APPENDIX E

GEOLOGY REPORT



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February 10, 2017 Project No. 1-217-0015

Mr. Matt Nohr **The Orosco Group** 10 Harris Court, Suite B-1 Monterey, CA 93940

Subject: PRELIMINARY GEOTECHNICAL ENGINEERING INVESTIGATION

PROPOSED WEST END DEVELOPMENT

SWC TIOGA AVENUE & CALIFORNIA AVENUE

SAND CITY, CALIFORNIA

Dear Mr. Nohr:

At your request and authorization, SALEM Engineering Group, Inc. (SALEM) has prepared this Preliminary Geotechnical Engineering Investigation report for the site of the proposed West End Development and appurtenant improvements to be located at the subject address. The development will be built on approximately 10.7 acres.

The recommendations provided in this report are preliminary recommendations and should be reviewed and, if needed, revised to accommodate the project final design. In the event that changes occur in the nature or design of the project, the conclusions and recommendations contained in this report will not be considered valid unless the changes are reviewed and the conclusions of our report are modified.

The accompanying report presents our findings, conclusions, and recommendations regarding the geotechnical aspects of designing and constructing the project as presently proposed. In our opinion, the proposed project is feasible from a geotechnical viewpoint provided our recommendations are incorporated into the design and construction of the project.

We appreciate the opportunity to assist you with this project. Should you have questions regarding this report or need additional information, please contact the undersigned at (559) 271-9700.

Respectfully Submitted,

SALEM ENGINEERING GROUP, INC.

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PRELIMINARY GEOTECHNICAL ENGINEERING INVESTIGATION PROPOSED WEST END DEVELOPMENT SWC TIOGA AVENUE & CALIFORNIA AVENUE SAND CITY, CALIFORNIA

1. PURPOSE AND SCOPE

This report presents the results of our Preliminary Geotechnical Engineering Investigation for the site of the proposed West End Development to be located on the subject address in Sand City, California, as depicted on Figure 1, Vicinity Map.

SALEM Engineering Group, Inc. (SALEM) has completed this preliminary geotechnical engineering investigation with the purpose to observe and sample the subsurface conditions encountered at the site, and provide conclusions and recommendations relative to the geotechnical aspects of constructing the project as presently proposed.

The scope of this investigation included a field exploration, laboratory testing, engineering analysis and the preparation of this report. Our field exploration was performed on January 17, 2017 and included the drilling of sixteen (16) small-diameter soil borings to a maximum depth of approximately 50.5 feet below ground surface. The locations of the soil borings are depicted on Figure 2, Site Plan. A detailed discussion of our field investigation and exploratory boring logs are presented in Appendix A.

Laboratory tests were performed on selected soil samples obtained during the investigation to evaluate pertinent physical properties for engineering analyses. Appendix B presents the laboratory test results in tabular and graphic format.

The recommendations presented herein are based on analysis of the data obtained during the investigation and our local experience with similar soil and geologic conditions.

If project details vary significantly from those described herein, SALEM should be contacted to determine the necessity for review and possible revision of this report.

2. PROJECT DESCRIPTION

We understand that design of the proposed project is currently underway; structural load information and other final details pertaining to the structure are unavailable. We understand that development of the site includes the demolition of existing site structures and the construction of commercial and residential buildings with subterranean parking garage and a new circulation road being considered. We also understand that the development will be built on approximately 10.7 acres. Based on preliminary information provided, we understand that the project will consist of two hotels, Hotel-H1 and Hotel-H2. In addition, the project will also include two multi-family residential buildings, Residential-R1 and



Residential-R2. The project site is located at the southwest corner of Tioga Avenue and California Avenue, in Sand City, California.

Hotel H1 will consist of 4 story slab on grade building, wood frame construction on an area approximately 2.31 acres. Hotel H2 will also consist of 4 story slab on grade building, wood frame construction on an area approximately 1.36 acres.

Both Residential R1 and Residential R2 buildings will consist of 2 levels of parking podium (concrete) over 5 levels of wood frame construction (multi-family residential). Portion of parking would be subterranean – exact configuration TBD. Residential-R1 will be built on an area approximately 1.12 acres, and Residential-R2 on an area approximately 2.92 acres.

Aerial photographs for the site indicate that proposed buildings coincide with existing buildings in most cases. Structural loads were not provided to us at the time this report was prepared.

We assume a minimum soil bearing pressure of 3,000 psf is required. It is assumed that maximum shear wall loads are on the order of 20 kips per linear foot dead load, and 4.8 kips per linear foot live load. Maximum interior column loads are on the order of 450 kips dead load and 100 kips live load, with maximum exterior column loads on the order of 225 kips dead load and 50 kips live load. Required floor slab soil bearing pressure is assumed to be on the order of 150 psf. Maximum allowable total and differential settlements are assumed to be 1 inch and ½ inch, respectively.

A site grading plan was not available at the time of preparation of this report. Based on the site condition during our field exploration, it is anticipated that cuts and fills during earthwork will be necessary to providing level building pad areas for the construction. Based on email correspondence with the client, we understand that the site will be re-graded in an effort to balance cut/fill so not to import or export soils and maintaining the grades / tie-in along the existing Tioga and California Aves then sloping the site up towards the west.

It is important to note that the recommendations provided in this report are preliminary recommendations and should be reviewed and, if needed, revised to accommodate the project final design. In the event that changes occur in the nature or design of the project, the conclusions and recommendations contained in this report will not be considered valid unless the changes are reviewed and the conclusions of our report are modified.

The site location and approximate locations of proposed improvements are shown on the Site Plan, Figure 2.

3. SITE LOCATION AND DESCRIPTION

The subject site is located at southwest corner of the intersection of Tioga Avenue & California Avenue, in Sand City, California (see Vicinity Map, Figure 1).

The site is bounded by Tioga Avenue to the north and northeast with commercial development beyond; California Avenue to the south and southeast, with commercial development beyond; and land that's partially developed with residential homes to the west with Highway 1 beyond. The proposed project area is currently occupied with a number of existing commercial structures, asphalt and concrete paved parking and driveways, and landscaped areas. At the time of our field exploration, it was noted that the site contained scattered concrete debris and trash. The majority of the proposed building areas footprint



overlaps with existing site structures. The site area has elevations ranging from approximately 37 feet on the northeast site to 60 feet on the southwest site, above mean sea level (AMSL) based on Google Earth.

4. FIELD EXPLORATION

Our field exploration consisted of site surface reconnaissance and subsurface exploration. The exploratory test borings (B-1 through B-16) were drilled on January 17 and 18, 2017 within or near the proposed building areas at the approximate locations shown on Figure No. 2, Site Plan. The test borings were advanced with 8-inch diameter hollow-stem auger rotated by a truck-mounted CME-55 drill rig and a 4-inch diameter hand auger.

The test borings were extended to depths of up to a maximum 50.5 feet approximately below the existing site grades. The materials encountered in the test borings were visually classified in the field, and logs were recorded by a field engineer at that time. Visual classification of the materials encountered in the test borings was generally made in accordance with the Unified Soil Classification System (ASTM D2487).

A Unified Soil Classification Chart and key to sampling is presented in Appendix A, including the logs of the test borings. Subsurface soil samples were obtained by driving a Modified California sampler (MCS) or a Standard Penetration Test (SPT) sampler. The Boring Logs include the soil type, color, moisture content, dry density, and the applicable Unified Soil Classification System symbol. The location of the test borings were determined by measuring from site features determined from information provided to us. Hence, accuracy can be implied only to the degree that this method warrants. The actual boundaries between different soil types may be gradual and soil conditions may vary. For a more detailed description of the materials encountered, the Boring Logs in Appendix A should be consulted.

Penetration resistance blow counts were obtained by dropping a 140-pound automated trip hammer through a 30-inch free fall to drive the sampler to a maximum penetration of 18 inches. The number of blows required to drive the last 12 inches, or less if very dense or hard, is recorded as Penetration Resistance (blows/foot) on the logs of borings.

Soil samples were obtained from the test borings at the depths shown on the logs of borings. The MCS samples were recovered and capped at both ends to preserve the samples at their natural moisture content; SPT samples were recovered and placed in a sealed bag to preserve their natural moisture content. At the completion of drilling and sampling, the test borings were backfilled with drill cuttings.

5. LABORATORY TESTING

Laboratory tests were performed on selected soil samples to evaluate their physical characteristics and engineering properties. The laboratory-testing program was formulated with emphasis on the evaluation of natural moisture, density, shear strength, consolidation, R-Value, and gradation characteristics of the materials encountered.

In addition, chemical tests were performed to evaluate the corrosivity of the soils to buried concrete and metal. Details of the laboratory test program and the results of laboratory test are summarized in Appendix B. This information, along with the field observations, was used to prepare the final boring logs in Appendix A.



6. GEOLOGIC SETTING

The site is located within the Coast Ranges Geomorphic Province. The province includes many separate mountain ranges and several major structural valleys. A peculiar distinction to this province is the presence of two entirely different core complexes: one being a disordered Jurassic-Cretaceous (205 to 60 million years before present) sequence of volcanic, metamorphic, and deep marine clastic sedimentary rocks, commonly known as the Franciscan Assemblage; and the other consisting of Early Cretaceous (138 to 96 million years before present) granitic intrusives and older metamorphic rocks. The two unrelated core complexes lie side by side separated by faults.

A thick blanket of Late Cretaceous and Cenozoic (less than 100 million years old) clastic sedimentary rocks covers large portions of the province. Folds, thrust faults, steep reverse faults, and strike-slip faults developed as a consequence of Cenozoic deformation. Some deformation is continuing today. More specifically, the site is located within a region of Quaternary alluvium (less than 2 million years old) deposited by the Pajaro River and its tributaries.

7. GEOLOGIC HAZARDS

7.1 Faulting and Seismicity

Based on the proximity of several dominant active faults and seismogenic structures, as well as the historic seismic record, the area of the subject site is considered subject to moderate to severe seismicity. The seismic hazard most likely to impact the site is ground-shaking due to a large earthquake on one of the major active regional faults. Moderate to large earthquakes have affected the area of the subject site within historic time.

The project area is not within an Alquist-Priolo Special Studies Zone and will not require a special site investigation by an Engineering Geologist. Soils on site are classified as Site Class D in accordance with Chapter 16 of the California Building Code. The proposed structures are determined to be in Seismic Design Category D.

To determine the distance of known active faults within 100 miles of the site, we used the United States Geological Survey (USGS) web-based application 2008 National Seismic Hazard Maps - Fault Parameters. Site latitude is 36.6157° North; site longitude is -121.8463° West. The ten closest active faults are summarized below in Table 7.1.



TABLE 7.1 REGIONAL FAULT SUMMARY

Fault Name	Distance to Site (miles)	Maximum Earthquake Magnitude, Mw
Monterey Bay-Tularcitos	1.97	7.3
Rinconada	6.42	7.5
San Gregorio Connected	10.12	7.5
Zayante-Vergeles	18.87	7.0
N. San Andreas; SAP+SAS	23.43	6.8
San Andreas fault-creeping segment	23.66	6.8
Calaveras; CC+CS	28.86	6.5
Hosgri	33.03	7.3
Calaveras; CN+CC	33.23	7.0
Quien Sabe	34.15	6.6

The faults tabulated above and numerous other faults in the region are sources of potential ground motion. However, earthquakes that might occur on other faults throughout California are also potential generators of significant ground motion and could subject the site to intense ground shaking.

7.2 Surface Fault Rupture

The site is not within a currently established State of California Earthquake Fault Zone for surface fault rupture hazards. No active faults with the potential for surface fault rupture are known to pass directly beneath the site. Therefore, the potential for surface rupture due to faulting occurring beneath the site during the design life of the proposed development is considered low.

7.3 Ground Shaking

We used the USGS web-based application *US Seismic Design Maps* to estimate the peak ground acceleration adjusted for site class effects (PGA_M). Because of the proximity to the subject site and the maximum probable events for these faults, it appears that a maximum probable event along the fault zones could produce a peak horizontal acceleration of approximately 0.57g (2% probability of being exceeded in 50 years).

While listing PGA is useful for comparison of potential effects of fault activity in a region, other considerations are important in seismic design, including frequency and duration of motion and soil conditions underlying the site.

7.4 Liquefaction

Soil liquefaction is a state of soil particles suspension caused by a complete loss of strength when the effective stress drops to zero. Liquefaction normally occurs under saturated conditions in soils such as sand in which the strength is purely frictional. Primary factors that trigger liquefaction are: moderate to strong ground shaking (seismic source), relatively clean, loose granular soils (primarily poorly graded sands and silty sands), and saturated soil conditions (shallow groundwater). Due to the increasing overburden pressure



with depth, liquefaction of granular soils is generally limited to the upper 50 feet of a soil profile. However, liquefaction has occurred in soils other than clean sand.

The soils encountered within the depth explored on the project site consisted of loose to dense sands. Free groundwater was not encountered during this investigation. Available groundwater depth records with the Department of Water Resources, indicated a depth greater than 100 feet below ground surface in the project vicinity.

A seismic hazard, which could cause damage to the proposed development during seismic shaking, is the post-liquefaction settlement of the liquefied sands. The site was evaluated for liquefaction potential. The liquefaction analysis indicated that the soils had a low potential for liquefaction under seismic conditions. Therefore, no mitigation measures are warranted. Detailed geotechnical engineering recommendations are presented in the remaining portions of the text. The recommendations are based on the properties of the materials identified during our investigation.

7.5 Seismic Densification

One of the most common phenomena during seismic shaking accompanying any earthquake is the induced settlement of loose unconsolidated soils. Based on site subsurface conditions and the high seismicity of the region, any loose granular materials at the site could be vulnerable to this potential hazard. Our analysis of dynamic densification of "dry" soil in the upper 50 feet of existing soil profile was performed.

For the analysis, a maximum earthquake magnitude of 6.7 M_w and a peak horizontal ground surface acceleration of 0.59g (with a 2 percent probability of exceedance in 50 years) were considered appropriate for the analysis. The seismic densification of dry to damp alluvial sandy soils due to onsite seismic activity is calculated to have a total settlement of approximately 0.46 inch.

7.6 Lateral Spreading

Lateral spreading is a phenomenon in which soils move laterally during seismic shaking and is often associated with liquefaction. The amount of movement depends on the soil strength, duration and intensity of seismic shaking, topography, and free face geometry. Due to the relatively flat site topography and low liquefaction potential, we judge the likelihood of lateral spreading to be nil to very low.

7.7 Landslides

There are no known landslides at the site, nor is the site in the path of any known or potential landslides. We do not consider the potential for a landslide to be a hazard to this project.

7.8 Tsunamis and Seiches

The site is located within a low-lying coastal area within $\pm \frac{1}{4}$ mile of the Pacific Ocean. Therefore, tsunamis (seismic sea waves) are considered a significant hazard at the site.

Seiches are large waves generated in enclosed bodies of water in response to ground shaking. No major water-retaining structures are located immediately up gradient from the project site. Flooding from a seismically-induced seiche is considered unlikely.



8. SOIL AND GROUNDWATER CONDITIONS

8.1 Subsurface Conditions

The subsurface conditions encountered appear typical of those found in the geologic region of the site. In general, the soils within the depth of exploration primarily consisted of loose to medium dense sands to the depth explored. Up to 2 feet of fill material was encountered within the project site. The thickness and extent of fill material was determined based on limited test borings. Thicker fill may be present at the site. Verification of the extent of fill should be determined during site grading.

The soils were classified in the field during the drilling and sampling operations. The stratification lines were approximated by the field engineer on the basis of observations made at the time of drilling. The actual boundaries between different soil types may be gradual and soil conditions may vary. For a more detailed description of the materials encountered, the Boring Logs in Appendix A should be consulted.

The Boring Logs include the soil type, color, moisture content, dry density, and the applicable Unified Soil Classification System symbol. The locations of the test borings were determined by measuring from feature shown on the Site Plan, provided to us. Hence, accuracy can be implied only to the degree that this method warrants.

8.2 Groundwater

The test boring locations were checked for the presence of groundwater during and after the drilling operations. Free groundwater was not encountered during this investigation. Available groundwater depth records with the Department of Water Resources, indicated a depth greater than 100 feet below ground surface in the project vicinity. It should be recognized that water table elevations may fluctuate with time, being dependent upon seasonal precipitation, irrigation, land use, localized pumping, and climatic conditions as well as other factors. Therefore, water level observations at the time of the field investigation may vary from those encountered during the construction phase of the project. The evaluation of such factors is beyond the scope of this report.

8.3. Soil Corrosion Screening

Excessive sulfate in either the soil or native water may result in an adverse reaction between the cement in concrete and the soil. The 2011 Edition of ACI 318 (ACI 318) has established criteria for evaluation of sulfate and chloride levels and how they relate to cement reactivity with soil and/or water. A soil sample was obtained from the project site and was tested for the evaluation of the potential for concrete deterioration or steel corrosion due to attack by soil-borne soluble salts and soluble chloride. The water-soluble sulfate concentration in the saturation extract from the soil sample was detected to be 50 mg/kg.

ACI 318 Tables 4.2.1 and 4.3.1 outline exposure categories, classes, and concrete requirements by exposure class. ACI 318 requirements for site concrete based upon soluble sulfate are summarized in Table 8.3 below.



TABLE 8.3 WATER SOLUBLE SULFATE EXPOSURE REQUIREMENTS

Dissolved Sulfate (SO ₄) in Soil % by Weight	Exposure Severity	Exposure Class	Maximum w/cm Ratio	Minimum Concrete Compressive Strength	Cementitious Materials Type
0.005	Not Applicable	SO	N/A	2,500 psi	No Restriction

The water-soluble chloride concentration detected in saturation extract from the soil samples was 18 mg/kg. This level of chloride concentration is considered negligible.

It is recommended that a qualified corrosion engineer be consulted regarding protection of buried steel or ductile iron piping and conduit or, at a minimum, applicable manufacturer's recommendations for corrosion protection of buried metal pipe be closely followed.

9. CONCLUSIONS AND RECOMMENDATIONS

9.1 General

9.1.1 Based upon the data collected during this investigation, and from a geotechnical engineering standpoint, it is our opinion that the site is suitable for the proposed construction of improvements at the site as planned, provided the recommendations contained in this report are incorporated into the project design and construction. The proposed buildings may be supported on shallow reinforced concrete foundations or drilled caissons provided that the recommendations presented herein are incorporated in the design and construction of the project. Conclusions and recommendations provided in this report are based on our review of available literature, analysis of data obtained from our field exploration and laboratory testing program, and our understanding of the proposed development at this time.

