APPENDIX 14.0

GEOTECHNICAL REPORT

REPORT OF GEOTECHNICAL INVESTIGATION
PROPOSED COMMERCIAL DEVELOPMENT
THE COMMONS AT HIDDEN SPRINGS
NWC OF CLINTON KEITH ROAD & HIDDEN SPRINGS ROAD
WILDOMAR, CALIFORNIA
APN 380-110-004, -009, -010, -014, & -016

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1.0 EXECUTIVE SUMMARY

Construction Testing & Engineering, South, Inc. (CTE) has performed a geotechnical investigation to provide site-specific geotechnical information for the proposed commercial development in Wildomar, California. The proposed development will consist of six buildings with a total footprint area of approximately 71,500 square feet. The development will include parking lots, hardscapes, utilities, and landscaping. It is anticipated the buildings will be founded on conventional shallow foundations with slabs-on-grade.

Based on our investigation and review of geologic maps, the site is underlain by sandstone of the Pauba formation, and sandstone and siltstone of the unnamed Sandstone of the Wildomar Area formation. Younger alluvium overlies portions of the formational materials in low lying areas of the site. Groundwater was encountered during our investigation at a depth of 19½ feet below the existing ground surface (bgs) in boring B-4.

Based on our investigation, the proposed development at the site is considered feasible from a geotechnical standpoint, provided the recommendations herein are implemented during project design and construction.

2.0 INTRODUCTION AND SCOPE OF SERVICES

2.1 Introduction

CTE has prepared this report for Somar Land Group. Presented herein are the results of the subsurface investigation performed as well as recommendations regarding the geotechnical engineering and dynamic loading criteria for the proposed construction.

2.2 Scope of Services

Our scope of services included:

- Review of readily available geologic and geotechnical literature pertinent to the site.
- Explorations to determine subsurface soil, rock and groundwater conditions to the depths influenced by the proposed development.
- Laboratory testing of representative soil samples to provide data to evaluate the geotechnical design characteristics of the site foundation soils.
- Definition of the general geology and evaluation of potential geologic hazards at the site.
- Preparation of this report detailing the investigation performed and providing conclusions and geotechnical engineering recommendations for design and construction. Included in the report are site geology and hazards, seismic effects and design parameters, earthwork recommendations, foundation design parameters including lateral resistance, retaining wall design parameters, and pavement structure section recommendations.

3.0 SITE AND PROPOSED CONSTRUCTION

The site is currently undeveloped land, consisting of five adjoining parcels, located at the northwest corner of Clinton Keith Road and Hidden Springs Road in the city of Wildomar, California. Figure 1 shows the location of the site. The site topography is predominantly sloping, with elevations ranging from approximately 1275 feet to 1321 feet above mean sea level (msl). A natural drainage course traverses through the site, beginning on the eastern mid portion of the site and draining to the southwest. Water was not present in the drainage course during our site investigation. The ground surface at the site is partially covered by grasses and brush. Vegetation ranges from medium sized shrubs to mature trees. Weed abatement in the form of discing has been conducted in portions of the site.

The proposed development will consist of six buildings with a total footprint area of approximately 71,500 square feet. The development will include parking lots, hardscapes, utilities, and landscaping. It is anticipated the buildings will be founded on conventional shallow foundations with slabs-on-grade.

4.0 FIELD AND LABORATORY INVESTIGATION

4.1 Field Investigation

Our field investigation was performed on September 9 and 10, 2019, and included 8 exploratory borings (identified as B-1 through B-8) and 4 test pits (identified as TP-1 through TP-4). The explorations were conducted at the proposed building and pavement locations. The exploration locations are shown on Figure 2.

The exploratory borings were excavated to investigate and obtain samples of the subsurface soils. The borings were excavated using a truck-mounted, eight-inch diameter, hollow-stem auger drill rig to a maximum explored depth of approximately 51½ feet bgs.

Soils encountered within the explorations were classified in the field in accordance with the Unified Soil Classification System. The field descriptions were later modified (as appropriate) based on the results of our laboratory testing program. In general, soil samples were obtained at 5-foot intervals with standard split spoon (SPT and California Modified) samplers. Specifics of the soils encountered can be found on the Exploration Logs, which are presented in Appendix A.

4.2 Laboratory Analyses

Laboratory tests were conducted on representative soil samples to evaluate their physical properties and engineering characteristics. Specific laboratory tests included: direct shear, maximum dry density and optimum moisture content, in-place moisture and dry density, "R" value, expansion index, gradation, Atterberg limits, and chemical analyses. These tests were conducted to determine the engineering properties and corrosivity of the on-site soils. Test method descriptions and laboratory results are presented in Appendix B and on the Exploration Logs.

5.0 GEOLOGY

5.1 General Physiographic Setting

Geomorphically, the subject site is situated on the western margin of the Perris structural block. The Perris structural block lies within the Peninsular Range Geomorphic Province and is a relatively stable, rectangular area located between the Elsinore and San Jacinto fault zones. These fault zones are major components of the San Andreas Fault system, which consists of a series of *en-echelon* northwest-striking right-lateral faults and pull-apart basins. The Perris block consists of phyllite, schist and gneiss of Mesozoic- to possibly Paleozoic-age metasedimentary rocks intruded by plutonic rocks of the Cretaceous-age Pennisular Range batholith. Tertiary-age sediments, Miocene-age volcanics, and Quaternary-age sediments unconformably cap the older Mesozoic-age rocks in this portion of the Perris block.

5.2 Site Geologic Conditions

Based on our investigation and review of geologic mapping (Kennedy and Morton, 2003), the site is underlain by sandstone of the Pauba formation, and sandstone and siltstone of the [unnamed] Sandstone of the Wildomar Area formation. Younger alluvium overlies portions of the formational materials in low lying areas of the site. Below is a brief description of the materials encountered during the investigation. More detailed descriptions are provided in the Exploration Logs in Appendix A. A geologic cross section of the site is presented on Figure 3.

5.2.1 Quaternary Younger Alluvium (Qya)

Quaternary younger alluvium was encountered in boring B-6 from the surface to a depth of 10½ feet bgs. The alluvium consisted of loose silty clayey sand.

5.2.2 Pauba Formation, Sandstone Member (Qpfs)

The Pleistocene-age Sandstone Member of the Pauba Formation was encountered in borings B-1 thru B4. The encountered Pauba formational materials consisted of highly to moderately weathered, moderately hard to hard sandstone. The materials, as excavated, classified as silty clayey sand, clayey sand and poorly-graded sand with clay.

5.2.3 Sandstone of the Wildomar Area (QTsw)

Pleistocene to late Pliocene-age unnamed formation, designated as Sandstone of the Wildomar area, was encountered in boring B-4 underlying the Pauba formation, and encountered in borings B-5 thru B-8 from the surface to the maximum explored depths. This formational material consisted of highly to moderately weathered, moderately hard to hard sandstone and siltstone. Calcium carbonate (caliche) was present in some of the layers. The sandstone and siltstone materials, as excavated, classified as silty sand, silty clayey sand, and sandy silt.

5.3 Groundwater Conditions

Groundwater was encountered in boring B-4 at a depth of 19½ feet below ground surface (bgs). Groundwater levels will fluctuate during periods of high precipitation. During grading and construction, water should be anticipated in the natural drainage course area, and groundwater could be encountered in deeper excavations on other low elevation areas of the site. In addition to groundwater, saturated subgrade conditions during or following periods of wet weather have the potential to impact grading or construction.

5.4 Geologic Hazards

From our investigation, it appears that geologic hazards at the site are limited primarily to those caused by strong shaking from earthquake-generated ground motions. Presented herein are the geologic hazards that are considered for potential impacts to site development.

5.4.1 Surface Fault Rupture

As defined by the California Geological Survey, an active fault is one that has had surface displacement within the Holocene Epoch (roughly the last 11,000 years). This definition is used in delineating Earthquake Fault Zones as mandated by the Alquist-Priolo Special Studies Zones Act of 1972 and revised in 1994 as the Alquist-Priolo Earthquake Fault Zoning Act. The name Special Studies Zones was changed to Earthquake Fault Zones as a result of a 1993 amendment. Special Publication - 42 was most recently revised in 2007 and is subject to periodic amendments. The intent of this act is to require fault investigations on sites located within Earthquake Fault Zones to preclude the construction of structures for human occupancy across the trace of an active fault. The site is not located in or adjacent to an Alquist-Priolo Earthquake Fault Zone.

Based on our site reconnaissance and review of the referenced literature, no known active fault traces underlie the site. Based on our investigation, the potential for surface rupture from displacement or fault movement beneath the improvements is considered low.

5.4.2 Local and Regional Faulting

The California Geological Survey broadly groups faults as “Class A” or “Class B” (Cao et al, 2003). Class A faults are identified based upon relatively well-defined paleoseismic activity and a fault slip rate of more than 5 millimeters per year (mm/yr). Class B faults are all other faults that are not defined as Class A faults. The following Table 1 presents the ten nearest active faults to the site and includes magnitude and fault classification.

TABLE 1
NEAR SITE FAULT PARAMETERS

FAULT NAME	APPROXIMATE DISTANCE FROM SITE (mi)	MAXIMUM EARTHQUAKE MAGNITUDE	CLASSIFICATION
Elsinore – Temecula	0.3	6.8	A
Elsinore – Glen Ivy	6.9	6.8	A
Elsinore – Julian	20.3	7.1	A
San Jacinto-San Jacinto Valley	20.8	6.9	A
San Jacinto – Anza	21.6	7.2	A
Chino-Central Ave (Elsinore)	24.7	6.7	B
Newport Inglewood (Offshore)	28.2	7.1	B
Whittier	28.7	6.8	A
San Jacinto – San Bernardino	29.2	6.7	A
Rose Canyon	33.7	7.2	B

A regional fault and seismicity map is presented on Figure 4.

5.4.3 Liquefaction and Seismic Settlement Evaluation

Liquefaction occurs when saturated fine sands, silts or low plasticity clays lose their physical strength during earthquake-induced shaking and behave as a liquid. This is due to loss of point-to-point grain contact and transfer of normal stress to the pore water. Liquefaction potential varies with groundwater level, soil type, material gradation, relative density, and the intensity and duration of ground shaking.

The potential for liquefaction and seismic settlement at the site is considered very low because underlying formational materials are bedrock.

5.4.4 Tsunami and Seiche Evaluation

Due to site elevation and distance from the Pacific Ocean, the site is not considered to be subject to damage from tsunamis. Based on the absence of large bodies of water in the area, seiche (oscillatory waves in standing bodies of water) damage is also not expected.

5.4.5 Landsliding

No features typically associated with landsliding were noted during the site investigation. In the reference review, no evidence of landsliding was found to have occurred within the area of the site. Therefore, the potential for landsliding to affect the site is considered very low.

5.4.6 Compressible and Expansive Soils

Based on our investigation and laboratory testing, site soil and rock materials are not expected to be compressible relative to the post-construction overburden. Based on the results of expansion index and Atterberg limits testing, site soils are anticipated to have very low expansion potential.

5.4.7 Flood Zones

Based on Federal Emergency Management Agency flood zone map (FEMA, 2008), the site is located in Zone X, which is identified as an "area of minimal flood hazard."

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 General

Based on our investigation, the proposed construction on the site is feasible from a geotechnical standpoint, provided the recommendations in this report are incorporated into design and construction of the project. Preliminary recommendations for the design and construction of the proposed development are included in the subsequent sections of this report. Additional recommendations could be required based on the actual conditions encountered during earthwork and/or improvement construction.

6.2 Site Preparation

6.2.1 General

Prior to grading, the site should be cleared of debris, pavement and deleterious materials. In areas to receive structures or distress-sensitive improvements, surficial eroded, desiccated, burrowed, or otherwise loose or disturbed soils should be removed to the depth of competent material as recommended below in Section 6.2.2. Organic and other deleterious materials not suitable for use as structural backfill should be disposed of offsite at a legal disposal site.

6.2.2 Remedial Grading and Excavations

In order to provide uniform structural support and reduce potential differential settlement due to the presence of disturbed/loose near-surface material, and to mitigate potential transitional bearing conditions, remedial grading will be required. Based on the conceptual grading plan provided (Pacific West), maximum cuts and fills are on the order of 11 and 30 feet, respectively. Table 2 below presents the maximum cut and fill depths for the proposed building pads, estimated minimum removal depths below existing grade and minimum over-excavation depths of fill areas for each building pad. These estimates may require modification based on the final grading plan.

TABLE 2
BUILDING PAD OVER-EXCAVATION ESTIMATES

Building No.	Existing Grade, ft.	Proposed Pad Elevation, ft.	Approximate Max. Cut, ft.	Approximate Max. Fill, ft.	Min. Over-Excavation for Cut Area, feet below proposed building footings	Min. Removal for Fill Area, feet below existing grade
1	1303-1314	1303.5	11	0.5	3	3
2	1306-1312	1301.5	10.5	0	3	N/A
3	1290-1311	1300.0	11	10	4½	3
4	1284-1298	1295.0	3	11	4½	3
5	1263-1292	1293.0	0	30	N/A	5 to 12
6	1266-1283	1279.0	4	13	5½	3

The over-excavation of cut areas is necessary to mitigate transition pad conditions and to produce uniform bearing conditions. The excavations should extend laterally at least 5-feet beyond the foundation limits. Over-excavations for pavement and hardscape areas may be limited to a depth of one-foot below existing or finish grade, whichever is greater.

The soils exposed at the bottom of the over-excavations should be documented by a geotechnical representative of this office to determine their suitability. If unsuitable materials are encountered at the bottom of the excavation, they should be removed to the depth of competent natural material. Groundwater, if encountered, should be removed from the excavations prior to placing fill.

Temporary, unsurcharged excavations up to three feet deep may be cut vertically. Deeper excavations should be sloped back or shored. Temporary sloped excavations should be cut at a slope of 1:1 (horizontal:vertical) or flatter. Vehicles and storage loads should not be placed within 10 feet of the top of the excavation. Berms are recommended along the tops of slopes to divert runoff water from entering the excavation and eroding the slope faces. Excavations should be stabilized within 30 days of initial excavation. Final slopes should be no steeper than 2:1 (horizontal:vertical). Safety provisions of Cal OSHA and other related statutory agencies should be followed, especially as related to support of adjacent structures.

6.2.3 Preparation of Areas to Receive Fill

Exposed excavation bottoms and subgrade surfaces to receive fill should be scarified to a minimum depth of 8 inches, brought to within +/- 2 percent of optimum moisture content and compacted to at least 90 percent of the maximum dry density as determined by ASTM D 1557.

6.2.4 Fill Placement and Compaction

Structural fill and backfill should be compacted to at least 95 percent of the maximum dry density (as determined by ASTM D 1557) at moisture content within +/- 2 percent of optimum. The top 12-inches of pavement subgrade should be compacted to at least 95 percent. Compaction equipment should be appropriate for the materials being compacted. The optimum lift thickness for fill soils will be dependent on the type of compaction equipment being utilized. Fill should be placed in uniform horizontal lifts not exceeding 8 inches in loose thickness. Placement and compaction of fill should be performed in general conformance with geotechnical recommendations and local ordinances.

Granular soils generated from on-site excavations are anticipated to be suitable for use as structural fill, provided they are free from pavement, debris and deleterious material and are dried to moisture content near optimum. Rocks or other soil fragments greater than four inches in size should not be used in the fills. Proposed import material should be evaluated by the project geotechnical engineer prior to being placed at the site. Import materials should consist of non-corrosive, granular material with an expansion index less than 20.

6.2.5 Filling on Natural Slopes

Benches are required for fill placement on natural slopes of 5:1 (horizontal:vertical) or steeper. Each bench should be a minimum of one equipment width with a vertical height of approximately 4-feet. The bench should be excavated into competent natural materials. Fills should be compacted as recommended above (Sec. 6.2.4).

6.2.6 Fill Slopes

Fill slopes should be constructed at an inclination of no steeper than 2:1 (horizontal:vertical). A fill key should be excavated to a minimum depth of 2-feet into competent natural material and a minimum of 15-feet wide at the base of all fill slopes. Prior to placing fill material, the exposed base of the key should be scarified and compacted as described in Section 6.2.3. The key should be tipped approximately 2% front to back and this angle should be maintained throughout the fill slope construction. Fill should be compacted as recommended above (Sec. 6.2.4). Fill slopes should be overbuilt and then trimmed back to grade, exposing the compacted inner core.

6.2.7 Utility Trenches

Utility trenches should be excavated in accordance with the recommendations presented in Section 6.2.2. Backfill should be placed in loose lifts no greater than eight inches and mechanically compacted to a relative compaction of at least 90 percent of the maximum dry density (per ASTM D 1557) at moisture content within +/- 2 percent of optimum.

6.3 Foundations and Slab Recommendations

6.3.1 General

Foundations and slabs for the proposed structures should be designed in accordance with structural considerations and the following minimum preliminary geotechnical recommendations. Foundations are expected to be supported in properly compacted fill. These recommendations assume that the foundation soils will have low potential for expansion, as anticipated.

6.3.2 Shallow Foundations

It is our opinion that the use of isolated and continuous footings will be geotechnically suitable for this project. We recommend that continuous footings be constructed a minimum of 15 inches wide and be founded at least 18 inches below the lowest adjacent rough grade elevation. Dimensions for isolated footings should be a minimum of 24 inches square and founded at least 18 inches below top of slab elevation.

