GEOTECHNICAL EVALUATION

FOR

PROPOSED SINGLE-FAMILY RESIDENTIAL DEVELOPMENT
29875 NEWPORT ROAD
MENIFEE, RIVERSIDE COUNTY, CALIFORNIA

PREPARED FOR

EXCEL ENGINEERING
440 STATE PLACE
ESCONDIDO, CALIFORNIA 92029

PREPARED BY

GEOTEK, INC.
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PROJECT NO. 1414-CR **MARCH 3, 2016**

GEOTEK

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March 3, 2016
Project No. 1414-CR

Excel Engineering
440 State Place
Escondido, California 92029

Attention: Mr. Rod Jones

Subject: Geotechnical Evaluation
Proposed Single-Family Residential Development
29875 Newport Road
Menifee, Riverside County, California

Dear Mr. Jones:

We are pleased to provide the results of our geotechnical evaluation for the proposed project located at the 29875 Newport Road, in the city of Menifee, Riverside County, California. This report presents the results of our evaluation, discussion of our findings, and provides geotechnical recommendations for foundation design and construction. In our opinion, site development appears feasible from a geotechnical viewpoint provided that the recommendations included in this report are incorporated into the design and construction phases of the project.

The opportunity to be of service is sincerely appreciated. If you should have any questions, please do not hesitate to contact our office.

Respectfully submitted,
GeoTek, Inc.

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1. PURPOSE AND SCOPE OF SERVICES

The purpose of this study was to evaluate the geotechnical conditions across the project site with respect to the proposed development. Services provided for this study included the following:

- Research and review of available geologic data and general information pertinent to the site,
- Site exploration consisting of the excavation, logging, and sampling of 14 exploratory borings,
- Perform 4 percolation tests;
- Laboratory testing of soil samples collected during the field investigation,
- Review and evaluation of site seismicity, and
- Compilation of this geotechnical report which presents our findings, conclusions, and recommendations for this site.

2. SITE DESCRIPTION AND PROPOSED DEVELOPMENT

2.1 SITE DESCRIPTION

The subject property is located at the southwest corner of Newport Road and Briggs Road in the city of Menifee, Riverside County, California (see Figure 1). The 78.8 acre site is the location of the former Abacherli Dairy. The site is occupied with several structures in the northeast portion including four residences, a milking building and a work shop building. The cow pens have generally been recently demolished and removed from the site and the dairy facility is no longer active. Concrete and asphalt parking/drive areas and landscaping also occupy the northeast portion of the property. The remaining portions of the site are undeveloped. The site can be accessed from Newport Road and Briggs Road.

The subject property is in an area largely characterized by mixed-use development. The site is bounded by Newport Road, followed by a residential development to the north; Briggs Road, followed by Ramona Egg Ranch and agricultural property to the east; Wilderness Lakes Recreational Vehicle Resort to the south; and a residential tract development to the west.

Natural drainage at the site is generally interpreted to be toward the southwest, conforming to the natural topography in the area. Standing water was observed on the site in several locations on the dates of our exploration due to the recent inclement weather. Additionally, several basins, approximately 5 feet to 20 feet in depth, are located in the western and southwestern portions of the site and collect storm water.

2.2 PROPOSED DEVELOPMENT

Based on the preliminary plan entitled "Abacherli Dairy Concept Site Plan" prepared by Excel Engineering (undated), the subject project will consist of the construction of:

- 319 single-family residential building pads;
- 4 tot lots;
- 3 playfield areas;
- A water quality basin at the west-central side of the site;
- A pond in the south-central portion of the site;
- A community building and swimming pool;
- 2 parking lots;
- Local streets, labeled "A" through "E"; and,
- A continuation of Tres Lagos Drive along the south side of the site.

A specific grading plan was not provided at the time of this report. This report is based on planned cuts and fills of approximately 3 feet with the exception of the existing basin areas where fills up to 20 feet is anticipated to bring the site up to project grades.

If site development differs from the project information presented in this report, the recommendations should be subject to further review and evaluation.

3. FIELD EXPLORATION AND LABORATORY TESTING

3.1 FIELD EXPLORATION

The field exploration for this investigation was conducted on February 9 and 10, 2016 and consisted of excavating 14 exploratory borings with the aid of a hollow stem tract drill rig to depths of 10 feet to 51.5 feet. The borings were drilled within the proposed development as shown on the attached Boring Location Map (Figure 2). Four of the borings were used for percolation tests. An engineer and geologist from our firm logged the excavations and collected soil samples for use in subsequent laboratory testing. The logs of the exploratory borings are included in Appendix A.

3.2 LABORATORY TESTING

Laboratory testing was performed on selected bulk and relatively undisturbed samples collected during the field exploration. The purpose of the laboratory testing was to confirm the field classification of the materials encountered and to evaluate their physical properties for use in the engineering design and analysis. Results of the laboratory testing program along with a brief description and relevant information regarding testing procedures are included in Appendix B.

3.3 PERCOLATION TEST INFORMATION

As requested, GeoTek performed four (4) percolation (infiltration) tests within the subject site at the approximate locations indicated in Figure 2. Percolation testing was conducted at a depth of 10 feet below existing grade.

Each boring diameter was approximately 8 inches. Approximately 2 inches of gravel was placed on the bottom of each of the percolation boring excavations. A 3-inch diameter perforated PVC pipe, wrapped in filter sock was placed in the percolation boring excavations and the annular space was filled with gravel to prevent caving within the boring. The test borings were then filled with water between the depths of 5 and 10 feet to pre-soak the hole. The hole was allowed to pre-soak overnight and the percolation test was performed the next day.

The results were converted to an infiltration rate via the Porchet Method as per Riverside County guidelines and a factor of safety of 3 was applied. Based on the results of our testing, the test locations have the following infiltration rates:

Test Hole	Infiltration Rate (in/hr)
P-1	0.02
P-2	0.01
P-3	0.06
P-4	0.04

Note that variations may occur within the site and with depth.

4. GEOLOGIC AND SOILS CONDITIONS

4.1 REGIONAL SETTING

The site is situated in the Peninsular Ranges province, which is one of the largest geomorphic units in western North America. Basically, it extends from the Transverse Ranges geomorphic province and the Los Angeles Basin, approximately 900 miles south to the tip of Baja California. This province varies in width from about 30 to 100 miles. It is bounded on the west by the Pacific Ocean, on the south by the Gulf of California and on the east by the Colorado Desert Province.

The Peninsular Ranges are essentially a series of northwest-southeast oriented fault blocks. Three major fault zones are found in this province. The Elsinore Fault zone and the San Jacinto Fault zone trend northwest-southeast and are found near the middle of the province. The San Andreas Fault zone borders the northeasterly margin of the province.

More specific to the property, the site is located in an area geologically mapped (see Figure 3) to be underlain by older alluvial fan deposits (Mortan, 2003).

4.2 GENERAL SOIL CONDITIONS

A brief description of the earth materials encountered is presented in this section. Based on our site reconnaissance, our exploratory excavations and review of published geologic maps, the area investigated is locally underlain by undocumented artificial fill, older alluvial materials and granitic bedrock at depth.

4.2.1 Undocumented Artificial Fill

Undocumented artificial fill (Afu) was encountered in borings B-1, B-8 and B-9 between approximate depths of 2 and 3 feet. Undocumented fill is associated with past grading to create berms/access roads. Based on a conversation with the current owner of the property, thicker zones of undocumented fill are known to exist on the site, including an area along the northwest portion of the site (north of one of the detention basins), where a zone approximately 9 feet wide by 100 feet long and 8 feet deep contains buried debris. The fill encountered consists of brown, orange brown and dark brown, slightly moist to moist, medium dense to dense silty fine to coarse sand with local cobbles.

4.2.2 Older Alluvium

Older alluvium (Qoal) was observed in all the borings. The older alluvium generally consists of red brown to orange brown and brown, slightly moist to moist, dense to very dense silty fine to coarse sand with occasional clay and, less common, stiff to hard clayey silt, silty clay, sandy clay and silt.

According to the results of the laboratory testing performed, the older alluvium tested exhibit a "low" expansion potential when tested in accordance with ASTM D 4829.

4.2.3 Bedrock

Granitic bedrock, likely consisting of granodiorite or tonalite as mapped by Mortan (2003) northeast of the subject property, was encountered underlying the older alluvium at depths of 20.5 and 15.5 feet in borings B-9 and B-10, respectively. The granitic bedrock is hard to very hard and consists of medium to coarse crystals which are tan, light orange brown and black.

4.3 SURFACE WATER AND GROUNDWATER

4.3.1 Surface Water

Surface water was locally observed on the site at the time of our subsurface exploration. The surface water encountered was the result of recent heavy rains. Overall surface drainage in the area is generally to the southwest. Provisions for surface drainage will need to be accounted for by the project civil engineer.

4.3.2 Groundwater

Water was not encountered in our exploratory excavations to a maximum depth of 51.5 feet below existing grade. According to a review of historical groundwater data (California

Department of Water Resources and California State Water Resources Control Board groundwater well data [http://wdl.water.ca.gov and http://geotracker.waterboards.ca.gov]) and in-house information, depth to groundwater is currently roughly 100 feet below ground surface in the general site area. Data obtained from the California Department of Water Resources for two wells located in the southern portion of the site indicate groundwater greater than 90 feet below ground surface.

It is possible that seasonal variations (temperature, rainfall, etc.) will cause fluctuations in the groundwater level. Additionally, perched water may be encountered in discontinuous zones within the overburden.

4.4 FAULTING AND SEISMICITY

4.4.1 Faulting

The geologic structure of the entire California area is dominated mainly by northwest-trending faults associated with the San Andreas system. The site is in a seismically active region. No active or potentially active fault is known to exist at this site nor is the site situated within a State of California designated *"Alquist-Priolo"* Earthquake Fault Zone or County of Riverside fault zone. The nearest zoned fault is the San Jacinto Fault, located approximately 6 miles to the east.

4.4.2 Seismic Design Parameters

The site is located at approximately latitude: 33.682797°N and longitude: -117.140393°W. Site spectral accelerations (S_s and S_1), for 0.2 and 1.0 second periods for a Class "D" site, were determined from the USGS Website, Earthquake Hazards Program, U.S. Seismic Design Maps for Risk-Targeted Maximum Considered Earthquake (MCE_R) Ground Motion Response Accelerations for the Conterminous 48 States by Latitude/Longitude. The results are presented in the following table:

SITE SEISMIC PARAMETERS	
Mapped 0.2 sec Period Spectral Acceleration, S_S	1.5g
Mapped 1.0 sec Period Spectral Acceleration, S_1	0.6g
Site Coefficient for Site Class "C", F_a	1.0
Site Coefficient for Site Class "C", F_v	1.5
Maximum Considered Earthquake Spectral Response Acceleration for 0.2 Second, S_{MS}	1.5g
Maximum Considered Earthquake Spectral Response Acceleration for 1.0 Second, S_{M1}	0.9g
5% Damped Design Spectral Response Acceleration Parameter at 0.2 Second, S_{DS}	1.0g
5% Damped Design Spectral Response Acceleration Parameter at 1 second, S_{D1}	0.6g

Final selection of the appropriate seismic design coefficients should be made by the project structural engineer based upon the local practices and ordinances, expected building response and desired level of conservatism.

4.5 LIQUEFACTION

Liquefaction describes a phenomenon in which cyclic stresses, produced by earthquake-induced ground motion, create excess pore pressures in relatively cohesionless soils. These soils may thereby acquire a high degree of mobility, which can lead to lateral movement, sliding, consolidation and settlement of loose sediments, sand boils and other damaging deformations. This phenomenon occurs only below the water table, but, after liquefaction has developed, the effects can propagate upward into overlying non-saturated soil as excess pore water dissipates.

The factors known to influence liquefaction potential include soil type and grain size, relative density, groundwater level, confining pressures, and both intensity and duration of ground shaking. In general, materials that are susceptible to liquefaction are loose, saturated granular soils having low fines content under low confining pressures.

The subject site is mapped within a "low" zone of potentially liquefiable soils by the Riverside County "Map My County" website http://mmc.rivcoit.org/MMC_Public/Custom/disclaimer/Default.htm. Liquefaction is not considered a hazard at the site due to great depth to groundwater (greater than 90 feet) and the underlying dense nature of the subsurface soils.

4.6 OTHER SEISMIC HAZARDS

Evidence of ancient landslides or slope instabilities at this site was not observed during our investigation. Thus, the potential for landslides is considered negligible.

The potential for secondary seismic hazards such as a seiche and tsunami are considered to be negligible due to site elevation and distance from an open body of water.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 GENERAL

The anticipated site development appears feasible from a geotechnical viewpoint provided that the following recommendations, and those provided by this firm at a later date, are properly incorporated into the design and construction phases of development. Site development and grading plans should be reviewed by GeoTek when they become available.

Undocumented fill was observed in portions of the site with an approximate thickness of 2 to 3 feet, with thicker zones likely. The undocumented fill is not a suitable bearing material and should be removed and replaced with engineered fill. In areas where thin zones or no undocumented fill exists, GeoTek recommends that the upper 3 feet of earth materials be removed prior to placement of engineered fill. At a minimum, 3 feet of engineered fill should be provided below proposed improvements or 2 feet below beneath foundation, whichever is greater.

In the existing retention basin areas, the loose surficial materials should be removed until competent native materials are exposed prior to placement of additional engineered fill.

A methane report was prepared by Carlin Environmental Consulting, Inc. (CEC). The report is included in Appendix C. CEC should be consulted on the appropriate remedial measures necessary for methane mitigation.

5.2 EARTHWORK CONSIDERATIONS

5.2.1 General

Earthwork and grading should be performed in accordance with the applicable grading ordinances of the city of Menifee, County of Riverside, the 2013 California Building Code (CBC), and recommendations contained in this report. The Grading Guidelines included in Appendix D outline general procedures and do not anticipate all site specific situations. In the event of conflict, the recommendations presented in the text of this report should supersede those contained in Appendix D.

5.2.2 Site Clearing and Preparation

Site preparation should commence with removal of existing structures, deleterious materials and vegetation. Existing underground utilities should either be properly capped off at the property boundaries and removed or be re-routed around the new development. All soils disturbed by the clearing operations should be removed and stockpiled on-site for future use as engineered fill. All debris and deleterious materials generated by the site stripping operations should be legally disposed off-site. Voids resulting from site clearing should be replaced with engineered fill materials with expansion characteristics similar to the on-site soils.

5.2.3 Removals

All undocumented fill should be removed. In areas where thin zones or no undocumented fill exists, the upper 3 feet of the existing earth materials should be removed and replaced with engineered fill. A minimum of 3 feet of engineered fill should be provided in areas of the proposed residential buildings and improvements or 2 feet beneath foundations, whichever is greater. A minimum of 2 feet of fill should be provided beneath the pavement subgrade. The lateral extent of removals should extend at least 5 feet outside the footings and floor-slabs, or a distance equal to the depth of overexcavation below the bottom of the structural elements, whichever is greater.

A representative of this firm should observe the bottom of all excavations. Upon approval, the exposed subgrade should be scarified to a depth of approximately 8 inches, moistened to at least the optimum moisture content and compacted to a minimum relative compaction of 90 percent (ASTM D1557).