The recommendations provided in this report are preliminary recommendations and should be reviewed and, if needed, revised to accommodate the project final design. In the event that changes occur in the nature or design of the project, the conclusions and recommendations contained in this report will not be considered valid unless the changes are reviewed and the conclusions of our report are modified.

- 9.1.2 The primary geotechnical constraints identified in our investigation is the presence of potentially compressible soils at the site. Recommendations to mitigate the potential effects of these soils are provided in this report.
- 9.1.3 During our investigation, up to 2 feet of fill material was encountered within the project site. The thickness and extent of fill material was determined based on limited test borings. Thicker fill may be present at the site. Limited testing was performed on the fill soils at the time of our investigation. The limited testing indicates that moderate compaction effort was applied to the fill material.



Most of the fill material is likely to be excavated to allow the construction of the subterranean parking. Within the proposed building and exterior flatwork areas, it is recommended that the ANY uncertified fill material remaining after excavation be removed and/or recompacted. Prior to fill placement, a representative of Salem Engineering Group, Inc. should inspect the bottom of the excavation to verify whether additional excavation will be required. Limits of recompaction should extend 5 feet beyond structural elements. Fill material should be worked until uniform and free from large clods, moisture-conditioned as necessary and recompacted to a minimum of 95 percent of maximum density based on ASTM Test Method D1557.

- 9.1.4 Site demolition/grading activities shall include removal of all trees/vegetation, as well as pavements and surface obstructions not intended to be incorporated into final site design. In addition, underground buried structures and/or utility lines encountered during demolition and construction should be properly removed and the resulting excavations backfilled with Engineered Fill. It is expected that demolition activities of the existing structures may disturb the upper soils. After demolition activities, it is recommended that disturbed soils be removed and/or recompacted.
- 9.1.5 The scope of this investigation did not include subsurface exploration within existing buildings at the site. As such, subsurface soil conditions and materials present below the existing site structures are unknown and may be different than those noted within this report. The presence of potentially unacceptable fill materials, undocumented fill, and/or loose soil material that may be present below existing site structures shall be taken into consideration. Our firm should be consulted at the time of demolition activities if soil conditions not consistent with those identified as part of this investigation are encountered so that we can provide additional recommendations as needed.

The proposed subsurface parking may be excavated to the proposed elevation. Sidewalls of the proposed excavation may be sloped or alternatively shored. Recommendations regarding excavation and shoring for temporary construction are presented in this report (see Section 9.11).

The site is located on sloping ground. It is recommended that the proposed cut and fill slopes be constructed to 2:1 (horizontal to vertical). In lieu of those slopes, a retaining wall may be used. Cut and fill slopes for the building pads should not exceed 2:1 (horizontal to vertical). Cut and fill slopes may be revised as recommended by the Soils Engineer upon the review of a more definite site plan.

9.1.6 To minimize the potential soil movement due to settlement, and provide uniform support for the proposed buildings, it is recommended that over-excavation and recompaction within the proposed building areas, where shallow foundations are utilized, be performed to a minimum depth of 24 inches below bottom of footing elevation. The resulting bottom-of over-excavation shall be scarified to a depth of at least 12 inches, worked until uniform and free from large clods, moisture-conditioned to near optimum moisture, and compacted to a minimum of 95 percent of the maximum density. The over-excavation and recompaction should also extend laterally to a minimum of 5 feet beyond the outer edges of the proposed footings. If higher bearing capacities are warranted, the footings should be supported by additional Engineered Fill (see Section 9.6).



- 9.1.7 Within the slab-on-grade, flatwork, and pavement areas, it is recommended that the upper 12 inches subgrade be uniformly moisture-conditioned to near optimum moisture content and compacted to at least 95% relative compaction.
- 9.1.8 Provided the site is graded in accordance with the recommendations of this report and foundations constructed as described herein, we estimate that total settlement due to static loads utilizing conventional shallow foundations for the proposed buildings will be within 1 inch and corresponding differential settlement will be less than ½ inch.
- 9.1.9 All references to relative compaction and optimum moisture content in this report are based on ASTM D 1557 (latest edition).
- 9.1.10 We should be retained to review the project plans as they develop further, provide engineering consultation as-needed, and perform geotechnical observation and testing services during construction.

9.2 Seismic Design Criteria

9.2.1 For seismic design of the structures, and in accordance with the seismic provisions of the 2016 CBC, our recommended parameters are shown below. These parameters are based on Probabilistic Ground Motion of 2% Probability of Exceedance in 50 years. The Site Class was determined based on the results of our field exploration.

TABLE 9.2.1 2016 CBC SEISMIC DESIGN PARAMETERS

Seismic Item	Symbol	Value	2010 ASCE 7 or 2016 CBC Reference
Site Coordinates (Datum = NAD 83)		36.6157 Lat -121.8463 Lon	
Site Class		D	ASCE 7 Table 20.3
Soil Profile Name		Stiff Soil	ASCE 7 Table 20.3
Risk Category		II	CBC Table 1604.5
Site Coefficient for PGA	F_{PGA}	1.000	ASCE 7 Table 11.8-1
Peak Ground Acceleration (adjusted for Site Class effects)	PGA _M	0.57	ASCE 7 Equation 11.8-1
Seismic Design Category	SDC	D	ASCE 7 Table 11.6-1 & 2
Mapped Spectral Acceleration (Short period - 0.2 sec)	S_{S}	1.486 g	CBC Figure 1613.3.1(1-6)
Mapped Spectral Acceleration (1.0 sec. period)	S_1	0.538 g	CBC Figure 1613.3.1(1-6)



Seismic Item	Symbol	Value	2010 ASCE 7 or 2016 CBC Reference
Site Class Modified Site Coefficient	F_a	1.000	CBC Table 1613.3.3(1)
Site Class Modified Site Coefficient	$F_{\rm v}$	1.500	CBC Table 1613.3.3(2)
MCE Spectral Response Acceleration (Short period - 0.2 sec) $S_{MS} = F_a S_S$	S_{MS}	1.486 g	CBC Equation 16-37
MCE Spectral Response Acceleration (1.0 sec. period) $S_{M1} = F_v S_1$	S_{M1}	0.808 g	CBC Equation 16-38
Design Spectral Response Acceleration S _{DS} = ² / ₃ S _{MS} (short period - 0.2 sec)	S_{DS}	0.991 g	CBC Equation 16-39
Design Spectral Response Acceleration $S_{DI}=\frac{2}{3}S_{MI}$ (1.0 sec. period)	S_{D1}	0.538 g	CBC Equation 16-40

9.2.2 Conformance to the criteria in the above table for seismic design does not constitute any kind of guarantee or assurance that significant structural damage or ground failure will not occur if a large earthquake occurs. The primary goal of seismic design is to protect life, not to avoid all damage, since such design may be economically prohibitive.

9.3 Soil and Excavation Characteristics

- 9.3.1 Based on the soil conditions encountered in our soil borings, the onsite soils can be excavated with moderate effort using conventional excavation equipment.
- 9.3.2 It is the responsibility of the contractor to ensure that all excavations and trenches are properly shored and maintained in accordance with applicable Occupational Safety and Health Administration (OSHA) rules and regulations to maintain safety and maintain the stability of adjacent existing improvements. Temporary excavations are further discussed in a later Section of this report.
- 9.3.3 The upper soils within the project site are identified primarily as sands. These soils, in their present condition, possess moderate risk to construction in terms of possible post-construction movement of the foundations and floor systems if no mitigation measures are employed. Accordingly, measures are recommended to mitigate potential settlement of foundation soils. Mitigation measures will not eliminate post-construction soil movement, but will reduce the soil movement. Success of the mitigation measures will depend on the thoroughness of the contractor in dealing with the soil conditions.
- 9.3.4 The near surface soils identified as part of our investigation are, generally, moist due to the absorption characteristics of the soil. Earthwork operations may encounter very moist unstable soils which may require removal to a stable bottom. Exposed native soils exposed as part of site grading operations shall not be allowed to dry out and should be kept continuously moist prior to placement of subsequent fill.



9.4 Materials for Fill

- 9.4.1 Excavated soils generated from cut operations at the site are suitable for use as general Engineered Fill in structural areas, provided they do not contain deleterious matter, organic material, or rock material larger than 3 inches in maximum dimension.
- 9.4.2 If elected, import soil intended for use as Engineered Fill soil, shall be well-graded, low-to-non-expansive slightly cohesive silty fine sand or sandy silt, with relatively impervious characteristics when compacted. This material should be approved by the Engineer prior to use and should typically possess the soil characteristics summarized below in Table 9.4.2.

TABLE 9.4.2 IMPORT FILL REQUIREMENTS

Minimum Percent Passing No. 200 Sieve	15
Maximum Percent Passing No. 200 Sieve	50
Maximum Particle Size	3"
Maximum Plasticity Index	15
Maximum CBC Expansion Index	20

- 9.4.3 The preferred materials specified for Engineered Fill are suitable for most applications with the exception of exposure to erosion. Project site winterization and protection of exposed soils during the construction phase should be the sole responsibility of the Contractor, since they have complete control of the project site.
- 9.4.4 Environmental characteristics and corrosion potential of import soil materials should also be considered.
- 9.4.5 Proposed import materials should be sampled, tested, and approved by SALEM prior to its transportation to the site.

9.5 Site Grading

- 9.5.1 A representative of our firm should be present during all site clearing and grading operations to test and/or observe earthwork construction. This testing and observation is an integral part of our service as acceptance of earthwork construction is dependent upon compaction of the material and the stability of the material. The Geotechnical Engineer may reject any material that does not meet compaction and stability requirements. Further recommendations of this report are predicated upon the assumption that earthwork construction will conform to recommendations set forth in this section as well as other portions of this report.
- 9.5.2 A preconstruction conference should be held at the site prior to the beginning of grading operations with the owner, contractor, civil engineer and geotechnical engineer in attendance.



- 9.5.3 Site demolition/grading activities shall include removal of all trees/vegetation, as well as pavements and surface obstructions not intended to be incorporated into final site design. In addition, underground buried structures and/or utility lines encountered during demolition and construction should be properly removed and the resulting excavations backfilled with Engineered Fill. It is expected that demolition activities of the existing structures may disturb the upper soils. After demolition activities, it is recommended that disturbed soils be removed and/or recompacted.
- 9.5.4 Site preparation should begin with removal of existing surface/subsurface structures, underground utilities (as required), disturbed soil, any existing uncertified/undocumented fill, and debris. Excavations or depressions resulting from site clearing operations, or other existing excavations or depressions, should be restored with Engineered Fill in accordance with the recommendations of this report.

During our investigation, up to 2 feet of fill material was encountered within the project site. The fill material predominately consisted of sands. The thickness and extent of fill material was determined based on limited test borings. Thicker fill may be present at the site. Testing and inspection reports performed on the fill placement within the project site were not available as of this report date. Limited testing was performed on the fill soils at the time of our investigation. The limited testing indicates that moderate compaction effort was applied to the fill material.

Most of the fill material is likely to be excavated to allow the construction of the subterranean parking. Within the proposed building and exterior flatwork areas, it is recommended that the ANY uncertified fill material remaining after excavation be removed and/or recompacted. Prior to fill placement, a representative of Salem Engineering Group, Inc. should inspect the bottom of the excavation to verify whether additional excavation will be required. Limits of recompaction should extend 5 feet beyond structural elements. Fill material should be worked until uniform and free from large clods, moisture-conditioned as necessary and recompacted to a minimum of 95 percent of maximum density based on ASTM Test Method D1557.

- 9.5.5 The scope of this investigation did not include subsurface exploration within existing buildings at the site. As such, subsurface soil conditions and materials present below the existing site structures are unknown and may be different than those noted within this report. The presence of potentially unacceptable fill materials, undocumented fill, and/or loose soil material that may be present below existing site structures shall be taken into consideration. Our firm should be consulted at the time of demolition activities if soil conditions not consistent with those identified as part of this investigation are encountered so that we can provide additional recommendations as needed.
- 9.5.6 Surface vegetation consisting of grass and other similar vegetation should be removed by stripping to a sufficient depth to remove organic-rich topsoil. The upper 3 to 6 inches of the soils containing asphaltic concrete, gravel, vegetation, roots and other objectionable organic matter encountered at the time of grading should be stripped and removed from the surface. Deeper stripping may be required in localized areas. In addition, existing concrete and asphalt materials shall be removed from areas of proposed improvements and stockpiled separately from excavated soil material. The stripped vegetation, asphalt and concrete materials will not be suitable for use



as Engineered Fill or within 5 feet of building pads or within pavement areas. However, stripped topsoil may be stockpiled and reused in landscape or non-structural areas or exported from the site.

- 9.5.7 Structural building pad areas should be considered as areas extending a minimum of 5 feet horizontally beyond the outside dimensions of buildings, including footings and non-cantilevered overhangs carrying structural loads.
- 9.5.8 In order to minimize post-construction differential settlement, all structures that are in a cut/fill transition zones should be cut a minimum of 2 feet below foundation depth. Additional cut is required for cut/fill transition zones greater than 6 feet. All structures that are in cut/fill transition zones greater than 6 feet should be cut ½ the thickness of the fill placed on the "fill" portion (10 feet maximum). This excavation should extend a minimum of 5 feet beyond structural elements, or to a minimum distance equal to the depth of over-excavation, whichever is greater.

To minimize the potential soil movement due to settlement, and provide uniform support for the proposed buildings, it is recommended that over-excavation and recompaction within the proposed building areas, where shallow foundations are utilized, be performed to a minimum depth of 24 inches below bottom of footing elevation. The resulting bottom-of over-excavation shall be scarified to a depth of at least 12 inches, worked until uniform and free from large clods, moisture-conditioned to near optimum moisture, and compacted to a minimum of 95 percent of the maximum density. The over-excavation and recompaction should also extend laterally to a minimum of 5 feet beyond the outer edges of the proposed footings. If higher bearing capacities are warranted, the footings should be supported by additional Engineered Fill (see Section 9.6).

- 9.5.9 All Engineered Fill (including scarified ground surfaces and backfill) should be placed in lifts no thicker than will allow for adequate bonding and compaction (typically 6 to 8 inches in loose thickness).
- 9.5.10 Engineered Fill soils should be placed, moisture conditioned to near optimum moisture content, and compacted to at least 95% relative compaction.
- 9.5.11 Cohesive soils, if any, should be placed, moisture conditioned to slightly higher than the optimum moisture content, and compacted to at least 90% relative compaction.
- 9.5.12 An integral part of satisfactory fill placement is the stability of the placed lift of soil. If placed materials exhibit excessive instability as determined by a SALEM field representative, the lift will be considered unacceptable and shall be remedied prior to placement of additional fill material. Additional lifts should not be placed if the previous lift did not meet the required dry density or if soil conditions are not stable.
- 9.5.13 Within the slab-on-grade, flatwork, and pavement areas, it is recommended that scarification, moisture conditioning and recompaction be performed to at least 12 inches below existing grade or finish grade, whichever is deeper. In addition, the upper 12 inches of final pavement subgrade, whether completed at-grade, by excavation, or by filling, should be uniformly moisture-conditioned to near the optimum moisture content and compacted to at least 95% relative compaction.



- 9.5.14 Final pavement subgrade should be finished to a smooth, unyielding surface. We recommend proof-rolling the subgrade with a loaded water truck (or similar equipment with high contact pressure) to verify the stability of the subgrade prior to placing aggregate base.
- 9.5.15 The most effective site preparation alternatives will depend on site conditions prior to grading. We should evaluate site conditions and provide supplemental recommendations immediately prior to grading, if necessary.
- 9.5.16 We do not anticipate groundwater or seepage to adversely affect construction if conducted during the drier months of the year (typically summer and fall). However, groundwater and soil moisture conditions could be significantly different during the wet season (typically winter and spring) as surface soil becomes wet; perched groundwater conditions may develop. Grading during this time period will likely encounter wet materials resulting in possible excavation and fill placement difficulties. Project site winterization consisting of placement of aggregate base and protecting exposed soils during construction should be performed. If the construction schedule requires grading operations during the wet season, we can provide additional recommendations as conditions warrant.
- 9.5.17 Typical remedial measures include: discing and aerating the soil during dry weather; mixing the soil with dryer materials; removing and replacing the soil with an approved fill material or placement of crushed rocks or aggregate base material; or mixing the soil with an approved lime or cement product.

The most common remedial measure of stabilizing the bottom of the excavation due to wet soil condition is to reduce the moisture of the soil to near the optimum moisture content by having the subgrade soils scarified and aerated or mixed with drier soils prior to compacting. However, the drying process may require an extended period of time and delay the construction operation. To expedite the stabilizing process, crushed rock may be utilized for stabilization provided this method is approved by the owner for the cost purpose.

If the use of crushed rock is considered, it is recommended that the upper soft and wet soils be replaced by 6 to 24 inches of ³/₄-inch to 1-inch crushed rocks. The thickness of the rock layer depends on the severity of the soil instability. The recommended 6 to 24 inches of crushed rock material will provide a stable platform. It is further recommended that lighter compaction equipment be utilized for compacting the crushed rock. A layer of geofabric is recommended to be placed on top of the compacted crushed rock to minimize migration of soil particles into the voids of the crushed rock, resulting in soil movement. Although it is not required, the use of geogrid (e.g. Tensar BX 1100, BX 1200 or TX 160) below the crushed rock will enhance stability and reduce the required thickness of crushed rock necessary for stabilization.

Our firm should be consulted prior to implementing remedial measures to provide appropriate recommendations.



9.6 Shallow Foundations

- 9.6.1 The site is suitable for use of conventional shallow foundations consisting of continuous footings and isolated pad footings bearing in properly compacted Engineered Fill.
- 9.6.2 The bearing wall footings considered for the structures should be continuous with a minimum width of 18 inches and extend to a minimum depth of 24 inches below the lowest adjacent grade. Isolated column footings should have a minimum width of 24 inches and extend a minimum depth of 30 inches below the lowest adjacent grade. Lowest adjacent grade is defined herein as sub-slab soil grade or exterior grade, whichever is lower.
- 9.6.3 For design purposes, total settlement due to static and seismic loading on the order of 1 inch may be assumed for shallow footings. Differential settlement due to static and seismic loading, along a 20-foot exterior wall footing or between adjoining column footings, should be ½ inch, producing an angular distortion of 0.002. Most of the settlement is expected to occur during construction as the loads are applied. However, additional post-construction settlement may occur if the foundation soils are flooded or saturated. The footing excavations should not be allowed to dry out any time prior to pouring concrete.
- 9.6.4 Footings proportioned as recommended above may be designed for the maximum allowable soil bearing pressures shown in the table below. These values are for dead and sustained live loads and may be increased by one-third (1/3) to include wind and seismic effects. To control settlement to less than 1.0 inch, analysis indicates that the <u>static design bearing shown below</u> should be limited to 5,000 psf.

