GEOTECHNICAL • ENVIRONMENTAL • GEOLOGY • MATERIALS TESTING & INSPECTION • FORENSIC • LABORATORY

SALEM
engineering group, inc.

GEOTECHNICAL ENGINEERING INVESTIGATION

PROPOSED COMMERCIAL DEVELOPMENT
SWC YUCAIPA BOULEVARD & 18TH STREET
YUCAIPA, CALIFORNIA

SALEM PROJECT NO. 3-218-0666B
AUGUST 29, 2018

PREPARED FOR:

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August 29, 2018 Project No. 3-218-0666B

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SUBJECT: GEOTECHNICAL ENGINEERING INVESTIGATION
PROPOSED COMMERCIAL DEVELOPMENT
SWC YUCAIPA BOULEVARD & 18TH STREET
YUCAIPA, CALIFORNIA

Dear Mr. Robinson:

At your request and authorization, SALEM Engineering Group, Inc. (SALEM) has prepared this Geotechnical Engineering Investigation report for the Proposed Commercial Development to be located at the subject site.

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 (909) 980-6455.

Respectfully Submitted,

SALEM ENGINEERING GROUP, INC.

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GEOTECHNICAL ENGINEERING INVESTIGATION
PROPOSED COMMERCIAL DEVELOPMENT
SWC YUCAIPA BOULEVARD & 18TH STREET
YUCAIPA, CALIFORNIA

1. PURPOSE AND SCOPE

This report presents the results of our Geotechnical Engineering Investigation for the Proposed Commercial Development in the City of Yucaipa, California (see Figure 1, Vicinity Map).

The purpose of our geotechnical engineering investigation was 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 the investigation does not include a fault study.

The scope of this investigation included a field exploration, percolation testing, laboratory testing, engineering analysis and the preparation of this report. Our field exploration was performed on August 1 through August 3, 2018, and included the drilling of nineteen (19) small-diameter soil borings to a maximum depth of 50½ feet at the site. Additionally, six (6) percolation tests were performed at depths of approximately 2 and 10 feet below existing grade for the determination of the infiltration rate. The locations of the soil borings and percolation tests are depicted on Figure 2, Site Plan. A detailed discussion of our field investigation, 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 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. Earthwork and Pavement Specifications are presented in Appendix C. If text of the report conflict with the specifications in Appendix C, the recommendations in the text of the report have precedence.

2. PROJECT DESCRIPTION

Based on the information provided to us, we understand that the proposed development of the site will include construction of a 34,000 square-foot health club (fitness), a 52,500 square-foot Major 2 (retail), six 3,000 to 5,000 square-foot fast-food and restaurant pads, a 9,000 square-foot Shop 1 (restaurants) shop, and a 3,220 square-foot carwash tunnel with a 240 square-foot office building and a 1,380 square-

foot equipment building. The existing gas station located at the northwest corner of the site will remain. On-site parking and landscaping are planned to be associated with the project.

A site grading plan was not available at the time of preparation of this report. As the existing project area is uneven and gently to considerably sloping down from Yucaipa Boulevard, we anticipate that fills during the earthwork will be minimal to substantial in providing level building pads and positive site drainage. The southern portion of the site is expected to receive over 10 to 15 feet of fill.

No significant cut is anticipated for the proposed development. 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 configuration and locations of proposed improvements are shown on the Site Plan, Figure 2.

3. SITE LOCATION AND DESCRIPTION

The site is irregular in shape and encompasses approximately 23.10 acres. The site is located on the southwest corner of Yucaipa Boulevard and 18th Street in the City of Yucaipa, California (see Site Plan, Figure 2). The northwest corner of the site is occupied by a gas station. The remaining site is vacant with debris, rocks, boulders, broken concrete slabs, dirt mounds, miscellaneous debris, and vegetation growths.

Based on available information, the norther portion of the site appeared to have been graded with more than 10 feet of fill. At the time of our field exploration, the site topography consisted of multiple uneven slopes, mounds and depressions. The site elevations range from approximately 2,120 to 2,070 feet above mean sea level based on Google Earth imagery.

4. FIELD EXPLORATION

Our field exploration consisted of site surface reconnaissance and subsurface exploration. The exploratory test borings (B-5 through B-23) were drilled on August 1 through August 3, 2018 in the areas shown on the Site Plan, Figure 2. The test borings were advanced with a 6-inch diameter hollow stem auger, and a 4-inch solid flight auger rotated by a truck-mounted CME 55 drill rig. The test borings were extended to a maximum depth of 50½ feet below existing grade.

The materials encountered in the test borings were visually classified in the field, and logs were recorded by a field engineer and stratification lines were approximated on the basis of observations made at the time of drilling. Visual classification of the materials encountered in the test borings were generally made in accordance with the Unified Soil Classification System (ASTM D2487). A soil classification chart and key to sampling is presented on the Unified Soil Classification Chart, in Appendix "A."

The logs of the test borings are presented in Appendix "A." 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 features shown on the Site Plan, 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.

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. The borings were backfilled with soil cuttings after completion of the drilling.

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 potential, expansion index, maximum density and optimum moisture determination, and gradation 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 northwestern portion of the San Gorgonio pass within the northernmost portion of the Peninsular Ranges Geomorphic Province. The San Gorgonio Pass is a tectonic physiographic feature that separates the San Bernardino Mountains of the Transverse Ranges on the north and the San Jacinto Mountains on the south. The San Gorgonio Pass is expressed as a narrow notch that cuts through the mountains into the Colorado Desert to the east. Most of the vicinity is underlain by a thick sequence of terrestrial sediments that rest on the basement comprising igneous-metamorphic rocks. Alluvium sediments have been deposited from Live Oak Creek and tributary channels. Deposits encountered on the subject site during exploratory drilling are discussed in detail in this report.

7. GEOLOGIC HAZARDS

7.1 Faulting and Seismicity

The Peninsular Range has historically been a province of high seismic activity. The nearest faults to the project site are associated with the San Andreas fault system located approximately 5.1 miles from the site. There are no known active fault traces in the project vicinity. Based on mapping and historical seismicity, the seismicity of the Peninsular Range has been generally high by the scientific community.

The site is not located within the Alquist-Priolo Earthquake Fault zone (AP 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 E.

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 34.0288° North; site longitude is 117.1151° 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, M_w
S. San Andreas; PK+CH+CC+BB+NM+SM+NSB+SSB+BG+CO	5.1	8.2
San Jacinto; SBV+SJV+A+CC+B+SM	5.3	7.9
San Jacinto; SBV	7.1	7.1
San Jacinto, A+CC+B+SM	9.5	7.6
S. San Andreas; PK+CH+CC+BB+NM+SM+NSB	10.4	8.0
Cleghorn	18.3	6.8
S. San Andreas; BG+CO	18.7	7.4
Cucamonga	21.5	6.7
North Frontal (West)	21.8	7.2
Pinto Mtn	22.7	7.3

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 for 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 0.65g (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 of 50½ feet on the project site consisted predominately of sandy silt with various amounts of clay and silty sand with various amounts of clay and gravel. Groundwater was not encountered during this investigation. Low to very low cohesion strength is associated with the sandy soil. 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 condition. Therefore, no mitigation measures are warranted.

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 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 soil profile was performed.

For the analysis, a maximum earthquake magnitude of 8.2 M_w and a peak horizontal ground surface acceleration of 0.65g (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 0.47 inch. The seismic settlement analysis is included in Appendix A.

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 potential for liquefaction, we judge the likelihood of lateral spreading to be 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 not located within a coastal area. Therefore, tsunamis (seismic sea waves) are not 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 consisted of up to 10½ feet of fill material underlain by alluvium deposits of stiff to very stiff sandy silt with various amounts of clay and loose to very dense silty sand with various amounts of clay and gravel. The fill consisted of medium dense to very dense silty sand with varying amounts of clay and gravel, and very stiff to hard sandy silt with various amounts of clay.

Thicker fill soils may be present onsite between our test boring locations. Limited testing was performed on the fill soils during the time of our field and laboratory investigations. The limited testing indicates that some compaction effort had been applied to the fill soils during placement. However, the consistency of the fills should be verified during site construction. Prior to fill placement, Salem Engineering Group, Inc. should inspect the bottom of the excavation to verify no additional excavation will be required. Verification of the extent of fill should be determined during site grading.

Based on available information and current site conditions, it appears the fill was associated with previous grading operations performed within portions of the site. It's unclear whether or not the fill has been certified. If the fill was placed with inspection and testing, it's recommended any compaction reports related to the fill placement be provided to us for an evaluation.

Based on the laboratory test results, the fill had a relative compaction of 84.8 to 97.6 percent of the anticipated maximum dry density based on ASTM D1557-07 Test Method with moisture content of 3.6 to 11.3%.

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.

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 2014 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 19.3.1.1 and 19.3.2.1 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

Water Soluble Sulfate (SO_4) in Soil, % by Weight	Exposure Severity	Exposure Class	Maximum w/cm Ratio	Min. Concrete Compressive Strength	Cementations Materials Type
0.0050	Not Applicable	S0	N/A	2,500 psi	No Restriction

The water-soluble chloride concentration detected in saturation extract from the soil samples was 49 mg/kg. This level of chloride concentration is not considered to be severely corrosive.

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.

8.4 Percolation Testing

Six percolation tests (P-3 through P-8) were performed within assumed infiltration areas and were conducted in accordance with the guidelines established by the County of San Bernardino. The approximate locations of the percolation tests are shown on the attached Site Plan, Figure 2.

The boreholes were advanced to the depths shown on the percolation test worksheets. The holes were pre-saturated before percolation testing commenced. Percolation rates were measured by filling the test holes with clean water and measuring the water drops at a certain time interval. The difference in the percolation rates are reflected by the varied type of soil materials at the bottom of the test holes. The test results are shown on the table below.

PERCOLATION TEST RESULTS

Test No.	Depth (feet)	Measured Percolation Rate (min/inch)	Infiltration Rate* (inch/hour)	Soil Type
P-3	2	31.3	0.30	Silty SAND (SM)
P-4	2	22.7	0.43	Silty SAND (SM)
P-5	10	125.0	0.03	Silty SAND (SM)
P-6	9.5	25.0	0.40	Silty SAND (SM)
P-7	9	27.8	0.18	Silty SAND (SM)
P-8	9.8	27.8	0.11	Silty SAND (SM)

*** Tested infiltration Rate = $(\Delta H\ 60\ r) / (\Delta t(r + 2H_{avg}))$**

The soil infiltration or percolation rates are based on tests conducted with clear water. The infiltration/percolation rates may vary with time as a result of soil clogging from water impurities. The infiltration/percolation rates will deteriorate over time due to the soil conditions.

The soils may also become less permeable to impermeable if the soil is compacted. Thus, periodic maintenance consisting of clearing the bottom of the drainage system of clogged soils should be expected. The infiltration/percolation rate may become slower if the surrounding soil is wet or saturated due to prolonged rainfalls. Additional percolation tests should be conducted at bottom of the drainage system during construction to verify the infiltration/percolation rate. Groundwater, if closer to the bottom of the drainage system, will also reduce the infiltration/percolation rate.

The scope of our services did not include a groundwater study and was limited to the performance of percolation testing and soil profile description, and the submitted data only. Our services did not include those associated with septic system design. Neither did services include an Environmental Site Assessment for the presence or absence of hazardous and/or toxic materials in the soil, groundwater, or atmosphere; or the presence of wetlands. Any statements, or absence of statements, in this report or on any boring logs regarding odors, unusual or suspicious items, or conditions observed, are strictly for descriptive purposes and are not intended to convey engineering judgment regarding potential hazardous and/or toxic assessment.

The geotechnical engineering information presented herein is based upon professional interpretation utilizing standard engineering practices. The work conducted through the course of this investigation, including the preparation of this report, has been performed in accordance with the generally accepted standards of geotechnical engineering practice, which existed in the geographic area at the time the report was written. No other warranty, express or implied, is made.

Please be advised 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.

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. 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.

9.1.2 The primary geotechnical constraints identified in our investigation is the presence of fill materials and the potentially compressible (collapsible) soils at the site. Recommendations to mitigate the effects of these soils are provided in this report.

9.1.3 Up to 10½ feet of fill soils were encountered in our borings. Thicker fill soils may be present onsite between our test boring locations. Limited testing was performed on the fill soils during the time of our field and laboratory investigations. The limited testing indicates that some compaction effort had been applied to the fill soils during placement. However, the consistency of the fills should be verified during site construction. Prior to fill placement, Salem Engineering Group, Inc. should inspect the bottom of the excavation to verify no additional excavation will be required. Any loose or undocumented fill soils encountered during construction should be replaced with Engineered Fill.

9.1.4 The scope of our services for the investigation does not include a slope stability evaluation of the site. Slopes should be constructed in accordance with the typical figures and details as shown in the General Earthwork and Pavement Specifications, Appendix C (i.e. Stabilization Fill, Buttress Fill, Daylight Shear key, Shear Key, Fill Slope above Natural Ground, Fill Slope Above Cut Slope, Backdrain, Geofabric Subdrain, Benching for Compacted Fill, Rock Disposal, Canyon Subdrain and Transition Lot).

9.1.5 Where fill slopes are to be constructed on original ground that slopes steeper than 6:1 (horizontal to vertical), the ground should be stepped or benched. The benches should be cut into the dense slope as the grading operations proceed. The first bench (base or key bench) should be at least 15 feet wide. Each bench should consist of a minimum 8 feet wide of level terrace, with the rise to the next bench held for 4 feet or less.

9.1.6 The horizontal distance between the outer edges of the footing bottom and the adjacent slope face should be at least 10 feet.

9.1.7 To reduce the erosion of graded slopes, it is recommended that all slopes be planted with ground cover vegetation and deep rooted vegetation as soon as practical. The proper maintenance of proper lot drainage and vegetation should be performed. Over-irrigation should be prevented. A rodent control program should be established and maintained.

9.1.8 All surface runoff should be directed away from the slope and toward approved drainage devices.

9.1.9 Site demolition activities shall include removal of all 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 suspected that possible 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.

9.1.10 Surface vegetation consisting of grasses and other similar vegetation should be removed by stripping to a sufficient depth to remove organic-rich topsoil. The upper 6 to 10 inches of the soils containing, 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. The stripped vegetation, 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.

9.1.11 The near-surface onsite soils are moisture-sensitive and are moderately to highly compressible (collapsible soil) under saturated conditions. Proposed structures may experience excessive post-construction settlement, when the foundation soils become near saturated. The collapsible or weak soils should be removed and recompacted according to the recommendations in the Grading section of this report (Section 9.5).

9.1.12 Based on the subsurface conditions at the site and the anticipated structural loading, we anticipate that the proposed structures may be supported using conventional shallow foundations provided that the recommendations presented herein are incorporated in the design and construction of the project.

9.1.13 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 and seismic loading utilizing conventional shallow foundations for the proposed building will be within 1½ inches and corresponding differential settlement will be less than ¾ inch over 20 feet.

9.1.14 All references to relative compaction and optimum moisture content in this report are based on ASTM D 1557 (latest edition).

9.1.15 SALEM shall review the project grading and foundation plans prior to final design submittal to assess whether our recommendations have been properly implemented and evaluate if additional analysis and/or recommendations are required. If SALEM is not provided plans and specifications for review, we cannot assume any responsibility for the future performance of the project.

9.1.16 SALEM shall be present at the site during site demolition and preparation to observe site clearing/demolition, preparation of exposed surfaces after clearing, and placement, treatment and compaction of fill material.

9.1.17 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.

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
SEISMIC DESIGN PARAMETERS

Seismic Item	Symbol	Value	2010 ASCE 7 or 2016 CBC Reference
Site Coordinates (Datum = NAD 83)		34.0288 Lat -117.1151 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	0.65 g	ASCE 7 Equation 11.8-1
Seismic Design Category	SDC	E	ASCE 7 Table 11.6-1 & 2
Mapped Spectral Acceleration (Short period - 0.2 sec)	S_S	1.616 g	CBC Figure 1613.3.1(1-6)
Mapped Spectral Acceleration (1.0 sec. period)	S_1	0.764 g	CBC Figure 1613.3.1(1-6)
Site Class Modified Site Coefficient	F_a	1.000	CBC Table 1613.3.3(1)
Site Class Modified Site Coefficient	F_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}	1.616 g	CBC Equation 16-37
MCE Spectral Response Acceleration (1.0 sec. period) $S_{M1} = F_v S_1$	S_{M1}	1.145 g	CBC Equation 16-38
Design Spectral Response Acceleration $S_{DS}=\frac{2}{3}S_{MS}$ (short period - 0.2 sec)	S_{DS}	1.077 g	CBC Equation 16-39
Design Spectral Response Acceleration $S_{D1}=\frac{2}{3}S_{M1}$ (1.0 sec. period)	S_{D1}	0.764 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 upper soils can be excavated with moderate to intensive effort using conventional heavy-duty earthmoving 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.

9.3.3 The upper soils are moisture-sensitive and moderately compressible (collapsible) under saturated conditions. 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 considered necessary to reduce anticipated collapse potential. 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 have an expansion index (EI) of less than 30; and do not contain deleterious matter, organic material, or rock material larger than 3 inches in maximum dimension.

9.4.2 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.

9.4.3 Import soil shall be well-graded, slightly cohesive silty fine sand or sandy silt, with relatively impervious characteristics when compacted. A clean sand or very sandy soil is not acceptable for this purpose. This material should be approved by the Engineer prior to use and should typically possess the soil characteristics summarized below in Table 9.4.3.

TABLE 9.4.3
IMPORT FILL REQUIREMENTS

Minimum Percent Passing No. 200 Sieve	20
Maximum Percent Passing No. 200 Sieve	50
Minimum Percent Passing No. 4 Sieve	80
Maximum Particle Size	3"
Maximum Plasticity Index	12
Maximum CBC Expansion Index	20

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 Grading

9.5.1 A SALEM representative should be present during all site clearing and grading operations to test and 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 preparation should begin with removal of existing surface/subsurface structures, underground utilities (as required), any existing uncertified 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.

9.5.4 Surface vegetation consisting of grasses and other similar vegetation should be removed by stripping to a sufficient depth to remove organic-rich topsoil. The upper 2 to 4 inches of the soils containing, 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.

9.5.5 Medium- to large- trees were present on the western boundary of 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 ½ 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.

9.5.6 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.

9.5.7 To minimize post-construction soil movement and provide uniform support for the proposed buildings, it is recommended that the overexcavation and recompaction within the proposed building area be performed to a minimum depth of **three (3)** feet below existing grade or **three (3)** feet below proposed footing bottom, whichever is deeper. The overexcavation and recompaction should also extend laterally to a minimum of 5 feet beyond the building area.

9.5.8 Within pavement and canopy areas, it is recommended that the overexcavation and recompaction be performed to a minimum depth of **one (1) foot** below existing grade or proposed grade, whichever is deeper. The overexcavation and recompaction should also extend laterally to a minimum of 2 feet beyond the pavement area.

9.5.9 Final pavement subgrade should be finished to a smooth, unyielding surface. We further 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.

9.5.10 <u>All uncompacted fill materials encountered during grading should be removed and replaced with engineered fill. The actual depth of the overexcavation and recompaction should be determined by our field representative during construction.</u>

9.5.11 <u>Up to 10½ feet of fill soils were encountered in our borings. Thicker fill soils may be present onsite between our test boring locations. Limited testing was performed on the fill soils during the time of our field and laboratory investigations. The limited testing indicates that some compaction effort had been applied to the fill soils during placement. However, the consistency of the fills should be verified during site construction.</u>

9.5.12 Prior to placement of fill soils, the upper 8 to 10 inches of native subgrade soils should be scarified, moisture-conditioned to **<u>no less</u>** than the optimum moisture content and recompacted to a minimum of 95 percent of the maximum dry density based on ASTM D1557-07 Test Method.

9.5.13 All Engineered Fill (including scarified ground surfaces and backfill) should be placed in thin lifts to allow for adequate bonding and compaction (typically 6 to 8 inches in loose thickness).

9.5.14 All Engineered Fill soils should be placed, moisture conditioned to near optimum moisture content, and compacted to at least 95% relative compaction.

9.5.15 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.

9.5.16 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.

9.5.17 We do not anticipate groundwater or seepage to adversely affect construction if conducted during the drier moths 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.

9.5.18 The soils, during wet winter months, may become very 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. The wet soils may become non conducive to site grading as the upper soils yield under the weight of the construction equipment. Therefore, mitigation measures should be performed for stabilization.

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 ¾-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 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 structure should be continuous with a minimum width of 15 inches and extend to a minimum depth of 18 inches below the lowest adjacent grade. Isolated column footings should have a minimum width of 24 inches and extend a minimum depth of 18 inches below the lowest adjacent grade.

9.6.3 The bottom of footing excavations should be maintained free of loose and disturbed soil. Footing concrete should be placed into a neat excavation.

9.6.4 Footings proportioned as recommended above may be designed for the maximum allowable soil bearing pressures shown in the table below.

Loading Condition	Allowable Bearing
Dead Load Only	2,500 psf
Dead-Plus-Live Load	3,000 psf
Total Load, Including Wind or Seismic Loads	4,000 psf

9.6.5 For design purposes, total settlement due to static and seismic loadings on the order of 1½ inch may be assumed for shallow footings. Differential settlement due to static and seismic loadings, along a 20-foot exterior wall footing or between adjoining column footings, should be ¾ inch, producing an angular distortion of 0.003. 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 0.45 acting between the base of foundations and the supporting native subgrade.

9.6.7 Lateral resistance for footings can alternatively be developed using an equivalent fluid passive pressure of 450 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 2016 CBC that includes wind or earthquake loads.

9.6.8 Minimum reinforcement for continuous footings should consist of four No. 4 steel reinforcing bars; two placed near the top of the footing and two near the bottom. Reinforcement for spread footings should be designed by the project structural engineer.

9.6.9 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.

9.6.10 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 Concrete Slabs-on-Grade

9.7.1 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.

9.7.2 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 or its approved equivalent to prevent capillary moisture rise.

9.7.3 The use of processed asphalt in the granular aggregate subbase material (i.e. recycled or miscellaneous base) will have to be approved by the owner. Asphalt is a petroleum hydrocarbon with numerous components, including naphthalene and other semi-volatile constituents that are regulated by California. This material in the subsurface could become a potential vapor intrusion risk (naphthalene is a recent risk-driver that DTSC is actively pursuing).

9.7.4 We recommend reinforcing slabs, at a minimum, with No. 3 reinforcing bars placed 18 inches on center, each way.

9.7.5 Slabs subject to structural loading may be designed utilizing a modulus of subgrade reaction K of 200 pounds per square inch per inch. The K value was approximated based on inter-relationship of soil classification and bearing values (Portland Cement Association, Rocky Mountain Northwest).

9.7.6 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.

9.7.7 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.

9.7.8 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.

9.7.9 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.

9.7.10 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.

9.7.11 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.

9.7.12 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.

9.7.13 Proper finishing and curing should be performed in accordance with the latest guidelines provided by the American Concrete Institute, Portland Cement Association, and ASTM.

9.8 Lateral Earth Pressures and Frictional Resistance

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

Lateral Pressures Drained and Level Backfill Conditions	**Equivalent Fluid Pressure, pcf**
Active Pressure	32
At-Rest Pressure	50
Passive Pressure	450
Related Parameters	
Allowable Coefficient of Friction	0.45
In-Place Soil Density (lbs/ft^3)	120

9.8.2 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.

9.8.3 The top one-foot of adjacent subgrade should be deleted from the passive pressure computation.

9.8.4 The foregoing values of lateral earth pressures represent equivalent soil values and a safety factor consistent with the design conditions should be included in their usage.

9.8.5 For stability against lateral sliding, which is resisted solely by the passive pressure, we recommend a minimum safety factor of 1.5.

9.8.6 For stability against lateral sliding, which is resisted by the combined passive and frictional resistance, a minimum safety factor of 2.0 is recommended.

9.8.7 For lateral stability against seismic loading conditions, we recommend a minimum safety factor of 1.1.

9.8.8 For dynamic seismic lateral loading the following equation shall be used:

Dynamic Seismic Lateral Loading Equation
Dynamic Seismic Lateral Load = $\frac{3}{8}\gamma K_h H^2$
Where: γ = In-Place Soil Density
K_h = Horizontal Acceleration = $\frac{2}{3}PGA_M$
H = Wall Height

9.9 Retaining Walls

9.9.1 Retaining and/or below grade walls should be drained with either perforated pipe encased in free-draining 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.

9.9.2 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.

9.9.3 Drainage pipes should be placed with perforations down and should discharge in a non-erosive manner away from foundations and other improvements. 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 ¼-inch in diameter.

9.9.4 If retaining walls are less than 5 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.

9.9.5 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.

9.10 Temporary Excavations

9.10.1 We anticipate that the majority of the sandy 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.

9.10.2 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.

9.10.3 Temporary excavations and slope faces should be protected from rainfall and erosion. Surface runoff should be directed away from excavations and slopes.

9.10.4 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	2:1

9.10.5 If, due to space limitation, excavations near property lines or existing structures are performed in a vertical position, slot cuts, 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.

9.10.6 Braced shorings should be designed for a maximum pressure distribution of 30H, (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.

9.10.7 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.

9.11 Underground Utilities

9.11.1 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.

9.11.2 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.

9.11.3 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.

9.11.4 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.

9.12 Surface Drainage

9.12.1 Proper surface drainage is critical to the future performance of the project. Uncontrolled infiltration of irrigation excess and storm runoff 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.

9.12.2 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.

9.12.3 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.

9.12.4 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.

9.13 Pavement Design

9.13.1 Based on site soil conditions, an R-value of 45 was used for the preliminary flexible asphaltic concrete pavement design. The R-value may be verified during grading of the pavement areas.

9.13.2 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 9.13.2
ASPHALT CONCRETE PAVEMENT

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

*****95% compaction based on ASTM D1557 Test Method***

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

TABLE 9.13.3
PORTLAND CEMENT CONCRETE PAVEMENT

Traffic Index	Portland Cement Concrete*	Class II Aggregate Base**	Compacted Subgrade**
5.0 (Light Duty)	5.0"	4.0"	12.0"
6.0 (Heavy Duty)	6.0"	4.0"	12.0"

**** Minimum Compressive Strength of 4,000 psi***
***** 95% compaction based on ASTM D1557 Test Method***

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 2. 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 (909) 980-6455.

