Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

TRANSMITTAL

To: **WILLIAMS ARCHITECTS**
276 North Second Street
Upland, California 91786

Date: July 22, 2011

Project No. 603176-001

Attention: Ms. Rene' Glynn, Vice President

Transmitted:		The Following:		For:	
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Subject: Geotechnical Exploration for Proposed Yucca Valley Animal Shelter, Southeast Corner of Paseo Los Ninos and Malin Way, Yucca Valley, San Bernardino County, California

LEIGHTON CONSULTING, INC.

By: Bob Riha, CEG / Simon Saiid, GE

Copies To: (4) addressee (plus CD)

75-400 Gerald Ford Drive, Unit 107 ▪ Palm Desert, CA 92211
760.776.4182 ▪ 760.776.4080 Fax

GEOTECHNICAL EXPLORATION
FOR PROPOSED YUCCA VALLEY ANIMAL SHELTER
APN 0597-021-080-000
SOUTHEAST CORNER OF PASEO LOS NINOS AND MALIN WAY,
YUCCA VALLEY, SAN BERNARDINO COUNTY, CALIFORNIA

Prepared for:

WILLIAMS ARCHITECTS
276 North Second Street
Upland, California 91786

Project No. 603176-001

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Upland, California 91786

Attention: Ms. Rene' Glynn, Vice President

Subject: Geotechnical Exploration for Proposed Yucca Valley Animal Shelter, APN 0597-021-080-000, Southeast Corner of Paseo Los Ninos and Malin Way, Yucca Valley, San Bernardino County, California

In accordance with your request and authorization, we have performed a geotechnical exploration for the proposed animal shelter located at southeast corner of Paseo Los Ninos and Malin Way in the Town of Yucca Valley, California. The purpose of our exploration was to evaluate geotechnical and geologic conditions on this site and provide geotechnical recommendations for foundation design and earthwork construction in accordance with our proposal dated May 26, 2010. Based on the results of this exploration, it is our opinion that the site is suitable for the proposed facility provided the recommendations included in this report are implemented during design and construction phases of development. Please note that the results of our fault investigation are submitted under a separate cover dated July 13, 2011.

We appreciate the opportunity to work with you on this project. If you have any questions, or if we can be of further service, please call us at your convenience at 760.834.6520.

Respectfully submitted,
LEIGHTON CONSULTING, INC.

REGISTERED GEOLOGIST ROBERT F. RIHA No. 1921 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

Robert F. Riha
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1.0 INTRODUCTION

1.1 Site Location and Project Description

As depicted on Figure 1, *Site Location Map*, the site of the proposed animal shelter is located west of Route 247, on the southeastern corner of Paseo Los Ninos and Marlin Way within the community of Yucca Valley, San Bernardino County, California. Based on the site plan provided by Williams Architects, Inc., the proposed animal shelter and associated parking lot will be located in the northern portion of the subject 5-acre parcel. However, recent fault evaluation may cause some shifting of the planned building location to the east and south (Leighton, 2011). The topography of the planned development portion slopes gently to the southeast; and ranges in elevation from approximately 3750 to 3762 feet above mean sea level.

We understand that the proposed building will consist of an animal shelter facility and associated onsite and offsite improvements as indicated on the site plans by Williams Architects, Inc., (dated April 28, 2011). It is also our understanding that the proposed facility will be developed in phases and will ultimately include: 12,040 square foot building; 16,744 square foot covered animal shelter; 60,900 square foot uncovered animal shelter; and associated parking areas. We anticipate that the proposed building will be a one-story lightly loaded steel frame structure founded on typical spread/isolated and/or continuous footings. Structural loads were not known at the time of this report but are not expected to exceed 50 kips per column or 5 kips per lineal foot of continuous wall footings. Although grading plans were not available at the time of this study, minimal cut and fill grading (±5 feet) is anticipated to achieve finish grades for the proposed structure and paved areas due to a relatively flat terrain. If site development significantly differs from the assumptions made herein, the recommendations included in this report should be subject to further review and evaluation.

1.2 Purpose and Scope of Exploration

The purpose of our exploration was to evaluate geotechnical and geologic conditions on this site and provide geotechnical recommendations for design and construction of the proposed improvements. More specifically, the scope of our exploration included:

- Utility Location Coordination –We contacted Underground Service Alert (USA) to have existing registered public underground utilities located and marked onsite prior to our subsurface exploration.
- Field Exploration - Our field exploration consisted of four geotechnical test pits utilizing a backhoe excavated to depths ranging from 12 to 15 feet. Approximate test

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pits locations are shown on the *Geotechnical Map*, Figure 2. A more detailed description of our field exploration is presented in Appendix A, *Field Exploration*.

- Geotechnical Laboratory Tests – Geotechnical laboratory tests were conducted on bulk soil samples obtained during our field exploration. Our laboratory-testing program was designed to evaluate engineering characteristics of site soils. Results of these laboratory tests are presented in Appendix A.

- Engineering Analysis - Data obtained from our field exploration was evaluated and analyzed to provide geotechnical conclusions and recommendations.

- Report Preparation - Results of our geotechnical exploration have been summarized and compiled in this report along with our geotechnical conclusions and recommendations for foundation design and construction.

This report does not address the potential for encountering hazardous materials in the soil and/or groundwater. Please also see the attached ASFE insert titled "*Important Information About Your Geotechnical Report*", see Appendix C.

2.0 FINDINGS

A summary of our findings from research, site-specific field exploration, geotechnical laboratory testing and engineering analysis, is discussed in the following sections.

2.1 Regional Geology

The project site is generally underlain by Holocene to Pliocene aged alluvium with a thin veneer of topsoil. The southerly elevated portion of the site is underlain by highly weathered granodiorite rock and capped by Tertiary-aged volcanic basalt.

2.2 Subsurface Soil Conditions

As indicated above, the site is generally underlain by Holocene to Pliocene aged alluvium with a thin veneer of topsoil:

- ***The topsoil*** is generally loose silty sand to sandy silt with abundant roots and extends to a depth of 3 to 5 feet below ground surface (BGS).

- ***The alluvial soils below the upper 3 to 5 foot depth*** are generally damp to moist and consisted of silty to well-graded sand. Based on the results of our field testing, the upper 5 to 8 feet BGS are generally loose to medium dense with an approximately 77 to 80 percent relative compaction per ASTM Test Method 1557. The alluvial soils below a depth of 8 feet appear to be relatively denser. Based on the results of our laboratory testing, the onsite soils are generally granular and considered non-expansive. A detailed geologic description of the onsite alluvium is provided in the fault investigation report (Leighton, 2011).

2.3 Groundwater

Groundwater was not encountered in the exploratory trenches to a maximum depth of 15 feet BGS. Department of Water Resource data for Wells 01N05E14P001S and 01N05E14Q001S indicates the depth to groundwater was on the order of 82 and 100 feet BGS in 1958.

2.4 Regional Faulting and Seismicity

The site is partially located within a State of California Alquist-Priolo Earthquake Fault Hazard Zone (Bryant, 2007). Two ground fractures/faults have been mapped by California Geologic Survey (Bryant, 1992) within and adjacent to the northwest corner as a result of the June 28, 1992 Landers earthquake. To evaluate the fault rupture hazard, we excavated an approximately 275-foot long by 10- to 15-foot deep exploratory fault trench across the property (see Figure 2). Although the results of our fault investigation indicate that no active faulting exists within the exploratory fault trench, a fault setback zone is recommended as shown on Figure 2. The results of our fault investigation are presented under a separate cover (Leighton, 2011).

The principal seismic hazard that could affect the site is ground shaking resulting from an earthquake occurring along several major active or potentially active faults in southern California. Known regional active and potentially active faults that could produce the most significant ground shaking at the site include the Landers, Pinto Mountain, Burnt Mountain, Eureka Peak, San Jacinto and San Andreas faults. The Landers fault, the most extensive fault in southern California is located approximately 2.1 miles (3.3 kilometers) northeast of the site.

2.5 Site-Specific Seismicity

Our evaluation of site-specific seismicity included a deterministic analysis using EQFAULT Program (Blake, 2000). Based on this analysis, the maximum earthquake magnitude is currently estimated to be 7.3Mw and the maximum associated peak site acceleration is 0.51g. The effect of strong seismic shaking should be considered to prevent failure of the structure by adhering to the 2010 California Building Code and Seismic Design Parameters suggested by the Structural Engineers Association of California. The seismic coefficients based on the 2010 California Building Code (CBC) are as follows:

Table 1. Geotechnical Earthquake Design Parameter (CBC 2010)

Design Parameters	Reference – CBC 2010	Design Value
Site Class	Table 1613.5.2	D
Mapped Spectral Acceleration at Short Period (S_S)	Figure 1613.5(3)	2.00 g
Mapped Spectral Acceleration at 1 Second (S_1)	Figure 1613.5(4)	0.79 g
Design Spectral Acceleration at Short Period (S_{DS})	***Equation 16-39***	***1.33 g***
Design Spectral Acceleration at 1 Second (S_{D1})	***Equation 16-40***	***0.79 g***
Maximum Considered Earthquake Spectral Response Acceleration for Short Periods (S_{ms})	Equation 16-37	2.00 g
Maximum Considered Earthquake Spectral Response Acceleration at 1 Second Period (S_{m1})	Equation 16-38	1.19 g
Mapped Spectral Response Acceleration at Short Period (F_a)	Table 1613.5.3(1)	1.0
Mapped Spectral Response Acceleration at 1-Second Period (F_v)	Table 1613.5.3(2)	1.5

The design values were calculated utilizing a software program published by United States Geological Survey (USGS) which follows the procedures stated in American Society of Civil Engineers (ASCE) Publication ASCE 7-10 and 2010 CBC Chapter 16.

2.6 Other Seismic Hazards

2.6.1 Liquefaction

Liquefaction is the loss of soil strength or stiffness due to a buildup of pore-water pressure during severe ground shaking. Liquefaction is associated primarily with loose (low density), saturated, fine- to medium-grained, cohesionless soils. Due to the absence of shallow groundwater (>50 feet), liquefaction potential at the site is considered very low.