Load	Allowable Loading*
Dead Load Only	2,250 psf
Dead-Plus-Live Load	3,000 psf
Total Load, Including Wind or Seismic Loads	4,000 psf

^{*}Footings are supported by 2 feet of Engineered Fill, Compacted 95 % Relative Compaction

Load	Allowable Loading*
Dead Load Only	3,000 psf
Dead-Plus-Live Load	4,000 psf
Total Load, Including Wind or Seismic Loads	5,330 psf

^{*}Footings are supported by 3 feet of Engineered Fill, Compacted 95 % Relative Compaction



Load	Allowable Loading*
Dead Load Only	3,750 psf
Dead-Plus-Live Load	5,000 psf
Total Load, Including Wind or Seismic Loads	6,660 psf

^{*}Footings are supported by 4 feet of Engineered Fill, Compacted 95 % Relative Compaction

- 9.6.5 Based on our calculations, total seismic-induced dry sand settlement is expected to be on the order of 0.46 inch. For design purposes, total settlement due to static and seismic loading on the order of 1 inch may be assumed for shallow footings. Differential settlement due to static and seismic loading, along a 20-foot exterior wall footing or between adjoining column footings, should be ½ inch, producing an angular distortion of 0.002. Most of the settlement is expected to occur during construction as the loads are applied. However, additional post-construction settlement may occur if the foundation soils are flooded or saturated. The footing excavations should not be allowed to dry out any time prior to pouring concrete.
- 9.6.6 Resistance to lateral footing displacement can be computed using an allowable coefficient of friction factor of 0.40 acting between the base of foundations and the supporting native subgrade.
- 9.6.7 Lateral resistance for footings can alternatively be developed using an allowable equivalent fluid passive pressure of 400 pounds per cubic foot acting against the appropriate vertical native footing faces. The frictional and passive resistance of the soil may be combined without reduction in determining the total lateral resistance. An increase of one-third is permitted when using the alternate load combination in Section 1605.3.2 of the 2015 IBC/2016 CBC that includes wind or earthquake loads.
- 9.6.8 Underground utilities running parallel to footings should not be constructed in the zone of influence of footings. The zone of influence may be taken to be the area beneath the footing and within a 1:1 plane extending out and down from the bottom edge of the footing.
- 9.6.9 The foundation subgrade should be sprinkled as necessary to maintain a moist condition without significant shrinkage cracks as would be expected in any concrete placement. Prior to placing rebar reinforcement, foundation excavations should be evaluated by a representative of SALEM for appropriate support characteristics and moisture content. Moisture conditioning may be required for the materials exposed at footing bottom, particularly if foundation excavations are left open for an extended period.

9.7 Foundation – Caissons

9.7.1 If deep foundations are utilized, it is recommended that these structures be supported on caissons using an allowable sidewall friction shown in Table 1. These values are for dead-plus-live loads and may be increased one-third for short duration loads, such as wind or seismic. Uplift loads can be resisted by caissons using the allowable sidewall friction shown in the table below and the weight of the pier.



9.7.2 The total settlement of caissons is not expected to exceed 1 inch assuming a caisson length of 50 feet. Differential settlement should be less than ½ inch. Most of the settlement is expected to occur during construction as the loads are applied. Sandy conditions were encountered at the site. Soils could cave during pier drilling. Casing of the drilled piers may be required. Uplift loads can be resisted by piles using 60 percent of the allowable downward side friction value (as showing in the table below) plus the weight of the pier.

ALLOWABLE SIDEWALL FRICTION

Minimum Embedment	Allowable Sid	e Friction, psf
Depth, feet	Downward	Uplift
0-5	300	180
5-10	475	285
10-15	600	360
15-20	750	450
20-25	900	540
25-30	1050	630
30-35	1200	720
35-40	1350	810
40-45	1500	900
45-50	1650	990

9.8 Concrete Slabs-on-Grade

- 9.8.1 Slab thickness and reinforcement should be determined by the structural engineer based on the anticipated loading. We recommend that non-structural slabs-on-grade be at least 4 inches thick and underlain by six (6) inches of compacted granular aggregate subbase material compacted to at least 95% relative compaction.
- 9.8.2 Granular aggregate subbase material shall conform to ASTM D-2940, Latest Edition (Table 1, bases) with at least 95 percent passing a 1½-inch sieve and not more than 8% passing a No. 200 sieve to prevent capillary moisture rise.
- 9.8.3 We recommend reinforcing slabs, at a minimum, with No. 3 reinforcing bars placed 18 inches on center, each way.
- 9.8.4 Slabs subject to structural loading may be designed utilizing a modulus of subgrade reaction K of 225 pounds per square inch per inch. The K value was approximated based on interrelationship of soil classification and bearing values (Portland Cement Association, Rocky Mountain Northwest).



- 9.8.5 The spacing of crack control joints should be designed by the project structural engineer. In order to regulate cracking of the slabs, we recommend that full depth construction joints or control joints be provided at a maximum spacing of 15 feet in each direction for 5-inch thick slabs and 12 feet for 4-inch thick slabs.
- 9.8.6 Crack control joints should extend a minimum depth of one-fourth the slab thickness and should be constructed using saw-cuts or other methods as soon as practical after concrete placement. The exterior floors should be poured separately in order to act independently of the walls and foundation system.
- 9.8.7 It is recommended that the utility trenches within the structure be compacted, as specified in our report, to minimize the transmission of moisture through the utility trench backfill. Special attention to the immediate drainage and irrigation around the structures is recommended.
- 9.8.8 Moisture within the structure may be derived from water vapors, which were transformed from the moisture within the soils. This moisture vapor penetration can affect floor coverings and produce mold and mildew in the structure. To minimize moisture vapor intrusion, it is recommended that a vapor retarder be installed in accordance with manufacturer's recommendations and/or ASTM guidelines, whichever is more stringent. In addition, ventilation of the structure is recommended to reduce the accumulation of interior moisture.
- 9.8.9 In areas where it is desired to reduce floor dampness where moisture-sensitive coverings are anticipated, construction should have a suitable waterproof vapor retarder (a minimum of 15 mils thick polyethylene vapor retarder sheeting, Raven Industries "VaporBlock 15, Stego Industries 15 mil "StegoWrap" or W.R. Meadows Sealtight 15 mil "Perminator") incorporated into the floor slab design. The water vapor retarder should be decay resistant material complying with ASTM E96 not exceeding 0.04 perms, ASTM E154 and ASTM E1745 Class A. The vapor barrier should be placed between the concrete slab and the compacted granular aggregate subbase material. The water vapor retarder (vapor barrier) should be installed in accordance with ASTM Specification E 1643-94.
- 9.8.10 The concrete maybe placed directly on vapor retarder. The vapor retarder should be inspected prior to concrete placement. Cut or punctured retarder should be repaired using vapor retarder material lapped 6 inches beyond damaged areas and taped.
- 9.8.11 The recommendations of this report are intended to reduce the potential for cracking of slabs due to soil movement. However, even with the incorporation of the recommendations presented herein, foundations, stucco walls, and slabs-on-grade may exhibit some cracking due to soil movement. This is common for project areas that contain expansive soils since designing to eliminate potential soil movement is cost prohibitive. The occurrence of concrete shrinkage cracks is independent of the supporting soil characteristics. Their occurrence may be reduced and/or controlled by limiting the slump of the concrete, proper concrete placement and curing, and by the placement of crack control joints at periodic intervals, in particular, where re-entrant slab corners occur.
- 9.8.12 Proper finishing and curing should be performed in accordance with the latest guidelines provided by the American Concrete Institute, Portland Cement Association, and ASTM.



9.9 Lateral Earth Pressures and Frictional Resistance

9.9.1 Active, at-rest and passive unit lateral earth pressures against footings and walls are summarized in the table below:

Lateral Pressure Conditions	Native Soil Equivalent Fluid Pressure, pcf
Active Pressure, Drained	35
At-Rest Pressure, Drained	55
Allowable Passive Pressure	400
Allowable Coefficient of Friction	0.40
In-Place Soil Density (lbs/ft³)	110

- 9.9.2 Active pressure applies to walls, which are free to rotate. At-rest pressure applies to walls, which are restrained against rotation. The preceding lateral earth pressures assume sufficient drainage behind retaining walls to prevent the build-up of hydrostatic pressure. The top one-foot of adjacent subgrade should be deleted from the passive pressure computation.
- 9.9.3 The allowable parameters include a safety factor of 1.5 and can be used in design for direct comparison of resisting loads against lateral driving loads.
- 9.9.4 If combined passive and frictional resistance is used in design, a 50% reduction in frictional resistance is recommended.
- 9.9.5 For lateral stability against seismic loading conditions, we recommend a minimum safety factor of 1.2.
- 9.9.6 For dynamic seismic lateral loading the following equation shall be used:

Dynamic Seismic Lateral Loading Equation
Dynamic Seismic Lateral Load = 3/8γK _h H ²
Where: γ = In-Place Soil Density (Section 9.9.1 above)
K_h = Horizontal Acceleration = $\frac{2}{3}PGA_M$ (Section 9.2.1 above)
H = Wall Height



9.10 Retaining Walls

- 9.10.1 Retaining and/or below grade walls should be drained with either perforated pipe encased in freedraining gravel or a prefabricated drainage system. The gravel zone should have a minimum width of 12 inches wide and should extend upward to within 12 inches of the top of the wall. The upper 12 inches of backfill should consist of native soils, concrete, asphaltic-concrete or other suitable backfill to minimize surface drainage into the wall drain system. The gravel should conform to Class II permeable materials graded in accordance with the current CalTrans Standard Specifications.
- 9.10.2 Prefabricated drainage systems, such as Miradrain®, Enkadrain®, or an equivalent substitute, are acceptable alternatives in lieu of gravel provided they are installed in accordance with the manufacturer's recommendations. If a prefabricated drainage system is proposed, our firm should review the system for final acceptance prior to installation.
- 9.10.3 Drainage pipes should be placed with perforations down and should discharge in a non-erosive manner away from foundations and other improvements.
- 9.10.4 The top of the perforated pipe should be placed at or below the bottom of the adjacent floor slab or pavements. The pipe should be placed in the center line of the drainage blanket and should have a minimum diameter of 4 inches. Slots should be no wider than 1/8-inch in diameter, while perforations should be no more than 1/4-inch in diameter.
- 9.10.5 If retaining walls are less than 6 feet in height, the perforated pipe may be omitted in lieu of weep holes on 4 feet maximum spacing. The weep holes should consist of 2-inch minimum diameter holes (concrete walls) or unmortared head joints (masonry walls) and placed no higher than 18 inches above the lowest adjacent grade. Two 8-inch square overlapping patches of geotextile fabric (conforming to the CalTrans Standard Specifications for "edge drains") should be affixed to the rear wall opening of each weep hole to retard soil piping.
- 9.10.6 During grading and backfilling operations adjacent to any walls, heavy equipment should not be allowed to operate within a lateral distance of 5 feet from the wall, or within a lateral distance equal to the wall height, whichever is greater, to avoid developing excessive lateral pressures. Within this zone, only hand operated equipment ("whackers," vibratory plates, or pneumatic compactors) should be used to compact the backfill soils.

9.11 Temporary Excavations

- 9.11.1 We anticipate that the majority of the dense site soils will be classified as Cal-OSHA "Type C" soil when encountered in excavations during site development and construction. Excavation sloping, benching, the use of trench shields, and the placement of trench spoils should conform to the latest applicable Cal-OSHA standards. The contractor should have a Cal-OSHA-approved "competent person" onsite during excavation to evaluate trench conditions and make appropriate recommendations where necessary.
- 9.11.2 It is the contractor's responsibility to provide sufficient and safe excavation support as well as protecting nearby utilities, structures, and other improvements which may be damaged by earth



movements. All onsite excavations must be conducted in such a manner that potential surcharges from existing structures, construction equipment, and vehicle loads are resisted. The surcharge area may be defined by a 1:1 projection down and away from the bottom of an existing foundation or vehicle load.

- 9.11.3 Temporary excavations and slope faces should be protected from rainfall and erosion. Surface runoff should be directed away from excavations and slopes.
- 9.11.4 Open, unbraced excavations in undisturbed soils should be made according to the slopes presented in the following table:

	RECOMMENDED EXCAVATION SLOPES
_	

Depth of Excavation (ft)	Slope (Horizontal : Vertical)
0-5	1:1
5-10	11/2:1
10-20	2:1

- 9.11.5 If, due to space limitation, excavations near existing structures are performed in a vertical position, braced shorings or shields may be used for supporting vertical excavations. Therefore, in order to comply with the local and state safety regulations, a properly designed and installed shoring system would be required to accomplish planned excavations and installation. A Specialty Shoring Contractor should be responsible for the design and installation of such a shoring system during construction.
- 9.11.6 Braced shorings should be designed for a maximum pressure distribution of 20H, (where H is the depth of the excavation in feet). The foregoing does not include excess hydrostatic pressure or surcharge loading. Fifty percent of any surcharge load, such as construction equipment weight, should be added to the lateral load given herein. Equipment traffic should concurrently be limited to an area at least 3 feet from the shoring face or edge of the slope.
- 9.11.7 The excavation and shoring recommendations provided herein are based on soil characteristics derived from the borings within the area. Variations in soil conditions will likely be encountered during the excavations. SALEM Engineering Group, Inc. should be afforded the opportunity to provide field review to evaluate the actual conditions and account for field condition variations not otherwise anticipated in the preparation of this recommendation. Slope height, slope inclination, or excavation depth should in no case exceed those specified in local, state, or federal safety regulation, (e.g. OSHA) standards for excavations, 29 CFR part 1926, or Assessor's regulations.

9.12 Underground Utilities

9.12.1 Underground utility trenches should be backfilled with properly compacted material. The material excavated from the trenches should be adequate for use as backfill provided it does not



contain deleterious matter, vegetation or rock larger than 3 inches in maximum dimension. Trench backfill should be placed in loose lifts not exceeding 8 inches and compacted to at least 95% relative compaction at or above optimum moisture content. The upper 12 inches of trench backfill within asphalt or concrete paved areas shall be moisture conditioned to at or above optimum moisture content and compacted to at least 95% relative compaction.

- 9.12.2 Bedding and pipe zone backfill typically extends from the bottom of the trench excavations to approximately 6 to 12 inches above the crown of the pipe. Pipe bedding and backfill material should conform to the requirements of the governing utility agency.
- 9.12.3 It is suggested that underground utilities crossing beneath new or existing structures be plugged at entry and exit locations to the building or structure to prevent water migration. Trench plugs can consist of on-site clay soils, if available, or sand cement slurry. The trench plugs should extend 2 feet beyond each side of individual perimeter foundations.
- 9.12.4 The contractor is responsible for removing all water-sensitive soils from the trench regardless of the backfill location and compaction requirements. The contractor should use appropriate equipment and methods to avoid damage to the utilities and/or structures during fill placement and compaction.

9.13 Surface Drainage

- 9.13.1 Proper surface drainage is critical to the future performance of the project. Uncontrolled infiltration of irrigation excess and storm rumoff into the soils can adversely affect the performance of the planned improvements. Saturation of a soil can cause it to lose internal shear strength and increase its compressibility, resulting in a change to important engineering properties. Proper drainage should be maintained at all times.
- 9.13.2 The ground immediately adjacent to the foundation shall be sloped away from the building at a slope of not less than 5 percent for a minimum distance of 10 feet. Impervious surfaces within 10 feet of the building foundation shall be sloped a minimum of 2 percent away from the building and drainage gradients maintained to carry all surface water to collection facilities and off site. These grades should be maintained for the life of the project. Ponding of water should not be allowed adjacent to the structure. Over-irrigation within landscaped areas adjacent to the structure should not be performed.
- 9.13.3 Roof drains should be installed with appropriate downspout extensions out-falling on splash blocks so as to direct water a minimum of 5 feet away from the structures or be connected to the storm drain system for the development.

9.14 Pavement Design

9.14.1 R-Value testing was performed on samples obtained from the site at the locations shown on the attached site plan. The samples were tested in accordance with the State of California Materials Manual Test Designation 301.



Results and sample identification are presented in the table below.

Sample ID	Depth, ft.	R-Value
RV-1	1 to 3	62
RV-2	1 to 3	65

The R-Value test results indicate that the onsite soils have good subgrade support characteristics under dynamic traffic loads. The following table shows the recommended pavement sections for various traffic indices based on an R-Value of 62.

9.14.2 The pavement design recommendations provided herein are based on the State of California Department of Transportation (CALTRANS) design manual. The asphaltic concrete (flexible pavement) is based on a 20-year pavement life utilizing 1200 passenger vehicles, 10 single unit trucks, and 2 multi-unit trucks. The following table shows the recommended pavement sections for various traffic indices.

TABLE 9.14.2.1
ASPHALT CONCRETE PAVEMENT THICKNESSES

Traffic Index	Asphaltic Concrete*	Class II Aggregate Base**	Compacted Subgrade***
5.0 (Parking and Vehicle Drive Areas)	3.0"	4.0"	12.0"
6.5 (Heavy Truck Areas)	4.0"	4.0"	12.0"

*1" or 1.5" wearing surface over tack coat over 2" binder course over prime coat
** 95% compaction based on ASTM D1557-07 Test Method or Cal 216

The following recommendations are for light-duty and heavy-duty Portland Cement Concrete pavement sections.

TABLE 9.14.2.2
PORTLAND CEMENT CONCRETE PAVEMENT THICKNESSES

Traffic Index	Portland Cement Concrete*	Class II Aggregate Base**	Compacted Subgrade***
6.5 (Heavy Duty)	6.0"	2.0"	12.0"

* Minimum Compressive Strength of 4,000 psi

** 95% compaction based on ASTM D1557-07 Test Method or Cal 216

^{***95% (90%} for cohesive soils) compaction based on ASTM D1557-07 Test Method



^{***95% (90%} for cohesive soils) compaction based on ASTM D1557-07 Test Method

9.15 Percolation Testing

9.15.1 Percolation Tests and Results: Three percolation tests (P-1 thru P-3) were performed in areas the designer pre-selected. The tests were conducted in accordance with the guidelines established by the Uniform Plumbing Code. The approximate locations of the percolation tests are shown on the attached Boring and Percolation Location Map, Figure 2. Approximately 8-inch diameter percolation boreholes were advanced using hollow-stem auger to the depths shown on Table 9.15.1. Approximately 2 inches of gravel was placed in the bottom of each hole followed by a 3-inch diameter perforated pipe. The holes were pre-saturated a minimum of 18 hours and maximum of 24 hours before percolation testing commenced. Pre-saturation water levels were kept at approximately 10 inches above the gravel at the bottom of hole for at least 4 hours.