Respectfully Submitted,

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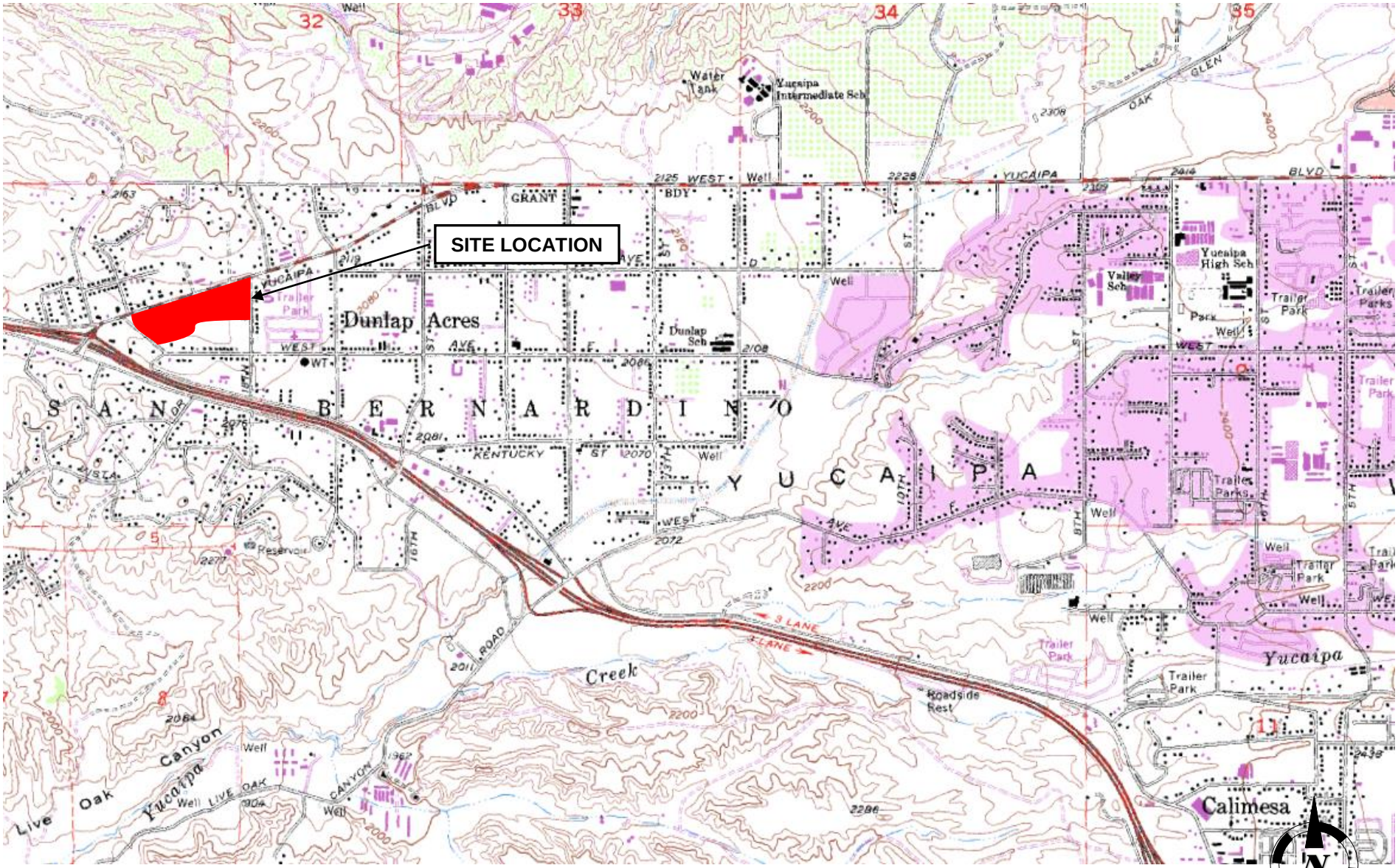


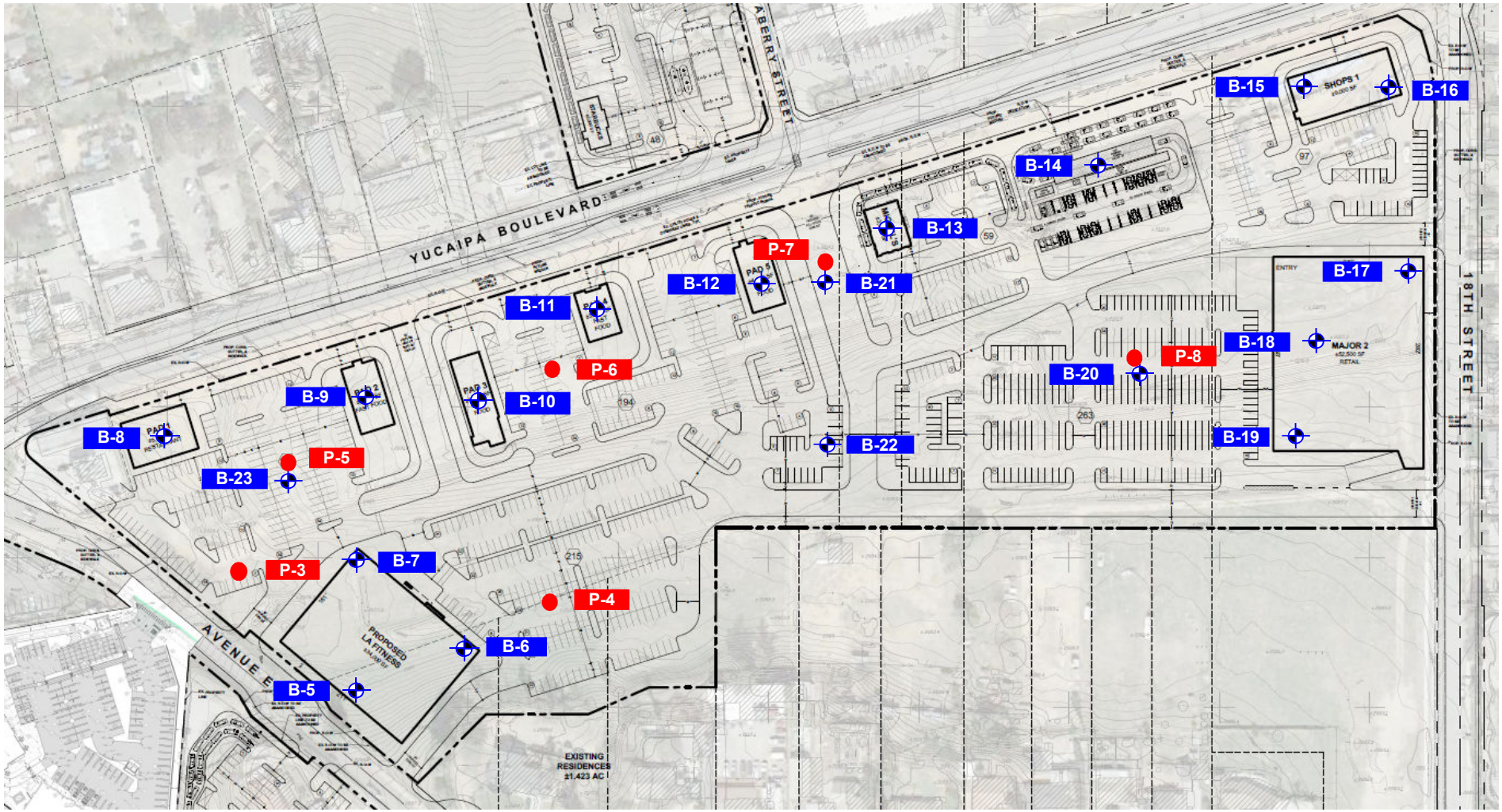
Source Image: U.S. Geological Survey Yucaipa, California 34117-A1-TF-024, 1967 (Photorevised 1988)

VICINITY MAP

GEOTECHNICAL ENGINEERING INVESTIGATION
Proposed Commercial Development
SWC Yucaipa Boulevard and 18th Street
Yucaipa, California

SCALE:	DATE:
NOT TO SCALE	08/2018
DRAWN BY: JC	APPROVED BY: CJ
PROJECT NO. 3-218-0666B	FIGURE NO. 1

SALEM engineering group, inc.



SITE PLAN

Geotechnical Engineering Investigation
Proposed Commercial Development
SWC Yucaipa Boulevard & 18th Street
Yucaipa, California

SCALE:	DATE:
NOT TO SCALE	08/2018
DRAWN BY: JC	APPROVED BY: II
PROJECT NO. 3-218-0666B	FIGURE NO. 2

LEGEND:

B-1 Soil Boring Locations
P-1 Percolation Locations

All Locations Approximate

SALEM engineering group, inc.

APPENDIX

A

APPENDIX A
FIELD EXPLORATION

Fieldwork for our investigation (drilling) was conducted on August 1 through August 3, 2018 and included a site visit, subsurface exploration, and soil sampling. Percolation testing was performed on August 2 and August 3, 2018. The locations of the exploratory borings and percolation tests are shown on the Site Plan, Figure 2. 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.

In general, our borings were performed using a truck-mounted CME 55 drill rig equipped with a 6-inch diameter hollow stem auger and a 4-inch solid flight auger. Sampling in the borings was accomplished using a hydraulic 140-pound hammer with a 30-inch drop. Samples were obtained with a 3-inch outside-diameter (OD), split spoon (California Modified) sampler, and a 2-inch OD, Standard Penetration Test (SPT) sampler. The number of blows required to drive the sampler the last 12 inches (or fraction thereof) of the 18-inch sampling interval were recorded on the boring logs. The blow counts shown on the boring logs should not be interpreted as standard SPT "N" values; corrections have not been applied. Upon completion, the borings were backfilled with drill cuttings.

Subsurface conditions encountered in the exploratory borings were visually examined, classified and logged in general accordance with the American Society for Testing and Materials (ASTM) Practice for Description and Identification of Soils (Visual-Manual Procedure D2488). This system uses the Unified Soil Classification System (USCS) for soil designations. The logs depict soil and geologic conditions encountered and depths at which samples were obtained. The logs also include our interpretation of the conditions between sampling intervals. Therefore, the logs contain both observed and interpreted data. We determined the lines designating the interface between soil materials on the logs using visual observations, drill rig penetration rates, excavation characteristics and other factors. The transition between materials may be abrupt or gradual. Where applicable, the field logs were revised based on subsequent laboratory testing.

Unified Soil Classification System

Major Divisions			Letter	Symbol	Description
Coarse-grained Soils More than ½ retained on the No. 200 Sieve	**Gravels** More than ½ coarse fraction retained on the No. 4 sieve	Clean Gravels	GW		Well-graded gravels and gravel-sand mixtures, little or no fines.
			GP		Poorly-graded gravels and gravel-sand mixtures, little or no fines.
		Gravels With Fines	GM		Silty gravels, gravel-sand-silt mixtures.
			GC		Clayey gravels, gravel-sand-clay mixtures.
	Sands More than ½ passing through the No. 200 sieve	Clean Sands	SW		Well-graded sands and gravelly sands, little or no fines.
			SP		Poorly-graded sands and gravelly sands, little or no fines.
		Sands With Fines	SM		Silty sands, sand-silt mixtures
			SC		Clayey sands, sandy-clay mixtures.
Fine-grained Soils More than ½ passing through the No. 200 Sieve	**Silts and Clays** Liquid Limit less than 50%		ML		Inorganic silts, very fine sands, rock flour, silty or clayey fine sands.
			CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
			OL		Organic clays of medium to high plasticity.
	Silts and Clays Liquid Limit greater than 50%		MH		Inorganic silts, micaceous or diatomaceous fines sands or silts, elastic silts.
			CH		Inorganic clays of high plasticity, fat clays.
			OH		Organic clays of medium to high plasticity.
Highly Organic Soils			PT		Peat, muck, and other highly organic soils.

Consistency Classification

Granular Soils			***Cohesive Soils***		
Description - Blows Per Foot (Corrected)			Description - Blows Per Foot (Corrected)		
	MCS	SPT		MCS	SPT
Very loose	<5	<4	Very soft	<3	<2
Loose	5 – 15	4 – 10	Soft	3 – 5	2 – 4
Medium dense	16 – 40	11 – 30	Firm	6 – 10	5 – 8
Dense	41 – 65	31 – 50	Stiff	11 – 20	9 – 15
Very dense	>65	>50	Very Stiff	21 – 40	16 – 30
			Hard	>40	>30

MCS = Modified California Sampler

SPT = Standard Penetration Test Sampler

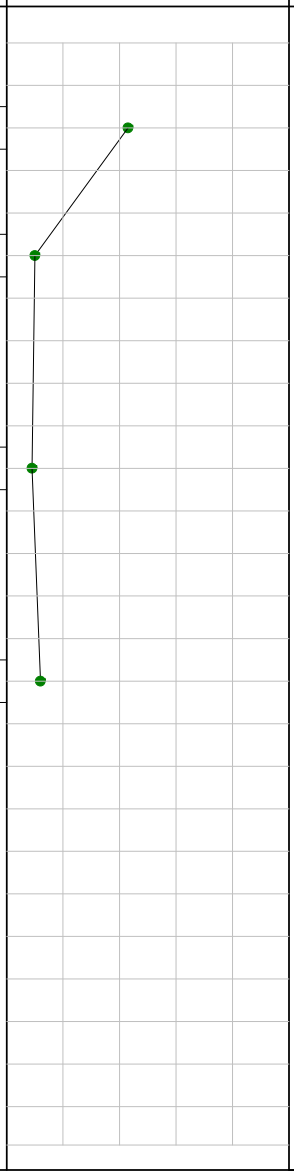
Boring No. B-5

Project: Proposed Commercial Development
Client: VantageOne Real Estate Investments, LLC
Location: SWC Yucaipa Boulevard & 18th Street, Yucaipa, California
Grnd. Surf. Elev. (Ft. MSL) -

Depth to Water>

Project No: 3-218-0666B
Figure No.: A-5
Logged By: II
Initial: -
At Completion: -

SUBSURFACE PROFILE			SAMPLE						
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture Content (%)	Sampler Type	Penetration	Blow Count	Penetration Test (20 40 60 80)	Water Level
		Ground Surface							
0		**Silty SAND (SM)** Dense; slightly moist; dark brown; fine to medium grain sand.	130.5	7.4	MCS		43		
5		Grades as above; loose; moist; reddish brown.	116.2	8.6	MCS		10		
10		Grades as above.	-	9.4	SPT		9		
15		Grades as above; medium dense.	-	8.0	SPT		12		
		End of Borehole							
20									
25									



Drill Method: Solid Flight
Drill Rig: CME 55
Driller: SALEM
Sheet: 1 of 1

Drill Date: 8/2/18
Borehole Size: 4 in.
Hammer Type: Automatic Trip
Weight & Drop: 140 lb/30 in

SALEM

Boring No. B-6

Project: Proposed Commercial Development
Client: VantageOne Real Estate Investments, LLC
Location: SWC Yucaipa Boulevard & 18th Street, Yucaipa, California
Grnd. Surf. Elev. (Ft. MSL) -

Depth to Water>

Project No: 3-218-0666B
Figure No.: A-6
Logged By: II
Initial: -
At Completion: -

SUBSURFACE PROFILE			SAMPLE						
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture Content (%)	Sampler Type	Penetration	Blow Count	Penetration Test (20 40 60 80)	Water Level
		Ground Surface							
0		**Silty SAND (SM)** Dense; moist; dark brown; fine to medium grain sand.	116.8	6.6	MCS		41		
5		Grades as above; reddish brown.	129.8	7.7	MCS		58		
10		Grades as above; medium dense; trace clay.	-	9.1	SPT		13		
15		Grades as above; no clay.	-	9.2	SPT		26		
		End of Borehole							
20									
25									

Drill Method: Solid Flight
Drill Rig: CME 55
Driller: SALEM
Sheet: 1 of 1

Drill Date: 8/2/18
Borehole Size: 4 in.
Hammer Type: Automatic Trip
Weight & Drop: 140 lb/30 in

SALEM

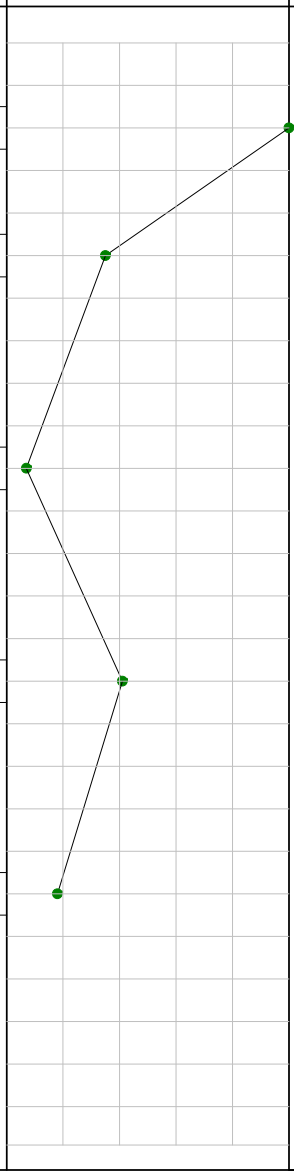
Boring No. B-7

Project: Proposed Commercial Development
Client: VantageOne Real Estate Investments, LLC
Location: SWC Yucaipa Boulevard & 18th Street, Yucaipa, California
Grnd. Surf. Elev. (Ft. MSL) -

Depth to Water>

Project No: 3-218-0666B
Figure No.: A-7
Logged By: II
Initial: -
At Completion: -

SUBSURFACE PROFILE			SAMPLE						
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture Content (%)	Sampler Type	Penetration	Blow Count	Penetration Test (20 40 60 80)	Water Level
		Ground Surface							
0		**Silty SAND (SM)** Very dense; slightly moist; dark brown; fine to medium grain sand.	134.9	4.4	MCS		111		
5		Grades as above; medium dense; moist; reddish brown.	122.1	7.5	MCS		35		
10		Grades as above; loose.	-	8.1	SPT		7		
15		Grades as above; dense; trace clay.	126.4	8.4	MCS		41		
20		Grades as above; medium dense.	-	9.0	SPT		18		
		End of Borehole							
25									



Drill Method: Solid Flight
Drill Rig: CME 55
Driller: SALEM
Sheet: 1 of 1

Drill Date: 8/2/18
Borehole Size: 4 in.
Hammer Type: Automatic Trip
Weight & Drop: 140 lb/30 in

SALEM

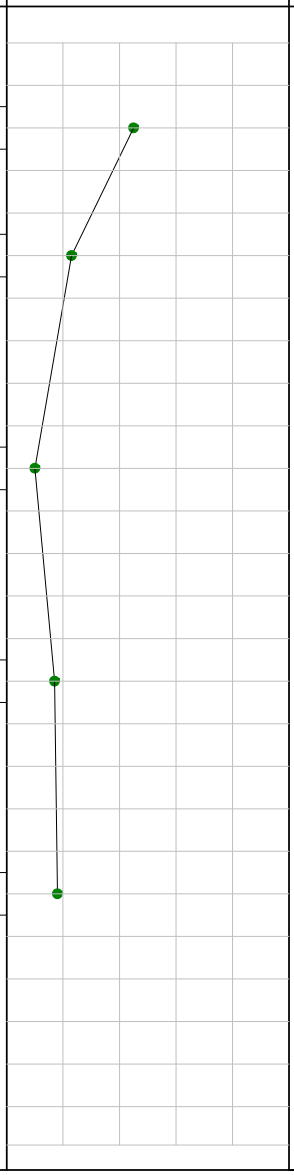
Boring No. B-8

Project: Proposed Commercial Development
Client: VantageOne Real Estate Investments, LLC
Location: SWC Yucaipa Boulevard & 18th Street, Yucaipa, California
Grnd. Surf. Elev. (Ft. MSL) -

Depth to Water>

Project No: 3-218-0666B
Figure No.: A-8
Logged By: SK
Initial: -
At Completion: -

SUBSURFACE PROFILE			SAMPLE						
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture Content (%)	Sampler Type	Penetration	Blow Count	Penetration Test (20 40 60 80)	Water Level
		Ground Surface							
0		**Silty SAND (SM)** Dense; moist; brown; fine to medium grain sand.	127.0	8.1	MCS		45		
5		Grades as above; medium dense.	126.7	8.3	MCS		23		
10		Grades as above.	-	9.1	SPT		10		
15		Grades as above.	-	9.8	SPT		17		
20		Grades as above; with clay.	-	11.3	SPT		18		
		End of Borehole							
25									



Drill Method: Solid Flight
Drill Rig: CME 55
Driller: SALEM
Sheet: 1 of 1

Drill Date: 8/3/18
Borehole Size: 4 in.
Hammer Type: Automatic Trip
Weight & Drop: 140 lb/30 in

SALEM

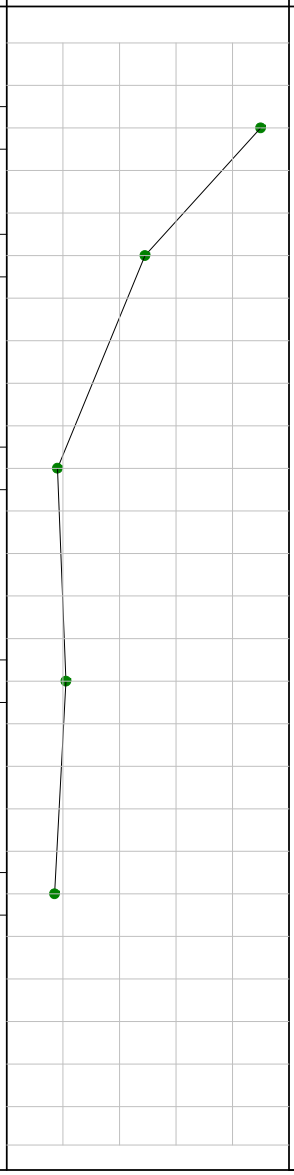
Boring No. B-9

Project: Proposed Commercial Development
Client: VantageOne Real Estate Investments, LLC
Location: SWC Yucaipa Boulevard & 18th Street, Yucaipa, California
Grnd. Surf. Elev. (Ft. MSL) -

Depth to Water>

Project No: 3-218-0666B
Figure No.: A-9
Logged By: SK
Initial: -
At Completion: -

SUBSURFACE PROFILE			SAMPLE						
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture Content (%)	Sampler Type	Penetration	Blow Count	Penetration Test (20 40 60 80)	Water Level
		Ground Surface							
0		**Silty SAND (SM)** **Fill:** Very dense; slightly moist; brown; fine to medium grain sand.	123.1	3.6	MCS		90		
5		**Silty SAND (SM)** medium dense; slightly moist; brown; fine to medium grain sand.	120.9	10.0	MCS		49		
10		Grades as above.	-	9.2	SPT		18		
15		**Sandy SILT (ML)** Very stiff; moist; brown; fine grain sand; with clay.	-	16.4	SPT		21		
20		**Silty SAND (SM)** Medium dense; moist; brown; fine to medium grain sand; trace clay.	-	9.7	SPT		17		
		End of Borehole							
25									



Drill Method: Solid Flight
Drill Rig: CME 55
Driller: SALEM
Sheet: 1 of 1

Drill Date: 8/3/18
Borehole Size: 4 in.
Hammer Type: Automatic Trip
Weight & Drop: 140 lb/30 in

SALEM

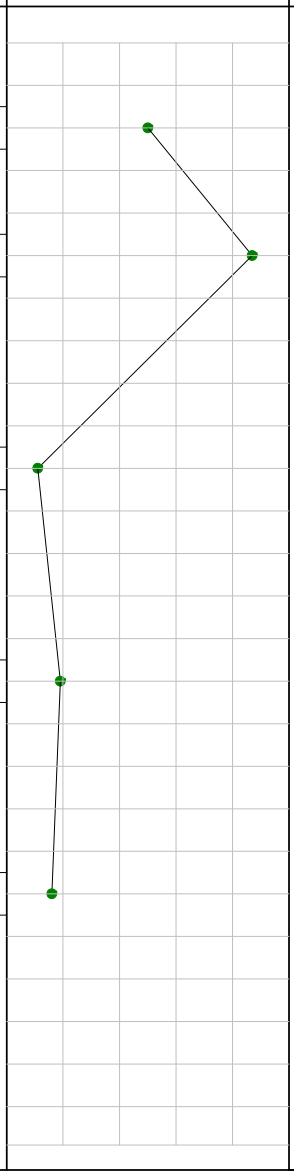
Boring No. B-10

Project: Proposed Commercial Development
Client: VantageOne Real Estate Investments, LLC
Location: SWC Yucaipa Boulevard & 18th Street, Yucaipa, California
Grnd. Surf. Elev. (Ft. MSL) -

Depth to Water>

Project No: 3-218-0666B
Figure No.: A-10
Logged By: SK
Initial: -
At Completion: -

SUBSURFACE PROFILE			SAMPLE						
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture Content (%)	Sampler Type	Penetration	Blow Count	Penetration Test (20 40 60 80)	Water Level
		Ground Surface							
0		**Silty SAND (SM)** **Fill:** Very dense; slightly moist; brown; fine to medium grain sand; trace gravel.	118.4	3.6	MCS		50		
5		Grades as above; with gravel.	123.2	4.3	MCS		87		
		Silty SAND (SM) Medium dense; moist; dark brown; no gravel; trace clay.							
10			-	11.6	SPT		11		
15		Grades as above.	-	9.2	SPT		19		
20		Grades as above; brown.	-	9.5	SPT		16		
		End of Borehole							
25									



Drill Method: Solid Flight
Drill Rig: CME 55
Driller: SALEM
Sheet: 1 of 1

Drill Date: 8/3/18
Borehole Size: 4 in.
Hammer Type: Automatic Trip
Weight & Drop: 140 lb/30 in