2.6.2 Dry Settlement

Ground accelerations generated from a seismic event can produce settlements above and below ground water table. Settlement above groundwater table (dry sand settlement) occurs in loose dry sands or granular earth materials with relative low density. Based on the recommended remedial grading recommendations presented in this report and relatively homogenous soil condition across the site/building, the dynamic-induced dry settlement is expected to be generally global and uniform. As such, the differential seismic settlement is expected to be less than 0.5 inch in a 30-foot horizontal distance within this site.

2.6.3 Ground Fissuring or Rupture

As indicated in Section 2.4 above, two ground fractures/faults have been mapped by California Geologic Survey report (Bryant, 1992) within and adjacent to the northwest corner of the site as a result of the June 28, 1992 Landers earthquake. However, the report/notes described the observed features as "shaking cracking", without apparent significant vertical or lateral displacement. As such, ground fissuring or rupture cannot be ruled out on this site during future earthquakes. If the presence of buried or filled fissures is observed during remedial grading, specific recommendations for mitigations should be provided.

3.0 CONCLUSIONS AND RECOMMENDATIONS

The proposed development of the site appears feasible from a geotechnical viewpoint provided that the following recommendations are incorporated into the design and construction phases of development. Our detailed geotechnical recommendations are provided in the following sections.

3.1 Geotechnical Review of Grading and Foundation Plans

Leighton Consulting, Inc. should review grading and foundation plans and project specifications, when available, to comment on geotechnical aspects and check for conformance to our recommendations presented in the following sections of this report. Additional analysis and/or exploration may be required based on final plans.

3.2 Earthwork and Grading

All grading should be performed in accordance with the *Earthwork and Grading Guide Specifications* presented in Appendix C, unless specifically revised or amended below or by future recommendations based on final development plans.

3.2.1 Site Preparation

Prior to construction, the site should be cleared of vegetation, trash and debris. Any underground obstructions onsite should be removed. Efforts should be made to locate any existing buried utilities. Those lines should be removed or rerouted where interfering with proposed construction, and resulting cavities should be properly backfilled and compacted. In addition, any undocumented fill, if encountered, should be excavated from proposed building footprints.

3.2.2 Over-excavation / Remedial Grading

To reduce the potential for adverse differential settlement of the proposed structure, we recommend that onsite native soils be over-excavated and recompacted to a minimum depth of 7 feet below existing grades or 5 feet below the bottom of the proposed footings, whichever is deeper. Over-excavation and recompaction should extend a minimum horizontal distance of 5 feet from perimeter edges of proposed footings. Local conditions such as previous fault trench backfill will require deeper over-excavation (up to 10 feet) to remove and recompact this loose backfill. Such areas should be evaluated by Leighton Consulting, Inc. during grading.

Areas outside the over-excavation limits of the proposed structures planned for asphalt or concrete pavement, flatwork, and areas to receive fill should be over excavated to a minimum depth of 3 feet below the existing ground surface or 2 feet below the proposed subgrade, whichever is deeper.

After completion of over-excavation, and prior to fill placement, exposed surfaces should be scarified to a minimum depth of 8 inches and flooded. Fill placement on the removal bottom may commence once moisture conditioning of the bottom yields a moisture content at or near optimum, and the bottom is compacted to a minimum 90 percent relative compaction, relative to the ASTM D 1557 laboratory maximum density.

3.2.3 Fill Placement and Compaction

Onsite soils, free of debris and oversized material (greater-than 3-inches in largest dimension) are suitable for use as compacted structural fill. Soils to be placed as fill, whether onsite or imported material, should be reviewed and tested as necessary by Leighton Consulting, Inc.

All fill soils should be placed in thin, loose lifts, moisture-conditioned, as necessary, to near optimum moisture content, and compacted to a minimum 90 percent relative compaction as determined by ASTM Test Method D 1557. The upper 12-inches of subgrade and all aggregate base for pavement should be compacted to a minimum of 95 percent relative compaction.

3.2.4 Shrinkage and Subsidence

The change in volume of excavated and recompacted soil varies according to soil type and location. This volume change is represented as a percentage increase (bulking) or decrease (shrinkage) in volume of fill after removal and recompaction. Subsidence occurs as natural ground is moisture-conditioned and densified to receive fill. Field and laboratory data used in our calculations included laboratory-measured maximum dry densities for soil types encountered at the subject site and the measured in-place densities of soils encountered. We estimate the following earth volume changes will occur during proper recompaction:

- **Shrinkage:** Shrinkage due to recompaction of soils will vary with depth, with shrinkage decreasing with depth. We suggest an estimated shrinkage ranging from 12 to 18 percent for the upper 7 feet.

- **Subsidence**: Subsidence due solely to scarification, moisture conditioning and recompaction of the exposed bottom of over-excavation, is expected to be on the order of 0.10 foot. This should be added to the above shrinkage value for the recompacted fill zone, to calculate overall recompaction subsidence.

The level of fill compaction, variations in the dry density of the existing soils and other factors influence the amount of volume change. Some adjustments to earthwork volume should be anticipated during grading of the site.

3.2.5 Trench Backfill

Utility trenches should be backfilled with compacted fill in accordance with Sections 306-1.2 and 306-1.3 of the Standard Specifications for Public Works Construction, ("Greenbook"), 2009 Edition. Fill material should be placed in lifts not exceeding 8 inches in uncompacted thickness and should be compacted to at least 90 percent relative compaction (ASTM D 1557) by mechanical means only. The upper 12-inches of backfill in all pavement areas should be compacted to at least 95 percent relative compaction or as required per City standards.

Where granular backfill is used in utility trenches adjacent to moisture sensitive subgrades and foundation soils, we recommend that a cut-off "plug" of impermeable material be placed in these trenches at the perimeter of buildings, and at pavement edges adjacent to irrigated landscaped areas. A "plug" can consist of a 5-foot long section of silty soils with more than 35-percent passing the No. 200 sieve, or a Controlled Low Strength Material (CLSM) consisting of one sack of Portland-cement plus one sack of bentonite per cubic-yard of sand. CLSM should generally conform to Section 201-6 of the Standard Specifications for Public Works Construction, ("Greenbook"), 2009 Edition. This CLSM plug is intended to reduce the likelihood of water migrating from landscaped areas, then seeping along permeable trench backfill into the building and pavement subgrades, resulting in wetting of moisture sensitive (collapsible) subgrade earth materials under buildings and pavements.

3.2.6 Surface Drainage

Surface drainage should be designed to direct runoff away from foundations and toward approved drainage devices. Irrigation of landscaping should be controlled to maintain as much as possible, consistent moisture content sufficient to provide healthy plant growth without over-watering.

3.3 Foundations

Based on the results of our exploration and past experience with similar projects, conventional shallow foundations may be used to support the loads of the proposed structure. Over-excavation and recompaction of footing subgrade soils should be performed as detailed in Section 3.2.2.

3.3.1 Minimum Embedment and Width

Based on our preliminary exploration, footings for the proposed structure should have a minimum embedment of 18 inches, with a minimum width of 24 and 12 inches for isolated and continuous footings, respectively.

3.3.2 Allowable Bearing Capacity

An allowable bearing capacity of 2,500 pounds-per-square-foot (psf) may be used, based on the minimum embedment depth and width, above. This allowable bearing value may be increased by 250 psf per foot increase in embedment-depth or width to a maximum allowable bearing pressure of 3,000 psf. These allowable bearing pressures are for total dead load and sustained live loads, and can be increased by one-third when considering short-duration wind or seismic loads. Footing reinforcement should be designed by the structural engineer.

3.3.3 Lateral Load Resistance

Soil resistance ability to withstand lateral loads on a shallow foundation is a function of the frictional resistance along the base of the footing and the passive resistance that may develop as the face of the structure tends to move into the soil. The frictional resistance between the base of the foundation and the subgrade soil may be computed using a coefficient of friction of 0.35. The passive resistance may be computed using an equivalent fluid pressure of 250 pounds-per-cubic-foot (pcf), assuming there is constant contact between the footing and undisturbed soil. These friction and passive values have already been reduced by a factor-of-safety of 1.5, and can be increased by one-third when considering short-duration wind or seismic loads. For spread footings and slabs-on-grade bearing on properly compacted fill over undisturbed native soils, full friction and passive resistance can be combined to resist lateral loads; although some lateral displacement is required to mobilize full passive resistance.

3.3.4 Settlement Estimates

The above recommended allowable bearing capacity is generally based on a total allowable, post-construction settlement of 1 inch for column loads no-greater-than (≤) 50 kips, with bearing wall loads not exceeding 5 kips-per-foot. Differential settlement is estimated at ½ inch over a horizontal distance of 30 feet. Since settlement is a function of footing sustained load, size and contact bearing pressure, differential settlement can be expected between adjacent columns or walls where a large differential loading condition exists. These settlement estimates should be reevaluated by this firm when foundation plans and actual loads for the proposed structure(s) become available.

3.4 Slab-On-Grade

Concrete slabs subjected to special loads should be designed by the structural engineer. Where conventional light floor loading conditions exist, the following minimum recommendations, which are based on a recompacted, very low expansive subgrade (EI<21), should be used:

- **Subgrade:** Slab-on-grade subgrade soil should be moisture conditioned to at least optimum moisture content prior to placing either a moisture barrier, steel or concrete.

- **Moisture Barrier:** A moisture barrier consisting of 10-mil Visqueen (or equivalent) should then be placed below slabs where moisture-sensitive floor coverings or equipment will be placed. We recommend that vapor retarder system used in the final design be reviewed and approved by the architect or entire design team including concrete subcontractors and manufactures of floor coverings.

- **Reinforced Concrete**: A conventionally reinforced concrete slab-on-grade with a thickness of at least 4 inches should then be placed. We recommend that reinforcement consists of at least No. 3 bars spaced 24-inches on center in two perpendicular directions. As an option, a post-tensioned slab-on-grade can be used. A modulus of subgrade reaction (k) as a linear spring constant, of 150 pounds-per-square-inch per inch deflection (pci) can be used for design of heavily loaded slabs-on-grade, assuming a linear response up to deflections on the order of ¾-inch.

