from the tests were plotted versus the applied normal pressures. An appropriate straight line was drawn through the plotted points to obtain the shear strength envelope. The cohesion and angle of internal friction of the soil materials were evaluated from the shear strength envelopes.

Particle Size Analysis

Particle size analyses were conducted per ASTM D422.

R-Value

An R-Value test was conducted per CAL-TEST 301.

Cousolidation/Hydro-Collapse Testing

Consolidation properties of the soils were determined using ASTM D2435.

Chemical Analyses

Soil corrosivity testing (pH and resistivity) was performed in accordance with ASTM D4972, CAL 417, and CAL 422.

Soil Density and Moisture Content

Lab No.	9784	9785	9786	9787	9788	9790
Boring No.	B-1	B-1	B-1	B-2	B-2	B-2
Depth, ft.	6'	11'	21'	3.5'	8.5'	16'
Moisture Content, %	19.9	19.7	17.9	16.5	21.5	27.9
Dry Density, pcf	111.7	112.2	112.2	113.7	105.0	97.1

Lab No.	9792	9793	9796
Boring No.	B-3	B-3	B-4
Depth, ft.	6'	11'	6'
Moisture Content, %	8.6	6.1	4.4
Dry Density, pcf	105.7	104.0	101.3

Sampled By: PJ
Date Sampled: 1-22-14
Engineer: JC

Reviewed by: Joseph Bouknight, P.E., C81517

AGS Inc. | **February 3, 2014**
Bernardo Shores | **GF13659**

AGS Inc Project No: 1207-08

R-Value Test Results

Subject: On 1/27/2014, One soil sample was submitted to G-Force for the above referenced project. The sample was identified as Sample B-2 @ 0-3' a Lab No. 9791 was assigned to the sample. The sample was submitted to Southern California Soil and Testing, Inc. for R-Value determinations. Results from Southern California Soil and Testing were received on 2/3/2014.

Results: Attached are R-value test results as reported by Southern California Soil and Testing, Inc..

Checked by: Joseph Bouknight, P.E., C61517

SOUTHERN CALIFORNIA SOIL AND TESTING, INC.

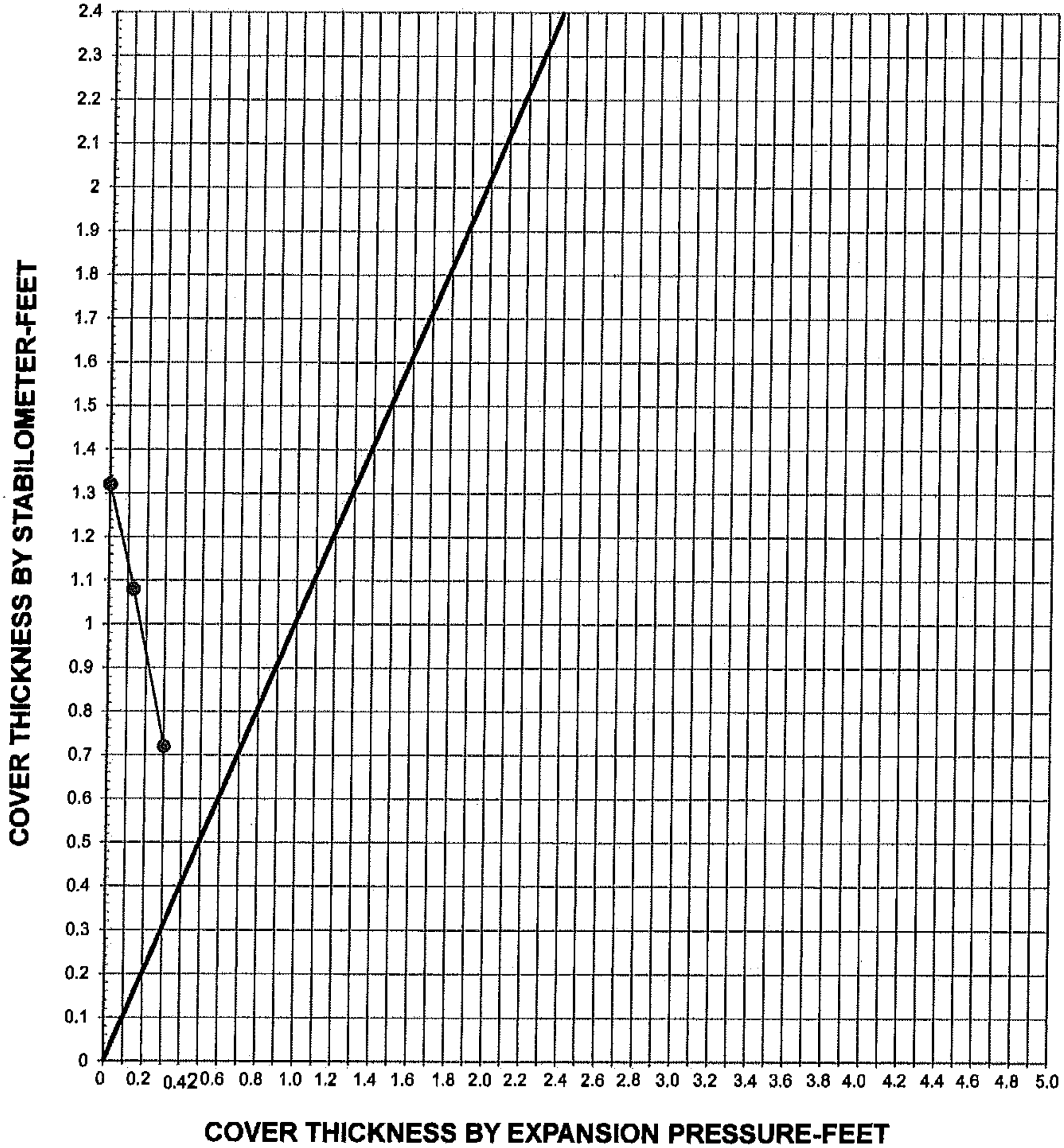
6280 RIVERDALE STREET, P. O. BOX 600627, SAN DIEGO, CA 92160 (619) 280-4321

☑ CAL-TEST 301
☐ ASTM D 2844

Job Name: G- Force #13659 **Job No.:** 1412005
Date: 01/28/14 **Street:**
Sample #: Lab #9791, B2@0-3 **Station:**
Source: **By:** DRB
Description: Brown Fine - Medium Sandy Clay

Test Specimen		A	B	C	D
Date Tested		1/28/2014	1/28/2014	1/28/2014	
Compactor Air Pressure	PSI	115	225	60	
Initial Moisture	%	2.0	2.0	2.0	
Soil Wt. Added	GRAMS	1080	1100	1060	
Water Added	ML	90	80	103	
Water Added	%	8.5	7.4	9.9	
Moisture At Compaction	%	10.5	9.4	11.9	
Weight of Briquette & Tare	GRAMS	3222	3218	3216	
Net Weight of Briquette	GRAMS	1162	1173	1157	
Briquette Height	IN	2.49	2.49	2.57	
Density	PCF	128.0	130.5	121.9	
Exudation Pressure	PSI	260	535	120	
Expansion Pressure	PSF	17	39	0	
PH at 1000 Pounds	PSI	42	28	61	
PH at 2000 Pounds	PSI	109	72	139	
Displacement	Turns	3.45	3.05	4.30	
R' Value		25	50	8	
Stabilometer Thickness	FT	1.08	0.72	1.32	
Expansion Thickness	FT	0.13	0.3	0	
Expansion Dial Reading		0004	0009	0000	
R' Value Modifier		0	0	0	
Corrected R-Value		25	50	8	
R-Value by Exudation Pressure			29		
Gravel Equivalent		0.45	0.45	0.45	
Traffic Index		4.5	4.5	4.5	
R-Value by Expansion Pressure			69		

EXPANSION PRESSURE CHART



SOUTHERN CALIFORNIA SOIL & TESTING, INC

SCST

SOUTHERN CALIFORNIA
SOIL AND TESTING, INC.

Job Name:		G- Force #13659	
By:	DRB	Date:	1/28/2014
Job No.:	1412005	Sample No.:	Lab #9791, B2@0-3
Gravel Equ:	0.45	Plate No.:	

Soil Corrosivity

(ASTM D4972,Cal 417,Cal 422)

Lab Number	Boring Location	Depth	PH	Resistivity (OHM-cm)
9795	B-3	3' - 6'	8.27	810
9791	B-2	0' - 3'	8.4	2363

Reviewed by:
Joseph Bouknight, P.E., C81517

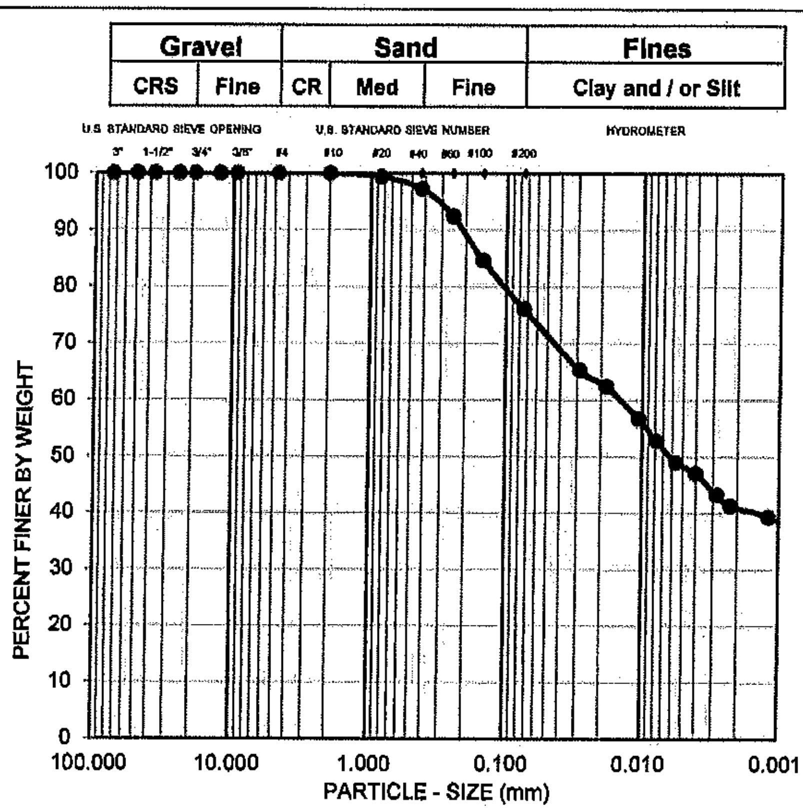
AGS Inc.
Bernardo Shores
AGS Job No. 1207-08

February 3, 2014
GF13659

Particle Size Analysis of Soil

(ASTM D422)

G Force Lab No.: 9783
Date Sampled: 1/22/2014 By: PJD
Date Submitted: 1/27/2014 By: PJD
Boring No.: B-1 Depth (ft.): 2.5 - 4.0'
Sample Description: Redish Brown Silty Clay (CL)



Sieve Size	% Passing	Specification Low	Specification High	X = Out of Spec
3"	100			
2"	100			
1-1/2"	100			
1"	100			
3/4"	100			
1/2"	100			
3/8"	100			
#4	100			
#10	100			
#20	99			
#40	97			
#60	92			
#100	85			
#200	76			

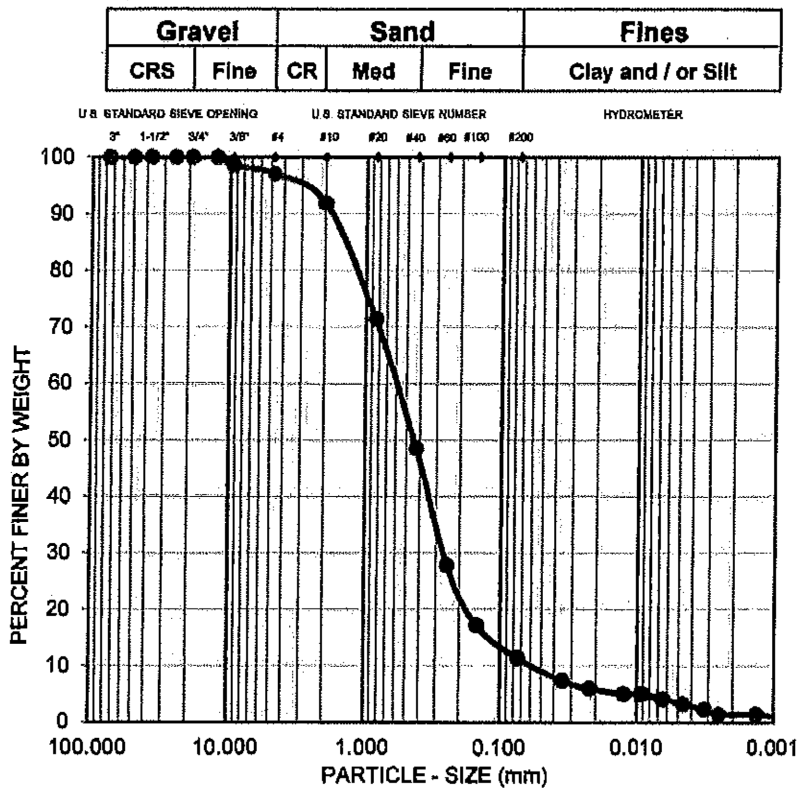
Particle Size	% Finer
0.0290	65.3
0.0185	62.4
0.0106	56.7
0.0079	52.8
0.0057	49.0
0.0040	47.1
0.0028	43.2
0.0022	41.3

Reviewed by: *[signature]*
Joseph Bouknight, P.E., C81517

Particle Size Analysis of Soil

(ASTM D422)

G Force Lab No.	9798		
Date Sampled:	1/22/2014	By:	PJD
Date Submitted:	1/27/2014	By:	PJD
Boring No.:	B-4	Depth (ft.):	10 - 11.5'
Sample Description:	Lt. Brown Silty Sand (SP/SM)		



Sieve Size	% Passing	Specification Low	Specification High	X = Out of Spec
3"	100			
2"	100			
1-1/2"	100			
1"	100			
3/4"	100			
1/2"	100			
3/8"	99			
#4	97			
#10	92			
#20	71			
#40	48			
#60	28			
#100	17			
#200	11			