SALEM

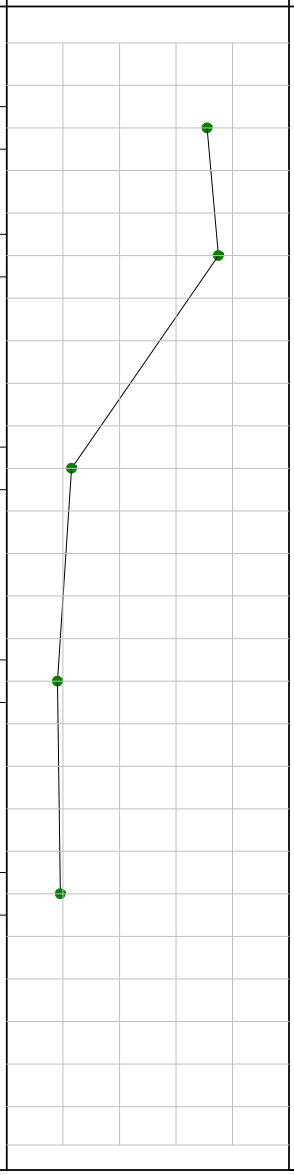
Boring No. B-11

Project: Proposed Commercial Development
Client: VantageOne Real Estate Investments, LLC
Location: SWC Yucaipa Boulevard & 18th Street, Yucaipa, California
Grnd. Surf. Elev. (Ft. MSL) -

Depth to Water>

Project No: 3-218-0666B
Figure No.: A-11
Logged By: SK
Initial: -
At Completion: -

SUBSURFACE PROFILE			SAMPLE						
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture Content (%)	Sampler Type	Penetration	Blow Count	Penetration Test (20 40 60 80)	Water Level
		Ground Surface							
0		**Silty SAND (SM)** **Fill:** Very dense; slightly moist; brown; fine to medium grain sand; trace gravel.	120.3	4.2	MCS		71		
5		Grades as above.	121.7	4.8	MCS		75		
		Silty SAND (SM) Medium dense; moist; dark brown; no gravel.							
10			-	9.1	SPT		23		
15		Grades as above; brown; with clay.	-	11.6	SPT		18		
20		Grades as above.	-	8.1	SPT		19		
		End of Borehole							
25									



Drill Method: Solid Flight
Drill Rig: CME 55
Driller: SALEM
Sheet: 1 of 1

Drill Date: 8/3/18
Borehole Size: 4 in.
Hammer Type: Automatic Trip
Weight & Drop: 140 lb/30 in

SALEM

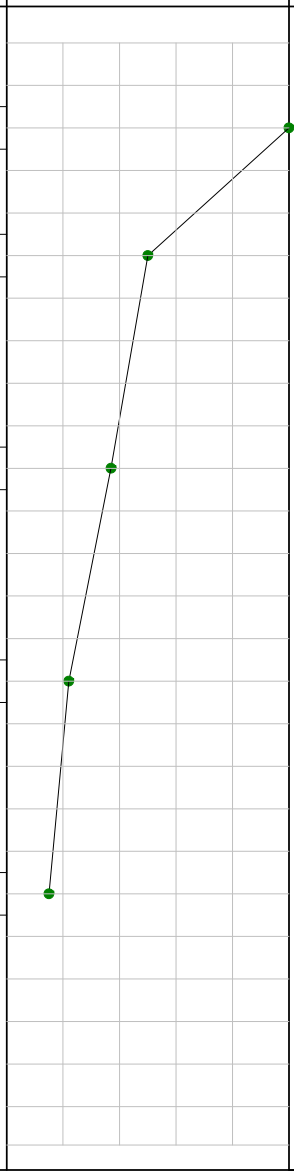
Boring No. B-12

Project: Proposed Commercial Development
Client: VantageOne Real Estate Investments, LLC
Location: SWC Yucaipa Boulevard & 18th Street, Yucaipa, California
Grnd. Surf. Elev. (Ft. MSL) -

Depth to Water>

Project No: 3-218-0666B
Figure No.: A-12
Logged By: SK
Initial: -
At Completion: -

SUBSURFACE PROFILE			SAMPLE						
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture Content (%)	Sampler Type	Penetration	Blow Count	Penetration Test (20 40 60 80)	Water Level
		Ground Surface							
0		**Silty SAND (SM)** **Fill:** Very dense; slightly moist; brown; fine to medium grain sand; trace gravel.	119.9	4.0	MCS		106		
5		Grades as above.	112.0	3.6	MCS		50		
		Silty SAND (SM) Medium dense; slightly moist; brown; fine to medium grain sand; trace gravel.							
10			-	5.8	SPT		37		
15		Grades as above; medium dense; moist; trace clay.	-	8.3	SPT		22		
20		Grades as above.	-	7.5	SPT		15		
		End of Borehole							
25									



Drill Method: Solid Flight
Drill Rig: CME 55
Driller: SALEM
Sheet: 1 of 1

Drill Date: 8/3/18
Borehole Size: 4 in.
Hammer Type: Automatic Trip
Weight & Drop: 140 lb/30 in

SALEM

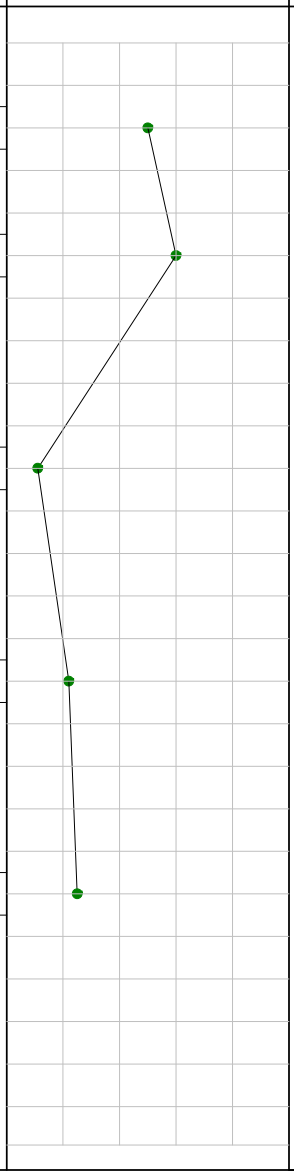
Boring No. B-13

Project: Proposed Commercial Development
Client: VantageOne Real Estate Investments, LLC
Location: SWC Yucaipa Boulevard & 18th Street, Yucaipa, California
Grnd. Surf. Elev. (Ft. MSL) -

Depth to Water>

Project No: 3-218-0666B
Figure No.: A-13
Logged By: II
Initial: -
At Completion: -

SUBSURFACE 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		Ground Surface							
		Silty SAND (SM) **Fill:** Dense; moist; reddish brown; fine to medium grain sand; trace clay.	124.1	7.4	MCS		50		
5		Grades as above; very dense; slightly moist.	116.2	4.6	MCS		60		
		Silty SAND (SM) Medium dense; moist; reddish brown; fine to medium grain sand; trace clay.							
10			-	8.2	SPT		11		
15		Grades as above.	-	9.2	SPT		22		
20		Grades as above.	-	9.2	SPT		25		
		End of Borehole							
25									



Drill Method: Solid Flight
Drill Rig: CME 55
Driller: SALEM
Sheet: 1 of 1

Drill Date: 8/2/18
Borehole Size: 4 in.
Hammer Type: Automatic Trip
Weight & Drop: 140 lb/30 in

SALEM

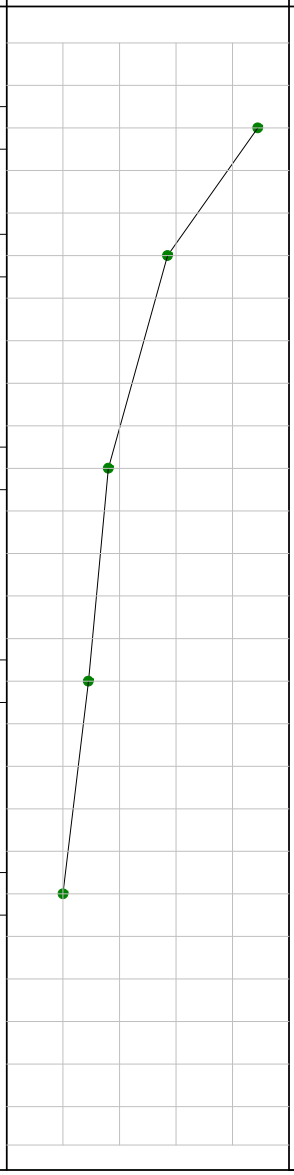
Boring No. B-14

Project: Proposed Commercial Development
Client: VantageOne Real Estate Investments, LLC
Location: SWC Yucaipa Boulevard & 18th Street, Yucaipa, California
Grnd. Surf. Elev. (Ft. MSL) -

Depth to Water>

Project No: 3-218-0666B
Figure No.: A-14
Logged By: II
Initial: -
At Completion: -

SUBSURFACE PROFILE			SAMPLE						
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture Content (%)	Sampler Type	Penetration	Blow Count	Penetration Test (20 40 60 80)	Water Level
		Ground Surface							
0		**Silty SAND (SM)** **Fill:** Very dense; slightly moist; reddish brown; fine to medium grain sand; trace clay.	122.3	4.2	MCS		89		
5		Grades as above; dense; moist.	128.4	9.1	MCS		57		
		Silty SAND (SM) Medium dense; moist; reddish brown; fine to medium grain sand; trace clay							
10			119.8	8.2	MCS		36		
15		Grades as above; slightly moist; brown; weathered.	-	6.1	SPT		29		
20		Grades as above; slightly moist.	-	4.3	SPT		20		
		End of Borehole							
25									



Drill Method: Solid Flight
Drill Rig: CME 55
Driller: SALEM
Sheet: 1 of 1

Drill Date: 8/2/18
Borehole Size: 4 in.
Hammer Type: Automatic Trip
Weight & Drop: 140 lb/30 in

SALEM

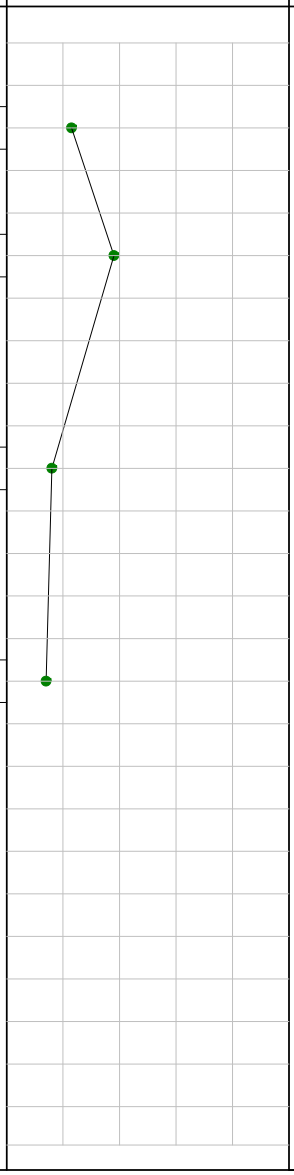
Boring No. B-15

Project: Proposed Commercial Development
Client: VantageOne Real Estate Investments, LLC
Location: SWC Yucaipa Boulevard & 18th Street, Yucaipa, California
Grnd. Surf. Elev. (Ft. MSL) -

Depth to Water>

Project No: 3-218-0666B
Figure No.: A-15
Logged By: II
Initial: -
At Completion: -

SUBSURFACE PROFILE			SAMPLE						
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture Content (%)	Sampler Type	Penetration	Blow Count	Penetration Test (20 40 60 80)	Water Level
		Ground Surface							
0		**Silty SAND (SM)** Medium dense; slightly moist; reddish brown; fine grain sand.	109.4	5.5	MCS		23		
5		**Sandy SILT (ML)** Very stiff; moist; reddish brown; fine grain sand; with clay.	114.5	12.1	MCS		38		
		Silty SAND (SM) Medium dense; moist; light brown; fine to meidum grain sand.							
10			-	7.7	SPT		16		
		Sandy SILT (ML) Stiff; very moist; brown; fine grain sand; with clay.							
15			-	23.1	SPT		14		
		End of Borehole							
20									
25									



Drill Method: Solid Flight
Drill Rig: CME 55
Driller: SALEM
Sheet: 1 of 1

Drill Date: 8/2/18
Borehole Size: 4 in.
Hammer Type: Automatic Trip
Weight & Drop: 140 lb/30 in

SALEM

Boring No. B-16

Project: Proposed Commercial Development
Client: VantageOne Real Estate Investments, LLC
Location: SWC Yucaipa Boulevard & 18th Street, Yucaipa, California
Grnd. Surf. Elev. (Ft. MSL) -

Depth to Water>

Project No: 3-218-0666B
Figure No.: A-16
Logged By: II
Initial: -
At Completion: -

SUBSURFACE PROFILE			SAMPLE						
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture Content (%)	Sampler Type	Penetration	Blow Count	Penetration Test (20 40 60 80)	Water Level
		Ground Surface							
0		**Silty SAND (SM)** Medium dense; moist; reddish brown; fine grain sand; with clay.	115.3	7.8	MCS		22		
5		Grades as above.	119.8	11.2	MCS		30		
		Sandy SILT (ML) Stiff; very moist; brown; fine grain sand; with clay.							
10			-	19.7	SPT		15		
		Silty SAND (SM) Medium dense; moist; reddish brown; fine to medium grain sand.							
15			-	5.5	SPT		16		
		Sandy SILT (ML) Stiff; very moist; reddish brown; fine grain sand; trace clay.							
20			-	23.8	SPT		14		
		End of Borehole							
25									

Drill Method: Solid Flight
Drill Rig: CME 55
Driller: SALEM
Sheet: 1 of 1

Drill Date: 8/2/18
Borehole Size: 4 in.
Hammer Type: Automatic Trip
Weight & Drop: 140 lb/30 in

SALEM

Boring No. B-17

Project: Proposed Commercial Development
Client: VantageOne Real Estate Investments, LLC
Location: SWC Yucaipa Boulevard & 18th Street, Yucaipa, California
Grnd. Surf. Elev. (Ft. MSL) -

Depth to Water>

Project No: 3-218-0666B
Figure No.: A-17
Logged By: SK
Initial: -
At Completion: -

SUBSURFACE PROFILE			SAMPLE						
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture Content (%)	Sampler Type	Penetration	Blow Count	Penetration Test (20 40 60 80)	Water Level
		Ground Surface							
0		**Silty SAND (SM)** Medium dense; moist; yellowish brown; fine to medium grain sand; trace clay.	102.1	8.7	MCS		30		
5		Grades as above; no clay.	101.1	6.7	MCS		17		
10		**Sandy SILT (ML)** Very stiff; very moist; brown; trace clay.	-	16.4	SPT		20		
15		Grades as above; with clay.	-	23.2	SPT		19		
		End of Borehole							
20									
25									

Drill Method: Solid Flight
Drill Rig: CME 55
Driller: SALEM
Sheet: 1 of 1

Drill Date: 8/1/18
Borehole Size: 4 in.
Hammer Type: Automatic Trip
Weight & Drop: 140 lb/30 in

SALEM

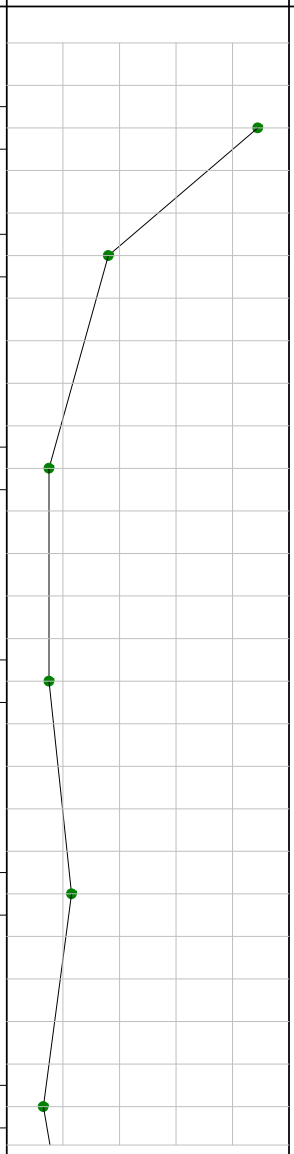
Boring No. B-18

Project: Proposed Commercial Development
Client: VantageOne Real Estate Investments, LLC
Location: SWC Yucaipa Boulevard & 18th Street, Yucaipa, California
Grnd. Surf. Elev. (Ft. MSL) -

Depth to Water>

Project No: 3-218-0666B
Figure No.: A-18
Logged By: II
Initial: -
At Completion: -

Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture Content (%)	Sampler Type	Penetration	Blow Count
		Ground Surface					
0		**Sandy SILT (ML)** **Fill:** hard; moist; dark brown; fine to medium grain sand; with clay. EI=26	124.0	9.0	MCS		89
5		**Silty SAND (SM)** **Fill:** medium dense; moist; reddish brown; fine to medium grain sand; with clay.	119.1	11.3	MCS		36
10		**Sandy SILT (ML)** Stiff; moist; brown; fine grain sand; with clay.	90.9	13.4	MCS		15
15		Grades as above; wet.	-	26.3	SPT		15
20		**Silty SAND (SM)** Medium dense; moist; reddish brown; fine to medium grain sand.	-	7.4	SPT		23
25		**Sandy SILT (ML)** Stiff; wet; reddish brown; fine grain sand; trace clay.	-	28.4	SPT		13



Water Level

Drill Method: Hollow Stem
Drill Rig: CME 55
Driller: SALEM
Sheet: 1 of 2

Drill Date: 8/2/18
Borehole Size: 6 in.
Hammer Type: Automatic Trip
Weight & Drop: 140 lb/30 in

SALEM

Boring No. B-18

Project: Proposed Commercial Development
Client: VantageOne Real Estate Investments, LLC
Location: SWC Yucaipa Boulevard & 18th Street, Yucaipa, California
Grnd. Surf. Elev. (Ft. MSL) -

Depth to Water>

Project No: 3-218-0666B
Figure No.: A-18
Logged By: II
Initial: -
At Completion: -

SUBSURFACE PROFILE			SAMPLE						
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture Content (%)	Sampler Type	Penetration	Blow Count	Penetration Test (20 40 60 80)	Water Level
		Silty SAND (SM) Medium dense; moist; reddish brown; fine to medium grain sand.							
30			-	9.1	SPT		26		
35		Grades as above.	-	8.5	SPT		25		
40		Grades as above.	-	9.8	SPT		21		
45		Grades as above; dense.	-	5.2	SPT		31		
50		Grades as above.	-	8.6	SPT		31		
		End of Borehole							

Drill Method: Hollow Stem
Drill Rig: CME 55
Driller: SALEM
Sheet: 2 of 2

Drill Date: 8/2/18
Borehole Size: 6 in.
Hammer Type: Automatic Trip
Weight & Drop: 140 lb/30 in

SALEM

Boring No. B-19

Project: Proposed Commercial Development
Client: VantageOne Real Estate Investments, LLC
Location: SWC Yucaipa Boulevard & 18th Street, Yucaipa, California
Grnd. Surf. Elev. (Ft. MSL) -

Depth to Water>

Project No: 3-218-0666B
Figure No.: A-19
Logged By: II
Initial: -
At Completion: -

SUBSURFACE PROFILE			SAMPLE						
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture Content (%)	Sampler Type	Penetration	Blow Count	Penetration Test (20 40 60 80)	Water Level
		Ground Surface							
0		**Silty SAND (SM)** Damp; reddish brown; fine to medium grain sand.	106.1	15.3	MCS		30		
		Sandy SILT (ML) Very stiff; moist; light brown; fine grain sand; trace clay.							
5		Grades as above; no clay.	89.9	17.4	MCS		28		
10		Grades as above; stiff; very moist; trace clay.	-	24.0	SPT		12		
15		Grades as above; with clay.	-	22.7	SPT		11		
		End of Borehole							
20									
25									

Drill Method: Hollow Stem
Drill Rig: CME 55
Driller: SALEM
Sheet: 1 of 1

Drill Date: 8/2/18
Borehole Size: 6 in.
Hammer Type: Automatic Trip
Weight & Drop: 140 lb/30 in

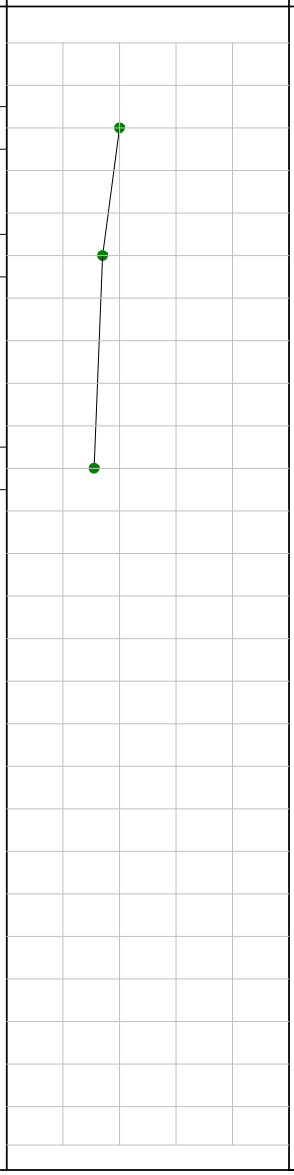
SALEM

Boring No. B-20

Project: Proposed Commercial Development
Client: VantageOne Real Estate Investments, LLC
Location: SWC Yucaipa Boulevard & 18th Street, Yucaipa, California
Grnd. Surf. Elev. (Ft. MSL) -

Project No: 3-218-0666B
Figure No.: A-20
Logged By: SK
Initial: -
Depth to Water>
At Completion: -

SUBSURFACE PROFILE			SAMPLE						
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture Content (%)	Sampler Type	Penetration	Blow Count	Penetration Test (20 40 60 80)	Water Level
		Ground Surface							
0		**Sandy SILT (ML)** **Fill:** very stiff; moist; brown; fine grain sand; with clay.	117.4	9.5	MCS		40		
5		Grades as above.	112.9	10.4	MCS		34		
		Silty SAND (SM) **Fill:** Dense; slightly moist; brown; fine to medium grain sand; trace clay.							
10			-	5.7	SPT		31		
		End of Borehole							
15									
20									
25									



Drill Method: Solid Flight
Drill Rig: CME 55
Driller: SALEM
Sheet: 1 of 1

Drill Date: 8/1/18
Borehole Size: 4 in.
Hammer Type: Automatic Trip
Weight & Drop: 140 lb/30 in

SALEM

Boring No. B-21

Project: Proposed Commercial Development
Client: VantageOne Real Estate Investments, LLC
Location: SWC Yucaipa Boulevard & 18th Street, Yucaipa, California
Grnd. Surf. Elev. (Ft. MSL) -

Depth to Water>

Project No: 3-218-0666B
Figure No.: A-21
Logged By: JR
Initial: -
At Completion: -

SUBSURFACE PROFILE			SAMPLE						
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture Content (%)	Sampler Type	Penetration	Blow Count	Penetration Test (20 40 60 80)	Water Level
		Ground Surface							
0		**Silty SAND (SM)** **Fill:** Very dense; slightly moist; brown; fine to coarse grain sand; trace gravel.	118.3	3.7	MCS		83		
5		Grades as above.	117.9	4.5	MCS		112		
10		Grades as above.	-	5.0	SPT		59		
		End of Borehole							
15									
20									
25									

Drill Method: Solid Flight
Drill Rig: CME 55
Driller: SALEM
Sheet: 1 of 1

Drill Date: 8/1/18
Borehole Size: 4 in.
Hammer Type: Automatic Trip
Weight & Drop: 140 lb/30 in

SALEM

Boring No. B-22

Project: Proposed Commercial Development
Client: VantageOne Real Estate Investments, LLC
Location: SWC Yucaipa Boulevard & 18th Street, Yucaipa, California
Grnd. Surf. Elev. (Ft. MSL) -

Project No: 3-218-0666B
Figure No.: A-22
Logged By: JR
Initial: -
Depth to Water>
At Completion: -

SUBSURFACE PROFILE			SAMPLE						
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture Content (%)	Sampler Type	Penetration	Blow Count	Penetration Test (20 40 60 80)	Water Level
		Ground Surface							
0		**Silty SAND (SM)** Loose; moist; brown; fine to coarse grain sand; trace gravel.	105.7	6.1	MCS		15		
5		Grades as above; medium dense.	-	7.8	MCS		16		
10		Grades as above; dense.	129.5	6.9	SPT		48		
		End of Borehole							
15									
20									
25									

Drill Method: Solid Flight
Drill Rig: CME 55
Driller: SALEM
Sheet: 1 of 1

Drill Date: 8/1/18
Borehole Size: 4 in.
Hammer Type: Automatic Trip
Weight & Drop: 140 lb/30 in

SALEM

Boring No. B-23

Project: Proposed Commercial Development
Client: VantageOne Real Estate Investments, LLC
Location: SWC Yucaipa Boulevard & 18th Street, Yucaipa, California
Grnd. Surf. Elev. (Ft. MSL) -

Depth to Water>

Project No: 3-218-0666B
Figure No.: A-23
Logged By: JR
Initial: -
At Completion: -

SUBSURFACE PROFILE			SAMPLE						
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture Content (%)	Sampler Type	Penetration	Blow Count	Penetration Test (20 40 60 80)	Water Level
		Ground Surface							
0		**Silty SAND (SM)** **Fill:** Moist; brown; fine to coarse grain sand; trace gravel.							
5		Grades as above.							
		Silty SAND (SM) Moist; brown; fine to coarse grain sand; trace gravel.							
10		End of Borehole							
15									
20									
25									

Drill Method: Solid Flight
Drill Rig: CME 55
Driller: SALEM
Sheet: 1 of 1

Drill Date: 8/1/18
Borehole Size: 4 in.
Hammer Type: Automatic Trip
Weight & Drop: 140 lb/30 in

SALEM

Percolation Test Worksheet

Project: **Proposed Commercial Development**
SWC Yucaipa Blvd. & 18th St.
Yucaipa, California

Job No.: **3-218-0666B**
Date Drilled: **8/2/2018**
Soil Classification: **Sitly SAND (SM)**

Hole Radius: 4 in.
Pipe Dia.: 3 in.
Total Depth of Hole: 24 in.

Test Hole No.: **P-3**
Tested by: **JC**
Drilled Hole Depth: **2** ft.