Percolation rates were measured by filling the test holes to approximately 6 inches above the top of the bottom inside the perforated pipe. The holes were then re-filled and this process was repeated for minimum two hours.

TABLE 9.15.1
PERCOLATION TEST RESULTS

Test No.	Depth (feet)	Percolation Rate (min/inch)	Absorption Capacity (gallon/square foot/day)	Soil Type
P-1	8.20	9.6	18.8	SAND (SP)
P-2	6.25	6.4	28.2	SAND (SP)
P-3	3.58	9.9	18.2	SAND (SP)

The soil absorption or percolation rates are based on tests conducted with clear water. The percolation rates may vary with time as a result of soil clogging from water impurities. The percolation rates will deteriorate over time due to the soil conditions and a minimum factor of safety (FS) of 3 should be applied. The percolation rate may become slower if the subgrade soil is wet or saturated due to shallow groundwater or prolonged rainfalls. The owner or civil engineer may elect to use a lower factor of safety for the design; however, more frequent maintenance will be expected. The soils may also become less permeable to impermeable if the soil is compacted.

It should be noted that when performing percolation testing services in relatively small diameter borings, that the testing may not fully model the actual full scale long term performance of a given site. This is particularly true where percolation test data is to be used in the design of large infiltration system such as may be proposed for the site. The measured percolation rate includes dispersion of the water at the sidewalls of the boring as well as into the underlying soils. Subsurface conditions, including percolation rates, can change over time as fine-grained soils migrate. It is not warranted that such information and interpretation cannot



be superseded by future geotechnical engineering developments. We emphasize that this report is valid for the project outlined above and should not be used for any other sites.

10. PLAN REVIEW, CONSTRUCTION OBSERVATION AND TESTING

10.1 Plan and Specification Review

10.1.1 SALEM should review the project plans and specifications prior to final design submittal to assess whether our recommendations have been properly implemented and evaluate if additional analysis and/or recommendations are required.

10.2 Construction Observation and Testing Services

- 10.2.1 The recommendations provided in this report are based on the assumption that we will continue as Geotechnical Engineer of Record throughout the construction phase. It is important to maintain continuity of geotechnical interpretation and confirm that field conditions encountered are similar to those anticipated during design. If we are not retained for these services, we cannot assume any responsibility for others interpretation of our recommendations, and therefore the future performance of the project.
- 10.2.2 SALEM should be present at the site during site preparation to observe site clearing, preparation of exposed surfaces after clearing, and placement, treatment and compaction of fill material.
- 10.2.3 SALEM's observations should be supplemented with periodic compaction tests to establish substantial conformance with these recommendations. Moisture content of footings and slab subgrade should be tested immediately prior to concrete placement. SALEM should observe foundation excavations prior to placement of reinforcing steel or concrete to assess whether the actual bearing conditions are compatible with the conditions anticipated during the preparation of this report.

11. LIMITATIONS AND CHANGED CONDITIONS

The analyses and recommendations submitted in this report are based upon the data obtained from the test borings drilled at the approximate locations shown on the Site Plan, Figure 1. The report does not reflect variations which may occur between borings. The nature and extent of such variations may not become evident until construction is initiated.

If variations then appear, a re-evaluation of the recommendations of this report will be necessary after performing on-site observations during the excavation period and noting the characteristics of such variations. The findings and recommendations presented in this report are valid as of the present and for the proposed construction. If site conditions change due to natural processes or human intervention on the property or adjacent to the site, or changes occur in the nature or design of the project, or if there is a substantial time lapse between the submission of this report and the start of the work at the site, the conclusions and recommendations contained in our report will not be considered valid unless the changes are reviewed by SALEM and the conclusions of our report are modified or verified in writing. The validity of the recommendations contained in this report is also dependent upon an adequate testing and observations program during the construction phase. Our firm assumes no responsibility for construction compliance



with the design concepts or recommendations unless we have been retained to perform the on-site testing and review during construction. SALEM has prepared this report for the exclusive use of the owner and project design consultants.

SALEM does not practice in the field of corrosion engineering. It is recommended that a qualified corrosion engineer be consulted regarding protection of buried steel or ductile iron piping and conduit or, at a minimum, that manufacturer's recommendations for corrosion protection be closely followed. Further, a corrosion engineer may be needed to incorporate the necessary precautions to avoid premature corrosion of concrete slabs and foundations in direct contact with native soil. The importation of soil and or aggregate materials to the site should be screened to determine the potential for corrosion to concrete and buried metal piping. The report has been prepared in accordance with generally accepted geotechnical engineering practices in the area. No other warranties, either express or implied, are made as to the professional advice provided under the terms of our agreement and included in this report.

If you have any questions, or if we may be of further assistance, please do not hesitate to contact our office at (559) 271-9700.

Respectfully Submitted,

SALEM ENGINEERING GROUP, INC.

Waseal K. Nagi, MS, PE Geotechnical Project Manager Central / Northern California RCE 86416 R. Sammy Salem, MS, PE, GE Principal Engineer RCE 52762 / RGE 2549





VICINITY MAP

GEOTECHNICAL ENGINEERING INVESTIGATION
Proposed West End Sand City Development
SWC Tioga Avenue & California Avenue
Sand City, California

SCALE:	DATE:
NOT TO SCALE	01/2017
DRAWN BY:	APPROVED BY:
AW	SR
PROJECT No.	FIGURE NO.
1-217-0015	1





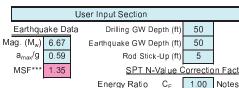
DRY SETTLEMENT DUE TO EARTHQUAKE SHAKING

* Use Fig. 11 of Tokimatsu & Seed (1987)

 Job No.
 1-217-0015
 Job Name
 Prop. West End Sand City Developmr ** Use Fig. 13 of Tokimatsu & Seed (1987)

 Boring No.
 B-1
 Drill Date
 2/08/2017
 **** MSF=10^{2.24}/Mw^{2.56}

 $^{\#}$ C_N=2.2/(1.2+ σ'_{o} /P_a)



SPT N-	Value 0	Correction	n Facto	or
Energy Ratio	CE	1.00	Notes	
Borehole Dia.	C_B	1.15	Notes	
Sampling Method	C_s	1.2	Notes	
Factor of Safety	FS	1.0	1	
Rod Length	C_R	Calcula	ited	
Overburden Press	C_N	Calcula	ited	

Lookup	Tables	3		
% Fines	ΔΝ	Length	C _R	
0	0	1	0.75	ľ
10	1	12	0.85	
25	2	20	0.95	
50	4	30	0.98	

									During Drilling					During EQ								
Depth	Dry Unit		Fines	SPT	Layer	Unit	Total σ _o	Total σ _o	Eff. σ'₀		SPT	1	Fines Corct'd SPT	Eff. σ' _{oeq}			Shear Modulus	Cyclic Shear Stress	Eff. Shear Strain	Vol. Strain (1-way)	Vol. Strain Mw Corct'd	S (2-way)
(ft)	Wt (pcf)	w (%)	%	Field N	(ft)	Wt (pcf)	(psf)	(psf)	(psf)	C _N #	(N ₁) ₆₀	ΔΝ	(N ₁) _{60f}	(psf)	$\sigma_o/\sigma_{o'eq}$	r _d	G _{max} ##	Tav	γ(%)*	V%**	V%*	in.
2	100	2.9	2	10	2.0	102.9	206	103	103	1,76	18.2	0.0	18.2	103	1.000	0.997	4.30E+05	39.4	2.8E-02	2.9E-2	0.02	0.01
5	100	3.9	2	14	3.0	103.9	518	362	362	1.59	23.1	0.0	23.1	362	1.000	0.990	8.73E+05	137.3	5.2E-02	3.9E-2	0.03	0.02
10	100	5.6	1	10	5.0	105.6	1046	782	782	1.38	16.2	0.0	16.2	782	1.000	0.979	1.14E+06	293.4	1.3E-01	1.5E-1	0.12	0.15
15	100	2.7	4	31	5.0	102.7	1559	1302	1302	1,19	48.3	0.0	48.3	1302	1.000	0.968	2.12E+06	483.6	5.8E-02	1.6E-2	0.01	0.02
20	100	3.3	4	26	5.0	103.3	2076	1817	1817	1.04	35,6	0.0	35.6	1817	1.000	0.956	2.26E+06	666.5	9.2E-02	3.9E-2	0.03	0.04
25	100	2.5	5	29	5.0	102.5	2588	2332	2332	0.93	36.5	0.0	36.5	2332	1.000	0.941	2.58E+06	841.5	1.0E-01	4.2E-2	0.03	0.04
30	100	2.4	3	32	5.0	102.4	3100	2844	2844	0.84	37.1	0.0	37.1	2844	1.000	0.919	2.87E+06	1002.5	1.1E-01	4.3E-2	0.03	0.04
35	100	4.2	5	27	5.0	104.2	3621	3361	3361	0.76	28.5	0.0	28.5	3361	1.000	0.888	2.85E+06	1144.8	1.4E-01	8.0E-2	0.06	0.08
40	100	2.8	5	38	5.0	102.8	4135	3878	3878	0.70	36.8	0.0	36.8	3878	1.000	0.848	3.34E+06	1260.7	1.1E-01	4.3E-2	0.03	0.04
45	100	2.4	5	82	5.0	102.4	4647	4391	4391	0.65	73.3	0.0	73.3	4391	1.000	0.799	4.47E+06	1346.1	5.9E-02	9.5E-3	0.01	0.01
50	110	4.2	5	50	5.0	114.6	5220	4934	4934	0.60	41.4	0.0	41.4	4934	1.000	0.748	3.92E+06	1415.0	8.3E-02	2.9E-2	0.02	0.03
			The tota	l seismi	c-induc	ed settlem	ent calcu	lation is	based o	n a wat	er table d	lepth of	50	feet bel	ow grade						Total	0.46

					Pe	ercolatio	n Test V	Vorksh	neet					
	Project:		ga Ave	City Deve & Californ			Job No.: te Drilled: sification:	1/17/20		Vol. in 1" Wtr Col. (in ³): 50.3 Hole Dia:: 8 in.				
Т	Hole No.: ested By: ole Depth:	P-1 SMG 8.2	ft.			Pipe Dia: 3 Presoaking Date: 1/17/2017 Gravel pack porceity: 0.4 Test Date: 1/18/2017 Gravel Correct Factor: 0.5				in. ft ***				
Time Start	Time Finish	Depth of Test Hole (ft)*	Refill- Yes or No	Elapsed Time (hrs:min)	Initial Water Level [#] (ft)	Final Water Level (ft)	Δ Water Level (in.)	ΔMin.	Meas. Perc Rate (min/in)	Grvl Pack Corr. Rate (min/in)	6" Dia. x 6" Water Equiv. MPI:	Avg. Ht. of Water Column** (in.)	Wetted Surf. Area of Column (in ²)	Absorp. Rate (gpd/ft ²)
7:36	7:37	9.5	Υ	0:01	7.63	7.72	1.08	1	0.9	1,9	4.5	21.3	586	40.3
7:37	7:38	9.5	N	0:01	7.72	7.78	0.72	1	1.4	2,9	6.4	20.4	563	28.0
7:38	7:39	9.5	N	0:01	7.78	7.83	0.60	1	1.7	3.4	7.5	19.7	546	24.0
7:39	7:40	9.5	N	0:01	7.83	7.86	0.36	1	2.8	5.7	12.2	19.3	534	14.7
7:40	7:41	9.5	N	0:01	7.86	7.89	0.36	1	2.8	5.7	12.0	18.9	525	15.0
7:41	7:42	9.5	N	0:01	7.89	7.92	0.36	1	2.8	5.7	11.8	18.5	516	15.2
7:42	7:43 7:44	9.5 9.5	N N	0:01	7.92	7.94 7.97	0.24	47	4.2 2.8	8.6 5.7	17.5	18.2	509	10.3
7:43 7:44	7:44	9.5	N N	0:01 0:01	7.94	7.97	0.36	1	4.2	8.6	11.5 16.9	17.9 17.6	501 494	15.7 10.6
7:44	7:45	9.5	N N	0:01	7.97	7.99 8.02	0.24	1	2.8	5.7	11.1	17.6	494	16.2
7:45	7:46	9.5	N	0:01	8.02	8.04	0.36	1	4.2	8.6	16.4	17.0	479	11.0
7:47	7:48	9.5	N	0:01	8.04	8.06	0.24	1	4.2	8.6	16.2	16.8	472	11.1
7:48	7:49	9.5	N	0:01	8.06	8.08	0.24	1	4.2	8.6	16.0	16.6	466	11.2
7:49	7:50	9.5	N	0:01	8.08	8.10	0.24		4.2	8.6	15.8	16.3	460	11.4
7:50	7:55	9.5	Y	0:05	7.95	8.03	0.96	5	5.2	10.8	21.0	17.5	491	8.6
7:55	8:00	9.5	N	0:05	8.03	8.10	0.84	5	6.0	12.3	22.9	16.6	468	7.8
8:00	8:05	9.5	N	0:05	8.10	8.16	0.72	5	6.9	14.3	25.6	15.8	448	7.0
8:05	8:10	9.5	N	0:05	8.16	8.21	0.60	5	8.3	17.2	29.6	15.2	432	6.1
8:10	8:15	9.5	N	0:05	8.21	8.26	0.60	5	8.3	17.2	28.6	14.6	417	6.3
8:15	8:20	9.5	N	0:05	8.26	8.31	0.60	5	8.3	17.2	27.6	14.0	402	6.5
8:20	8:25	9.5	N	0:05	8.31	8.37	0.72	5	6.9	14.3	22.0	13.3	385	8.2
8:25	8:30	9.5	N	0:05	8.37	8.43	0.72	5	6.9	14.3	21.0	12.6	367	8.6
8:30	8:35	9.5	N	0:05	8.43	8.47	0.48	5	10.4	21.5	30.2	12.0	352	6.0
8:35	8:40	9.5	N	0:05	8.47	8.52	0.60	5	8.3	17.2	23.2	11.5	338	7.8
8:40	8:45	9.5	N	0:05	8.52	8.55	0.36	5	13.9	28.7	37.3	11.0	326	4.8
8:45	8:50	9.5	N	0:05	8.55	8.58	0.36	5	13.9	28.7	36.3	10.6	317	5.0
8:50	8:55	9.5	N	0:05	8,58	8.62	0.48	5	10.4	21.5	26.3	10.2	307	6.8
8:55	8:56	9.5	Y	0:01	8.32	8.34	0.24	1	4.2	8.6	13.3	13.4	388	13.5
8:56	8:57	9.5	N	0:01	8.34	8.35	0.12	1	8.3	17.2	26.3	13.3	384	6.8
8:57	8:58	9.5	N N	0:01	8.35	8.36	0.12	1	8.3	17.2	26.1	13.1	381	6.9
8:58 8:59	8:59 9:00	9.5 9.5	N N	0:01 0:01	8.36 8.37	8.37 8.39	0.12	1	8.3 4.2	17.2 8.6	25.9 12.8	13.0 12.8	377 373	6.9 14.1
9:00	9:00	9.5	N N	0:01	8.37	8.41	0.24	1	4.2	8.6	12.8	12.8	367	14.1
9:00	9:01	9.5	N N	0:01	8.41	8.44	0.24	1	2.8	5.7	8.2	12.5	359	21.9
9:01	9:02	9.5	N	0:01	8.44	8.47	0.36	1	2.8	5.7	8.0	11.9	359	21.9
9:03	9:04	9.5	N	0:01	8.47	8.49	0.30	1	4.2	8.6	11.8	11.6	343	15.3
9:04	9:05	9.5	N	0:01	8.49	8.51	0.24	1	4.2	8.6	11.6	11.4	337	15.6
0.01	0.00	0.0			00	0.0	· · · · ·					ption Rate*		18.8
#from top	of pipe to 1	op of grave	al .						6	" Dia. Borel		of Water Equi	valent MPI ⁽¹⁾ :	9,6
	from grade											•		



⁽⁺ or - from grade)

** Top of water to base of hole (below approximately 2" of gravel)
*last 4 readings
Note:

Percolation Test Worksheet

Project: West End Sand City Development

SWC Tioga Ave & California Ave

Sand City, CA

Test Hole No.: P-2

Tested By: SMG

Job No.: 1-217-0015 Date Drilled: 1/17/2017 Soil Classification: SP

Hole Dia.: 8 in.
Pipe Dia.: 3 in.
Gravel pack porosity: 0.4

6" Dia. Borehole with 6" of Water Equivalent MPI⁽¹⁾:

Gravel Correc Factor: 0.5

Pipe stickup: 1.8 ft ##

Vol. in 1" Wtr Col. (in³): 50.3

Presoaking Date: 1/17/2017 Test Date: 1/18/2017

Drilled Hole Depth:		6.25	ft.									Pipe stickup:	1.8	π
Time Start	Time Finish	Depth of Test Hole (ft)#	Refill- Yes or No	Elapsed Time (hrs:min)	Initial Water Level [#] (ft)	Final Water Level [#] (ft)	Δ Water Level (in.)	Δ Min.	Meas. Perc Rate (min/in)	Corr	6" Dia. x 6" Water Equiv. MPI:	Avg. Ht. of Water Column** (in.)	Wetted Surf. Area of Column (in ²)	Absorp. Rate (gpd/ft²)
12:56	13:01	8.2	Υ	0:05	7.40	8.22	9.84	5	0.5	1.0	0.7	4.9	174	247.3
13:01	13:06	8.2	Υ	0:05	7.07	8.22	13.80	5	0.4	0.7	0.7	6.9	224	269.7
13:06	13:11	8.2	Υ	0:05	6.71	7.76	12.60	5	0.4	0.8	1.1	11.8	347	158.6
13:11	13:16	8.2	Υ	0:05	6.75	7.69	11.28	5	0.4	0.9	1.3	12.0	352	140.1
13:16	13:21	8.2	Υ	0:05	6.76	7.07	3.72	5	1.3	2.8	4.9	15.7	444	36.6
13:21	13:26	7.9	N	0:05	7.07	7.22	1.80	5	2.8	5.7	6.0	8.5	263	29.9
13:26	13:31	7.9	N	0:05	7.22	7.32	1.20	5	4.2	8.6	7.7	7.0	225	23.3
13:31	13:36	7.9	N	0:05	7.32	7.46	1.68	5	3.0	6.1	4.6	5.5	189	38.9
13:36	13:41	7.9	N	0:05	7.46	7.63	2.04	5	2.5	5.1	2.9	3.7	142	62.7
13:41	13:46	7.9	N	0:05	7.63	7.85	2.64	5	1.9	3.9	1.3	1.3	83	138.3
13:46	13:51	7.9	Υ	0:05	6.71	6.99	3.36	5	1.5	3.1	4.3	12.0	352	41.7
13:51	13:56	7.9	N	0:05	6.99	7.13	1.68	5	3.0	6.1	7.1	9.5	289	25.5
13:56	14:01	7.9	N	0:05	7.13	7.42	3.48	5	1.4	3.0	2.6	6.9	224	68.0
14:01	14:06	7.9	N	0:05	7.42	7.65	2.76	5	1.8	3.7	2.2	3.8	145	83.0
14:06	14:11	7.9	Υ	0:05	6.97	7.10	1.56	5	3.2	6.6	7.8	9.8	296	23.0
14:11	14:12	7.9	Υ	0:01	7.11	7.18	0.84	1	1.2	2.5	2.6	8.5	263	69.8
14:12	14:13	7.9	N	0:01	7.18	7.23	0.60	1	1.7	3.4	3.4	7.7	245	53.6
14:13	14:14	7.9	N	0:01	7.23	7.27	0.48	1	2.1	4.3	4.0	7.2	231	45.4
14:14	14:15	7.9	N	0:01	7.27	7.31	0.48	1	2.1	4.3	3.8	6.7	219	47.9
14:15	14:16	7.9	N	0:01	7.31	7.34	0.36	1	2.8	5.7	4.8	6.3	209	37.7
14:16	14:17	7.9	N	0:01	7.34	7.36	0.24	1	4.2	8.6	6.9	6.0	201	26.1
14:17	14:18	7.9	N	0:01	7.36	7.38	0.24	1	4.2	8.6	6.7	5.8	195	26.9
14:18	14:19	7.9	N	0:01	7.38	7.40	0.24	1	4.2	8.6	6.5	5.5	189	27.8
14:19	14:20	7.9	N	0:01	7.40	7.42	0.24	1	4.2	8.6	6.3	5.3	183	28.7
14:20	14:21	7.9	N	0:01	7.42	7.44	0.24	1	4.2	8.6	6.1	5.0	177	29.6
								Absorption Rate*					28.2	

[#] from top of pipe to top of gravel

Note:



^{## (+} or - from grade)
** Top of water to base of hole (below approximately 2" of gravel)
...

Percolation Test Worksheet Project: West End Sand City Development Job No.: 1-217-0015 Vol. in 1" Wtr Col. (in3): 50.3 SWC Tioga Ave & California Ave Date Drilled: 1/17/2017 Sand City, CA Soil Classification: SP Hole Dia.: Pipe Dia.: Test Hole No.: P-3 Presoaking Date: 1/17/2017 Gravel pack porosity: 0.4 Tested By: SMG Test Date: 1/18/2017 Gravel Correc Factor Drilled Hole Depth: 3.58 Pipe stickup Grvl Pack Wetted Avg. Ht. of Water Depth of Refill-Elapsed Initial Final Meas. 6" Dia. x 6" Absorp. Δ Water Surf. Area Time Time Corr. Rate Test Yes or Time Water Water Δ Min Perc Rate Water Rate Start Finish Level (in.) Column** of Column (hrs:min) Level# (ft) Level" (ft) (min/in) quiv. MPI (gpd/ft²) Hole (ft) No (min/in) (in.) (in²) 0:02 4.4 162 9:51 9:53 0:02 3.45 3.67 0.8 1.6 6.8 129.9 4.1 2.64 1.4 222 9:53 4.1 Ν 0:02 4.11 5.28 0.4 0.8 0.4 2.9 123 470.4 9:55 3.67 9:55 9:57 4.1 3.49 120.7 Υ 0:02 3.23 3.12 0.6 1.3 1.5 9.2 282 9:57 9:59 4.1 Ν 0:02 3.49 3.66 2.04 1.0 2.0 1.8 6.7 218 102.4 10:01 0:02 4.11 5.40 0.4 0.8 0.4 2.9 124 475.3 10:01 10:03 4.1 0:02 2.95 3.40 0.4 0.8 1.0 11.5 338 174.4 3.40 1.92 5.4 34.1 10:08 0:05 3.56 5.3 7.8 246 10:03 4.1 Ν 3.00 10:08 10:13 3.81 3.4 2.5 5.3 71.1 4.1 0:05 3.56 184 Ν 10:13 10:18 4.1 0:05 2.95 3.10 1.80 2.8 5.7 8.8 13.3 384 20.5 10:18 10:23 Ν 0:05 1.80 5 2.8 5.7 7.7 11.5 338 23.3 10:23 10:28 4.1 Ν 0:05 3.25 3.36 1.32 5 3.8 7.8 9.3 9.9 299 19.3 3.46 10:28 10:33 4.1 Ν 0:05 1.20 5 4.2 8.6 9.2 8.6 267 19.6 3.46 10:33 10:38 4.1 Ν 0:05 1.08 4.6 9.6 9.1 7.5 239 19.8 3,59 3.55 0.48 21.5 10:38 10:43 4.1 0:05 5 10.4 18.8 6.7 219 9.6 0:05 0.72 6.9 14.3 11.7 6.1 204 15.4 3.65 10:48 10:53 4.1 Ν 0:05 3.70 0.60 5 8.3 17.2 12.9 5.5 187 14.0 3.74 12.1 10:53 10:58 Ν 0:05 3.70 0.48 10.4 21.5 14.9 4.9 174 10:58 11:03 4.1 Ν 0:05 3.74 3.76 0.24 5 20.8 43.0 28.3 4.6 165 6.4 11:03 11:04 4.1 0:01 3.47 3.49 0.24 4.2 8.6 8.5 7.8 246 21.3 11:04 11:05 4.1 Ν 0:01 3.50 0.12 8.3 17.2 16.6 7.6 242 10.8 11:05 11:06 4.1 Ν 0:01 3.50 3.52 0.24 4.2 8.6 8.1 7.4 237 22.1 11:06 11:07 4.1 Ν 0:01 3.53 0.12 8.3 17.2 16.0 7.3 11.3 233 11:07 3.54 8.3 17.2 15.8 7.1 11.4 11:08 4.1 0:01 3.53 0.12 230 Ν 11:08 4.1 7.0 11.6 11:09 Ν 0:01 3.54 3.55 0.12 8.3 17.2 15.6 227 11:09 11:10 4.1 Ν 0:01 3.57 0.24 4.2 8.6 7.6 6.8 222 23.6 11:10 11:11 4.1 Ν 0:01 3.57 3.59 0.24 1 4.2 8.6 7.4 6.6 216 24.3 3.60 3.61 11:12 4.1 0:01 3.59 3.60 8.3 17.2 14.5 6.4 11:11 Ν 0.12 212 12.4 11:12 11:13 Ν 0:01 0.12 8.3 209 12.6 17.2 18.2 Absorption Rate 6" Dia. Borehole with 6" of Water Equivalent MPI(1) 9,9

Note:



[#] from top of pipe to top of gravel

^{## (+} or - from grade)

^{**} Top of water to base of hole (below approximately 2" of gravel)

^{*} last 4 readings

APPENDIX

A



APPENDIX A

FIELD EXPLORATION

Fieldwork for our investigation was conducted on January 17 and 18, 2017 and included a site visit, subsurface exploration, and soil sampling. The locations of the exploratory borings are shown on the Site Plan, Figure 1. Boring logs for our exploration are presented in figures following the text in this appendix. Borings were located in the field using existing reference points. Therefore, actual boring locations may deviate slightly.

The test borings were advanced with a 4-inch diameter hand auger and an 8-inch diameter hollow-stem auger rotated by a truck-mounted CME-55 drill rig. Visual classification of the materials encountered in the test borings was generally made in accordance with the Unified Soil Classification System (ASTM D2487).

Penetration resistance blow counts were obtained by dropping a 140-pound automated trip hammer through a 30-inch free fall to drive the sampler to a maximum penetration of 18 inches. The number of blows required to drive the last 12 inches, or less if very dense or hard, is recorded as Penetration Resistance (blows/foot) on the logs of borings. Soil samples were obtained from the test borings at the depths shown on the logs of borings. The MCS samples were recovered and capped at both ends to preserve the samples at their natural moisture content; SPT samples were recovered and placed in a sealed bag to preserve their natural moisture content. At the completion of drilling and sampling, the test borings were backfilled with drill cuttings.



Unified Soil Classification System

M	ajor Divisio	ns	Letter	Symbol	Description
eve	rse n the	Clean	GW		Well-graded gravels and gravel-sand mixtures, little or no fines.
Coarse-grained Soils More than ½ retained on the No. 200 Sieve	Gravels More than ½ coarse fraction retained on the No. 4 sieve	Gravels	GP	5000 2000 2000	Poorly-graded gravels and gravel-sand mixtures, little or no fines.
Soils he No.	Grayre than on reta	Gravels	GM		Silty gravels, gravel-sand-silt mixtures.
uined on t	Mo fracti	With Fines	GC		Clayey gravels, gravel-sand-clay mixtures.
Coarse-grained Soils ½ retained on the No	assing 4 sieve	Clean Sands	SW		Well-graded sands and gravelly sands, little or no fines.
C0a1		Clean Bands	SP		Poorly-graded sands and gravelly sands, little or no fines.
re tha	Sands More than ½ p through the No.	Sands With	SM		Silty sands, sand-silt mixtures
Moi	Mor throu	Fines	SC		Clayey sands, sandy-clay mixtures.
Fine-grained Soils More than ½ passing through the No. 200 Sieve	Silts an	d Clays	ML		Inorganic silts, very fine sands, rock flour, silty or clayey fine sands.
oils hroug	Liquid Lim	nit less than	CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
Fine-grained Soils an ½ passing thro No. 200 Sieve	30	170	OL		Organic clays of medium to high plasticity.
e-gra ½ pa No. 20	Silts on	d Clays	МН		Inorganic silts, micaceous or diatomaceous fines sands or silts, elastic silts.
Fin than	Liquid Limit	greater than	СН		Inorganic clays of high plasticity, fat clays.
More	30	0	ОН		Organic clays of medium to high plasticity.
Higl	hly Organic	Soils	PT		Peat, muck, and other highly organic soils.
			Consis	stency Cl	assification
	Granular	Soils			Cohesive Soils
Descriptio	n - Blows l	Per Foot (Cor	rected)		Description - Blows Per Foot (Corrected)
Very loose Loose Medium d Dense Very dens	MCS SPT <4 se 5-15 4-10 ium dense 16-40 11-30 se 41-65 31-50				soft $\frac{MCS}{<3}$ $\frac{SPT}{<2}$ $3-5$ $2-4$ $6-10$ $5-8$ $11-20$ $9-15$ $21-40$ $16-30$ >40 >30
MCS =	Modified Cal	ifornia Sampl	ler	S	PT = Standard Penetration Test Sampler

Project: Proposed West End Sand City Development

Client: The Orosco Group

Location: SWC Tioga Avenue & California Avenue, Sand City, CA

Grnd. Surf. Elev. (Ft. MSL) N/A

Project No: 1-217-0015

Figure No.: A-1 Logged By: JH Initial: None

Depth to Water> At Completion: None

		SUBSURFACE PROFILE		SA	MPLE	7.00	ompletion: None	
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture Content (%)	Sampler Type	Penetration	Blow Count	Penetration Test Nater Level
0-	\$6.24.5 N 6	Ground Surface						
-	4 <u>4</u>	Concrete = 6.75 Inches SAND (SP) [Fill] With concrete debris.	104.2	7,3	MCS		21	•
		SAND (SP) Medium dense; brown; moist; medium to fine-grained.						
5-		Grades as above; light brown.	100.4	4.7	MCS		16	•
10-	-	Grades as above.	99.1	4.0	MCS		39	
15-		Grades as above.		4.5	SPT		25	
20-		End of Borehole						
25-								

Drill Method: Hollow Stem Auger

Drill Rig: CME 55

Driller: Salem Engineering Group, Inc.

Sheet: 1 of 1



Project: Proposed West End Sand City Development

Client: The Orosco Group

Location: SWC Tioga Avenue & California Avenue, Sand City, CA

Grnd. Surf. Elev. (Ft. MSL) N/A

Project No: 1-217-0015

Figure No.: A-2 Logged By: JH

Initial: None

Depth to Water> At Completion: None

		SUBSUDEACE DECEU E		C A	MDIE	ALC	ompletion: None	
		SUBSURFACE PROFILE		5A	MPLE			
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture Content (%)	Sampler Type	Penetration	Blow Count	Penetration Test 20 40 60 80 Mater Level
0-		Ground Surface						
-		SAND (SP) Loose; light brown; moist; medium to fine- grained.	99.7	2.9	MCS		12	
5-		Grades as above; medium dense.	101.1	3.9	MCS		18	
10-		Grades as above; loose.	101.1	5.6	MCS		13	
15-	-	Grades as above; dense.		2.7	SPT		31	
20-	-	Grades as above; medium dense.		3.3	SPT		26	
25-		Grades as above.		2.5	SPT		29	

Drill Method: Hollow Stem Auger

Drill Rig: CME 55

Driller: Salem Engineering Group, Inc.

Sheet: 1 of 2



Project: Proposed West End Sand City Development

Client: The Orosco Group

Location: SWC Tioga Avenue & California Avenue, Sand City, CA

Grnd. Surf. Elev. (Ft. MSL) N/A

Project No: 1-217-0015

Figure No.: A-2 Logged By: JH

Initial: None

Depth to Water> At Completion: None

		At Completion: None								
	SUBSURFACE PROFILE		SA	MPLE						
Depth (ft) Symbol	Description	Dry Density (pcf)	Moisture Content (%)	Sampler Type	Penetration	Blow Count	Penetration Test 20 40 60 80 Mater Level			
30 -	Grades as above; dense.		2.4	SPT		32				
35 – -	Grades as above; medium dense; reddish brown.		4.2	SPT		27				
40 -	Grades as above; dense.		2.8	SPT		38				
45 – -	Grades as above; very dense; light brown.		2.4	SPT		82				
50-	Grades as above; light gray; with coarse to fine-grained gravel.		4.2	SPT		20				
	End of Borehole									

Drill Method: Hollow Stem Auger

Drill Rig: CME 55

Driller: Salem Engineering Group, Inc.

Sheet: 2 of 2



Project: Proposed West End Sand City Development

Client: The Orosco Group

Location: SWC Tioga Avenue & California Avenue, Sand City, CA

Grnd. Surf. Elev. (Ft. MSL) N/A

Project No: 1-217-0015

Figure No.: A-3 Logged By: JH

Initial: None
Depth to Water>

At Completion: None

		SUBSURFACE PROFILE		SA	MPLE			ompletion: None	
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture Content (%)	Sampler Type	Penetration	Blow Count	Penetration Test 20 40 60 80	Water Level
0-	9000	Ground Surface							
-	90°B 20°S 20°S	GRAVEL Surface Gravelly SAND (SP) [Fill] Dark brown; moist; coarse to fine-grained.							
-		SAND (SP) Loose; brown; moist; medium to fine-grained.	97.9	3.1	MCS		14	•	
5-	-	Grades as above; light brown; medium	100.0	4.0	MCS		21		
-		dense.							
10-		Grades as above.		2.8	SPT		11		
15-	-	End of Borehole							

Drill Method: Hollow Stem Auger

Drill Rig: CME 55

Driller: Salem Engineering Group, Inc.

Sheet: 1 of 1



Project: Proposed West End Sand City Development

Client: The Orosco Group

Location: SWC Tioga Avenue & California Avenue, Sand City, CA

Grnd. Surf. Elev. (Ft. MSL) N/A

Project No: 1-217-0015

Figure No.: A-4 Logged By: JH

Initial: None

Depth to Water> At Completion: None

		SUBSURFACE PROFILE		SA	MPLE			Monpietion: None	
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture Content (%)	Sampler Type	Penetration	Blow Count	Penetration Test 20 40 60 80	Water Level
0-	92.62	Ground Surface							
	90°50	GRAVEL Surface							
-		SAND (SP) Dense; brown; moist; medium to fine-grained.	119.2	8.5	MCS		44	•	
-									
5-		Grades as above; dark brown; medium dense.	106.7	5.7	MCS		22	-	
-	-								
10-		Grades as above; light brown; some debris of concrete.	101.5	1.8	MCS		23	-	
-									
15-		Grades as above; with no debris.		2.2	SPT		18		
-									
20-		Grades as above; coarse to fine-grained.		2.5	SPT		22		
	_	End of Borehole							
25-									

Drill Method: Hollow Stem Auger

Drill Rig: CME 55

Driller: Salem Engineering Group, Inc.

Sheet: 1 of 1



Project: Proposed West End Sand City Development

Client: The Orosco Group

Location: SWC Tioga Avenue & California Avenue, Sand City, CA

Grnd. Surf. Elev. (Ft. MSL) N/A

Project No: 1-217-0015

Figure No.: A-5 Logged By: JH

Depth to Water>

At Completion: None

		SUBSURFACE PROFILE		SA	MPLE			_	
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture Content (%)	Sampler Type	Penetration	Blow Count	Penetration Test 20 40 60 80	Water Level
0-	Sec. 4 - 3	Ground Surface							
_	3.1	Concrete = 7.25 Inches							
-	-	SAND (SP) Medium dense; brown; moist; medium to fine-grained.	102.1	5.4	MCS		16		
5-		Grades as above; light brown.	102.6	3.7	MCS		21		
10-		Grades as above.	98.9	3.6	MCS		36		
15-		Grades as above.		2.8	SPT		20	•	
20-		End of Borehole							

Drill Method: Hollow Stem Auger

Drill Rig: CME 55

Driller: Salem Engineering Group, Inc.