The removals in the areas of the existing basins should extend down to competent native materials. Competent native materials are defined as natural soils that are uniform in appearance, not relatively visibly porous and with an in-place relative compaction of at least 85 percent.

5.2.4 Engineered Fill

On-site materials are generally considered suitable for reuse as engineered fill provided they are free from vegetation, roots, and other deleterious material. Rock fragments greater than 6 inches in maximum dimension should not be incorporated into engineered fill.

Engineered fill materials should be placed in horizontal lifts not exceeding 8 inches in loose thickness, moisture conditioned to at least the optimum moisture content and compacted to a minimum relative compaction of 90% (ASTM D 1557). The upper 12 inches of pavement subgrade should be compacted to 95%.

5.2.5 Excavation Characteristics

Excavation in the on-site soils is expected to be feasible utilizing heavy-duty grading equipment in good operating condition. All temporary excavations for grading purposes and installation of underground utilities should be constructed in accordance with local and Cal-OSHA guidelines. Temporary vertical excavations within the on-site materials should be stable at five (5) feet with a 1:1 (horizontal: vertical) cut above.

5.2.6 Slopes

Fill and cut slopes constructed at gradients of 2:1 or flatter, in accordance with industry standards, are anticipated to be both grossly and surficially stable. Fill placed on slopes should be properly benched into competent soils per the soils engineer.

5.2.7 Shrinkage and Bulking

Several factors will impact earthwork balancing on the site, including shrinkage, subsidence, trench spoil from utilities and footing excavations, as well as the accuracy of topography.

Shrinkage and subsidence are primarily dependent upon the degree of compactive effort achieved during construction, depth of fill and underlying site conditions. For planning purposes, a shrinkage factor from 5 to 15 percent may be considered for the materials requiring removal and recompaction. Site balance areas should be available in order to adjust project grades, depending on actual field conditions at the conclusion of site earthwork construction. Subsidence on the order of up to 0.10 foot may be anticipated for the underlying soils.

5.2.8 Trench Excavations and Backfill

Trench excavations should conform to Cal-OSHA regulations. The contractor should have a competent person, per OSHA requirements, on site during construction to observe conditions and to make the appropriate recommendations.

Utility trench backfill should consist of sandy soil with a "very low" expansion potential and compacted to at least 90% relative compaction (as determined per ASTM D 1557). Where applicable, based on jurisdictional requirements, the top 12 inches of backfill below subgrade for road pavements should be compacted to at least 95 percent relative compaction.

Compaction should be achieved with a mechanical compaction device. Jetting of trench backfill is not recommended. If soils to be used as backfill have dried out, they should be thoroughly moisture conditioned prior to placement in trenches.

5.3 DESIGN RECOMMENDATIONS

5.3.1 Foundation Design Criteria

Foundation design criteria for a conventional foundation system, in general conformance with the 2013 CBC, are presented herein. Based on the results of our laboratory testing, it is anticipated that the soils near subgrade will classify as having a "very low" to "low" expansion potential ($20 \leq EI \leq 50$) in accordance with ASTM D 4829. Typical design criteria for the site based upon a "very low" and "low" expansion potential are tabulated below. These are minimal recommendations and are not intended to supersede the design by the project structural engineer.

The foundation elements for the proposed structures and other improvements should be founded entirely in engineered fill soils. Foundations should be designed in accordance with the *2013 California Building Code* (CBC).

Additional expansion index and soluble sulfate testing of the soils should be performed during construction to evaluate the as-graded conditions. Final recommendations should be based upon the as-graded soils conditions.

A summary of our foundation design recommendations is presented in the following table:

GEOTECHNICAL RECOMMENDATIONS FOR FOUNDATION DESIGN

DESIGN PARAMETER	0≤EI≤20	21≤EI≤50
Foundation Depth or Minimum Perimeter Beam Depth (inches below lowest adjacent grade)	One- and Two-Story - 12 Three-Story - 18	One- and Two-Story - 12 Three-Story - 18
Minimum Foundation Width (inches)*	12	12
Minimum Slab Thickness (inches)	4 (actual)	4 (actual)
Sand Blanket and Moisture Retardant Membrane Below On-Grade Building Slabs	2 inches of sand ** overlying moisture vapor retardant membrane overlying 2 inches of sand **	2 inches of sand ** overlying moisture vapor retardant membrane overlying 2 inches of sand **
Minimum Slab Reinforcing	6"x6"- W1.4/1.4 welded wire fabric placed in middle of slab	6"x6"- W2.9/2.9 welded wire fabric placed in middle of slab
Minimum Reinforcement for Continuous Footings, Grade Beams and Retaining Wall Footings	Two No. 4 reinforcing Bars, one placed near the top and one near the bottom	Two No. 4 reinforcing Bars, one placed near the top and one near the bottom
Effective Plasticity Index	N/A	15
Presaturation of Subgrade Soil (Percent of Optimum/Depth in Inches)	Minimum of 100% of the optimum moisture content to a depth of at least 12 inches prior to placing concrete	Minimum of 110% of the optimum moisture content to a depth of at least 12 inches prior to placing concrete

* Code minimums per Table 1809.7 of the 2013 CBC

** Sand should have a Sand Equivalent of at least 30

It should be noted that the above recommendations are based on soil support characteristics only. The structural engineer should design the slab and beam reinforcement based on actual loading conditions.

The following criteria for design of foundations should be implemented:

5.3.1.1 An allowable bearing capacity of 1,800 pounds per square foot (psf) may be used for design of continuous footings 12 inches deep and 12 inches wide, and pad footings 24 inches square and 12 inches deep. This value may be increased by 250 pounds per square foot for each additional 12 inches in depth and 150 pounds per square foot for each additional 12 inches in width to a maximum value of 2,500 psf. Additionally, an increase of one-third may be applied when considering short-term live loads (e.g. seismic and wind loads).

5.3.1.2 The recommended allowable bearing capacity is based on a total post-construction settlement of one (1) inch. Differential settlement of up to one-half of the total settlement over a horizontal distance of 40 feet could result.

5.3.1.3 Spread footings for an individual structure should be tied together in two orthogonal directions with either reinforced grade-beams and/or continuous footings to provide a more rigid and monolithic shallow foundation system.

5.3.1.4 The passive earth pressure may be computed as an equivalent fluid having a density of 250 psf per foot of depth, to a maximum earth pressure of 2,500 psf for footings founded in engineered fill. A coefficient of friction between engineered fill and concrete of 0.35 may be used with dead load forces. When combining passive pressure and frictional resistance, the passive pressure component should be reduced by one-third.

5.3.1.5 A grade beam, 12 inches wide by 12 inches deep (minimum), should be utilized across large openings. The base of the grade beam should be at the same elevation as the bottom of the adjoining footings.

5.3.1.6 A moisture and vapor retarding system should be placed below slabs-on-grade where moisture migration through the slab is undesirable. Guidelines for these systems are provided in the 2013 California Green Building Standards Code (CALGreen) Section 4.505.2 and the 2013 CBC Section 1907.1 and ACI 360R-10. The vapor retarder design and construction should also meet the requirements of ASTM E1643. A portion of the vapor retarder design should be the implementation of a moisture vapor retardant membrane.

It should be realized that the effectiveness of the vapor retarding membrane can be adversely impacted as a result of construction related punctures (e.g. stake penetrations, tears, punctures from walking on the aggregate layer, etc.). These occurrences should be limited as much as possible during construction. Thicker membranes are generally more resistant to accidental puncture than thinner ones. Products specifically designed for use as moisture/vapor retarders may also be more puncture resistant. Although the CBC specifies a 6 mil vapor retarder membrane, it is GeoTek's opinion that a minimum 10 mil thick membrane with joints properly overlapped and sealed should be considered, unless otherwise specified by the slab design professional. The membrane should consist of Stego wrap or the equivalent.

Moisture and vapor retarding systems are intended to provide a certain level of resistance to vapor and moisture transmission through the concrete, but do not eliminate it. The acceptable level of moisture transmission through the slab is to a large extent based on the type of flooring used and environmental conditions. Ultimately, the vapor retarding system should be comprised of suitable elements to limit migration of water and reduce transmission of water vapor through the slab to acceptable levels. The selected elements should have suitable properties (i.e., thickness, composition, strength, and permeability) to achieve the desired performance level. Consideration should be given to consulting with an individual possessing specific expertise in this area for additional evaluation.

Moisture retarders can reduce, but not eliminate, moisture vapor rise from the underlying soils up through the slab. Moisture retarders should be designed and constructed in accordance with applicable American Concrete Institute, Portland Cement Association, Post-Tensioning Concrete Institute, ASTM and California Building Code requirements and guidelines.

GeoTek recommends that a qualified person, such as the flooring contractor, structural engineer, and/or architect be consulted to evaluate the general and specific moisture vapor transmission paths and any impact on the proposed construction. That person (or persons) should provide recommendations for mitigation of potential adverse impact of moisture vapor transmission on various components of the structures as deemed appropriate.

In addition, the recommendations in this report and our services in general are not intended to address mold prevention, since we along with geotechnical consultants in general, do not practice in areas of mold prevention. If specific recommendations are desired, a professional mold prevention consultant should be contacted.

5.3.1.7 We recommend that control joints be placed in two orthogonal directions spaced approximately 24 to 36 times the thickness of the slab in inches. These joints are a widely accepted means to control cracks and should be reviewed by the project structural engineer.

5.3.2 Miscellaneous Foundation Recommendations

5.3.2.1 Isolated exterior footings should be tied back to the main foundation system in two orthogonal directions.

5.3.2.2 To reduce moisture penetration beneath the slab on grade areas, utility trenches should be backfilled with engineered fill, lean concrete or concrete slurry where they intercept the perimeter footing or thickened slab edge.

5.3.2.3 Soils from the footing excavations should not be placed in the slab-on-grade areas unless properly compacted and tested. The excavations should be free of loose/sloughed materials and be neatly trimmed at the time of concrete placement.

5.3.3 Retaining Wall Design and Construction

5.3.3.1 General Design Criteria

Recommendations presented in this report apply to typical masonry or concrete retaining walls to a maximum height of up to 6 feet. Additional review and recommendations should be requested for higher walls. These are typical design criteria and are not intended to supersede the design by the structural engineer.

Retaining wall foundations should be embedded a minimum of 18 inches into engineered fill and should be designed in accordance with Section 5.3.1 of this report. Structural needs may govern and should be evaluated by the project structural engineer.

All earth retention structure plans, as applicable, should be reviewed by this office prior to finalization.

Earthwork considerations, site clearing and remedial earthwork for all earth retention structures should meet the requirements of this report, unless specifically provided otherwise, or more stringent requirements or recommendations are made by the designer. The backfill material placement for all earth retention structures should meet the requirement of Section 5.3.3.4 in this report.

In general, cantilever earth retention structures, which are designed to yield at least 0.001H, where H is equal to the height of the earth retention structure to the base of its footing, may be designed using the active condition. Rigid earth retention structures (including but not limited to rigid walls, and walls braced at top, such as typical basement walls) should be designed using the at-rest condition.

In addition to the design lateral forces due to retained earth, surcharges due to improvements, such as an adjacent building or traffic loading, should be considered in the design of the earth retention structures. Loads applied within a 1:1 (h:v) projection from the surcharge on the stem and footing of the earth retention structure should be considered in the design.

Final selection of the appropriate design parameters should be made by the designer of the earth retention structures.

5.3.3.2 Cantilevered Walls

The recommendations presented below are for cantilevered retaining walls up to 6 feet high. Active earth pressure may be used for retaining wall design, provided the top of the wall is not restrained from minor deflections. An equivalent fluid pressure approach may be used to compute the horizontal pressure against the wall. Appropriate fluid unit weights are given below for specific slope gradients of the retained material. These do not include other superimposed loading conditions such as traffic, structures, seismic events, or adverse geologic conditions.

ACTIVE EARTH PRESSURES	
Surface Slope of Retained Materials (h:v)	Equivalent Fluid Pressure (pcf) Select Backfill*
Level	30
2:1	45

* The design pressures assume the backfill material has an expansion index less than or equal to 20. Backfill zone includes area between back of the wall to a plane (1:1 h:v) up from bottom of the wall foundation (on the backside of the wall) to the (sloped) ground surface.

5.3.3.3 Restrained Retaining Walls

Retaining walls that will be restrained at the top that support level backfill or that have reentrant or male corners, should be designed for an equivalent at-rest fluid pressure of 55 pcf, plus any applicable surcharge loading. For areas of male or reentrant corners, the restrained wall design should extend a minimum distance of twice the height of the wall laterally from the corner, or a distance otherwise determined by the project structural engineer.

5.3.3.4 Retaining Wall Backfill and Drainage

Retaining walls should be provided with an adequate pipe and gravel back drain system to help prevent buildup of hydrostatic pressures. Backdrains should consist of a 4-inch diameter perforated collector pipe (Schedule 40, SDR 35, or approved equivalent) embedded in a minimum of one (1) cubic foot per linear foot of ¾- to 1-inch clean crushed rock or an approved equivalent, wrapped in filter fabric (Mirafi 140N or an approved equivalent). The drain system should be connected to a suitable outlet. Waterproofing of site walls should be performed where moisture migration through the wall is undesirable.

Retaining wall backfill should be placed in lifts no greater than eight (8) inches in thickness and compacted to a minimum of 90% relative compaction in accordance with ASTM Test Method D 1557. The wall backfill should also include a minimum one (1) foot wide section of ¾- to 1-inch clean crushed rock (or an approved equivalent). The rock should be placed immediately adjacent to the back of the wall and extend up from a back drain to within approximately 24 inches of the finish grade. The rock should be separated from the earth with filter fabric. The upper 24 inches should consist of compacted on-site soil.

As an alternative to the drain rock and fabric, Miradrain 2000, or approved equivalent, may be used behind the retaining wall. The Miradrain 2000 should extend from the base of the wall to within 2 feet of the ground surface. The subdrain should be placed at the base of the wall in direct contact with the Miradrain 2000.

The presence of other materials might necessitate revision to the parameters provided and modification of the wall designs. Proper surface drainage needs to be provided and maintained.

5.3.4 Pavement Design

The recommended thicknesses presented below are considered typical and minimum for the utilized parameters. In designing the proposed paved areas, the existing subgrade conditions must be considered together with the expected traffic use and loading conditions. The conditions that will influence the pavement design can be summarized as follows:

1) Subgrade support characteristics of the subgrade. This is typically represented by a R-Value for the design of flexible pavements in this region.
2) Vehicular traffic, in terms of the number and frequency of vehicles and their range of axle loads.
3) Probable increase in vehicular use over the life of the pavement.

We recommend that the exposed subgrade be prepared in accordance with the site preparation requirements specified previously in this report. The upper one foot of pavement subgrade should be compacted to at least 95% of the maximum dry density as determined by the modified Proctor (ASTM D1557).

The appropriate pavement section depends primarily upon the type of subgrade soil, shear strength, traffic load, and planned pavement life. For preliminary purposes, we have provided traffic indices of TI=5.0 (typically for parking areas) through TI=7.0 (typically for those driveway and truck lanes subject to relatively heavy traffic). The provided traffic indices should be verified by the project civil engineer prior to construction. Based on the results of our subsurface exploration, we have utilized an R-value of 25 for the near-surface soils within pavement areas. Since an evaluation of the characteristics of the actual soils at pavement subgrade can only be provided at the completion of grading, the following pavement sections should be used for planning purposes only. Final pavement designs should be evaluated after R-value tests have been performed on the actual subgrade material.