Minor cracking of concrete after curing due to drying and shrinkage, is normal and should be expected. However, cracking is often aggravated by a high water/cement ratio, high concrete temperature at the time of placement, small nominal aggregate size, and rapid moisture loss due to hot, dry, and/or windy weather conditions during placement and curing. Cracking due to temperature and moisture fluctuations can also be expected. The use of low-slump concrete or low water/cement ratios can reduce the potential for shrinkage cracking. Cracking due to ground shaking may also occur.

Moisture barriers can retard, but not eliminate moisture vapor movement from the underlying soils up through the slab. Floor covering manufacturers should be consulted for specific recommendations. If long-term storage of moisture sensitive records (files) or floor coverings (e.g. vinyl tile, etc.) is to be used, additional moisture mitigation measures may be employed within or beneath concrete slab-on-grade floors. Moisture vapor transmission may be additionally reduced by use of concrete additives. Leighton Consulting, Inc. does not practice in the field of moisture vapor transmission evaluation/mitigation. Therefore, we recommend that a qualified person/firm be engaged/consulted with to evaluate the general and specific moisture vapor transmission paths and any impact on the proposed construction. This person/firm should provide recommendations for mitigation of potential adverse impact of moisture vapor transmission on various components of the structure as deemed appropriate.

3.5 Retaining Walls

If retaining walls are to be constructed as part of the development, we recommend that a backdrain be installed in accordance with the recommendations below. Using expansive soil as retaining wall backfill will result in higher lateral earth pressures exerted on the wall. Based on these recommendations for non-expansive backfill, the lateral earth pressure parameters presented in Table 2, *Recommended Lateral Earth Pressures* may be used for the design of conventional retaining walls up to 10 feet tall, with a level backfill:

Table 2. Recommended Lateral Earth Pressures

Conditions	Equivalent Fluid Pressure (pounds-per-cubic-foot)
Active (cantilever)	35 (level backfill)
At-Rest (braced)	55 (level backfill)
Passive	300 (Maximum of 3,500 psf)

Cantilever walls that are designed to yield at least 0.001 multiplied by H, where H is equal to the wall height, may be designed using the active condition. Rigid walls and walls braced at the top should be designed using the at-rest condition. Passive pressure is used to compute soil resistance to lateral structural movement. In addition, for sliding resistance, a frictional resistance coefficient of 0.35 may be used at the concrete and soil interface. The lateral passive resistance should be taken into account only if it is ensured that soil providing passive resistance, embedded against the foundation elements, will remain intact with time.

In addition to the above lateral forces due to retained earth, surcharge due to improvements, such as an adjacent structure or traffic loading, should be considered in the design of the retaining wall. For lateral surcharge conditions, a 2-foot-thick uniform soil surcharge can be used to model light traffic surcharge in the design of the walls. Loads applied within a 1:1 projection from the surcharging structure on the stem of the wall should be considered in the design. A third of uniform vertical surcharge-loads should be applied as a horizontal pressure on cantilever (active) retaining walls, while half of uniform vertical surcharge-loads should be applied as a horizontal pressure on braced (at-rest) retaining walls. For sliding and overturning analyses, soil unit weight of 125 pcf may be assumed for calculating the actual weight of soil over wall footings. Retaining wall footings may be designed in accordance with Section 3.3 of this report.

3.6 Sulfate Attack and Ferrous Corrosion Protection

Based on the 2007 CBC, concrete structures in contact with the onsite soil will have "moderate" exposure to water-soluble sulfates in the soil. Type II cement or similar may be used for design of concrete structures. Import fill soils should be tested for corrosivity and sulfate attack before they are brought on to the site. Additional sulfate content testing should be conducted on the compacted fill soils at or near finished grade, prior to construction, in order to confirm the test results observed during this exploration.

Based on minimum resistivity laboratory test results, tested onsite soil is considered "moderately corrosive" to ferrous metals. Therefore, corrosion protection to ferrous conduit should be considered. Any imported soils should be tested for corrosion prior to being brought on site. In-situ resistivity testing or additional corrosivity testing should be conducted on the compacted fill soils at or near finished grade, prior to construction, in order to confirm the test results observed during this exploration. Corrosion information presented in this report should be provided to your underground utility subcontractors.

3.7 Preliminary Pavement Design

The preliminary pavement design provided in Table 3 is based on an assumed R-value of 35 and Traffic Indices (TIs) ranging from 4 to 7. These pavement sections should be verified based on actual R-value testing performed at the completion of site grading.

Table 3. Asphalt Pavement Sections

Traffic Index	Asphalt Concrete (AC) Thickness (inches)	Class 2 Aggregate Base (AB) Thickness (inches)
4.0 (auto parking)	3.0	4.0
5.0 (auto access)	3.0	4.0
6.0 (main driveways)	3.0	6.0
7.0 (bus lanes)	3.5	8.0

Traffic Indices (TIs) used in our pavement design are considered reasonable values for the proposed pavement, and should provide a pavement life of approximately 20 years with a normal amount of flexible pavement maintenance. Irrigation adjacent to pavements, without a deep curb or other cutoff to separate landscaping from the paving, will result in premature pavement failure. Traffic parameters used for design were selected based on engineering judgment and not on information furnished to us such as an equivalent wheel load analysis or a traffic study.

Asphalt concrete and aggregate base should conform to *Caltrans Standard Specifications* Sections 39 and 26-1.02A, respectively. As an alternative, asphalt concrete can conform to Section 203-6 of the *Standard Specifications for Public Works Construction* (Green Book), 2009 Edition. Crushed aggregate base can conform to Sections 200-2.2 and 200-2.4 of the Green Book, respectively.

4.0 CONSTRUCTION CONSIDERATIONS

4.1 Temporary Excavations and Shoring

All temporary excavations, including utility trenches, retaining wall excavations and other excavations should be performed in accordance with project plans, specifications, all OSHA and Cal-OSHA requirements, and the current edition of the *California Construction Safety Orders*. Contractors should be advised that sandy soils (such as fills generated from the onsite alluvium) could make excavations particularly unsafe. All safety precautions should be properly implemented at all times. Site safety is the responsibility of the contractor. Leighton Consulting, Inc. does not consult in the area of safety engineering.

The contractor must be responsible for providing a "competent person" as defined in Article 6 of the *California Construction Safety Orders*. During construction, exposed soil conditions should be regularly evaluated to verify that conditions are as anticipated.

Spoil piles from the excavation(s) and construction equipment should be kept away from the sides of the trenches. Surcharge loads should not be permitted within a horizontal distance equal to the height of cut or 5 feet, whichever is greater, measured from the top of the cut, unless the cut is shored appropriately. Excavations that extend below an imaginary plane inclined at 45 degrees below the edge of any adjacent existing site foundation should be properly shored to maintain support of the adjacent structures.

Typical cantilever shoring can be designed based on the active equivalent fluid pressure presented in the retaining wall section. If excavations are braced at the top and at specific design intervals, then braced earth pressure may be approximated by a uniform rectangular soil pressure distribution. This uniform pressure expressed in pounds-per-square-foot (psf), may be assumed to be 28 multiplied by H for design, where H is equal to the depth of the excavation being shored, in feet.

4.2 Additional Geotechnical Services

Our geotechnical recommendations presented in this report are based on subsurface conditions as interpreted from five exploratory trenches on this site, and limited geotechnical laboratory testing. Our geotechnical recommendations provided in this report are based on information available at the time the report was prepared and may change as plans are developed. However, additional geotechnical exploration and analysis may be required based on final development plans. Leighton Consulting, Inc. should review site, grading and foundation plans, when available, and comment further on the geotechnical aspects of the project, if needed. Geotechnical observation and testing should be conducted during excavation and all phases of grading. Geotechnical conclusions and preliminary recommendations should be reviewed and verified by us (Leighton Consulting, Inc.) during construction, and revised accordingly if geotechnical conditions encountered vary from our findings and interpretations. Geotechnical observation and testing should be provided:

- After completion of site clearing,
- During over-excavation of compressible soil,
- During compaction of all fill materials,
- After excavation of all footings and prior to placement of concrete,
- During utility trench backfilling and compaction,
- During pavement subgrade and base and/or subbase preparation, and
- When any unusual conditions are encountered.

5.0 LIMITATIONS

This report was based in part on data obtained from a limited number of observations, site visits, soil excavations, samples and tests. Such information is, by necessity, incomplete. The nature of many sites is such that differing soil or geologic conditions can be present within small distances and under varying climatic conditions. Changes in subsurface conditions can and do occur over time. Therefore, our findings, conclusions and recommendations presented in this report are based on the assumption that Leighton Consulting, Inc. will provide geotechnical observation and testing during construction.

Environmental services were not included as part of this study, nor are they within the scope of this report. This report was prepared for the sole use of Williams Architects and their design team, for application to the design of the proposed facility in accordance with generally accepted geotechnical engineering practices at this time in California.

REFERENCES

Blake, T. F., 2000, EQFAULT, *A Computer Program for the Estimation of Peak Horizontal Acceleration from 3-D Fault Sources*, Windows 95/98 Version, User's Manual, April 2000.

Boore, D.M., Joyner, W.B. and T.E. Fumal, 1997, *Equations for Estimating Horizontal Response Spectra and Peak Acceleration from Western North American Earthquakes*. *Seismological Research Letters*, Vol. 68, No. 1, January/February, pp. 128-153.

Bryant, William A., 1992, Surface Rupture along the Johnson Valley, Homestead Valley, and Related Faults Associated with the Ms 7.5 28 June 1992 Landers Earthquake, CGS Fault Evaluation Report, FER-234, dated November 17, 1992.

California Department of Water Resources (CDWR), 2000, *Water Data Library* (WDL) home page, http://well.water.ca.gov/.