Presoaking Date: **8/2/2018**
Test Date: **8/3/2018**

Pipe Stick up: 0 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.)	Δ Min.	Meas. Perc Rate (min/in)	Initial Height of Water (in)	Final Height of Water (in)	Average Height of Water (in)	Infiltration Rate, It (in/hr)
10:28	10:58	2.0	Y	0:30	0.60	0.75	1.80	30	16.7	16.8	15.0	15.9	0.40
10:58	11:28	2.0	N	0:30	0.75	0.87	1.44	30	20.8	15.0	13.6	14.3	0.35
11:28	11:58	2.0	N	0:30	0.87	0.97	1.20	30	25.0	13.6	12.4	13.0	0.32
11:58	12:28	2.0	N	0:30	0.97	1.07	1.15	30	26.0	12.4	11.2	11.8	0.33
12:28	12:58	2.0	N	0:30	1.07	1.15	1.01	30	29.8	11.2	10.2	10.7	0.32
12:58	13:28	2.0	N	0:30	1.15	1.23	0.96	30	31.3	10.2	9.2	9.7	0.33
13:30	14:00	2.0	Y	0:30	0.72	0.83	1.32	30	22.7	15.4	14.0	14.7	0.32
14:00	14:30	2.0	N	0:30	0.83	0.93	1.20	30	25.0	14.0	12.8	13.4	0.31
14:30	15:00	2.0	N	0:30	0.93	1.02	1.08	30	27.8	12.8	11.8	12.3	0.30
15:00	15:30	2.0	N	0:30	1.02	1.11	1.08	30	27.8	11.8	10.7	11.2	0.33
15:30	16:00	2.0	N	0:30	1.11	1.19	0.96	30	31.3	10.7	9.7	10.2	0.31
16:00	16:30	2.0	N	0:30	1.19	1.27	0.96	30	31.3	9.7	8.8	9.2	0.34
Recommended for Design:										**Infiltration Rate**			**0.30**

Measured from top of pipe

SALEM engineering group, inc.

Percolation Test Worksheet

Project: **Proposed Commercial Development**
SWC Yucaipa Blvd. & 18th St.
Yucaipa, California

Job No.: **3-218-0666B**
Date Drilled: **8/2/2018**
Soil Classification: **Silty SAND (SM)**

Hole Radius: 4 in.
Pipe Dia.: 3 in.
Total Depth of Hole: 24 in.

Test Hole No.: **P-4**
Tested by: **JC**
Drilled Hole Depth: **2** ft.

Presoaking Date: **8/2/2018**
Test Date: **8/3/2018**

Pipe Stick up: 0.2 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.)	Δ Min.	Meas. Perc Rate (min/in)	Initial Height of Water (in)	Final Height of Water (in)	Average Height of Water (in)	Infiltration Rate, It (in/hr)
10:31	11:01	2.2	Y	0:30	0.42	0.66	2.88	30	10.4	21.4	18.5	19.9	0.53
11:01	11:31	2.2	N	0:30	0.66	0.85	2.28	30	13.2	18.5	16.2	17.3	0.47
11:31	12:01	2.2	N	0:30	0.85	1.01	1.92	30	15.6	16.2	14.3	15.2	0.45
12:01	12:31	2.2	N	0:30	1.01	1.15	1.68	30	17.9	14.3	12.6	13.4	0.44
12:31	13:01	2.2	N	0:30	1.15	1.28	1.56	30	19.2	12.6	11.0	11.8	0.45
13:01	13:31	2.2	N	0:30	1.28	1.40	1.44	30	20.8	11.0	9.6	10.3	0.47
13:32	14:02	2.2	Y	0:30	0.53	0.72	2.28	30	13.2	20.0	17.8	18.9	0.44
14:02	14:32	2.2	N	0:30	0.72	0.89	2.04	30	14.7	17.8	15.7	16.7	0.44
14:32	15:02	2.2	N	0:30	0.89	1.04	1.80	30	16.7	15.7	13.9	14.8	0.43
15:02	15:32	2.2	N	0:30	1.04	1.18	1.68	30	17.9	13.9	12.2	13.1	0.45
15:32	16:02	2.2	N	0:30	1.18	1.31	1.56	30	19.2	12.2	10.7	11.5	0.46
16:02	16:32	2.2	N	0:30	1.31	1.42	1.32	30	22.7	10.7	9.4	10.0	0.44
Recommended for Design:										**Infiltration Rate**			**0.43**

Measured from top of pipe

SALEM engineering group, inc.

Percolation Test Worksheet

Project: **Proposed Commercial Development**
SWC Yucaipa Blvd. & 18th St.
Yucaipa, California

Job No.: **3-218-0666B**
Date Drilled: **8/1/2018**
Soil Classification: **Silty SAND (SM)**

Hole Radius: 4 in.
Pipe Dia.: 3 in.
Total Depth of Hole: 120 in.

Test Hole No.: **P-5**
Tested by: **JC**
Drilled Hole Depth: **10** ft.

Presoaking Date: **8/1/2018**
Test Date: **8/2/2018**

Pipe Stick up: 0.5 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.)	Δ Min.	Meas. Perc Rate (min/in)	Initial Height of Water (in)	Final Height of Water (in)	Average Height of Water (in)	Infiltration Rate, It (in/hr)
10:18	10:48	10.5	Y	0:30	7.24	7.30	0.72	30	41.7	39.1	38.4	38.8	0.07
10:48	11:18	10.5	N	0:30	7.30	7.35	0.60	30	50.0	38.4	37.8	38.1	0.06
11:18	11:48	10.5	N	0:30	7.35	7.40	0.60	30	50.0	37.8	37.2	37.5	0.06
11:48	12:18	10.5	N	0:30	7.40	7.44	0.48	30	62.5	37.2	36.7	37.0	0.05
12:18	12:48	10.5	N	0:30	7.44	7.48	0.48	30	62.5	36.7	36.2	36.5	0.05
12:48	13:18	10.5	N	0:30	7.48	7.52	0.48	30	62.5	36.2	35.8	36.0	0.05
13:18	13:48	10.5	N	0:30	7.52	7.55	0.36	30	83.3	35.8	35.4	35.6	0.04
13:48	14:18	10.5	N	0:30	7.55	7.58	0.36	30	83.3	35.4	35.0	35.2	0.04
14:18	14:48	10.5	N	0:30	7.58	7.61	0.36	30	83.3	35.0	34.7	34.9	0.04
14:48	15:18	10.5	N	0:30	7.61	7.63	0.24	30	125.0	34.7	34.4	34.6	0.03
15:18	15:48	10.5	N	0:30	7.63	7.65	0.24	30	125.0	34.4	34.2	34.3	0.03
15:48	16:18	10.5	N	0:30	7.65	7.67	0.24	30	125.0	34.2	34.0	34.1	0.03
Recommended for Design:										**Infiltration Rate**			**0.03**

Measured from top of pipe

SALEM engineering group, inc.

Percolation Test Worksheet

Project: **Proposed Commercial Development**
SWC Yucaipa Blvd. & 18th St.
Yucaipa, California

Job No.: **3-218-0666B**
Date Drilled: **8/1/2018**
Soil Classification: **Silty SAND (SM)**

Hole Radius: 4 in.
Pipe Dia.: 3 in.
Total Depth of Hole: 114 in.

Test Hole No.: **P-6**
Tested by: **JC**
Drilled Hole Depth: **9.5** ft.

Presoaking Date: **8/1/2018**
Test Date: **8/2/2018**

Pipe Stick up: 0.5 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.)	Δ Min.	Meas. Perc Rate (min/in)	Initial Height of Water (in)	Final Height of Water (in)	Average Height of Water (in)	Infiltration Rate, It (in/hr)
10:21	10:51	10.0	Y	0:30	6.82	7.22	4.80	30	6.3	38.2	33.4	35.8	0.51
10:51	11:21	10.0	N	0:30	7.22	7.55	3.96	30	7.6	33.4	29.4	31.4	0.47
11:21	11:51	10.0	N	0:30	7.55	7.81	3.12	30	9.6	29.4	26.3	27.8	0.42
11:51	12:21	10.0	N	0:30	7.81	8.04	2.76	30	10.9	26.3	23.5	24.9	0.41
12:21	12:51	10.0	N	0:30	8.04	8.25	2.52	30	11.9	23.5	21.0	22.3	0.42
12:51	13:21	10.0	N	0:30	8.25	8.44	2.28	30	13.2	21.0	18.7	19.9	0.42
13:21	13:51	10.0	N	0:30	8.44	8.61	2.04	30	14.7	18.7	16.7	17.7	0.41
13:51	14:21	10.0	N	0:30	8.61	8.77	1.92	30	15.6	16.7	14.8	15.7	0.43
14:21	14:51	10.0	N	0:30	8.77	8.91	1.68	30	17.9	14.8	13.1	13.9	0.42
14:51	15:21	10.0	N	0:30	8.91	9.03	1.44	30	20.8	13.1	11.6	12.4	0.40
15:21	15:51	10.0	N	0:30	9.03	9.14	1.32	30	22.7	11.6	10.3	11.0	0.41
15:51	16:21	10.0	N	0:30	9.14	9.24	1.20	30	25.0	10.3	9.1	9.7	0.41
Recommended for Design:										**Infiltration Rate**			**0.40**

Measured from top of pipe

SALEM engineering group, inc.

Percolation Test Worksheet

Project: **Proposed Commercial Development**
SWC Yucaipa Blvd. & 18th St.
Yucaipa, California

Job No.: **3-218-0666B**
Date Drilled: **8/2/2018**
Soil Classification: **Silty SAND (SM)**

Hole Radius: 4 in.
Pipe Dia.: 3 in.
Total Depth of Hole: 108 in.

Test Hole No.: **P-7**
Tested by: **JC**
Drilled Hole Depth: **9** ft.

Presoaking Date: **8/2/2018**
Test Date: **8/3/2018**

Pipe Stick up: 1 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.)	Δ Min.	Meas. Perc Rate (min/in)	Initial Height of Water (in)	Final Height of Water (in)	Average Height of Water (in)	Infiltration Rate, It (in/hr)
11:16	11:46	10.0	Y	0:30	6.62	6.86	2.88	30	10.4	40.6	37.7	39.1	0.28
11:46	12:16	10.0	N	0:30	6.86	7.05	2.28	30	13.2	37.7	35.4	36.5	0.24
12:16	12:46	10.0	N	0:30	7.05	7.22	2.04	30	14.7	35.4	33.4	34.4	0.22
12:46	13:16	10.0	N	0:30	7.22	7.37	1.80	30	16.7	33.4	31.6	32.5	0.21
13:16	13:46	10.0	N	0:30	7.37	7.51	1.68	30	17.9	31.6	29.9	30.7	0.21
13:46	14:16	10.0	N	0:30	7.51	7.64	1.56	30	19.2	29.9	28.3	29.1	0.20
14:16	14:46	10.0	N	0:30	7.64	7.76	1.44	30	20.8	28.3	26.9	27.6	0.19
14:46	15:16	10.0	N	0:30	7.76	7.87	1.32	30	22.7	26.9	25.6	26.2	0.19
15:16	15:46	10.0	N	0:30	7.87	7.97	1.20	30	25.0	25.6	24.4	25.0	0.18
15:46	16:16	10.0	N	0:30	7.97	8.07	1.20	30	25.0	24.4	23.2	23.8	0.19
16:16	16:46	10.0	N	0:30	8.07	8.16	1.08	30	27.8	23.2	22.1	22.6	0.18
16:46	17:16	10.0	N	0:30	8.16	8.25	1.08	30	27.8	22.1	21.0	21.5	0.18
Recommended for Design:										**Infiltration Rate**			**0.18**

Measured from top of pipe

SALEM engineering group, inc.

Percolation Test Worksheet

Project: **Proposed Commercial Development**
SWC Yucaipa Blvd. & 18th St.
Yucaipa, California

Job No.: **3-218-0666B**
Date Drilled: **8/2/2018**
Soil Classification: **Silty SAND (SM)**

Hole Radius: 4 in.
Pipe Dia.: 3 in.
Total Depth of Hole: 117.6 in.

Test Hole No.: **P-8**
Tested by: **JC**
Drilled Hole Depth: **9.8** ft.

Presoaking Date: **8/2/2018**
Test Date: **8/3/2018**

Pipe Stick up: 0.2 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.)	Δ Min.	Meas. Perc Rate (min/in)	Initial Height of Water (in)	Final Height of Water (in)	Average Height of Water (in)	Infiltration Rate, It (in/hr)
11:10	11:40	10.0	Y	0:30	5.71	5.91	2.40	30	12.5	51.5	49.1	50.3	0.18
11:40	12:10	10.0	N	0:30	5.91	6.07	1.92	30	15.6	49.1	47.2	48.1	0.15
12:10	12:40	10.0	N	0:30	6.07	6.20	1.56	30	19.2	47.2	45.6	46.4	0.13
12:40	13:10	10.0	N	0:30	6.20	6.32	1.44	30	20.8	45.6	44.2	44.9	0.12
13:10	13:40	10.0	N	0:30	6.32	6.43	1.32	30	22.7	44.2	42.8	43.5	0.12
13:40	14:10	10.0	N	0:30	6.43	6.54	1.32	30	22.7	42.8	41.5	42.2	0.12
14:10	14:40	10.0	N	0:30	6.54	6.65	1.32	30	22.7	41.5	40.2	40.9	0.12
14:40	15:10	10.0	N	0:30	6.65	6.75	1.20	30	25.0	40.2	39.0	39.6	0.12
15:10	15:40	10.0	N	0:30	6.75	6.85	1.20	30	25.0	39.0	37.8	38.4	0.12
15:40	16:10	10.0	N	0:30	6.85	6.94	1.08	30	27.8	37.8	36.7	37.3	0.11
16:10	16:40	10.0	N	0:30	6.94	7.03	1.08	30	27.8	36.7	35.6	36.2	0.11
16:40	17:10	10.0	N	0:30	7.03	7.12	1.08	30	27.8	35.6	34.6	35.1	0.12
Recommended for Design:										**Infiltration Rate**			**0.11**

Measured from top of pipe

SALEM engineering group, inc.

DRY SETTLEMENT DUE TO EARTHQUAKE SHAKING

Job No. 3-218-0666B **Job Name** Proposed Commercial Development
Boring No. B-18 **Drill Date** 08/02/18

* Use Fig. 11 of Tokimatsu & Seed (1987)
** Use Fig. 13 of Tokimatsu & Seed (1987)
*** $MSF=10^{2.24}/Mw^{2.56}$
# $C_N=2.2/(1.2+\sigma'_o/P_a)$
+ From Pradel, D. (1998) equations for modulus reduction curves

User Input Section

Earthquake Data	
Mag. (M_w)	8.2
a_{max}/g	0.65
MSF***	0.80

Drilling GW Depth (ft)	-
Earthquake GW Depth (ft)	50
Rod Stick-Up (ft)	3

SPT N-Value Correction Factors

Energy Ratio	C_E	1.60	Notes
Borehole Dia.	C_B	1.05	Notes
Sampling Method	C_S	1.2	Notes
Factor of Safety	FS	1.0	
Rod Length	C_R	Calculated	
Overburden Press	C_N	Calculated	

Lookup Tables

% Fines	ΔN	Length	C_R
0	0	1	0.75
10	1	12	0.85
25	2	20	0.95
50	4	30	0.98
75	5	33	1

Δ = -0.0006(% Fines)^2 + 0.1088(% Fines) - 0.0852
C_R = -0.0002(Length)^2 + 0.0131(Length) + 0.7324

Depth (ft)	USCS	Dry Unit Wt (pcf)	w (%)	Fines %	SPT Field N	Layer (ft)	Unit Wt (pcf)	Total σ_o bottom (psf)	Total σ_o mid-pt. (psf)	During Drilling Eff. σ'_o (psf)	C_N #	SPT $(N_1)_{60}$	ΔN	Fines Corct'd SPT $(N_1)_{60f}$	During EQ Eff. σ'_{oeq} (psf)	$\sigma_o/\sigma_{o'eq}$	r_d	Shear Modulus G_{max} ##	Cyclic Shear Stress T_{av}	Shear Strain/Shear Modulus Ratio $\gamma_{eff}(G_{eff}/G_{max})$	Eff. Shear Strain γ(%)*	Vol. Strain (1-way) V%**	Vol. Strain Mw Corct'd V%*	S (2-way) in.
2	ML	124	9.0	57	55	2.0	135.2	270	135	135	1.74	144.3	4.0	148.3	135	1.000	0.997	9.92E+05	56.9	5.74E-05	8.7E-03	5.5E-4	0.00	0.00
5	SM	119	11.3	35	22	3.0	132.6	668	469	469	1.53	51.0	2.0	53.0	469	1.000	0.990	1.31E+06	196.3	1.50E-04	3.7E-02	9.3E-3	0.01	0.01
10	ML	91	13.4	51	9	5.0	103.1	1183	926	926	1.32	20.4	4.0	24.4	926	1.000	0.979	1.42E+06	382.9	2.69E-04	1.3E-01	8.8E-2	0.00	0.00
15	ML	90	26.3	51	15	5.0	113.7	1752	1468	1468	1.14	29.2	4.0	33.2	1468	1.000	0.968	1.99E+06	600.4	3.02E-04	1.2E-01	5.5E-2	0.00	0.00
20	SM	100	7.4	21	23	5.0	107.4	2289	2020	2020	1.00	43.8	1.0	44.8	2020	1.000	0.956	2.57E+06	816.3	3.17E-04	1.0E-01	3.3E-2	0.04	0.05
25	ML	90	28.4	62	13	5.0	115.6	2867	2578	2578	0.88	22.0	4.0	26.0	2578	1.000	0.941	2.43E+06	1024.8	4.23E-04	2.1E-01	1.4E-1	0.00	0.00
30	SM	100	9.1	31	26	5.0	109.1	3412	3139	3139	0.79	41.6	2.0	43.6	3139	1.000	0.919	3.18E+06	1219.1	3.83E-04	1.3E-01	4.2E-2	0.05	0.06
35	SM	100	8.5	31	25	5.0	108.5	3955	3683	3683	0.72	36.5	2.0	38.5	3683	1.000	0.888	3.30E+06	1382.3	4.19E-04	1.5E-01	5.6E-2	0.07	0.08
40	SM	100	9.8	31	21	5.0	109.8	4504	4229	4229	0.66	28.1	2.0	30.1	4229	1.000	0.848	3.26E+06	1514.6	4.64E-04	1.8E-01	9.6E-2	0.11	0.14
45	SM	100	5.2	17	31	5.0	105.2	5030	4767	4767	0.61	38.4	1.0	39.4	4767	1.000	0.799	3.79E+06	1609.8	4.25E-04	1.3E-01	4.7E-2	0.06	0.07
50	SM	100	8.6	17	31	5.0	108.6	5573	5301	5301	0.57	35.7	1.0	36.7	5301	1.000	0.748	3.90E+06	1675.0	4.29E-04	1.2E-01	4.9E-2	0.06	0.07

The total seismic-induced settlement calculation is based on a water table depth of 50 feet below grade

Total 0.47

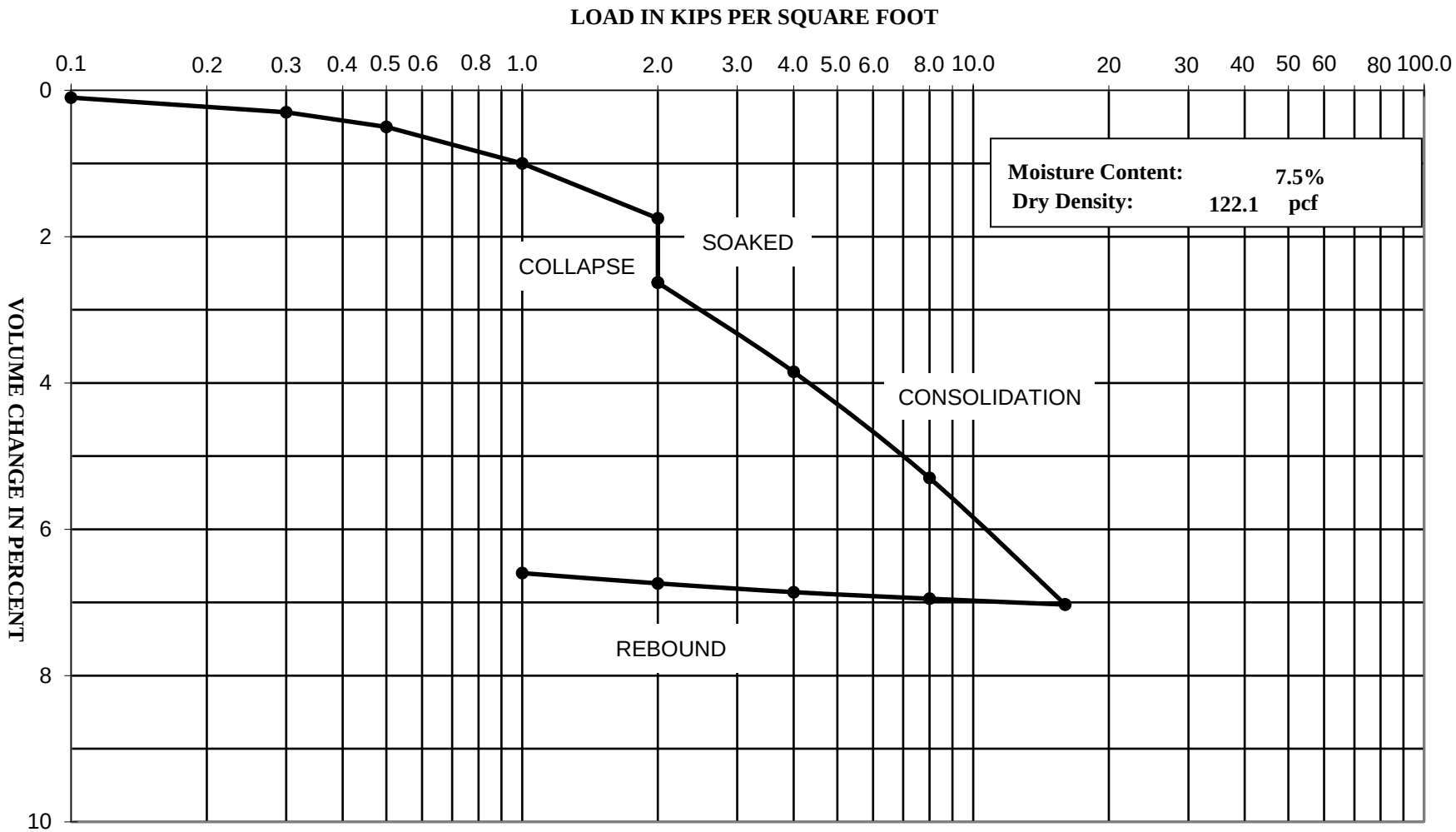
APPENDIX

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, expansion index, shear strength, maximum dry density and optimum moisture, and grain size distribution. The results of the laboratory tests are summarized in the following figures.

CONSOLIDATION - PRESSURE TEST DATA
ASTM D2435



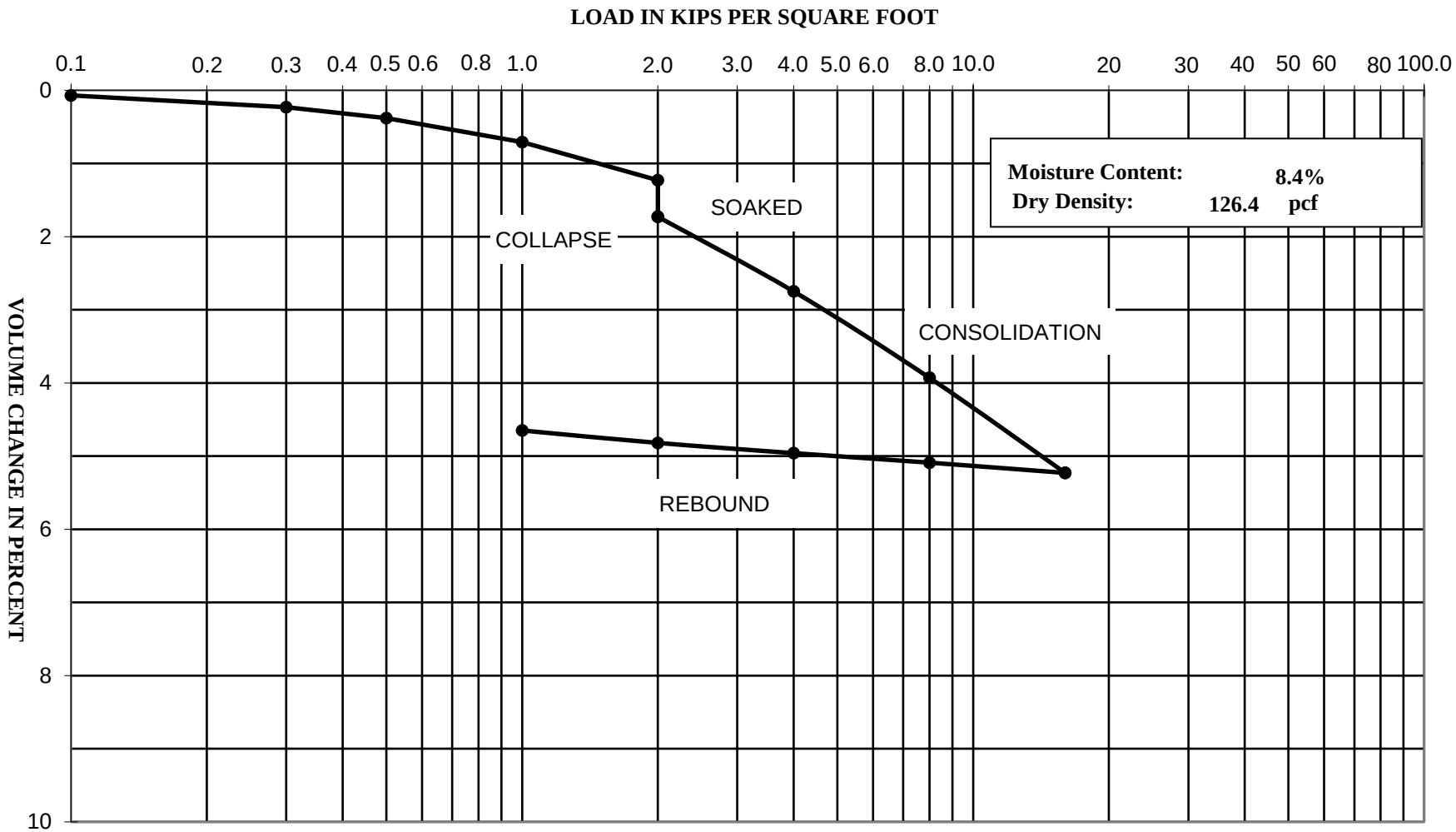
Project Name: Comm Development - Yucaipa, CA

Project Number: 3-218-0666

Boring: B-7 @ 5'

SALEM engineering group, inc.