Sheet: 1 of 1



Project: Proposed West End Sand City Development

Client: The Orosco Group

Location: SWC Tioga Avenue & California Avenue, Sand City, CA

Grnd. Surf. Elev. (Ft. MSL) N/A

Project No: 1-217-0015

Figure No.: A-6 Logged By: JH

Initial: None
Depth to Water>

At Completion: None

		SUBSURFACE PROFILE		SA	MPLE				
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture Content (%)	Sampler Type	Penetration	Blow Count	Penetration Test 20 40 60 80	Water Level
0-	9000	Ground Surface							
_		GRAVEL Surface							
-	-	SAND (SP) Medium dense; light brown; moist; medium to fine-grained.	101.1	4.3	MCS		17		
5-		Grades as above.	100.3	4.5	MCS		20		
		Grades as above.	98.6	8.0	MCS		24		
		Grades as above.	30.0	0.0	IVICO		24		
-	-								
15-		Grades as above.		4.6	SPT		24	•	
-									
20-		Grades as above; dense.		4.0	SPT		32		
25-	-	End of Borehole							

Drill Method: Hollow Stem Auger

Drill Rig: CME 55

Driller: Salem Engineering Group, Inc.

Sheet: 1 of 1



Project: Proposed West End Sand City Development

Client: The Orosco Group

Location: SWC Tioga Avenue & California Avenue, Sand City, CA

Grnd. Surf. Elev. (Ft. MSL) N/A

Project No: 1-217-0015

Figure No.: A-7 Logged By: JH

Initial: None

Depth to Water> At Completion: None

				_			ALC	ompletion: None
		SUBSURFACE PROFILE	SAMPLE					
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture Content (%)	Sampler Type	Penetration	Blow Count	Penetration Test Nater Level
0-	960011100	Ground Surface						
-		SAND (SP) [Fill] Dark brown; moist; coarse to fine-grained; trace of wood chips. SAND (SP)	99.1	4.9	MCS		16	
-	-	Medium dense; brown; moist; medium to fine-grained.					>	
5-		Grades as above; loose; dark brown.	100.9	4.9	MCS		12	
-	-				•			
10-		Grades as above; medium dense; light brown.	96.7	6.1	MCS		25	
-		Siowii.						
15-		Grades as above.		4.6	SPT		18	
-	-							
20-	-	Grades as above; loose; dark brown.		6.9	SPT		9	
- - - 25-	-	End of Borehole						

Drill Method: Hollow Stem Auger

Drill Rig: CME 55

Driller: Salem Engineering Group, Inc.

Sheet: 1 of 1



Project: Proposed West End Sand City Development

Client: The Orosco Group

Location: SWC Tioga Avenue & California Avenue, Sand City, CA

Grnd. Surf. Elev. (Ft. MSL) N/A

Project No: 1-217-0015

Figure No.: A-8 Logged By: JH

Initial: None

Depth to Water> At Completion: None

							ALC	ompletic	II. INOII	ie .	\Box
		SUBSURFACE PROFILE	SAMPLE								
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture Content (%)	Sampler Type	Penetration	Blow Count		ration		Water Level
0-		Ground Surface									
_	\$000 \$000 \$000	Asphalt Concrete = 2 Inches									
_		Aggregate Base = 7 Inches	102.0	4.1	MCS		15				
-		SAND (SP) Loose to medium dense; brown; moist; medium to fine-grained.	102.0	4.1	IVICO)				
5-		Grades as above; medium dense; dark	101.1	3.9	MCS		17	<u> </u>			
-		brown.			•						-
10-		Grades as above; light brown	101.4	4.3	MCS		27				
15-		Grades as above.		1.7	SPT		20	•			
20-		End of Borehole									

Drill Method: Hollow Stem Auger

Drill Rig: CME 55

Driller: Salem Engineering Group, Inc.

Sheet: 1 of 1



Project: Proposed West End Sand City Development

Client: The Orosco Group

Location: SWC Tioga Avenue & California Avenue, Sand City, CA

Grnd. Surf. Elev. (Ft. MSL) N/A

Project No: 1-217-0015

Figure No.: A-9 Logged By: JH

Initial: None

Depth to Water> At Completion: None

							ALC	Completion: None			
		SUBSURFACE PROFILE		SA	MPLE						
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture Content (%)	Sampler Type	Penetration	Blow Count			on Tes	ter L
0-		Ground Surface									
-	_	SAND (SP) Medium dense; light brown; moist; medium to fine-grained.	98.1	3.5	MCS		17	•			
5-	-	Grades as above.	96.2	3.3	MCS		18	•			
10-		Grades as above; loose.	96.7	4.3	MCS		15				
-	_	Grades as above, loose.	30.7	4.5	IVICS		15				
15-		Grades as above; medium dense.		3.2	SPT		11	-			
20 -		End of Borehole									

Drill Method: Hollow Stem Auger

Drill Rig: CME 55

Driller: Salem Engineering Group, Inc.

Sheet: 1 of 1



Project: Proposed West End Sand City Development

Client: The Orosco Group

Location: SWC Tioga Avenue & California Avenue, Sand City, CA

Grnd. Surf. Elev. (Ft. MSL) N/A

Project No: 1-217-0015

Figure No.: A-10 Logged By: JH

Initial: None

Depth to Water> At Completion: None

	CUDCUDEACE DROFILE		C A	MDLE		ALC	omple		OHE	
	SUBSUKFACE PROFILE	+								
Symbol	Description	Dry Density (pcf)	Moisture Content (%)	Sampler Type	Penetration	Blow Count				Water Level
	Ground Surface									
_	SAND (SP) Loose to medium dense; brown; moist; medium to fine-grained.									
		100.3	5.4	MCS		15				
-				>						
-	Grades as above; light brown; medium dense.	100.4	5.2	MCS		19				
-	Grades as above		42	SPT		18				
				01 1						
-	End of Borehole									
		Ground Surface SAND (SP) Loose to medium dense; brown; moist; medium to fine-grained. Grades as above; light brown; medium dense. Grades as above. End of Borehole	Grades as above: light brown; medium dense. Grades as above: light brown; medium dense. Grades as above. End of Borehole	Ground Surface SAND (SP) Loose to medium dense; brown; moist; medium to fine-grained. Grades as above; light brown; medium dense. Grades as above. 4.2 End of Borehole	Ground Surface SAND (SP) Loose to medium dense; brown; moist; medium to fine-grained. Grades as above; light brown; medium dense. Grades as above. Grades as above. Find of Borehole And (%) trained (%) we show that the surface of the surface	Description Description	SUBSURFACE PROFILE Description Ground Surface SAND (SP) Loose to medium dense; brown; moist; medium to fine-grained. Grades as above; light brown; medium dense. Grades as above. Grades as above. 4.2 SPT 18 End of Borehole	SUBSURFACE PROFILE Description Ground Surface SAND (SP) Loose to medium dense; brown; moist; medium to fine-grained. Grades as above; light brown; medium dense. Grades as above. Grades as above. Find of Borehole SAMPLE Pend (\$\frac{3}{5}\) tues to go on the part of the point of the pend (\$\frac{3}{5}\) tues to medium dense; brown; moist; medium to fine-grained. 100.3 5.4 MCS 115 Grades as above. Find of Borehole	SUBSURFACE PROFILE Description Description Ground Surface SAND (SP) Loose to medium dense; brown; moist; medium dense. Grades as above; light brown; medium dense. Grades as above. Find of Borehole SAMPLE Penetration 20 40 6 20 40 6 Penetration 20 40	Description A

Drill Method: Hollow Stem Auger

Drill Rig: CME 55

Driller: Salem Engineering Group, Inc.

Sheet: 1 of 1



Project: Proposed West End Sand City Development

Client: The Orosco Group

Location: SWC Tioga Avenue & California Avenue, Sand City, CA

Grnd. Surf. Elev. (Ft. MSL) N/A

Project No: 1-217-0015

Figure No.: A-11 Logged By: JH

Initial: None

Depth to Water> At Completion: None

		SUBSURFACE PROFILE	SAMPLE					ompletion: None
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture Content (%)	Sampler Type	Penetration	Blow Count	Penetration Test 20 40 60 80 Mater Level
0-		Ground Surface						
-	-	SAND (SP) Medium dense; brown; moist; medium to fine-grained.	103.0	2.2	MCS		25	
5-	-	Grades as above; light brown.	101.0	6.9	MCS		23	
10-		Grades as above; dark brown.	101.9	5.0	MCS		17	
15-		Grades as above; reddish brown.		6.5	SPT		11	
20-		Grades as above; light brown. End of Borehole		2.7	SPT		27	
25-	-							

Drill Method: Hollow Stem Auger

Drill Rig: CME 55

Driller: Salem Engineering Group, Inc.

Sheet: 1 of 1



Project: Proposed West End Sand City Development

Client: The Orosco Group

Location: SWC Tioga Avenue & California Avenue, Sand City, CA

Grnd. Surf. Elev. (Ft. MSL) N/A

Project No: 1-217-0015

Figure No.: A-12 Logged By: JH

Initial: None

Depth to Water> At Completion: None

	At Completion: None							
SUBSURFACE PROFILE				SA	MPLE			
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture Content (%)	Sampler Type	Penetration	Blow Count	Penetration Test 20 40 60 80 Mater Level
0-	2000	Ground Surface						
	9000	Sandy GRAVEL (GP) [Fill] Dark brown; moist; coarse to fine-grained; metal.	115.8	5.4	MCS		30	•
		Silty SAND/SAND (SM/SP) Medium dense; light gray; moist; medium to fine-grained.					>	
5-	-	SAND (SP) Medium dense; light gray; moist; medium to fine-grained.	1		MCS		22	
10-		Grades as above; dark brown.	102.1	6.7	MCS		38	
-	_							
15-		Grades as above; brown.		4.2	SPT		18	
20-		End of Borehole						

Drill Method: Hollow Stem Auger

Drill Rig: CME 55

Driller: Salem Engineering Group, Inc.

Sheet: 1 of 1



Project: Proposed West End Sand City Development

Client: The Orosco Group

Location: SWC Tioga Avenue & California Avenue, Sand City, CA

Grnd. Surf. Elev. (Ft. MSL) N/A

Project No: 1-217-0015

Figure No.: A-13 Logged By: JH

Initial: None

Depth to Water> At Completion: None

		SUBSURFACE PROFILE	SSURFACE PROFILE SAMPLE						
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture Content (%)	Sampler Type	Penetration	Blow Count	Penetration Test 20 40 60 80	Water Level
0-	N.S. COLOR	Ground Surface							
		Concrete = 7.0 Inches							
-		Silty SAND (SM) Medium dense; brown; moist; medium to fine-grained.	105.6	8.9	MCS		32		
5-		Gravelly SAND (SP) Medium dense; gray; moist; coarse to finegrained.	93.1	11.8	MCS		24		
10-		SAND with Silt (SP-SM) Medium dense; light brown; moist; medium to fine-grained.	103.1	4.5	MCS		24		
- - - 15-		Grades as above.		3.5	SPT		19		
-	-	End of Borehole							
20-	-								
25-	-								

Drill Method: Hollow Stem Auger

Drill Rig: CME 55

Driller: Salem Engineering Group, Inc.

Sheet: 1 of 1



Project: Proposed West End Sand City Development

Client: The Orosco Group

Location: SWC Tioga Avenue & California Avenue, Sand City, CA

Grnd. Surf. Elev. (Ft. MSL) N/A

Project No: 1-217-0015

Figure No.: A-14 Logged By: JH

Initial: None

Depth to Water> At Completion: None

	At Completion: None							ightharpoonup			
SUBSURFACE PROFILE				SA	MPLE						
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture Content (%)	Sampler Type	Penetration	Blow Count		60		Water Level
0-	ніннін	Ground Surface									
		Silty SAND (SM) Dark brown; moist; medium to fine-grained; with organic. SAND (SP)									
		Light brown; moist; medium to fine-grained.									
-				2.6	BB						-
-	-				>						-
5-	_	Grades as above.		3.0	BB						
-	-	End of Borehole									-
_											
-	1										
10-	-										_
											-

Drill Method: Hand Auger

Drill Rig: N/A

Driller: Salem Engineering Group, Inc.

Sheet: 1 of 1

Drill Date: 01/17/2017 Borehole Size: 4 Inches Hammer Type: Manual Sliding

Weight & Drop: 10 lbs/18 in.



Project: Proposed West End Sand City Development

Client: The Orosco Group

Location: SWC Tioga Avenue & California Avenue, Sand City, CA

Grnd. Surf. Elev. (Ft. MSL) N/A

Project No: 1-217-0015

Figure No.: A-15 Logged By: JH

Initial: None

Depth to Water> At Completion: None

	At Completion: None									
SUBSURFACE PROFILE			SAMPLE							
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture Content (%)	Sampler Type	Penetration	Blow Count		on Te:	ter L
0-		Ground Surface								
-	-	SAND (SP) Brown; moist; medium to fine-grained; with organic (roots)								
-	_		-	7.5	BB					
-										
5-	-	Grades as above.		3.1	BB					
-	-	End of Borehole								
10-	-									

Drill Method: Hand Auger

Drill Rig: N/A

Driller: Salem Engineering Group, Inc.

Sheet: 1 of 1

Drill Date: 01/17/2017

Borehole Size: 4 Inches

Hammer Type: Manual Sliding

Weight & Drop: 10 lbs/18 in.



Project: Proposed West End Sand City Development

Client: The Orosco Group

Location: SWC Tioga Avenue & California Avenue, Sand City, CA

Grnd. Surf. Elev. (Ft. MSL) N/A

Project No: 1-217-0015

Figure No.: A-16 Logged By: JH

Initial: None

Depth to Water> At Completion: None

		SUBSURFACE PROFILE		SAMPLE				ompletion: None
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture Content (%)	Sampler Type	Penetration	Blow Count	Penetration Test 20 40 60 80 Age Level
0-	9760 64 5	Ground Surface Asphalt Concrete = 1 Inches Aggregate Base = 3 Inches SAND (SP) Dark brown; moist; medium to fine-grained.			<u> </u>			
-			1	5.4	ВВ			
5-		Grades as above; brown. End of Borehole		5.4	ВВ			
10-								

Drill Method: Hand Auger

Drill Rig: N/A

Driller: Salem Engineering Group, Inc.

Sheet: 1 of 1

Drill Date: 01/18/2017
Borehole Size: 4 Inches
Hammer Type: Manual Sliding
Weight & Drop: 10 lbs/18 in.



APPENDIX

B



APPENDIX B LABORATORY TESTING

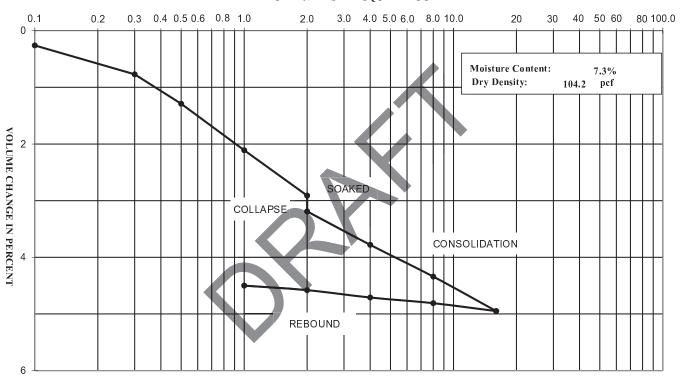
Laboratory tests were performed in accordance with generally accepted test methods of the American Society for Testing and Materials (ASTM), Caltrans, or other suggested procedures. Selected samples were tested for in-situ dry density and moisture content, corrosivity, consolidation, shear strength, R-Value, and grain size distribution. The results of the laboratory tests are summarized in the following figures.





CONSOLIDATION - PRESSURE TEST DATA ASTM D 2435

LOAD IN KIPS PER SQUARE FOOT

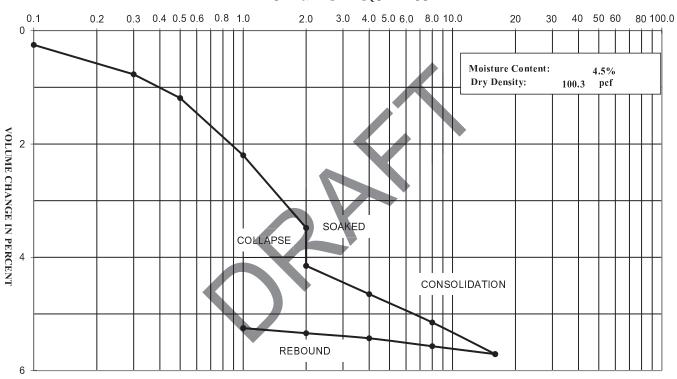


Prop. West_End_Development_Sand City_CA
Project Number: 1-217-0015
Boring: B-1 @ 2'



CONSOLIDATION - PRESSURE TEST DATA ASTM D 2435

LOAD IN KIPS PER SQUARE FOOT

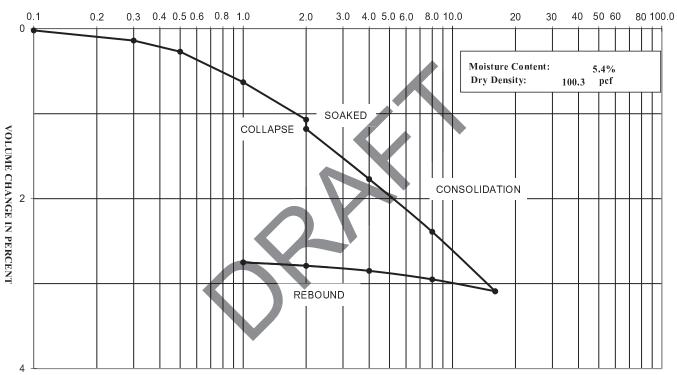


Prop. West_End_Development_Sand City_CA
Project Number: 1-217-0015
Boring: B-6 @ 5'



CONSOLIDATION - PRESSURE TEST DATA ASTM D 2435

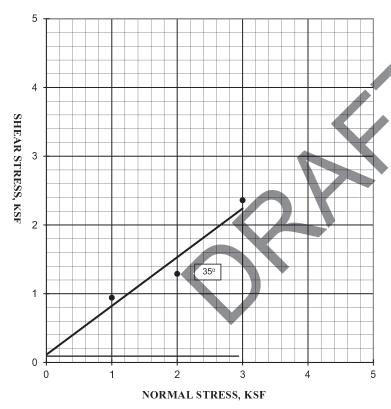
LOAD IN KIPS PER SQUARE FOOT



Prop. West_End_Development_Sand City_CA
Project Number: 1-217-0015
Boring: B-10 @ 2'