Particle Size	% Finer
0.0350	7.4
0.0222	6.0
0.0125	5.1
0.0091	5.1
0.0065	4.1
0.0046	3.2
0.0032	2.3
0.0025	1.4

Reviewed by: Joe Bouknight
Joseph Bouknight, P.E., C81517

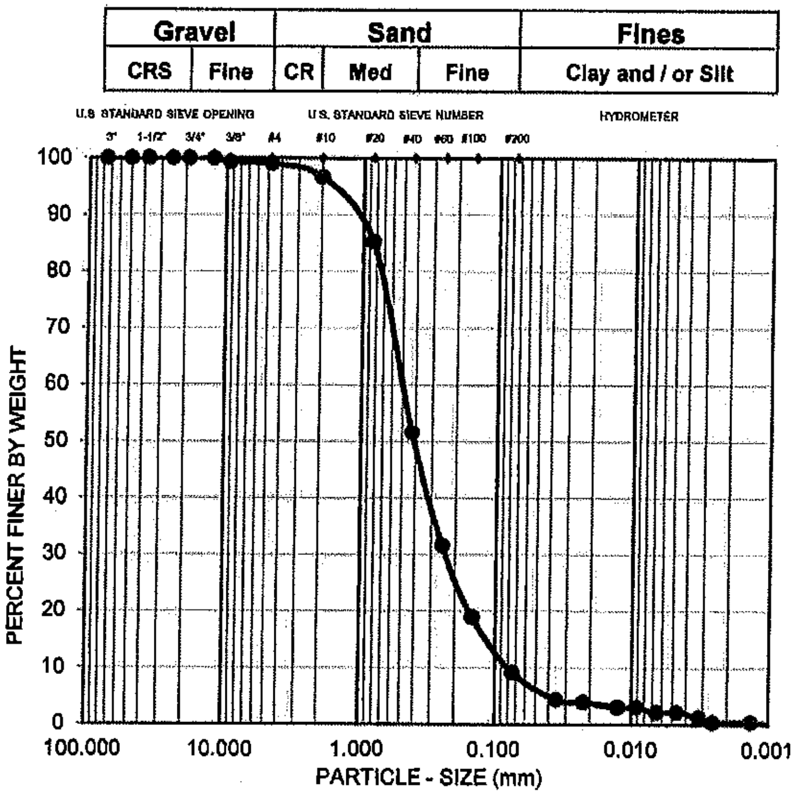
AGS Inc.
Bernardo Shores
AGS Job No. 1207-08

February 3, 2014
GF13659

Particle Size Analysis of Soil

(ASTM D422)

G Force Lab No.	9794		
Date Sampled:	1/22/2014	By:	PJD
Date Submitted:	1/27/2014	By:	PJD
Boring No.:	B-3	Depth (ft.):	15-16.5
Sample Description:	Brown to Gray Sand (SP)		



Sieve Size	% Passing	Specification Low	Specification High	X = Out of Spec
3"	100			
2"	100			
1-1/2"	100			
1"	100			
3/4"	100			
1/2"	100			
3/8"	99			
#4	99			
#10	97			
#20	85			
#40	52			
#60	32			
#100	19			
#200	9			

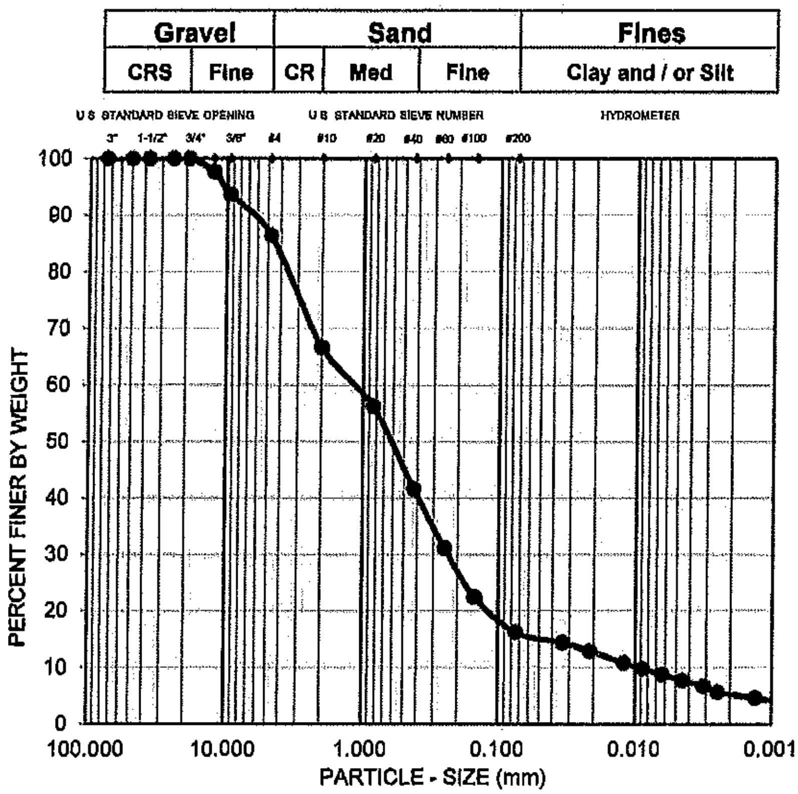
Particle Size	% Finer
0.0356	4.4
0.0224	4.0
0.0126	3.1
0.0092	3.1
0.0066	2.2
0.0046	2.2
0.0032	1.3
0.0026	0.4

Reviewed by: ______________________
Joseph Bouknight, P.E., C81517

Particle Size Analysis of Soil

(ASTM D422)

G Force Lab No. 9797
Date Sampled: 1/22/2014 By: PJD
Date Submitted: 1/27/2014 By: PJD
Boring No.: B-4 Depth (ft.): 7.5 - 9'
Sample Description: Brown Silty Sand (SM)



Sieve Size	% Passing	Specification Low	Specification High	X = Out of Spec
3"	100			
2"	100			
1-1/2"	100			
1"	100			
3/4"	100			
1/2"	98			
3/8"	94			
#4	86			
#10	67			
#20	56			
#40	42			
#60	31			
#100	22			
#200	16			

Particle Size	% Finer
0.0337	14.4
0.0214	12.9
0.0121	10.8
0.0089	9.8
0.0063	8.7
0.0045	7.7
0.0031	6.7
0.0025	5.7

Reviewed by: [signature]
Joseph Bouknight, P.E., C81517

AGS Inc.
Bernardo Shores
AGS Job No. 1207-08

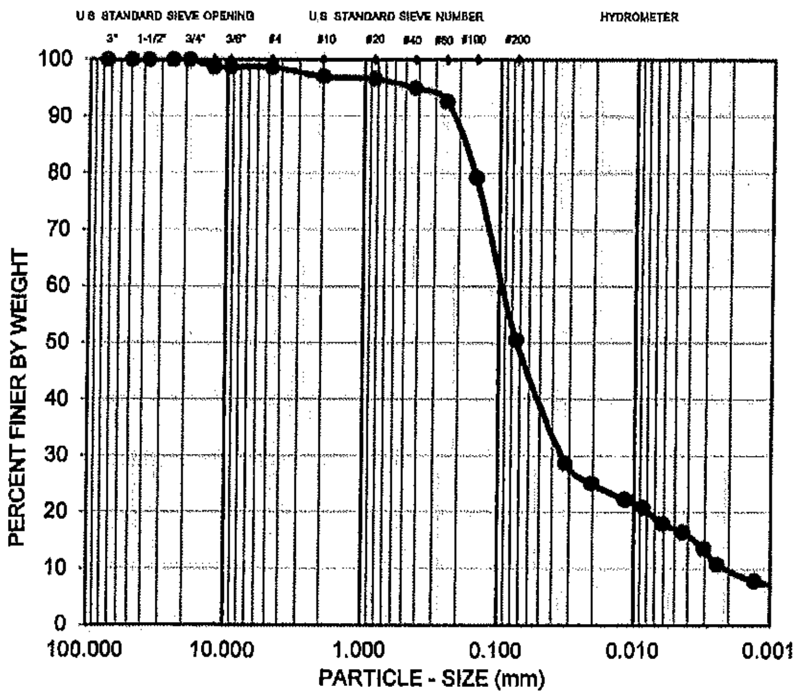
February 3, 2014
GF13659

Particle Size Analysis of Soil

(ASTM D422)

G Force Lab No.	9789		
Date Sampled:	1/22/2014	By:	PJD
Date Submitted:	1/27/2014	By:	PJD
Boring No.:	B-2	Depth (ft.):	10' - 11.5'
Sample Description:	Brown Sandy Silt (SM)		

Gravel		Sand			Fines
CRS	Fine	CR	Med	Fine	Clay and / or Silt



Sieve Size	% Passing	Specification Low	Specification High	X = Out of Spec
3"	100			
2"	100			
1-1/2"	100			
1"	100			
3/4"	100			
1/2"	99			
3/8"	99			
#4	99			
#10	97			
#20	97			
#40	95			
#60	93			
#100	79			
#200	50			

Particle Size	% Finer
0.0323	28.7
0.0207	25.1
0.0117	22.3
0.0086	20.8
0.0062	18.0
0.0044	16.5
0.0031	13.6
0.0025	10.8

Reviewed by: ________________________

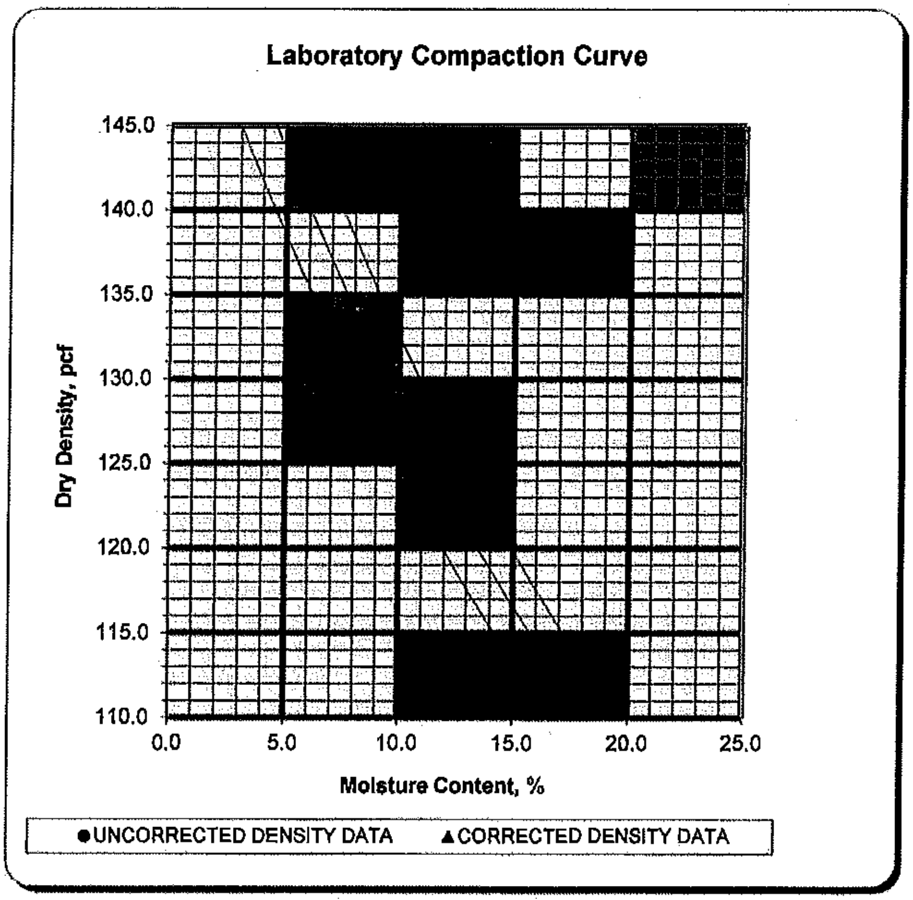
Joseph Bouknight, P.E., C81517

LABORATORY COMPACTION CURVE

G Force Lab No.:	**9791**		
Sample Location:	**B-2**	Depth, ft.:	**0-3'**
Soil Description:	**Brown Clayey Sand W/ Gravel (SC)**		
Source of Soil:	**Native**		

Test Designation:		**ASTM D1557**	Method	**A**	
% +3/4"	**0.2**	% +3/8" **1.6**		% +#4	**4.4**
Oversize Correction Applied?		**No**			
Method of Sample Preparation:		**Dry**			
Type of Rammer Used:		**Manual**			

M/D Curve No. A



Test Results

Maximum Density, pcf	**136.5**
Optimum Moisture, %	**7.5**

Oversize Corrected Results

Maximum Density, pcf	**N/A**
Optimum Moisture, %	**N/A**

Reviewed by: Joseph Bouknight, P.E., C81517

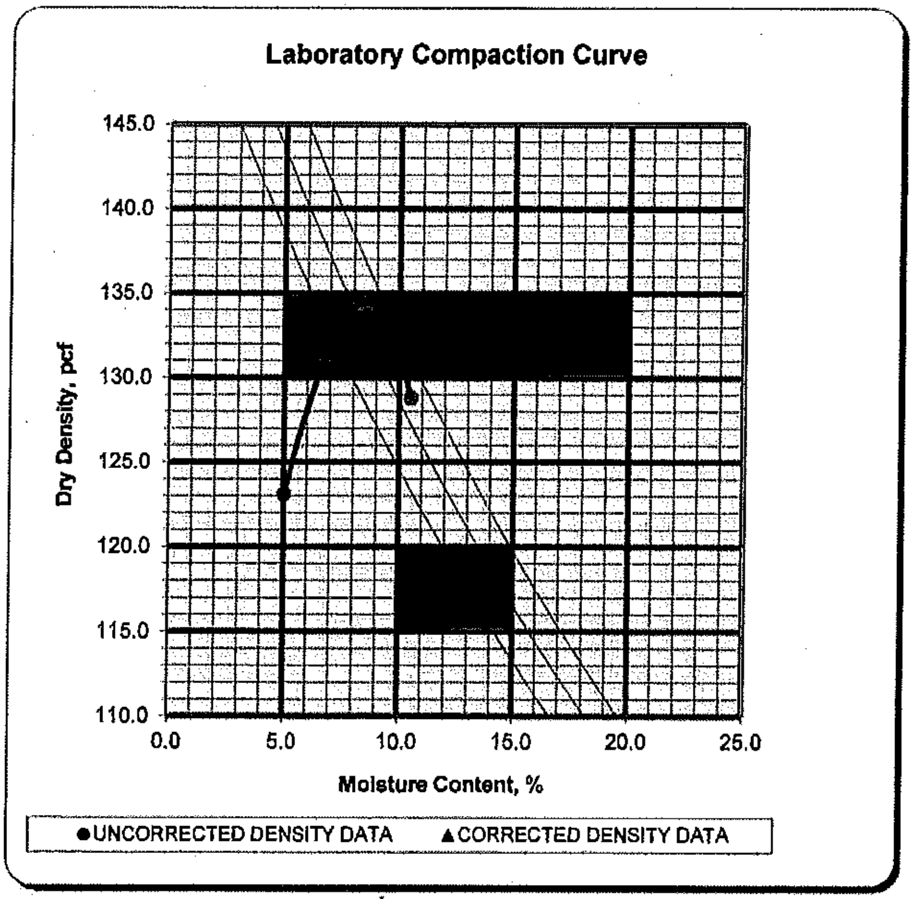
AGS Inc. **January 30, 2014**
Bernardo Shores **GF13659**