Foundation dimensions should be based on an allowable bearing pressure of 1,500 pounds per square foot (psf) for minimum footing dimensions of one foot in width and one foot in depth. The values may be increased by 20 percent for each additional foot of width or depth to a maximum value of 3,000 psf. The allowable bearing value may be increased by one-third for short-duration loading which includes the effects of wind or seismic forces.

Footing reinforcement within continuous footings should consist of a minimum of four number 4 bars, two located at the top of the footing and two located at the bottom. This minimum reinforcement is due to geotechnical conditions and is not to be used in lieu of that needed for structural considerations. Reinforcement for isolated footings should be determined by the structural engineer.

Resistance to lateral loading may be provided by friction acting at the base of foundations and by passive earth pressure within the natural soils or compacted fill. An allowable coefficient of friction of 0.35 may be used with the dead load forces.

For spread footings in compacted or natural soils the allowable passive earth pressure may be computed as an equivalent fluid having a density of 150 pounds per cubic foot with a maximum earth pressure of 1,500 pounds per square foot. When combining the passive and friction values for calculating the lateral resistance, the passive component shall be reduced by one third.

6.3.3 Settlement of Foundations

We have analyzed settlement potential during construction and for long-term performance. Construction settlement is expected to occur as loads are applied and structures are brought to their operational weight. Long-term settlement is expected to occur over time as a result of compression of wetted or partially saturated soil.

It is anticipated that shallow foundations designed and constructed as recommended will experience total settlement of less than 1 inch and differential static settlement of less than 1/2 inch over a distance of 30 feet or more.

6.3.4 Concrete Slabs-On-Grade

Concrete slabs-on-grade should be designed for the anticipated loading. Lightly-loaded concrete slabs should measure a minimum of 5 inches thick and be reinforced with a minimum of number 3 reinforcing bars placed on 18-inch centers, each way at mid-slab height. Floor slabs should be underlain by 4 inches of coarse clean sand or crushed stone. An uncorrected modulus of subgrade reaction of 100 pci may be used for elastic design. Concrete slabs subjected to heavier loads may require thicker slab sections and/or increased reinforcement as per the project structural engineer. The correct placement of the reinforcement in the slab is vital for satisfactory performance under normal conditions.

In areas to receive moisture-sensitive floor coverings or used to store moisture-sensitive materials, a polyethylene or visqueen moisture vapor retarder (15-mil or thicker) should be placed beneath the slab. A two-inch layer of coarse clean sand or crushed stone should underlie the moisture vapor retarder.

It is recommended that a water-cement ratio of 0.5 or less be used for concrete, and that the slab be moist-cured for at least five days in accordance with methods recommended by the American Concrete Institute. On-site quality control should be used to confirm the design conditions.

6.3.5 Pipe Bedding and Thrust Blocks

We recommend that pipes be supported on a minimum of 6 inches of sand, gravel, or crushed rock. The pipe bedding material should be placed around the pipe, without voids, and to an elevation of at least 12 inches above the top of the pipe. The pipe bedding material should be compacted in accordance with the recommendations in the earthwork section of this report.

Thrust forces may be resisted by thrust blocks and the adjacent soil. Thrust blocks may be designed using a passive resistance in engineered fill equal to the pressure developed by a fluid with a density of 250 pounds per cubic foot (pcf). A friction value of 0.25 may be used between the pipe and adjacent soil.

6.4 Seismic Design Criteria

The seismic ground motion values listed in Table 3 below were derived in accordance with the ASCE 7-10 Standard that is incorporated into the California Building Code, 2016 (effective January 1, 2017). This was accomplished by establishing the Site Class based on the soil properties at the site, and then calculating the site coefficients and parameters using the United States Geological Survey Seismic Design Maps application for the 2016 CBC values. These values are intended for the design of structures to resist the effects of earthquake ground motions. The site coordinates used in the application were 33.59478°N and 117.24824°W. Site Class C was used for the analysis.

TABLE 3 SEISMIC GROUND MOTION VALUES	
PARAMETER	VALUE
Site Class	C
Mapped Spectral Response Acceleration Parameter, S_S	2.300g
Mapped Spectral Response Acceleration Parameter, S_1	0.933g
Seismic Coefficient, F_a	1.000
Seismic Coefficient, F_v	1.300
MCE Spectral Response Acceleration Parameter, S_{MS}	2.300g
MCE Spectral Response Acceleration Parameter, S_{M1}	1.213g
Design Spectral Response Acceleration Parameter, S_{DS}	1.533g
Design Spectral Response Acceleration Parameter, S_{D1}	0.809g
Mapped MCE Geometric Peak Ground Acceleration, PGA_m	0.920g
Seismic Design Category	E

6.5 Vehicular Pavements

Pavement sections were evaluated using a design ‘R’ value of 15, correlating to a modulus of subgrade reaction of approximately 100 pci for site subgrade soil. The laboratory determined ‘R’ values for site soil were 15 and 39. The pavement section recommendations are based on the assumption that the subgrade soil (the top 12-inches minimum) will be compacted to a minimum of 95 percent of the maximum dry density (per ASTM D 1557).

If concrete pavement is used, it should have a minimum modulus of rupture (flexural strength) of 600 psi. We estimate that a 4,500 psi 28-day compressive strength concrete would generally provide the minimum required flexural strength; however, other mix designs could also meet the requirements. As such, we recommend that the contractor submit the proposed mix design with necessary documentation to offer a proper level of confidence in the proposed concrete materials. Recommended concrete pavement sections are presented below in Table 4.

TABLE 4

PORTLAND CEMENT CONCRETE (PCC) PAVEMENT SECTION

Traffic Area	Assumed Traffic Index	Design Modulus of Subgrade Reaction (pci)	PCC Thickness (inches)
Auto Parking Areas	5.0	100	6.0
Truck Drive Lanes	6.0	100	7.0

An unreinforced pavement with the minimum thickness indicated above should generally be constructed with maximum joint spacing of 24 times the pavement thickness, in both directions, and in nearly square patterns. As an alternative, the concrete pavement could be constructed with typical minimal reinforcement consisting of #4 bars at 18 inches, on-center, both ways, at or above mid-slab height and with proper concrete cover.

Recommended asphalt concrete pavement sections are presented below in Table 5.

TABLE 5

PRELIMINARY ASPHALT CONCRETE (AC) PAVEMENT SECTIONS

Traffic Area	Assumed Traffic Index	Design 'R' Value	AC Thickness (inches)	Aggregate Base Thickness* (inches)
Auto Parking Areas	5.0	15	3.0	9.0
Truck Drive Lanes	6.0	15	3.5	11.0

* Minimum R Value of 78.

In addition, it is recommended that pavement areas conform to the following criteria:

- Placement and construction of the recommended pavement section should be performed in accordance with the Standard Specifications for Public Works Construction (Greenbook, latest edition).

- Aggregate base should conform to the specification for Caltrans Class 2 Aggregate Base (Caltrans, 2015) or Greenbook Crushed Aggregate Base.

Pavement sections are prepared assuming that periodic maintenance will be done, including sealing of cracks and other measures.

6.6 Retaining Walls

For the design of walls where the surface of the backfill is level, it may be assumed that the on-site soils will exert an active lateral pressure equal to that developed by a fluid with a density of 40 pounds per cubic foot (pcf). The active pressure should be used for walls free to yield at the top at least 0.2 percent of the wall height. For walls restrained at the top so that such movement is not permitted, a pressure corresponding to an equivalent fluid density of 60 pcf should be used, based on at-rest soil conditions. These pressures should be increased by 20 pcf for walls retaining soils inclined at 2:1 (horizontal:vertical).

Retaining walls over six feet high should be designed for earthquake forces. Lateral pressures on cantilever retaining walls (yielding walls) due to earthquake motions may be calculated based on work by Seed and Whitman (1970). The total lateral thrust against a properly drained and backfilled cantilever retaining wall above the groundwater level can be expressed as:

$$P_{AE} = P_A + \Delta P_{AE}$$

For non-yielding (or “restrained’) walls, the total lateral thrust may be similarly calculated based on work by Wood (1973):

$$P_{KE} = P_K + \Delta P_{KE}$$

Where:

P_A = Static Active Thrust

P_K = Static Restrained Wall Thrust

ΔP_{AE} = Dynamic Active Thrust Increment = $(3/8)\ k_h\ \gamma H^2$

ΔP_{KE} = Dynamic Restrained Thrust Increment = $k_h\ \gamma H^2$

k_h = 2/3 Peak Ground Acceleration =2/3 (PGA_M) = 0.61g

H = Total Height of the Wall

γ = Total Unit Weight of Soil $\approx$ 135 pounds per cubic foot

The increment of dynamic thrust in both cases should be distributed as an inverted triangle, with a resultant located at 0.6H above the bottom of the wall. Recommendations for waterproofing the walls to reduce moisture infiltration should be provided by the project architect or structural engineer.

We recommend that walls be backfilled with soil having an expansion index of 20 or less with less than 30 percent passing the #200 sieve. The backfill area should include the zone defined by a 1:1 sloping plane, extended back from the base of the wall footing. Wall backfill should be compacted to at least 90 percent relative compaction, based on ASTM D 1557. Backfill should not be placed until walls have achieved adequate structural strength. Heavy compaction equipment, which could cause distress to walls, should not be used. The recommended lateral earth pressures presented herein assume that drainage will be provided behind the walls to prevent the accumulation of hydrostatic pressures. A backdrain system (similar to that shown on Figure 5) should be provided to reduce the potential for the accumulation of hydrostatic pressures.

6.7 Corrosive Soils

Sulfate-containing solutions or soil can have a deleterious effect on the in-service performance of concrete. In order to evaluate the foundation environment, a representative sample of site soil was laboratory tested for pH, resistivity, soluble sulfate and chloride. The results of the tests are summarized in Table 6.

TABLE 6 SUMMARY OF CHEMICAL ANALYSES				
Sample Location	pH	Resistivity (ohm-cm)	Sulfate (mg/kg)	Chloride (mg/kg)
B-4 @ 0-5 ft.	6.5	5300	ND	ND
B-8 @ 5-10 ft.	7.1	4400	ND	ND

ND – Not Detected

Based on ACI 318-14 Building Code and Commentary, the onsite soil tested is a sulfate exposure class of S0, which is considered low and injurious sulfate attack is not a concern. We recommend concrete containing Type II cement be used. A three inch concrete cover over reinforcing steel is recommended for concrete in contact with the soil.

Based on the results of the resistivity tests, site soil appears to be *moderately corrosive* to ferrous metals. We recommend plastic pipes be used. CTE does not practice in the field of corrosion engineering. Therefore, a corrosion engineer could be consulted to determine the appropriate protection for metallic improvements in contact with site soils.

6.8 Exterior Flatwork

Exterior concrete flatwork should have a minimum thickness of four inches (unless otherwise specified by the project architect) and be underlain by four inches of compacted aggregate base. To reduce the potential for distress to exterior flatwork caused by minor settlement of foundation soils, we recommend that such flatwork be installed with crack-control joints at appropriate spacing as recommended by the structural engineer. Flatwork, such as sidewalks, and architectural features, should be installed with crack control joints. The upper six inches of subgrade should be prepared in accordance with the earthwork recommendations provided herein. Positive drainage should be established and maintained adjacent to flatwork as per the recommendations of the project civil engineer of record.

6.9 Drainage

Positive drainage at a slope of 2 percent or more should be established for a minimum distance of five feet away from structures and improvements, and as recommended by the project civil engineer of record. To facilitate this, the proper use of construction elements such as roof drains, downspouts, earthen and/or concrete swales, sloped external slabs-on-grade, and subdrains may be employed. The project civil engineer should thoroughly evaluate the on-site drainage and make provisions as necessary to keep surface water from entering structural areas.

Slabs and planted areas immediately adjacent to the appurtenant structures should slope away from the structures to mitigate pooling of water and should drain to a safe point of collection. Planter boxes adjacent to buildings should have concrete bottoms and drainage away from the buildings. Joints in slabs and swales should be maintained sealed with an appropriate joint compound. Drainage devices shall be provided as specified by the Building Code and grading ordinances.

6.10 Plan Review

CTE should be authorized to review project grading and foundation plans and the project specifications before the start of earthwork to identify potential conflicts with the recommendations contained in this report.

6.11 On-Site Construction Reviews

On-site construction reviews of grading, drainage and foundation work should be performed by a field representative of this office to ascertain compliance with the recommendations of this report. Final grading and/or construction should be observed and a written observation form or report issued by this office stating that the work meets the recommendations of this report. As a minimum, on-site construction reviews are to be performed at the following stages of work:

1. Observation of exposed temporary cut slope surface before excavation is more than five feet deep, and again after final excavation before workman enter or placement of any steel.

2. Observation of footing excavations prior to placement of form boards or reinforcing steel.

3. As called for in the Grading Section/Appendix C herein, for on-site construction reviews and testing of grading work and of compacted earth backfilling behind retaining walls.

4. During proof rolling of subgrade before placement of base material or reinforcing steel, and again following the placement of base material prior to placing reinforcing steel.

5. Observation following installation of sub-drain perforated pipes before covering with gravel or filter material, and again after placing the filter material over perforated pipes before covering with backfill.

6. Following installation of drainage structures and completion of all work.

This office should be given a minimum 48 hours prior notice for any required on-site observations.

6.12 Permits

Design and construction should be carried out under applicable conditions and permits of the City of Wildomar/Riverside County, California Building Code, and other concerned statutory authorities.

7.0 LIMITATIONS

The recommendations provided in this report are based on the anticipated construction and the subsurface conditions found in our explorations. The interpolated subsurface conditions should be checked in the field during construction to document that conditions are as anticipated.

Recommendations provided in this report are based on the understanding and assumption that CTE will provide the observation and testing services for the project. Earthwork should be observed and tested to document that grading activity has been performed according to the recommendations contained within this report. The project geotechnical engineer should evaluate footing excavations prior to placement of reinforcing steel.

The field evaluation, laboratory testing and geotechnical analysis presented in this report have been conducted according to current engineering practice and the standard of care exercised by reputable geotechnical consultants performing similar tasks in this area. No other warranty, expressed or implied, is made regarding the conclusions, recommendations and opinions expressed in this report. Variations may exist and conditions not observed or described in this report may be encountered during construction.

This report is applicable to the site for a period of three years after the issue date provided the project remains as described herein. Modifications to the standard of practice and regulatory requirements may necessitate an update to this report prior to the three years from issue.

Our conclusions and recommendations are based on an analysis of the observed conditions. If conditions different from those described in this report are encountered, our office should be notified and additional recommendations, if required, will be provided upon request. CTE should review project specifications for earthwork, foundation, and shoring-related activities prior to the solicitation of construction bids.

We appreciate this opportunity to be of service on this project. If you have any questions regarding this report, please do not hesitate to contact the undersigned.

Respectfully submitted,
CONSTRUCTION TESTING & ENGINEERING, SOUTH, INC.