CONSOLIDATION - PRESSURE TEST DATA
ASTM D2435



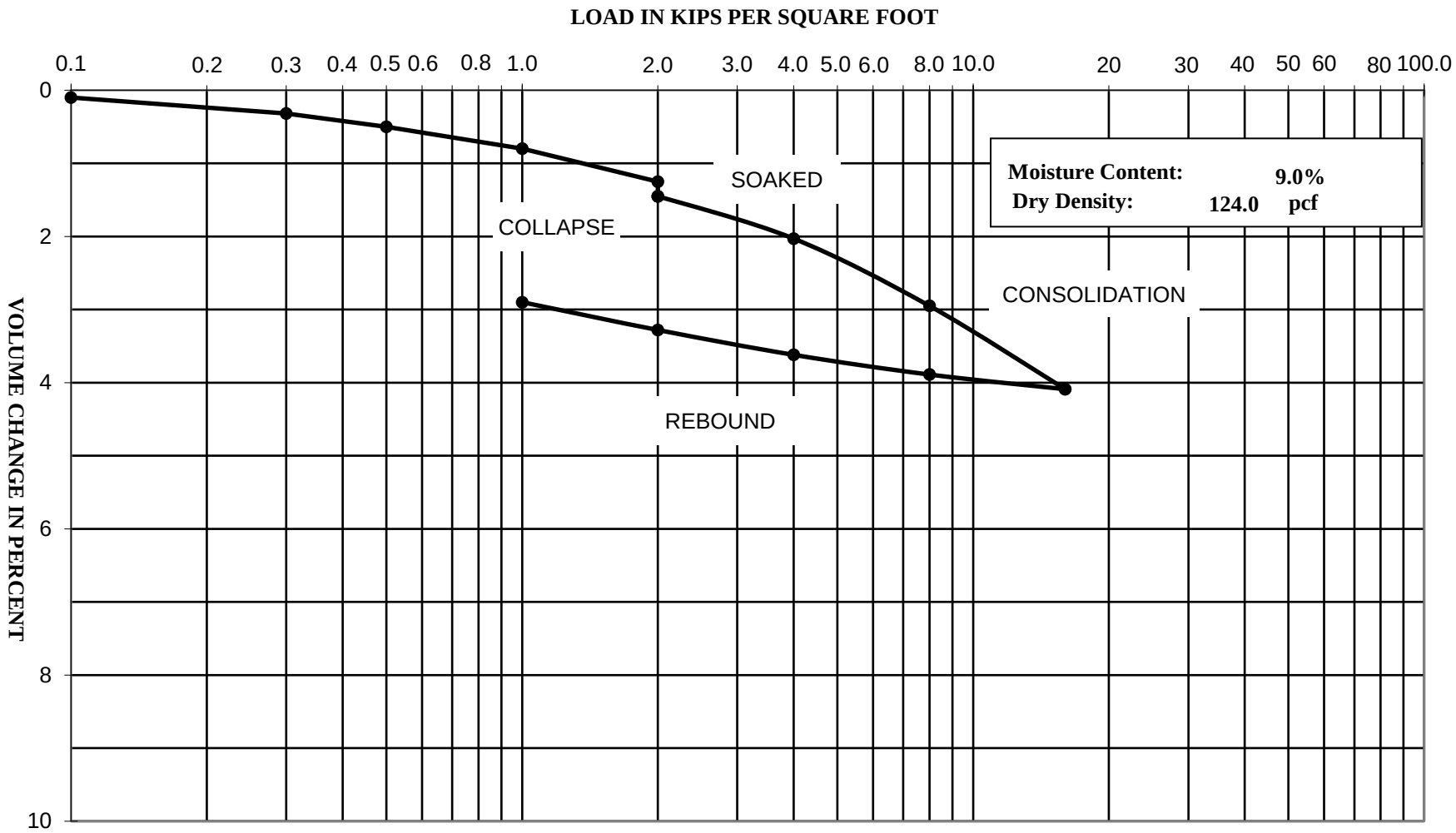
Project Name: Comm Development - Yucaipa, CA

Project Number: 3-218-0666

Boring: B-7 @ 15'

SALEM engineering group, inc.

CONSOLIDATION - PRESSURE TEST DATA
ASTM D2435



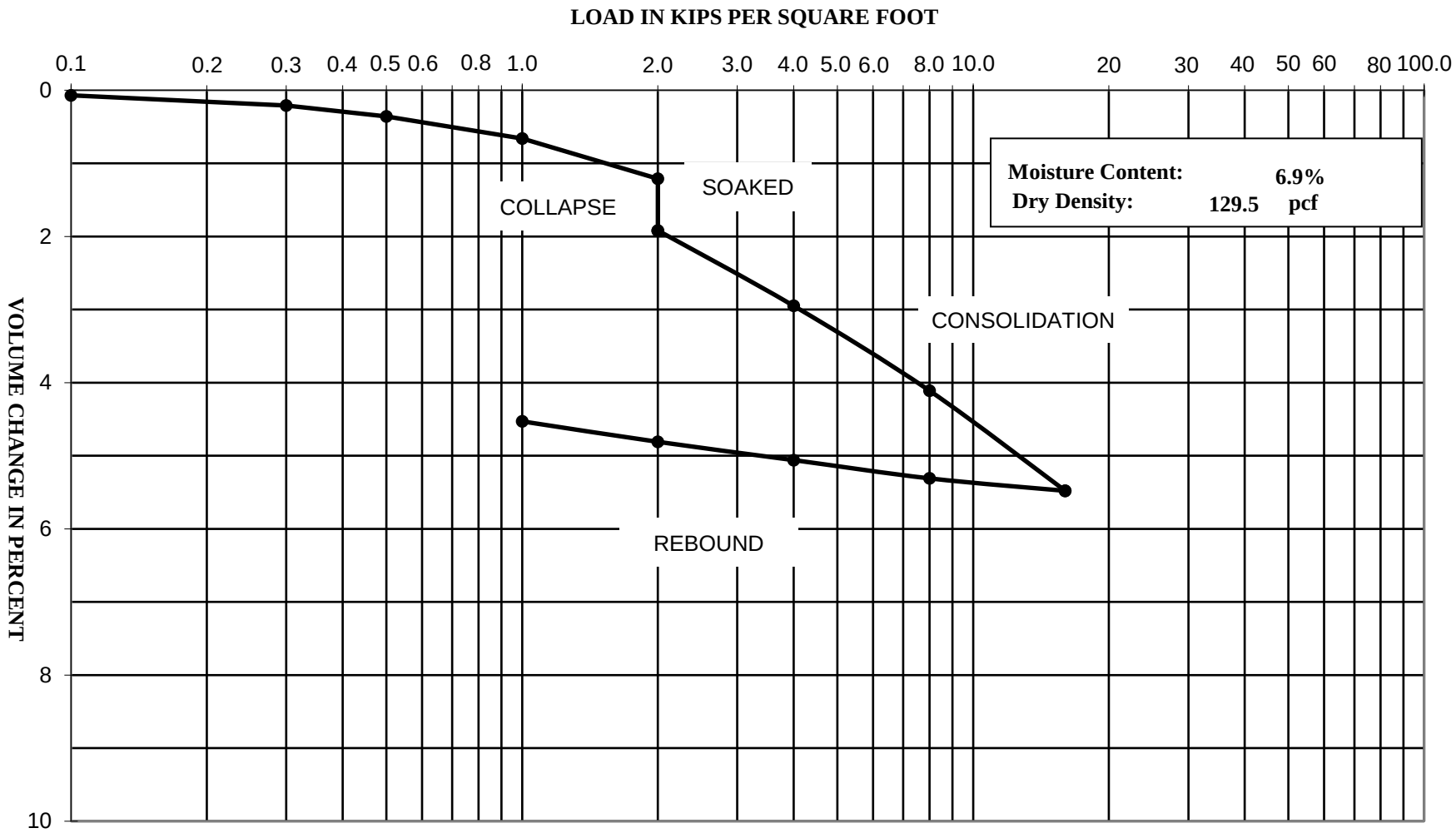
Project Name: Comm Development - Yucaipa, CA

Project Number: 3-218-0666

Boring: B-18 @ 2'

SALEM engineering group, inc.

CONSOLIDATION - PRESSURE TEST DATA
ASTM D2435



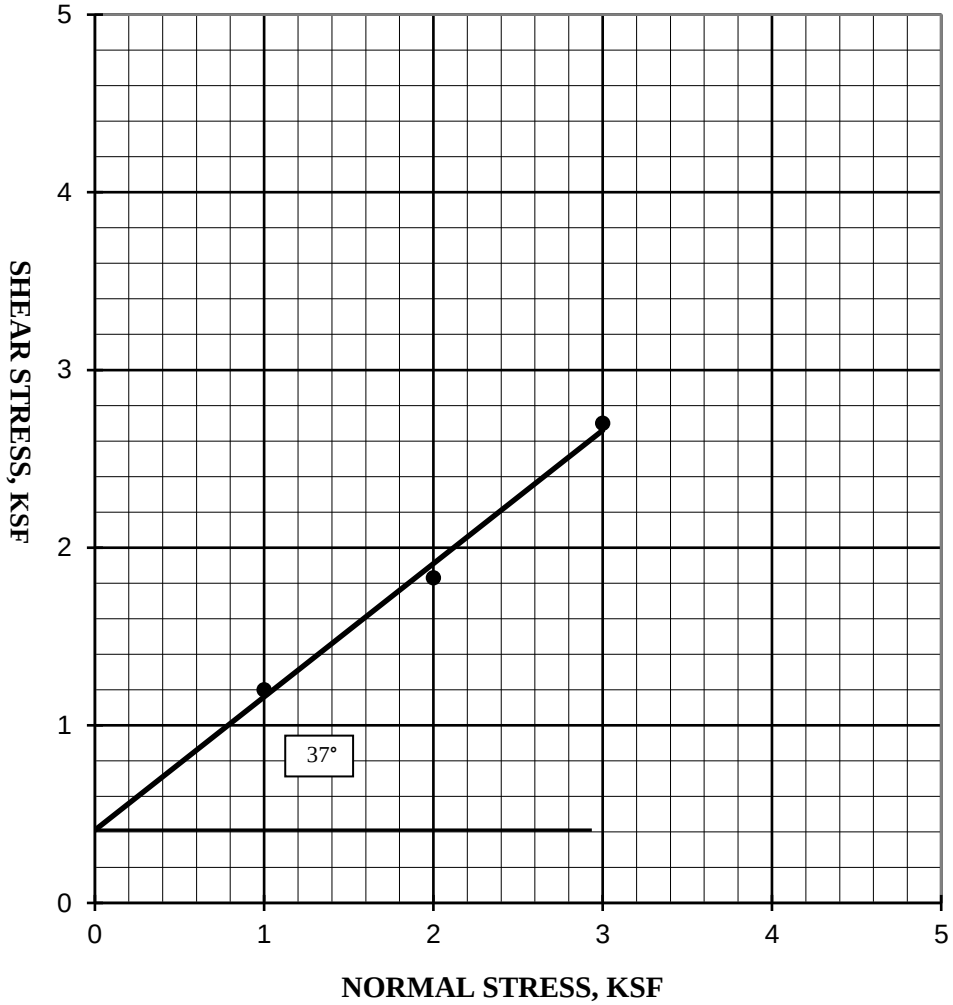
Project Name: Comm Development - Yucaipa, CA

Project Number: 3-218-0666

Boring: B-22 @ 10'

SALEM engineering group, inc.

SHEAR STRENGTH DIAGRAM
(DIRECT SHEAR)
ASTM D3080



Project Name: Comm Development - Yucaipa, CA

Project Number: 3-218-0666

Boring: B-7 @ 2'
Soil Type: Silty SAND (SM)

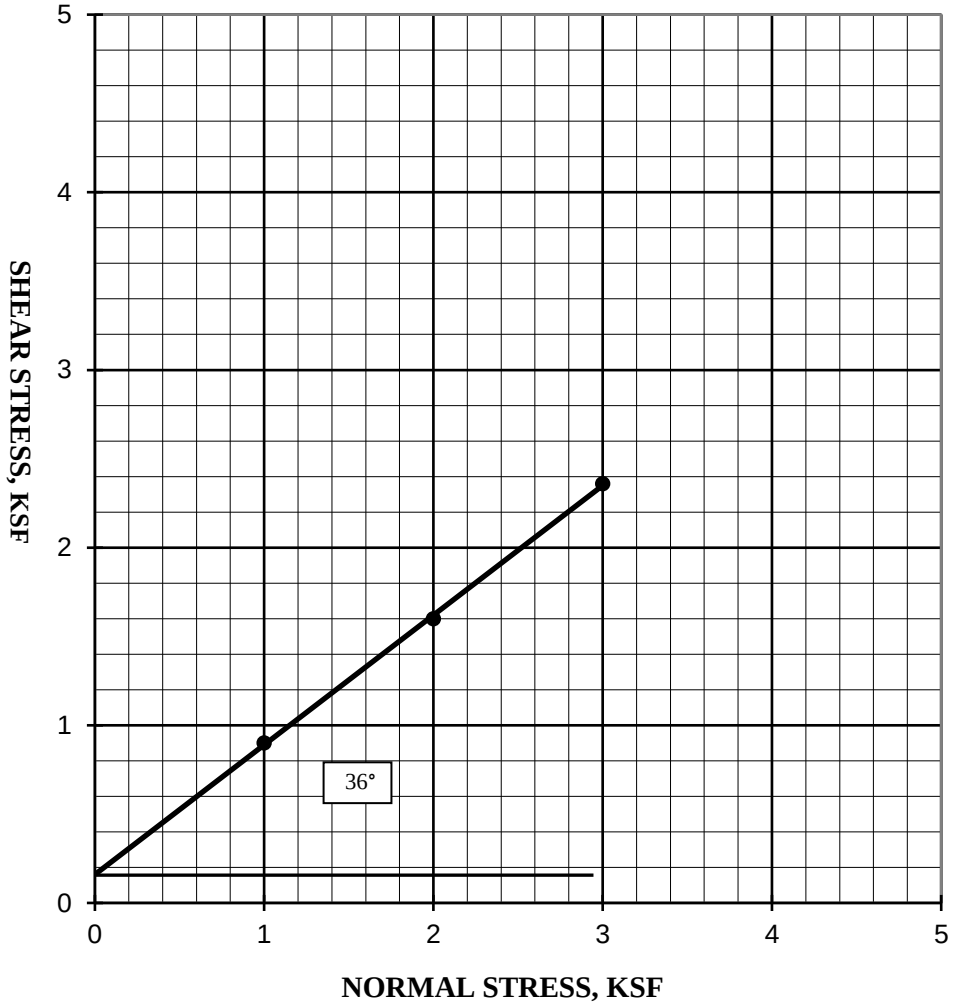
Friction Angle: 37 degrees
Cohesion: 410 psf

Moisture Content 4.4%

Dry Density 134.9 pcf

SALEM engineering group, inc.

SHEAR STRENGTH DIAGRAM
(DIRECT SHEAR)
ASTM D3080



Project Name: Comm Development - Yucaipa, CA

Project Number: 3-218-0666

Boring: B-18 @ 5'
Soil Type: Silty SAND (SM)

Friction Angle: 36 degrees
Cohesion: 160 psf

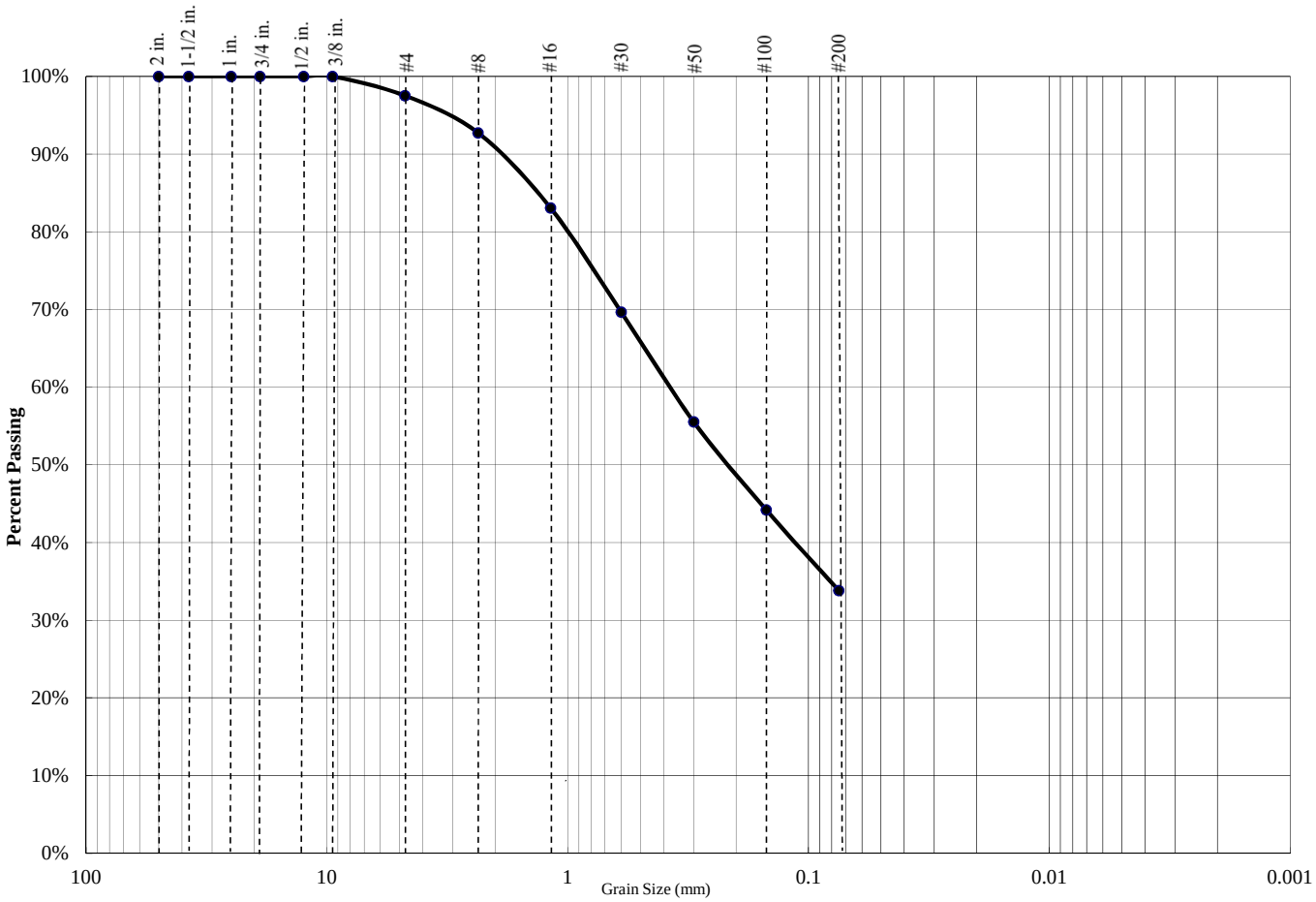
Moisture Content 11.3%

Dry Density 119.1 pcf

SALEM engineering group, inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
2%	64%	34%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	100.0%
#4	97.5%
#8	92.7%
#16	83.1%
#30	69.7%
#50	55.5%
#100	44.2%
#200	33.8%

Atterberg Limits		
PL=	**LL=**	**PI=**

Coefficients				
D_{85}=		**D_{60}=**		**D_{50}=**
D_{30}=		**D_{15}=**		**D_{10}=**
C_u=	N/A	**C_c=**	N/A	

USCS CLASSIFICATION
Silty SAND (SM)

Project Name: Comm Development - Yucaipa, CA

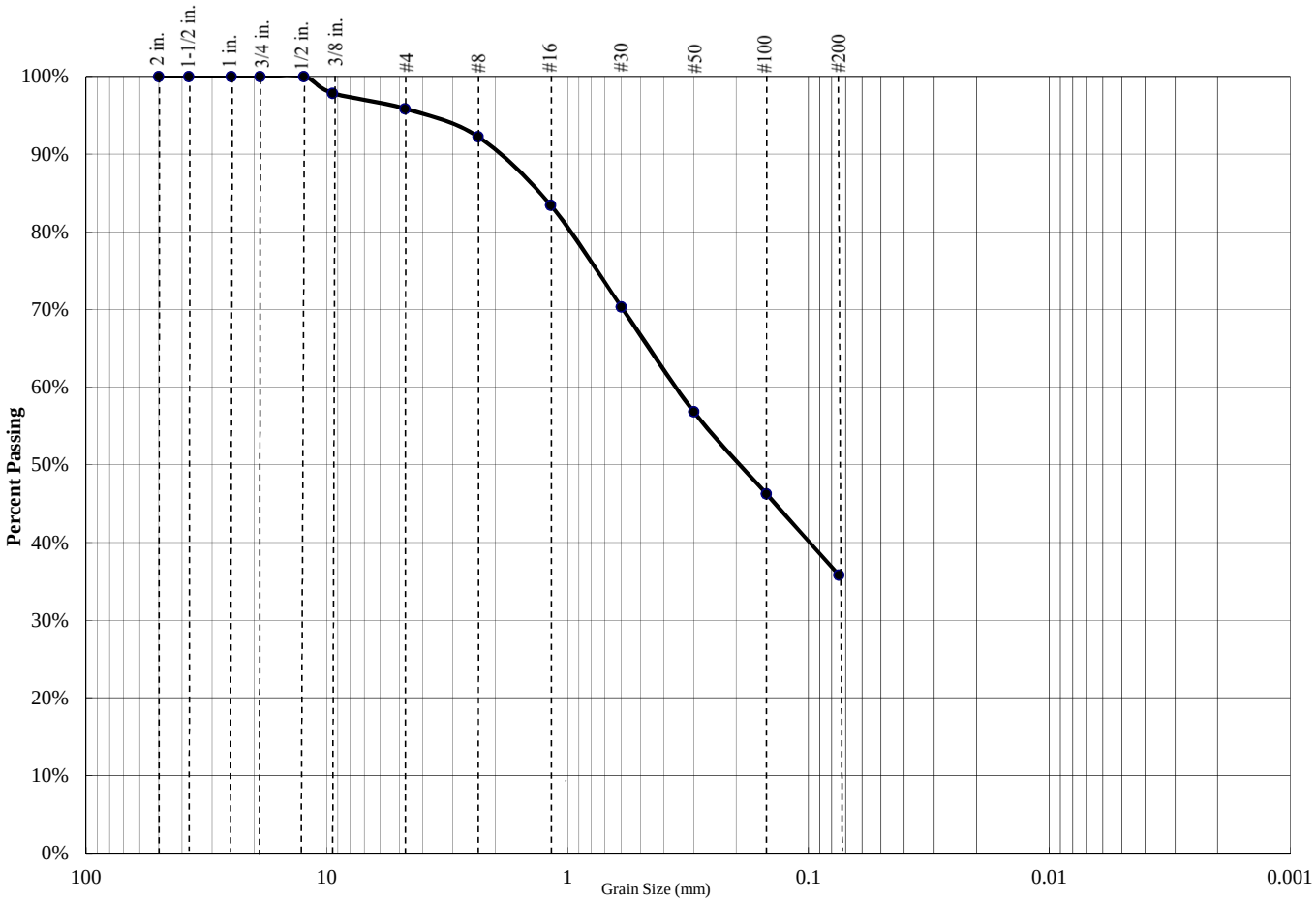
Project Number: 3-218-0666

Boring: B-7 @ 2'

SALEM engineering group, inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
4%	60%	36%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	97.9%
#4	95.9%
#8	92.2%
#16	83.4%
#30	70.4%
#50	56.9%
#100	46.3%
#200	35.8%

Atterberg Limits		
PL=	**LL=**	**PI=**

Coefficients				
D_{85}=		**D_{60}=**		**D_{50}=**
D_{30}=		**D_{15}=**		**D_{10}=**
C_u=	N/A	**C_c=**	N/A	

USCS CLASSIFICATION
Silty SAND (SM)

Project Name: Comm Development - Yucaipa, CA

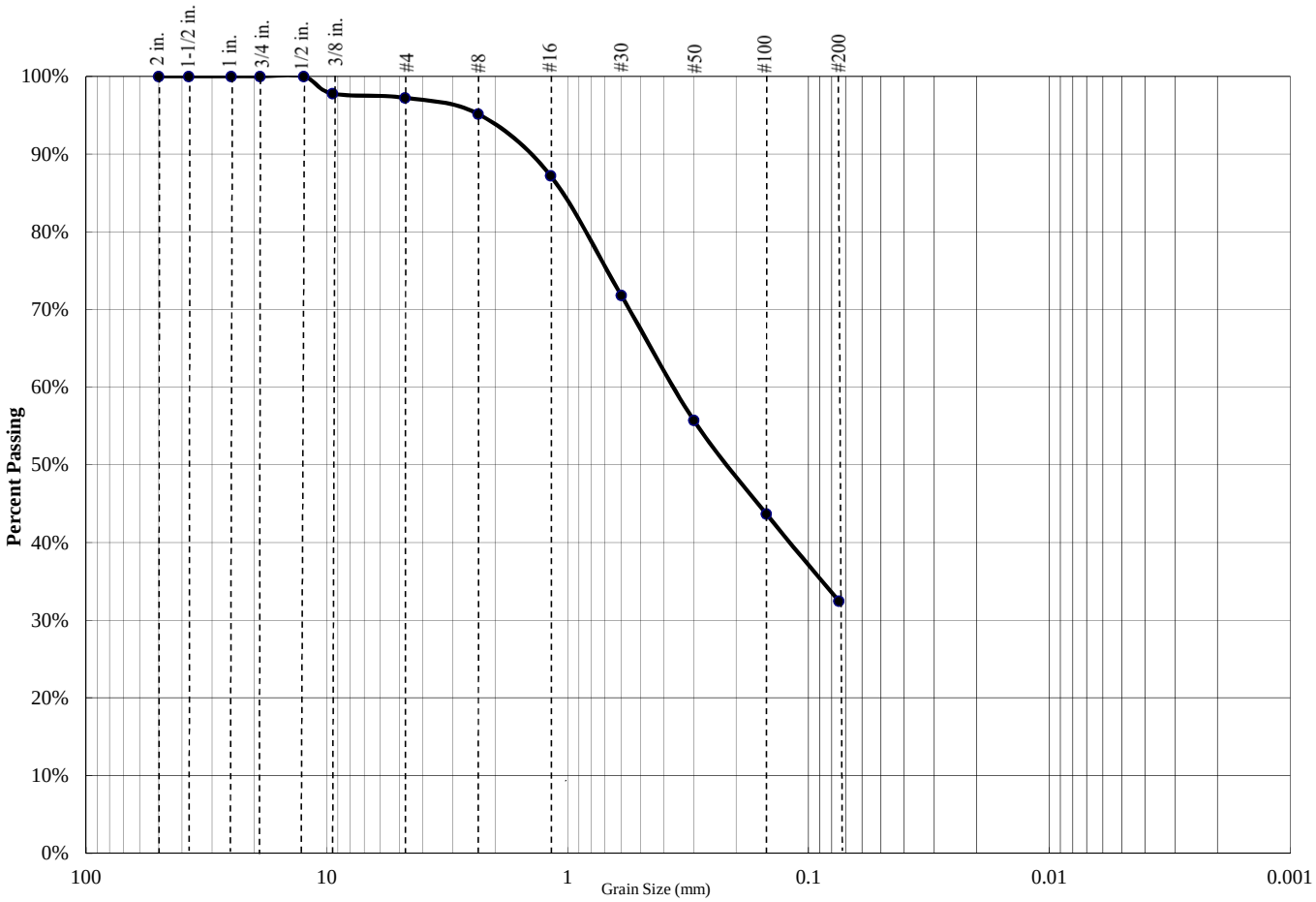
Project Number: 3-218-0666

Boring: B-7 @ 5'