LABORATORY COMPACTION CURVE

G Force Lab No.:	**9795**		
Sample Location:	**B-3**	Depth, ft.:	**3-6'**
Soil Description:	**Brown Clayey Sand (SC)**		
Source of Soil:	**Native**		

Test Designation:	**ASTM D1557**	Method	**A**
% +3/4" **0**	% +3/8" **0**	% +#4	**1.8**
Oversize Correction Applied?	**No**		
Method of Sample Preparation:	**Dry**		
Type of Rammer Used:	**Manual**		

M/D Curve No. A



Test Results

Maximum Density, pcf	**134.5**
Optimum Moisture, %	**8.5**

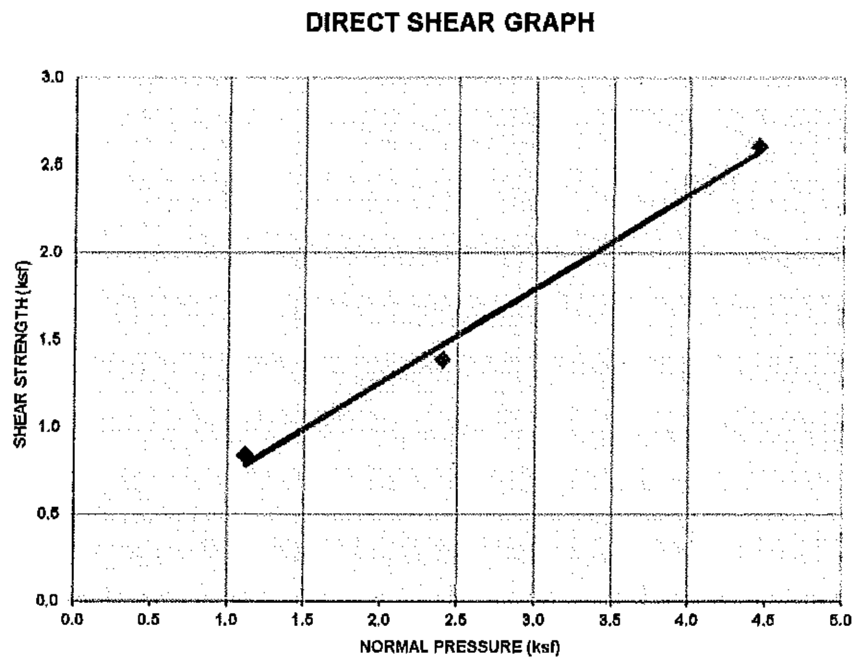
Oversize Corrected Results

Maximum Density, pcf	**N/A**
Optimum Moisture, %	**N/A**

Reviewed by: ______________________
Joseph Bouknight, P.E., C81517

DIRECT SHEAR TEST REPORT

G-FORCE LAB NO.:	9795
SAMPLE LOCATION:	B-3 @ 3-6'
SOIL TYPE:	Brown Sandy Clay (CL)
SAMPLE TYPE:	Remolded @ 90% RC



CALCULATED DATA

INITIAL					
	WET DENSITY	pcf	129.9	131.5	131.5
	DRY DENSITY	pcf	118.6	120.8	121.3
	MOISTURE	%	9.6	8.8	8.4
FINAL, at failure					
	MOISTURE	%	15.7	14.7	13.7

NORMAL PRESSURE, ksf	1.11	2.40	4.45
SHEAR STRENGTH, ksf	0.84	1.39	2.61
FRICTION ANGLE, degrees	28.6		
COHESION, ksf	0.19		

Reviewed by: Joseph Bouknight, P.E., C81517

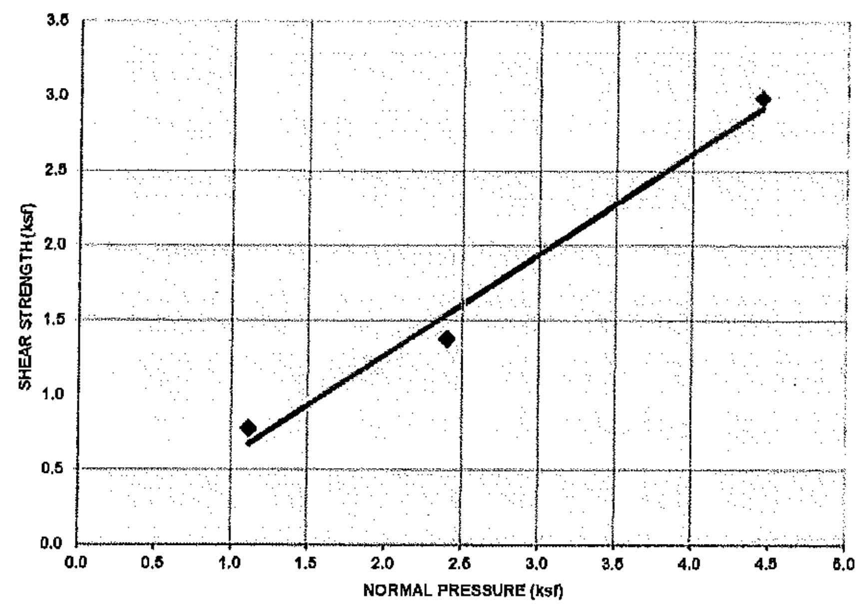
DVBE SDVOSB SBE

AGS Inc.
Bernardo Shores

February 3, 2014
Project No. GF13659

DIRECT SHEAR TEST REPORT

G-FORCE LAB NO.:	9791
SAMPLE LOCATION:	B-2 @ 0-3'
SOIL TYPE:	Brown Clayey Sand (SC)
SAMPLE TYPE:	Remolded @ 90% RC



CALCULATED DATA

INITIAL					
	WET DENSITY	pcf	130.4	132.6	132.2
	DRY DENSITY	pcf	118.1	121.3	120.6
	MOISTURE	%	10.4	9.4	9.6
FINAL, at failure					
	MOISTURE	%	15.0	14.1	13.8

NORMAL PRESSURE, ksf	1.11	2.40	4.45
SHEAR STRENGTH, ksf	0.78	1.38	2.99
FRICTION ANGLE, degrees	33.3		
COHESION, ksf	0.07		

Reviewed by: Joseph Bouknight, P.E., C81517

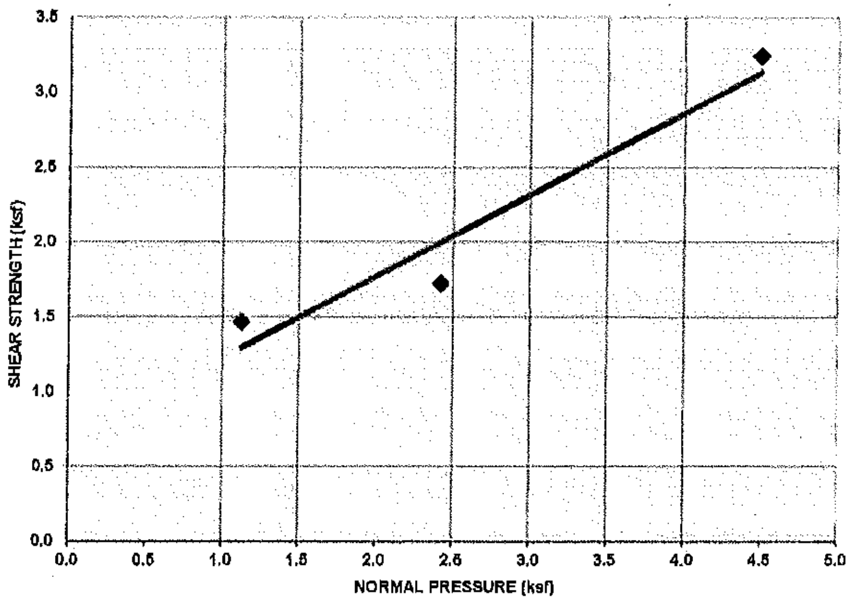
G FORCE

AGS Inc.
Bernardo Shores

February 3, 2014
Project No. GF13659

DIRECT SHEAR TEST REPORT

G-FORCE LAB NO.:	9787
SAMPLE LOCATION:	B-2 @ 3.5'
SOIL TYPE:	Red Orange Sandy Clay (CL)
SAMPLE TYPE:	Undisturbed



CALCULATED DATA

INITIAL					
	WET DENSITY	pcf	133.1	128.9	131.8
	DRY DENSITY	pcf	114.6	109.5	113.3
	MOISTURE	%	16.2	17.7	16.4
FINAL, at failure					
	MOISTURE	%	18.2	19.8	17.6

NORMAL PRESSURE, ksf	1.12	2.42	4.49
SHEAR STRENGTH, ksf	1.47	1.73	3.24
FRICTION ANGLE, degrees	29.6		
COHESION, ksf	0.69		

Reviewed by
Joseph Bouknight, P.E., C81517

G FORCE
DVBE SDVOSB SBE

♦ *4035 Pacific Highway, San Diego, CA 92110* ♦ *Tel: 619-583-6633* ♦
www.gforceca.com

AGS **January 31, 2014**

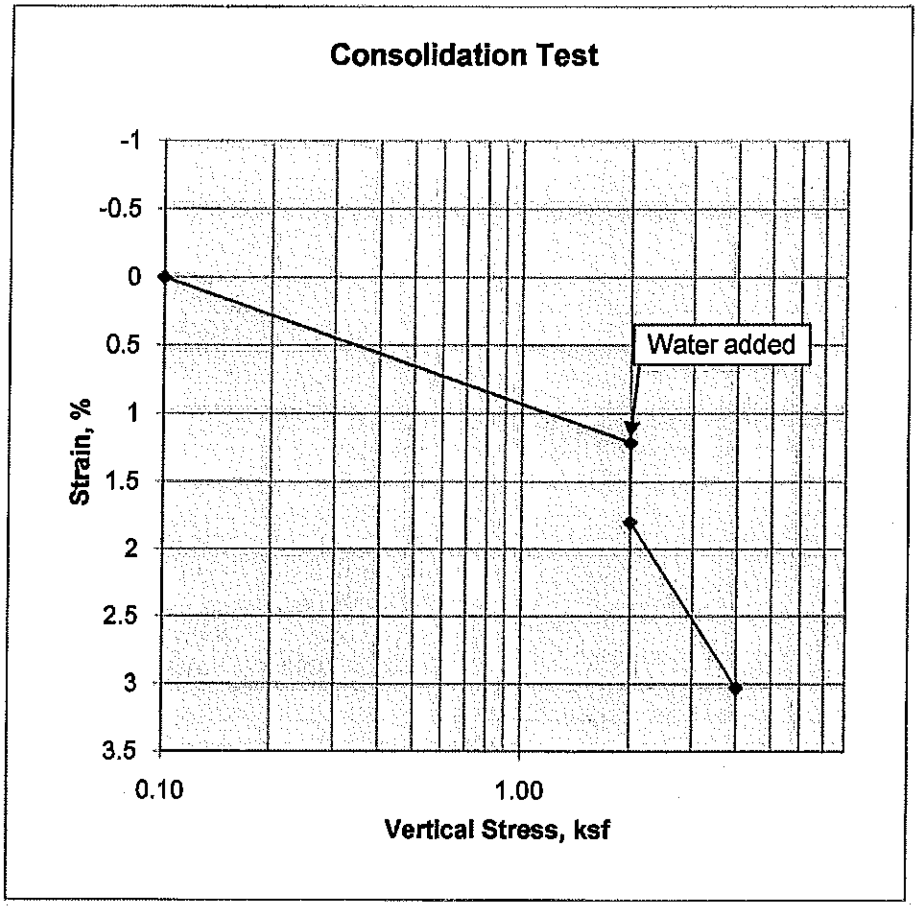
Bernardo Shores **GF13659**

AGS Project No. 1207-08

Consolidation Properties of Soils

ASTM D2435

Sample Location: B-3 @ 6'
Date Sampled January 22, 2014
Sample Description: Brown Clayey Sand (SC)
G Force Lab No. **9792**



Consolidation Data

Stress, ksf	Strain, %	Void Ratio
0.10	0	0.489
2.00	1.21	0.471
2.00	1.80	0.462
4.00	3.03	0.444