California Geologic Survey, 1998, *Maps of Known Active Fault Near-Source Zones in California and Adjacent Portions of Nevada*, to be used with the 1997 Uniform Building Code, International Conference of Building Officials, February, 1998.

California Geologic Survey, 2000, CD-ROM containing digital images of *Official Maps of Alquist-Priolo Earthquake Fault Zones that affect the Southern Region*, DMG CD 2000-003 2000.

California Geologic Survey, 2003, Seismic Shaking Hazards in California, Based on the USGS/CGS Probabilistic Seismic Hazards Assessment (PSHA) Model, 2002 (revised April 2003), *CGS website*, http://www.consrv.ca.gov/cgs/rghm/pshamap/pshamain.html.

California Geologic Survey, 2010, *Fault Activity Map of California*

Campbell, K.W. and Y. Bozorgnia (2003), *Updated Near-Source Ground Motion (Attenuation) Relations for the Horizontal and Vertical Components of Peak Ground Acceleration and Acceleration Response Spectra*, Bulletin of the Seismological Society of America, Vol. 93, No. 1, February, pp. 314-331.

Cao, T., Bryant, W. A., Rowshandel, B., Branum, D., and Wills, C. J., 2003, *The Revised 2002 California Probabilistic Seismic Hazard Maps*, June 2003.

Civiltech Corporation, 2005, Liquefy Pro Version 5.1, A Computer Program for Evaluation of Liquefaction and Seismic Settlement.

FEMA, 2008, Flood Hazard Map 06065C1585G, August, 2008.

Frankel, A.D., Petersen, M.D., Mueller, C.S., Haller, K., Wheeler, R.L., Leyendecker, E.V., Wesson, R.L., Harmsen, S.C., Cramer, C.H., Perkins, D.M., and K.S. Rukstales (2002), *Documentation for the 2002 Update of the National Seismic Hazard Maps*, USGS Open-File Report 02-420, U.S. Geological Survey, Denver, CO.

Frankel, A.D., Mueller, C.S., Barnhard, T., Perkins, D.M., Leyendecker, E.V., Dickman, N., Hanson, S., and M. Hopper (1996), *National Seismic Hazard Maps, June 1996 Documentation*, USGS Open-File Report 96-532, U.S. Geological Survey, Denver, CO.

International Conference of Building Officials (ICBO), *Maps of Known Active Fault Near-Source Zones in California and Adjacent Portion of Nevada* - To be Used With the 1997 Uniform Building Code, Prepared by California Department of Conservation, Division of Mines and Geology in cooperation with Structural Engineers Association of California - Seismology Committee, February.

Ishihara, K., and Yoshimine, M., 1992, *Evaluation of Settlements in Sand Deposits Following Liquefaction during Earthquakes, Soils and Foundations*, Vol. 32, No. 1, p. 173-188.

Jennings, C.W., 1994, *Fault Activity Map of California and Adjacent Areas*, California Division of Mines and Geology, Geologic Data Map Series, No. 6, Scale 1:750,000.

Leighton and Associates, Inc., 2011, Fault Investigation Report, Proposed Yucca Valley Animal Shelter, Yucca Valley, California, dated July 13, 2011, Project No. 603176-002.

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

Morton, D.M., and Miller, F.K., 2004, *Preliminary Geologic Map of the Santa Ana 30'X60' Quadrangle, Southern California,* USGS Open File Report 99-172, Sheet 1 of 2, digital version 2.0.

Public Works Standard, Inc., 2009, *Greenbook, Standard Specifications for Public Works Construction: 2009 Edition*, BNI Building News, Anaheim, California.

Riverside County, 2003, *County of Riverside General Plan*, Riverside County Integrated Project Web Site.

Tokimatsu, K. and H.B. Seed, 1987, *Evaluation of Settlements in Sands Due to Earthquake Shaking*, Journal of Geotechnical Engineering Division, ASCE, Vol. 113, No. 8, published August 1987.

Wesnousky, S. G., 1986, *Earthquakes, Quaternary Faults, and Seismic Hazard in California*, Journal of Geophysical Research, v.91, p. 12,587-12,631.

Youd, T. L., and Idriss, I. M., 1997, *Proceedings of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils,* Technical Report NCEER-97-0022, p. 1-88.

Youd, T.L. and I.M. Idriss (Co-Chair), 2001, *Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils*, Journal of Geotechnical and Geoenvironmental Engineering, ASCE, Vol. 127, No. 10, published October 2001.

Project: 603176-001	Eng/Geol: SIS/RFR
Scale: 1 " = 2,000 '	Date: July, 2011

Base Map: ESRI Resource Center, 2010
Thematic Info: Leighton
Author: (mmurphy)

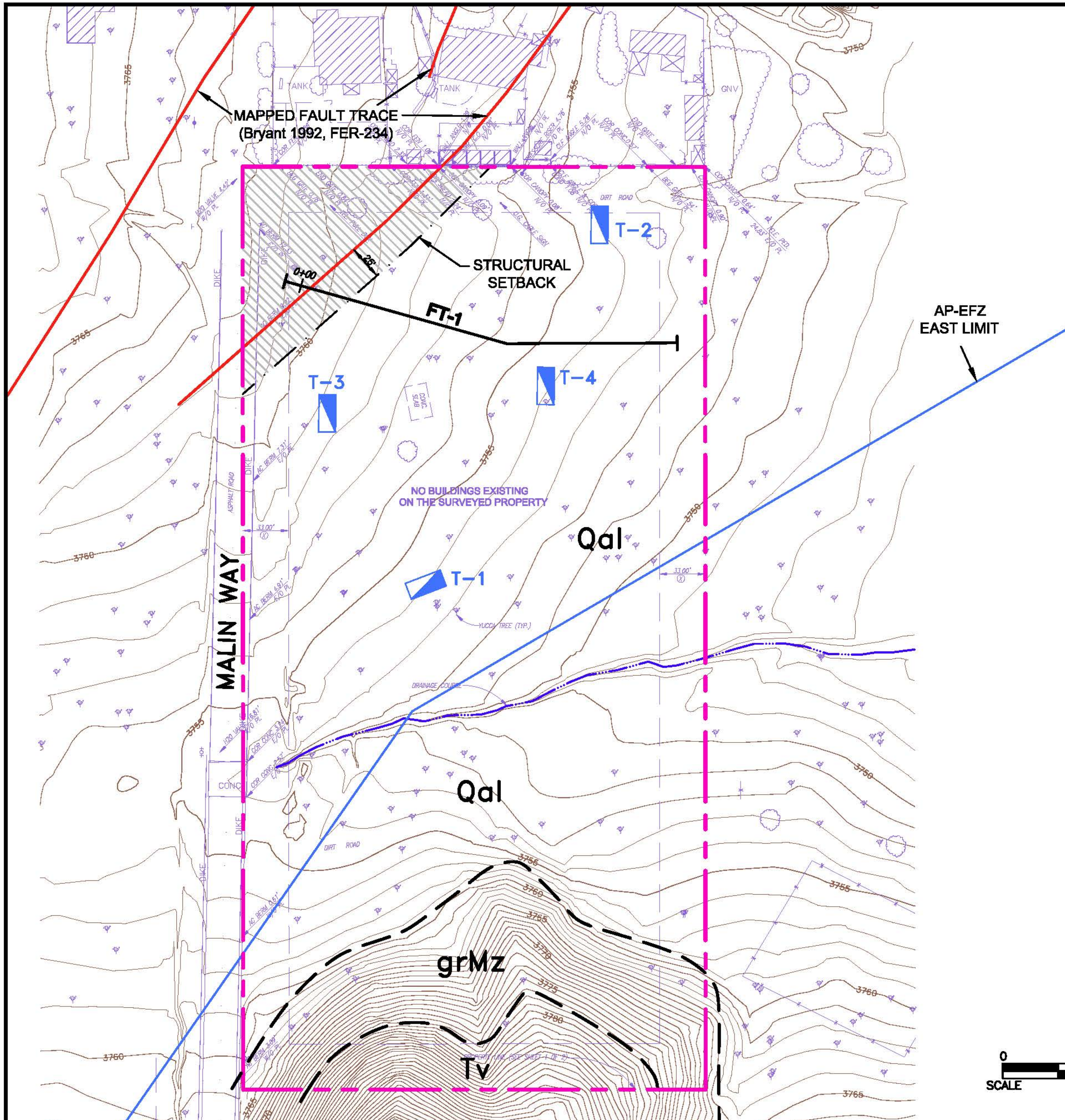
SITE LOCATION MAP

Yucca Valley Animal Shelter
Yucca Valley, California

Figure 1

Leighton

Map Saved as P:\drafting\603176\002\GIS\Figure1.mxd on 7/6/2011 9:10:03 AM



LEGEND

(magenta dashed box)	SITE BOUNDARY
0+00 FT-1	LOCATION OF FAULT EXPLORATION TRENCH (SEPARATE STUDY, LEIGHTON, 2011)
(black dashed line)	APPROXIMATE GEOLOGIC CONTACT
(red line)	FAULT TRACE, BRYANT 1992
(hatched box)	STRUCTURE SETBACK ZONE
T-1	APPROXIMATE TEST PIT LOCATION
Qal	ALLUVIUM
Tv	TERTIARY VOLCANICS
grMz	MESOZOIC UNDIFFERENTIATED GRANITIC BEDROCK

N

0 80 160

SCALE FEET

REFERENCE: KELSOE AND ASSOCIATES, INC., ALTA/ACSM LAND TITLE SURVEY, JOB NO. KA1 11-2093, DATED 05-12-11

GEOTECHNICAL MAP

YUCCA VALLEY ANIMAL SHELTER

YUCCA VALLEY, CALIFORNIA

FIGURE 2

Proj: 603176-001	Eng/Geol: SIS/RFR
Scale: 1"=80'	Date: 07/2011

Leighton

A P P E N D I X   A

Logs of Test Pits and Results of Geotechnical Laboratory Testing

Logs of Test Pits

The field exploration was performed on June 27, 2011 and consisted of 4 exploratory test pits and a fault trench. The results of the fault trench are submitted under a separate cover (Leighton, 2011). The test pits were excavated using a rubber-tire backhoe (Cat 630). Test pits locations are shown on the accompanying Figure 2.