Dharmesh Amin, MS, PE, GE
Principal Engineer

Vincent J. Patula, CEG
Senior Engineering Geologist

Robert L. Ellerbusch
Project Geologist

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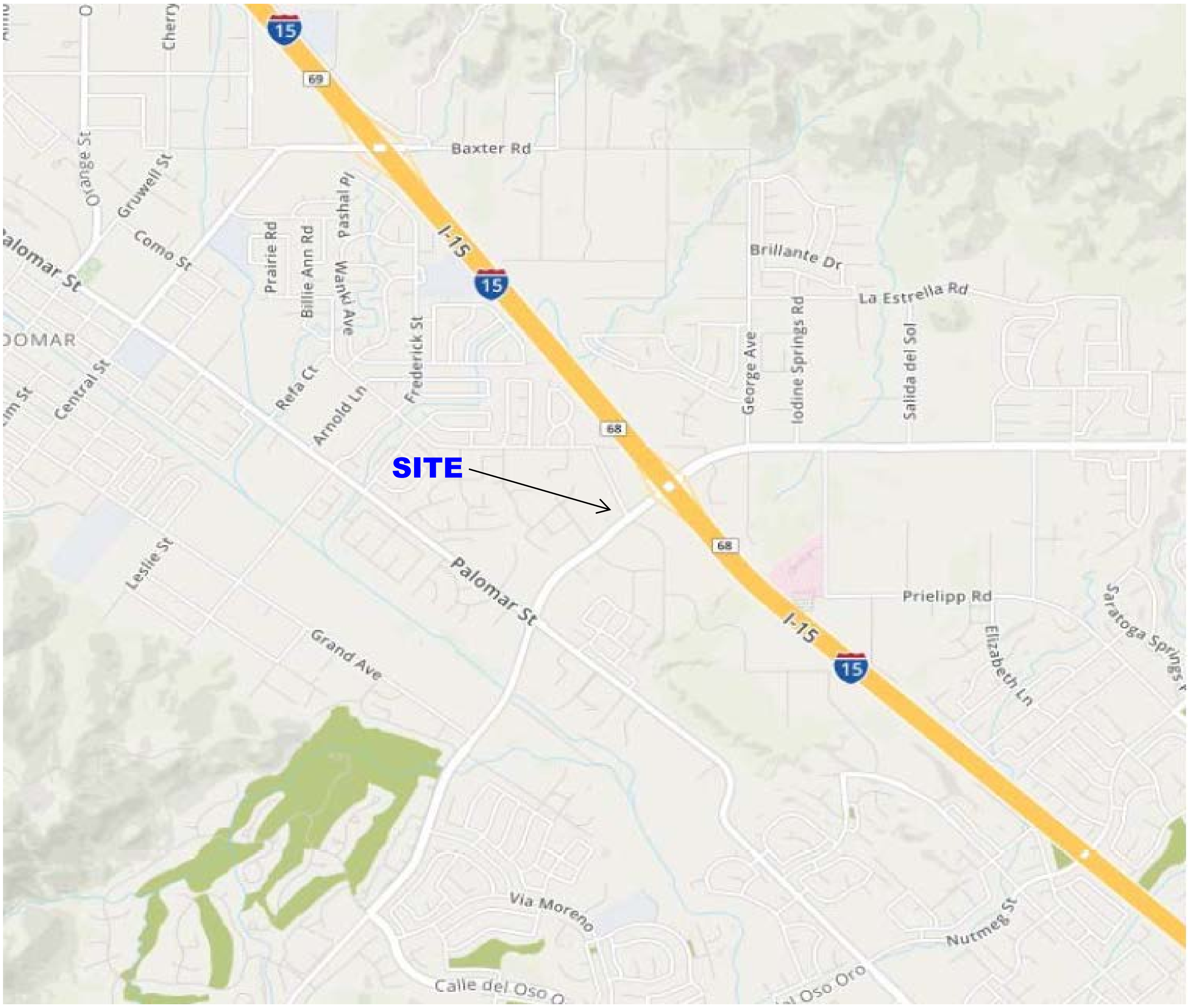

NO SCALE

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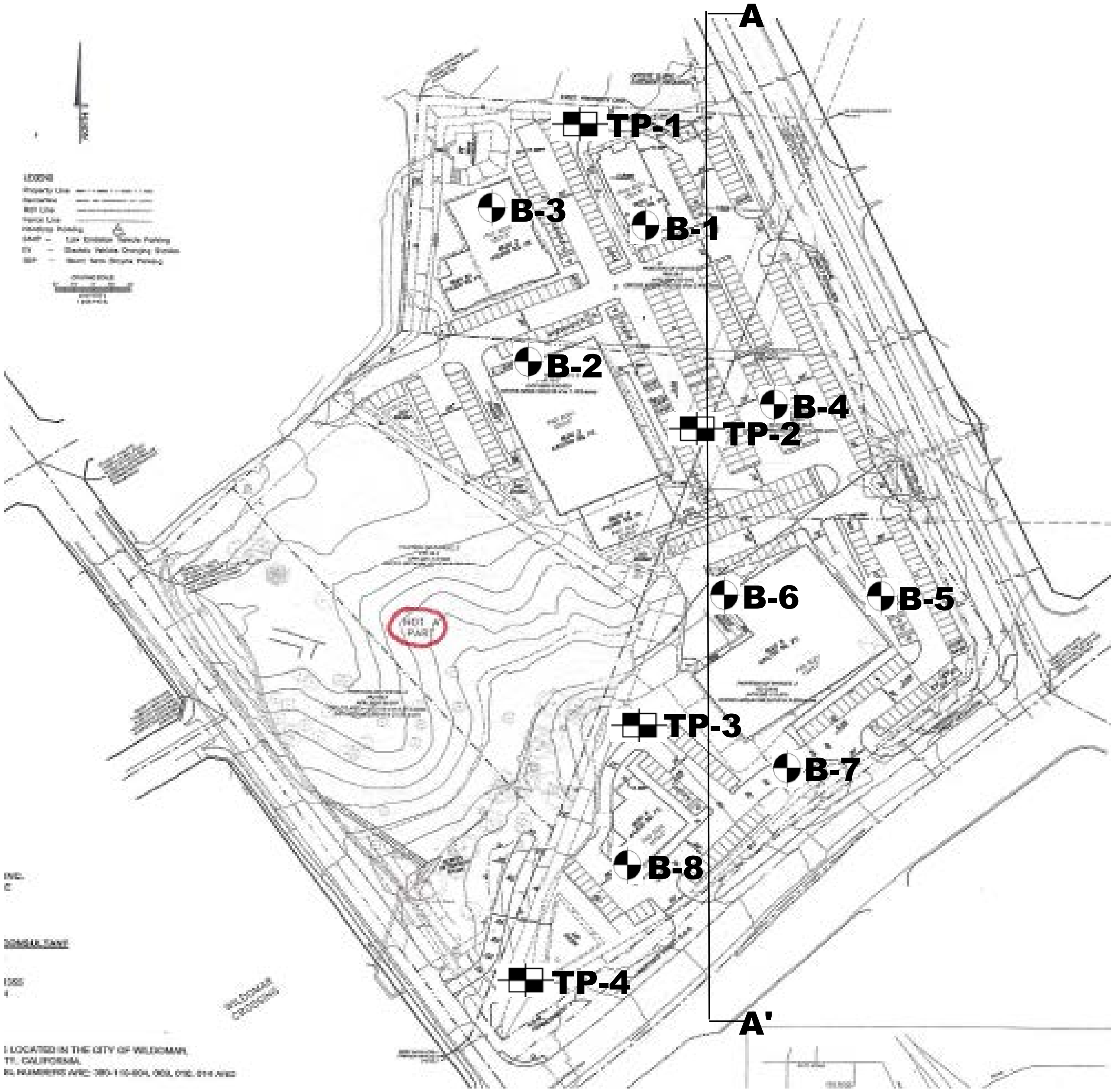
SITE LOCATION MAP

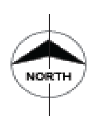
THE COMMONS AT HIDDEN SPRINGS

CLINTON KEITH ROAD & HIDDEN SPRINGS ROAD

WILDOMAR, CALIFORNIA

Job No.	Date	Figure
40-3779G	OCT 2019	1





NO SCALE

LEGEND

B-1	Approximate Boring Location
TP-1	Approximate Test Pit Location
A___A'	Geologic Cross Section

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EXPLORATION LOCATION MAP

THE COMMONS AT HIDDEN SPRINGS

CLINTON KEITH ROAD & HIDDEN SPRINGS ROAD

WILDOMAR, CALIFORNIA

Job No.	Date	Figure
40-3779G	OCT 2019	2

EXPLANATION

B-1 APPROXIMATE BORING LOCATION

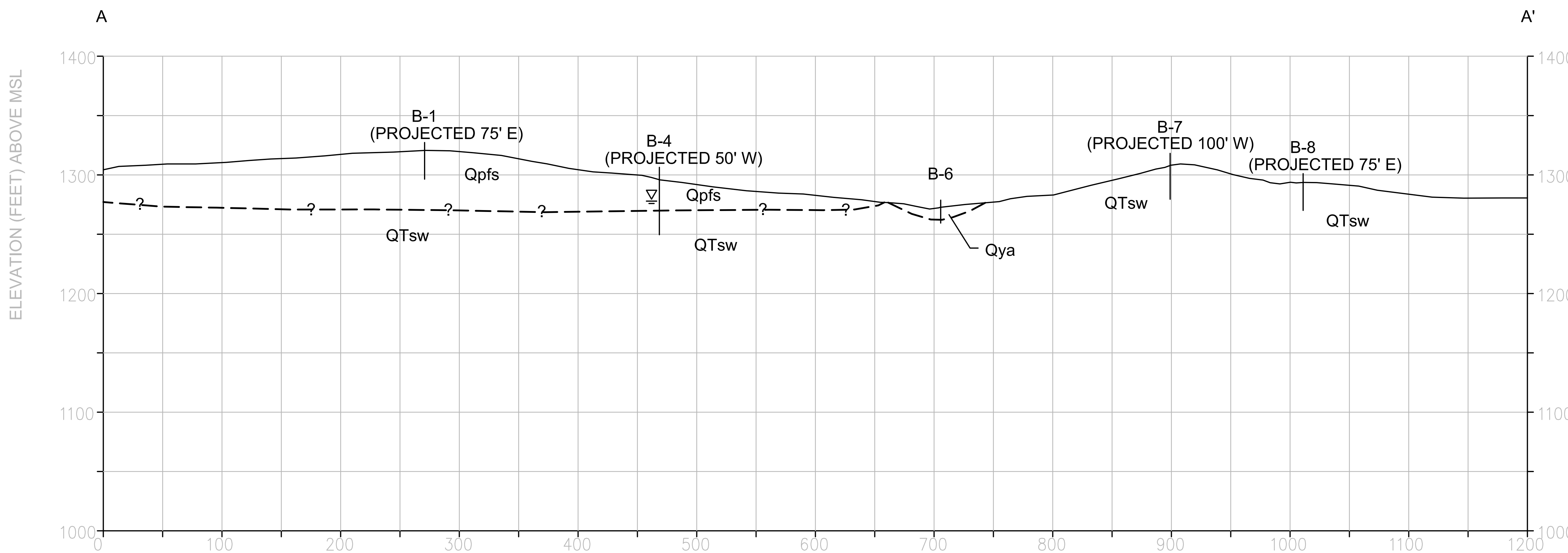
ENCOUNTERED GROUNDWATER ELEVATION

APPROXIMATE GEOLOGIC CONTACT
QUERIED WHERE UNCERTAIN

Qya QUATERNARY YOUNGER ALLUVIUM

Qpfs PAUBA FORMATION- SANDSTONE MEMBER

QTsw SANDSTONE OF THE WILDOMAR AREA



100' 0 50' 100'

1 inch = 100ft.

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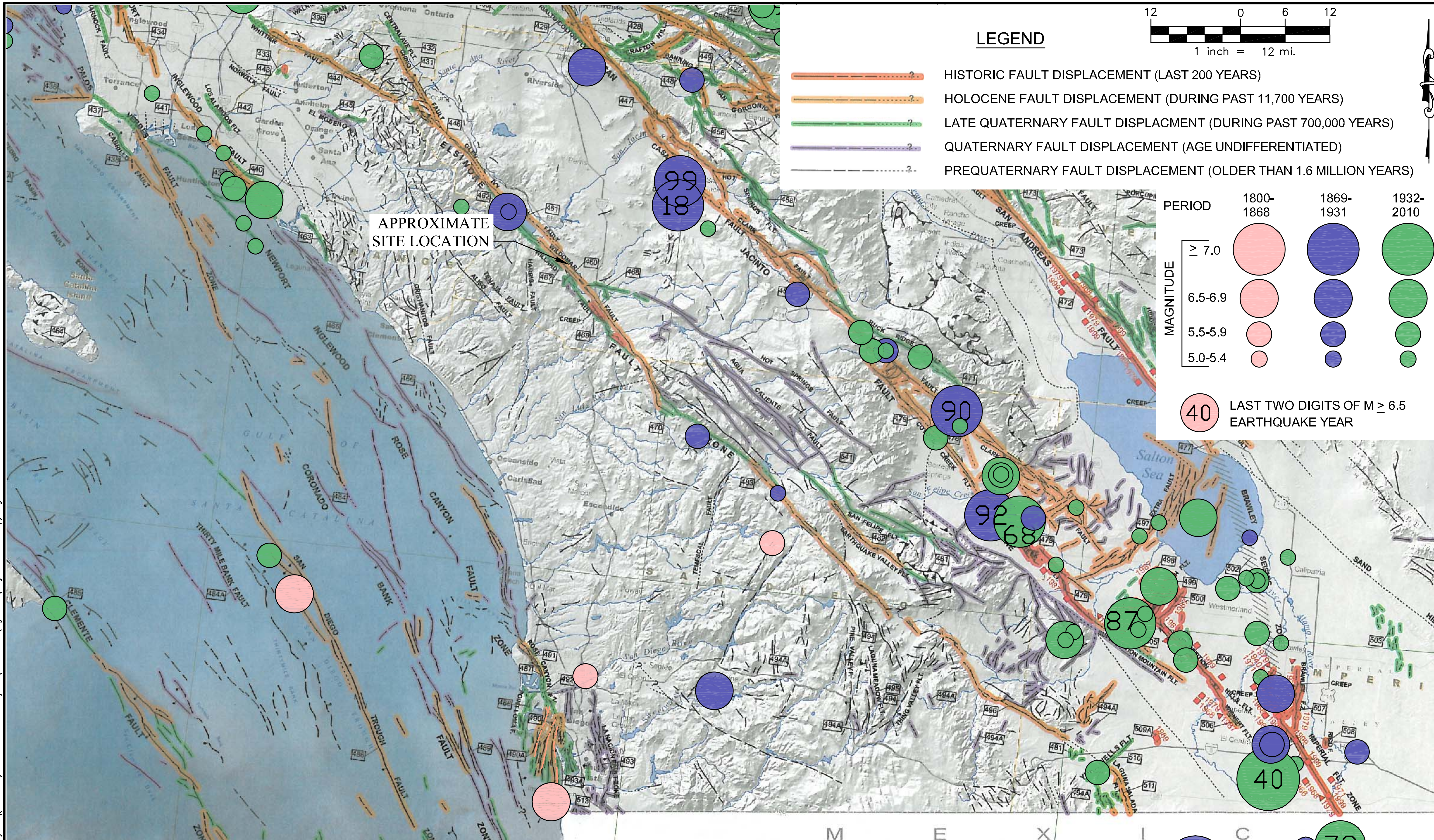
GEOLOGIC CROSS SECTION A–A'
THE COMMONS AT HIDDEN SPRINGS
CLINTON KEITH ROAD & HIDDEN SPRINGS ROAD
WILDOMAR, CALIFORNIA

CTE JOB NO: 40-3779G
SCALE: 1" = 100'
DATE: 10/19
FIGURE: 3

\\ESC_SERVER\Projects\(40-0000) Riverside Office Projects\40-3779G\Fig 3.dwg



NOTES: FAULT ACTIVITY MAP OF CALIFORNIA, 2010, CALIFORNIA GEOLOGIC DATA MAP SERIES MAP NO. 6;
EPICENTERS OF AND AREAS DAMAGED BY M≥5 CALIFORNIA EARTHQUAKES, 1800-1999 ADAPTED AFTER TOPPOZADA, BRANUM, PETERSEN, HALLSTORM, CRAMER, AND REICHLE, 2000, CDMG MAP SHEET 49
REFERENCE FOR ADDITIONAL EXPLANATION; MODIFIED WITH CISN AND USGS SEISMIC MAPS

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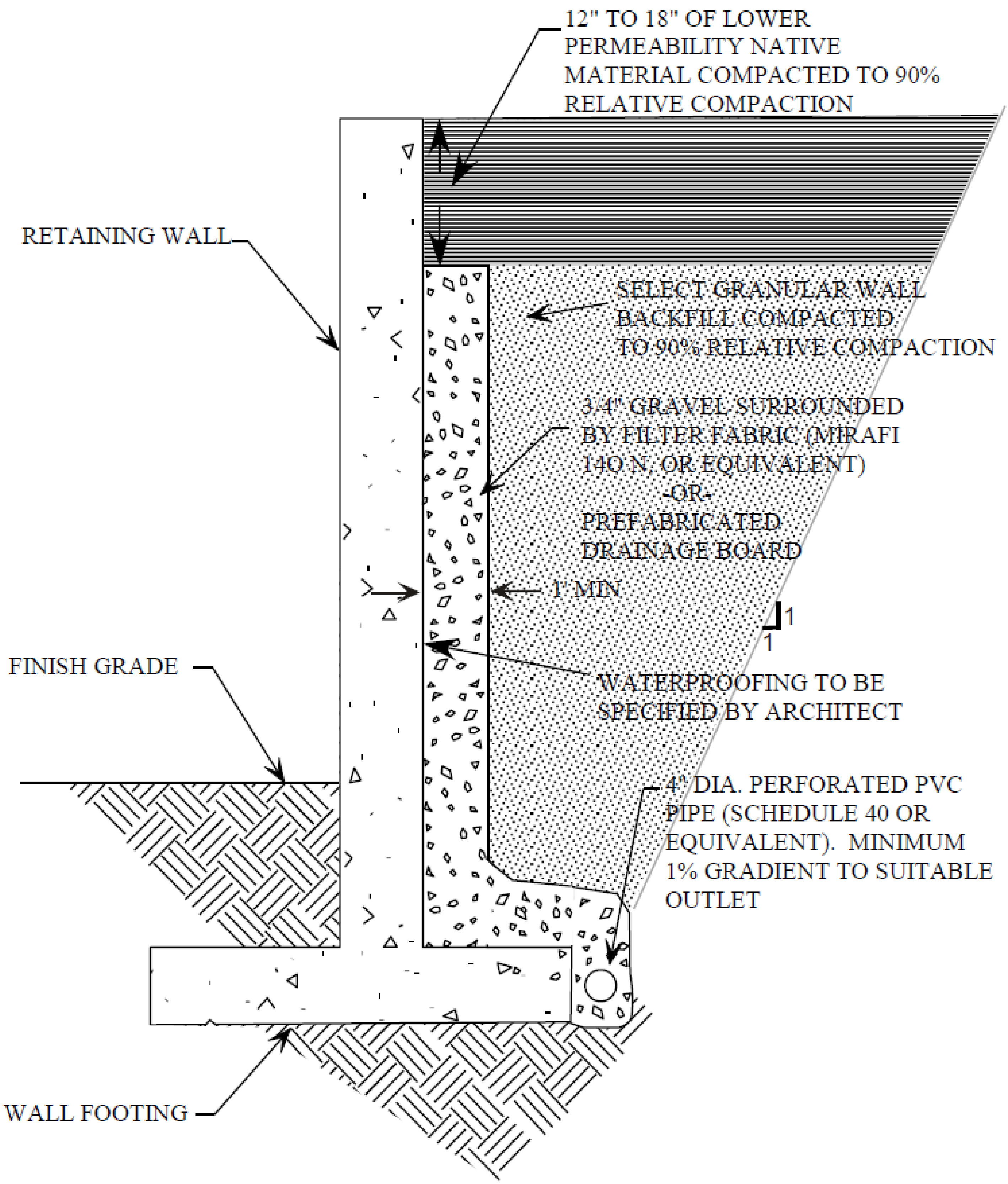
REGIONAL FAULT AND SEISMICITY MAP
THE COMMONS AT HIDDEN SPRINGS
CLINTON KEITH ROAD & HIDDEN SPRINGS ROAD
WILDOMAR, CALIFORNIA

CTE JOB NO:	40-3779G
SCALE:	1 inch = 12 miles
DATE: 10/19	FIGURE: 4

\\ESC_SERVER\Projects\(40-0000) Riverside Office Projects\40-3779G\Figure 4 (Regional Fault Map).dwg



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RETAINING WALL DRAIN DETAIL

THE COMMONS AT HIDDEN SPRINGS
WILDOMAR, CALIFORNIA

Job No.	Date	Figure
40-3779G	OCT 2019	5

APPENDIX A

FIELD EXPLORATION METHODS AND EXPLORATION LOGS

APPENDIX A

FIELD EXPLORATION METHODS AND EXPLORATION LOGS

Soil Boring Methods

Relatively “Undisturbed” Soil Samples

Relatively “undisturbed” soil samples were collected using a modified California-drive sampler (2.4-inch inside diameter, 3-inch outside diameter) lined with sample rings. Drive sampling was conducted in general accordance with ASTM D-3550. The steel sampler was driven into the bottom of the borehole with successive drops of a 140-pound weight falling 30-inches. Blow counts (N) required for sampler penetration are shown on the boring logs in the column “Blows/Foot.” The soil was retained in brass rings (2.4 inches in diameter, 1.0 inch in height) and sealed in waterproof plastic containers for shipment to the CTE, South, Inc. geotechnical laboratory.