Moisture and Density Data

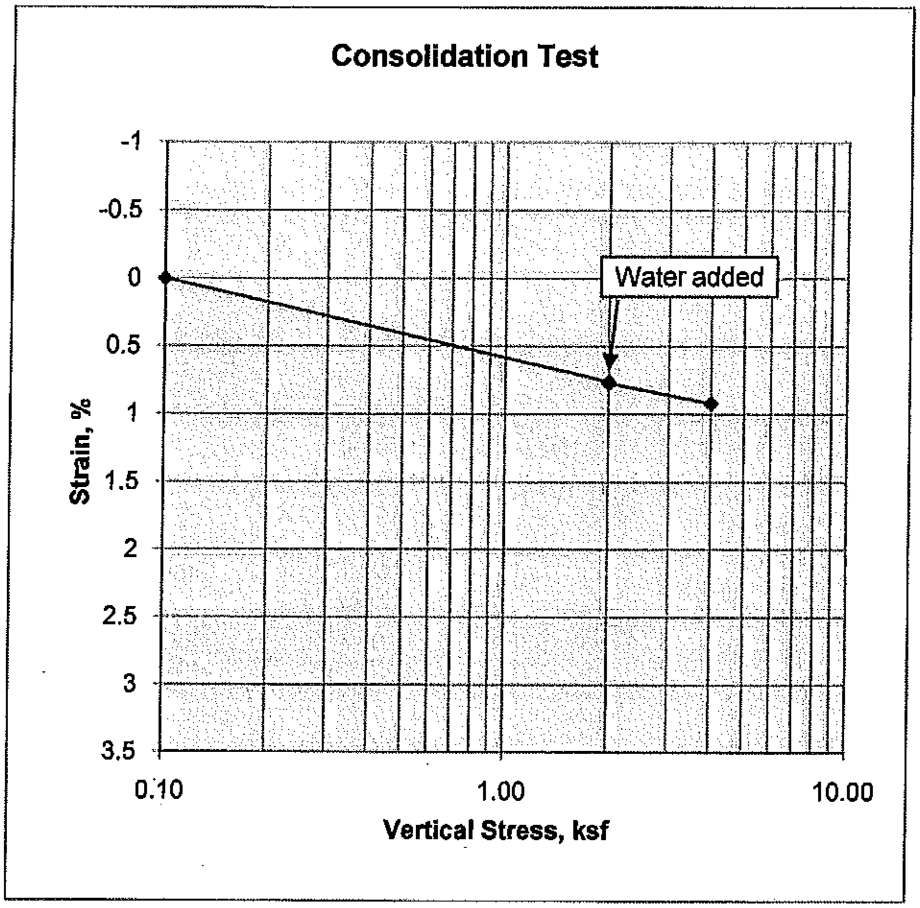
	Initial	Final
Moisture Content, %	10.3	16.2
Dry Density, pcf	113.2	114.0

Reviewed by: Joseph Bouknight, P.E., C81517

Consolidation Properties of Soils

ASTM D2435

Sample Location:	B-1 @ 21'
Date Sampled	January 22, 2014
Sample Description:	Brown med - fine Sand (SP-SM)
G Force Lab No.	**9786**



Consolidation Data

Stress, ksf	Strain, %	Void Ratio
0.10	0	0.597
2.00	0.76	0.585
2.00	0.77	0.584
4.00	0.92	0.582

Moisture and Density Data

	Initial	Final
Moisture Content, %	21.2	19.1
Dry Density, pcf	105.6	105.8

Reviewed by: Joseph Bouknight, P.E., C81517

APPENDIX D

GENERAL EARTHWORK SPECIFICATIONS AND

GRADING DETAILS

GENERAL EARTHWORK SPECIFICATIONS

I. General

A. General procedures and requirements for earthwork and grading are presented herein. The earthwork and grading recommendations provided in the geotechnical report are considered part of these specifications, and where the general specifications provided herein conflict with those provided in the geotechnical report, the recommendations in the geotechnical report shall govern. Recommendations provided herein and in the geotechnical report may need to be modified depending on the conditions encountered during grading.

B. The contractor is responsible for the satisfactory completion of all earthwork in accordance with the project plans, specifications, applicable building codes, and local governing agency requirements. Where these requirements conflict, the stricter requirements shall govern.

C. It is the contractor's responsibility to read and understand the guidelines presented herein and in the geotechnical report as well as the project plans and specifications. Information presented in the geotechnical report is subject to verification during grading. The information presented on the exploration logs depicts conditions at the particular time of excavation and at the location of the excavation. Subsurface conditions present at other locations may differ, and the passage of time may result in different subsurface conditions being encountered at the locations of the exploratory excavations. The contractor shall perform an independent investigation and evaluate the nature of the surface and subsurface conditions to be encountered and the procedures and equipment to be used in performing his work.

D. The contractor shall have the responsibility to provide adequate equipment and procedures to accomplish the earthwork in accordance with applicable requirements. When the quality of work is less than that required, the Geotechnical Consultant may reject the work and may recommend that the operations be suspended until the conditions are corrected.

E. Prior to the start of grading, a qualified Geotechnical Consultant should be employed to observe grading procedures and provide testing of the fills for conformance with the project specifications, approved grading plan, and guidelines presented herein. All remedial removals, clean-outs, removal bottoms, keyways, and subdrain installations should be observed and documented by the Geotechnical Consultant prior to placing fill. It is the contractor's responsibility to apprise the Geotechnical Consultant of their schedules and notify the Geotechnical Consultant when those areas are ready for observation.

F. The contractor is responsible for providing a safe environment for the Geotechnical Consultant to observe grading and conduct tests.

II. Site Preparation

A. Clearing and Grubbing: Excessive vegetation and other deleterious material shall be sufficiently removed as required by the Geotechnical Consultant, and such materials shall be properly disposed of offsite in a method acceptable to the owner and governing agencies. Where applicable, the contractor may obtain permission from the Geotechnical Consultant, owner, and governing agencies to dispose of vegetation and other deleterious materials in designated areas onsite.

B. Unsuitable Soils Removals: Earth materials that are deemed unsuitable for the support of fill shall be removed as necessary to the satisfaction of the Geotechnical Consultant.

C. Any underground structures such as cesspools, cisterns, mining shafts, tunnels, septic tanks, wells, pipelines, other utilities, or other structures located within the limits of grading shall be removed and/or abandoned in accordance with the requirements of the governing agency and to the satisfaction of the Geotechnical Consultant.

D. Preparation of Areas to Receive Fill: After removals are completed, the exposed surfaces shall be scarified to a depth of approximately 8 inches, watered or dried, as needed, to achieve a generally uniform moisture content that is at or near optimum moisture content. The scarified materials shall then be compacted to the project requirements and tested as specified.

E. All areas receiving fill shall be observed and approved by the Geotechnical Consultant prior to the placement of fill. A licensed surveyor shall provide survey control for determining elevations of processed areas and keyways.

III. Placement of Fill

A. Suitability of fill materials: Any materials, derived onsite or imported, may be utilized as fill provided that the materials have been determined to be suitable by the Geotechnical Consultant. Such materials shall be essentially free of organic matter and other deleterious materials, and be of a gradation, expansion potential, and/or strength that is acceptable to the Geotechnical Consultant. Fill materials shall be tested in a laboratory approved by the Geotechnical Consultant, and import materials shall be tested and approved prior to being imported.

B. Generally, different fill materials shall be thoroughly mixed to provide a relatively uniform blend of materials and prevent abrupt changes in material type. Fill materials derived from benching should be dispersed throughout the fill area instead of placing the materials within only an equipment-width from the cut/fill contact.

C. Oversize Materials: Rocks greater than 8 inches in largest dimension shall be disposed of offsite or be placed in accordance with the recommendations by the Geotechnical Consultant in the areas that are designated as suitable for oversize rock placement. Rocks that are smaller than 8 inches in largest dimension may be utilized in the fill provided that they are not nested and are their quantity and distribution are acceptable to the Geotechnical Consultant.

D. The fill materials shall be placed in thin, horizontal layers such that, when compacted, shall not exceed 6 inches. Each layer shall be spread evenly and shall be thoroughly mixed to obtain near uniform moisture content and uniform blend of materials.

E. Moisture Content: Fill materials shall be placed at or above the optimum moisture content or as recommended by the geotechnical report. Where the moisture content of the engineered fill is less than recommended, water shall be added, and the fill materials shall be blended so that near uniform moisture content is achieved. If the moisture content is above the limits specified by the Geotechnical Consultant, the fill materials shall be aerated by discing, blading, or other methods until the moisture content is acceptable.

F. Each layer of fill shall be compacted to the project standards in accordance to the project specifications and recommendations of the Geotechnical Consultant. Unless otherwise specified by the Geotechnical

Consultant, the fill shall be compacted to a minimum of 90 percent of the maximum dry density as determined by ASTM Test Method: D1557-09.

G. Benching: Where placing fill on a slope exceeding a ratio of 5 to 1 (horizontal to vertical), the ground should be keyed or benched. The keyways and benches shall extend through all unsuitable materials into suitable materials such as firm materials or sound bedrock or as recommended by the Geotechnical Consultant. The minimum keyway width shall be 15 feet and extend into suitable materials, or as recommended by the geotechnical report and approved by the Geotechnical Consultant. The minimum keyway width for fill over cut slopes is also 15 feet, or as recommended by the geotechnical report and approved by the Geotechnical Consultant. As a general rule, unless otherwise recommended by the Geotechnical Consultant, the minimum width of the keyway shall be equal to 1/2 the height of the fill slope.

H. Slope Face: The specified minimum relative compaction shall be maintained out to the finish face of fill and stabilization fill slopes. Generally, this may be achieved by overbuilding the slope and cutting back to the compacted core. The actual amount of overbuilding may vary as field conditions dictate. Alternately, this may be achieved by back rolling the slope face with suitable equipment or other methods that produce the designated result. Loose soil should not be allowed to build up on the slope face. If present, loose soils shall be trimmed to expose the compacted slope face.

I. Slope Ratio: Unless otherwise approved by the Geotechnical Consultant and governing agencies, permanent fill slopes shall be designed and constructed no steeper than 2 to 1 (horizontal to vertical).

J. Natural Ground and Cut Areas: Design grades that are in natural ground or in cuts should be evaluated by the Geotechnical Consultant to determine whether scarification and processing of the ground and/or overexcavation is needed.

K. Fill materials shall not be placed, spread, or compacted during unfavorable weather conditions. When grading is interrupted by rain, filing operations shall not resume until the Geotechnical Consultant approves the moisture and density of the previously placed compacted fill.

IV. Cut Slopes

A. The Geotechnical Consultant shall inspect all cut slopes, including fill over cut slopes, and shall be notified by the contractor when cut slopes are started.

B. If adverse or potentially adverse conditions are encountered during grading; the Geotechnical Consultant shall investigate, evaluate, and make recommendations to mitigate the adverse conditions.

C. Unless otherwise stated in the geotechnical report, cut slopes shall not be excavated higher or steeper than the requirements of the local governing agencies. Short-term stability of the cut slopes and other excavations is the contractor's responsibility.

V. Drainage

A. Back drains and Subdrains: Back drains and subdrains shall be provided in fill as recommended by the Geotechnical Consultant and shall be constructed in accordance with the governing agency and/or recommendations of the Geotechnical Consultant. The location of subdrains, especially outlets, shall be surveyed and recorded by the Civil Engineer.

B. Top-of-slope Drainage: Positive drainage shall be established away from the top of slope. Site drainage shall not be permitted to flow over the tops of slopes.

C. Drainage terraces shall be constructed in compliance with the governing agency requirements and/or in accordance with the recommendations of the Geotechnical Consultant.

D. Non-erodible interceptor swales shall be placed at the top of cut slopes that face the same direction as the prevailing drainage.

VI. Erosion Control

A. All finish cut and fill slopes shall be protected from erosion and/or planted in accordance with the project specifications and/or landscape architect's recommendations. Such measures to protect the slope face shall be undertaken as soon as practical after completion of grading.

B. During construction, the contractor shall maintain proper drainage and prevent the ponding of water. The contractor shall take remedial measures to prevent the erosion of graded areas until permanent drainage and erosion control measures have been installed.

VII. Trench Excavation and Backfill

A. Safety: The contractor shall follow all OSHA requirements for safety of trench excavations. Knowing and following these requirements is the contractor's responsibility. All trench excavations or open cuts in excess of 5 feet in depth shall be shored or laid back. Trench excavations and open cuts exposing adverse geologic conditions may require further evaluation by the Geotechnical Consultant. If a contractor fails to provide safe access for compaction testing, backfill not tested due to safety concerns may be subject to removal.

B. Bedding: Bedding materials shall be non-expansive and have a Sand Equivalent greater than 30. Where permitted by the Geotechnical Consultant, the bedding materials can be densified by jetting.

C. Backfill: Jetting of backfill materials is generally not acceptable. Where permitted by the Geotechnical Consultant, the bedding materials can be densified by jetting provided the backfill materials are granular, free-draining and have a Sand Equivalent greater than 30.

VIII. Geotechnical Observation and Testing During Grading

A. Compaction Testing: Fill shall be tested by the Geotechnical Consultant for evaluation of general compliance with the recommended compaction and moisture conditions. The tests shall be taken in the compacted soils beneath the surface if the surficial materials are disturbed. The contractor shall assist the Geotechnical Consultant by excavating suitable test pits for testing of compacted fill.

B. Where tests indicate that the density of a layer of fill is less than required, or the moisture content not within specifications, the Geotechnical Consultant shall notify the contractor of the unsatisfactory conditions of the fill. The portions of the fill that are not within specifications shall be reworked until the required density and/or moisture content has been attained. No additional fill shall be placed until the last lift of fill is tested and found to meet the project specifications and approved by the Geotechnical Consultant.

C. If, in the opinion of the Geotechnical Consultant, unsatisfactory conditions, such as adverse weather, excessive rock or deleterious materials being placed in the fill, insufficient equipment, excessive rate of fill placement, results in a quality of work that is unacceptable, the consultant shall notify the contractor, and the contractor shall rectify the conditions, and if necessary, stop work until conditions are satisfactory.