Encountered soils were continuously logged in the field by our representative and described in accordance with the Unified Soil Classification System (ASTM D 2488). Bulk samples of representative soil types were obtained from the test pits. Logs of these subsurface explorations, as well as a key to the classification of the soil, are included as part of this appendix.

The attached subsurface exploration logs and related information depict subsurface conditions only at the locations indicated and at the particular date designated on the logs. Subsurface conditions at other locations may differ from conditions occurring at these locations. The passage of time may result in altered subsurface conditions due to environmental changes. In addition, any stratification lines on the logs represent the approximate boundary between soil types and the transition may be gradual.

LOG OF TEST PIT

PROJECT NO.:	603176-001	**LOGGED BY:**	JTD
PROJECT NAME:	Yucca Valley Animal Shelter	**EQUIPMENT:**	Cat 460 Backhoe
LOCATION:	See Figure 2	**DATE:**	6/27/2011
ELEVATION:	~3754	**TREND OF TRENCH:**	N 80° W

TEST PIT NO.: T-1

Depth (ft)	SAMPLES: Sample Type*	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	REMARKS
0			SM	@ Surface: **Quaternary Alluvium (Qal)**; Light Gray-Brown, dry-to-damp, silty fine to coarse grained SAND with fine Gravel, organics @ 0-2.0': Brown, damp-to-moist, Silty fine to coarse grained SAND, abundant roots @ 2.0'-12.0': Gray-Brown, moist, Silty fine to coarse grained SAND, interbedded Sand and Silt layers, few fine gravel and cobble	
12			SW	@ 12.0'-15.0': **Older Alluvium (Qalo)**; Dark Yellow-Brown, moist, fine to coarse grained SAND with fine Gravel, few Silt and Clay	
15				Total Depth = 15.0' Below Ground Surface, Backfilled with Spoils	

Depth scale marks: 5, 10, 15

LEGEND

Sample Type: ---Small Bulk ---Large Bulk ---Chunk

Laboratory Testing:
AL = Attiberg Limits
EI = Expansion Index
RV = R-Value Test
SA = Sieve Analysis
SR = Sulfate/Resisitivity Test
SH = Shear Testing
MD = Maximum Density

LOG OF TEST PIT

PROJECT NO.:	603176-001	**LOGGED BY:**	JTD
PROJECT NAME:	Yucca Valley Animal Shelter	**EQUIPMENT:**	Cat 630 Backhoe
LOCATION:	See Figure 2	**DATE:**	6/27/2011
ELEVATION:	~3755	**TREND OF TRENCH:**	NS

TEST PIT NO.: T-2

Depth (ft)	SAMPLES: Sample Type*	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Dry Density (pcf)*	Moisture (%)*	Laboratory
			SM	@ Surface: **Quaternary Alluvium (Qal)**; Light Gray-Brown, dry-to-damp, Silty fine to coarse grained SAND, trace fine Gravel, organics			
			SW-SM	@ 0-1.5': Light Gray-Brown, damp-to-moist, interbedded fine to coarse grained SAND and Silty SAND with fine Gravel, abundant roots			
			SW	@ 1.5'-3.0': Light Gray, damp-to-moist, fine to coarse grained SAND with fine Gravel, trace silt	97.4	7.1	
5	Large Bulk	B-1	SM	@ 3.0'-8.0': Gray-Brown, moist, Silty fine to medium grained SAND (130.5 @ 8.0%, 15% fines, EI=0)	104.0	5.8	MD, SA, EI, CR
10			SW	@ 8.0'-11.0': Gray-Brown, moist, fine to coarse grained SAND, few Gravel and Cobble to 6", caving			
			SW	@ 11.0'-12.0': **Older Alluvium (Qalo)**: Dark Yellow-Brown, moist, fine to coarse grained SAND with fine Gravel, trace Clay			
15				Total Depth = 12.0' Below ground srurface, no groundwater encountered, backfilled with spoils on 06-27-11			

* Dry Density and Moisture content were determined in the field via ASTM D6938 Nuclear Gauge Method

LEGEND

Sample Type: ---Small Bulk ---Large Bulk ---Chunk

Laboratory Testing: AL = Attiberg Limits; EI = Expansion Index; RV = R-Value Test; SA = Sieve Analysis; SR = Sulfate/Resisitivity Test; SH = Shear Testing; MD = Maximum Density

LOG OF TEST PIT

PROJECT NO.:	603176-001	**LOGGED BY:**	JTD
PROJECT NAME:	Yucca Valley Animal Shelter	**EQUIPMENT:**	Cat 630 Backhoe
LOCATION:	See Figure 2	**DATE:**	6/27/2011
ELEVATION:	~3757	**TREND OF TRENCH:**	N 40° E

TEST PIT NO.: T-3

Depth (ft)	SAMPLES: Sample Type*	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Dry Density (pcf)*	Moisture (%)*	Remarks
	Large Bulk	B-1		@ Surface: **Quaternary Alluvium (Qal)**; Light Gray-Brown, dry-to-damp, silty fine to coarse grained SAND, abundant fine Gravel, organics			
			SM	@ 0-2.0': Light Gray-Brown, damp-to-moist, Silty fine to coarse grained SAND, few fine Gravel, abundant roots			
				@ 2.0'-6.0': Light Gray-Brown, damp-to-moist, Silty fine to coarse grained SAND, few fine gravel, caving	105.7	5.5	
					103.1	5.0	
5							
				@ 6.0'-12.0': Yellow Brown, damp-to-moist, Silty fine to coarse grained SAND, few Gravel and Cobble to 8"			
10							
				@ 12.0'-13.0': **Older Alluvium (Qalo)**; Dark Yellow-Brown, moist, fine to coarse grained SAND, few Silt, trace fine Gravel			
				Total Depth = 13.0' below ground surface, no groundwater encountered, backfilled with spoils on 06-28-11			
15							
				* Dry Density and Moisture content were determined in the field via ASTM D6938 Nuclear Gauge Method			

LEGEND

Sample Type: ---Small Bulk ---Large Bulk ---Chunk

Laboratory Testing: AL = Attiberg Limits; EI = Expansion Index; RV = R-Value Test; SA = Sieve Analysis; SR = Sulfate/Resisitivity Test; SH = Shear Testing; MD = Maximum Density

LOG OF TEST PIT

PROJECT NO.:	603176-001	**LOGGED BY:**	JTD
PROJECT NAME:	Yucca Valley Animal Shelter	**EQUIPMENT:**	Cat 630 Backhoe
LOCATION:	See Figure 2	**DATE:**	6/27/2011
ELEVATION:	~3754	**TREND OF TRENCH:**	N 40° E

TEST PIT NO.: T-4

Depth (ft)	SAMPLES: Sample Type*	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Dry Density (pcf)*	Moisture (%)*	Laboratory
				@ Surface: <u>Quaternary Alluvium (Qal)</u>; Light Gray-Brown, dry-to-damp, silty fine to coarse grained SAND, abundant fine Gravel, organics			
			SM	@ 0-2.0': Light Gray-Brown, damp-to-moist, Silty fine to coarse grained SAND, few fine gravel, abundant roots			
				@ 2.0'-4.0': Light Gray-Brown, damp-to-moist, Silty fine to coarse grained SAND, few fine Gravel	98.9	5.8	
				@ 4.0'-10.0': Gray-Brown, moist, Silty fine to coarse grained SAND, few fine Gravel	100.9	6.3	
5							
10			SW	@ 10.0'-14.0': Yellow-Brown, moist, fine to coarse grained SAND with abundant Gravel and Cobble to 8"			
	Large Bulk	B-1	SP-SM	@ 14.0'-15.0': <u>Older Alluvium (Qalo)</u>; Dark Yellow-Brown, moist, fine to coarse silty SAND with fine Gravel, trace Clay (SA=10% fines)			SA
15				Total Depth = 15.0' below ground surface, no groundwater encountered, backfilled with spoils on 06-28-11			
				* Dry Density and Moisture content were determined in the field via ASTM D6938 Nuclear Gauge Method			

LEGEND

Sample Type: ---Small Bulk ---Large Bulk ---Chunk

Laboratory Testing: AL = Attiberg Limits; EI = Expansion Index; RV = R-Value Test; SA = Sieve Analysis; SR = Sulfate/Resisitivity Test; SH = Shear Testing; MD = Maximum Density

Results of Geotechnical Laboratory Testing

MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Leighton

Project Name:	Yucca Valley Animal Shelter	Tested By :	G. Berdy	Date:	07/07/11
Project No.:	603176-001	Input By :	J. Ward	Date:	07/08/11
Boring No.:	T-2	Depth (ft.)	4-5		
Sample No. :	B-1				
Soil Identification:	Olive silty sand (SM)				

Preparation Method: [X] Moist [ ] Dry — [X] Mechanical Ram [ ] Manual Ram

Mold Volume (ft³) 0.03340 — *Ram Weight = 10 lb.; Drop = 18 in.*

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	3853.0	3972.0	4025.0	3984.0		
Weight of Mold (g)	1880.0	1880.0	1880.0	1880.0		
Net Weight of Soil (g)	1973.0	2092.0	2145.0	2104.0		
Wet Weight of Soil + Cont. (g)	621.20	637.30	575.80	622.00		
Dry Weight of Soil + Cont. (g)	605.30	612.00	546.20	581.30		
Weight of Container (g)	224.60	227.20	233.70	230.70		
Moisture Content (%)	4.18	6.57	9.47	11.61		
Wet Density (pcf)	130.2	138.1	141.6	138.9		
Dry Density (pcf)	125.0	129.6	129.3	124.4		