SALEM engineering group, inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
3%	65%	32%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	97.8%
#4	97.2%
#8	95.2%
#16	87.2%
#30	71.8%
#50	55.7%
#100	43.7%
#200	32.5%

Atterberg Limits		
PL=	**LL=**	**PI=**

Coefficients			
D_{85}=		**D_{60}=**	**D_{50}=**
D_{30}=		**D_{15}=**	**D_{10}=**
C_u=	N/A	**C_c=**	N/A

USCS CLASSIFICATION
Silty SAND (SM)

Project Name: Comm Development - Yucaipa, CA

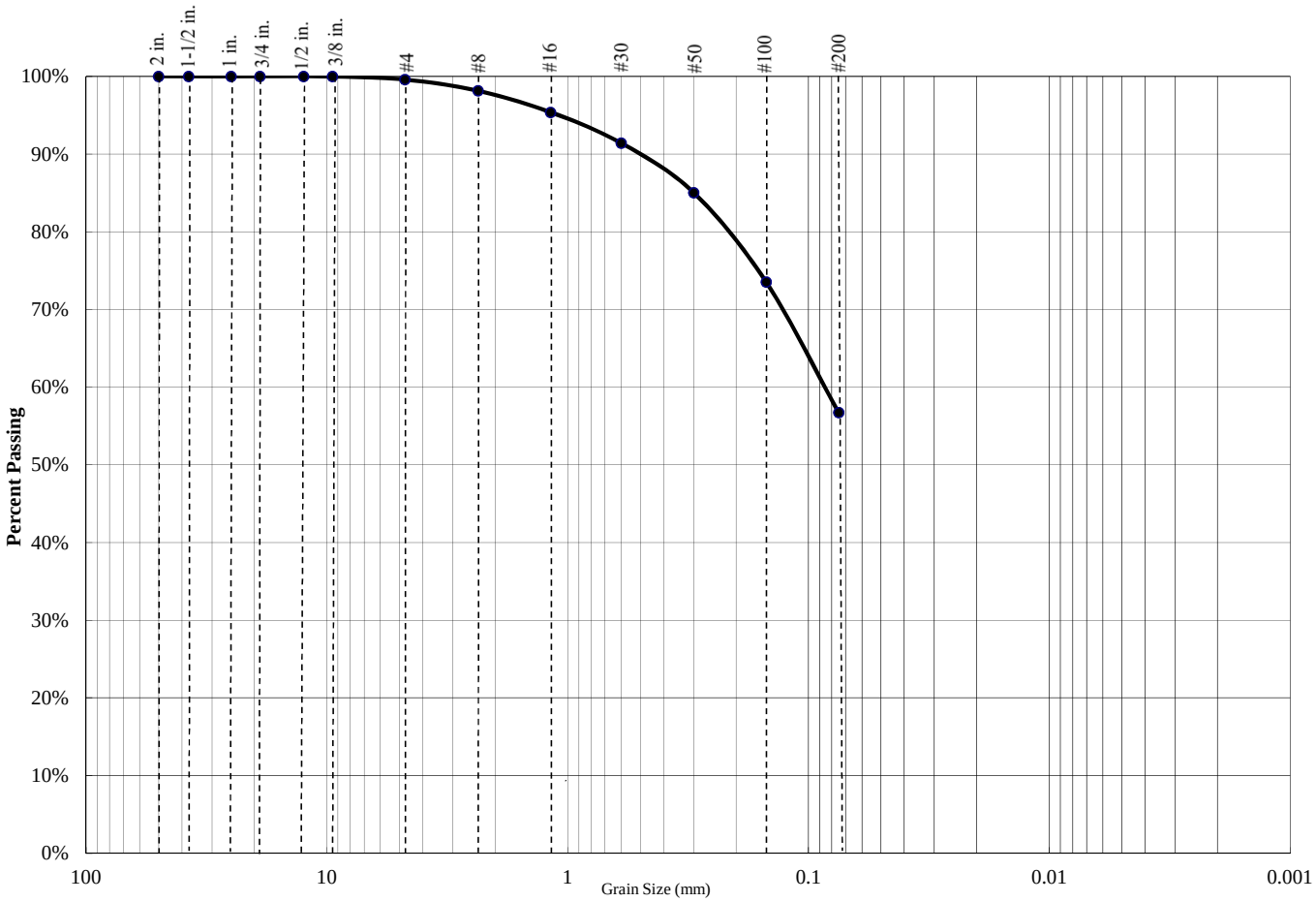
Project Number: 3-218-0666

Boring: B-7 @ 15'

SALEM engineering group, inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
0%	43%	57%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	100.0%
#4	99.6%
#8	98.2%
#16	95.4%
#30	91.4%
#50	85.0%
#100	73.5%
#200	56.7%

Atterberg Limits		
PL=	**LL=**	**PI=**

Coefficients					
D_{85}=		**D_{60}=**		**D_{50}=**	
D_{30}=		**D_{15}=**		**D_{10}=**	
C_u=	N/A	**C_c=**	N/A		

USCS CLASSIFICATION
Sandy SILT (ML)

Project Name: Comm Development - Yucaipa, CA

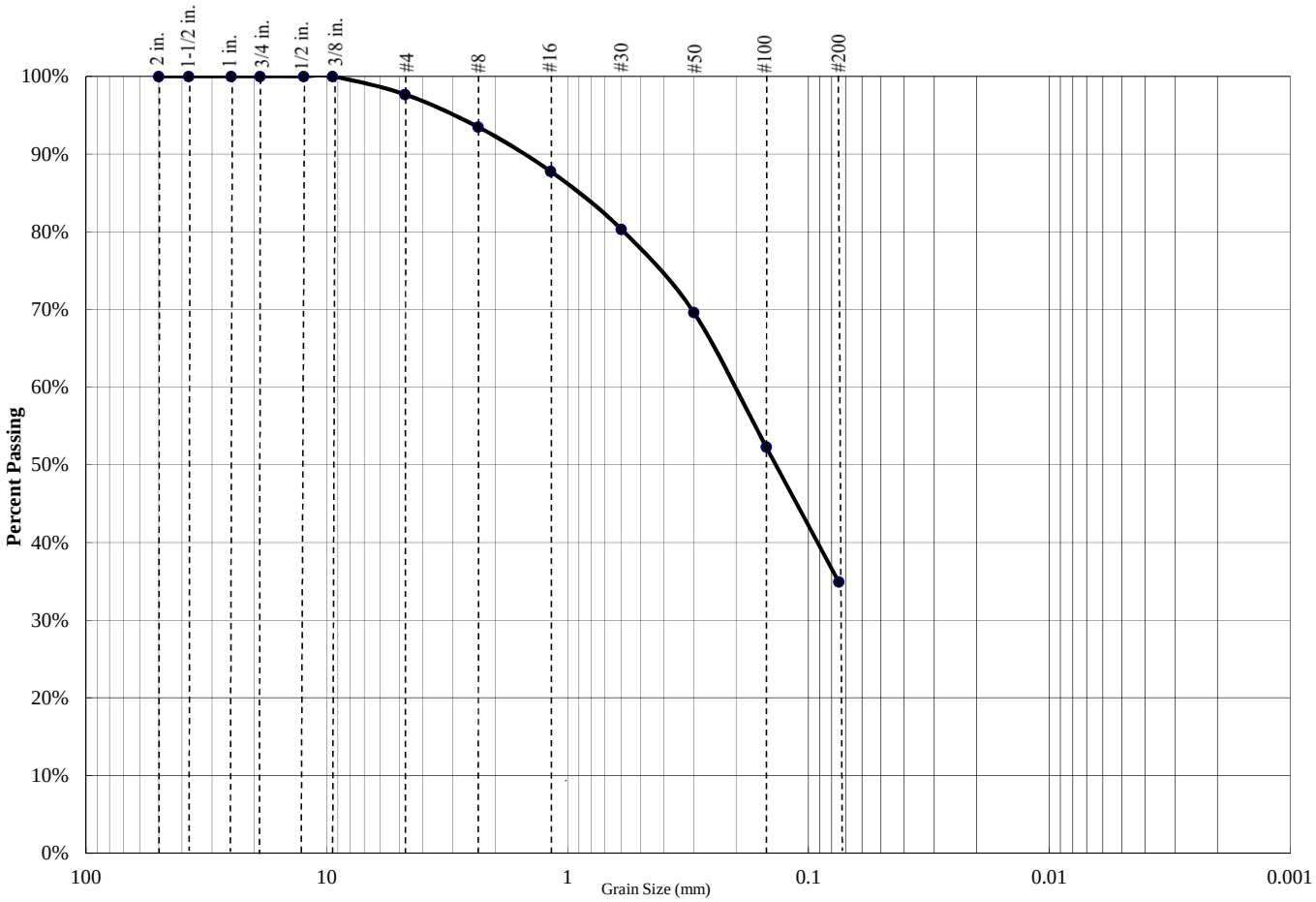
Project Number: 3-218-0666

Boring: B-18 @ 2'

SALEM engineering group, inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
2%	63%	35%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	100.0%
#4	97.7%
#8	93.5%
#16	87.8%
#30	80.3%
#50	69.6%
#100	52.3%
#200	35.0%

Atterberg Limits		
PL=	**LL=**	**PI=**

Coefficients		
D_{85}=	**D_{60}=**	**D_{50}=**
D_{30}=	**D_{15}=**	**D_{10}=**
C_u= N/A	**C_c=** N/A	

USCS CLASSIFICATION
Silty SAND (SM)

Project Name: Comm Development - Yucaipa, CA

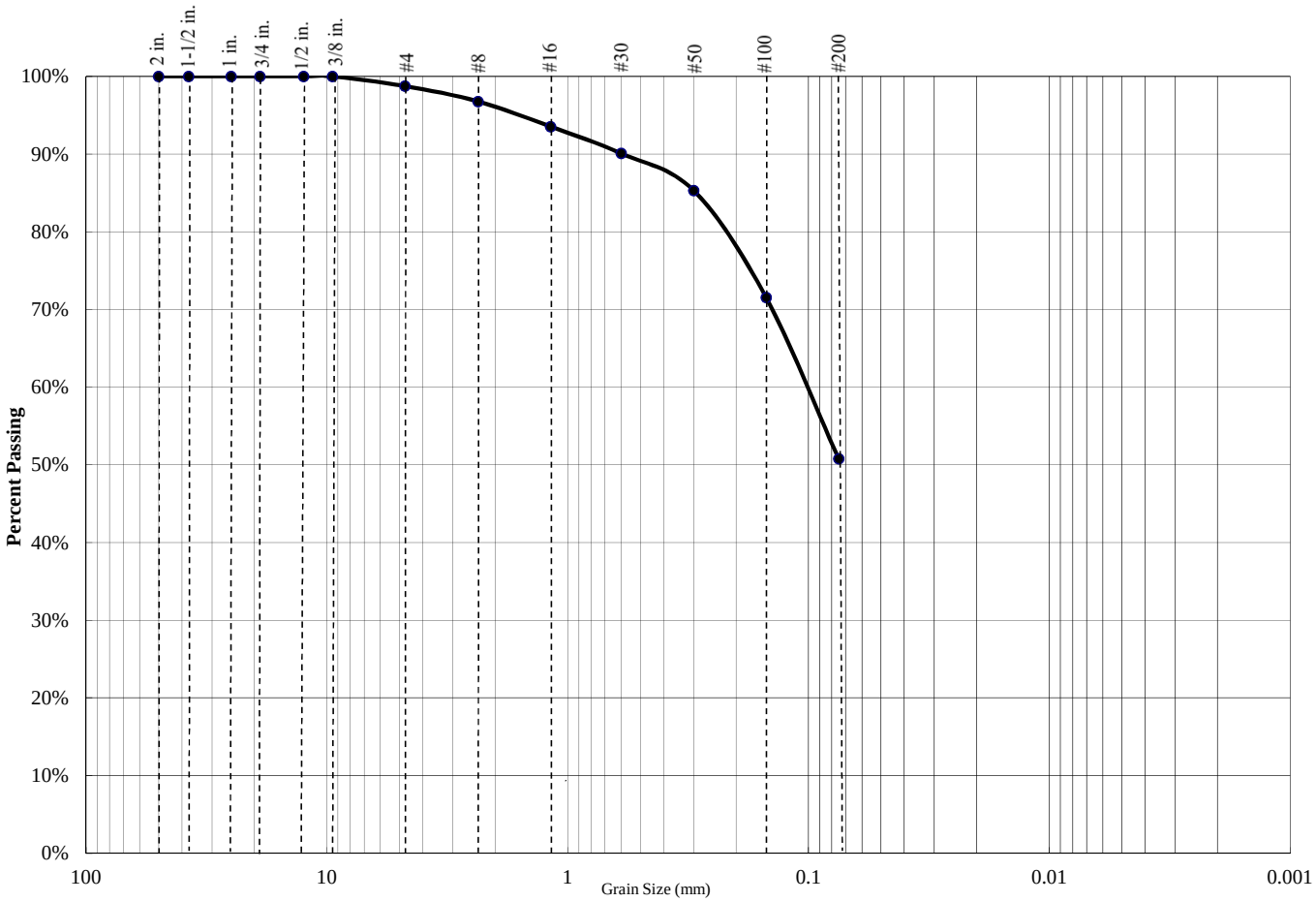
Project Number: 3-218-0666

Boring: B-18 @ 5'

SALEM engineering group, inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
1%	48%	51%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	100.0%
#4	98.7%
#8	96.8%
#16	93.5%
#30	90.1%
#50	85.3%
#100	71.5%
#200	50.8%

Atterberg Limits		
PL=	**LL=**	**PI=**

Coefficients				
D_{85}=		**D_{60}=**		**D_{50}=**
D_{30}=		**D_{15}=**		**D_{10}=**
C_u=	N/A	**C_c=**	N/A	

USCS CLASSIFICATION
Silty SAND (SM)

Project Name: Comm Development - Yucaipa, CA

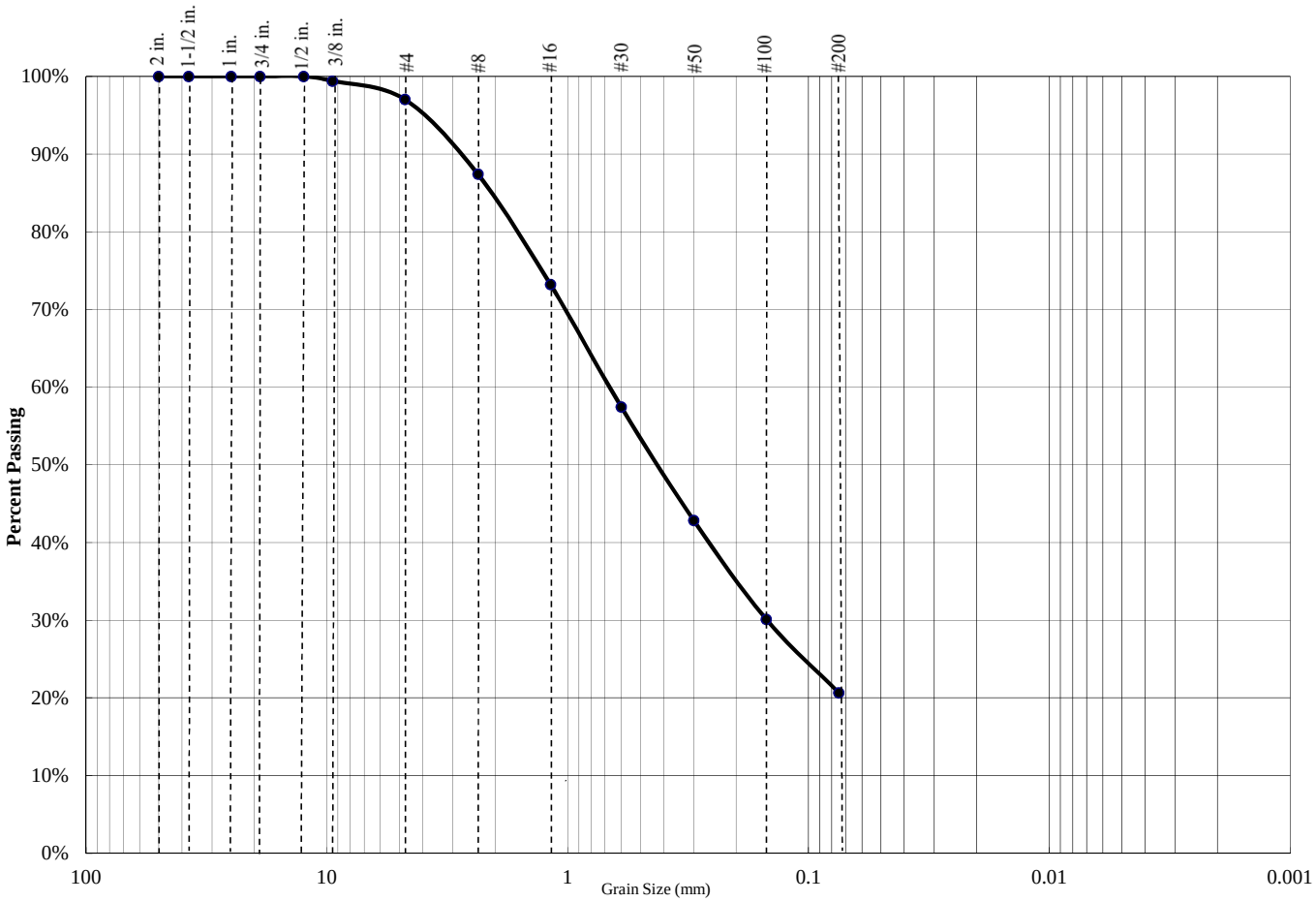
Project Number: 3-218-0666

Boring: B-18 @ 10'

SALEM engineering group, inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
3%	76%	21%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	99.4%
#4	97.0%
#8	87.4%
#16	73.2%
#30	57.5%
#50	42.9%
#100	30.1%
#200	20.7%

Atterberg Limits		
PL=	**LL=**	**PI=**

Coefficients			
D_{85}=		**D_{60}=**	**D_{50}=**
D_{30}=		**D_{15}=**	**D_{10}=**
C_u=	N/A	**C_c=**	N/A

USCS CLASSIFICATION
Silty SAND (SM)

Project Name: Comm Development - Yucaipa, CA

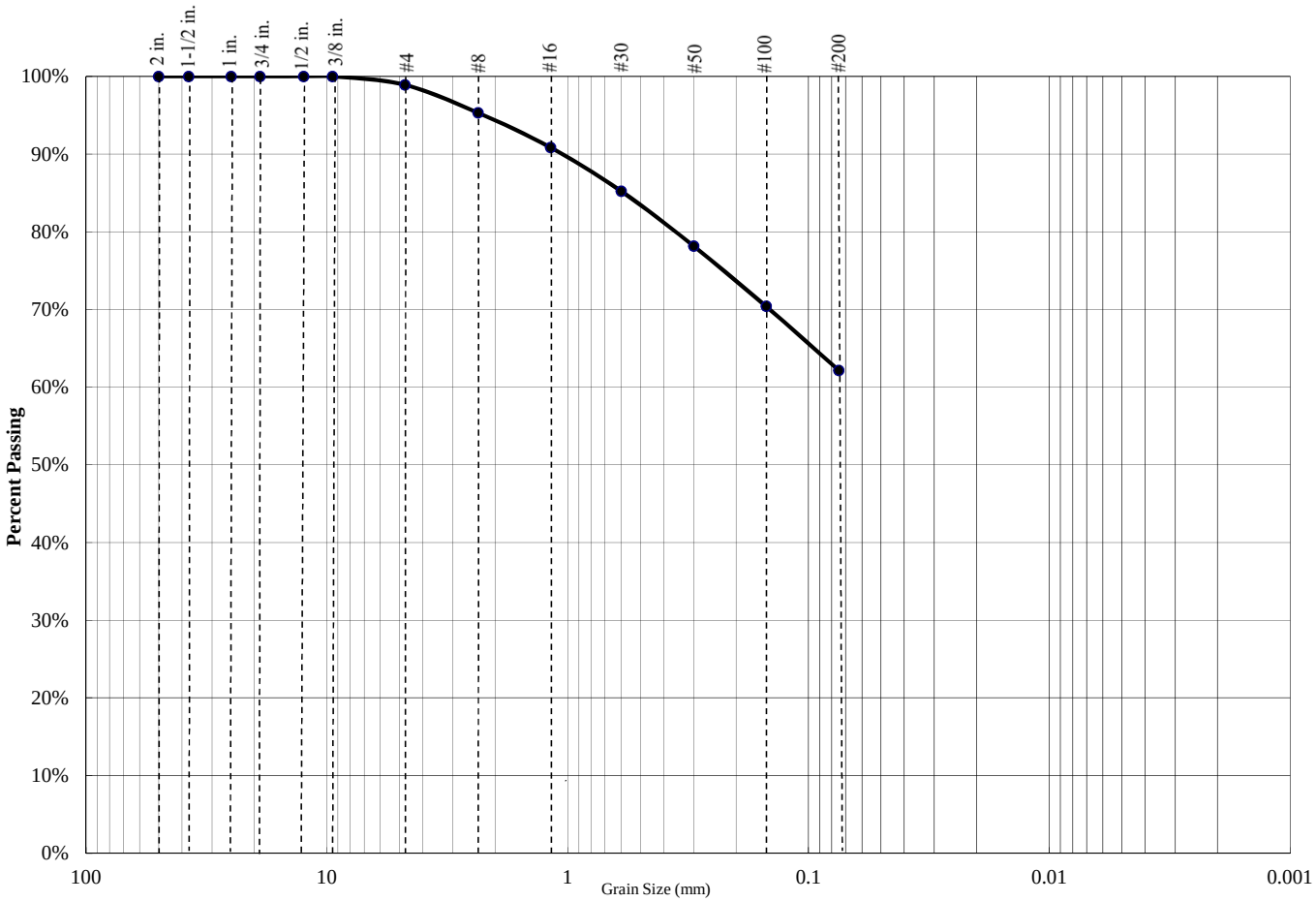
Project Number: 3-218-0666

Boring: B-18 @ 20'

SALEM engineering group, inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
1%	37%	62%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	100.0%
#4	98.9%
#8	95.3%
#16	90.8%
#30	85.2%
#50	78.1%
#100	70.4%
#200	62.2%

Atterberg Limits		
PL=	**LL=**	**PI=**

Coefficients				
D_{85}=		**D_{60}=**		**D_{50}=**
D_{30}=		**D_{15}=**		**D_{10}=**
C_u=	N/A	**C_c=**	N/A	

USCS CLASSIFICATION
Sandy SILT (ML)

Project Name: Comm Development - Yucaipa, CA

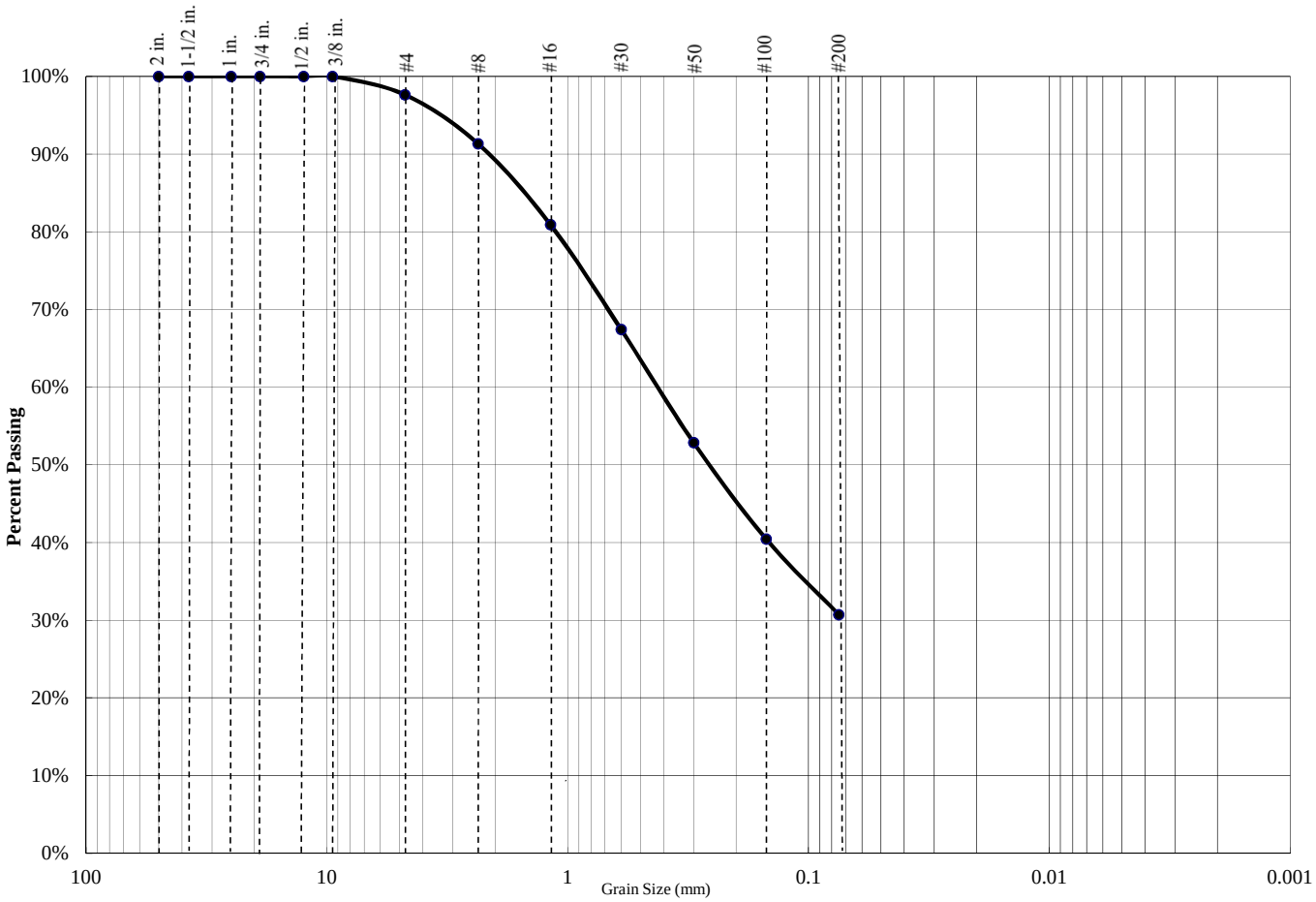
Project Number: 3-218-0666

Boring: B-18 @ 25'