SHEAR STRENGTH DIAGRAM (DIRECT SHEAR) ASTM D - 3080



Prop. West_End_Development_Sand City_CA

Project Number: 1-217-0015

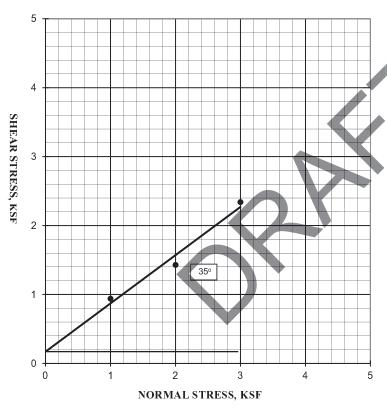
Boring: B-1 @ 5' Soil Type: SAND (SP)

Friction Angle: 35 degrees Cohesion: 115 psf

Moisture Content 4.7%
Dry Density 100.4 pcf



SHEAR STRENGTH DIAGRAM (DIRECT SHEAR) ASTM D - 3080



Prop. West_End_Development_Sand City_CA

Project Number: 1-217-0015

Boring: B-6 @ 2' Soil Type: SAND (SP)

Friction Angle: 35 degrees Cohesion: 170 psf

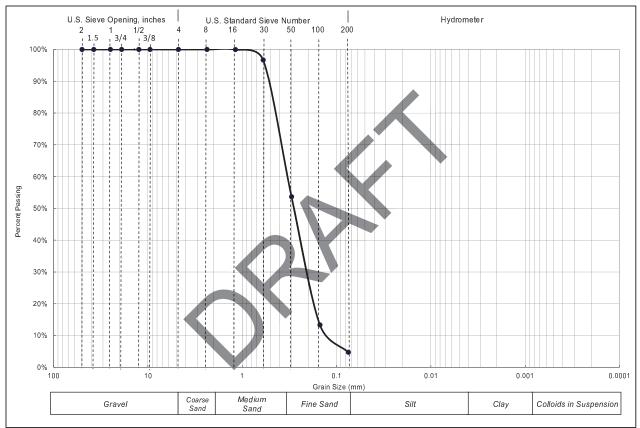
Moisture Content 4.3%

Dry Density 101.1 pcf



PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Prop. West_End_Development_Sand City_CA
Project Number: 1-217-0015
Boring: B-1 @ 2'



DRY SIEVE ANALYSIS

ASTM C136 (without Hydrometer)

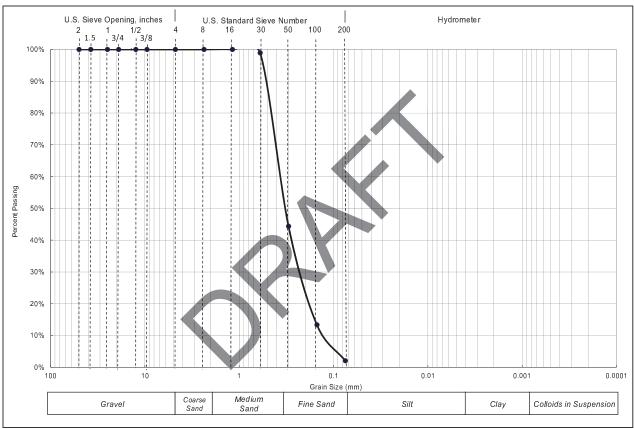
Sieve Size	Particle Size, mm	Percent Passing
1 1/2-in.	37.5	100.0%
1-in.	25	100.0%
3/4-in.	19	100.0%
1/2-in.	12.5	100.0%
3/8-in.	9.5	100.0%
No. 4	4.75	100.0%
No. 8	2.36	100.0%
No. 16	1.18	100.0%
No. 30	0.6	96.7%
No. 50	0.3	53.6%
No. 100	0.15	13.3%
No. 200	0.075	4.73%

Prop. West_End_Development_Sand City_CA
Project Number: 1-217-0015
Boring: B-1 @ 2'



PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Prop. West_End_Development_Sand City_CA
Project Number: 1-217-0015
Boring: B-1 @ 5'



DRY SIEVE ANALYSIS

ASTM C136 (without Hydrometer)

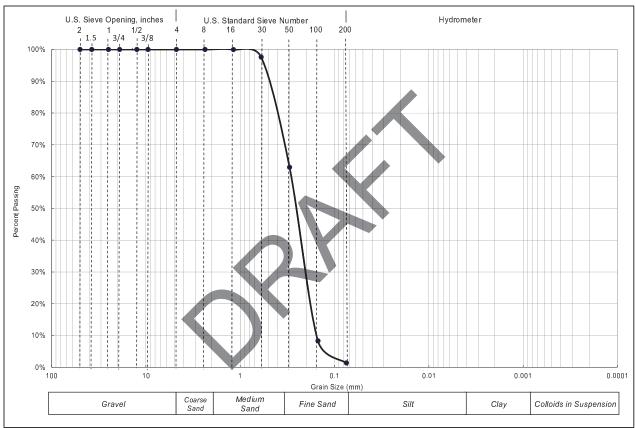
Sieve Size	Particle Size, mm	Percent Passing
1 1/2-in.	37.5	100.0%
1-in.	25	100.0%
3/4-in.	19	100.0%
1/2-in.	12.5	100.0%
3/8-in.	9.5	100.0%
No. 4	4.75	100.0%
No. 8	2.36	100.0%
No. 16	1.18	100.0%
No. 30	0.6	98.9%
No. 50	0.3	44.4%
No. 100	0.15	13.3%
No. 200	0.075	2.04%

Prop. West_End_Development_Sand City_CA
Project Number: 1-217-0015
Boring: B-1 @ 5'



PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Prop. West_End_Development_Sand City_CA
Project Number: 1-217-0015
Boring: B-2 @ 2'



DRY SIEVE ANALYSIS

ASTM C136 (without Hydrometer)

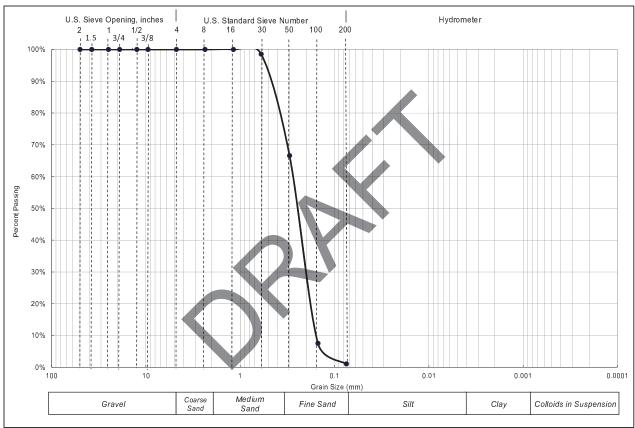
Sieve Size	Particle Size, mm	Percent Passing
1 1/2-in.	37.5	100.0%
1-in.	25	100.0%
3/4-in.	19	100.0%
1/2-in.	12.5	100.0%
3/8-in.	9.5	100.0%
No. 4	4.75	100.0%
No. 8	2.36	100.0%
No. 16	1.18	100.0%
No. 30	0.6	97.6%
No. 50	0.3	62.9%
No. 100	0.15	8.3%
No. 200	0.075	1.36%

Prop. West_End_Development_Sand City_CA
Project Number: 1-217-0015
Boring: B-2 @ 2'



PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Prop. West_End_Development_Sand City_CA
Project Number: 1-217-0015
Boring: B-2 @ 10'



DRY SIEVE ANALYSIS

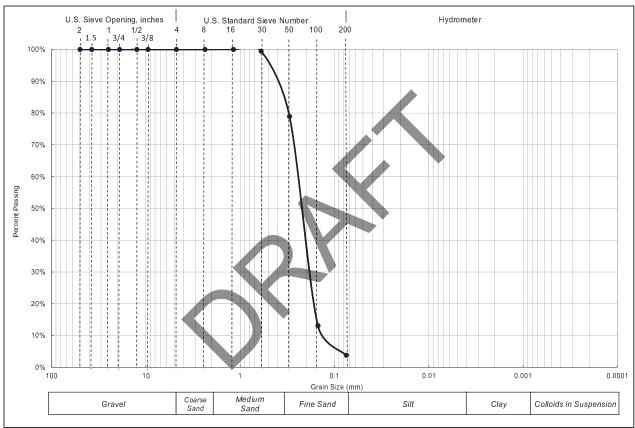
ASTM C136 (without Hydrometer)

Sieve Size	Particle Size, mm	Percent Passing
1 1/2-in.	37.5	100.0%
1-in.	25	100.0%
3/4-in.	19	100.0%
1/2-in.	12.5	100.0%
3/8-in.	9.5	100.0%
No. 4	4.75	100.0%
No. 8	2.36	100.0%
No. 16	1.18	100.0%
No. 30	0.6	98.6%
No. 50	0.3	66.6%
No. 100	0.15	7.5%
No. 200	0.075	1.05%

Prop. West_End_Development_Sand City_CA
Project Number: 1-217-0015
Boring: B-2 @ 10'



GRADATION TEST - ASTM C136



Prop. West_End_Development_Sand City_CA
Project Number: 1-217-0015
Boring: B-2 @ 20'



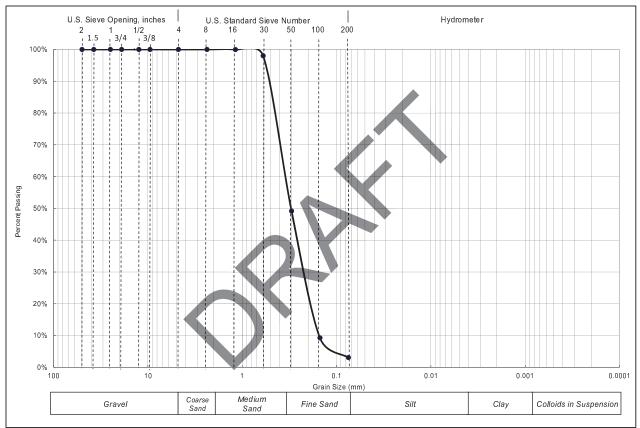
ASTM C136 (without Hydrometer)

Sieve Size	Particle Size, mm	Percent Passing
1 1/2-in.	37.5	100.0%
1-in.	25	100.0%
3/4-in.	19	100.0%
1/2-in.	12.5	100.0%
3/8-in.	9.5	100.0%
No. 4	4.75	100.0%
No. 8	2.36	100.0%
No. 16	1.18	100.0%
No. 30	0.6	99.4%
No. 50	0.3	78.9%
No. 100	0.15	13.1%
No. 200	0.075	3.77%

Prop. West_End_Development_Sand City_CA
Project Number: 1-217-0015
Boring: B-2 @ 20'



GRADATION TEST - ASTM C136



Prop. West_End_Development_Sand City_CA
Project Number: 1-217-0015
Boring: B-2 @ 30'

17-0015
0'

SALEVI
engineering group, inc.

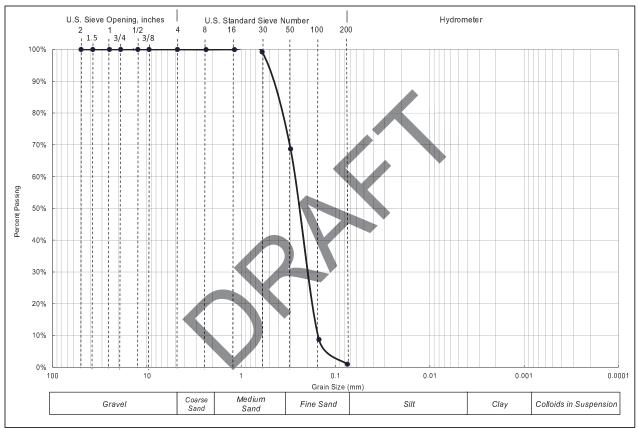
ASTM C136 (without Hydrometer)

Sieve Size	Particle Size, mm	Percent Passing
1 1/2-in.	37.5	100.0%
1-in.	25	100.0%
3/4-in.	19	100.0%
1/2-in.	12.5	100.0%
3/8-in.	9.5	100.0%
No. 4	4.75	100.0%
No. 8	2.36	100.0%
No. 16	1.18	100.0%
No. 30	0.6	98.0%
No. 50	0.3	49.2%
No. 100	0.15	9.2%
No. 200	0.075	3.05%

Prop. West_End_Development_Sand City_CA
Project Number: 1-217-0015
Boring: B-2 @ 30'



GRADATION TEST - ASTM C136



Prop. West_End_Development_Sand City_CA
Project Number: 1-217-0015
Boring: B-6 @ 2'



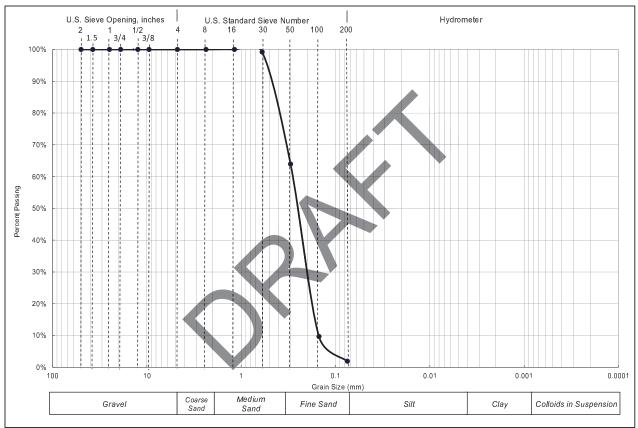
ASTM C136 (without Hydrometer)

Sieve Size	Particle Size, mm	Percent Passing
1 1/2-in.	37.5	100.0%
1-in.	25	100.0%
3/4-in.	19	100.0%
1/2-in.	12.5	100.0%
3/8-in.	9.5	100.0%
No. 4	4.75	100.0%
No. 8	2.36	100.0%
No. 16	1.18	100.0%
No. 30	0.6	99.2%
No. 50	0.3	68.7%
No. 100	0.15	8.8%
No. 200	0.075	0.97%

Prop. West_End_Development_Sand City_CA
Project Number: 1-217-0015
Boring: B-6 @ 2'



GRADATION TEST - ASTM C136



Prop. West_End_Development_Sand City_CA
Project Number: 1-217-0015
Boring: B-6 @ 5'



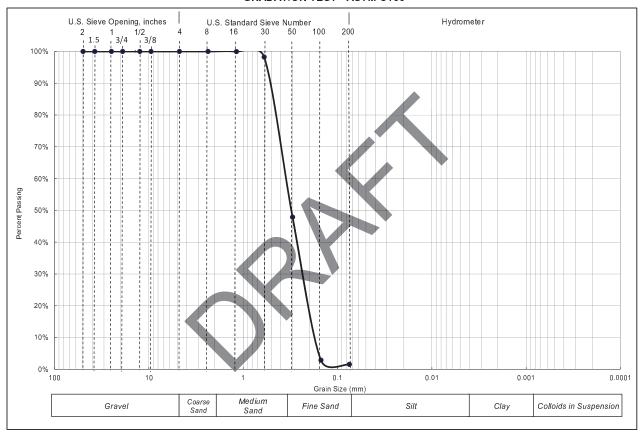
ASTM C136 (without Hydrometer)

Sieve Size	Particle Size, mm	Percent Passing
1 1/2-in.	37.5	100.0%
1-in.	25	100.0%
3/4-in.	19	100.0%
1/2-in.	12.5	100.0%
3/8-in.	9.5	100.0%
No. 4	4.75	100.0%
No. 8	2.36	100.0%
No. 16	1.18	100.0%
No. 30	0.6	99.2%
No. 50	0.3	64.0%
No. 100	0.15	9.7%
No. 200	0.075	1.91%

Prop. West_End_Development_Sand City_CA
Project Number: 1-217-0015
Boring: B-6 @ 5'



GRADATION TEST - ASTM C136



Prop. West_End_Development_Sand City_CA
Project Number: 1-217-0015
Boring: B-10 @ 2'



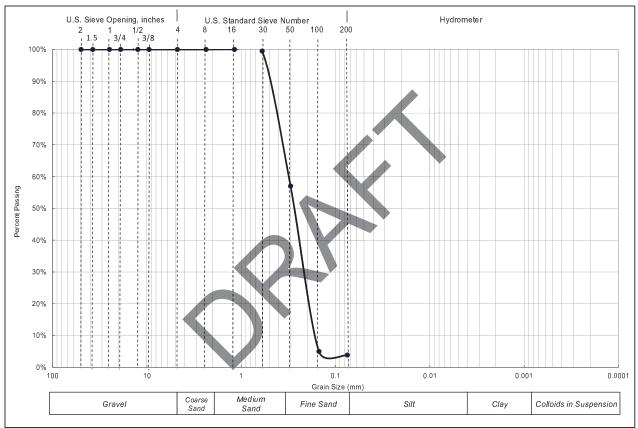
ASTM C136 (without Hydrometer)

Sieve Size	Particle Size, mm	Percent Passing
1 1/2-in.	37.5	100.0%
1-in.	25	100.0%
3/4-in.	19	100.0%
1/2-in.	12.5	100.0%
3/8-in.	9.5	100.0%
No. 4	4.75	100.0%
No. 8	2.36	100.0%
No. 16	1.18	100.0%
No. 30	0.6	98.3%
No. 50	0.3	47.9%
No. 100	0.15	2.8%
No. 200	0.075	1.53%

Prop. West_End_Development_Sand City_CA
Project Number: 1-217-0015
Boring: B-10 @ 2'



GRADATION TEST - ASTM C136



Prop. West_End_Development_Sand City_CA
Project Number: 1-217-0015
Boring: B-10 @ 5'



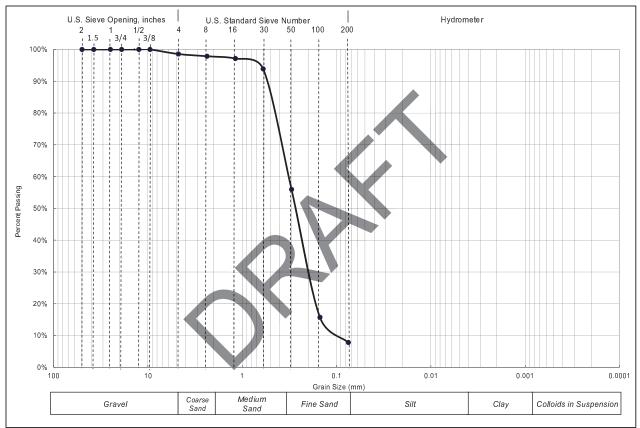
ASTM C136 (without Hydrometer)