Maximum Dry Density (pcf) 130.5 — **Optimum Moisture Content (%)** 8.0

PROCEDURE USED

[X] **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

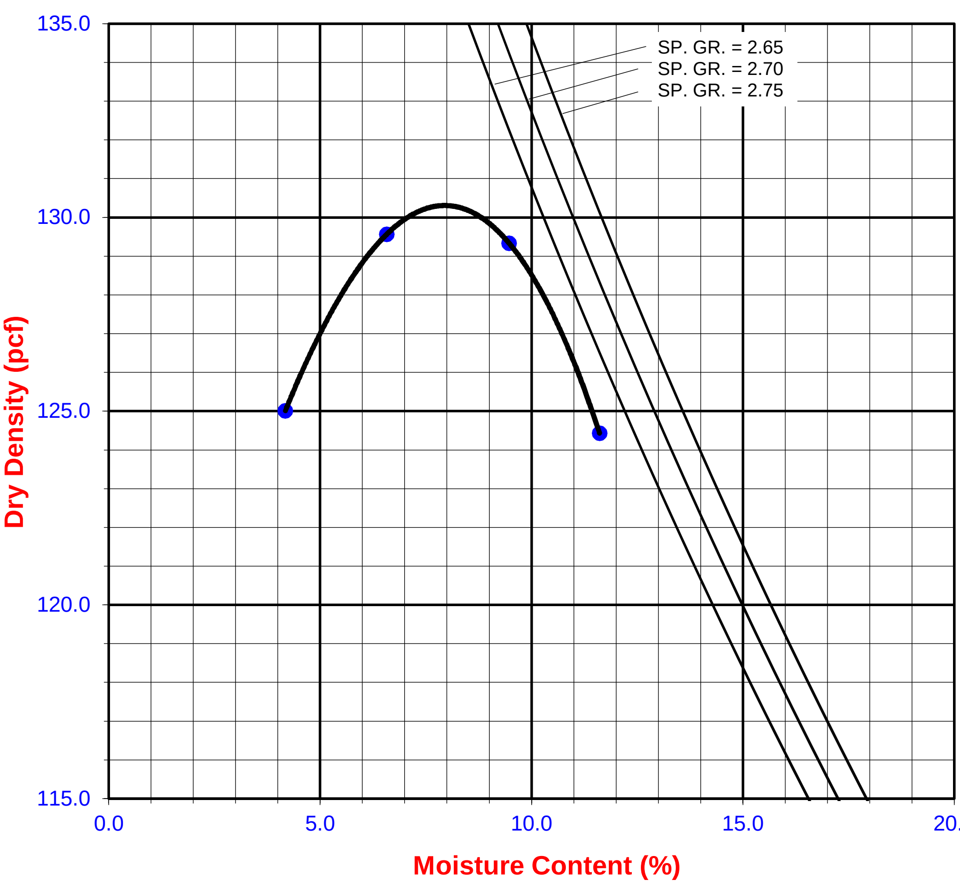
[ ] **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

[ ] **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution:
2:83:15
GR:SA:FI

Atterberg Limits:

LL,PL,PI



EXPANSION INDEX of SOILS

ASTM D 4829

Leighton

Project Name:	Yucca Valley Animal Shelter	Tested By:	S. Felter	Date:	07/06/11
Project No. :	603176-001	Checked By:	J. Ward	Date:	07/08/11
Boring No.:	T-2	Depth (ft.)	4-5		
Sample No. :	B-1				
Soil Identification:	Olive silty sand (SM)				

Dry Wt. of Soil + Cont. (g)	1000.00
Wt. of Container No. (g)	0.00
Dry Wt. of Soil (g)	1000.00
Weight Soil Retained on #4 Sieve	0.00
Percent Passing # 4	100.00

MOLDED SPECIMEN	Before Test	After Test
Specimen Diameter (in.)	4.01	4.01
Specimen Height (in.)	1.0000	0.9990
Wt. Comp. Soil + Mold (g)	622.40	432.00
Wt. of Mold (g)	205.10	0.00
Specific Gravity (Assumed)	2.70	2.70
Container No.	O	O
Wet Wt. of Soil + Cont. (g)	826.40	637.10
Dry Wt. of Soil + Cont. (g)	760.20	589.00
Wt. of Container (g)	0.00	205.10
Moisture Content (%)	8.71	12.53
Wet Density (pcf)	125.9	130.4
Dry Density (pcf)	115.8	115.9
Void Ratio	0.456	0.454
Total Porosity	0.313	0.312
Pore Volume (cc)	64.8	64.6
Degree of Saturation (%) [S_{meas}]	**51.6**	74.5

SPECIMEN INUNDATION in distilled water for the period of 24 h or expansion rate < 0.0002 in./h

Date	Time	Pressure (psi)	Elapsed Time (min.)	Dial Readings (in.)
07/06/11	11:20	1.0	0	0.0930
07/06/11	11:30	1.0	10	0.0930
Add Distilled Water to the Specimen				
07/06/11	12:55	1.0	85	0.0930
07/07/11	6:45	1.0	1155	0.0920
07/07/11	8:10	1.0	1240	0.0920

Expansion Index (EI_{meas}) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	**0**

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PARTICLE-SIZE DISTRIBUTION (GRADATION) of SOILS USING SIEVE ANALYSIS

ASTM D 6913

Project Name: Yucca Valley Animal Shelter

Project No.: 603176-001

Exploration No.: T-2

Sample No.: B-1

Soil Identification: Olive silty sand (SM)

Tested By: A. Santos Date: 07/05/11

Checked By: J. Ward Date: 07/08/11

Depth (feet): 4-5

Calculation of Dry Weights	Whole Sample	Sample Passing #4	Moisture Contents	Whole Sample	Sample passing #4
Container No.:	N/A	903	Wt. of Air-Dry Soil + Cont.(g)	1232.90	0.00
Wt. Air-Dried Soil + Cont.(g)	16929.60	625.30	Wt. of Dry Soil + Cont. (g)	1184.60	0.00
Wt. of Container (g)	58.20	110.50	Wt. of Container No.______(g)	110.50	1.00
Dry Wt. of Soil (g)	16144.88	514.80	Moisture Content (%)	4.50	0.00

Passing #4 Material After Wet Sieve		
	Container No.	903
	Wt. of Dry Soil + Container (g)	549.20
	Wt. of Container (g)	110.50
	Dry Wt. of Soil Retained on # 200 Sieve (g)	438.70

U. S. Sieve Size		Cumulative Weight of Dry Soil Retained (g)		Percent Passing (%)
	(mm.)	Whole Sample	Sample Passing #4	
6"	152.400			
3"	75.000			
1 1/2	37.500	0.00		100.0
3/4"	19.000	29.04		99.8
3/8"	9.500	92.65		99.4
#4	4.750	265.80		98.4
#8	2.360		52.24	88.4
#16	1.180		151.52	69.4
#30	0.600		240.00	52.5
#50	0.300		321.10	37.0
#100	0.150		391.10	23.6
#200	0.075		435.50	15.2
PAN				

GRAVEL: **2 %**

SAND: **83 %**

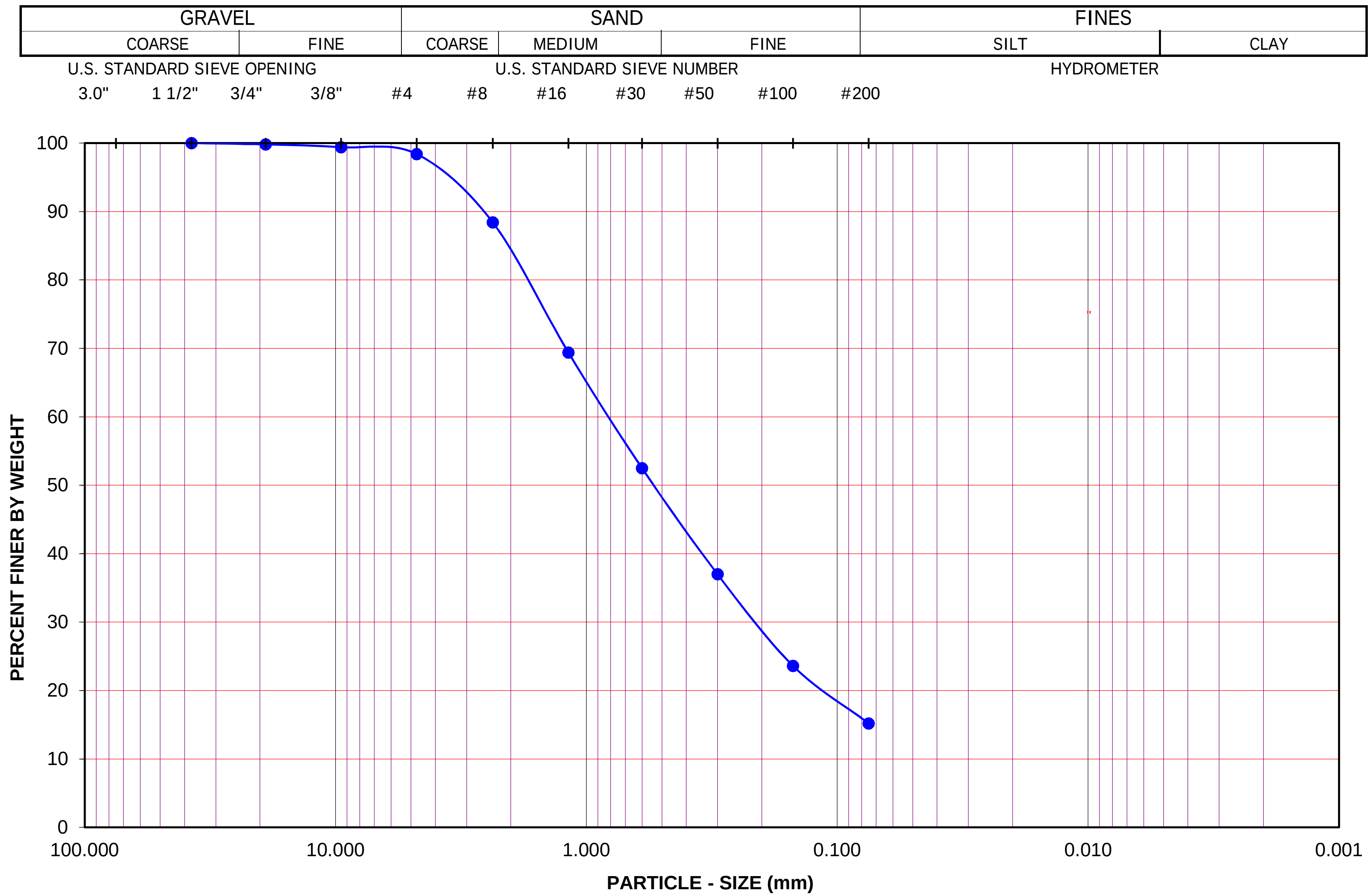
FINES: **15 %**

GROUP SYMBOL: **SM**

Cu = D60/D10 = ________

Cc = $(D30)^2/(D60*D10)$ = ________

Remarks:



Project Name: Yucca Valley Animal Shelter

Project No.: 603176-001

Exploration No.: T-2 | Sample No.: B-1

Depth (feet): 4-5 | Soil Type : SM

Soil Identification: Olive silty sand (SM)

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 6913

GR:SA:FI : (%) 2 : 83 : 15

Jul-11

Leighton

Soluble Sulfates
(Hach Sulfate Test Kit)

Project Name: Yucca Valley Animal Shelter
Project Number: 603176-001
Date: 07/06/11
Technician: A. Santos

Sample Identification		Dilution	Reading (PPM)			**% Sulfates**
			Tube Reading		H_2O:Soil Ratio	
Boring No.:	T-2	3 :1	50	X	3	**0.0150**
Sample No:	B-1		=	150		
Depth (ft.):	4-5					
Boring No.:						
Sample No:						
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Depth (ft.):						

A P P E N D I X B

General Earthwork and Grading Guidelines

APPENDIX B

LEIGHTON CONSULTING, INC.
EARTHWORK AND GRADING GUIDE SPECIFICATIONS

TABLE OF CONTENTS

B-1.0 GENERAL

B-1.1 Intent

These Earthwork and Grading Guide Specifications are for grading and earthwork shown on the current, approved grading plan(s) and/or indicated in the Leighton Consulting, Inc. geotechnical report(s). These Guide Specifications are a part of the recommendations contained in the geotechnical report(s). In case of conflict, the project-specific recommendations in the geotechnical report shall supersede these Guide Specifications. Leighton Consulting, Inc. shall provide geotechnical observation and testing during earthwork and grading. Based on these observations and tests, Leighton Consulting, Inc. may provide new or revised recommendations that could supersede these specifications or the recommendations in the geotechnical report(s).

B-1.2 Role of Leighton Consulting, Inc.

Prior to commencement of earthwork and grading, Leighton Consulting, Inc. shall meet with the earthwork contractor to review the earthwork contractor's work plan, to schedule sufficient personnel to perform the appropriate level of observation, mapping and compaction testing. During earthwork and grading, Leighton Consulting, Inc. shall observe, map, and document subsurface exposures to verify geotechnical design assumptions. If observed conditions are found to be significantly different than the interpreted assumptions during the design phase, Leighton Consulting, Inc. shall inform the owner, recommend appropriate changes in design to accommodate these observed conditions, and notify the review agency where required. Subsurface areas to be geotechnically observed, mapped, elevations recorded, and/or tested include (1) natural ground after clearing to receiving fill but before fill is placed, (2) bottoms of all "remedial removal" areas, (3) all key bottoms, and (4) benches made on sloping ground to receive fill.

Leighton Consulting, Inc. shall observe moisture-conditioning and processing of the subgrade and fill materials, and perform relative compaction testing of fill to determine the attained relative compaction. Leighton Consulting, Inc. shall provide *Daily Field Reports* to the owner and the Contractor on a routine and frequent basis.

B-1.3 The Earthwork Contractor

The earthwork contractor (Contractor) shall be qualified, experienced and knowledgeable in earthwork logistics, preparation and processing of ground to receive fill, moisture-conditioning and processing of fill, and compacting fill. The Contractor shall review and accept the plans, geotechnical report(s), and these Guide Specifications prior to commencement of grading. The Contractor shall be solely responsible for performing grading and backfilling in accordance with the current, approved plans and specifications.

The Contractor shall inform the owner and Leighton Consulting, Inc. of changes in work schedules at least one working day in advance of such changes so that appropriate observations and tests can be planned and accomplished. The Contractor shall not assume that Leighton Consulting, Inc. is aware of all grading operations.

The Contractor shall have the sole responsibility to provide adequate equipment and methods to accomplish earthwork and grading in accordance with the applicable grading codes and agency ordinances, these Guide Specifications, and recommendations in the approved geotechnical report(s) and grading plan(s). If, in the opinion of Leighton Consulting, Inc., unsatisfactory conditions, such as unsuitable soil, improper moisture condition, inadequate compaction, adverse weather, etc., are resulting in a quality of work less than required in these specifications, Leighton Consulting, Inc. shall reject the work and may recommend to the owner that earthwork and grading be stopped until unsatisfactory condition(s) are rectified.

B-2.0 PREPARATION OF AREAS TO BE FILLED

B-2.1 Clearing and Grubbing

Vegetation, such as brush, grass, roots and other deleterious material shall be sufficiently removed and properly disposed of in a method acceptable to the owner, governing agencies and Leighton Consulting, Inc.. Care should be taken not to encroach upon or otherwise damage native and/or historic trees designated by the Owner or appropriate agencies to remain. Pavements, flatwork or other construction should not extend under the “drip line” of designated trees to remain.

Leighton Consulting, Inc. shall evaluate the extent of these removals depending on specific site conditions. Earth fill material shall not contain more than 3 percent of organic materials (by dry weight: ASTM D 2974-00). Nesting of the organic materials shall not be allowed.

If potentially hazardous materials are encountered, the Contractor shall stop work in the affected area, and a hazardous material specialist shall be informed immediately for proper evaluation and handling of these materials prior to continuing to work in that area. As presently defined by the State of California, most refined petroleum products (gasoline, diesel fuel, motor oil, grease, coolant, etc.) have chemical constituents that are considered to be hazardous waste. As such, the indiscriminate dumping or spillage of these fluids onto the ground may constitute a misdemeanor, punishable by fines and/or imprisonment, and shall not be allowed.

B-2.2 Processing

Existing ground that has been declared satisfactory for support of fill, by Leighton Consulting, Inc., shall be scarified to a minimum depth of 6 inches (15 cm). Existing ground that is not satisfactory shall be overexcavated as specified in the following Section B-2.3. Scarification shall continue until soils are broken down and free of large clay lumps or clods and the working surface is reasonably uniform, flat, and free of uneven features that would inhibit uniform compaction.

B-2.3 Overexcavation

In addition to removals and overexcavations recommended in the approved geotechnical report(s) and the grading plan, soft, loose, dry, saturated, spongy, organic-rich, highly fractured or otherwise unsuitable ground shall be overexcavated to competent ground as evaluated by Leighton Consulting, Inc. during grading. All undocumented fill soils under proposed structure footprints should be excavated

B-2.4 Benching

Where fills are to be placed on ground with slopes steeper than 5:1 (horizontal to vertical units), (>20 percent grade) the ground shall be stepped or benched. The lowest bench or key shall be a minimum of 15 feet (4.5 m) wide and at least 2 feet (0.6 m) deep, into competent material as evaluated by Leighton Consulting, Inc.. Other benches shall be excavated a minimum height of 4 feet (1.2 m) into competent material or as otherwise recommended by Leighton Consulting, Inc.. Fill placed on ground sloping flatter than 5:1 (horizontal to vertical units), (<20 percent grade) shall also be benched or otherwise overexcavated to provide a flat subgrade for the fill.

B-2.5 Evaluation/Acceptance of Fill Areas

All areas to receive fill, including removal and processed areas, key bottoms, and benches, shall be observed, mapped, elevations recorded, and/or tested prior to being accepted by Leighton Consulting, Inc. as suitable to receive fill. The Contractor shall obtain a written acceptance (*Daily Field Report*) from Leighton Consulting, Inc. prior to fill placement. A licensed surveyor shall provide the survey control for determining elevations of processed areas, keys, and benches.

B-3.0 FILL MATERIAL

B-3.1 Fill Quality

Material to be used as fill shall be essentially free of organic matter and other deleterious substances evaluated and accepted by Leighton Consulting, Inc. prior to placement. Soils of poor quality, such as those with unacceptable gradation, high expansion potential, or low strength shall be placed in areas acceptable to Leighton Consulting, Inc. or mixed with other soils to achieve satisfactory fill material.

B-3.2 Oversize

Oversize material defined as rock, or other irreducible material with a maximum dimension greater than 6 inches (15 cm), shall not be buried or placed in fill unless location, materials and placement methods are specifically accepted by Leighton Consulting, Inc.. Placement operations shall be such that nesting of oversized material does not occur and such that oversize material is completely surrounded by compacted or densified fill. Oversize material shall not be placed within 10 feet (3 m) measured vertically from finish grade, or within 2 feet (0.61 m) of future utilities or underground construction.

B-3.3 Import

If importing of fill material is required for grading, proposed import material shall meet the requirements of Section B-3.1, and be free of hazardous materials ("contaminants") and rock larger than 3-inches (8 cm) in largest dimension. All import soils shall have an Expansion Index (EI) of 20 or less and a sulfate content no greater than (≤) 500 parts-per-million (ppm). A representative sample of a potential import source shall be given to Leighton Consulting, Inc. at least four full working days before importing begins, so that suitability of this import material can be determined and appropriate tests performed.

B-4.0 FILL PLACEMENT AND COMPACTION

B-4.1 Fill Layers

Approved fill material shall be placed in areas prepared to receive fill, as described in Section B-2.0, above, in near-horizontal layers not exceeding 8 inches (20 cm) in loose thickness. Leighton Consulting, Inc. may accept thicker layers if testing indicates the grading procedures can adequately compact the thicker layers, and only if the building officials with the appropriate jurisdiction approve. Each layer shall be spread evenly and mixed thoroughly to attain relative uniformity of material and moisture throughout.