It should be noted that additional earthwork and/or ground improvement efforts may be required during grading on the actual subgrade material, in order to achieve the aforementioned design parameters and assumptions. These design thicknesses assume that a properly prepared subgrade has been achieved.

Flexible Pavement Recommendations

Traffic Index	Recommended Pavement Section
5.0	3 inches AC over 6½ inches Class II Aggregate Base
6.0	4 inches AC over 6½ inches Class II Aggregate Base
7.0	4½ inches AC over 8 inches Class II Aggregate Base

Concrete pavement is recommended in areas that receive continuous repetitive traffic such as loading areas and parking lot entrances. Due to heavy wheel loads and impact loads, concrete approach aprons and dumpster pads, should have a minimum thickness of 6 inches, with an underlying 4-inch thick section of Class II Aggregate Base (AB). Portland Cement Concrete pavement sections should incorporate appropriate steel reinforcement and crack control joints as designed by the project structural engineer. We recommend that sections be as nearly squared as possible and no more than 15 feet on a side. A minimum 3,500 psi mix is recommended. The actual design should also be in accordance with design criteria specified by the governing jurisdiction.

Asphalt Concrete (AC), Portland Cement Concrete, and Class II aggregate base should conform to and be placed in accordance with the latest revision of the California Department of Transportation Standard Specifications and American Concrete Institute (ACI) codes. Aggregate base should be compacted to a minimum of 95 percent of the maximum dry density as determined by the modified Proctor (ASTM D1557) prior to placement of AC. Subgrade preparation for pavement areas is included in the Site Preparation section of this report.

5.3.4.1 Other Design Considerations

- Wall design should consider the additional surcharge loads from superjacent slopes and/or footings, where appropriate.
- No backfill should be placed against concrete until minimum design strengths are evident by compression tests of cylinders.
- The retaining wall footing excavations, backcuts, and backfill materials should be approved the project geotechnical engineer or their authorized representative.

5.3.5 Soil Corrosivity

The soil resistivity at this site was tested in the laboratory on two samples collected during the field investigation. The results of the testing (Resistivity = 270 and 1,100 ohm-cm) indicate that the on-site soils are considered "extremely corrosive" to "highly corrosive" to buried ferrous metal in accordance with current standards used by corrosion engineers. We recommend that a corrosion engineer be consulted to provide recommendations for the protection of buried ferrous metal at this site.

5.3.6 Soil Sulfate Content

The sulfate content was determined in the laboratory for two on-site soil samples. The results indicate that the water soluble sulfate result is less than 0.1 percent by weight, which is considered "not applicable" (negligible) as per Table 4.2.1 of ACI 318.

5.4 CONCRETE CONSTRUCTION

5.4.1 General

Concrete construction should follow the 2013 CBC and ACI guidelines regarding design, mix placement and curing of the concrete. If desired, we could provide quality control testing of the concrete during construction.

5.4.2 Concrete Mix Design

As indicated in Section 5.3.5, no special concrete mix design is required by Code to resist sulfate attack based on the existing test results. However, additional testing should be performed during grading so that specific recommendations can be formulated based on the as-graded conditions.

5.4.3 Concrete Flatwork

Exterior concrete flatwork is often one of the most visible aspects of site development. They are typically given the least level of quality control, being considered "non-structural" components. Cracking of these features is fairly common due to various factors. While cracking is not usually detrimental, it is unsightly. We suggest that the same standards of care be applied to these features as to the structure itself.

Flatwork may consist of 4-inch thick concrete and the use of reinforcement is suggested. The project structural engineer should provide final design recommendations.

5.4.4 Concrete Performance

Concrete cracks should be expected. These cracks can vary from sizes that are essentially unnoticeable to more than 1/8 inch in width. Most cracks in concrete while unsightly do not significantly impact long-term performance. While it is possible to take measures (proper concrete mix, placement, curing, control joints, etc.) to reduce the extent and size of cracks that occur, some cracking will occur despite the best efforts to minimize it. Concrete undergoes chemical processes that are dependent on a wide range of variables, which are difficult, at best, to control. Concrete, while seemingly a stable material, is subject to internal expansion and contraction due to external changes over time.

One of the simplest means to control cracking is to provide weakened control joints for cracking to occur along. These do not prevent cracks from developing; they simply provide a relief point for the stresses that develop. These joints are a widely accepted means to control cracks but are not always effective. Control joints are more effective the more closely spaced they are. GeoTek suggests that control joints be placed in two directions and located a distance apart approximately equal to 24 to 36 times the slab thickness.

5.5 POST CONSTRUCTION CONSIDERATION

5.5.1 Irrigation

Control of irrigation water is a necessary part of site maintenance. Soggy ground, near-surface perched water, or seeps may result if irrigation water is excessively or improperly applied. All irrigation systems should be adjusted to provide the minimum water needed to sustain landscaping and prevent excessive drying of the soils. Generally significant runoff during an irrigation cycle indicates excessive irrigation, while soils which dry to a depth of more than several inches between irrigation cycles indicate inadequate irrigation. Adjustments should be made for changes in the climate and rainfall. Irrigation should stop when sufficient water is provided by precipitation.

It is important to avoid repeated wetting and drying of the slope surface, which may cause the soil to crack, loosen and/or slowly move laterally (creep) downslope. Landscaping and irrigation will reduce repeated wetting and drying of the slopes.

It is important to maintain uniform soil moisture conditions adjacent to the structure to reduce soil expansion and shrinkage that can cause cracking to the structure. Irrigation should be utilized to prevent the soils from drying to a depth more than several inches.

Broken, leaking or plugged sprinklers or irrigation lines should be repaired immediately. Frequent inspections of the irrigation systems should be performed.

It is common for planting to be placed adjacent to structures in planter or lawn areas. This will result in the introduction of water into the ground adjacent to the foundation. This type of landscaping should be avoided. If used, then extreme care should be exercised with regard to the irrigation and drainage in these areas. Waterproofing of the foundation and/or subdrains may be necessary and advisable.

5.5.2 Drainage

The need to maintain proper surface drainage and subsurface systems cannot be overly emphasized. Positive site drainage should be maintained at all times. Drainage should not flow uncontrolled down any descending slope. Water should be directed away from foundations and not allowed to pond or seep into the ground adjacent to the footings. Soil areas within 10 feet of the proposed structure should slope at a minimum of 5 percent away from the building, if possible unless the area is paved. Paved areas are to be sloped at 2 percent away from the structure. Roof gutters and downspouts should discharge onto paved surfaces sloping away from the structure or into a closed pipe system which outfalls to the street gutter pan or directly to the storm drain system. Pad drainage should be directed toward approved areas and not be blocked by other improvements.

It is the owner's responsibility to maintain and clean drainage devices on or contiguous to their lot. In order to be effective, maintenance should be conducted on a regular and routine schedule and necessary corrections made prior to each rainy season.

5.6 PLAN REVIEW AND CONSTRUCTION OBSERVATIONS

We recommend that site grading, specifications, and foundation plans be reviewed by this office prior to construction to check for conformance with the recommendations of this report. We also recommend that GeoTek representatives be present during site grading and foundation construction to observe and document for proper implementation of the geotechnical recommendations. The owner/developer should have GeoTek perform at least the following duties:

- Observe site clearing and grubbing operations for proper removal of all unsuitable materials.
- Observe and test bottom of removals prior to fill placement.
- Evaluate the suitability of on-site and import materials for fill placement, and collect soil samples for laboratory testing where necessary.
- Observe the fill for uniformity during placement including utility trenches. Also, test the fill for field density, relative compaction and moisture content.
- Observe and probe foundation excavations to confirm suitability of bearing materials.
- Observed retaining wall subdrain.

If requested, a construction observation and compaction report can be provided by GeoTek which can comply with the requirements of the governmental agencies having jurisdiction over the project. We recommend that these agencies be notified prior to commencement of construction so that necessary grading permits can be obtained

6. INTENT

It is the intent of this report to aid in the design and construction of the proposed development. Implementation of the advice presented in this report is intended to reduce risk associated with construction projects. The professional opinions and geotechnical advice contained in this report are not intended to imply total performance of the project or guarantee that unusual or variable conditions will not be discovered during or after construction.

The scope of our evaluation is limited to the area explored that is shown on the Boring Location Map (Figure 2). This evaluation does not and should in no way be construed to encompass any areas beyond the specific area of the proposed construction as indicated to us by the client. Further, no evaluation of any existing site improvements is included. The scope is based on our understanding of the project and the client's needs, our proposal (Proposal No. P-1104215) dated December 1, 2015 and geotechnical engineering standards normally used on similar projects in this region.

7. LIMITATIONS

Our findings are based on site conditions observed and the stated sources. Thus, our comments are professional opinions that are limited to the extent of the available data.

GeoTek has prepared this report in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practicing under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report.

Since our recommendations are based on the site conditions observed and encountered, and laboratory testing, our conclusions and recommendations are professional opinions that are limited to the extent of the available data. Observations during construction are important to allow for any change in recommendations found to be warranted. These opinions have been derived in accordance with current standards of practice and no warranty of any kind is expressed or implied. Standards of care/practice are subject to change with time.

8. SELECTED REFERENCES

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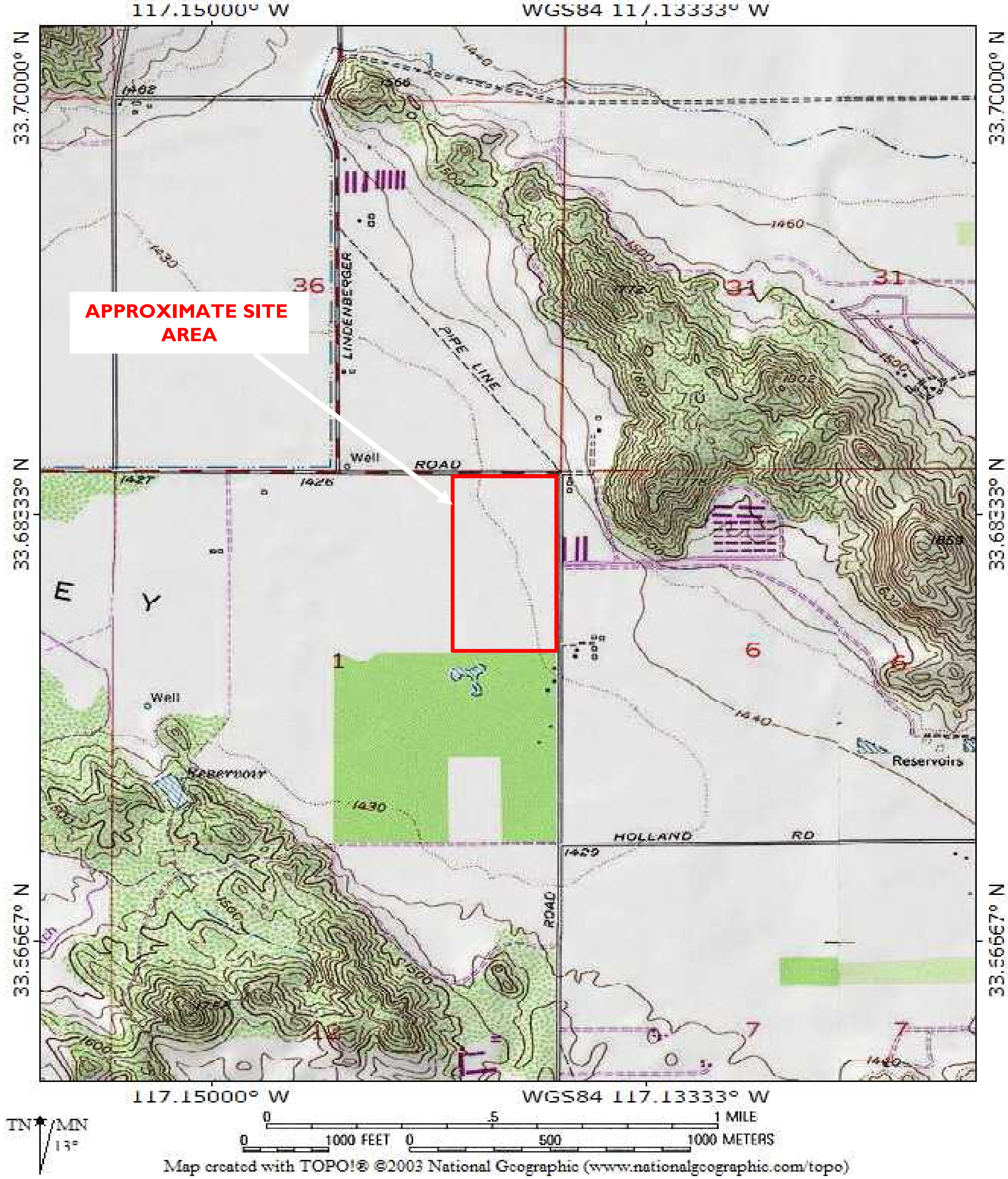
Mortan, D.M., Bovard, K.R. and Mortan, Gregory, 2003, Geologic Map of the Romoland 7.5' quadaragle, Riverside County, California, USGS Survey OF-2003-102, scale 1:24,000.

Seismic Design Values for Buildings (http://geohazards.usgs.gov/designmaps/us/application.php).