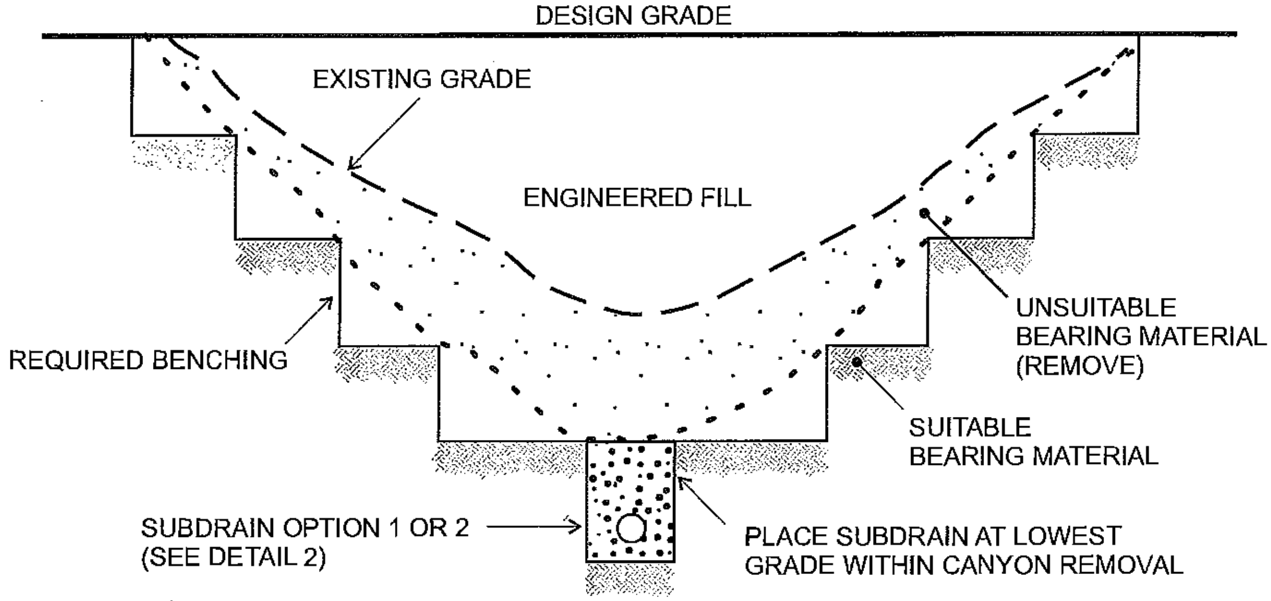
D. Frequency of Compaction Testing: The location and frequency of tests shall be at the Geotechnical Consultant's discretion. Generally, compaction tests shall be taken at intervals not exceeding two feet in fill height and 1,000 cubic yards of fill materials placed.

E. Compaction Test Locations: The Geotechnical Consultant shall document the approximate elevation and horizontal coordinates of the compaction test locations. The contractor shall coordinate with the surveyor to assure that sufficient grade stakes are established so that the Geotechnical Consultant can determine the test locations. Alternately, the test locations can be surveyed and the results provided to the Geotechnical Consultant.

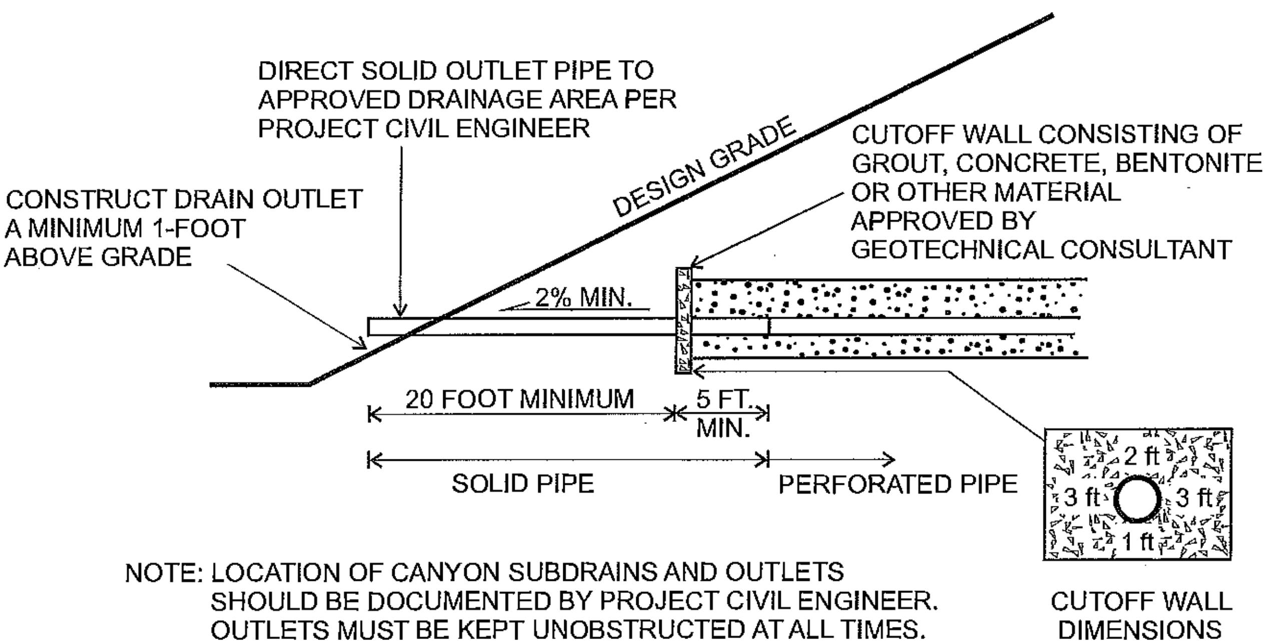
F. Areas of fill that have not been observed or tested by the Geotechnical Consultant may have to be removed and recompacted at the contractor's expense. The depth and extent of removals will be determined by the Geotechnical Consultant.

G. Observation and testing by the Geotechnical Consultant shall be conducted during grading in order for the Geotechnical Consultant to state that, in his opinion, grading has been completed in accordance with the approved geotechnical report and project specifications.

H. Reporting of Test Results: After completion of grading operations, the Geotechnical Consultant shall submit reports documenting their observations during construction and test results. These reports may be subject to review by the local governing agencies.



CANYON SUBDRAIN PROFILE



NOTE: LOCATION OF CANYON SUBDRAINS AND OUTLETS SHOULD BE DOCUMENTED BY PROJECT CIVIL ENGINEER. OUTLETS MUST BE KEPT UNOBSTRUCTED AT ALL TIMES.

CANYON SUBDRAIN TERMINUS

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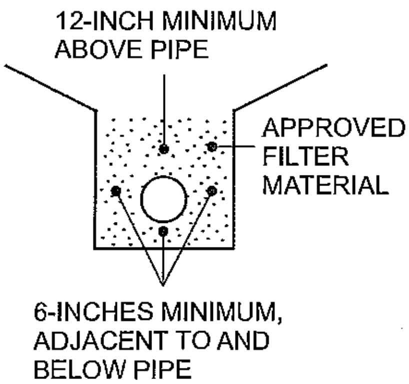
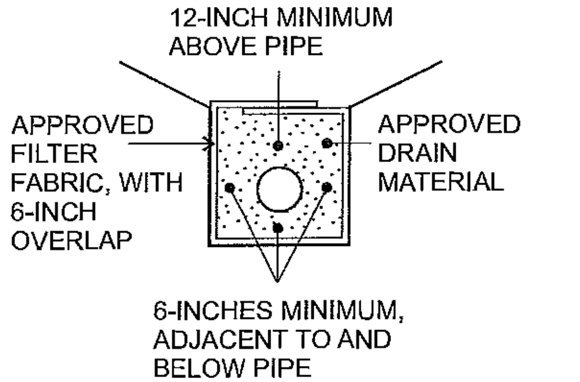
AGS ADVANCED GEOTECHNICAL SOLUTIONS	CANYON SUBDRAIN	DETAIL 1



OPTION 1

FILTER MATERIAL: MINIMUM VOLUME OF 9 CUBIC FEET PER LINEAL FOOT OF CALTRANS CLASS 2 PERMEABLE MATERIAL



OPTION 2

DRAIN MATERIAL: MINIMUM VOLUME OF 9 CUBIC FEET PER LINEAL FOOT OF 3/4-INCH MAX ROCK OR APPROVED EQUIVALENT SUBSTITUTE

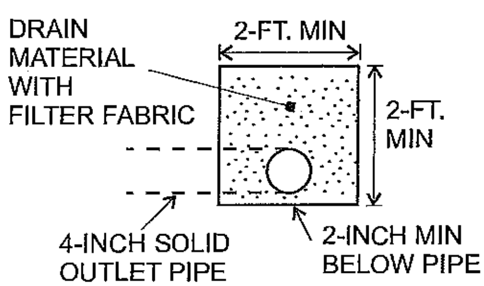
FILTER FABRIC: MIRAFI 140 FILTER FABRIC OR APPROVED EQUIVALENT SUBSTITUTE

PIPE: 6 OR 8-INCH ABS OR PVC PIPE OR APPROVED SUBSTITUTE WITH A MINIMUM OF 8 PERFORATIONS (1/4-INCH DIAMETER) PER LINEAL FOOT IN BOTTOM HALF OF PIPE

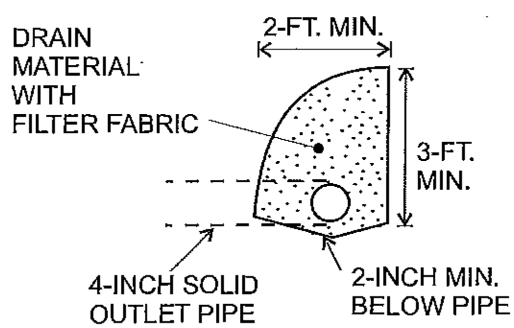
(ASTM D2751, SDR-35 OR ASTM D3034, SDR-35
ASTM D1527, SCHD. 40 OR ASTM D1785, SCHD. 40)

NOTE: CONTINUOUS RUN IN EXCESS OF 5OO FEET REQUIRES 8-INCH DIAMETER PIPE (ASTM D3034, SDR-35, OR ASTM D1785, SCHD. 40)

CANYON SUBDRAIN



OPTION 1



OPTION 2

DRAIN MATERIAL: GRAVEL TRENCH TO BE FILLED WITH 3/4-INCH MAX ROCK OR APPROVED EQUIVALENT SUBSTITUTE

FILTER FABRIC: MIRAFI 140 FILTER FABRIC OR EQUIVALENT SUBSTITUTE WITH A MINIMUM 6-INCH OVERLAP

PIPE: 4-INCH ABS OR PVC PIPE OR APPROVED EQUIVALENT SUBSTITUTE WITH A MINIMUM OF 8 PERFORATIONS (1/4-INCH DIAMETER) PER LINEAL FOOT IN BOTTOM HALF OF PIPE

(ASTM D2751, SDR-35 OR ASTM D3034, SDR-35
ASTM D1527, SCHD. 40 OR ASTM D1785, SCHD. 40)

BUTTRESS/STABILIZATION DRAIN

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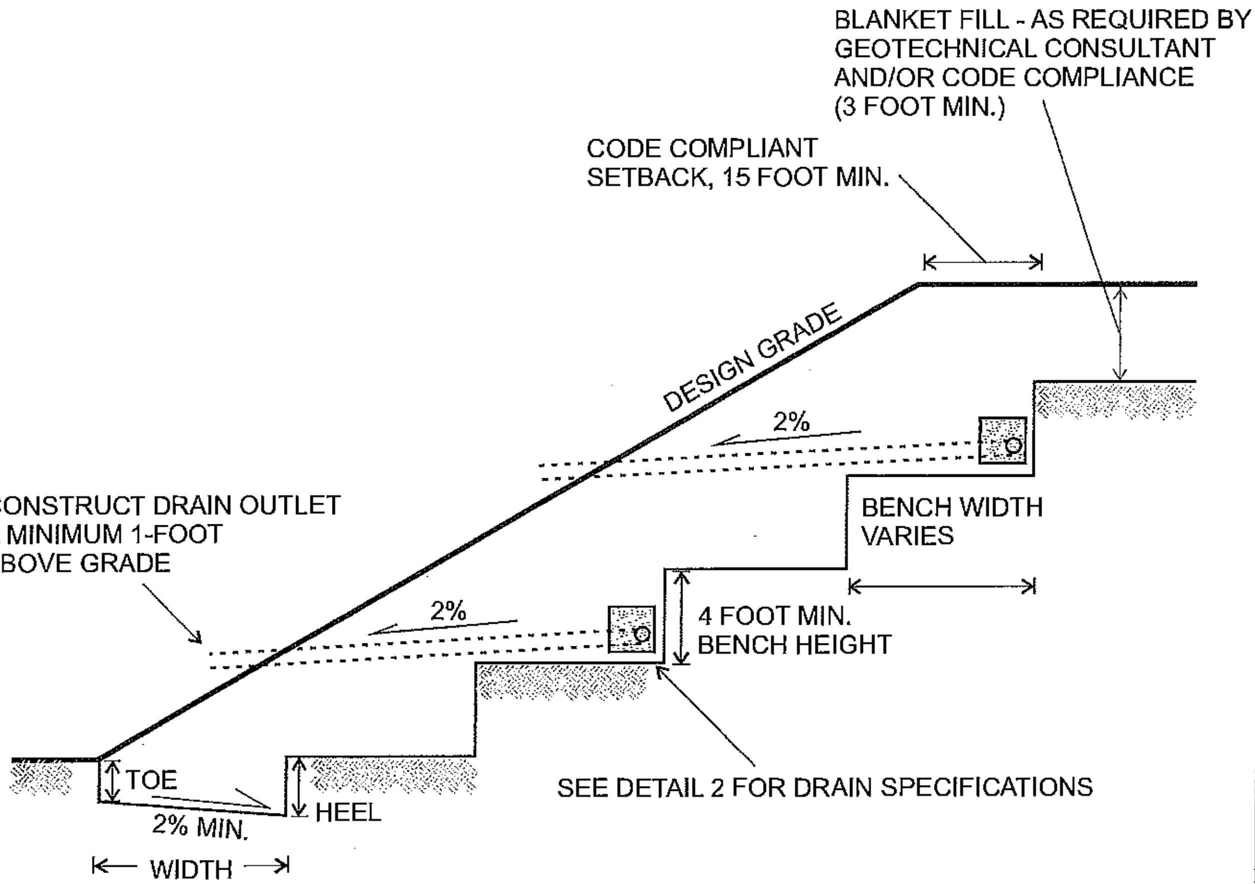
AGS ADVANCED GEOTECHNICAL SOLUTIONS	DRAIN SPECIFICATIONS	DETAIL 2



CODE COMPLIANT KEYWAY WITH MINIMUM DIMENSIONS:

TOE 2 FOOT MIN.
HEEL 3 FOOT MIN.
WIDTH 15 FOOT MIN.