SALEM engineering group, inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
2%	67%	31%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	100.0%
#4	97.6%
#8	91.3%
#16	80.9%
#30	67.4%
#50	52.8%
#100	40.4%
#200	30.7%

Atterberg Limits		
PL=	**LL=**	**PI=**

Coefficients				
D_{85}=		**D_{60}=**		**D_{50}=**
D_{30}=		**D_{15}=**		**D_{10}=**
C_u=	N/A	**C_c=**	N/A	

USCS CLASSIFICATION
Silty SAND (SM)

Project Name: Comm Development - Yucaipa, CA

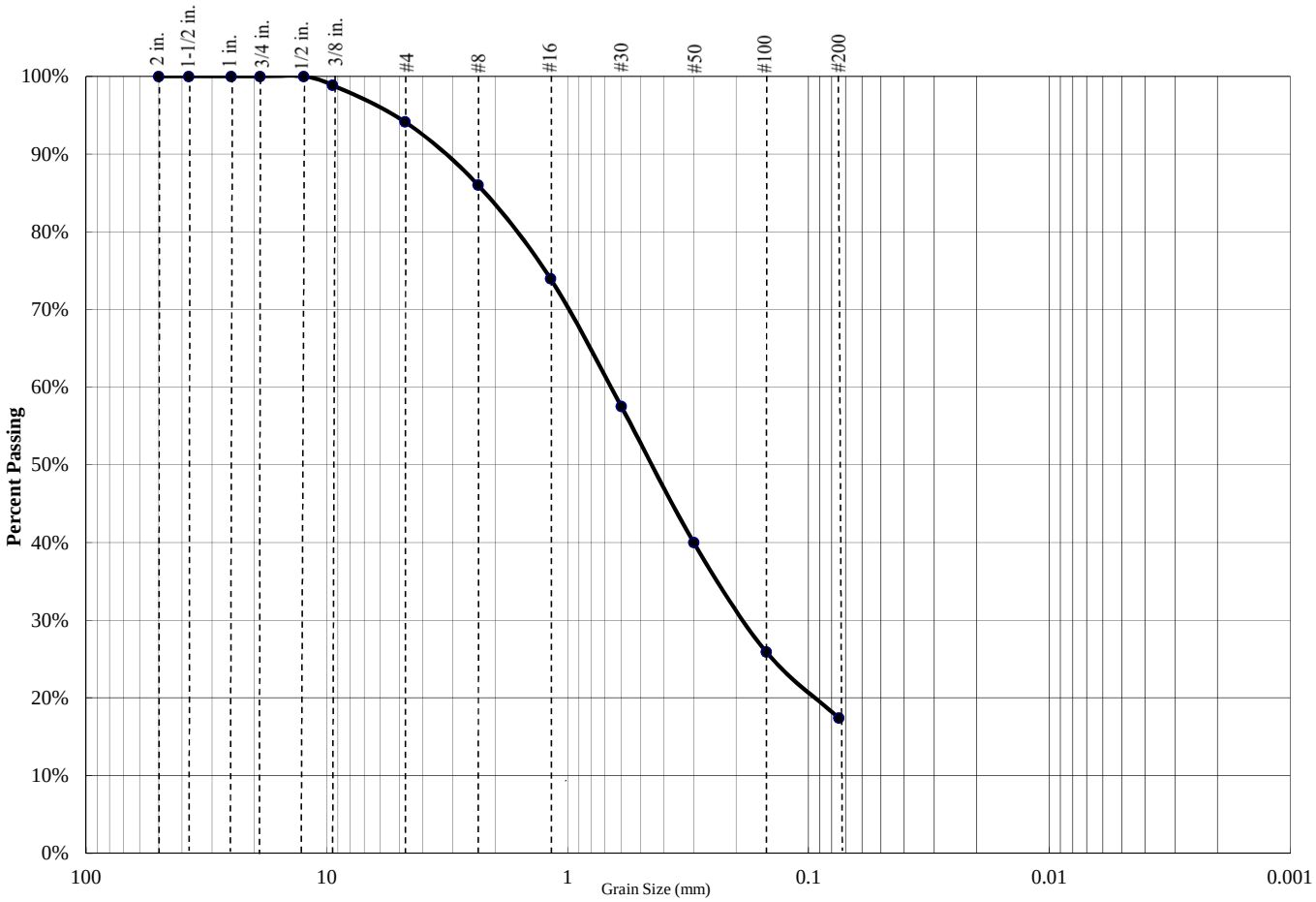
Project Number: 3-218-0666

Boring: B-18 @ 30'

SALEM engineering group, inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
6%	77%	17%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	98.9%
#4	94.2%
#8	86.0%
#16	74.0%
#30	57.5%
#50	40.0%
#100	25.9%
#200	17.4%

Atterberg Limits		
PL=	**LL=**	**PI=**

Coefficients				
D_{85}=		**D_{60}=**		**D_{50}=**
D_{30}=		**D_{15}=**		**D_{10}=**
C_u=	N/A	**C_c=**	N/A	

USCS CLASSIFICATION
Silty SAND (SM)

Project Name: Comm Development - Yucaipa, CA

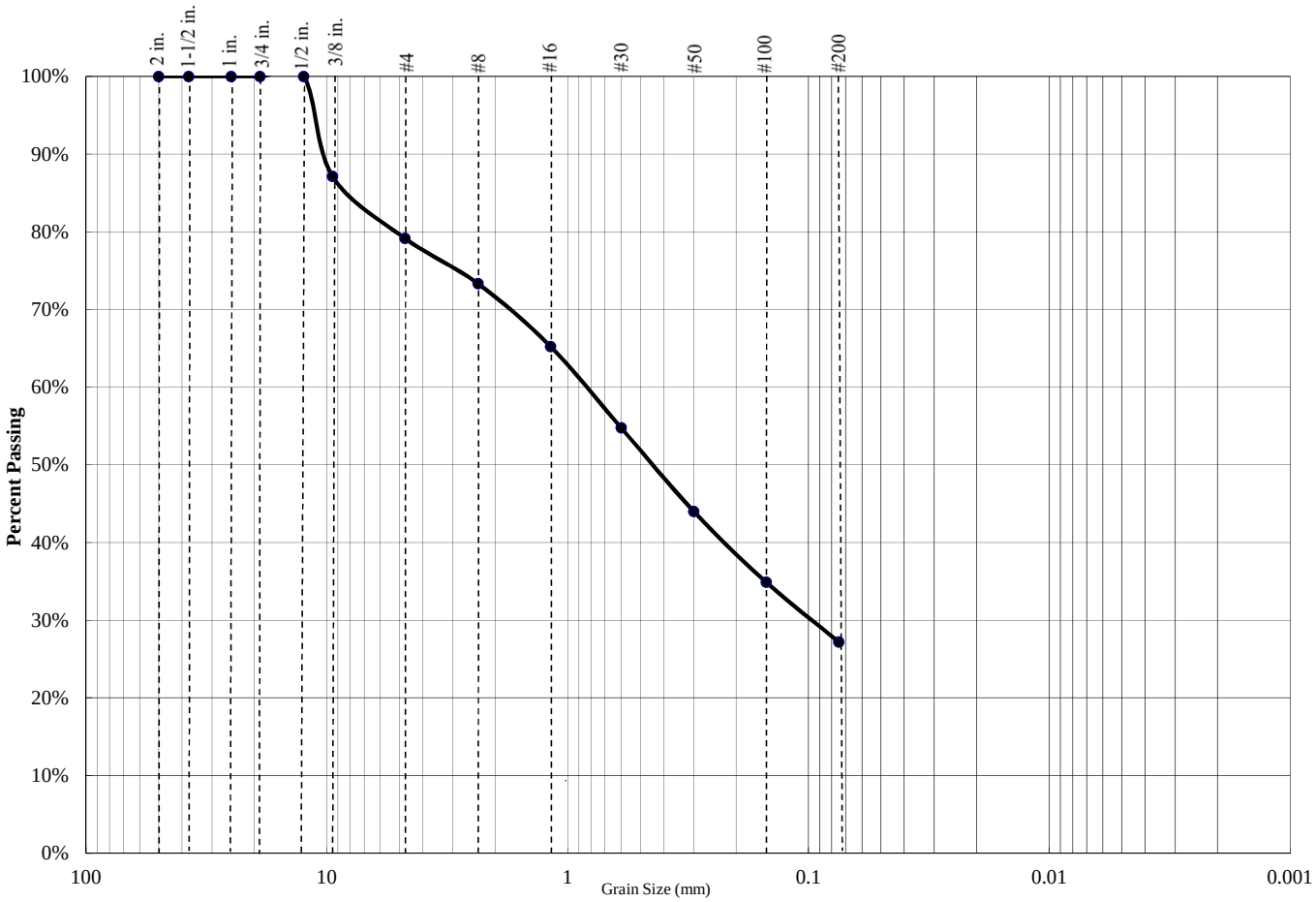
Project Number: 3-218-0666

Boring: B-18 @ 45'

SALEM engineering group, inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
21%	52%	27%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	87.2%
#4	79.2%
#8	73.3%
#16	65.2%
#30	54.8%
#50	44.0%
#100	34.9%
#200	27.2%

Atterberg Limits		
PL=	**LL=**	**PI=**

Coefficients				
D_{85}=		**D_{60}=**		**D_{50}=**
D_{30}=		**D_{15}=**		**D_{10}=**
C_u=	N/A	**C_c=**	N/A	

USCS CLASSIFICATION
Silty SAND (SM)

Project Name: Comm Development - Yucaipa, CA

Project Number: 3-218-0666

Boring: B-22 @ 10'

SALEM engineering group, inc.

EXPANSION INDEX TEST
ASTM D4829

Project Name: Comm Development - Yucaipa, CA
Project Number: 3-218-0666
Date Sampled: 8/1/18 to 8/3/18 Date Tested: 8/14/18
Sampled By: SEG Tested By: AV
Sample Location: B-18 @ 0 - 3'
Soil Description: Dark Brown Sandy SILT (ML) w/ trace clay

Trial #	1	2	3
Weight of Soil & Mold, g.	596.8		
Weight of Mold, g.	188.2		
Weight of Soil, g.	408.6		
Wet Density, pcf	123.2		
Weight of Moisture Sample (Wet), g.	840.0		
Weight of Moisture Sample (Dry), g.	770.0		
Moisture Content, %	9.1		
Dry Density, pcf	113.0		
Specific Gravity of Soil	2.7		
Degree of Saturation, %	49.9		

Time	Inital	30 min	1 hr	6 hrs	12 hrs	24 hrs
Dial Reading	0	0.0221	0.023	--	--	0.0258

Expansion Index $_{measured}$ = 25.8
Expansion Index $_{50}$ = 25.8

Expansion Index = 26

Expansion Potential Table	
Exp. Index	Potential Exp.
0 - 20	Very Low
21 - 50	Low
51 - 90	Medium
91 - 130	High
>130	Very High

SALEM engineering group, inc.

CHEMICAL ANALYSIS

SO_4 - Modified CTM 417 & Cl - Modified CTM 417/422

Project Name: Comm Development - Yucaipa, CA
Project Number: 3-218-0666
Date Sampled: 8/1/18 to 8/3/18 Date Tested: 8/9/18
Sampled By: SEG Tested By: RA
Soil Description: Dark Brown Sandy SILT (ML) w/ trace clay

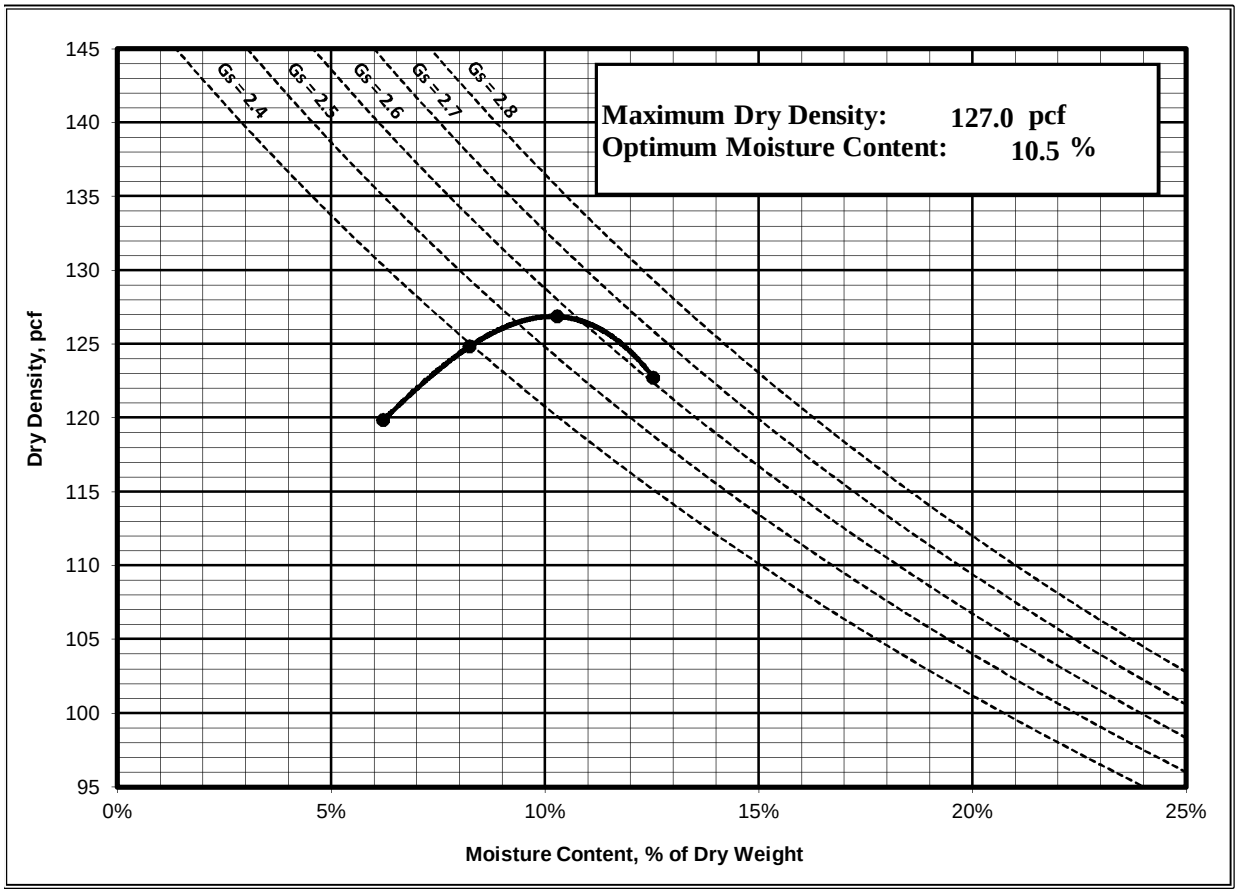
Sample Number	Sample Location	Soluble Sulfate SO_4-S	Soluble Chloride Cl	pH
1a.	B-18 @ 0 - 3'	50 mg/kg	49 mg/kg	7.9
1b.	B-18 @ 0 - 3'	50 mg/kg	49 mg/kg	7.9
1c.	B-18 @ 0 - 3'	50 mg/kg	49 mg/kg	7.9
Average:		**50 mg/kg**	**49 mg/kg**	**7.9**

SALEM engineering group, inc.

Laboratory Compaction Curve
ASTM D1557

Project Name: Comm Development - Yucaipa, CA
Project Number: 3-218-0666
Date Sampled: 8/1/18 to 8/3/18 Date Tested: 8/14/18
Sampled By: SEG Tested By: JG
Sample Location: B-18 @ 0 - 3'
Soil Description: Dark Brown Sandy SILT (ML) w/ trace clay
Test Method: Method A

	1	2	3	4
Weight of Moist Specimen & Mold, (g)	3909.9	4027.9	4100.5	4073.2
Weight of Compaction Mold, (g)	1985.2	1985.2	1985.2	1985.2
Weight of Moist Specimen, (g)	1924.7	2042.7	2115.3	2088.0
Volume of Mold, (ft^3)	0.0333	0.0333	0.0333	0.0333
Wet Density, (pcf)	127.3	135.1	139.9	138.1
Weight of Wet (Moisture) Sample, (g)	336.4	336.4	336.4	336.4
Weight of Dry (Moisture) Sample, (g)	316.7	310.8	305.0	298.9
Moisture Content, (%)	6.2%	8.2%	10.3%	12.5%
Dry Density, (pcf)	119.8	124.8	126.8	122.7



SALEM engineering group, inc.

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.

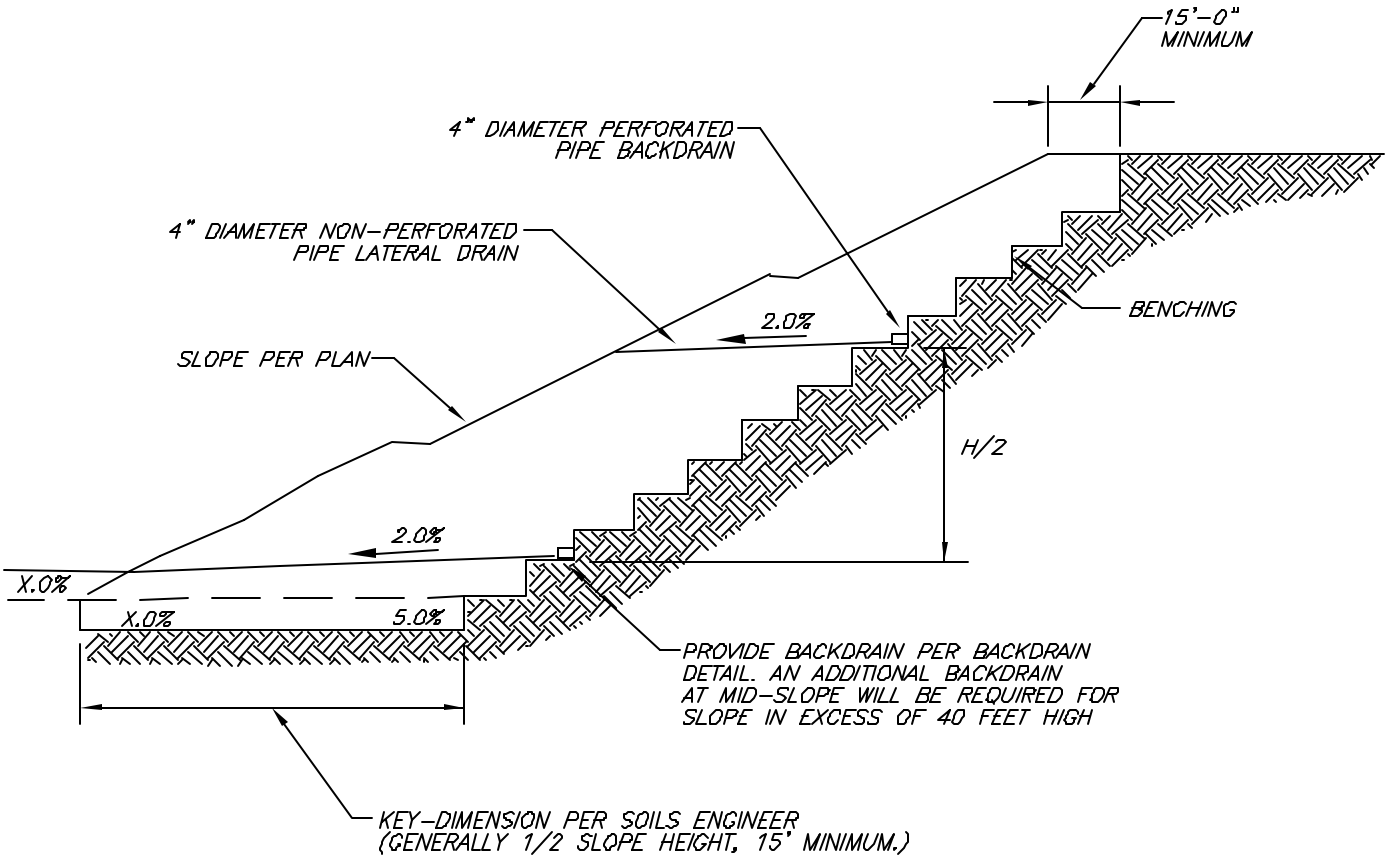
The term "Standard Specifications": hereinafter referred to, is the most recent edition of the Standard Specifications of the State of California, Department of Transportation. The term "relative compaction" refers to the field density expressed as a percentage of the maximum laboratory density as determined 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.

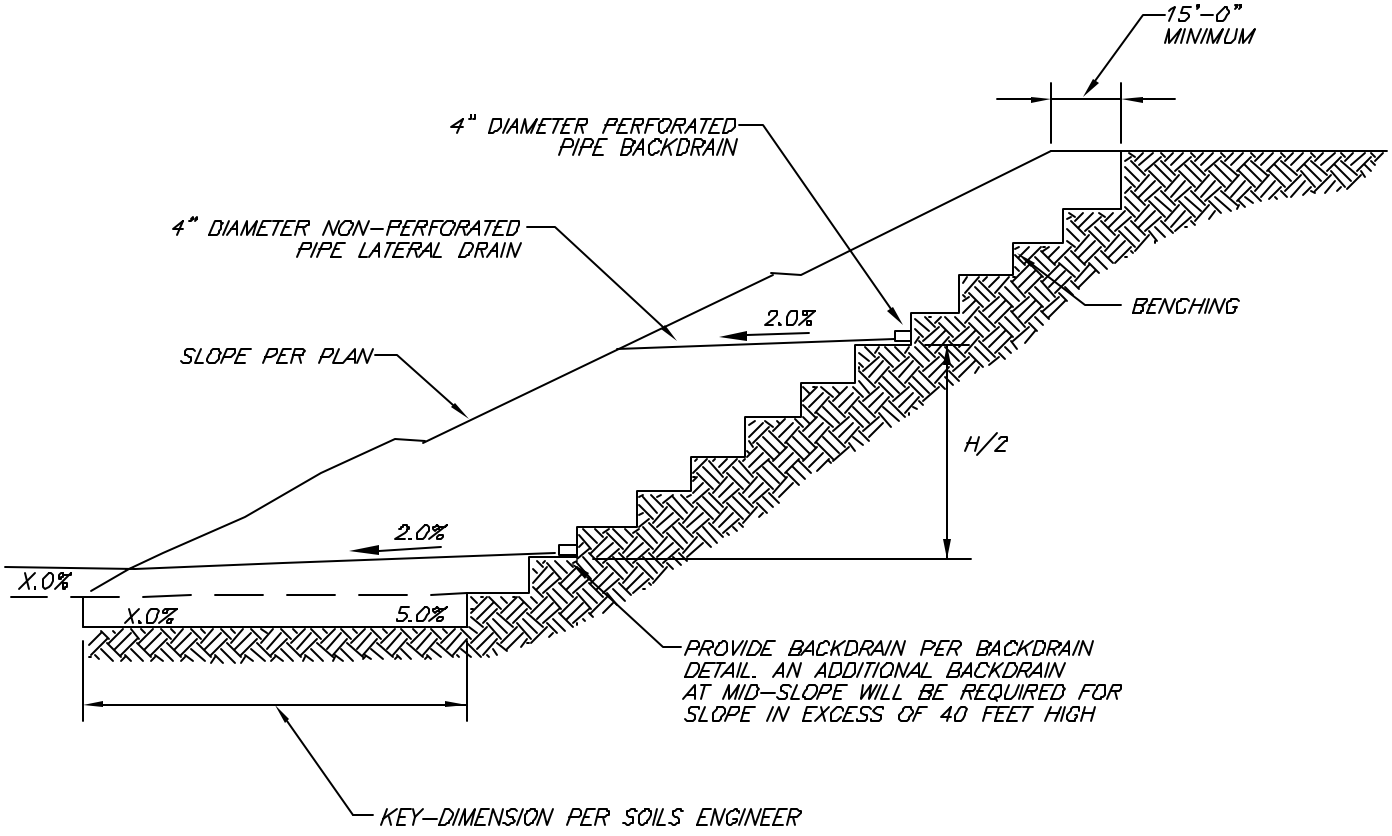
15.0 AGGREGATE SUBBASE - The aggregate subbase shall be spread and compacted on the prepared subgrade in conformity with the lines, grades, and dimensions shown on the plans. The aggregate subbase material shall conform to the requirements of Section 25 of the Standard Specifications for Class II Subbase 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.