Excel Engineering
APN 364-190-004
29875 Newport Road
Menifee, Riverside County, California

GeoTek Project No. 1414-CR

Modified from USGS 7.5 Topographic Map

Figure 1

Site Location Map

GEOTEK

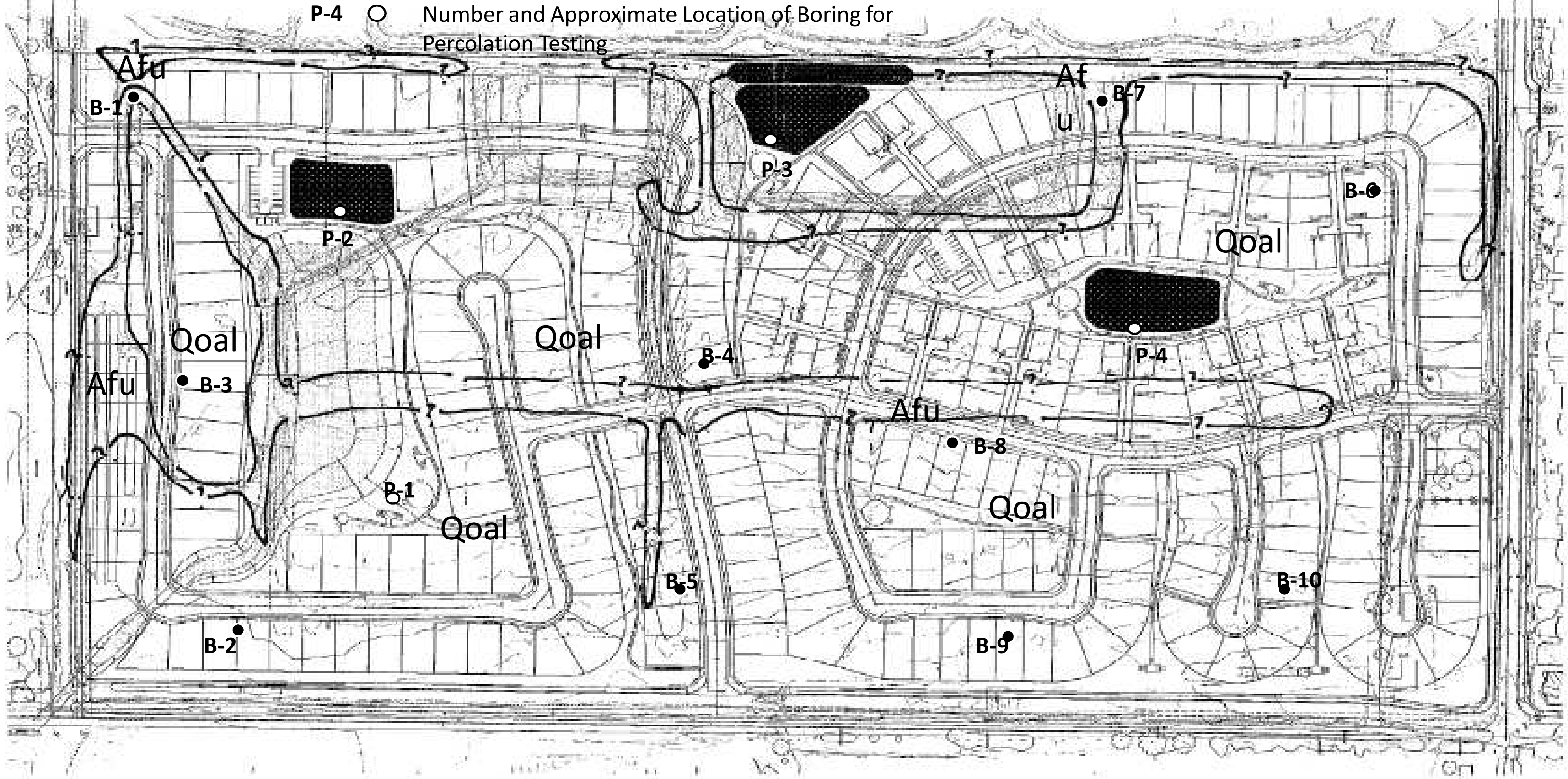
GEOTECHNICAL MAP

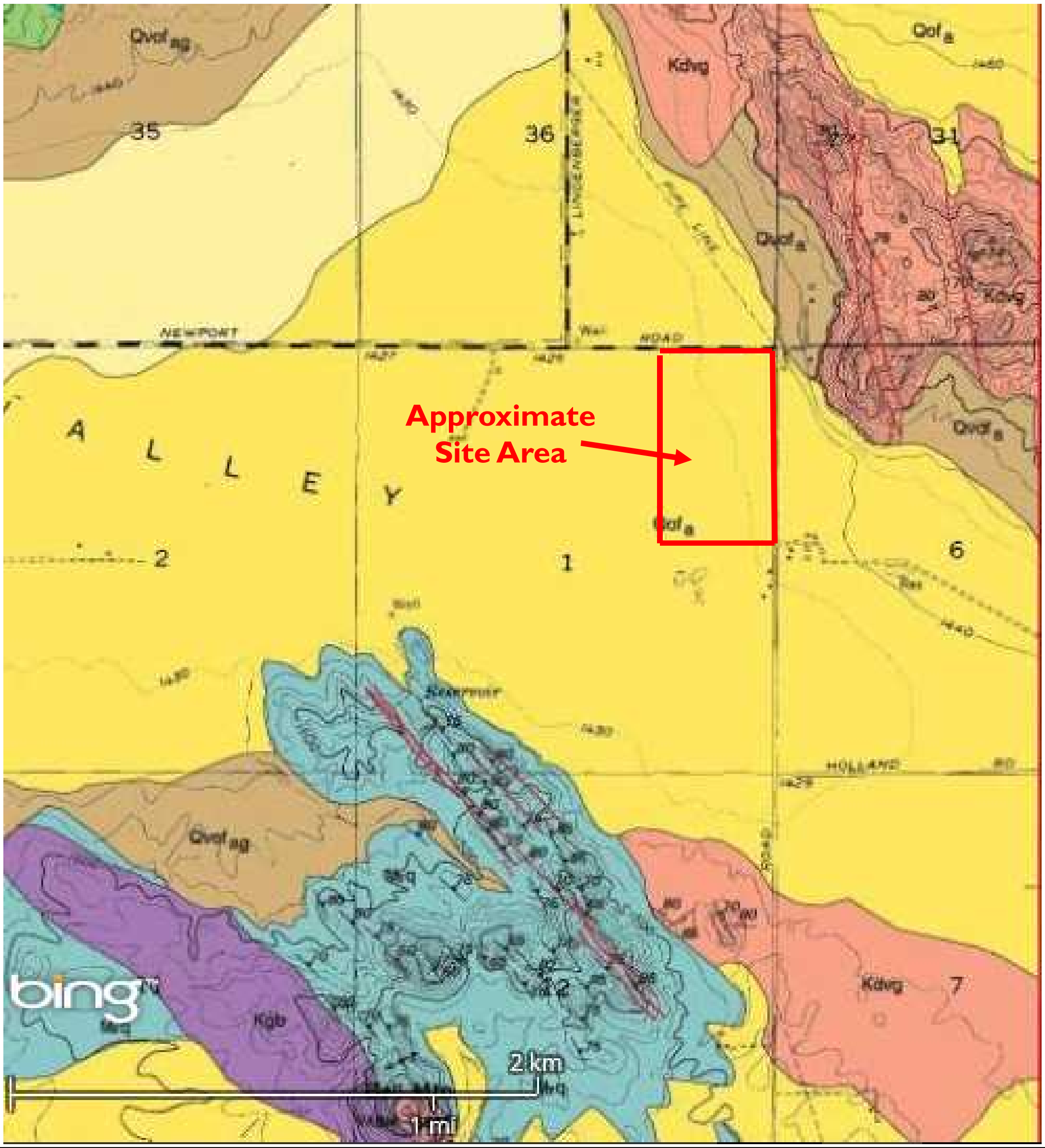
0 100
Scale
(feet)

LEGEND

? (line)	Approximate Contact	Afu	Undocumented Artificial Fill
B-10 ●	Number and Approximate Location of Exploratory Boring	Qoal	Older Alluvium
P-4 ○	Number and Approximate Location of Boring for Percolation Testing		

GEOTEK	Geotechnical Map
Figure 2 GEOTEK Project No. 1414-CR	Excel Engineering Newport Ranch Menifee, Riverside, CA





LEGEND

Qofa - Quaternary Old Alluvial Fan Deposits

Qvofa - Quaternary Very Old Alluvial Fan Deposits

Kdvg – Grandiorite to Tonalite

Mzq - Quartz rich rocks

Reference Map: Geologic Map of the Romoland 7.5' Quadarangle, Riverside County, CA, Mortan, et.al., USGS Survey OF-2003-102.

Excel Engineering 29875 Newport Road Menifee, Riverside County, California GeoTek Project No. 1428-CR	N	**Figure 3** **Regional Geologic Map**	GEOTEK

APPENDIX A

LOGS OF EXPLORATORY BORINGS

Excel Engineering

29875 Newport Road, Menifee, Riverside County, California

Project No. 1414-CR

GEOTEK

A - FIELD TESTING AND SAMPLING PROCEDURES

The Modified Split-Barrel Sampler (Ring)
The Ring sampler is driven into the ground in accordance with ASTM Test Method D 3550. The sampler, with an external diameter of 3.0 inches, is lined with 1-inch high, thin brass rings with an inside diameter of approximately 2.4 inches. The sampler is typically driven into the ground 12 or 18 inches with a 140-pound hammer free falling from a height of 30 inches. Blow counts are recorded for every 6 inches of penetration as indicated on the log of boring. The samples are removed from the sample barrel in the brass rings, sealed, and transported to the laboratory for testing.

The Split-Spoon Sampler (SPT)
During the sampling procedure, Standard Penetration Tests (SPT) were performed in accordance with ASTM D1586. The SPT for soil borings is performed by driving a split-spoon sampler with an outside diameter of 2 inches into the undisturbed formation located at the bottom of the advanced borehole with repeated blows of a 140-pound hammer falling a vertical distance of 30 inches. The number of blows required to drive the sampler for three consecutive 6-inch intervals were recorded, and the sum of the blow counts for the last 12 inches of penetration is a measure of the soil consistency. Samples were identified in the field, placed in sealed containers and transported to the laboratory for further classification and testing.

Bulk Samples (Large)
These samples are normally large bags of earth materials over 20 pounds in weight collected from the field by means of hand digging or exploratory cuttings.

B - BORING LOG LEGEND

The following abbreviations and symbols often appear in the classification and description of soil and rock on the log of boring:

SOILS

USCS	Unified Soil Classification System
f-c	Fine to coarse
f-m	Fine to medium

GEOLOGIC

B: Attitudes	Bedding: strike/dip
J: Attitudes	Joint: strike/dip
C: Contact line	
………..	Dashed line denotes USCS material change
———	Solid Line denotes unit / formational change
━━━	Thick solid line denotes end of boring

(Additional denotations and symbols are provided on the log of boring)

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Excel Enginering	**DRILLER:**	2R Drilling	**LOGGED BY:**	R. Hankes
PROJECT NAME:	29875 Newport Rd.	**DRILL METHOD:**	Hollow Stem	**OPERATOR:**	Jeff/George
PROJECT NO.:	1414-CR	**HAMMER:**	140#/30"	**RIG TYPE:**	CME 75
LOCATION:	Menifee, CA			**DATE:**	2/9/2016

Boring No.: B-1

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
0	Large Bulk			SM	**UNDOCUMENTED ARTIFICIAL FILL** Silty f SAND, dark brown, slightly moist, medium dense, some cobble size rock			
	Ring	12 16 18		SM	**OLDER ALLUVIUM** Silty f SAND, brown to dark brown, moist, medium dense	9.9	127.0	
5	Ring	15 28 33		ML	f Sandy SILT, brown, moist, hard	14.7	120.1	
	Ring	11 21 29		SC	Clayey m-c SAND, brown with white specs, sligthly moist to moist, dense	8.8	132.1	LL=24, PL=14, PI=10 Fines=39%
10								
15	SPT	4 8 5		CL	m Sandy CLAY, brown, moist, stiff	22.1		LL=40, PL=19, PI=21
20	SPT	7 12 18		SM	Silty m-f SAND, brown, moist, dense	14.3		
25	SPT	5 12 21		ML	f Sandy SILT, brown to dark brown, moist, hard, with mica	15.7		
30	SPT	7 11 18			f Sandy SILT, brown to dark brown, moist, very stiff, with mica	15.2		

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:

AL = Atterberg Limits	EI = Expansion Index	SA = Sieve Analysis	RV = R-Value Test
SR = Sulfate/Resisitivity Test	SH = Shear Test	HC= Consolidation	MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Excel Engineering	**DRILLER:**	2R Drilling	**LOGGED BY:**	R. Hankes
PROJECT NAME:	29875 Newport Rd.	**DRILL METHOD:**	Hollow Stem	**OPERATOR:**	Jeff/George
PROJECT NO.:	1414-CR	**HAMMER:**	140#/30"	**RIG TYPE:**	CME 75
LOCATION:	Menifee, CA			**DATE:**	2/9/2016

Boring No.: B-1(Cont.)

Depth (ft)	SAMPLES: Sample Type	Blows/ 6 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Dry Density (pcf)	Others
30					(see previous page)			
35	SPT	7 16 20		ML	f-m Sandy SILT, brown, miost, hard, with mica	15.7		
40	SPT	8 13 23			same	14.0		
45	SPT	8 18 29		SP	f-m SAND, tan, slighlty moist, dense	4.2		
50	SPT	8 14 28		ML	f sandy SILT, brown, moist, hard, with mica	15.0		
					Boring Terminated at 51.5 feet Boring backfilled with excavated soils. No groundwater encountered. Fill to 3.5 feet			
55								
60								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:
AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test
SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Methane Related Services	**DRILLER:**	2R Drilling	**LOGGED BY:**	R. Hankes
PROJECT NAME:	29875 Newport Rd.	**DRILL METHOD:**	Hollow Stem	**OPERATOR:**	Jeff/George
PROJECT NO.:	1414-CR	**HAMMER:**	140#/30"	**RIG TYPE:**	CME 75
LOCATION:	Menifee, CA			**DATE:**	2/9/2016

Boring No.: B-2

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
0					**OLDER ALLUVIUM**			
	Ring	33 50/6"		ML	f Sandy SILT, brown, slightly moist, hard, with some gravel	6.3	128.5	
5	Ring	50/6"				6.7	122.4	
	Ring	30 50/3"			with caliche	9.3	126.9	
10	SPT	25 35 42		ML	SILT, brown, slightly moist, hard, with some m sand grains	9.0		
15	SPT	9 23 21		SM	SILT, brown, moist, hard, with caliche and some f sand grains	14.8		
20	SPT	10 18 30		ML	f Sandy SILT, brown, moist, hard	12.0		
					Boring Terminated at 21.5 feet Boring backfilled with excavated soils. No groundwater encountered. No fill.			
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	Excel Engineering	**DRILLER:**	2R Drilling	**LOGGED BY:**	R. Hankes
PROJECT NAME:	29875 Newport Rd.	**DRILL METHOD:**	Hollow Stem	**OPERATOR:**	Jeff/George
PROJECT NO.:	1414-CR	**HAMMER:**	140#/30"	**RIG TYPE:**	CME 75
LOCATION:	Menifee, CA			**DATE:**	2/9/2016

Boring No.: B-3

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
0					**OLDER ALLUVIUM**			
	Ring	17 34 40		SM	Silty f SAND, brown, moist, dense	12.3	125.7	
5	Ring	16 30 36			with trace clay	11.5	126.6	
	Ring	16 25 26				12.8	123.0	
10								
15	SPT	11 18 16		ML	SILT, brown, moist, hard, with mica and some f-m sand grains	13.6		
20	SPT	10 16 22		SP	f-m SAND, tan and light brown, slightly miost to moist, dense	7.3		
					Boring Terminated at 21.5 feet Boring backfilled with excavated soils. No groundwater encountered. No fill.			
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:
AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test
SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	Excel Engineering	**DRILLER:**	2R Drilling	**LOGGED BY:**	R. Hankes
PROJECT NAME:	29875 Newport Rd.	**DRILL METHOD:**	Hollow Stem	**OPERATOR:**	Jeff/George
PROJECT NO.:	1414-CR	**HAMMER:**	140#/30"	**RIG TYPE:**	CME 75
LOCATION:	Menifee, CA			**DATE:**	2/9/2016