NOTES:

1. DRAIN OUTLETS TO BE PROVIDED EVERY 100 FEET CONNECT TO PERFORATED DRAIN PIPE BY "L" OR "T" AT A MINIMUM 2% GRADIENT.

2. THE NECESSITY AND LOCATION OF ADDITIONAL DRAINS SHALL BE DETERMINED IN THE FIELD BY THE GEOTECHNICAL CONSULTANT. UPPER STAGE OUTLETS SHOULD BE EMPTIED ONTO CONCRETE TERRACE DRAINS.

3. DRAIN PIPE TO EXTEND FULL LENGTH OF STABILIZATION/BUTTRESS WITH A MINIMUM GRADIENT OF 2% TO SOLID OUTLET PIPES.

4. LOCATION OF DRAINS AND OUTLETS SHOULD BE DOCUMENTED BY PROJECT CIVIL ENGINEER. OUTLETS MUST BE KEPT UNOBSTRUCTED AT ALL TIMES.

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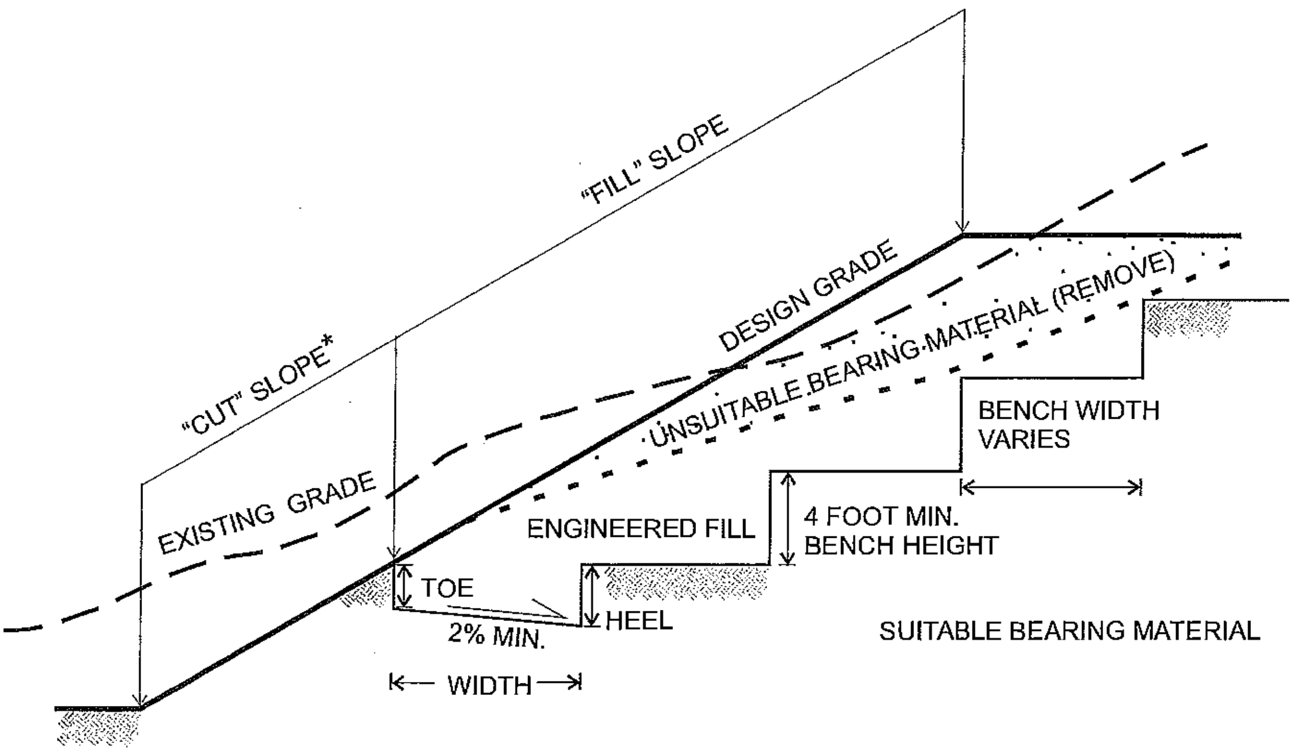
AGS ADVANCED GEOTECHNICAL SOLUTIONS	STABILIZATION/BUTTRESS FILL	DETAIL 3

* THE "CUT" PORTION OF THE SLOPE SHALL BE EXCAVATED AND EVALUATED BY THE GEOTECHNICAL CONSULTANT PRIOR TO CONSTRUCTING THE "FILL" PORTION



SUITABLE
BEARING MATERIAL

CODE COMPLIANT KEYWAY
WITH MINIMUM DIMENSIONS:

TOE: 2 FOOT MIN.
HEEL: 3 FOOT MIN.
WIDTH: 15 FOOT MIN.

NOTES:

1. THE NECESSITY AND LOCATION OF DRAINS SHALL BE DETERMINED IN THE FIELD BY THE GEOTECHNICAL CONSULTANT

2. SEE DETAIL 2 FOR DRAIN SPECIFICATIONS

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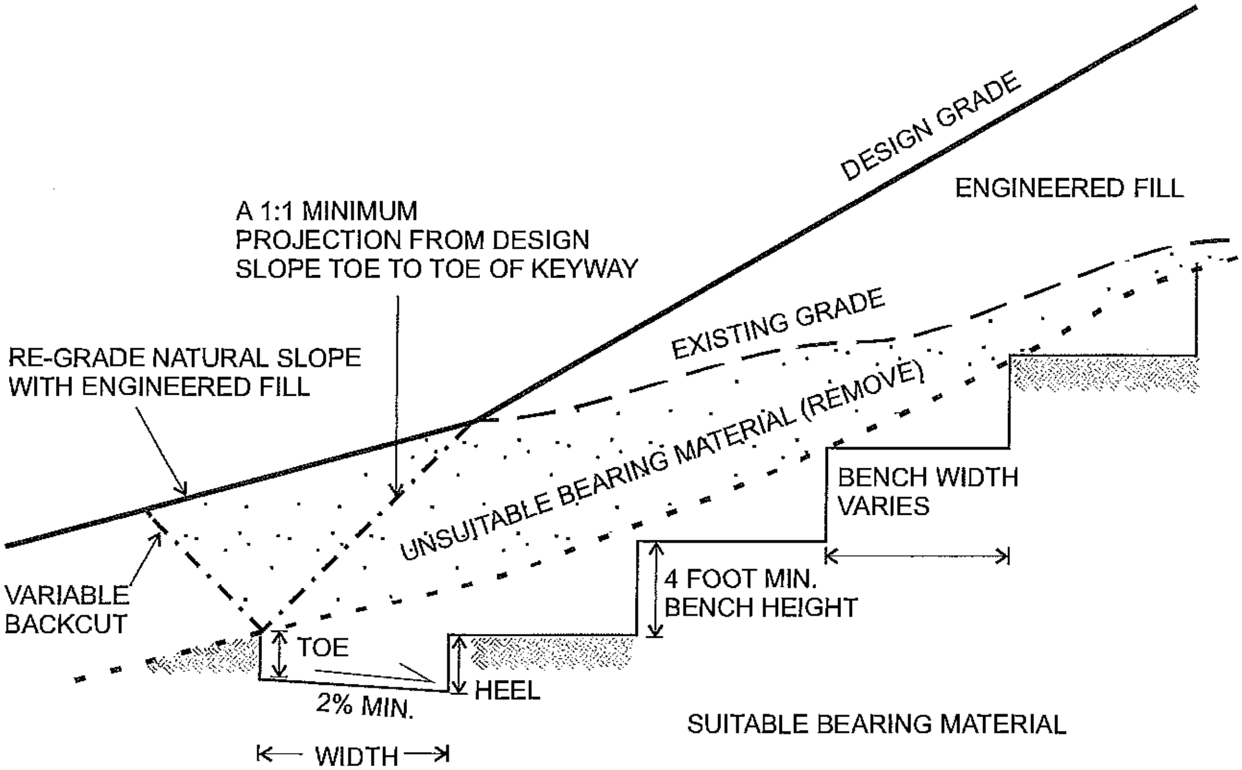
AGS
ADVANCED GEOTECHNICAL SOLUTIONS

FILL OVER CUT SLOPE

DETAIL 4



CODE COMPLIANT KEYWAY
WITH MINIMUM DIMENSIONS:

TOE: 2 FOOT MIN.
HEEL: 3 FOOT MIN.
WIDTH: 15 FOOT MIN.

NOTES:

1. WHEN THE NATURAL SLOPE APPROACHES OR EXCEEDS THE DESIGN GRADE SLOPE RATIO, SPECIAL RECOMMENDATIONS ARE NECESSARY BY THE GEOTECHNICAL CONSULTANT

2. THE GEOTECHNICAL CONSULTANT WILL DETERMINE THE REQUIREMENT FOR AND LOCATION OF SUBSURFACE DRAINAGE SYSTEMS.

3. MAINTAIN MINIMUM 15 FOOT HORIZONTAL WIDTH FROM FACE OF SLOPE TO BENCH/BACKCUT

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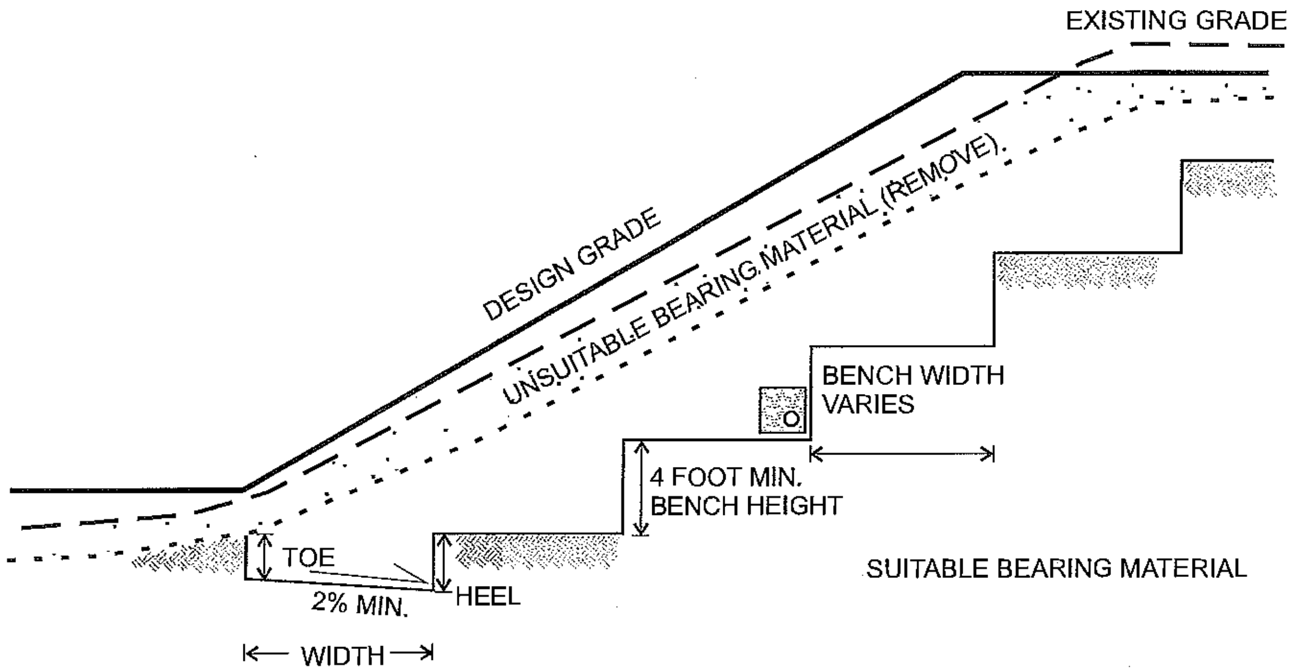
AGS ADVANCED GEOTECHNICAL SOLUTIONS	FILL OVER NATURAL SLOPE	DETAIL 5



CODE COMPLIANT KEYWAY
WITH MINIMUM DIMENSIONS:

TOE: 2 FOOT MIN.
HEEL: 3 FOOT MIN.
WIDTH: 15 FOOT MIN.