Disturbed Soil Sampling

Bulk soil samples were collected for laboratory analysis using two methods. Standard Penetration Tests (SPT) were performed according to ASTM D-1586 at selected depths in the borings using a standard (1.4-inches inside diameter, 2-inches outside diameter) split-barrel sampler. The steel sampler was driven into the bottom of the borehole with successive drops of a 140-pound weight falling 30-inches. Blow counts (N) required for sampler penetration are shown on the boring logs in the column “Blows/Foot.” Samples collected in this manner were placed in sealed plastic bags. Bulk soil samples of the drill cuttings were also collected in large plastic bags. The disturbed soil samples were returned to the CTE, South, Inc. geotechnical laboratory for analysis.

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DEFINITION OF TERMS

PRIMARY DIVISIONS			SYMBOLS	SECONDARY DIVISIONS
COARSE GRAINED SOILS MORE THAN HALF OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	**GRAVELS** MORE THAN HALF OF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE	CLEAN GRAVELS < 5% FINES	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES LITTLE OR NO FINES
			GP	POORLY GRADED GRAVELS OR GRAVEL SAND MIXTURES, LITTLE OF NO FINES
		GRAVELS WITH FINES	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES, NON-PLASTIC FINES
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES, PLASTIC FINES
	SANDS MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE	CLEAN SANDS < 5% FINES	SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
			SP	POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		SANDS WITH FINES	SM	SILTY SANDS, SAND-SILT MIXTURES, NON-PLASTIC FINES
			SC	CLAYEY SANDS, SAND-CLAY MIXTURES, PLASTIC FINES
FINE GRAINED SOILS MORE THAN HALF OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	**SILTS AND CLAYS** LIQUID LIMIT IS LESS THAN 50		ML	INORGANIC SILTS, VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS, SLIGHTLY PLASTIC CLAYEY SILTS
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY, SANDY, SILTS OR LEAN CLAYS
			OL	ORGANIC SILTS AND ORGANIC CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT IS GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTY CLAYS
HIGHLY ORGANIC SOILS			PT	PEAT AND OTHER HIGHLY ORGANIC SOILS

GRAIN SIZES

BOULDERS	COBBLES	GRAVEL		SAND			SILTS AND CLAYS
		COARSE	FINE	COARSE	MEDIUM	FINE	

12" 3" 3/4" 4 10 40 200

CLEAR SQUARE SIEVE OPENING U.S. STANDARD SIEVE SIZE

ADDITIONAL TESTS

(OTHER THAN TEST PIT AND BORING LOG COLUMN HEADINGS)

MAX- Maximum Dry Density
GS- Grain Size Distribution
SE- Sand Equivalent
EI- Expansion Index
CHM- Sulfate and Chloride Content , pH, Resistivity
COR - Corrosivity
SD- Sample Disturbed

PM- Permeability
SG- Specific Gravity
HA- Hydrometer Analysis
AL- Atterberg Limits
RV- R-Value
CN- Consolidation
CP- Collapse Potential
HC- Hydrocollapse
REM- Remolded

PP- Pocket Penetrometer
WA- Wash Analysis
DS- Direct Shear
UC- Unconfined Compression
MD- Moisture/Density
M- Moisture
SC- Swell Compression
OI- Organic Impurities

FIGURE: BL1

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PROJECT:	DRILLER:	SHEET: of
CTE JOB NO:	DRILL METHOD:	DRILLING DATE:
LOGGED BY:	SAMPLE METHOD:	ELEVATION:

Depth (Feet) | Bulk Sample | Driven Type | Blows/Foot | Dry Density (pcf) | Moisture (%) | U.S.C.S. Symbol | Graphic Log

BORING LEGEND

DESCRIPTION

Laboratory Tests

0
5
10
15
20
25

Block or Chunk Sample

Bulk Sample

Standard Penetration Test

Modified Split-Barrel Drive Sampler (Cal Sampler)

Thin Walled Army Corp. of Engineers Sample

Groundwater Table

Soil Type or Classification Change

? ? ? ? ? ? ?

Formation Change [(Approximate boundaries queried (?)]

"SM"

Quotes are placed around classifications where the soils exist in situ as bedrock

FIGURE: BL2

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PROJECT:	The Commons at Hidden Springs	DRILLER:	2R Drilling CME 75	SHEET:	1 of 2
CTE JOB NO:	40-3779G	DRILL METHOD:	8" Hollow Stem Auger	DRILLING DATE:	9/9/2019
LOGGED BY:	R.E.	SAMPLE METHOD:	140 lb/30" Autohammer	ELEVATION:	~1314' msl

BORING: B-1

Depth (Feet)	Bulk Sample	Driven Type	Blows/6-inches	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
0								**Pauba Formation - Sandstone Member (Qpfs)** scattered cobbles on surface SANDSTONE, moist, light brown. (excavates as silty clayey sand)	
5									
10			29 43 50/3"	118.0	8.2			SANDSTONE, moderately hard, moderately weathered, moist, light yellowish brown. (excavates as poorly graded sand with clay)	WA (7% fines) MD
15			20 29 36		7.3			SANDSTONE, moderately hard, moderately weathered, moist, light yellowish brown. (excavates as poorly graded sand with clay)	M
20			31 50/4"	122.3	9.0			SANDSTONE, hard, moderately weathered, moist, light brown, iron-oxide staining. (excavates as silty clayey sand)	MD
25									

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PROJECT:	The Commons at Hidden Springs	DRILLER:	2R Drilling CME 75	SHEET:	2 of 2
CTE JOB NO:	40-3779G	DRILL METHOD:	8" Hollow Stem Auger	DRILLING DATE:	9/9/2019
LOGGED BY:	R.E.	SAMPLE METHOD:	140 lb/30" Autohammer	ELEVATION:	~1314' msl

BORING: B-1 Cont'd.

Depth (Feet)	Bulk Sample	Driven Type	Blows/6-inches	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
25		▯	17 22 28		9.4			SANDSTONE, hard, moderately weathered, moist, light brown, iron-oxide staining. (excavates as silty clayey sand)	M
								Total Depth 26.5 feet bgs. No Groundwater encountered. Bore hole backfilled with soil cuttings.	
30									
35									
40									
45									
50									

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Inspection | Testing | Geotechnical | Environmental & Construction Engineering | Civil Engineering | Surveying

PROJECT:	The Commons at Hidden Springs	DRILLER:	2R Drilling CME 75	SHEET:	1 of 2
CTE JOB NO:	40-3779G	DRILL METHOD:	8" Hollow Stem Auger	DRILLING DATE:	9/9/2019
LOGGED BY:	R.E.	SAMPLE METHOD:	140 lb/30" Autohammer	ELEVATION:	~1310' msl

BORING: B-2

Depth (Feet)	Sample Type	Blows/6-inches	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
0							**Pauba Formation - Sandstone Member (Qpfs)** scattered cobbles on surface SANDSTONE, moist, olive brown. (excavates as clayey sand)	
5	Bulk (5–15)							
10	Driven	40 50/3"	106.7	7.9			SANDSTONE, moderately hard, moderately weathered, moist, light yellowish brown, medium to coarse grain. (excavates as clayey sand)	MD GS (30% fines) AL (LL=29, PI=9)
15	Driven	12 18 30		7.4			SANDSTONE, moderately hard, moderately weathered, moist, light yellowish brown, fine to medium grain. (excavates as clayey sand) difficult to drill from 15 to 20 ft.	M
20	Driven	22 50/5"	119.8	13.2			SANDSTONE, hard, moderately weathered, moist, olive brown, fine grain. (excavates as poorly-graded sand with clay) very difficult to drill from 20 to 25 ft.	MD
25								

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PROJECT:	The Commons at Hidden Springs	DRILLER:	2R Drilling CME 75	SHEET:	2 of 2
CTE JOB NO:	40-3779G	DRILL METHOD:	8" Hollow Stem Auger	DRILLING DATE:	9/9/2019
LOGGED BY:	R.E.	SAMPLE METHOD:	140 lb/30" Autohammer	ELEVATION:	~1310' msl

BORING: B-2 Cont'd.

Depth (Feet)	Bulk Sample	Driven Type	Blows/6-inches	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
25		X	11 19 22		12.9			SANDSTONE, hard, moderately weathered, moist, olive brown, fine grain, mica-rich. (excavates as poorly-graded sand with clay)	M
								Total Depth 26.5 feet bgs. No Groundwater encountered. Bore hole backfilled with soil cuttings.	
30									
35									
40									
45									
50									

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PROJECT:	The Commons at Hidden Springs	DRILLER:	2R Drilling CME 75	SHEET:	1 of 2
CTE JOB NO:	40-3779G	DRILL METHOD:	8" Hollow Stem Auger	DRILLING DATE:	9/9/2019
LOGGED BY:	R.E.	SAMPLE METHOD:	140 lb/30" Autohammer	ELEVATION:	~1308' msl

BORING: B-3

Depth (Feet)	Bulk Sample	Driven Type	Blows/6-inches	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
0								**Pauba Formation - Sandstone Member (Qpfs)** scattered cobbles on surface SANDSTONE, moist, light brown. (excavates as clayey sand)	
5									
10	X	Driven	10 14 16		8.0			SANDSTONE, moderately hard, weathered, moist, light brown, fine to coarse. (excavates as clayey sand)	M
15		Driven	50	109.5	5.7			SANDSTONE, moderately hard, moderately weathered, moist, light brown, fine to coarse. (excavates as poorly-graded sand with clay)	MD
20		Driven	14 22 26		6.6			SANDSTONE, moderately hard, moderately weathered, moist, light gray. (excavates as poorly-graded sand with clay)	M
25									

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PROJECT:	The Commons at Hidden Springs	DRILLER:	2R Drilling CME 75	SHEET:	2 of 2
CTE JOB NO:	40-3779G	DRILL METHOD:	8" Hollow Stem Auger	DRILLING DATE:	9/9/2019
LOGGED BY:	R.E.	SAMPLE METHOD:	140 lb/30" Autohammer	ELEVATION:	~1308' msl

BORING: B-3 Cont'd.

Depth (Feet)	Bulk Sample	Driven Type	Blows/6-inches	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
25		◪	50	111.6	7.9			SANDSTONE, hard, moderately weathered, light gray.	MD
								Total Depth 25.5 feet bgs. No Groundwater encountered. Bore hole backfilled with soil cuttings.	
30									
35									
40									
45									
50									

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PROJECT:	The Commons at Hidden Springs	DRILLER:	2R Drilling CME 75	SHEET:	1 of 3
CTE JOB NO:	40-3779G	DRILL METHOD:	8" Hollow Stem Auger	DRILLING DATE:	9/9/2019
LOGGED BY:	R.E.	SAMPLE METHOD:	140 lb/30" Autohammer	ELEVATION:	~1292' msl

BORING: B-4

Depth (Feet)	Bulk Sample	Driven Sample Type	Blows/6-inches	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
0	X							**Pauba Formation - Sandstone Member (Qpfs)**	
								SANDSTONE, damp, light brown, scattered angular gravel. (excavates as silty clayey sand)	RV GS (18% fines) CHM
5		X	50	113.0	4.9			SANDSTONE, hard, moderately weathered, damp, light brown, fine to coarse, faint iron-oxide staining. (excavates as poorly-graded sand with silty clay)	DS, MD
10		X	16 32 50/5"		5.2			SANDSTONE, hard, moderately weathered, damp, light gray, fine to coarse. (excavates as poorly-graded sand with silty clay)	M
15		X	50/5"	108.0	6.9			SANDSTONE, hard, moderately weathered, moist, light brown, fine to coarse. (excavates as poorly-graded sand with silty clay)	MD
							▼	Groundwater encountered at 19.5 feet bgs.	
20		X	23 33 41		14.4			SANDSTONE, hard, moderately weathered, wet, (excavates as poorly-graded sand with silty clay)	M
25									

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PROJECT:	The Commons at Hidden Springs	DRILLER:	2R Drilling CME 75	SHEET:	2 of 3
CTE JOB NO:	40-3779G	DRILL METHOD:	8" Hollow Stem Auger	DRILLING DATE:	9/9/2019
LOGGED BY:	R.E.	SAMPLE METHOD:	140 lb/30" Autohammer	ELEVATION:	~1292' msl

BORING: B-4 Cont'd.

Depth (Feet)	Bulk Sample	Driven Sample Type	Blows/6-inches	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
25		X	50/4"	112.0	12.8			SANDSTONE, hard, wet, light gray, medium to coarse, faint iron-oxide staining.	MD
30		X	13 27 38		16.8			**Sandstone of the Wildomar Area (QTsw)** SILTSTONE, moderately hard, very moist, brown. (excavates as sandy silt)	M WA (67% fines)
35		X	42 50/3"	127.9	13.6			SILTSTONE, hard, moist, brown. (excavates as sandy silt)	MD
40		X	14 33 50/4"		14.9			SILTSTONE, hard, moist, brown, laminated. (excavates as sandy silt)	M
45								very hard to drill from 45 to 50 ft.	
50									

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PROJECT:	The Commons at Hidden Springs	DRILLER:	2R Drilling CME 75	SHEET:	3 of 3
CTE JOB NO:	40-3779G	DRILL METHOD:	8" Hollow Stem Auger	DRILLING DATE:	9/9/2019
LOGGED BY:	R.E.	SAMPLE METHOD:	140 lb/30" Autohammer	ELEVATION:	~1292' msl

BORING: B-4 Cont'd.