Boring No.: B-4

Depth (ft)	SAMPLES: Sample Type	Blows/ 6 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Dry Density (pcf)	Others
0					**OLDER ALLUVIUM**			
	Ring	14 20 15		SM	Silty f SAND, brown, slightly moist, medium dense, trace gravel	7.3	116.8	
5								
	Ring	37 50/5"		ML	m-f Sandy SILT, brown, slightly moist, hard, with caliche	7.3	126.8	
10	Ring	11 13 15		ML	Clayey SILT, brown and light brown, moist, very stiff	16.3	111.5	
15	SPT	4 10 15		CL	m Sandy CLAY, brown, moist, very stiff	14.8		
20	SPT	6 10 17		ML	f Sandy SILT, brown to dark brown, moist, very stiff, with mica	16.9		
					Boring Terminated at 21.5 feet Boring backfilled with excavated soils. No groundwater encountered. No fill.			
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:
AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test
SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	Excel Engineering	**DRILLER:**	2R Drilling	**LOGGED BY:**	R. Hankes
PROJECT NAME:	29875 Newport Rd.	**DRILL METHOD:**	Hollow Stem	**OPERATOR:**	Jeff/George
PROJECT NO.:	1414-CR	**HAMMER:**	140#/30"	**RIG TYPE:**	CME 75
LOCATION:	Menifee, CA			**DATE:**	2/9/2016

Boring No.: B-5

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
0					**OLDER ALLUVIUM**			
	Ring	18 50/5"		SM	Silty f SAND, brown to dark brown, slightly moist, very dense, with some gravel	5.8	112.0	
5								
	Ring	50/6"			slightly moist to moist	7.9	125.1	
	Ring	50/6"				7.5	121.4	
10								
15	SPT	11 31 50/4"		SM	Silty m-c SAND, reddish brown, slightly moist to moist, very dense	10.5		
20	SPT	14 21 33		SM	Silty f-m sand, reddish brown, slightly moist to moist, very dense, with mica	10.1		
					Boring Terminated at 21.5 feet			
					Boring backfilled with excavated soils. No groundwater encountered.			
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:
AL = Atterberg Limits
EI = Expansion Index
SA = Sieve Analysis
RV = R-Value Test
SR = Sulfate/Resisitivity Test
SH = Shear Test
HC= Consolidation
MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Excel Engineering	**DRILLER:**	2R Drilling	**LOGGED BY:**	DRB
PROJECT NAME:	29875 Newport Rd.	**DRILL METHOD:**	Hollow Stem	**OPERATOR:**	Jeff/George
PROJECT NO.:	1414-CR	**HAMMER:**	140#/30"	**RIG TYPE:**	CME 75
LOCATION:	Menifee, CA			**DATE:**	2/10/2016

Boring No.: B-6

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
0					**OLDER ALLUVIUM**			
				SM	Silty f-c SAND, orange-brown, moderately moist, very dense			
	Ring	30 50/3"				12.5	123.4	
5								
	Ring	8 15 19		ML/CL	Silty CLAY to Clayey SILT, medium brown, moist, very stiff, some sand micaceous	15.8	114.9	
10	Ring	14 24 50		SM	Silty m-c SAND, brown, moderately moist to moist, dense, trace clay	9.0	127.5	
15	SPT	9 18 35		ML	f Sandy SILT to SILT, orange brown, medium brown, tan, moist, hard	20.2		
20	SPT	12 21 25		SM	Silty f SAND to Sandy SILT, brown to orange brown, moist, dense, hard, micaceous	10.1		
25	SPT	14 30 50/5"		SM	Silty f-c SAND, orange brown, moderately moist, very dense	7.3		
30	SPT	12 20 28		SP/SM	m-c SAND, Silty SAND, some small gravel, light to medium brown, slightly moist, dense	4.8		

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:
AL = Atterberg Limits EI = Expansion Index SA = Sieve Analysis RV = R-Value Test
SR = Sulfate/Resisitivity Test SH = Shear Test HC= Consolidation MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Excel Engineering	**DRILLER:**	2R Drilling	**LOGGED BY:**	DRB
PROJECT NAME:	29875 Newport Rd.	**DRILL METHOD:**	Hollow Stem	**OPERATOR:**	Jeff/George
PROJECT NO.:	1414-CR	**HAMMER:**	140#/30"	**RIG TYPE:**	CME 75
LOCATION:	Menifee, CA			**DATE:**	2/10/2016

Boring No.: B-6 (Cont.)

Depth (ft)	Sample Type	Blows/ 6 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Water Content (%)	Dry Density (pcf)	Others
30					(see previous page)			
35	SPT	12 16 20		SM	Silty f-c SAND, brown, orange brown, moist, dense	15.6		
40	SPT	10 23 38		SM	Silty f-c SAND, brown, gold brown, moist, very dense, micaceous	8.3		
45	SPT	14 27 34		SM/ML	Silty f-c SAND to Sandy SILT, brown, moist, very dense, hard	11.0		
50	SPT	14 24 31		SM	Silty f-c SAND, brown, orange brown, moist, very dense	9.2		
					Boring Terminated at 51.5 feet Boring backfilled with excavated soils. No ground water encountered. No fill.			
55								
60								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	Excel Engineering	**DRILLER:**	2R Drilling	**LOGGED BY:**	DRB
PROJECT NAME:	29875 Newport Rd.	**DRILL METHOD:**	Hollow Stem	**OPERATOR:**	Jeff/George
PROJECT NO.:	1414-CR	**HAMMER:**	140#/30"	**RIG TYPE:**	CME 75
LOCATION:	Menifee, CA			**DATE:**	2/10/2016

Boring No.: B-7

Depth (ft)	SAMPLES: Sample Type	Blows/ 6 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Dry Density (pcf)	Others
0					**OLDER ALLUVIUM**			
				ML	Clayey SILT, brown, moist, hard			
	Ring	40 50/4"			same	17.2	107.6	LL=32, PL=29, PI=3
5								
	Ring	3 4 5		CL	Silty CLAY, brown, very moist, medium stiff	32.8	88.1	
10	Ring	6 11 14		CL/ML	Silty CLAY to Clayey SILT, brown, moist, stiff	17.3	115.8	
15	SPT	4 7 11		SM	Silty f-c SAND, some clay, brown, moist, medium dense	24.4		
					Boring Terminated at 16.5 feet			
					Boring backfilled with excavated soils. No ground water encountered. No fill.			
20								
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:
AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test
SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	Excel Engineering	**DRILLER:**	2R Drilling	**LOGGED BY:**	DRB
PROJECT NAME:	29875 Newport Rd.	**DRILL METHOD:**	Hollow Stem	**OPERATOR:**	Jeff/George
PROJECT NO.:	1414-CR	**HAMMER:**	140#/30"	**RIG TYPE:**	CME 75
LOCATION:	Menifee, CA			**DATE:**	2/10/2016

Boring No.: B-8

Depth (ft)	SAMPLES: Sample Type	Blows/ 6 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Dry Density (pcf)	Others
0					**UNDOCUMENTED ARTIFICIAL FILL**			
				SM	Silty f-c SAND, brown, orange brown, moist dense			
	Ring	7 19 22		SM	**ALLUVIUM** Silty f-c SAND, orange brown, moist, medium dense	13.1	121.3	
5								
	Ring	11 27 49		SM	Silty f-c SAND, brown and orange brown, moderately moist to moist, very dense	8.2	127.2	
10	Ring	26 50/5"		SM/SC	Silty and Clayey f-c SAND, brown, orange brown, moderately moist to moist, very dense	11.2	123.8	
15	SPT	9 14 30		SM	Silty m-c SAND, red brown, brown, moderately moist, dense	11.5		
20	SPT	9 17 24		SM	Silty m-c SAND, medium red and orange brown, moderately moist, dense	11.5		
					Boring Terminated at 21.5 feet Boring backfilled with excavated soils. No ground water encountered. Fill to approximatly 3 feet.			
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:
AL = Atterberg Limits EI = Expansion Index SA = Sieve Analysis RV = R-Value Test
SR = Sulfate/Resisitivity Test SH = Shear Test HC= Consolidation MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Excel Engineering	**DRILLER:**	2R Drilling	**LOGGED BY:**	DRB
PROJECT NAME:	29875 Newport Rd.	**DRILL METHOD:**	Hollow Stem	**OPERATOR:**	Jeff/George
PROJECT NO.:	1414-CR	**HAMMER:**	140#/30"	**RIG TYPE:**	CME 75
LOCATION:	Menifee, CA			**DATE:**	2/10/2016

Boring No.: B-9

Depth (ft)	SAMPLES: Sample Type	Blows/ 6 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Dry Density (pcf)	Others
0					**ALLUVIUM**			
				SM	Silty f-m SAND, brown, orange brown, moderately moist, dense			
	Ring	15 26 27		SM/ML	Silty f SAND to Sandy SILT, medium brown, moderately moist, dense/ very stiff	6.7	109.1	
5								
	Ring	50/6"		SM	Silty f-c SAND, orange brown, moderately moist, very dense, some mica very dense	8.0	119.6	
	Ring	50/6"		SM	Silty f-c SAND, red brown, orange brown, moderately moist, very dense, some mica	8.0	117.7	
10								
15	SPT	12 14 22		SM/ML	Silty f-m SAND to Sandy SILT, orange brown, brown, moderately moist to moist, dense/hard	11.0		
20	SPT	8				5.5		
		31 50			**BEDROCK** Granite, tan, light orange brown and black crystals, hard to very hard			
					Boring Terminated at 21.5 feet Boring backfilled with excavated soils. No ground water encountered. No fill.			
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	Excel Engineering	**DRILLER:**	2R Drilling	**LOGGED BY:**	DRB
PROJECT NAME:	29875 Newport Rd.	**DRILL METHOD:**	Hollow Stem	**OPERATOR:**	Jeff/George
PROJECT NO.:	1414-CR	**HAMMER:**	140#/30"	**RIG TYPE:**	CME 75
LOCATION:	Menifee, CA			**DATE:**	2/10/2016

Boring No.: B-10

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
0					**UNDOCUMENTED ARTIFICIAL FILL** Silty f-m SAND, brown, orange brown, moderately moist, dense			
					ALLUVIUM			
	Ring	13 20 44		SM	Silty f-m SAND, orange brown, brown, moderately moist to moist, dense, local small gravel	6.6	125.6	
5								
	Ring	40 50/3"		SM	Silty f-c SAND, red to orange brown, moderately moist to moist, very dense	8.3	115.3	
10	Ring	23 50/2"		SM	Silty f-c SAND, red brown, moderately moist to moist, very dense	9.0	126.6	
15	SPT	17 50/2"				5.7		
					BEDROCK Granite, tan, light orange brown and black crystals, hard to very hard, weathered			
20	SPT	50/2"						
					Boring Terminated at 20.5 feet Boring backfilled with excavated soils. No ground water encountered. Approximately 2 feet of fill.			
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:
AL = Atterberg Limits, EI = Expansion Index, SA = Sieve Analysis, RV = R-Value Test
SR = Sulfate/Resisitivity Test, SH = Shear Test, HC= Consolidation, MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	Excel Engineering	**DRILLER:**	2R Drilling	**LOGGED BY:**	R. Hankes
PROJECT NAME:	29875 Newport Rd.	**DRILL METHOD:**	Hollow Stem	**OPERATOR:**	Jeff/George
PROJECT NO.:	1414-CR	**HAMMER:**	140#/30"	**RIG TYPE:**	CME 75
LOCATION:	Menifee, CA			**DATE:**	2/9/2016

Boring No.: P-1

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
0					**OLDER ALLUVIUM**			
5	Ring	35 50/5"		SM	Silty f-m SAND, brown, slightly moist to moist, very dense	9.5	127.7	
	Ring	12 24 44		ML	Clayey SILT, brown, moist, hard, with some coarse sand	16.4	117.4	
10					**Boring Terminated at 10 feet** No groundwater encountered. No fill. Pipe and gravel set for percolation testing.			
15								
20								
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:
AL = Atterberg Limits
EI = Expansion Index
SA = Sieve Analysis
RV = R-Value Test
SR = Sulfate/Resisitivity Test
SH = Shear Test
HC= Consolidation
MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	Excel Engineering	**DRILLER:**	2R Drilling	**LOGGED BY:**	R. Hankes
PROJECT NAME:	29875 Newport Rd.	**DRILL METHOD:**	Hollow Stem	**OPERATOR:**	Jeff/George
PROJECT NO.:	1414-CR	**HAMMER:**	140#/30"	**RIG TYPE:**	CME 75
LOCATION:	Menifee, CA			**DATE:**	2/9/2016

Boring No.: P-2

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
0					**OLDER ALLUVIUM**			
5	Ring	18 22 25		ML	SILT, brown, moist, hard, with some m sand and rock fragments	15.1	119.0	
	Ring	12 24 23		ML	f-m Sandy SILT, brown, slightly moist to moist, hard	11.8	124.8	
10					**Boring Terminated at 10 feet** No groundwater encountered. No fill. Pipe and gravel set for percolation testing.			
15								
20								
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:
AL = Atterberg Limits
EI = Expansion Index
SA = Sieve Analysis
RV = R-Value Test
SR = Sulfate/Resisitivity Test
SH = Shear Test
HC= Consolidation
MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Excel Engineering	**DRILLER:**	2R Drilling	**LOGGED BY:**	R. Hankes
PROJECT NAME:	29875 Newport Rd.	**DRILL METHOD:**	Hollow Stem	**OPERATOR:**	Jeff/George
PROJECT NO.:	1414-CR	**HAMMER:**	140#/30"	**RIG TYPE:**	CME 75
LOCATION:	Menifee, CA			**DATE:**	2/9/2016

Boring No.: P-3

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
0					**OLDER ALLUVIUM**			
5	Ring	20 33 46		ML	f Sandy SILT, light brown and dark greenish brown, moist, hard, with mica	16.6	116.6	
	Ring	28 33 44				14.7	120.1	
10					**Boring Terminated at 10 feet** No groundwater encountered. No fill. Pipe and gravel set for percolation testing.			
15								
20								
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:

AL = Atterberg Limits, EI = Expansion Index, SA = Sieve Analysis, RV = R-Value Test

SR = Sulfate/Resisitivity Test, SH = Shear Test, HC= Consolidation, MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	Excel Engineering	**DRILLER:**	2R Drilling	**LOGGED BY:**	DRB
PROJECT NAME:	29875 Newport Rd.	**DRILL METHOD:**	Hollow Stem	**OPERATOR:**	Jeff/George
PROJECT NO.:	1414-CR	**HAMMER:**	140#/30"	**RIG TYPE:**	CME 75
LOCATION:	Menifee, CA			**DATE:**	2/10/2016

Boring No.: P-4

Depth (ft)	SAMPLES: Sample Type	Blows/ 6 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Dry Density (pcf)	Others
0					**ALLUVIUM**			
				SM/ML	Silty f SAND to Sandy SILT, medium orange brown, moderately moist, dense, stiff			
5	Ring	38 40 43		ML	SILT with Clay and Sand, brown, moderately moist, hard	10.4	123.5	
	Ring	18 24 24		ML	Clayey SILT, some sand, brown, orange brown, moist, hard	10.9	125.1	
10					**Boring Terminated at 10 feet** No ground water encountered. No fill. Pipe and gravel set for percolation testing.			
15								
20								
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

APPENDIX B

RESULTS OF LABORATORY TESTING

Excel Engineering
29875 Newport Road, Menifee, Riverside County, California
Project No. 1414-CR

GEOTEK

SUMMARY OF LABORATORY TESTING

Classification
Soils were classified visually in general accordance to the Unified Soil Classification System (ASTM Test Method D 2487). The soil classifications are shown on the logs of borings in Appendix A.