NOTES:

1. MAINTAIN MINIMUM 15 FOOT HORIZONTAL WIDTH FROM FACE OF SLOPE TO BENCH/BACKCUT
2. SEE DETAIL 2 FOR DRAIN SPECIFICATIONS

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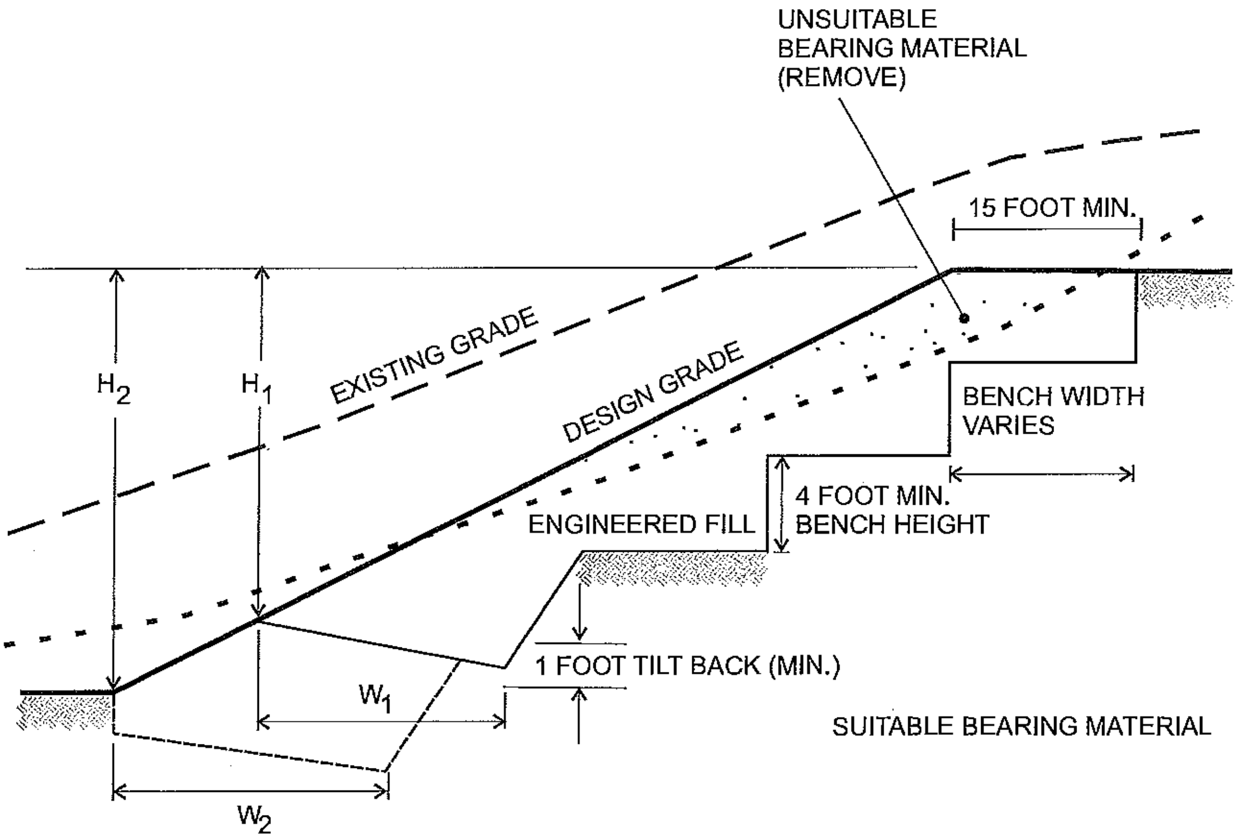
AGS ADVANCED GEOTECHNICAL SOLUTIONS	SKIN FILL CONDITION	DETAIL 6



NOTES:

1. IF RECOMMENDED BY THE GEOTECHNICAL CONSULTANT, THE REMAINING CUT PORTION OF THE SLOPE MAY REQUIRE REMOVAL AND REPLACEMENT WITH AN ENGINEERED FILL

2. "W" SHALL BE EQUIPMENT WIDTH (15 FEET) FOR SLOPE HEIGHT LESS THAN 25 FEET. FOR SLOPES GREATER THAN 25 FEET, "W" SHALL BE DETERMINED BY THE GEOTECHNICAL CONSULTANT. AT NO TIME SHALL "W" BE LESS THAN H/2

3. DRAINS WILL BE REQUIRED (SEE DETAIL 2)

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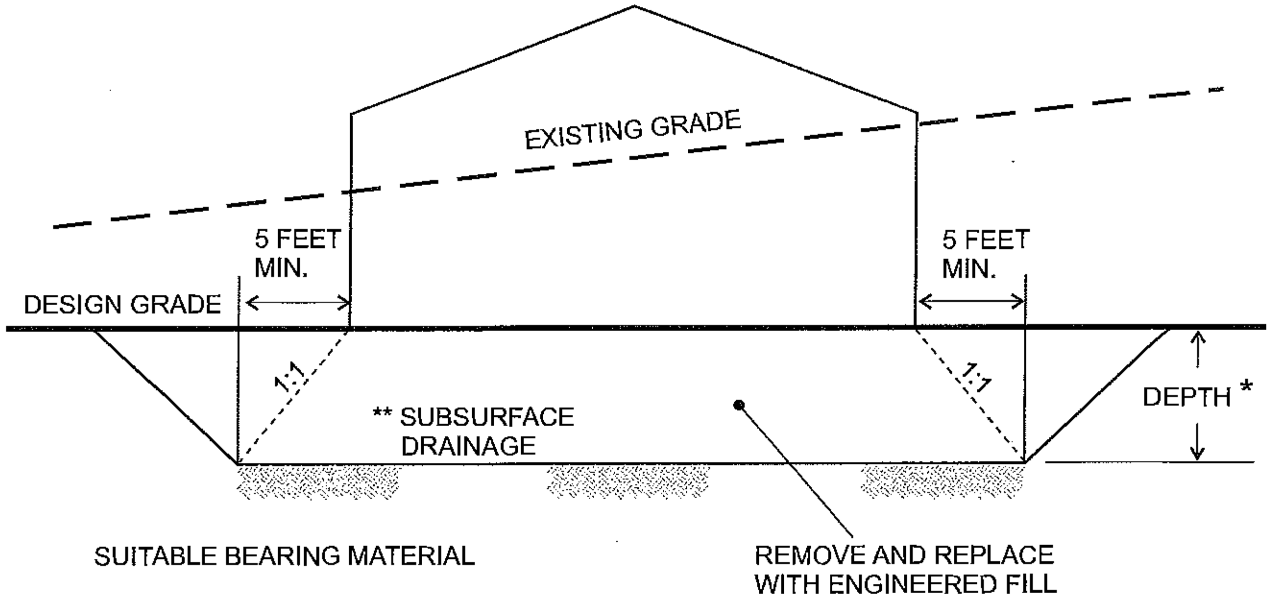
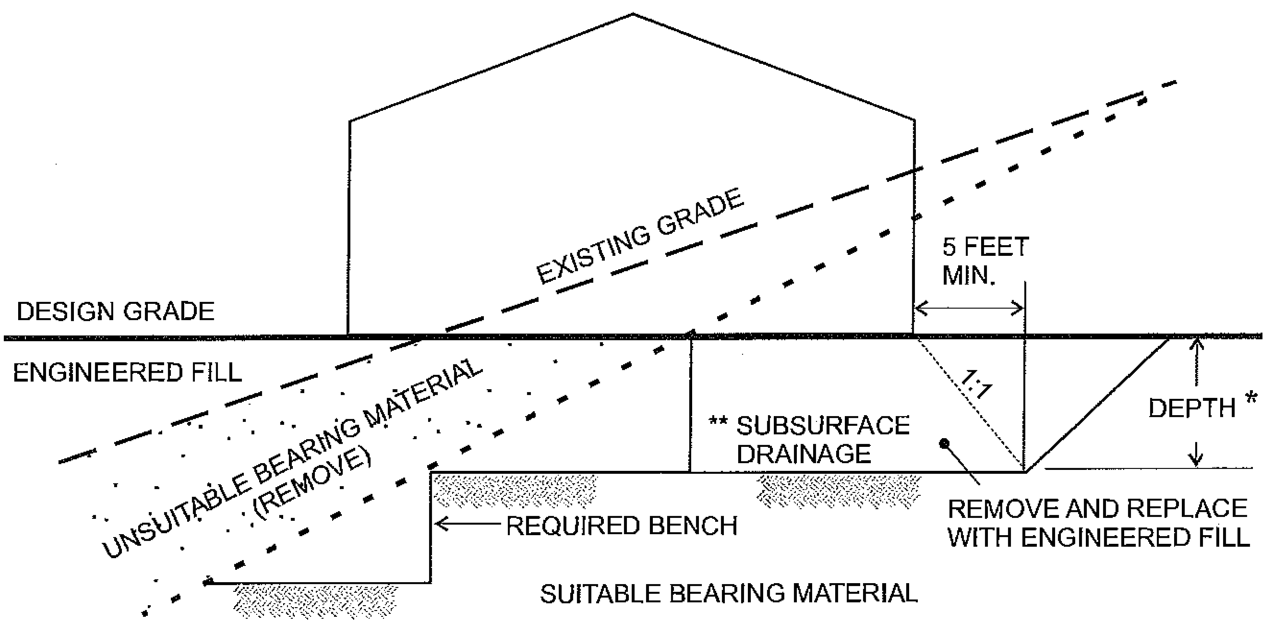
AGS ADVANCED GEOTECHNICAL SOLUTIONS	PARTIAL CUT SLOPE STABILIZATION	DETAIL 7



CUT LOT OVEREXCAVATION



CUT-FILL LOT OVEREXCAVATION

NOTES:

* SEE REPORT FOR RECOMMENDED DEPTHS, DEEPER OVEREXCAVATION MAY BE REQUIRED BY THE GEOTECHNICAL CONSULTANT BASED ON EXPOSED FIELD CONDITIONS

** CONSTRUCT EXCAVATION TO PROVIDE FOR POSITIVE DRAINAGE TOWARDS STREETS, DEEPER FILL AREAS OR APPROVED DRAINAGE DEVICES BASED ON FIELD CONDITIONS

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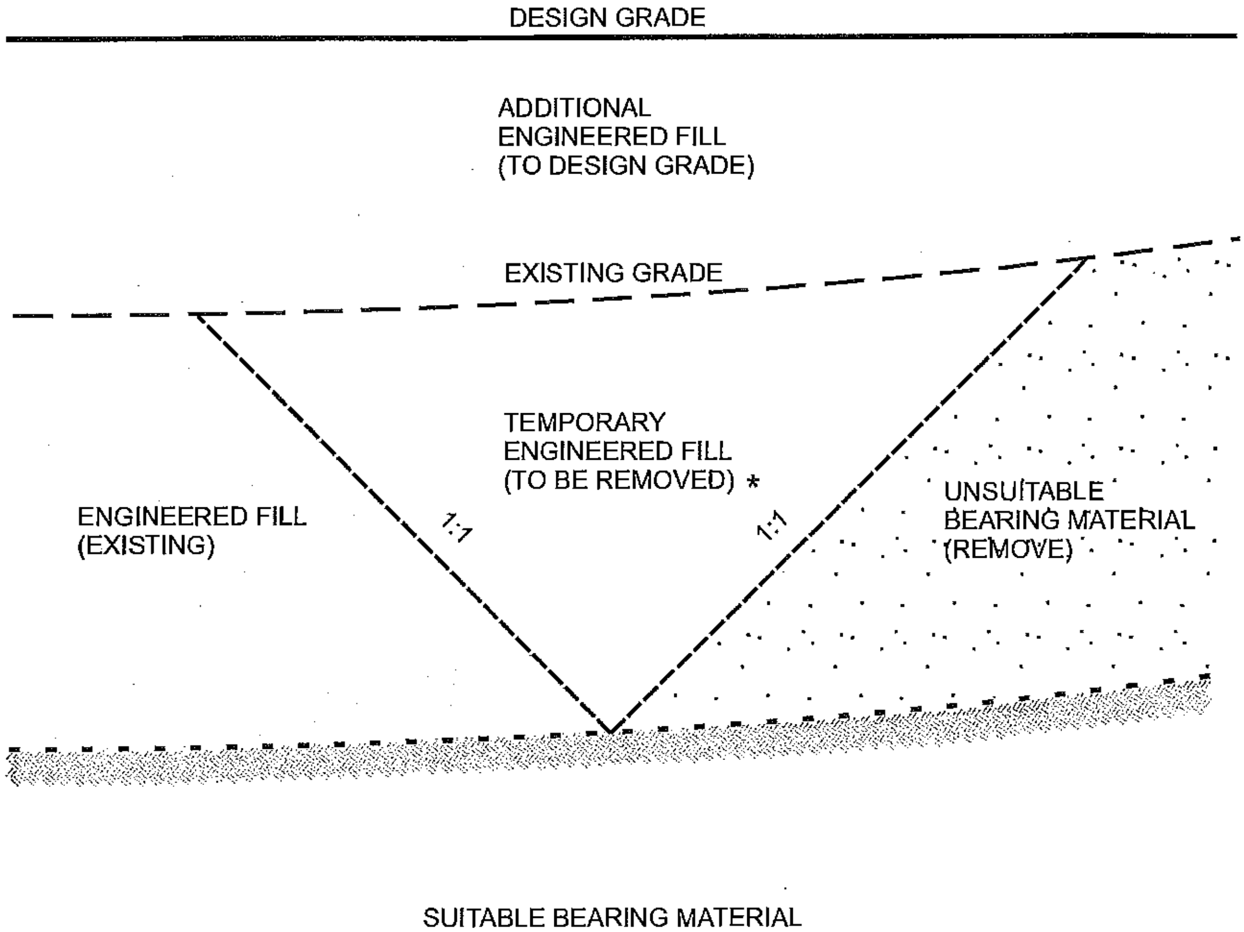
AGS ADVANCED GEOTECHNICAL SOLUTIONS	CUT & CUT-FILL LOT OVEREXCAVATION	DETAIL 8



* REMOVE BEFORE PLACING ADDITIONAL ENGINEERED FILL

TYPICAL UP-CANYON PROFILE

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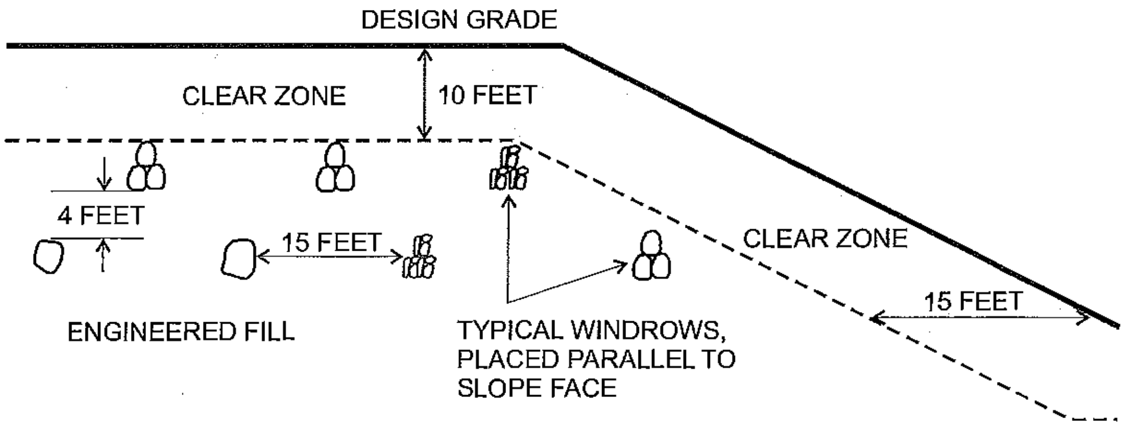
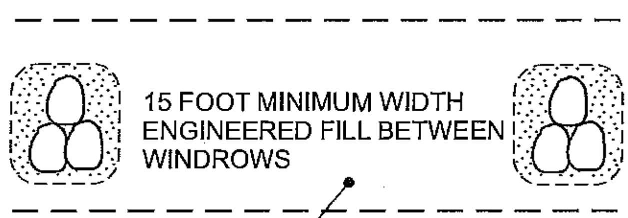
AGS ADVANCED GEOTECHNICAL SOLUTIONS	REMOVAL ADJACENT TO EXISTING FILL	DETAIL 9