Depth (Feet)	Bulk Sample	Driven Sample Type	Blows/6-inches	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
50		▯	15 31 50/5"		14.2			SILTSTONE, hard, moist, dark gray. (excavates as sandy silt)	M
								Total Depth 51.5 feet bgs. Groundwater encountered at 19.5 feet bgs. Bore hole backfilled with soil cuttings and bentonite plug.	
55									
60									
65									
70									
75									

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PROJECT:	The Commons at Hidden Springs	DRILLER:	2R Drilling CME 75	SHEET:	1 of 1
CTE JOB NO:	40-3779G	DRILL METHOD:	8" Hollow Stem Auger	DRILLING DATE:	9/9/2019
LOGGED BY:	R.E.	SAMPLE METHOD:	140 lb/30" Autohammer	ELEVATION:	~1293' msl

BORING: B-5

Depth (Feet)	Bulk Sample	Driven Sample Type	Blows/6-inches	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
0	X							**Sandstone of the Wildomar Area (QTsw)**	GS (24% fines)
5		X	50	122.9	5.0			SANDSTONE, moderately hard, moderately weathered, damp, light brown, fine to medium, with carbonates. (excavates as silty sand)	MD
10		X	21 32 36		4.8			SANDSTONE, moderately hard, moderately weathered, damp, light brown, fine to coarse, with carbonates. (excavates as silty sand)	M
15		X	32 50/4"	109.7	9.1			SANDSTONE, moderately hard, moderately weathered, moist, light brown, fine to medium, with carbonates. (excavates as silty sand)	MD
20		X	25 50		9.3			SANDSTONE, moderately hard, moderately weathered, moist, light brown, fine to medium.	M
								Total Depth 21 feet bgs. No Groundwater encountered. Bore hole backfilled with soil cuttings.	
25									

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PROJECT:	The Commons at Hidden Springs	DRILLER:	2R Drilling CME 75	SHEET:	1 of 1
CTE JOB NO:	40-3779G	DRILL METHOD:	8" Hollow Stem Auger	DRILLING DATE:	9/9/2019
LOGGED BY:	R.E.	SAMPLE METHOD:	140 lb/30" Autohammer	ELEVATION:	~1265' msl

BORING: B-6

Depth (Feet)	Sample: Bulk	Sample Type: Driven	Blows/6-inches	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	DESCRIPTION	Laboratory Tests
0	X					SM	**Quaternary Younger Alluvium (Qya)** Silty SAND, moist, brown, fine.	
5		X	6 4 5		11.5	SC-SM	Silty Clayey SAND, loose, moist, dark brown.	M
10		X	10 21 30		11.7		**Sandstone of the Wildomar Area (QTsw)** SANDSTONE, moderately hard, very moist, light brown.	M
							Total Depth 11.5 feet bgs. No Groundwater encountered. Bore hole backfilled with soil cuttings.	
15								
20								
25								

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PROJECT:	The Commons at Hidden Springs	DRILLER:	2R Drilling CME 75	SHEET:	1 of 2
CTE JOB NO:	40-3779G	DRILL METHOD:	8" Hollow Stem Auger	DRILLING DATE:	9/9/2019
LOGGED BY:	R.E.	SAMPLE METHOD:	140 lb/30" Autohammer	ELEVATION:	~1300' msl

BORING: B-7

Depth (Feet)	Sample: Bulk	Sample: Driven Type	Blows/6-inches	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
0								**Sandstone of the Wildomar Area (QTsw)** SANDSTONE, damp, light brown, fine. (excavates as silty sand)	
5	X							SANDSTONE, damp, light brown, fine. (excavates as silty sand)	
10									
15	X	X	30 50		4.0			SANDSTONE, moderately hard, moderately weathered, damp, light brown, fine to medium, trace sub-angular gravel, with carbonates. (excavates as silty sand)	M WA (14% fines)
20		X	50/5"	110.5	4.4			SANDSTONE, hard, moderately weathered, damp, light brown, fine to medium, faint iron-oxide staining. (excavates as silty sand) hard to drill from 20 to 25 feet	MD
25									

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PROJECT:	The Commons at Hidden Springs	DRILLER:	2R Drilling CME 75	SHEET:	2 of 2
CTE JOB NO:	40-3779G	DRILL METHOD:	8" Hollow Stem Auger	DRILLING DATE:	9/9/2019
LOGGED BY:	R.E.	SAMPLE METHOD:	140 lb/30" Autohammer	ELEVATION:	~1300' msl

BORING: B-7 Cont'd.

Depth (Feet)	Bulk Sample	Driven Type	Blows/6-inches	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
25		▯	17 35 50/4"		8.5			SANDSTONE, hard, moderately weathered, moist, light brown, fine. (excavates as silty sand)	M
								Total Depth 26.5 feet bgs. No Groundwater encountered. Bore hole backfilled with soil cuttings.	
30									
35									
40									
45									
50									

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PROJECT:	The Commons at Hidden Springs	DRILLER:	2R Drilling CME 75	SHEET:	1 of 1
CTE JOB NO:	40-3779G	DRILL METHOD:	8" Hollow Stem Auger	DRILLING DATE:	9/9/2019
LOGGED BY:	R.E.	SAMPLE METHOD:	140 lb/30" Autohammer	ELEVATION:	~1268' msl

BORING: B-8

Depth (Feet)	Sample: Bulk	Sample Type: Driven	Blows/6-inches	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
0								**Sandstone of the Wildomar Area (QTsw)** SANDSTONE, damp, light brown, fine to medium.	
5	X	X	50/5"	120.2	9.0			SANDSTONE, moderately hard, highly weathered, moist, dark brown, very silty. (excavates as silty clayey sand)	DS, MD RV GS (37% fines) CHM
10		X	7 13 21		10.1			SILTSTONE, moderately weathered, moist, brown. (excavates as sandy silt) hard to drill from 10 to 15 feet	M
15		X	13 24 50	120.2	11.6			SILTSTONE, hard, moderately weathered, moist, brown. (excavates as sandy silt) very hard to drill from 15 to 20 feet	MD
20		X	14 17 25		15.7			SILTSTONE, hard, moderately weathered, moist, brown. (excavates as sandy silt)	M
								Total Depth 21.5 feet bgs. No Groundwater encountered. Bore hole backfilled with soil cuttings.	
25									

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PROJECT:	The Commons at Hidden Springs	EXCAVATOR:	Chamberlain	SHEET:	1 of 1
CTE JOB NO:	40-3779G	EXCAV. METHOD:	Backhoe	EXCAV. DATE:	9/10/2019
LOGGED BY:	VP/WL	SAMPLE METHOD:	Bulk/grab	ELEVATION:	

TEST PIT: TP-1

Depth (Feet)	Bulk Sample	Driven Type	Blows/6-inches	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
0								**Pauba Formation - Sandstone Member (Qpfs)**	
								SANDSTONE, highly weathered, damp, grayish brown, slighty porous.	
	☒				3.2			(excavates as poorly-graded sand with clay)	M
	☒				4.7			reddish brown	M
5									
	☒				5.1				M
	☒				6.7			(excavates as silty clayey sand)	M
10									
	☒				8.1				M
								Total Depth = 11.5 feet bgs. Test pit backfilled with excavated soil. No Groundwater encountered.	
15									
20									
25									

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PROJECT:	The Commons at Hidden Springs	EXCAVATOR:	Chamberlain	SHEET:	1 of 1
CTE JOB NO:	40-3779G	EXCAV. METHOD:	Backhoe	EXCAV. DATE:	9/10/2019
LOGGED BY:	VP/WL	SAMPLE METHOD:	Bulk/grab	ELEVATION:	

TEST PIT: TP-2

Depth (Feet)	Bulk Sample	Driven Type	Blows/6-inches	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
0								**Pauba Formation - Sandstone Member (Qpfs)** SANDSTONE, weathered, damp, light yellowish brown, slightly porous, weathered granitic cobble with iron-oxide staining. (excavates as silty clayey sand)	
	☒				4.7				M
5								Total Depth = 5 feet bgs. Test pit backfilled with excavated soil. No Groundwater encountered.	
10									
15									
20									
25									

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PROJECT:	The Commons at Hidden Springs	EXCAVATOR:	Chamberlain	SHEET:	1 of 1
CTE JOB NO:	40-3779G	EXCAV. METHOD:	Backhoe	EXCAV. DATE:	9/10/2019
LOGGED BY:	VP/WL	SAMPLE METHOD:	Bulk/grab	ELEVATION:	

TEST PIT: TP-3

Depth (Feet)	Bulk Sample	Driven Type	Blows/6-inches	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
0								**Quaternary Younger Alluvium (Qya)** slopewash	
								Pauba Formation - Sandstone Member (Qpfs) SANDSTONE, weathered, moist, reddish brown, iron-oxide staining, blocky. (excavates as clayey sand)	
5									
	☒				6.6				M
								Total Depth = 6.5 feet bgs. Test pit backfilled with excavated soil. No Groundwater encountered.	
10									
15									
20									
25									

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PROJECT:	The Commons at Hidden Springs	EXCAVATOR:	Chamberlain	SHEET:	1 of 1
CTE JOB NO:	40-3779G	EXCAV. METHOD:	Backhoe	EXCAV. DATE:	9/10/2019
LOGGED BY:	VP/WL	SAMPLE METHOD:	Bulk/grab	ELEVATION:	

TEST PIT: TP-4

Depth (Feet)	Sample: Bulk	Sample Type: Driven	Blows/6-inches	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
0						SC		Clayey SAND, moist, reddish brown, weakly cemented.	
	☒				7.0				AL (LL=31, PI=11)
5								Total Depth = 4.5 feet bgs. Test pit backfilled with excavated soil. No Groundwater encountered.	
10									
15									
20									
25									

APPENDIX B

LABORATORY METHODS AND RESULTS

APPENDIX B
LABORATORY METHODS AND RESULTS

Laboratory tests were performed on selected soil samples to evaluate their engineering properties. Tests were performed following test methods of the American Society for Testing and Materials (ASTM), or other accepted standards. The following presents a brief description of the various test methods used. Laboratory results are presented in the following section of this Appendix.

Atterberg Limits
The liquid limit and plasticity index were determined on a selected soil sample in accordance with ASTM D4318.

Chemical Analysis
Soil materials were collected and tested for Sulfate and Chloride content, pH, and Resistivity in accordance with Caltrans test methods.

Classification
Soils were classified visually according to the Unified Soil Classification System. Visual classifications were supplemented by laboratory testing of selected samples according to ASTM D 2487.

Direct Shear
Direct shear tests were performed on relatively undisturbed samples. Direct shear testing was performed in accordance with ASTM D 3080. The samples were inundated during shearing to represent adverse field conditions.

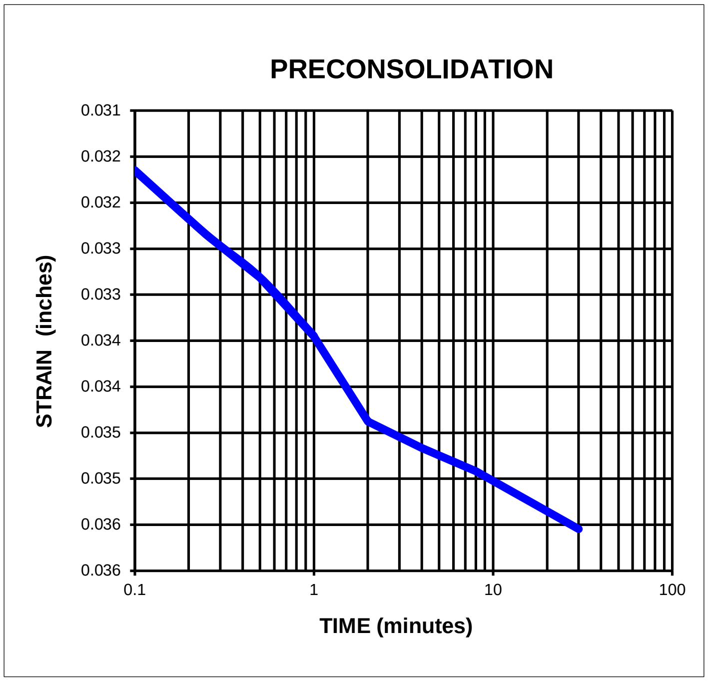
Expansion Index
Expansion Index testing was performed on a selected sample of the on-site soil according to ASTM D 4829.

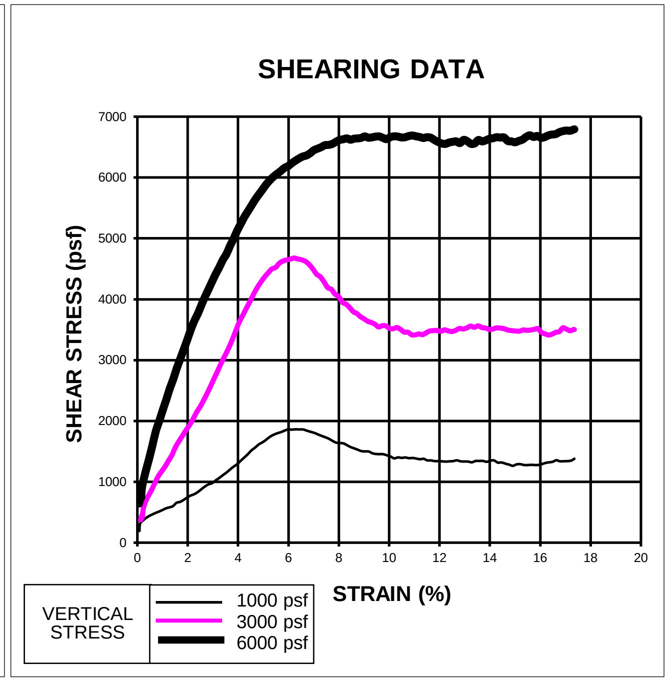
In-Place Moisture/Density
The in-place moisture content and dry unit weight of selected relatively undisturbed samples in accordance with ASTM D 2216 and D 2937, respectively.

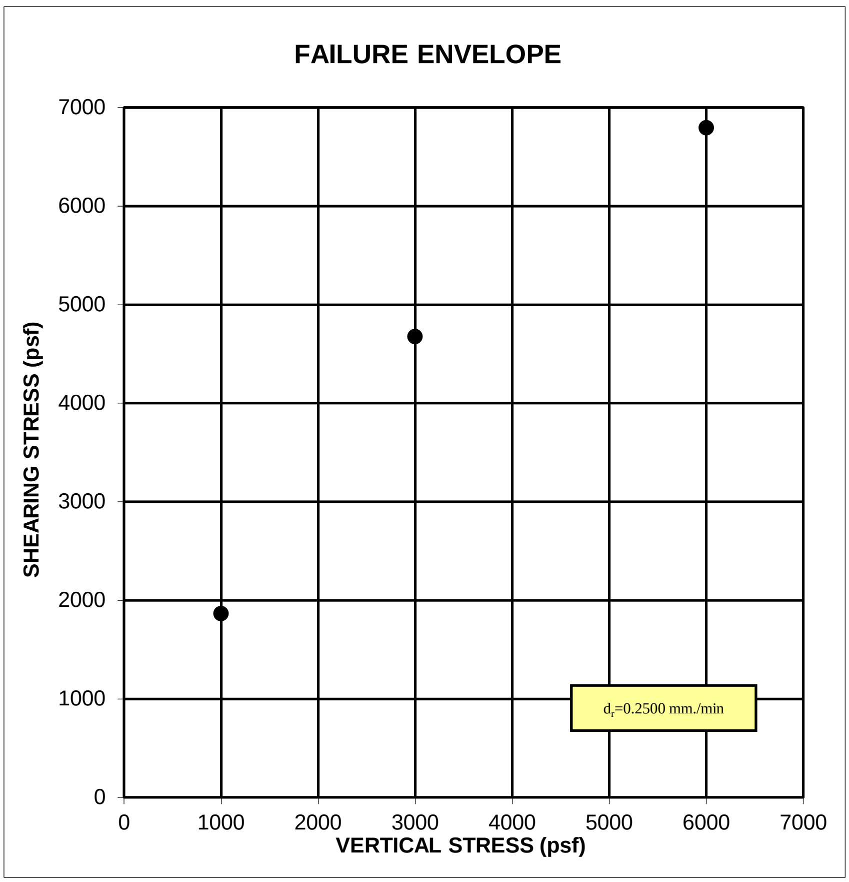
Moisture-Density Relations
Laboratory maximum dry density and optimum moisture content were evaluated according to ASTM D 1557.

Resistance "R" Value
The resistance "R"-value was measured by the CTM 301. The graphically determined "R" value at an exudation pressure of 300 pounds per square inch is the value used for pavement section calculation.

Sieve Analysis (Gradation)
Sieve analyses and 200 washes were performed on selected representative samples according to ASTM C 136 and D 1140 to determine grain-size distribution.