Gradation Analysis
Gradation analysis was performed on selected samples of the site soils according to ASTM 422. The results of this testing is presented in the boring logs in Appendix A.

Atterberg Limits
Liquid Limit, Plastic Limit and Plasticity Index testing was completed on bulk soil samples collected from the site. Results are included on the boring logs in Appendix A.

Expansion Index
Expansion index testing was performed on two soil samples. Testing was performed in general accordance with ASTM Test Method D 4829. The result indicates that the tested soil is considered to be in the "very low" expansion range.

Location	Depth	Soil Type	Expansion Index	Classification
B-1	0-5'	Silty Sand	14	Very Low
B-7	0-2.5’	Clayey Silt	22	Low

In-Situ Moisture and Density
The natural water content was determined (ASTM D 2216) on samples of the materials recovered from the subsurface exploration. In addition, in-place dry density determination (ASTM D 2937) were performed on relatively undisturbed samples to measure the unity weight of the subsurface soils. Results of these tests are shown on the boring logs at the appropriate sample depths in Appendix A.

Moisture-Density Relationship
Laboratory testing was performed on two samples collected during the subsurface exploration. The laboratory maximum dry density and optimum moisture content for the soil type was determined in general accordance with test method ASTM Test Procedure D 1557. The results are included herein in Appendix B.

Direct Shear
Shear testing was performed in a direct shear machine of the strain-control type in general accordance with ASTM Test Method D 3080. The rate of deformation is approximately 0.01 inches per minute. The samples were sheared under varying confining loads in order to determine the coulomb shear strength parameters, angle of internal friction and cohesion. One test was performed on a bulk sample that was remolded to 90 percent relative compaction. The shear test results are presented herein in Appendix B.

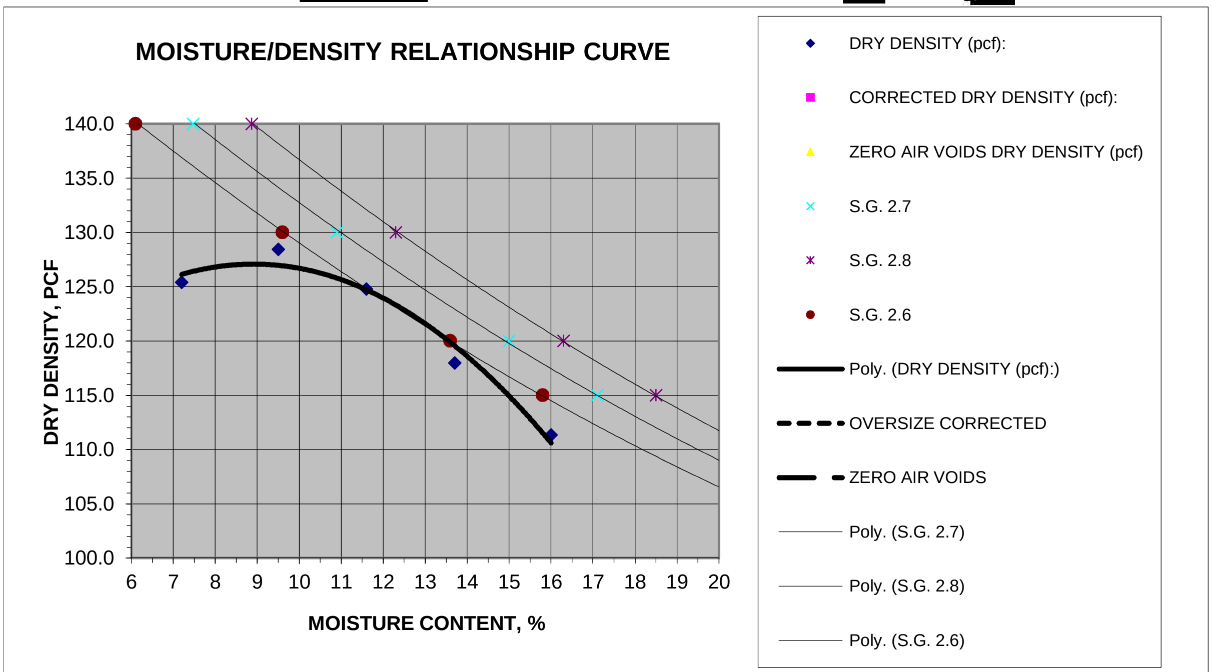
Sulfate Content, Resistivity and Chloride Content
Testing to determine the water-soluble sulfate content was performed by others in general accordance with California Test No. 417. Resistivity testing was completed by others in general accordance with California Test No. 643. Testing to determine the chloride content was performed by others in general accordance with California Test No. 422. The results are included herein in Appendix B.

MOISTURE/DENSITY RELATIONSHIP

Client: Excel Engineering
Job No.: 1414-CR
Project: 29875 Newport Rd.
Lab No.: Corona
Location: Menifee
Material Type: Brown F - M Silty Sand
Material Supplier:
Material Source:
Sample Location: B-1 @ 0 - 5

Sampled By: RH
Date Sampled: 9-Feb-16
Received By: DI
Date Received: 10-Feb-16
Tested By: AH
Date Tested: 12-Feb-16
Reviewed By:
Date Reviewed:

Test Procedure: ASTM 1557 **Method:** A
Oversized Material (%): 1.1 **Correction Required:** ☐ yes ☒ no



MOISTURE DENSITY RELATIONSHIP VALUES

Maximum Dry Density, pcf	128.5	**@ Optimum Moisture, %**	9.5
Corrected Maximum Dry Density, pcf		**@ Optimum Moisture, %**	

MATERIAL DESCRIPTION

Grain Size Distribution:

	% Gravel (retained on No. 4)
	% Sand (Passing No. 4, Retained on No. 200)
	% Silt and Clay (Passing No. 200)

Atterberg Limits:

	Liquid Limit, %
	Plastic Limit, %
	Plasticity Index, %

Classification:

Unified Soils Classification:
AASHTO Soils Classification:

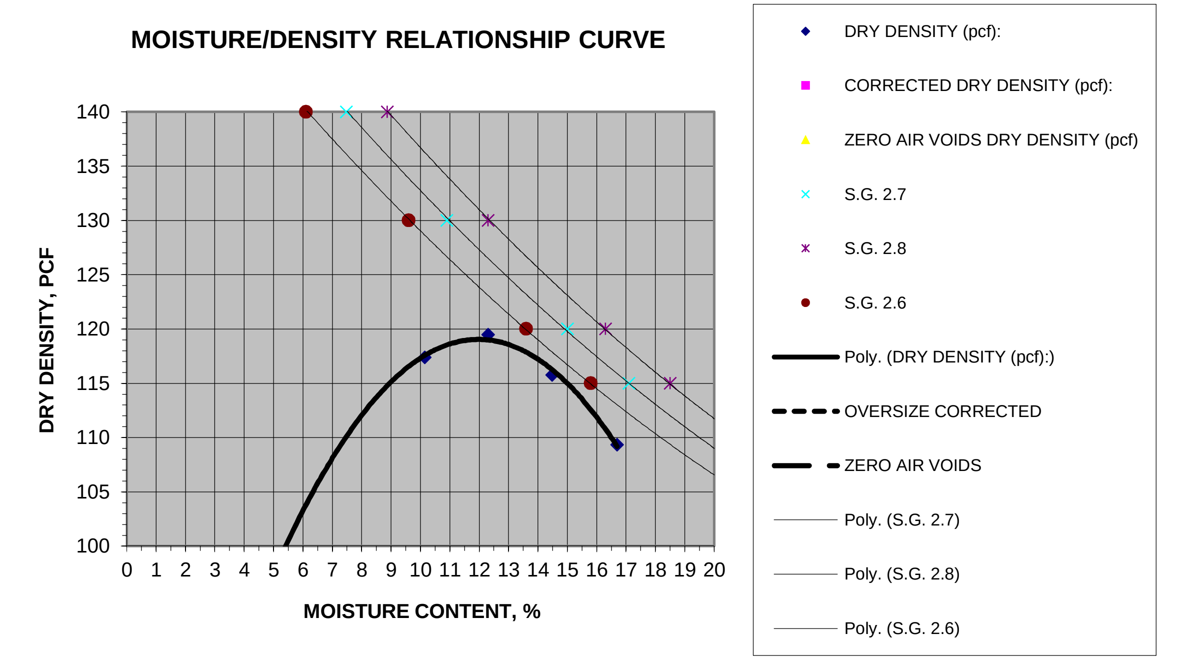
MD-1

MOISTURE/DENSITY RELATIONSHIP

Client:	Excel Engineering	**Job No.:**	1414-CR
Project:	29875 Newport Rd.	**Lab No.:**	Corona
Location:	Menifee		
Material Type:	Brown F - M Silty Sand		
Material Supplier:			
Material Source:			
Sample Location:	B-7 @ 0 - 2.5		
Sampled By:	RH	**Date Sampled:**	9-Feb-16
Received By:	DI	**Date Received:**	10-Feb-16
Tested By:	AH	**Date Tested:**	15-Feb-16
Reviewed By:		**Date Reviewed:**	

Test Procedure: ASTM 1557 **Method:** A

Oversized Material (%): 1.1 **Correction Required:** ☐ yes ☒ no



MOISTURE DENSITY RELATIONSHIP VALUES

Maximum Dry Density, pcf	119.5	**@ Optimum Moisture, %**	12.0
Corrected Maximum Dry Density, pcf		**@ Optimum Moisture, %**	

MATERIAL DESCRIPTION

Grain Size Distribution:

	% Gravel (retained on No. 4)
	% Sand (Passing No. 4, Retained on No. 200)
	% Silt and Clay (Passing No. 200)

Atterberg Limits:

	Liquid Limit, %
	Plastic Limit, %
	Plasticity Index, %

Classification:

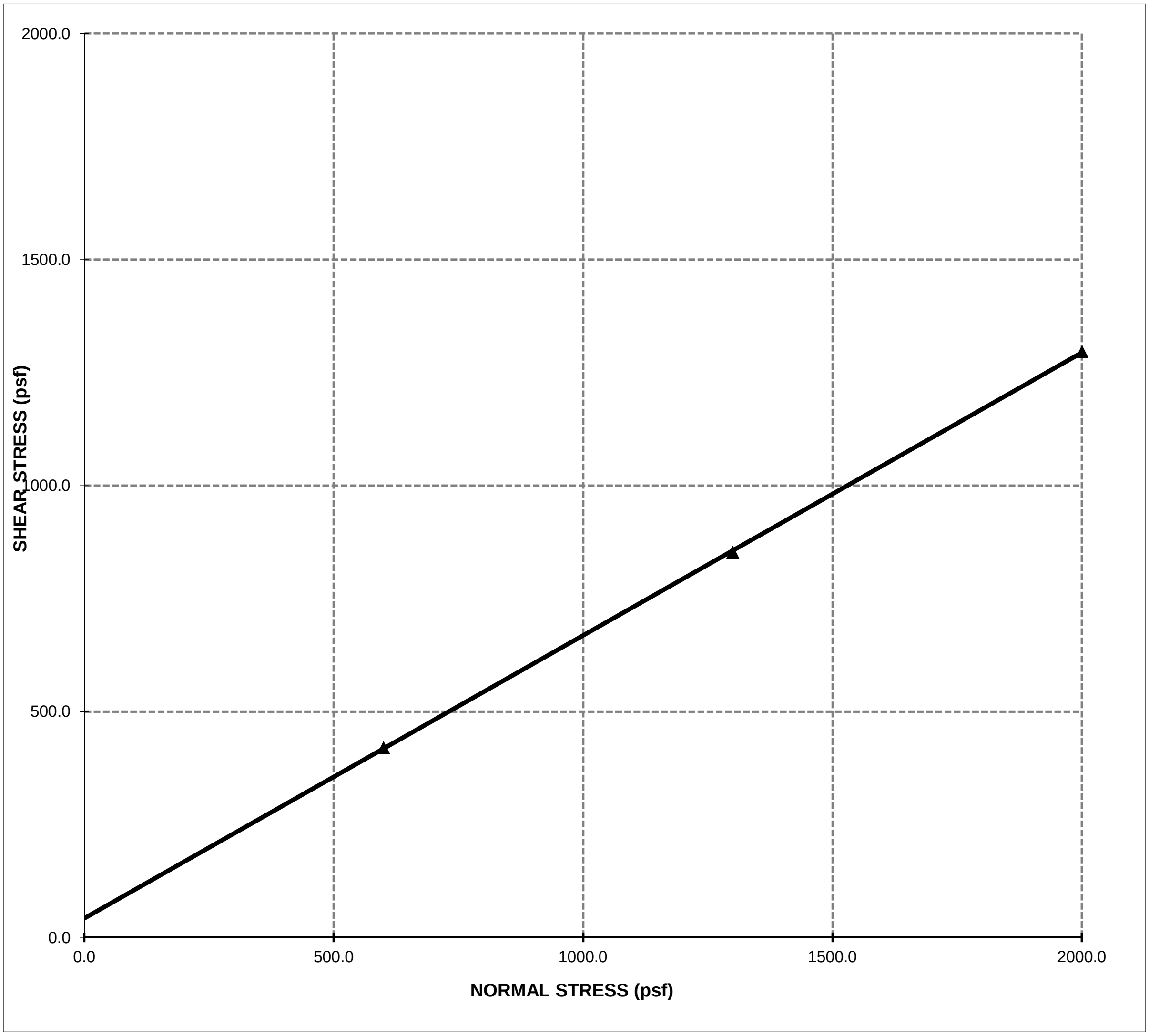
Unified Soils Classification:

AASHTO Soils Classification:

MD-2

DIRECT SHEAR TEST

Project Name:	29875 Newport Rd., Menifee	***Sample Location:***	B-1 @ 0 - 5
Project Number:	1414-CR	***Date Tested:***	2/22/2016



Shear Strength: Φ = **32.0 °** , **C = 42.57 psf**

Notes: 1 - The soil specimen used in the shear box was a ring sample remolded to approximately 90% relative compaction from a bulk sample collected during the field investigation.

2 - The above reflect residual shear strength at saturated conditions.

3 - The tests were run at a shear rate of 0.035 in/min.

GeoTek, Inc.
710 East Parkridge Avenue, Suite 105
Corona, California 92879

Client: Excel Engineering
W.O.: 1414-CR
Project: 29875 Newport Rd, Menifee

Date: February 22, 2016
QCI Project No.: 16-167-002h
Summarized by: KA

Corrosivity Test Results

Sample ID	Sample Depth (Feet)	pH CT-532 (643)	Chloride CT-422 (ppm)	Sulfate CT-417 (% By Weight)	Resistivity CT-532 (643) (ohm-cm)
B-1	0.5’	7.21	20	0.0890	270
B-7	0-2.5’	8.52	45	0.0070	1100

APPENDIX C

METHANE REPORT BY CEC

Excel Engineering

29875 Newport Road, Menifee, Riverside County, California

Project No. 1414-CR

GEOTEK

Carlin Environmental Consulting, Inc.
Assessment X Remediation X Mitigation Design
2522 Chambers Road, # 100
Tustin, California 92780
714-508-1111

GeoTek, Inc.
710 E. Parkridge Ave. Suite 105
Corona, CA 92879

February 24, 2016

Attention: Ed LaMont

Subject: Methane Related Services For the Former Abacherli Dairy Site, City of Menifee, Riverside County, California.