CLEAR ZONE DIMENSIONS FOR REFERENCE ONLY, ACTUAL DEPTH, WIDTH, WINDROW LENGTH, ETC. TO BE BASED ON ELEVATIONS OF FOUNDATIONS, UTILITIES OR OTHER STRUCTURES PER THE GEOTECHNICAL CONSULTANT OR GOVERNING AGENCY APPROVAL

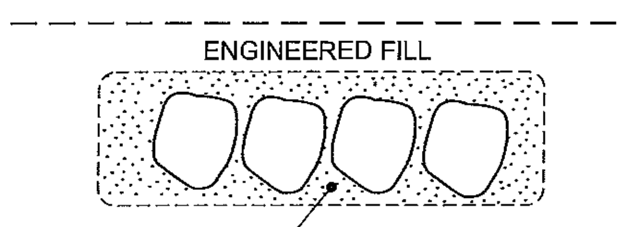
OVERSIZED MATERIAL DISPOSAL PROFILE



HORIZONTALLY PLACED ENGINEERED FILL, FREE OF OVERSIZED MATERIALS AND COMPACTED TO MINIMUM PROJECT STANDARDS

COMPACT ENGINEERED FILL ABOVE OVERSIZED MATERIALS TO FACILITATE "TRENCH" CONDITION PRIOR TO FLOODING GRANULAR MATERIALS

WINDROW CROSS-SECTION



GRANULAR MATERIAL APPROVED BY THE GEOTECHNICAL CONSULTANT AND CONSOLIDATED IN-PLACE BY FLOODING

WINDROW PROFILE

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AGS ADVANCED GEOTECHNICAL SOLUTIONS	OVERSIZED MATERIAL DISPOSAL CRITERIA	DETAIL 10

APPENDIX E

HOMEOWNERS MAINTENANCE GUIDELINES

HOMEOWNER MAINTENANCE AND IMPROVEMENT CONSIDERATIONS

Homeowners are accustomed to maintaining their homes. They expect to paint their houses periodically, replace wiring, clean out clogged plumbing, and repair roofs. Maintenance of the home site, particularly on hillsides, should be considered on the same basis or even on a more serious basis because neglect can result in serious consequences. In most cases, lot and site maintenance can be taken care of along with landscaping, and can be carried out more economically than repair after neglect.

Most slope and hillside lot problems are associated with water. Uncontrolled water from a broken pipe, cesspool, or wet weather causes most damage. Wet weather is the largest cause of slope problems, particularly in California where rain is intermittent, but may be torrential. Therefore, drainage and erosion control are the most important aspects of home site stability; these provisions must not be altered without competent professional advice. Further, maintenance must be carried out to assure their continued operation.

As geotechnical engineers concerned with the problems of building sites in hillside developments, we offer the following list of recommended home protection measures as a guide to homeowners.

Expansive Soils

Some of the earth materials on site have been identified as being expansive in nature. As such, these materials are susceptible to volume changes with variations in their moisture content. These soils will swell upon the introduction of water and shrink upon drying. The forces associated with these volume changes can have significant negative impacts (in the form of differential movement) on foundations, walkways, patios, and other lot improvements. In recognition of this, the project developer has constructed homes on these lots on post-tensioned or mat slabs with pier and grade beam foundation systems, intended to help reduce the potential adverse effects of these expansive materials on the residential structures within the project. Such foundation systems are not intended to offset the forces (and associated movement) related to expansive soil, but are intended to help soften their effects on the structures constructed thereon.

Homeowners purchasing property and living in an area containing expansive soils must assume a certain degree of responsibility for homeowner improvements as well as for maintaining conditions around their home. Provisions should be incorporated into the design and construction of homeowner improvements to account for the expansive nature of the onsite soils material. Lot maintenance and landscaping should also be conducted in consideration of the expansive soil characteristics. Of primary importance is minimizing the moisture variation below all lot improvements. Such design, construction and homeowner maintenance provisions should include:

- Employing contractors for homeowner improvements who design and build in recognition of local building code and site specific soils conditions.
- Establishing and maintaining positive drainage away from all foundations, walkways, driveways, patios, and other hardscape improvements.
- Avoiding the construction of planters adjacent to structural improvements. Alternatively, planter sides/bottoms can be sealed with an impermeable membrane and drained away from the improvements via subdrains into approved disposal areas.
- Sealing and maintaining construction/control joints within concrete slabs and walkways to reduce the potential for moisture infiltration into the subgrade soils.

- Utilizing landscaping schemes with vegetation that requires minimal watering. Alternatively, watering should be done in a uniform manner as equally as possible on all sides of the foundation, keeping the soil "moist" but not allowing the soil to become saturated.
- Maintaining positive drainage away from structures and providing roof gutters on all structures with downspouts installed to carry roof runoff directly into area drains or discharged well away from the structures.
- Avoiding the placement of trees closer to the proposed structures than a distance of one-half the mature height of the tree.
- Observation of the soil conditions around the perimeter of the structure during extremely hot/dry or unusually wet weather conditions so that modifications can be made in irrigation programs to maintain relatively constant moisture conditions.

Sulfates

Homeowners should be cautioned against the import and use of certain fertilizers, soil amendments, and/or other soils from offsite sources in the absence of specific information relating to their chemical composition. Some fertilizers have been known to leach sulfate compounds into soils otherwise containing "negligible" sulfate concentrations and increase the sulfate concentrations in near-surface soils to "moderate" or "severe" levels. In some cases, concrete improvements constructed in soils containing high levels of soluble sulfates may be affected by deterioration and loss of strength.

Water - Natural and Man Induced

Water in concert with the reaction of various natural and man-made elements, can cause detrimental effects to your structure and surrounding property. Rain water and flowing water erodes and saturates the ground and changes the engineering characteristics of the underlying earth materials upon saturation. Excessive irrigation in concert with a rainy period is commonly associated with shallow slope failures and deep seated landslides, saturation of near structure soils, local ponding of water, and transportation of water soluble substances that are deleterious to building materials including concrete, steel, wood, and stucco.

Water interacting with the near surface and subsurface soils can initiate several other potentially detrimental phenomena other than slope stability issues. These may include expansion/contraction cycles, liquefaction potential increase, hydro-collapse of soils, ground surface settlement, earth material consolidation, and introduction of deleterious substances.

The homeowners should be made aware of the potential problems which may develop when drainage is altered through construction of retaining walls, swimming pools, paved walkways and patios. Ponded water, drainage over the slope face, leaking irrigation systems, over-watering or other conditions which could lead to ground saturation must be avoided.

- Before the rainy season arrives, check and clear roof drains, gutters and down spouts of all accumulated debris. Roof gutters are an important element in your arsenal against rain damage. If you do not have roof gutters and down spouts, you may elect to install them. Roofs, with their, wide, flat area can shed tremendous quantities of water. Without gutters or other adequate drainage, water falling from the eaves collects against foundation and basement walls.
- Make sure to clear surface and terrace drainage ditches, and check them frequently during the rainy season. This task is a community responsibility.
- Test all drainage ditches for functioning outlet drains. This should be tested with a hose and done before the rainy season. All blockages should be removed.
- Check all drains at top of slopes to be sure they are clear and that water will not overflow the slope itself, causing erosion.

- Keep subsurface drain openings (weep-holes) clear of debris and other material which could block them in a storm.
- Check for loose fill above and below your property if you live on a slope or terrace.
- Monitor hoses and sprinklers. During the rainy season, little, if any, irrigation is required. Oversaturation of the ground is unnecessary, increases watering costs, and can cause subsurface drainage.
- Watch for water backup of drains inside the house and toilets during the rainy season, as this may indicate drain or sewer blockage.
- Never block terrace drains and brow ditches on slopes or at the tops of cut or fill slopes. These are designed to carry away runoff to a place where it can be safely distributed.
- Maintain the ground surface upslope of lined ditches to ensure that surface water is collected in the ditch and is not permitted to be trapped behind or under the lining.
- Do not permit water to collect or pond on your home site. Water gathering here will tend to either seep into the ground (loosening or expanding fill or natural ground), or will overflow into the slope and begin erosion. Once erosion is started, it is difficult to control and severe damage may result rather quickly.
- Never connect roof drains, gutters, or down spouts to subsurface drains. Rather, arrange them so that water either flows off your property in a specially designed pipe or flows out into a paved driveway or street. The water then may be dissipated over a wide surface or, preferably, may be carried away in a paved gutter or storm drain. Subdrains are constructed to take care of ordinary subsurface water and cannot handle the overload from roofs during a heavy rain.
- Never permit water to spill over slopes, even where this may seem to be a good way to prevent ponding. This tends to cause erosion and, in the case of fill slopes, can eat away carefully designed and constructed sites.
- Do not cast loose soil or debris over slopes. Loose soil soaks up water more readily than compacted fill. It is not compacted to the same strength as the slope itself and will tend to slide when laden with water; this may even affect the soil beneath the loose soil. The sliding may clog terrace drains below or may cause additional damage in weakening the slope. If you live below a slope, try to be sure that loose fill is not dumped above your property.
- Never discharge water into subsurface blanket drains close to slopes. Trench drains are sometimes used to get rid of excess water when other means of disposing of water are not readily available. Overloading these drains saturates the ground and, if located close to slopes, may cause slope failure in their vicinity.
- Do not discharge surface water into septic tanks or leaching fields. Not only are septic tanks constructed for a different purpose, but they will tend, because of their construction, to naturally accumulate additional water from the ground during a heavy rain. Overloading them artificially during the rainy season is bad for the same reason as subsurface subdrains, and is doubly dangerous since their overflow can pose a serious health hazard. In many areas, the use of septic tanks should be discontinued as soon as sewers are made available.
- Practice responsible irrigation practices and do not over-irrigate slopes. Naturally, ground cover of ice plant and other vegetation will require some moisture during the hot summer months, but during the wet season, irrigation can cause ice plant and other heavy ground cover to pull loose. This not only destroys the cover, but also starts serious erosion. In some areas, ice plant and other heavy cover can cause surface sloughing when saturated due to the increase in weight and weakening of the near-surface soil. Planted slopes should be planned where possible to acquire sufficient moisture when it rains.
- Do not let water gather against foundations, retaining walls, and basement walls. These walls are built to withstand the ordinary moisture in the ground and are, where necessary, accompanied by subdrains to carry off the excess. If water is permitted to pond against them, it may seep through the wall, causing dampness and leakage inside the basement. Further, it may cause the foundation to swell up, or the water pressure could cause structural damage to walls.

- Do not try to compact soil behind walls or in trenches by flooding with water. Not only is flooding the least efficient way of compacting fine-grained soil, but it could damage the wall foundation or saturate the subsoil.
- Never leave a hose and sprinkler running on or near a slope, particularly during the rainy season. This will enhance ground saturation which may cause damage.
- Never block ditches which have been graded around your house or the lot pad. These shallow ditches have been put there for the purpose of quickly removing water toward the driveway, street or other positive outlet. By all means, do not let water become ponded above slopes by blocked ditches.
- Seeding and planting of the slopes should be planned to achieve, as rapidly as possible, a well-established and deep-rooted vegetal cover requiring minimal watering.
- It should be the responsibility of the landscape architect to provide such plants initially and of the residents to maintain such planting. Alteration of such a planting scheme is at the resident's risk.
- The resident is responsible for proper irrigation and for maintenance and repair of properly installed irrigation systems. Leaks should be fixed immediately. Residents must undertake a program to eliminate burrowing animals. This must be an ongoing program in order to promote slope stability. The burrowing animal control program should be conducted by a licensed exterminator and/or landscape professional with expertise in hill side maintenance.

Geotechnical Review

Due to the fact that soil types may vary with depth, it is recommended that plans for the construction of rear yard improvements (swimming pools, spas, barbecue pits, patios, etc.), be reviewed by a geotechnical engineer who is familiar with local conditions and the current standard of practice in the vicinity of your home.

In conclusion, your neighbor's slope, above or below your property, is as important to you as the slope that is within your property lines. For this reason, it is desirable to develop a cooperative attitude regarding hillside maintenance, and we recommend developing a "good neighbor" policy. Should conditions develop off your property, which are undesirable from indications given above, necessary action should be taken by you to insure that prompt remedial measures are taken. Landscaping of your property is important to enhance slope and foundation stability and to prevent erosion of the near surface soils. In addition, landscape improvements should provide for efficient drainage to a controlled discharge location downhill of residential improvements and soil slopes.

Additionally, recommendations contained in the Geotechnical Engineering Study report apply to all future residential site improvements, and we advise that you include consultation with a qualified professional in planning, design, and construction of any improvements. Such improvements include patios, swimming pools, decks, etc., as well as building structures and all changes in the site configuration requiring earth cut or fill construction.

TENTATIVE MAP & COASTAL DEVELOPMENT PERMIT FOR: BERNARDO SHORES, IMPERIAL BEACH, CA PHASE 1

LEGEND

- B-4 — Approximate Location of Exploratory Boring (AGS, 2014)
- CPT-5 — Approximate Location of CPT Sounding (AGS, 2012)
- afu — Artificial Fill - Undocumented
- Qop_6 — Old Paralic Deposits (Bracketed where buried)
- Geologic Contact (Queried where uncertain)

PLATE 1
Geologic Map and Exploration Location Plan

AGS
ADVANCED GEOTECHNICAL SOLUTIONS, INC.

Project: P/W 1207-08 Report: 1207-08-B-4

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DATE PREPARED: 9-4-13

PLSA 2045