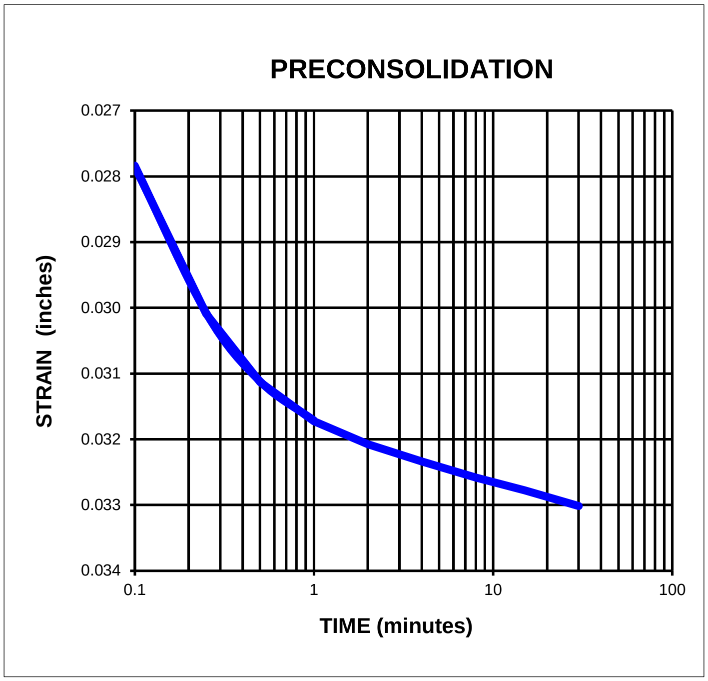


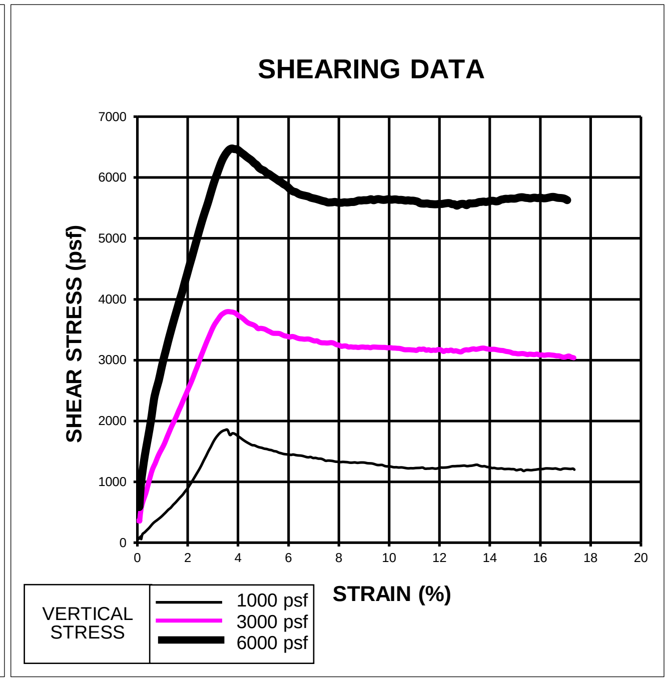


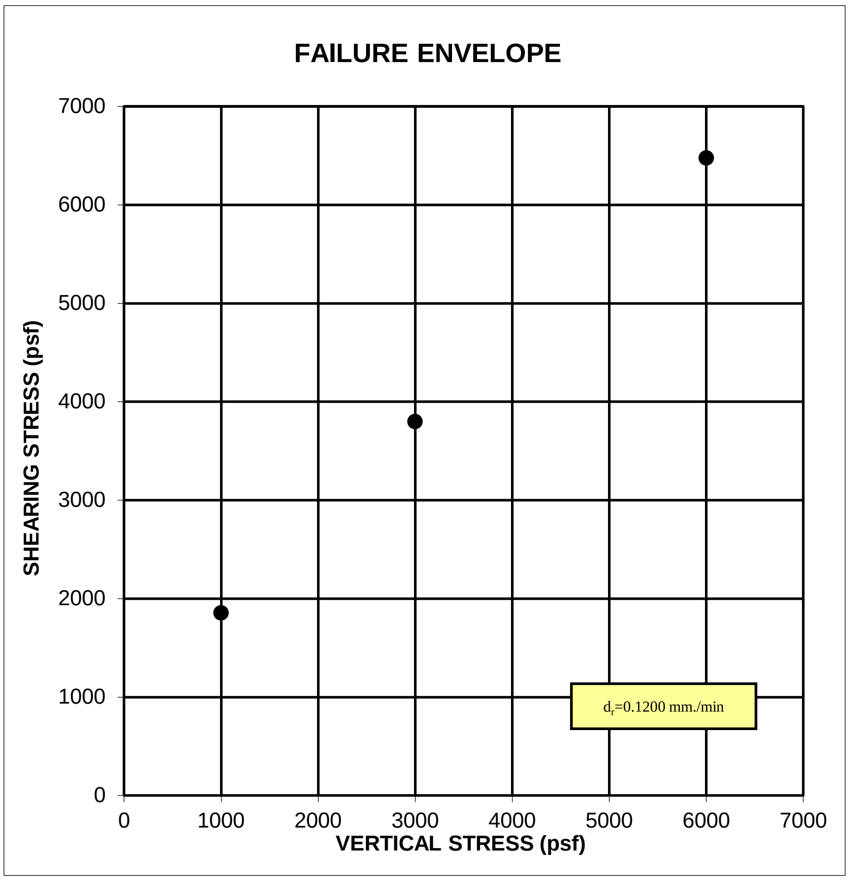


SHEAR STRENGTH TEST - ASTM D3080

Job Name:	The Commons at Hidden Spring			Initial Dry Density (pcf):	113.0
Project Number:	40-3779G	Sample Date:	9/9/2019	Initial Moisture (%):	4.9
Lab Number:	29938	Test Date:	9/13/2019	Final Moisture (%):	16.3
Sample Location:	B-4 @ 5-5.5'	Tested by:	KF	Cohesion:	1230 psf
Sample Description:	Sandstone			Angle Of Friction:	43.9







SHEAR STRENGTH TEST - ASTM D3080

Job Name:	The Commons at Hidden Spring			Initial Dry Density (pcf):	120.2
Project Number:	40-3779G	Sample Date:	9/9/2019	Initial Moisture (%):	9.0
Lab Number:	29938	Test Date:	9/16/2019	Final Moisture (%):	14.9
Sample Location:	B-8 @ 5-5.5'	Tested by:	KF	Cohesion:	960 psf
Sample Description:	Fine-grained Sandstone			Angle Of Friction:	42.7

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REPORT OF RESISTANCE 'R' VALUE-EXPANSION PRESSURE

Project Name: The Commons at Hidden Springs
Project No.: 40-3379G
Sample Location: B-4 @ 0-5'
Soil Description: Light Brown SC-SM
Test Procedure: Cal 301

Lab No.: 29938
Sampled By: R.E./W.L. **Date:** 9/9/2019
Submitted By: R.E./W.L. **Date:** 9/9/2019
Tested By: Larry Sachs **Date:** 9/16/2019
Reviewed By: Erik Campbell **Date:** 9/17/2019

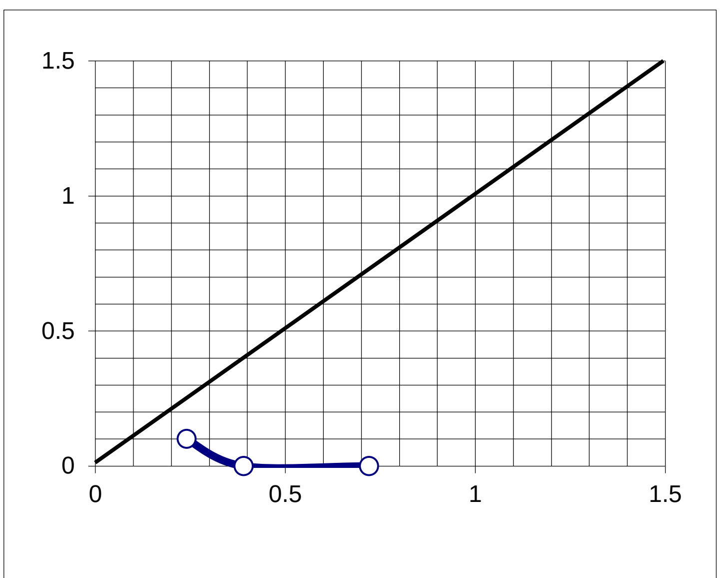
Specimen/ Mold No.	3	2	1	
Compactor Air Pressure, ft.lbs.	350	350	350	
Initial Moisture, %	3.0	3.0	3.0	
Wet Weight / Tare (g)	1955.8	1955.8	1955.8	
Dry Weight / Tare (g)	1920.9	1920.9	1920.9	
Tare (g)	755.5	755.5	755.5	
Water Added, ml	75	80	100	
Moisture at Compaction, %	9.4	9.9	11.6	
Wt. Of Briquette and Mold, g	3208	3231	3234	
Wt. Of Mold, g	2095	2096	2110	
Wt. Of Briquitte,g	1113	1135	1124	
Height of Briquette, in	2.44	2.48	2.45	
Dry Density, pcf	126.4	126.3	124.7	
Stabilometer PH @ 1000 lbs	16	26	46	
Stabilometer PH @ 2000 lbs	26	44	98	
Displacement	4.10	4.55	5.00	
R' Value	75	59	24	
Corrected 'R' Value	75	59	24	
Exudation Pressure, lbs	7600	5400	2600	
Exudation Pressure, psi	608	432	208	
Stabilometer Thickness - ft	0.24	0.39	0.72	
Expansion Pressure	0.0003	0.0000	0.0000	
Expansion Press, Thick-ft	0.10	0.00	0.00	

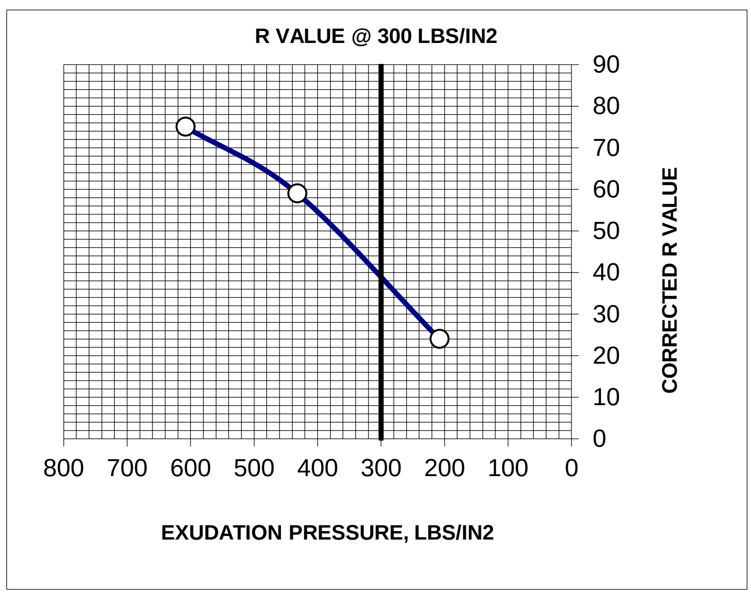
Exudation 39

Expansion 82

R-value **39**

TI	4.5
Expansion	82





Cover Thickness by Expansion Pressure-Feet

Expansion From Graph:	0.17

Erik Campbell
Laboratory Manager

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REPORT OF RESISTANCE 'R' VALUE-EXPANSION PRESSURE

Project Name: The Commons at Hidden Springs
Project No.: 40-3779G
Sample Location: B-8 @ 5-10'
Soil Description: Brown SC
Test Procedure: Cal 301

Lab No.: 29938
Sampled By: R.E./W.L. **Date:** 9/9/2019
Submitted By: R.E./W.L. **Date:** 9/9/2019
Tested By: Larry Sachs **Date:** 9/16/2019
Reviewed By: Erik Campbell **Date:** 9/17/2019

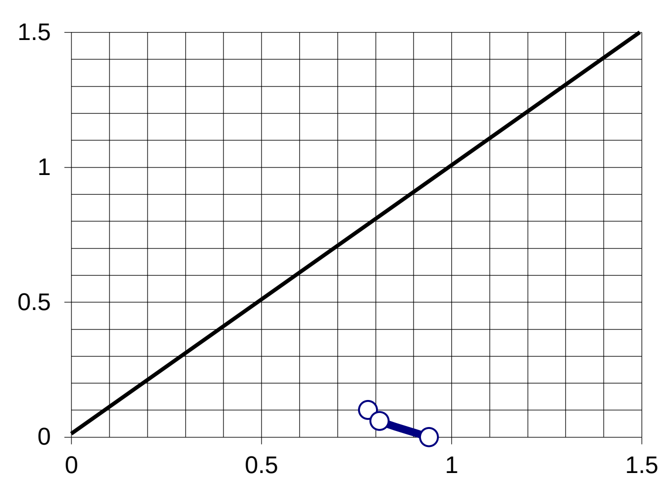
Specimen/ Mold No.	9	8	7	
Compactor Air Pressure, ft.lbs.	350	250	100	350
Initial Moisture, %	4.7	4.7	4.7	
Wet Weight / Tare (g)	1902.0	1902.0	1902.0	
Dry Weight / Tare (g)	1848.3	1848.3	1848.3	
Tare (g)	701.4	701.4	701.4	
Water Added, ml	75	80	100	
Moisture at Compaction, %	11.2	11.7	13.4	
Wt. Of Briquette and Mold, g	3226	3239	3247	
Wt. Of Mold, g	2073	2073	2073	
Wt. Of Briquitte,g	1153	1166	1174	
Height of Briquette, in	2.55	2.53	2.59	
Dry Density, pcf	123.2	125.1	121.2	
Stabilometer PH @ 1000 lbs	5	54	70	
Stabilometer PH @ 2000 lbs	116	120	146	
Displacement	4.30	4.57	8.11	
R' Value	18	15	2	
Corrected 'R' Value	18	15	2	
Exudation Pressure, lbs	4950	3700	1650	
Exudation Pressure, psi	396	296	132	
Stabilometer Thickness - ft	0.78	0.81	0.94	
Expansion Pressure	0.0003	0.0002	0.0000	
Expansion Press, Thick-ft	0.10	0.06	0.00	

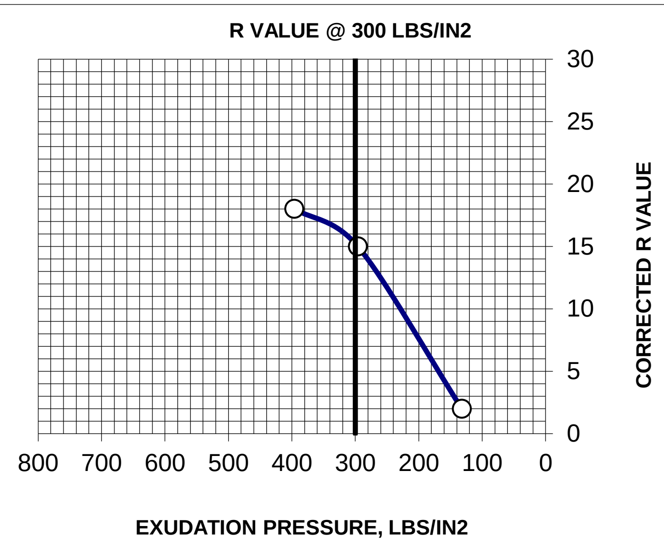
Exudation 15

Expansion 96

R-value **15**

TI	4.5
Expansion	96





Cover Thickness by Expansion Pressure-Feet

Expansion From Graph:	0.04

Erik Campbell
Laboratory Manager

EXPANSION INDEX TEST

ASTM D 4829

CTE Project Number: **40-3779G**

Project Name: **The Commons at Hidden Springs, Wildomar, CA**

Sample ID: B-2 @ 10-15 ft.
Sample Description: Clayey Sand

Test Start Date:	Time:	Initial Reading:
9-13-2019	10:25 am	0.0012

Test Finish Date:	Time:	Final Reading:
9-14-2019	10:25 am	0.0022

Specimen Moisture Content, %: 9.2
Specimen Dry Density, pcf: 112.3
Specimen Saturation, %: 53.3

Expansion (inches): 0.0010

Expansion Index: **1**

Expansion Potential: **Very Low**

LABORATORY COMPACTION OF SOIL (MODIFIED PROCTOR)

ASTM D 1557

Project Name:	Wildomar Commons	**Sampled By:**	RE/WL	**Date:**	9-9-19
CTE Project No.:	40-3779G	**Tested By:**	WL	**Date:**	9-16-19
Lab No.:	9031	**Reviewed By:**	RE	**Date:**	9/16/19
Sample ID:	B-2 @ 10-15				
Sample Description:	Yellowish-brown clayey sand				

TEST NO.	1	2	3	4	
Wt. Comp. Soil + Mold (lbs)	8.899	9.098	9.095	8.925	
Wt. of Mold (lbs)	4.421	4.421	4.421	4.421	
Net Wt. of Soil (lbs)	4.478	4.677	4.674	4.504	
Wet Wt. of Soil + Cont. (g)	1233.7	1325.9	1348.7	1387.5	
Dry Wt. of Soil + Cont. (g)	1187.1	1260.7	1286.1	1290.3	
Wt. of Container (g)	497.7	495.6	655.4	499.5	
Moisture Content (%)	6.8	8.5	9.9	12.3	
Wet Density (pcf)	134.9	140.9	140.8	135.7	
Dry Density (pcf)	126.3	129.8	128.1	120.8	

Preparation Method: Dry [ ] Moist [X]

Mechanical Rammer [ ]
Manual Rammer [X]

Hammer Weight: 10.0 lb.

Drop: 18 in.