In accordance with your request, it is Carlin Environmental Consulting, Inc's. (CEC) pleasure to provide environmental consulting services related to methane issues at the Abacherli Site in the City of Menifee, California (Figure 1). The subject investigation was conducted for the purpose of providing preliminary information regarding methane beneath the site with the goal of providing guidance during grading and/or development of the site. However, the investigation conducted cannot replace the Requirements of the County of Riverside, which requires testing on a lot-by-lot basis after rough grading has been completed.

The County of Riverside protocols require that minimum methane mitigation measures be incorporated into the construction plans for approval by the County's Building and Safety Staff where previous dairy, livestock or related activities have occurred. The actual mitigation measures are dependent on testing that can only be conducted 30-days after the site has been graded. The County has minimum standards for methane mitigation depending on the level of methane encountered. Methane mitigation must be provided on the foundation plans and approved by the appropriate agency. During construction the methane design engineer is required to certify and approve the installation of the mitigation measures on each lot or cluster of lots.

Methane production beneath the ground surface is controlled by several factors. It is produced in an anaerobic (oxygen depleted) environment where there is sufficient organic material present. Near the ground surface (upper three feet) there is little

Modified from Google Earth

Site Location Map

Carlin Environmental Consulting

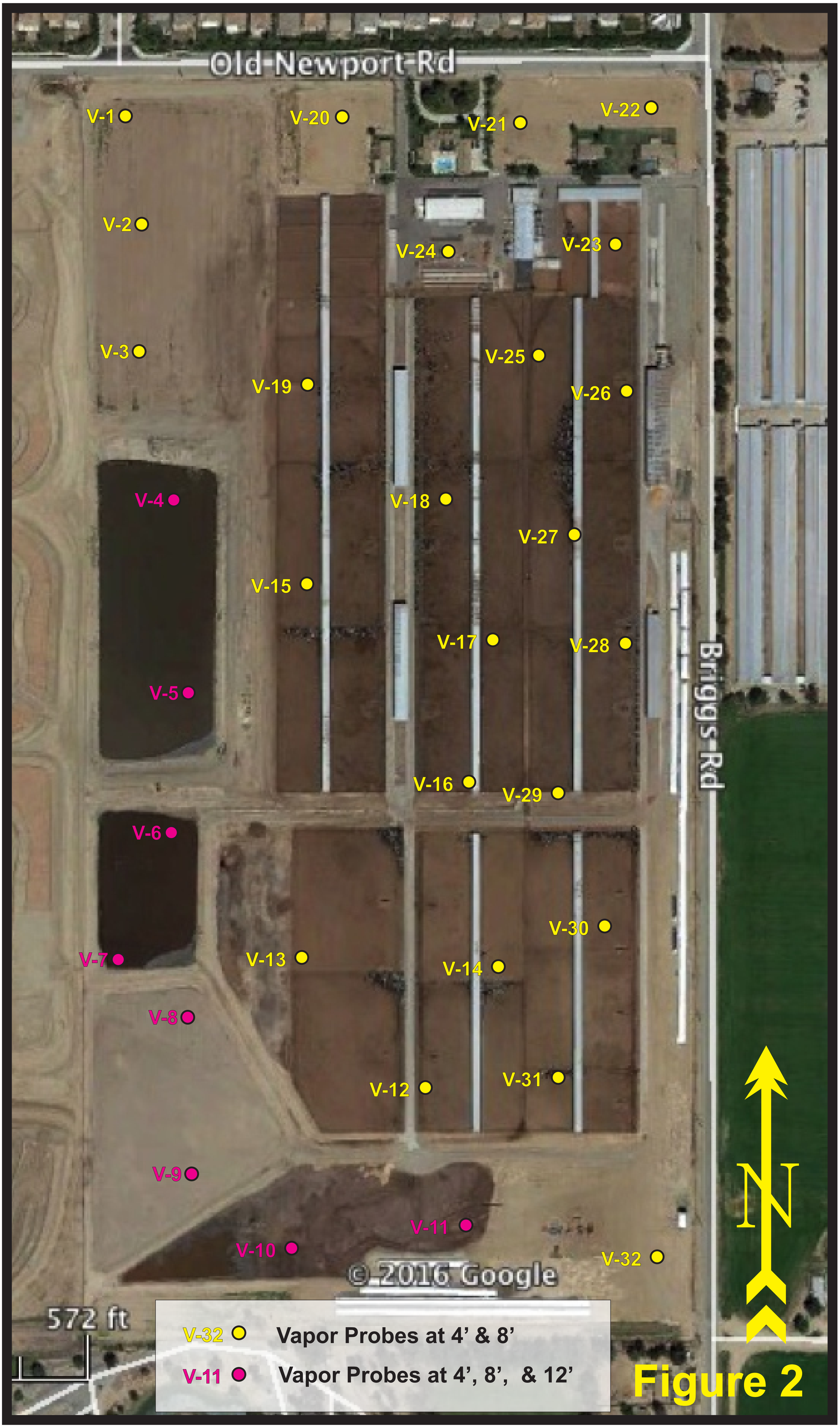
Figure 1

methane production because the oxygen content is too high. This is especially true in sandier soils. With depth, the oxygen content decreases and therefore, the potential for methane production increases. Generally the organic content of soils decreases with depth as the amount of roots and other natural organic material decreases. For a typical dairy operation there is variable organic material beneath the surface due to the significant quantities of manure and urine produced by the livestock. The organics are flushed into the subsurface soils through rain and/or with the urine. The area where the waste products are either stockpiled and/or in the stock ponds have increased flushing of organics into the soils and therefore, the methane production is typically greatest in these areas.

Preliminary Methane Investigation

A preliminary Methane study is required by the County of Riverside, which identifies whether or not the project site, or portions of the site, were previously occupied by dairy operations and within a County of Riverside zone that requires special methane protocols. The subject site is rectangular shaped and approximately 75 acres in size. It is our understanding that the proposed development will consist of single-family homes sites along with associated improvements. CEC reviewed aerial photographs available from Google Earth dating 1994 to present and from Historicaerials.com, which has photographs available from 1967 to present. In addition regional and historical topographic maps were also observed.

Based on a preliminary review of readily available information it appears that approximately 85% of the site was utilized for previous livestock activities and will require evaluation and/or mitigation for methane. Figure 3 indicates those areas that have been identified to have been utilized for livestock related activities and those areas that did not have related activities (highlighted in green). The non-related activities areas include the residential structure areas, areas that were used primarily related to crops, and the site perimeter areas.


Old Newport Rd
Briggs Rd
V-1
V-2
V-3
V-4
V-5
V-6
V-7
V-8
V-9
V-10
V-11
V-12
V-13
V-14
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V-32
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572 ft
N
V-32 Vapor Probes at 4' & 8'
V-11 Vapor Probes at 4', 8', & 12'

Figure 2

Field Testing for Methane

As requested, preliminary testing for methane was conducted at the site for the purpose of guiding future grading operations. Thirty-two probe sets were installed in a two-day period (Figure 2). This is approximately 1/2 probe per acre of land that was utilized for former dairy related activities. In the areas of former stock pens and other uses, the probes were set at depths of 4 and 8 feet below existing grade. In former pond areas a third probe was placed at a depth of approximately 12 feet below existing grades. The soil-gas probes were installed with a direct push rig that punches a hole in the ground. The tubing and gas probes are then placed in the hole and backfilled with sand surrounding the probes and bentonite plugs between the probe depths. The probe tubes are extended above the surface where they can be connected to a device that monitors/reads the amount of methane gas within the soil column. Each probe was monitored twice after the probes were installed in order to verify consistent results. The results of the methane monitoring are presented on Table 1.

Findings

Review of the site history and past uses at the site indicates three general areas present at the site. These are 1) Areas where there was not significant use for domestic animal /dairy related uses; 2) Areas where domestic animals were present and kept in pens and/or manure stored and spread; 3) Areas of stock ponds or desilting basins that collected the urine and other liquid waste from the animals at the site. The methane concentrations from the vapor probes were compared to these three use areas. Figure 3 indicates the maximum concentration measured (for either of the two readings) for the probes installed at each location. Analysis of the data in comparison to the past site usage indicates that for those areas that did not have domestic animal use (Area 1) had the lowest methane readings. In theses areas (highlighted in green on Figure 3) the maximum concentration of methane detected was less than 200 parts per million (ppm). In Area 2, where the stock pens were located, the concentrations of methane were generally above 100 ppm and below 1,200 ppm. In the stock pond areas (Area 3 highlighted in red on Figure 3) methane concentrations were generally above 200 ppm and were as high as 50,000 ppm.

Conclusions and Recommendations

It is CEC's conclusion that the concentrations of methane measured in the subsurface probes match well with the previous site uses. Therefore, CEC's recommendations are specific to each of the three areas as discussed below.

Area 1 - Aerial photographs and methane readings both indicate that these areas were not used for significant domestic animal related uses, therefore these areas are considered exempt from methane mitigation and/or testing after grading has been completed. Care should be taken not to import fill from other portions of the site that has significant manure or organic content into this area. Prior to site development the proposed grading plan, which indicates the layout of individual lots, should be reviewed to determine specific lots that are exempt from methane investigation and/or mitigation.

Area 2 – This area (un-highlighted on Figure 3) has moderate methane concentrations beneath the surface. Due to the presence of domesticated animals, County regulations indicate that these areas must be tested on a lot-by-lot basis a minimum 30 days after grading has been conducted. In addition manure remnants were observed in the near surface within these former stock pen areas. CEC recommends that this near surface highly organic material be skimmed from these areas and removed offsite. Any former manure stockpiles should also be removed from the site.

Area 3 – The stock pond and desilting basin areas have collected urine and other waste products from the former daily operations and the subsurface soils have significant concentrations of organic material that have resulted in the production of methane. The production of significant methane was measured at depths of up to 12 feet. It is likely that that methane is being produced at depths greater than 12 feet. Remedial removals in former stock pond areas should be carefully observed during grading. Because the organics have been flushed deep into the native soils it may not be economically feasible

Old Newport Rd
Briggs Rd
V-1 120 160
V-2 110 180
V-3 75 190
V-4 2450 50000 3800
V-5 360 7050 1250
V-6 400 800 3800
V-7 1250 7800 15750
V-8 800 5780 5250
V-9 1600 3500
V-10 130 14000 15000
V-11 210 590 1200
V-12 180 330
V-13 110 160
V-14 270 450
V-15 200 330
V-16 150 320
V-17 180 320
V-18 130 230
V-19 300 290
V-20 95 150
V-21 100
V-22 95 160
V-23 280 350
V-24 250 45
V-25 160 270
V-26 220 430
V-27 260 1160
V-28 260 640
V-29 290 410
V-30 160 540
V-31 160 420
V-32 180 570
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572 ft
N
130 - 4' -Probe reading
14000 - 8' -Probe reading
15000 - 12' -Probe reading
- Areas exempt from further methane testing
- Former/existing Stock Pond Areas

Figure 3

to remove all the organics that are producing significant methane. The near surface soils may not currently be producing the greatest quantities of methane, however this may be due to increased oxygen content, which is less favorable for methane production.

To develop the site into single-family residences will require significant grading to create level pads and associated improvements. A preliminary plan for the site also indicates the potential for a lake and/or deep drainage/desilting basin. To reduce the potential for methane production any highly organic manure stockpiles or the near surface remaining manure should be skimmed from the surface and removed offsite. Remedial removals in the stock pond areas should be based on visual observations to determine if highly organic rich layers are present. The methane testing conducted during this investigation suggests that remedial removals as deep as 10 feet below the former stock ponds would be prudent. However, ultimately the geotechnical consultant must also determine the appropriate remedial removal depths to provide a suitable foundation material.

As indicated previously, organic rich soils should not be placed within those areas that are designated as exempt from methane testing protocols (highlighted in green on Figure 3). County protocols also indicate that the organic content of fill materials beneath residential structures should be less than 1%.

Prior to site development the proposed grading plan which indicates the layout of individual lots should be reviewed to determine specific lots that are exempt from methane investigation and/or mitigation.

If you have any questions, comments, or addendums to this proposal, please feel free to contact Gary Carlin at any time at 714-508-1111.

Sincerely,
Carlin Environmental Services, Inc.

Don Terres	Gary T. Carlin
Project Geologist	President/Environmental Scientist
P.G. 4349, CEG 1362	

Table 1 - Menifee Project

Probe #	1st Reading - 2-2-16			2nd Reading - 2-3-16		
	4'	8'	12'	4'	8'	12'
1	120	100	x	95	160	x
2	110	180	x	110	140	x
3	75	190	x	50	190	x
4	2,450	50,000	3,800	2,350	49,000	2,700
5	360	7,050	1,250	160	4,400	900
6	35	800	3,800	400	290	1,200
7	1,250	7,800	15,750	590	3,600	4,900
8	800	5,780	5,250	Fail*	Fail*	Fail*
9	1,600	3,500	Fail*	Fail	4,500-Fail	Fail*
10	130	12,500	25,000	120	14,000-Fail	15,000-Fail
11	200	590	1,200	210	580	750
12	160	320	x	180	330	x
13	110	160	x	60	150	x
14	270	450	x	210	220	x
15	not read**	not read**	x	200	330	x
16	150	310	x	130	320	x
17	180	320	x	170	240	x
18	130	120	x	65	230	x
19	300	290	x	not read**	not read**	x
20	95	150	x	25	85	x
21	100	Fail*	x	85	Fail*	x
22	95	160	x	75	150	x
23	280	350	x	150	200	x
24	250	-	x	190	45	x
25	160	250	x	120	270	x
26	220	430	x	150	260	x
27	250	1,150	x	260	850-Fail	x
28	260	640	x	250	340	x
29	290	410	x	280	390	x
30	160	510	x	160	540-Fail	x
31	140	420	x	160	420	x
32	160	15	x	180	570	x

* Fail = Lack of Air in vapor Probe for Instrument to read

** Probe could not be located

APPENDIX D

GENERAL GRADING GUIDELINES

Excel Engineering

29875 Newport Road, Menifee, Riverside County, California

Project No. 1414-CR

GEOTEK

GENERAL GRADING GUIDELINES

Guidelines presented herein are intended to address general construction procedures for earthwork construction. Specific situations and conditions often arise which cannot reasonably be discussed in general guidelines, when anticipated these are discussed in the text of the report. Often unanticipated conditions are encountered which may necessitate modification or changes to these guidelines. It is our hope that these will assist the contractor to more efficiently complete the project by providing a reasonable understanding of the procedures that would be expected during earthwork and the testing and observation used to evaluate those procedures.

General

Grading should be performed to at least the minimum requirements of governing agencies, Chapters 18 and 33 of the Uniform Building Code, CBC (2013) and the guidelines presented below.

Preconstruction Meeting

A preconstruction meeting should be held prior to site earthwork. Any questions the contractor has regarding our recommendations, general site conditions, apparent discrepancies between reported and actual conditions and/or differences in procedures the contractor intends to use should be brought up at that meeting. The contractor (including the main onsite representative) should review our report and these guidelines in advance of the meeting. Any comments the contractor may have regarding these guidelines should be brought up at that meeting.