B-4.2 Fill Moisture Conditioning

Fill soils shall be watered, dried back, blended, and/or mixed, as necessary to attain a relatively uniform moisture content at or slightly over optimum. Maximum density and optimum soil moisture content tests shall be performed in accordance with the American Society of Testing and Materials (ASTM) Test Method D 1557.

B-4.3 Compaction of Fill

After each layer has been moisture-conditioned, mixed, and evenly spread, it shall be uniformly compacted to not less than 90 percent of maximum dry density as determined by ASTM Test Method D 1557. For fills thicker than 15 feet (4.5 m), the portion of the fill deeper than 15 feet below proposed finish grade shall be compacted to 95 percent of the ASTM D 1557 laboratory maximum density. Compaction equipment shall be adequately sized and be either specifically designed for soil compaction or of proven reliability to efficiently achieve the specified level of compaction with uniformity.

B-4.4 Compaction of Fill Slopes

In addition to normal compaction procedures specified above, compaction of slopes shall be accomplished by backrolling of slopes with sheepsfoot rollers at increments of 3 to 4 feet (1 to 1.2 m) in fill elevation, or by other methods producing satisfactory results acceptable to Leighton Consulting, Inc.. Upon completion of grading, relative compaction of the fill, out to the slope face, shall be at least 90 percent of the ASTM D 1557 laboratory maximum density.

B-4.5 Compaction Testing

Field-tests for moisture content and relative compaction of the fill soils shall be performed by Leighton Consulting, Inc.. Location and frequency of tests shall be at our field representative(s) discretion based on field conditions encountered. Compaction test locations will not necessarily be selected on a random basis. Test locations shall be selected to verify adequacy of compaction levels in areas that are judged to be prone to inadequate compaction (such as close to slope faces and at the fill/bedrock benches).

B-4.6 Compaction Test Locations

Leighton Consulting, Inc. shall document the approximate elevation and horizontal coordinates of each density test location. The Contractor shall coordinate with the project surveyor to assure that sufficient grade stakes are established so that Leighton Consulting, Inc. can determine the test locations with sufficient accuracy. Adequate grade stakes shall be provided.

B-5.0 EXCAVATION

Excavations, as well as over-excavation for remedial purposes, shall be evaluated by Leighton Consulting, Inc. during grading. Remedial removal depths shown on geotechnical plans are estimates only. The actual extent of removal shall be determined by Leighton Consulting, Inc. based on the field evaluation of exposed conditions during grading. Where fill-over-cut slopes are to be graded, the cut portion of the slope shall be made, evaluated, and accepted by Leighton Consulting, Inc. prior to placement of materials for construction of the fill portion of the slope, unless otherwise recommended by Leighton Consulting, Inc..

B-6.0 TRENCH BACKFILLS

B-6.1 Safety

The Contractor shall follow all OSHA and Cal/OSHA requirements for safety of trench excavations. Work should be performed in accordance with Article 6 of the *California Construction Safety Orders*, 2003 Edition or more current (see also: http://www.dir.ca.gov/title8/sb4a6.html).

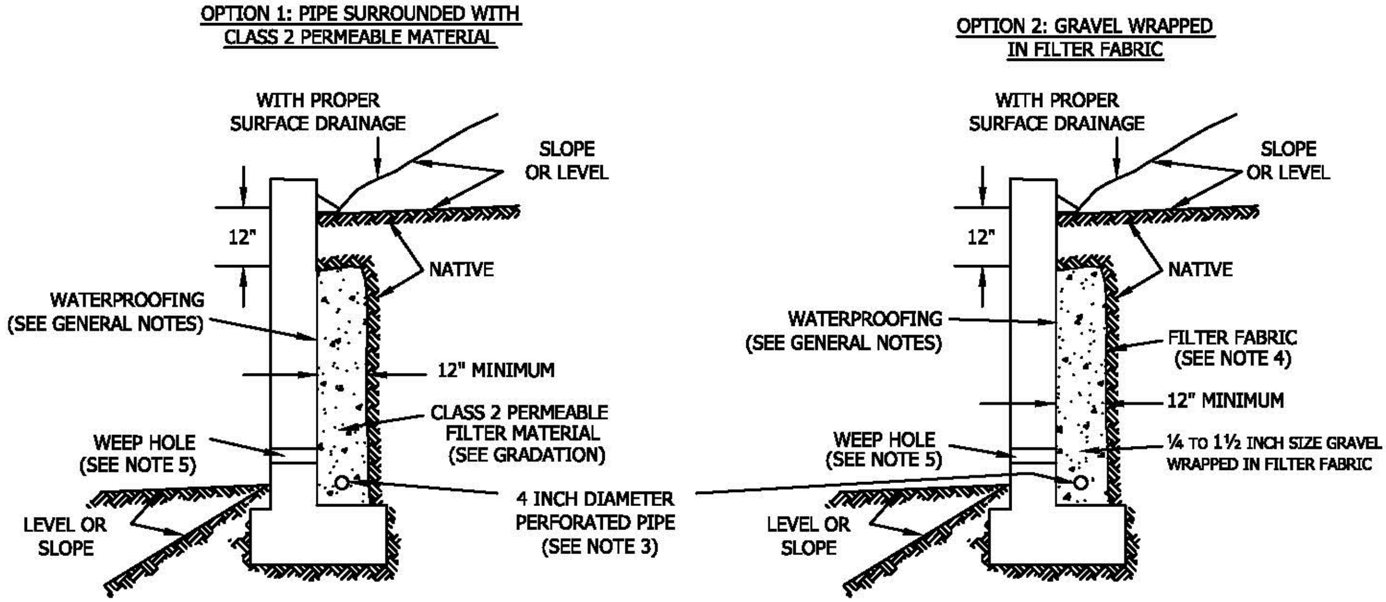
B-6.2 Bedding and Backfill

All utility trench bedding and backfill shall be performed in accordance with applicable provisions of the 2009 Edition of the *Standard Specifications for Public Works Construction* (Green Book). Bedding material shall have a Sand Equivalent greater than 30 (SE>30). Bedding shall be placed to 1-foot (0.3 m) over the top of the conduit, and densified by jetting in areas of granular soils, if allowed by the permitting agency. Otherwise the pipe bedding zone should be backfilled with Controlled Low Strength Material (CLSM) consisting of at least one sack of Portland cement per cubic-yard of sand, and conforming to Section 201-6 of the 2009 Edition of the *Standard Specifications for Public Works Construction* (Green Book). Backfill over the bedding zone shall be placed and densified mechanically to a minimum of 90 percent of relative compaction (ASTM D 1557) from 1 foot (0.3 m) above the top of the conduit to the surface. Backfill above the pipe zone shall **not** be jetted. Jetting of the bedding around the conduits shall be observed by Leighton Consulting, Inc. and backfill above the pipe zone (bedding) shall be observed and tested by Leighton Consulting, Inc..

B-6.3 Lift Thickness

Lift thickness of trench backfill shall not exceed those allowed in the Standard Specifications of Public Works Construction unless the Contractor can demonstrate to Leighton Consulting, Inc. that the fill lift can be compacted to the minimum relative compaction by his alternative equipment and method, and only if the building officials with the appropriate jurisdiction approve.

SUBDRAIN OPTIONS AND BACKFILL WHEN NATIVE MATERIAL HAS EXPANSION INDEX OF ≤50



Class 2 Filter Permeable Material Gradation
Per Caltrans Specifications

Sieve Size	Percent Passing
1"	100
3/4"	90-100
3/8"	40-100
No. 4	25-40
No. 8	18-33
No. 30	5-15
No. 50	0-7
No. 200	0-3

GENERAL NOTES:

* Waterproofing should be provided where moisture nuisance problem through the wall is undesirable.
* Water proofing of the walls is not under purview of the geotechnical engineer
* All drains should have a gradient of 1 percent minimum
*Outlet portion of the subdrain should have a 4-inch diameter solid pipe discharged into a suitable disposal area designed by the project engineer. The subdrain pipe should be accessible for maintenance (rodding)
*Other subdrain backfill options are subject to the review by the geotechnical engineer and modification of design parameters.

Notes:
1) Sand should have a sand equivalent of 30 or greater and may be densified by water jetting.
2) 1 Cu. ft. per ft. of 1/4- to 1 1/2-inch size gravel wrapped in filter fabric
3) Pipe type should be ASTM D1527 Acrylonitrile Butadiene Styrene (ABS) SDR35 or ASTM D1785 Polyvinyl Chloride plastic (PVC), Schedule 40, Armco A2000 PVC, or approved equivalent. Pipe should be installed with perforations down. Perforations should be 3/8 inch in diameter placed at the ends of a 120-degree arc in two rows at 3-inch on center (staggered)
4) Filter fabric should be Mirafi 140NC or approved equivalent.
5) Weephole should be 3-inch minimum diameter and provided at 10-foot maximum intervals. If exposure is permitted, weepholes should be located 12 inches above finished grade. If exposure is not permitted such as for a wall adjacent to a sidewalk/curb, a pipe under the sidewalk to be discharged through the curb face or equivalent should be provided. For a basement-type wall, a proper subdrain outlet system should be provided.
6) Retaining wall plans should be reviewed and approved by the geotechnical engineer.
7) Walls over six feet in height are subject to a special review by the geotechnical engineer and modifications to the above requirements.

RETAINING WALL BACKFILL AND SUBDRAIN DETAIL FOR WALLS 6 FEET OR LESS IN HEIGHT

WHEN NATIVE MATERIAL HAS EXPANSION INDEX OF ≤50

Leighton

Figure

A P P E N D I X C

Important Information About Your Geotechnical Report

Important Information About Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

The following information is provided to help you manage your risks.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely, on Your ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you ASFE-member geotechnical engineer for more information.

ASFE
THE BEST PEOPLE ON EARTH

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