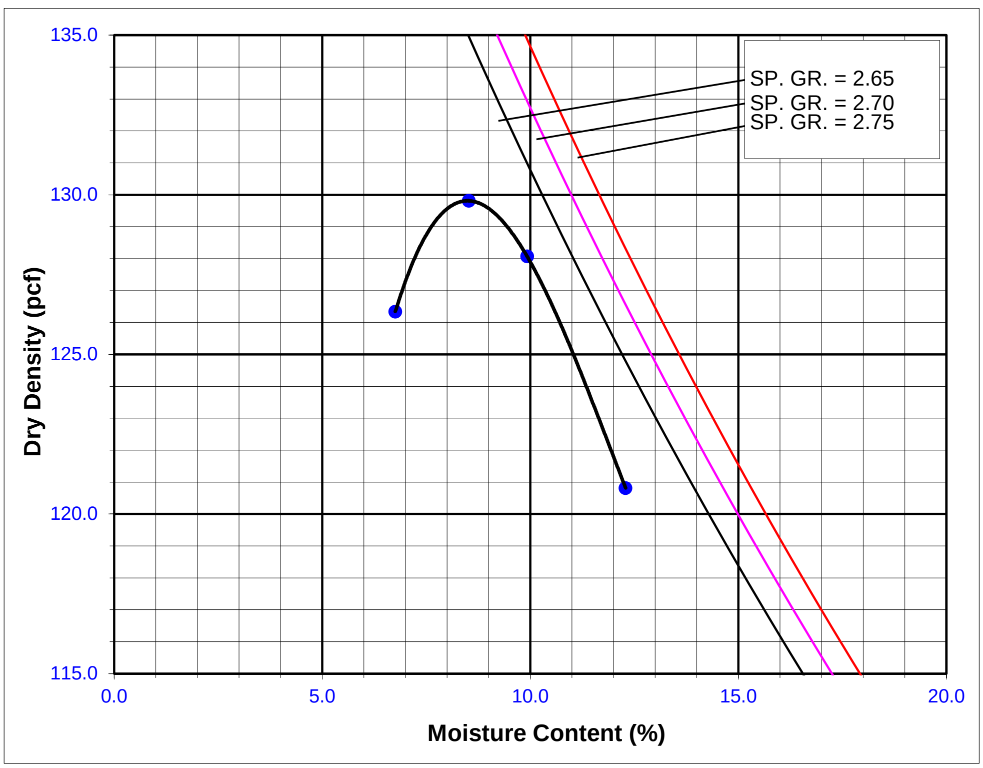
Mold Volume (ft.^{3}): 0.03320

METHOD USED

[ ] **Method A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if No.4 retained =/< 25%

[X] **Method B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if 3/8" retained =/< 25%

[ ] **Method C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
May be used if 3/4" retained =/< 30%



OVERSIZE FRACTION

Total Sample Weight (g): 9756.1

Weight Retained (g)		Percent Retained
	Plus 3/4"	0.0
28.1	Plus 3/8"	0.3
	Plus #4	0.0

Maximum Dry Density (pcf) **129.8**

Optimum Moisture Content (%) **8.5**

Rock Correction Applied per ASTM D 4718

Maximum Dry Density (pcf)

Optimum Moisture Content (%)

LABORATORY COMPACTION OF SOIL (MODIFIED PROCTOR)

ASTM D 1557

Project Name: Wildomar Commons
CTE Project No.: 40-3779G
Lab No.: 9031
Sample ID: B-5 @ 0-5
Sample Description: Yellowish-brown silty sand

Sampled By: ______ **Date:** 9-9-19
Tested By: WL **Date:** 9-16-19
Reviewed By: RE **Date:** 9-16-19

TEST NO.	1	2	3	4	
Wt. Comp. Soil + Mold (lbs)	9.061	9.148	9.045	8.875	
Wt. of Mold (lbs)	4.421	4.421	4.421	4.421	
Net Wt. of Soil (lbs)	4.640	4.727	4.624	4.454	
Wet Wt. of Soil + Cont. (g)	1316.1	1316.4	1376.2	1275.4	
Dry Wt. of Soil + Cont. (g)	1280.0	1265.1	1308.9	1238.5	
Wt. of Container (g)	742.2	651.8	650.5	497.5	
Moisture Content (%)	6.7	8.4	10.2	5.0	
Wet Density (pcf)	139.8	142.4	139.3	134.2	
Dry Density (pcf)	131.0	131.4	126.4	127.8	

Preparation Method: Dry [ ] Moist [X]

Mechanical Rammer [ ]
Manual Rammer [X]

Hammer Weight: 10.0 lb.

Drop: 18 in.

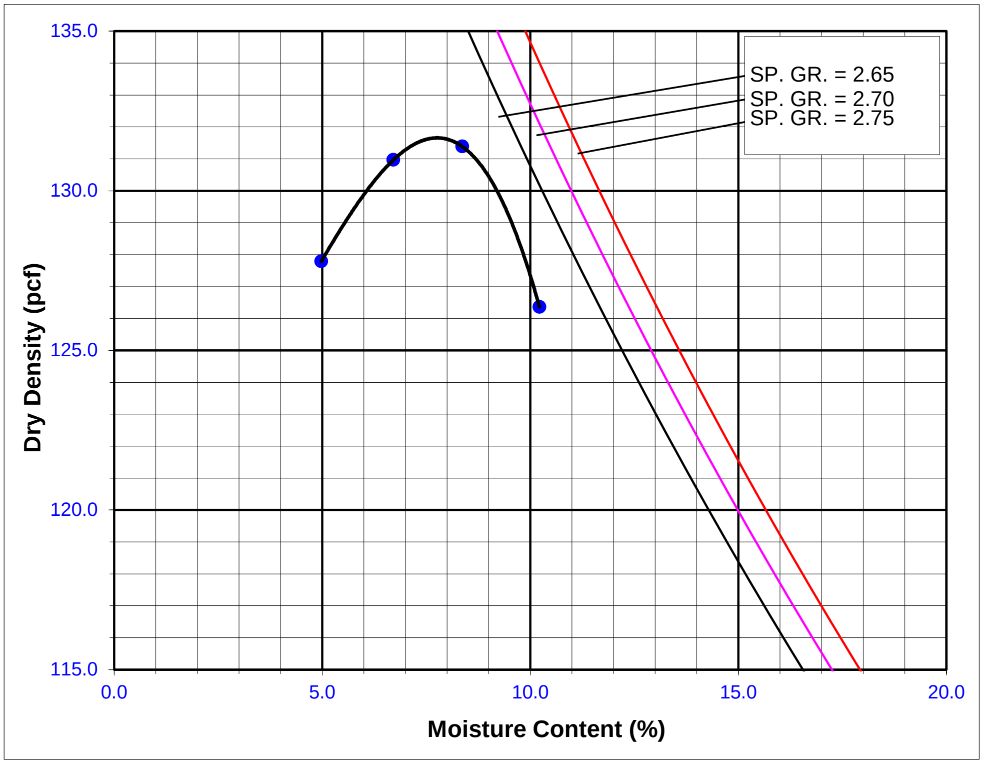
Mold Volume ($ft.^3$): 0.03320

METHOD USED

[ ] **Method A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if No.4 retained =/< 25%

[X] **Method B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if 3/8" retained =/< 25%

[ ] **Method C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
May be used if 3/4" retained =/< 30%



OVERSIZE FRACTION

Total Sample Weight (g): 15463.8

Weight Retained (g)		Percent Retained
	Plus 3/4"	0.0
34.4	Plus 3/8"	0.2
	Plus #4	0.0

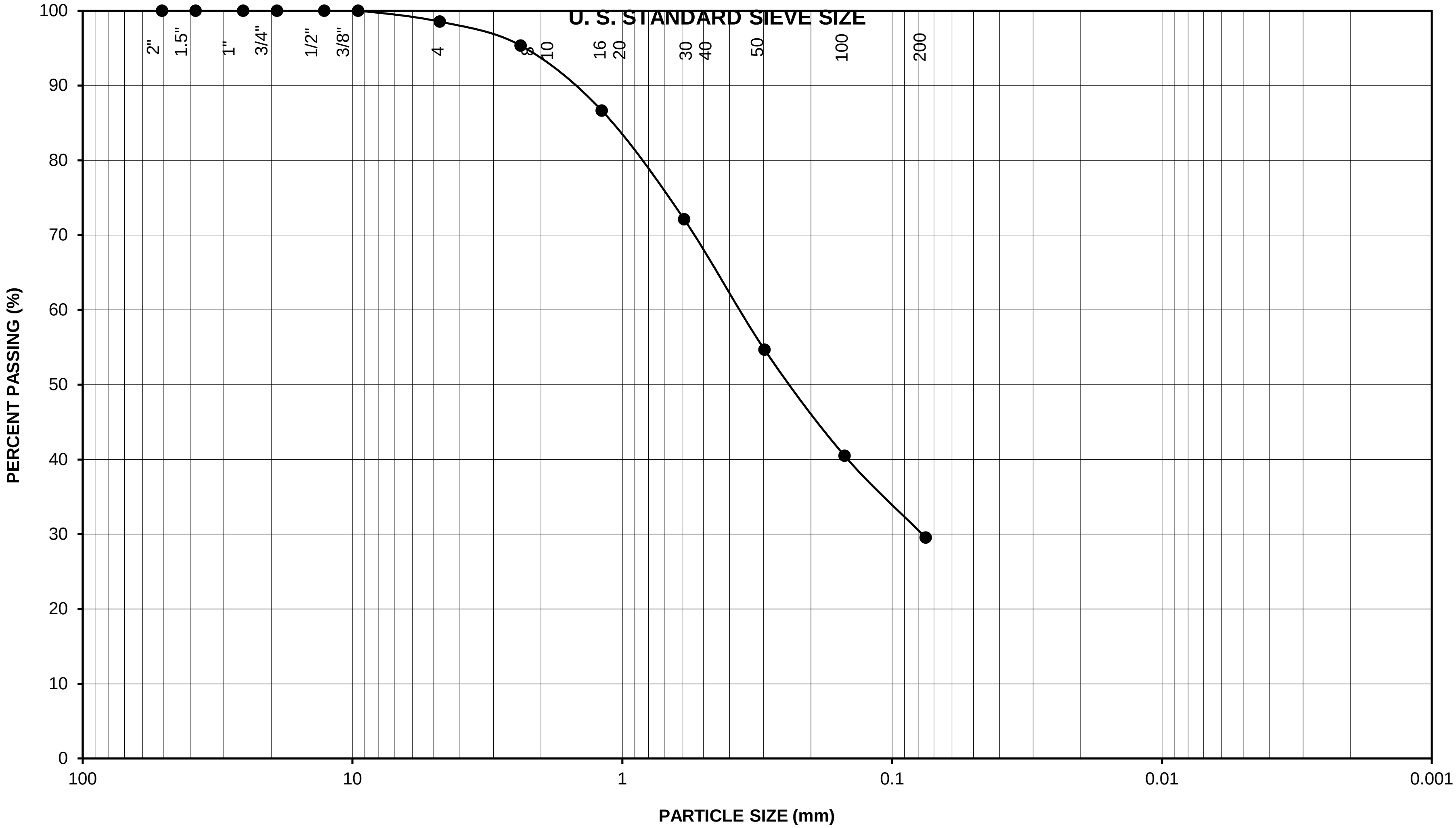
Maximum Dry Density (pcf) 131.6

Optimum Moisture Content (%) 8.0

Rock Correction Applied per ASTM D 4718

Maximum Dry Density (pcf)

Optimum Moisture Content (%)



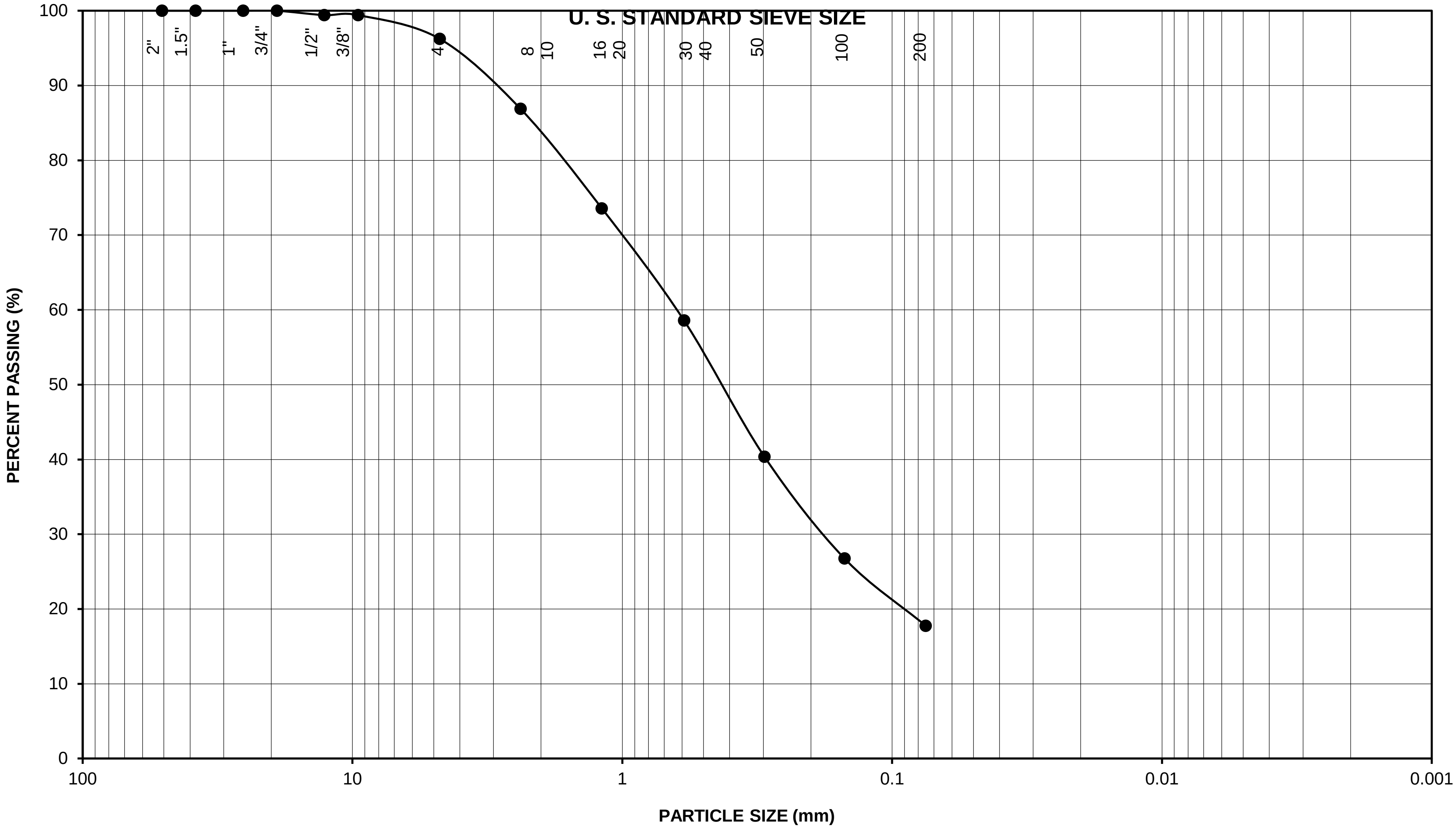
PARTICLE SIZE ANALYSIS

Sample Designation	Sample Depth (feet)	Symbol	Liquid Limit (%)	Plasticity Index	Classification
B-2	10-15	●	29	9	SC
		■			

CTE SOUTH Construction Testing & Engineering, South, Inc.
Inspection | Testing | Geotechnical | Environmental & Construction Engineering | Civil Engineering | Surveying

CTE JOB NUMBER: 40-3779G

Wildomar Commons



PARTICLE SIZE ANALYSIS

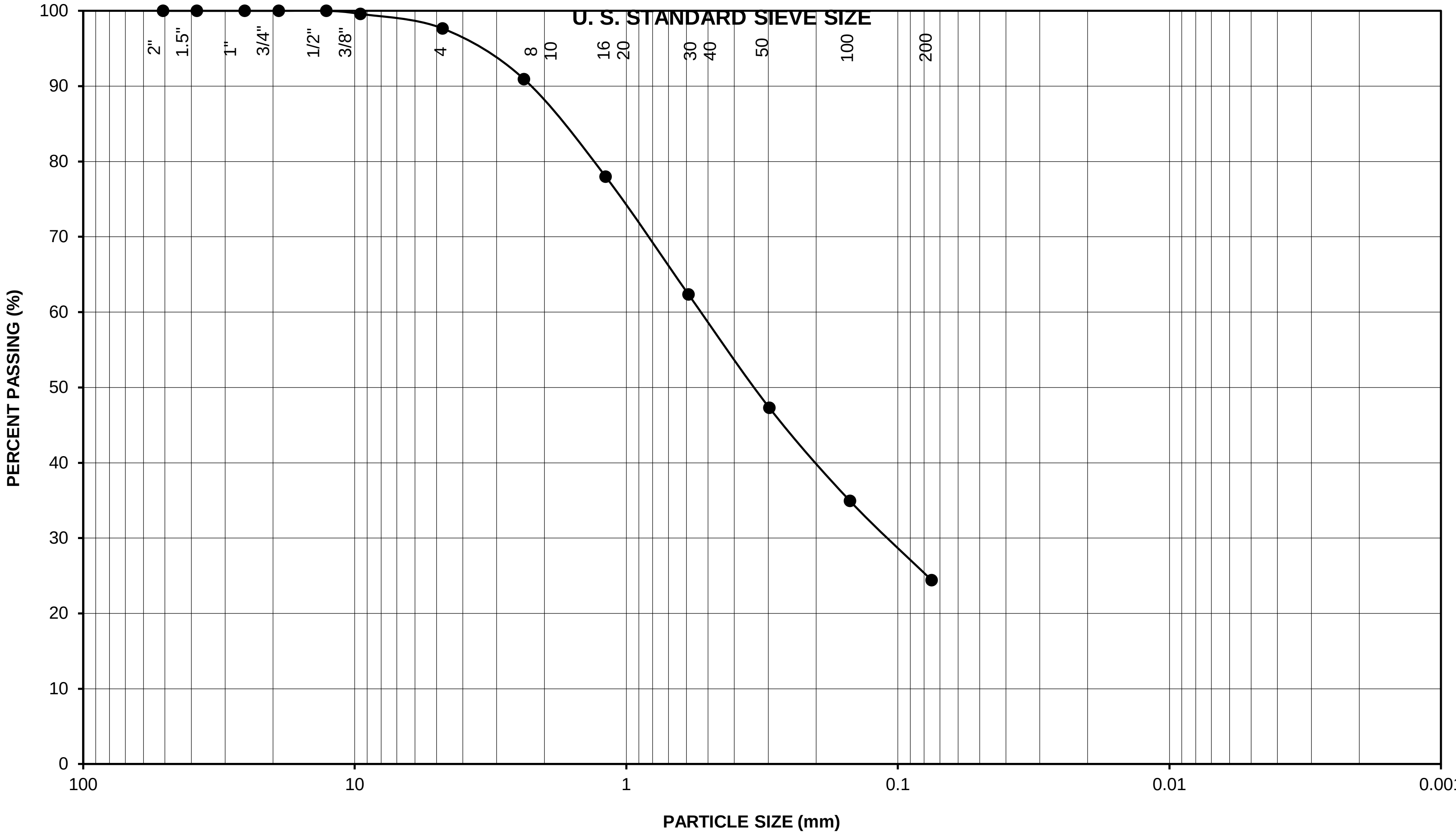
Construction Testing & Engineering, South, Inc.