Grading Observation and Testing

1. Observation of the fill placement should be provided by our representative during grading. Verbal communication during the course of each day will be used to inform the contractor of test results. The contractor should receive a copy of the "Daily Field Report" indicating results of field density tests that day. If our representative does not provide the contractor with these reports, our office should be notified.
2. Testing and observation procedures are, by their nature, specific to the work or area observed and location of the tests taken, variability may occur in other locations. The contractor is responsible for the uniformity of the grading operations; our observations and test results are intended to evaluate the contractor's overall level of efforts during grading. The contractor's personnel are the only individuals participating in all aspect of site work. Compaction testing and observation should not be considered as relieving the contractor's responsibility to properly compact the fill.
3. Cleanouts, processed ground to receive fill, key excavations, and subdrains should be observed by our representative prior to placing any fill. It will be the contractor's responsibility to notify our representative or office when such areas are ready for observation.
4. Density tests may be made on the surface material to receive fill, as considered warranted by this firm.

5. In general, density tests would be made at maximum intervals of two feet of fill height or every 1,000 cubic yards of fill placed. Criteria will vary depending on soil conditions and size of the fill. More frequent testing may be performed. In any case, an adequate number of field density tests should be made to evaluate the required compaction and moisture content is generally being obtained.
6. Laboratory testing to support field test procedures will be performed, as considered warranted, based on conditions encountered (e.g. change of material sources, types, etc.) Every effort will be made to process samples in the laboratory as quickly as possible and in progress construction projects are our first priority. However, laboratory workloads may cause in delays and some soils may require a **minimum of 48 to 72 hours to complete test procedures**. Whenever possible, our representative(s) should be informed in advance of operational changes that might result in different source areas for materials.
7. Procedures for testing of fill slopes are as follows:
   a) Density tests should be taken periodically during grading on the flat surface of the fill, three to five feet horizontally from the face of the slope.
   b) If a method other than over building and cutting back to the compacted core is to be employed, slope compaction testing during construction should include testing the outer six inches to three feet in the slope face to determine if the required compaction is being achieved.
8. Finish grade testing of slopes and pad surfaces should be performed after construction is complete.

Site Clearing

1. All vegetation, and other deleterious materials, should be removed from the site. If material is not immediately removed from the site it should be stockpiled in a designated area(s) well outside of all current work areas and delineated with flagging or other means. Site clearing should be performed in advance of any grading in a specific area.
2. Efforts should be made by the contractor to remove all organic or other deleterious material from the fill, as even the most diligent efforts may result in the incorporation of some materials. This is especially important when grading is occurring near the natural grade. All equipment operators should be aware of these efforts. Laborers may be required as root pickers.
3. Nonorganic debris or concrete may be placed in deeper fill areas provided the procedures used are observed and found acceptable by our representative.

Treatment of Existing Ground

1. Following site clearing, all surficial deposits of alluvium and colluvium as well as weathered or creep effected bedrock, should be removed unless otherwise specifically indicated in the text of this report.

2. In some cases, removal may be recommended to a specified depth (e.g. flat sites where partial alluvial removals may be sufficient). The contractor should not exceed these depths unless directed otherwise by our representative.
3. Groundwater existing in alluvial areas may make excavation difficult. Deeper removals than indicated in the text of the report may be necessary due to saturation during winter months.
4. Subsequent to removals, the natural ground should be processed to a depth of six inches, moistened to near optimum moisture conditions and compacted to fill standards.
5. Exploratory back hoe or dozer trenches still remaining after site removal should be excavated and filled with compacted fill if they can be located.

Fill Placement

1. Unless otherwise indicated, all site soil and bedrock may be reused for compacted fill; however, some special processing or handling may be required (see text of report).
2. Material used in the compacting process should be evenly spread, moisture conditioned, processed, and compacted in thin lifts six (6) to eight (8) inches in compacted thickness to obtain a uniformly dense layer. The fill should be placed and compacted on a nearly horizontal plane, unless otherwise found acceptable by our representative.
3. If the moisture content or relative density varies from that recommended by this firm, the contractor should rework the fill until it is in accordance with the following:
   a) Moisture content of the fill should be at or above optimum moisture. Moisture should be evenly distributed without wet and dry pockets. Pre-watering of cut or removal areas should be considered in addition to watering during fill placement, particularly in clay or dry surficial soils. The ability of the contractor to obtain the proper moisture content will control production rates.
   b) Each six-inch layer should be compacted to at least 90 percent of the maximum dry density in compliance with the testing method specified by the controlling governmental agency. In most cases, the testing method is ASTM Test Designation D 1557.
4. Rock fragments less than eight inches in diameter may be utilized in the fill, provided:
   a) They are not placed in concentrated pockets;
   b) There is a sufficient percentage of fine-grained material to surround the rocks;
   c) The distribution of the rocks is observed by, and acceptable to, our representative.
5. Rocks exceeding eight (8) inches in diameter should be taken off site, broken into smaller fragments, or placed in accordance with recommendations of this firm in areas designated suitable for rock disposal. On projects where significant large quantities of oversized materials are anticipated, alternate guidelines for placement may be included. If significant oversize materials are encountered during construction, these guidelines should be requested.
6. In clay soil, dry or large chunks or blocks are common. If in excess of eight (8) inches minimum dimension, then they are considered as oversized. Sheepsfoot compactors or other suitable

methods should be used to break up blocks. When dry, they should be moisture conditioned to provide a uniform condition with the surrounding fill.

Slope Construction

1. The contractor should obtain a minimum relative compaction of 90 percent out to the finished slope face of fill slopes. This may be achieved by either overbuilding the slope and cutting back to the compacted core, or by direct compaction of the slope face with suitable equipment.
2. Slopes trimmed to the compacted core should be overbuilt by at least three (3) feet with compaction efforts out to the edge of the false slope. Failure to properly compact the outer edge results in trimming not exposing the compacted core and additional compaction after trimming may be necessary.
3. If fill slopes are built "at grade" using direct compaction methods, then the slope construction should be performed so that a constant gradient is maintained throughout construction. Soil should not be "spilled" over the slope face nor should slopes be "pushed out" to obtain grades. Compaction equipment should compact each lift along the immediate top of slope. Slopes should be back rolled or otherwise compacted at approximately every 4 feet vertically as the slope is built.
4. Corners and bends in slopes should have special attention during construction as these are the most difficult areas to obtain proper compaction.
5. Cut slopes should be cut to the finished surface. Excessive undercutting and smoothing of the face with fill may necessitate stabilization.

UTILITY TRENCH CONSTRUCTION AND BACKFILL

Utility trench excavation and backfill is the contractors responsibility. The geotechnical consultant typically provides periodic observation and testing of these operations. While efforts are made to make sufficient observations and tests to verify that the contractors' methods and procedures are adequate to achieve proper compaction, it is typically impractical to observe all backfill procedures. As such, it is critical that the contractor use consistent backfill procedures.

Compaction methods vary for trench compaction and experience indicates many methods can be successful. However, procedures that "worked" on previous projects may or may not prove effective on a given site. The contractor(s) should outline the procedures proposed, so that we may discuss them **prior** to construction. We will offer comments based on our knowledge of site conditions and experience.

1. Utility trench backfill in slopes, structural areas, in streets and beneath flat work or hardscape should be brought to at least optimum moisture and compacted to at least 90 percent of the laboratory standard. Soil should be moisture conditioned prior to placing in the trench.

2. Flooding and jetting are not typically recommended or acceptable for native soils. Flooding or jetting may be used with select sand having a Sand Equivalent (SE) of 30 or higher. This is typically limited to the following uses:
   a) shallow (12 + inches) under slab interior trenches and,
   b) as bedding in pipe zone.

   The water should be allowed to dissipate prior to pouring slabs or completing trench compaction.
3. Care should be taken not to place soils at high moisture content within the upper three feet of the trench backfill in street areas, as overly wet soils may impact subgrade preparation. Moisture may be reduced to 2% below optimum moisture in areas to be paved within the upper three feet below sub grade.
4. Sand backfill should not be allowed in exterior trenches adjacent to and within an area extending below a 1:1 projection from the outside bottom edge of a footing, unless it is similar to the surrounding soil.
5. Trench compaction testing is generally at the discretion of the geotechnical consultant. Testing frequency will be based on trench depth and the contractors procedures. A probing rod would be used to assess the consistency of compaction between tested areas and untested areas. If zones are found that are considered less compact than other areas, this would be brought to the contractors attention.

JOB SAFETY

General

Personnel safety is a primary concern on all job sites. The following summaries are safety considerations for use by all our employees on multi-employer construction sites. On ground personnel are at highest risk of injury and possible fatality on grading construction projects. The company recognizes that construction activities will vary on each site and that job site safety is the contractor's responsibility. However, it is, imperative that all personnel be safety conscious to avoid accidents and potential injury.

In an effort to minimize risks associated with geotechnical testing and observation, the following precautions are to be implemented for the safety of our field personnel on grading and construction projects.

1. Safety Meetings: Our field personnel are directed to attend the contractor's regularly scheduled safety meetings.
2. Safety Vests: Safety vests are provided for and are to be worn by our personnel while on the job site.
3. Safety Flags: Safety flags are provided to our field technicians; one is to be affixed to the vehicle when on site, the other is to be placed atop the spoil pile on all test pits.

In the event that the contractor's representative observes any of our personnel not following the above, we request that it be brought to the attention of our office.

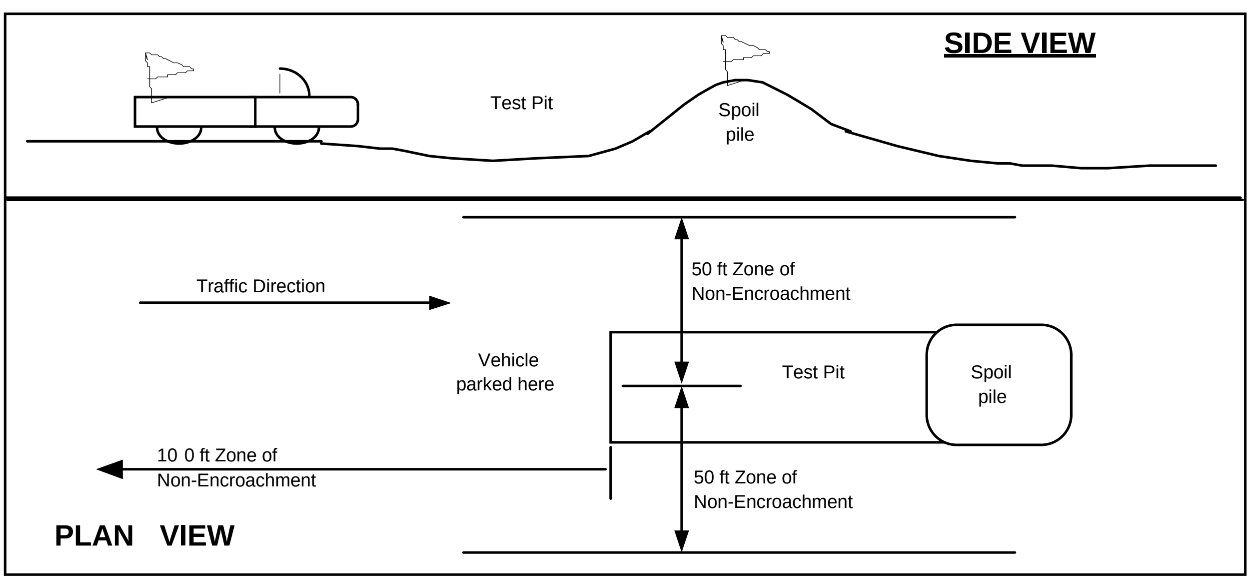
Test Pits Location, Orientation and Clearance

The technician is responsible for selecting test pit locations. The primary concern is the technician's safety. However, it is necessary to take sufficient tests at various locations to obtain a representative sampling of the fill. As such, efforts will be made to coordinate locations with the grading contractors authorized representatives (e.g. dump man, operator, supervisor, grade checker, etc.), and to select locations following or behind the established traffic pattern, preferably outside of current traffic. The contractors authorized representative should direct excavation of the pit and safety during the test period. Again, safety is the paramount concern.

Test pits should be excavated so that the spoil pile is placed away from oncoming traffic. The technician's vehicle is to be placed next to the test pit, opposite the spoil pile. This necessitates that the fill be maintained in a drivable condition. Alternatively, the contractor may opt to park a piece of equipment in front of test pits, particularly in small fill areas or those with limited access.

A zone of non-encroachment should be established for all test pits (see diagram below). No grading equipment should enter this zone during the test procedure. The zone should extend outward to the sides approximately 50 feet from the center of the test pit and 100 feet in the direction of traffic flow. This zone is established both for safety and to avoid excessive ground vibration, which typically decreases test results.

TEST PIT SAFETY PLAN



Slope Tests

When taking slope tests, the technician should park their vehicle directly above or below the test location on the slope. The contractor's representative should effectively keep all equipment at a safe operation distance (e.g. 50 feet) away from the slope during testing.

The technician is directed to withdraw from the active portion of the fill as soon as possible following testing. The technician's vehicle should be parked at the perimeter of the fill in a highly visible location.

Trench Safety

It is the contractor's responsibility to provide safe access into trenches where compaction testing is needed. Trenches for all utilities should be excavated in accordance with CAL-OSHA and any other applicable safety standards. Safe conditions will be required to enable compaction testing of the trench backfill.

All utility trench excavations in excess of 5 feet deep, which a person enters, are to be shored or laid back. Trench access should be provided in accordance with OSHA standards. Our personnel are directed not to enter any trench by being lowered or "riding down" on the equipment.

Our personnel are directed not to enter any excavation which;

1. is 5 feet or deeper unless shored or laid back,
2. exit points or ladders are not provided,
3. displays any evidence of instability, has any loose rock or other debris which could fall into the trench, or
4. displays any other evidence of any unsafe conditions regardless of depth.

If the contractor fails to provide safe access to trenches for compaction testing, our company policy requires that the soil technician withdraws and notifies their supervisor. The contractors representative will then be contacted in an effort to effect a solution. All backfill not tested due to safety concerns or other reasons is subject to reprocessing and/or removal.

Procedures

In the event that the technician's safety is jeopardized or compromised as a result of the contractor's failure to comply with any of the above, the technician is directed to inform both the developer's and contractor's representatives. If the condition is not rectified, the technician is required, by company policy, to immediately withdraw and notify their supervisor. The contractor's representative will then be contacted in an effort to effect a solution. No further testing will be performed until the situation is rectified. Any fill placed in the interim can be considered unacceptable and subject to reprocessing, recompaction or removal.

In the event that the soil technician does not comply with the above or other established safety guidelines, we request that the contractor bring this to technicians attention and notify our project manager or office. Effective communication and coordination between the contractors' representative and the field technician(s) is strongly encouraged in order to implement the above safety program and safety in general.

The safety procedures outlined above should be discussed at the contractor's safety meetings. This will serve to inform and remind equipment operators of these safety procedures particularly the zone of non-encroachment.

The safety procedures outlined above should be discussed at the contractor's safety meetings. This will serve to inform and remind equipment operators of these safety procedures particularly the zone of non-encroachment.