Sieve Size	Particle Size, mm	Percent Passing
1 1/2-in.	37.5	100.0%
1-in.	25	100.0%
3/4-in.	19	100.0%
1/2-in.	12.5	100.0%
3/8-in.	9.5	100.0%
No. 4	4.75	100.0%
No. 8	2.36	100.0%
No. 16	1.18	100.0%
No. 30	0.6	99.5%
No. 50	0.3	57.0%
No. 100	0.15	5.0%
No. 200	0.075	3.84%

Prop. West_End_Development_Sand City_CA
Project Number: 1-217-0015
Boring: B-10 @ 5'



GRADATION TEST - ASTM C136



Prop. West_End_Development_Sand City_CA Project Number: 1-217-0015

Boring: B-12 @ 2'



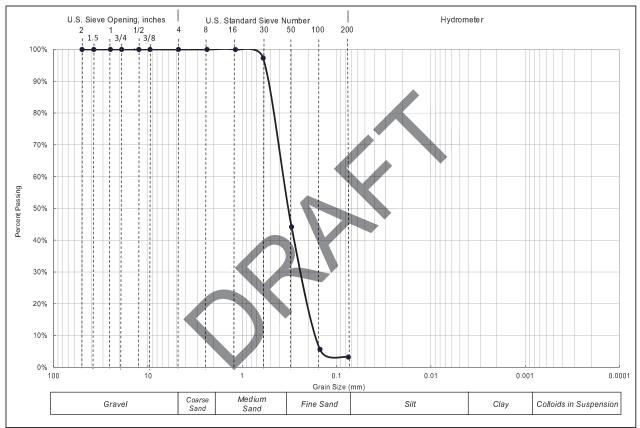
ASTM C136 (without Hydrometer)

Sieve Size	Particle Size, mm	Percent Passing
1 1/2-in.	37.5	100.0%
1-in.	25	100.0%
3/4-in.	19	100.0%
1/2-in.	12.5	100.0%
3/8-in.	9.5	100.0%
No. 4	4.75	98.6%
No. 8	2.36	97.9%
No. 16	1.18	97.1%
No. 30	0.6	93.9%
No. 50	0.3	55.9%
No. 100	0.15	15.7%
No. 200	0.075	7.81%

Prop. West_End_Development_Sand City_CA
Project Number: 1-217-0015
Boring: B-12 @ 2'



GRADATION TEST - ASTM C136



Prop. West_End_Development_Sand City_CA
Project Number: 1-217-0015

Boring: B-12 @ 10'



ASTM C136 (without Hydrometer)

Sieve Size	Particle Size, mm	Percent Passing
1 1/2-in.	37.5	100.0%
1-in.	25	100.0%
3/4-in.	19	100.0%
1/2-in.	12.5	100.0%
3/8-in.	9.5	100.0%
No. 4	4.75	100.0%
No. 8	2.36	100.0%
No. 16	1.18	100.0%
No. 30	0.6	97.3%
No. 50	0.3	44.2%
No. 100	0.15	5.6%
No. 200	0.075	3.21%

Prop. West_End_Development_Sand City_CA
Project Number: 1-217-0015
Boring: B-12 @ 10'



Resistance R - Value and Expansion Pressure of Compacted Soils ASTM D2844-94, Cal 301

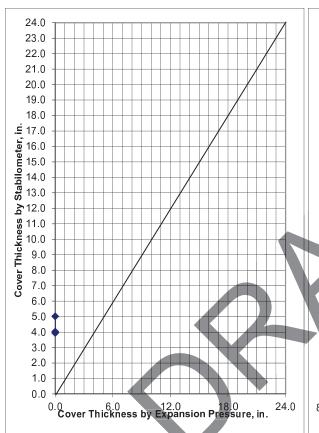
Prop. West End Development Sand City CA

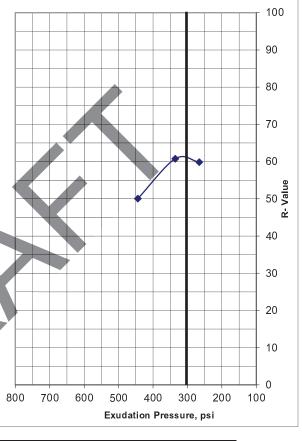
Project Number: 1-217-0015

Sample Date: 1/17/17 Date Tested: 1/26/17 Sampled By: JH Tested By: VT

Sample Location: RV-1 @ 0' - 3'

Material Description: Silty SAND (SM)





Specimen	1	2	3
Exudation Pressure, psi	444.2	335.2	265.6
Moisture at Test, %	11.1	11.7	12.3
Dry Density, pcf	104.8	106.4	105.0
Expansion Pressure, psf	0	0	0.0
Thickness by Stabilometer, in.	5.0	3.9	4.0
Thickness by Expansion Pressure, in	0.0	0.0	0.0
R-Value by Stabilometer	50	61	60
R-Value by Expansion Pressure		NA	
R-Value at 300 psi Exudation Pressure		62	

Controlling R-Value	62



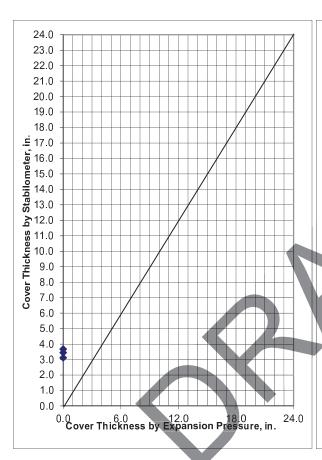
Resistance R - Value and Expansion Pressure of Compacted Soils ASTM D2844-94, Cal 301

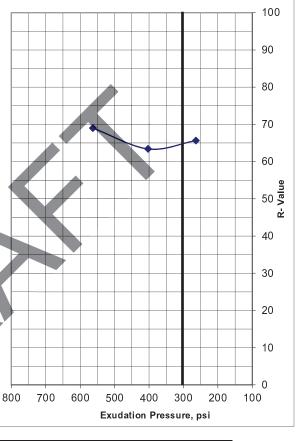
Prop. West End Development Sand City CA

Project Number: 1-217-0015

Sample Date: 1/17/17 Date Tested: 1/27/17 Sampled By: JH Tested By: VT

Sample Location: RV-2 @ 0' - 3' Material Description: SAND (SP)





Specimen	1	2	3
Exudation Pressure, psi	563.2	402.7	263.7
Moisture at Test, %	8.9	9.2	10.3
Dry Density, pcf	110.1	110.0	111.8
Expansion Pressure, psf	0	0	0.0
Thickness by Stabilometer, in.	3.1	3.7	3.4
Thickness by Expansion Pressure, in	0.0	0.0	0.0
R-Value by Stabilometer	69	63	66
R-Value by Expansion Pressure		NA	
R-Value at 300 psi Exudation Pressure		65	

Controlling R-Value	65



<u>LABORATORY COMPACTION CURVE</u> ASTM - D1557, D698

Prop. West End Development Sand City CA

Project Number: 1-217-0015

Date Tested: 1/23/17

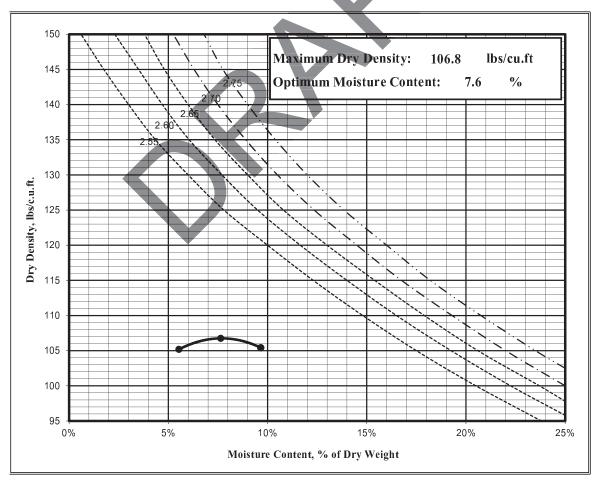
Sample Location: B-2 @ 0' - 3'

Soil Classification: SAND with slight organics, Dark Bronn, Non-Cohesive

0

Sample/Curve Number: 1 Test Method: 1557 A

	1	2	3
Weight of Moist Specimen & Mold, gm	3683.2	3742.1	3751.2
Weight of Compaction Mold, gm	2004.9	2004.9	2004.9
Weight of Moist Specimen, gm	1678.3	1737.2	1746.3
Volume of mold, cu. ft.	0.0333	0.0333	0.0333
Wet Density, lbs/cu.ft.	111.0	114.9	115.6
Weight of Wet (Moisture) Sample, gm	333.6	331.1	329.2
Weight of Dry (Moisture) Sample, gm	316.1	307.6	300.2
Moisture Content, %	5.5%	7.6%	9.7%
Dry Density, lbs/cu.ft.	105.2	106.8	105.4





CHEMICAL ANALYSIS

SO₄ - Modified Caltrans 417 & Cl - Modified Caltrans 417/422

Prop. West_End_Development_Sand City_CA

Project Number: 1-217-0015

Date: 1/21/17

Soil Classification: SAND (SP)

Sample	Sample	Soluble Sulfate	Soluble Chloride	рН
Number	Location	SO ₄ -S	Cl	
1a.	B-2 @ 0' - 3'	50 mg/Kg	18 mg/Kg	7.0
1b.	B-2 @ 0' - 3'	50 mg/Kg	18 mg/Kg	7.0
1c.	B-2 @ 0' - 3'	50 mg/Kg	18 mg/Kg	7.0
Ave	rage:	50 mg/Kg	18 mg/Kg	7.0





APPENDIX

C

APPENDIX C GENERAL EARTHWORK AND PAVEMENT SPECIFICATIONS

When the text of the report conflicts with the general specifications in this appendix, the recommendations in the report have precedence.

- 1.0 SCOPE OF WORK: These specifications and applicable plans pertain to and include all earthwork associated with the site rough grading, including, but not limited to, the furnishing of all labor, tools and equipment necessary for site clearing and grubbing, stripping, preparation of foundation materials for receiving fill, excavation, processing, placement and compaction of fill and backfill materials to the lines and grades shown on the project grading plans and disposal of excess materials.
- **2.0 PERFORMANCE:** The Contractor shall be responsible for the satisfactory completion of all earthwork in accordance with the project plans and specifications. This work shall be inspected and tested by a representative of SALEM Engineering Group, Incorporated, hereinafter referred to as the Soils Engineer and/or Testing Agency. Attainment of design grades, when achieved, shall be certified by the project Civil Engineer. Both the Soils Engineer and the Civil Engineer are the Owner's representatives. If the Contractor should fail to meet the technical or design requirements embodied in this document and on the applicable plans, he shall make the necessary adjustments until all work is deemed satisfactory as determined by both the Soils Engineer and the Civil Engineer. No deviation from these specifications shall be made except upon written approval of the Soils Engineer, Civil Engineer, or project Architect.

No earthwork shall be performed without the physical presence or approval of the Soils Engineer. The Contractor shall notify the Soils Engineer at least 2 working days prior to the commencement of any aspect of the site earthwork.

The Contractor shall assume sole and complete responsibility for job site conditions during the course of construction of this project, including safety of all persons and property; that this requirement shall apply continuously and not be limited to normal working hours; and that the Contractor shall defend, indemnify and hold the Owner and the Engineers harmless from any and all liability, real or alleged, in connection with the performance of work on this project, except for liability arising from the sole negligence of the Owner or the Engineers.

- **3.0 TECHNICAL REQUIREMENTS**: All compacted materials shall be densified to no less that 95 percent of relative compaction (90 percent for cohesive soils) based on ASTM D1557 Test Method (latest edition), UBC or CAL-216, or as specified in the technical portion of the Soil Engineer's report. The location and frequency of field density tests shall be determined by the Soils Engineer. The results of these tests and compliance with these specifications shall be the basis upon which satisfactory completion of work will be judged by the Soils Engineer.
- **4.0 SOILS AND FOUNDATION CONDITIONS**: The Contractor is presumed to have visited the site and to have familiarized himself with existing site conditions and the contents of the data presented in the Geotechnical Engineering Report. The Contractor shall make his own interpretation of the data contained in the Geotechnical Engineering Report and the Contractor shall not be relieved of liability for any loss sustained as a result of any variance between conditions indicated by or deduced from said report and the actual conditions encountered during the progress of the work.



- **5.0 DUST CONTROL:** The work includes dust control as required for the alleviation or prevention of any dust nuisance on or about the site or the borrow area, or off-site if caused by the Contractor's operation either during the performance of the earthwork or resulting from the conditions in which the Contractor leaves the site. The Contractor shall assume all liability, including court costs of codefendants, for all claims related to dust or wind-blown materials attributable to his work. Site preparation shall consist of site clearing and grubbing and preparation of foundation materials for receiving fill.
- **6.0 CLEARING AND GRUBBING:** The Contractor shall accept the site in this present condition and shall demolish and/or remove from the area of designated project earthwork all structures, both surface and subsurface, trees, brush, roots, debris, organic matter and all other matter determined by the Soils Engineer to be deleterious. Such materials shall become the property of the Contractor and shall be removed from the site.

Tree root systems in proposed improvement areas should be removed to a minimum depth of 3 feet and to such an extent which would permit removal of all roots greater than 1 inch in diameter. Tree roots removed in parking areas may be limited to the upper 1½ feet of the ground surface. Backfill of tree root excavations is not permitted until all exposed surfaces have been inspected and the Soils Engineer is present for the proper control of backfill placement and compaction. Burning in areas which are to receive fill materials shall not be permitted.

7.0 SUBGRADE PREPARATION: Surfaces to receive Engineered Fill and/or building or slab loads shall be prepared as outlined above, scarified to a minimum of 12 inches, moisture-conditioned as necessary, and recompacted to 95 percent relative compaction (90 percent for cohesive soils).

Loose soil areas and/or areas of disturbed soil shall be moisture-conditioned as necessary and recompacted to 95 percent relative compaction (90 percent for cohesive soils). All ruts, hummocks, or other uneven surface features shall be removed by surface grading prior to placement of any fill materials. All areas which are to receive fill materials shall be approved by the Soils Engineer prior to the placement of any fill material.

- **8.0 EXCAVATION:** All excavation shall be accomplished to the tolerance normally defined by the Civil Engineer as shown on the project grading plans. All over-excavation below the grades specified shall be backfilled at the Contractor's expense and shall be compacted in accordance with the applicable technical requirements.
- **9.0 FILL AND BACKFILL MATERIAL:** No material shall be moved or compacted without the presence or approval of the Soils Engineer. Material from the required site excavation may be utilized for construction site fills, provided prior approval is given by the Soils Engineer. All materials utilized for constructing site fills shall be free from vegetation or other deleterious matter as determined by the Soils Engineer.
- **10.0 PLACEMENT, SPREADING AND COMPACTION:** The placement and spreading of approved fill materials and the processing and compaction of approved fill and native materials shall be the responsibility of the Contractor. Compaction of fill materials by flooding, ponding, or jetting shall not be permitted unless specifically approved by local code, as well as the Soils Engineer. Both cut and fill shall be surface-compacted to the satisfaction of the Soils Engineer prior to final acceptance.



- **11.0 SEASONAL LIMITS:** No fill material shall be placed, spread, or rolled while it is frozen or thawing, or during unfavorable wet weather conditions. When the work is interrupted by heavy rains, fill operations shall not be resumed until the Soils Engineer indicates that the moisture content and density of previously placed fill is as specified.
- **12.0 DEFINITIONS** The term "pavement" shall include asphaltic concrete surfacing, untreated aggregate base, and aggregate subbase. The term "subgrade" is that portion of the area on which surfacing, base, or subbase is to be placed.

The term "Standard Specifications": hereinafter referred to, is the most recent edition of the Standard Specifications of the State of California, Department of Transportation. The term "relative compaction" refers to the field density expressed as a percentage of the maximum laboratory density as determined by ASTM D1557 Test Method (latest edition) or California Test Method 216 (CAL-216), as applicable.

- 13.0 PREPARATION OF THE SUBGRADE The Contractor shall prepare the surface of the various subgrades receiving subsequent pavement courses to the lines, grades, and dimensions given on the plans. The upper 12 inches of the soil subgrade beneath the pavement section shall be compacted to a minimum relative compaction of 95 percent based upon ASTM D1557. The finished subgrades shall be tested and approved by the Soils Engineer prior to the placement of additional pavement courses.
- 14.0 AGGREGATE BASE The aggregate base material shall be spread and compacted on the prepared subgrade in conformity with the lines, grades, and dimensions shown on the plans. The aggregate base material shall conform to the requirements of Section 26 of the Standard Specifications for Class II material, ¾-inch or 1½-inches maximum size. The aggregate base material shall be compacted to a minimum relative compaction of 95 percent based upon CAL-216. The aggregate base material shall be spread in layers not exceeding 6 inches and each layer of aggregate material course shall be tested and approved by the Soils Engineer prior to the placement of successive layers.
- **15.0 AGGREGATE SUBBASE** The aggregate subbase shall be spread and compacted on the prepared subgrade in conformity with the lines, grades, and dimensions shown on the plans. The aggregate subbase material shall conform to the requirements of Section 25 of the Standard Specifications for Class II Subbase material. The aggregate subbase material shall be compacted to a minimum relative compaction of 95 percent based upon CAL-216, and it shall be spread and compacted in accordance with the Standard Specifications. Each layer of aggregate subbase shall be tested and approved by the Soils Engineer prior to the placement of successive layers.
- 16.0 ASPHALTIC CONCRETE SURFACING Asphaltic concrete surfacing shall consist of a mixture of mineral aggregate and paving grade asphalt, mixed at a central mixing plant and spread and compacted on a prepared base in conformity with the lines, grades, and dimensions shown on the plans. The viscosity grade of the asphalt shall be PG 64-10, unless otherwise stipulated or local conditions warrant more stringent grade. The mineral aggregate shall be Type A or B, ½ inch maximum size, medium grading, and shall conform to the requirements set forth in Section 39 of the Standard Specifications. The drying, proportioning, and mixing of the materials shall conform to Section 39. The prime coat, spreading and compacting equipment, and spreading and compacting the mixture shall conform to the applicable chapters of Section 39, with the exception that no surface course shall be placed when the atmospheric temperature is below 50 degrees F. The surfacing shall be rolled with a combination steel-wheel and pneumatic rollers, as described in the Standard Specifications. The surface course shall be placed with an approved self-propelled mechanical spreading and finishing machine.