Inspection | Testing | Geotechnical | Environmental & Construction Engineering | Civil Engineering | Surveying

Sample Designation	Sample Depth (feet)	Symbol	Liquid Limit (%)	Plasticity Index	Classification
B-4	0-5	●			SC-SM
		■			

CTE JOB NUMBER: 40-3779G

Wildomar Commons



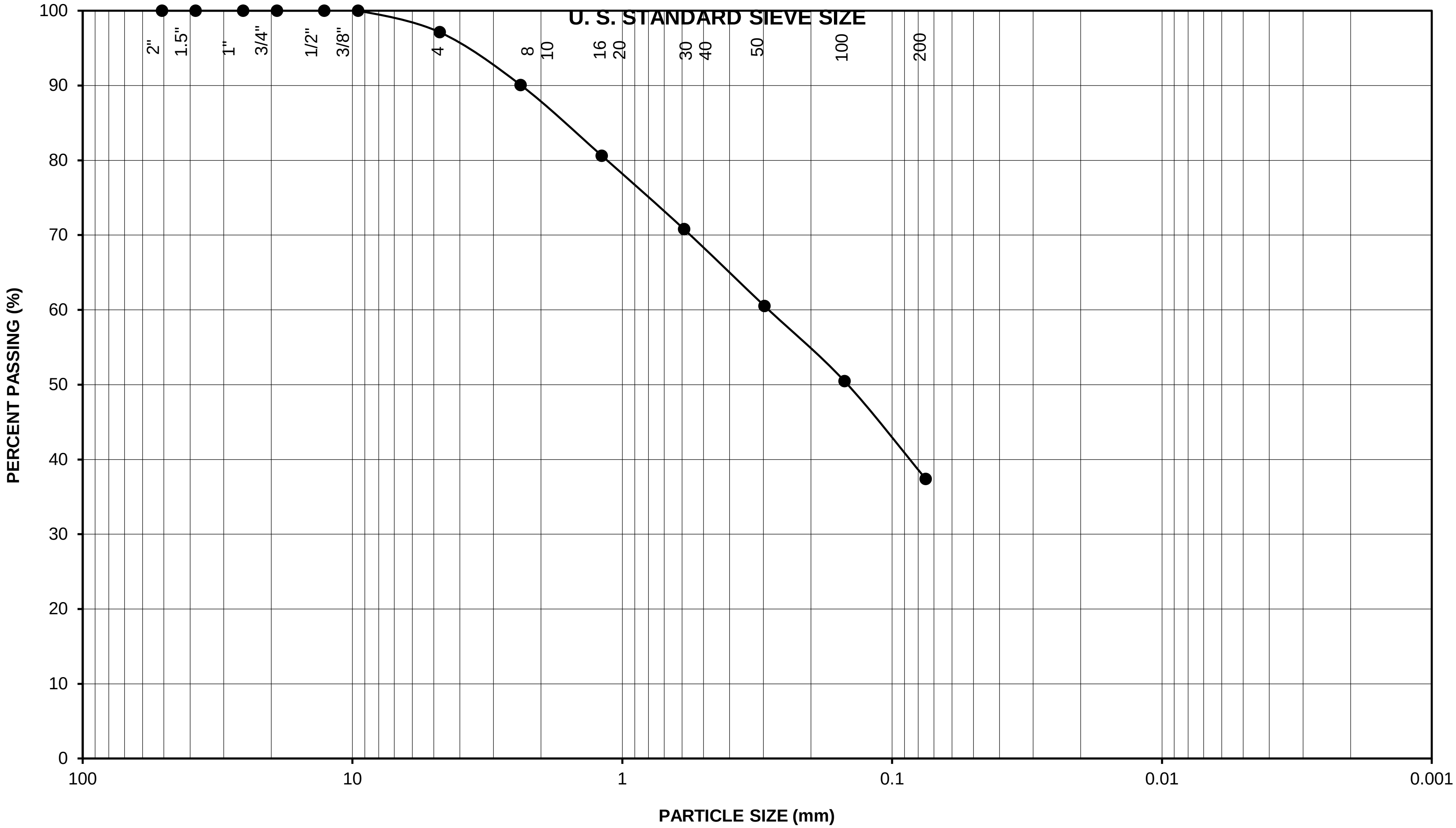
PARTICLE SIZE ANALYSIS

CTE SOUTH Construction Testing & Engineering, South, Inc.
Inspection | Testing | Geotechnical | Environmental & Construction Engineering | Civil Engineering | Surveying

Sample Designation	Sample Depth (feet)	Symbol	Liquid Limit (%)	Plasticity Index	Classification
B-5	0-5	●	NP	NP	SM
		■			

CTE JOB NUMBER: 40-3779G

Wildomar Commons



PARTICLE SIZE ANALYSIS

CTE SOUTH Construction Testing & Engineering, South, Inc.
Inspection | Testing | Geotechnical | Environmental & Construction Engineering | Civil Engineering | Surveying

Sample Designation	Sample Depth (feet)	Symbol	Liquid Limit (%)	Plasticity Index	Classification
B-8	5-10	●			
		■			

CTE JOB NUMBER: 40-3779G

Wildomar Commons

BABCOCK Laboratories, Inc.
The Standard of Excellence for Over 100 Years

Client Name:	Construction Testing & Eng., Inc.	Analytical Report:	Page 1 of 4
Contact:	Robert Ellerbusch	Project Name:	Const. Test.-Soils
Address:	14538 Meridian Parkway, Suite A Riverside, CA 92518	Project Number:	Wildomar Commons
Report Date:	16-Sep-2019	**Work Order Number:**	**B9I1692**

Received on Ice (Y/N): No Temp: 26 °C

Attached is the analytical report for the sample(s) received for your project. Below is a list of the individual sample descriptions with the corresponding laboratory number(s). Also, enclosed is a copy of the Chain of Custody document (if received with your sample(s)). Please note any unused portion of the sample(s) may be responsibly discarded after 30 days from the above report date, unless you have requested otherwise.

Thank you for the opportunity to serve your analytical needs. If you have any questions or concerns regarding this report please contact our client service department.

Sample Identification

Lab Sample #	Client Sample ID	Matrix	Date Sampled	By	Date Submitted	By
B9I1692-01	40-3979 B4 @ 0' - 5'	Soil	09/09/19 12:00	Walter Leung	09/11/19 14:30	Walter Leung
B9I1692-02	40-3979 B8 @ 5' - 10'	Soil	09/09/19 15:00	Walter Leung	09/11/19 14:30	Walter Leung

BABCOCK Laboratories, Inc.

The Standard of Excellence for Over 100 Years

Client Name: Construction Testing & Eng., Inc.
Contact: Robert Ellerbusch
Address: 14538 Meridian Parkway, Suite A
Riverside, CA 92518

Report Date: 16-Sep-2019

Project Name: Const. Test.-Soils

Project Number: Wildomar Commons

Work Order Number: B9I1692

Received on Ice (Y/N): No Temp: 26 °C

Laboratory Reference Number

B9I1692-01

Sample Description	Matrix	Sampled Date/Time	Received Date/Time
40-3979 B4 @ 0' - 5'	Soil	09/09/19 12:00	09/11/19 14:30

Analyte(s)	Result	RDL	Units	Method	Analysis Date	Analyst	Flag
Anions							
Chloride	ND	5.0	mg/kg	Cal Trans 422	09/14/19 09:03	KBS	
Sulfate	ND	5.0	mg/kg	Cal Trans 417	09/14/19 09:03	KBS	
Saturated Paste							
pH	6.5	0.1	pH Units	S-1.10 W.S.	09/16/19 13:39	TML	
Minimum Resistivity	5300	10	ohm-cm	Cal Trans 643	09/16/19 13:39	TML	

Client Name: Construction Testing & Eng., Inc.
Contact: Robert Ellerbusch
Address: 14538 Meridian Parkway, Suite A
Riverside, CA 92518

Report Date: 16-Sep-2019

Project Name: Const. Test.-Soils
Project Number: Wildomar Commons

Work Order Number: B9I1692

Received on Ice (Y/N): No   Temp: 26 °C

Laboratory Reference Number

B9I1692-02

Sample Description	Matrix	Sampled Date/Time	Received Date/Time
40-3979 B8 @ 5' - 10'	Soil	09/09/19 15:00	09/11/19 14:30

Analyte(s)	Result	RDL	Units	Method	Analysis Date	Analyst	Flag
Anions							
Chloride	ND	5.0	mg/kg	Cal Trans 422	09/14/19 09:41	KBS	
Sulfate	ND	5.0	mg/kg	Cal Trans 417	09/14/19 09:41	KBS	
Saturated Paste							
pH	7.1	0.1	pH Units	S-1.10 W.S.	09/16/19 13:39	TML	
Minimum Resistivity	4400	10	ohm-cm	Cal Trans 643	09/16/19 13:39	TML	

ESB

BABCOCK Laboratories, Inc.
The Standard of Excellence for Over 100 Years

Client Name:	Construction Testing & Eng., Inc.	Analytical Report:	Page 4 of 4
Contact:	Robert Ellerbusch	Project Name:	Const. Test.-Soils
Address:	14538 Meridian Parkway, Suite A Riverside, CA 92518	Project Number:	Wildomar Commons
Report Date:	16-Sep-2019	**Work Order Number:**	**B9I1692**
		Received on Ice (Y/N):	No Temp: 26 °C

Notes and Definitions

ND:	Analyte NOT DETECTED at or above the Method Detection Limit **(if MDL is reported)**, otherwise at or above the Reportable Detection Limit (RDL)
NR:	Not Reported
RDL:	Reportable Detection Limit
MDL:	Method Detection Limit
* / "' :	NELAP does not offer accreditation for this analyte/method/matrix combination

Approval

Enclosed are the analytical results for the submitted sample(s). Babcock Laboratories certify the data presented as part of this report meet the minimum quality standards in the referenced analytical methods. Any exceptions have been noted.

Angela Brown **Angela E. Brown For KayeLani A. Marshall**

cc:

e-Short_No Alias.rpt

This report applies only to the sample(s) analyzed. As a mutual protection to clients, the public, and Babcock Laboratories, Inc., this report is submitted and accepted for the exclusive use of the Client to whom it is addressed. Interpretation and use of the information contained within this report are the sole responsibility of the Client. Babcock Laboratories, Inc. is not responsible for any misinformation or consequences that may result from misinterpretation or improper use of this report. This report is not to be modified or abbreviated in any way. Additionally, this report is not to be used, in whole or in part, in any advertising or publicity matter without written authorization from Babcock Laboratories, Inc. The liability of Babcock Laboratories, Inc. is limited to the actual cost of the requested analyses, unless otherwise agreed upon in writing. There is no other warranty expressed or implied.

APPENDIX C

STANDARD SPECIFICATIONS FOR GRADING AND TRENCH BACKFILL

RECOMMENDED EARTHWORK SPECIFICATIONS

The following specifications are recommended to provide a basis for quality control during the placement of compacted fill or backfill as applicable.

1. Areas that are to receive compacted fill shall be observed by Soil/Geotechnical Engineer (GE) or his/her representative prior to the placement of fill.

2. All drainage devices shall be properly installed and observed by GE and/or owner's representative(s) prior to placement of backfill.

3. Fill soils shall consist of imported soils or on-site soils free of organics, cobbles, and deleterious material provided each material is approved by GE. GE shall evaluate and/or test the import material for its conformance with the report recommendations prior to its delivery to the site. The contractor shall notify GE 72 hours prior to importing material to the site

4. Fill shall be placed in controlled layers (lifts), the thickness of which is compatible with the type of compaction equipment used. The fill materials shall be brought to optimum moisture content or above, thoroughly mixed during spreading to obtain a near uniform moisture condition and uniform blend of materials, and then placed in layers with a thickness (loose) not exceeding 8 inches. Each layer shall be compacted to a minimum compaction of 90% relative to the maximum dry density determined per the latest ASTM D1557 test. Density testing shall be performed by GE to verify relative compaction. The contractor shall provide proper access and level areas for testing.

5. Rocks or rock fragments less than eight (8) inches in the largest dimension may be utilized in the fill, provided they are not placed in concentrated pockets, except rocks larger than four (4) inches shall not be placed within three (3) feet of finish grade.

6. Rocks greater than eight (8) inches in largest dimension shall be taken offsite, or placed in accordance with the recommendation of the Soils Engineer in areas designated as suitable for rock disposal.

7. Where space limitations do not allow for conventional fill compaction operations, special backfill materials and procedures may be required. Pea gravel or other select fill can be used in areas of limited space. A sand and Portland cement slurry (2 sacks per cubic-yard mix) shall be used in limited space areas for shallow backfill near final pad grade, and pea gravel shall be placed in deeper backfill near drainage systems.

8. GE shall observe the placement of fill and conduct in-place field density tests on the compacted fill to check for adequate moisture content and the required relative compaction. Where less than specified relative compaction is indicated, additional compacting effort shall be applied and the soil moisture conditioned as necessary until adequate relative compaction is attained.

9. The Contractor shall comply with the minimum relative compaction out to the finish slope face of fill slopes, buttresses, and stabilization fills as set forth in the specifications for compacted fill. This may be achieved by either overbuilding the slope and cutting back as necessary, or by direct compaction of the slope face with suitable equipment, or by any other procedure that produces the required result.

10. Any abandoned underground structures such as cesspools, cisterns, mining shafts, tunnels, septic tanks, wells, pipelines or others not discovered prior to grading are to be removed or treated to the satisfaction of the Soils Engineer and/or the controlling agency for the project.

11. The Contractor shall have suitable and sufficient equipment during a particular operation to handle the volume of fill being placed. When necessary, fill placement equipment shall be shut down temporarily in order to permit proper compaction of fills, correction of deficient areas, or to facilitate required field-testing.

12. The Contractor shall be responsible for the satisfactory completion of all earthwork in accordance with the project plans and specifications.

13. Final reports shall be submitted after completion of earthwork and after the Soils Engineer and Engineering Geologist have finished their observations of the work. No additional excavation or filling shall be performed without prior notification to the Soils Engineer and/or Engineering Geologist.

14. Whenever the words “supervision”, “inspection” or “control” are used, they shall mean observation of the work and/or testing of the compacted fill by GE to assess whether substantial compliance with plans, specifications and design concepts has been achieved, and does not include direction of the actual work of the contractor or the contractor’s workmen.

RECOMMENDED SPECIFICATIONS
FOR PLACEMENT OF TRENCH BACKFILL

1. Trench excavations to receive backfill shall be free of trash, debris or other unsatisfactory materials prior to backfill placement, and shall be observed by project soil/geotechnical engineer (GE) representative.

2. Except as stipulated herein, soils obtained from the excavation may be used as backfill if they are essentially free of organics and deleterious materials.

3. Rocks generated from the trench excavation not exceeding three (3) inches in largest dimension may be used as backfill material. However, such material may not be placed within 12 inches of the top of the pipeline. No more than 30 percent of the backfill volume shall contain particles larger than 1-½ inches in diameter, and rocks shall be well mixed with finer soil.

4. Soils (other than aggregates) with a Sand Equivalent (SE) greater than or equal to 30, as determined by ASTM D 2419 Standard Test Method or at the discretion of the engineer or representative in the field, may be used for bedding and shading material in the pipe zone areas. These soils are considered satisfactory for compaction by jetting procedures.

5. No jetting will be permitted in utility trenches within the top 2 feet of the subgrade of concrete slabs-on-grade.

6. Trench backfill other than bedding and shading shall be compacted by mechanical methods as tamping sheepsfoot, vibrating or pneumatic rollers or other mechanical tampers to achieve the density specified herein. The backfill materials shall be brought to optimum moisture content or above, thoroughly mixed during spreading to obtain a near uniform moisture condition and uniform blend of materials, and then placed in horizontal layers with a thickness (loose) not exceeding 8 inches. Trench backfills shall be compacted to a minimum compaction of 90 percent relative to the maximum dry density determined per the latest ASTM D1557 test.

7. The contractor shall select the equipment and process to be used to achieve the specified density without damage to the pipeline, the adjacent ground, existing improvements or completed work.

8. Observations and field tests shall be carried on during construction by GE to confirm that the required degree of compaction has been obtained. Where compaction is less than that specified, additional compaction effort shall be made with adjustment of the moisture content as necessary until the specified compaction is obtained. Field density tests may be omitted at the discretion of the engineer or his representative in the field.

9. Whenever, in the opinion of GE or the Owner's Representative(s), an unstable condition is being created, either by cutting or filling, the work shall not proceed until an investigation has been made and the excavation plan revised, if deemed necessary.

10. Fill material shall not be placed, spread, or rolled during unfavorable weather conditions. When the work is interrupted by heavy rain, fill operations shall not be resumed until field tests by GE indicate the moisture content and density of the fill are as specified.

11. Whenever the words "supervision", "inspection", or "control" are used, they shall mean <u>observation</u> of the work and/or testing of the compacted fill by GE to assess whether substantial compliance with plans, specifications and design concepts has been achieved.