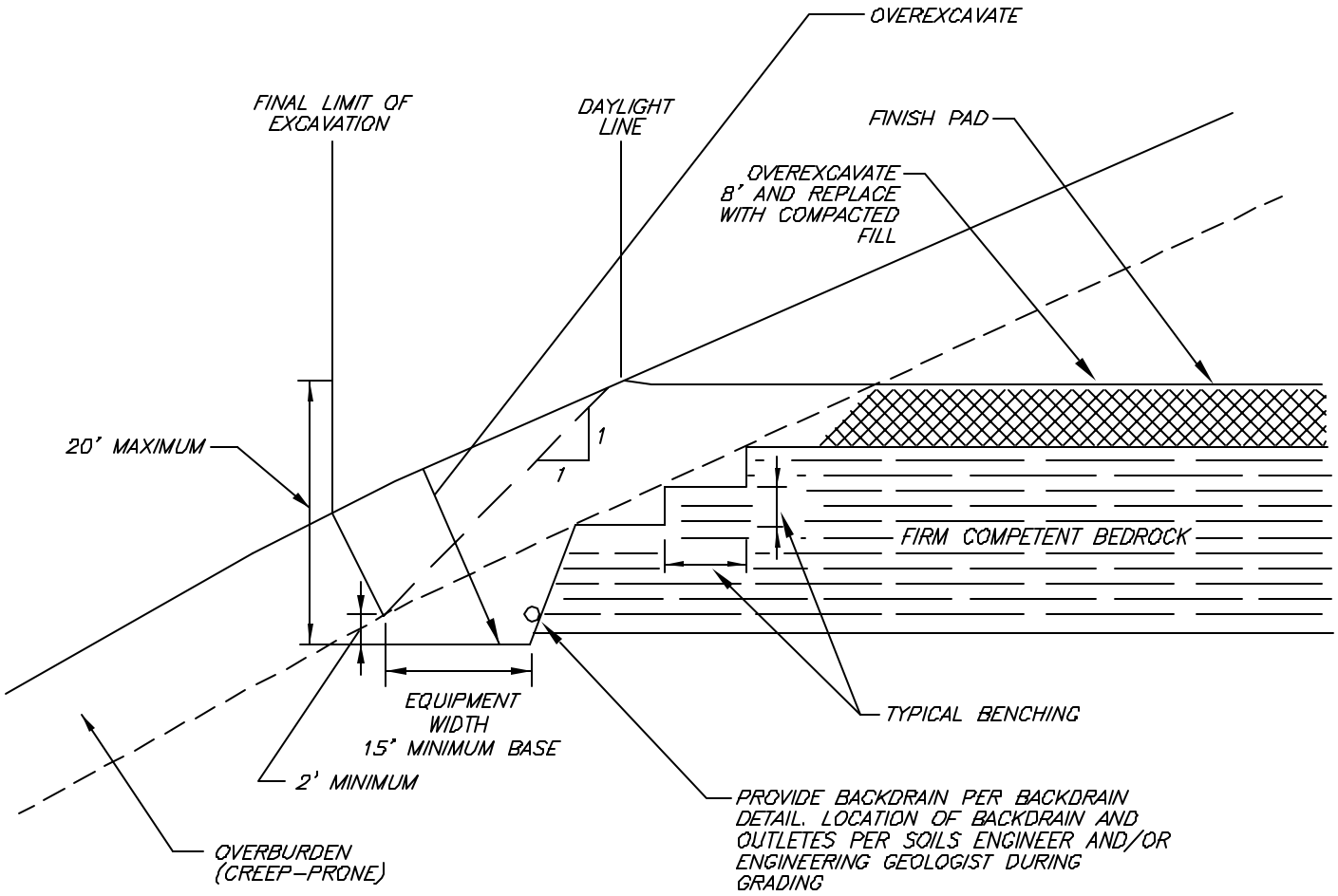
TYPICAL STABILIZATION FILL DETAIL

SALEM Engineering Group, Inc.



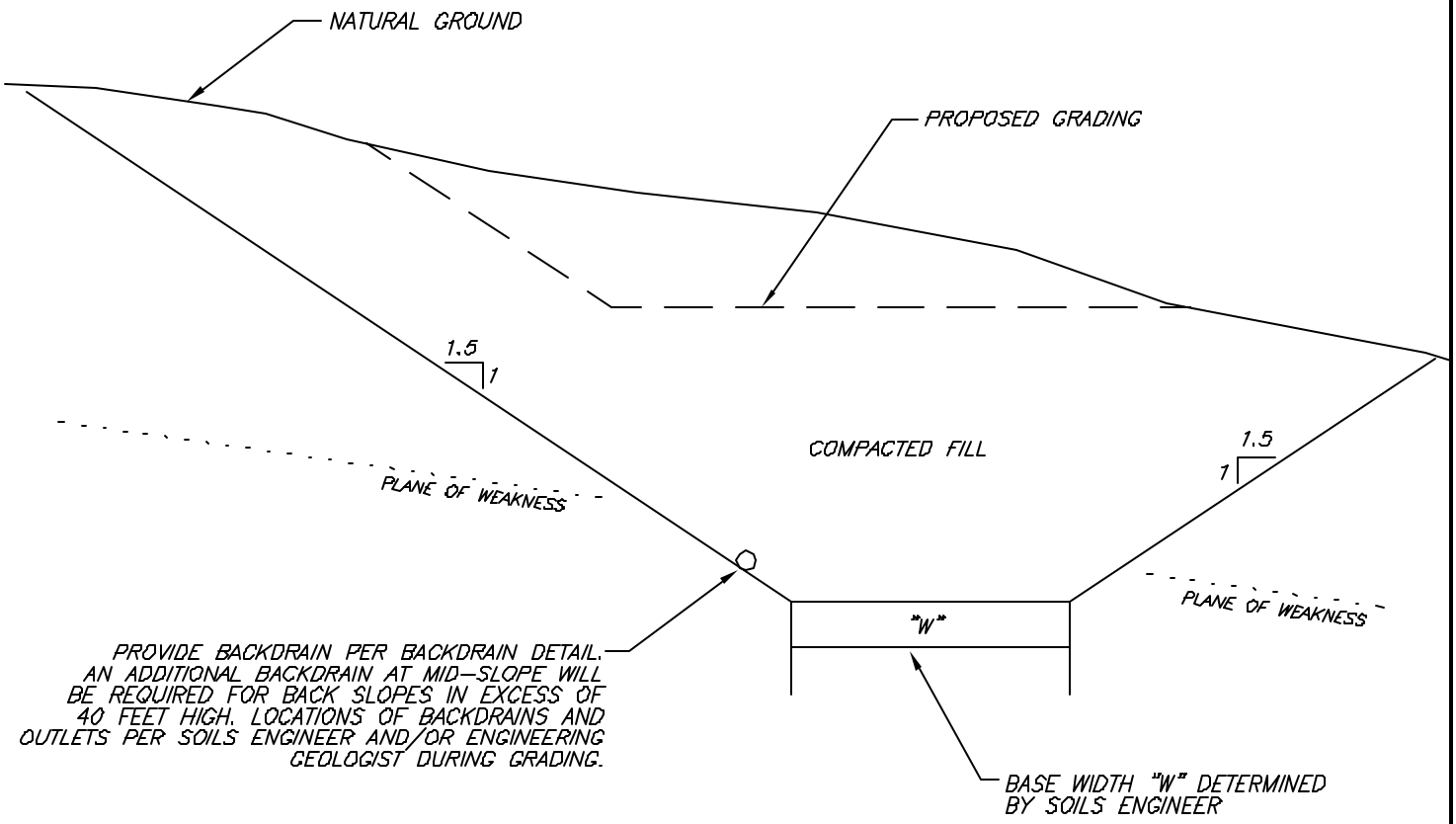
TYPICAL BUTTRESS FILL DETAIL

SALEM
Engineering Group, Inc.



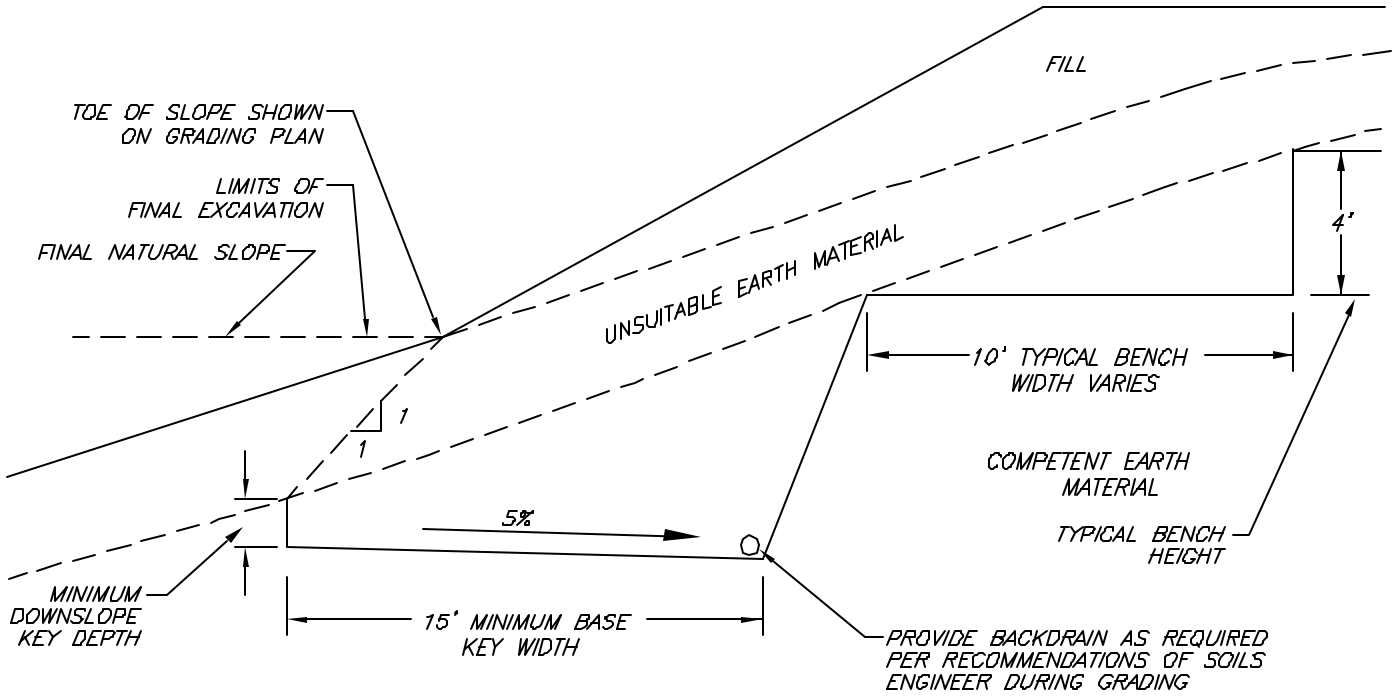
DAYLIGHT SHEAR KEY DETAIL

SALEM Engineering Group, Inc.



TYPICAL SHEAR KEY DETAIL

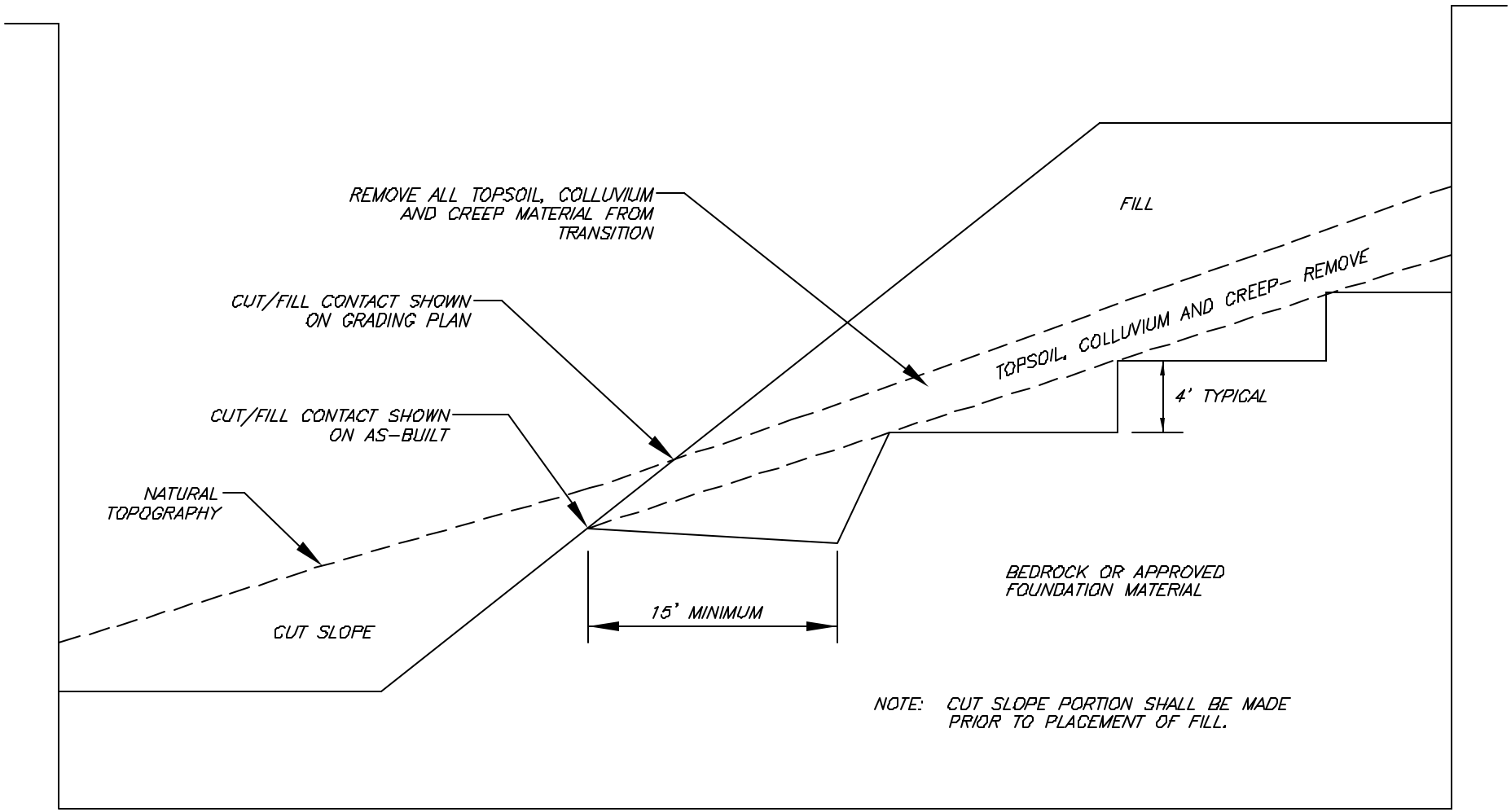
SALEM Engineering Group, Inc.



WHERE NATURAL SLOPE IS 5:1 OR LESS, BENCHING IS NOT NECESSARY, HOWEVER, FILL IS NOT TO BE PLACED ON COMPRESSIBLE OR UNSUITABLE MATERIAL.

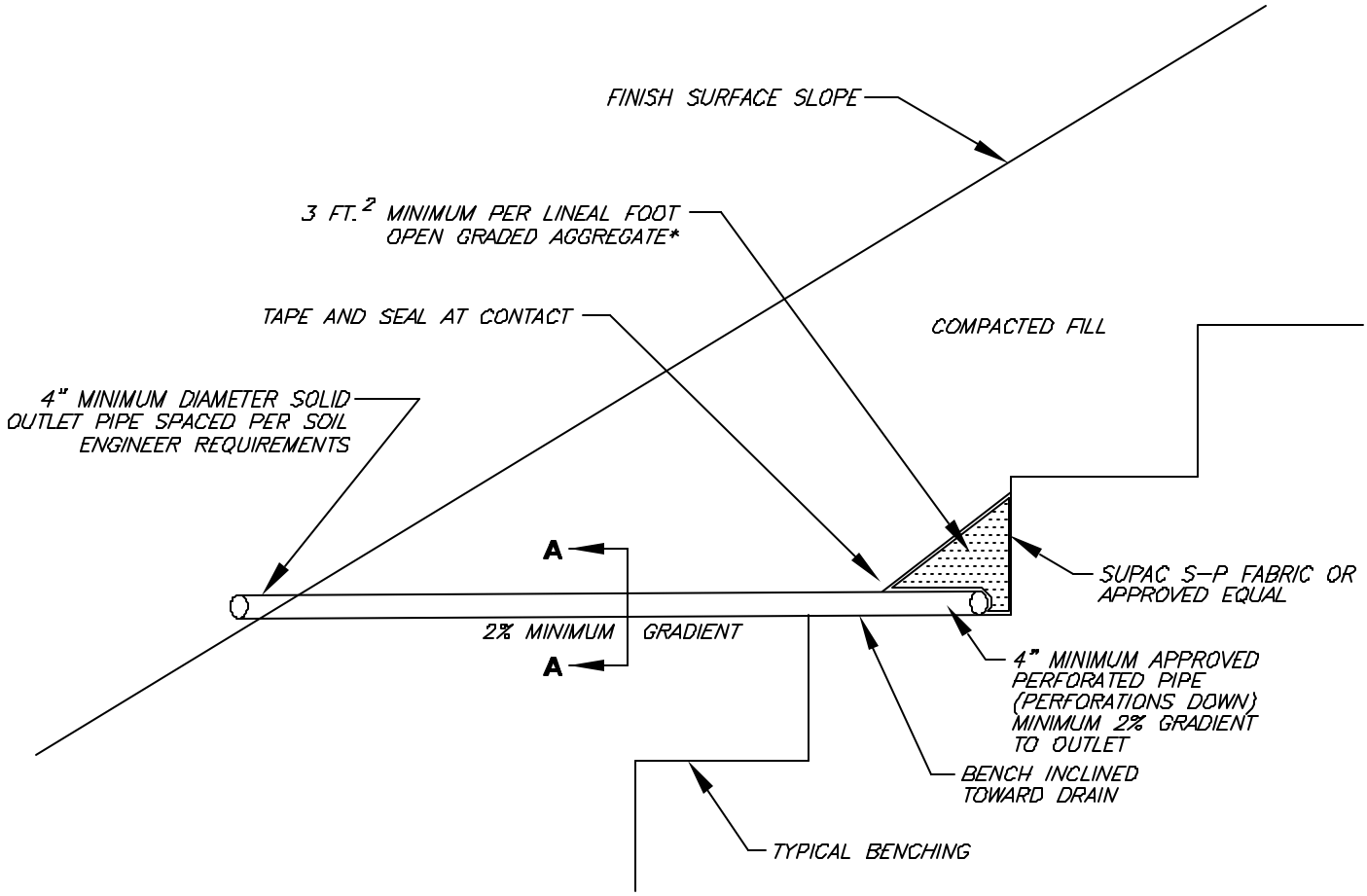
FILL SLOPE ABOVE NATURAL GROUND DETAIL

SALEM Engineering Group, Inc.

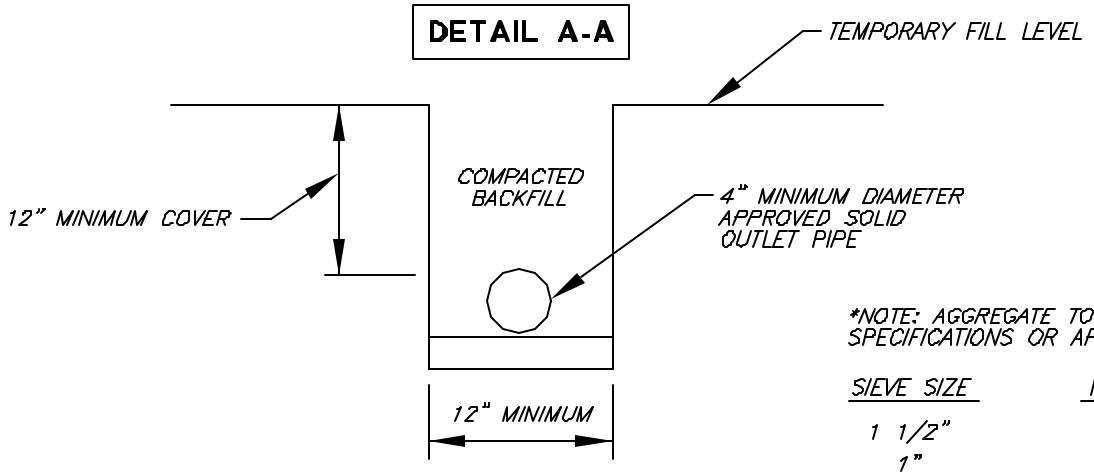


FILL SLOPE ABOVE CUT SLOPE DETAIL

SALEM Engineering Group, Inc.



DETAIL A-A

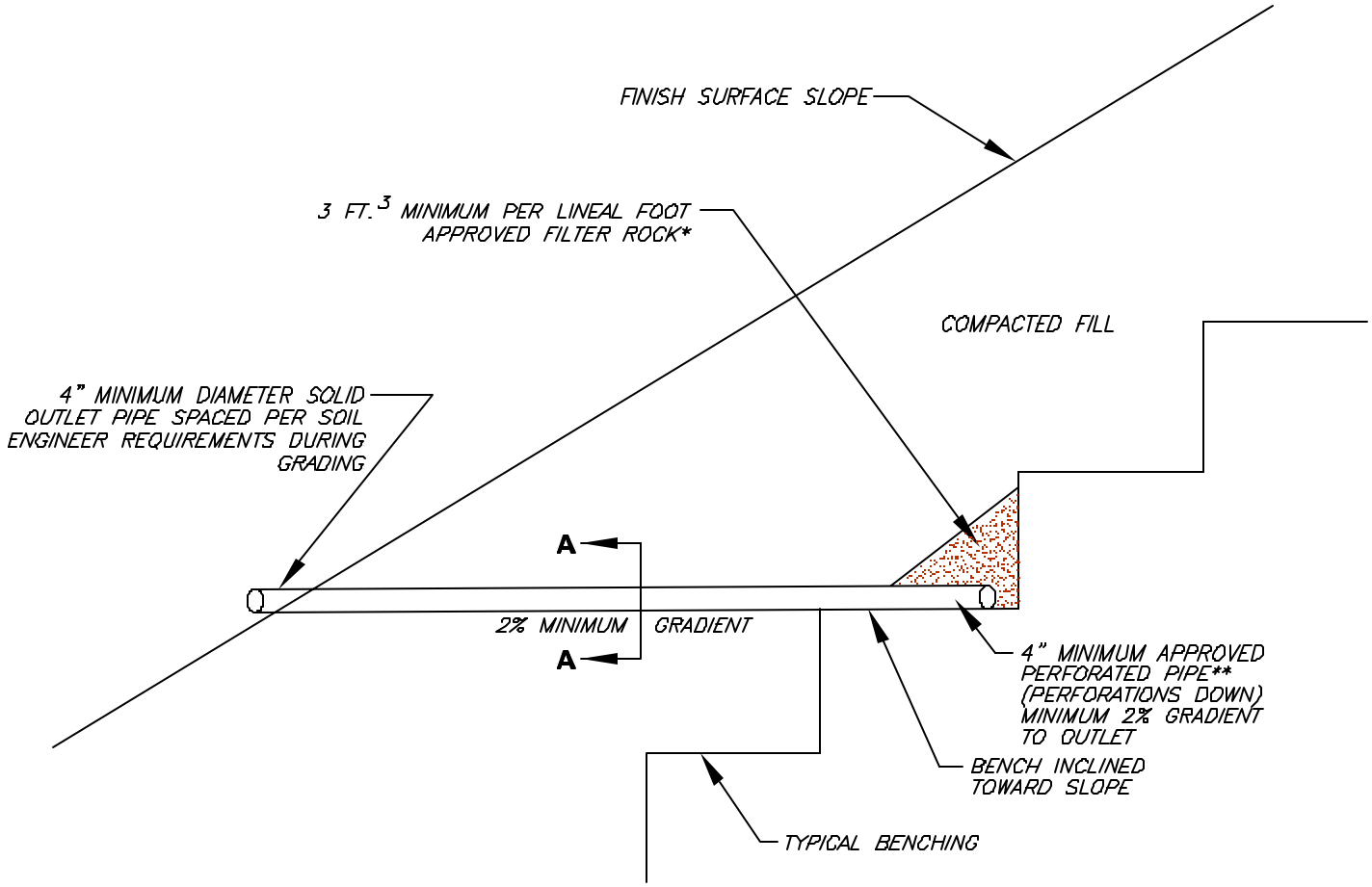


*NOTE: AGGREGATE TO MEET FOLLOWING SPECIFICATIONS OR APPROVED EQUAL:

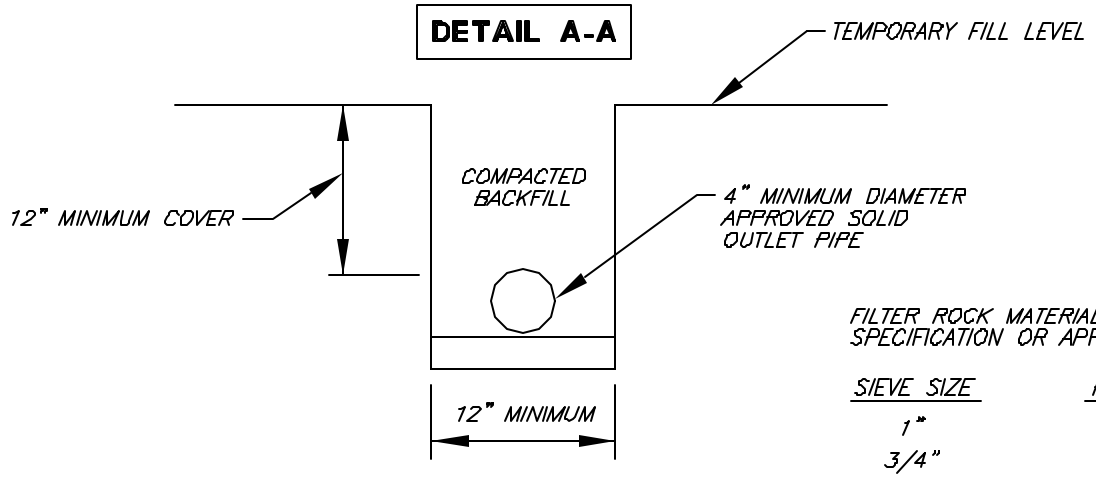
SIEVE SIZE	PERCENTAGE PASSING
1 1/2"	100
1"	5-40
3/4"	0-17
3/8"	0-7
NO. 200	0-3

BACKDRAIN DETAIL (GEOFABRIC)

SALEM Engineering Group, Inc.



DETAIL A-A



FILTER ROCK MATERIAL TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUAL:

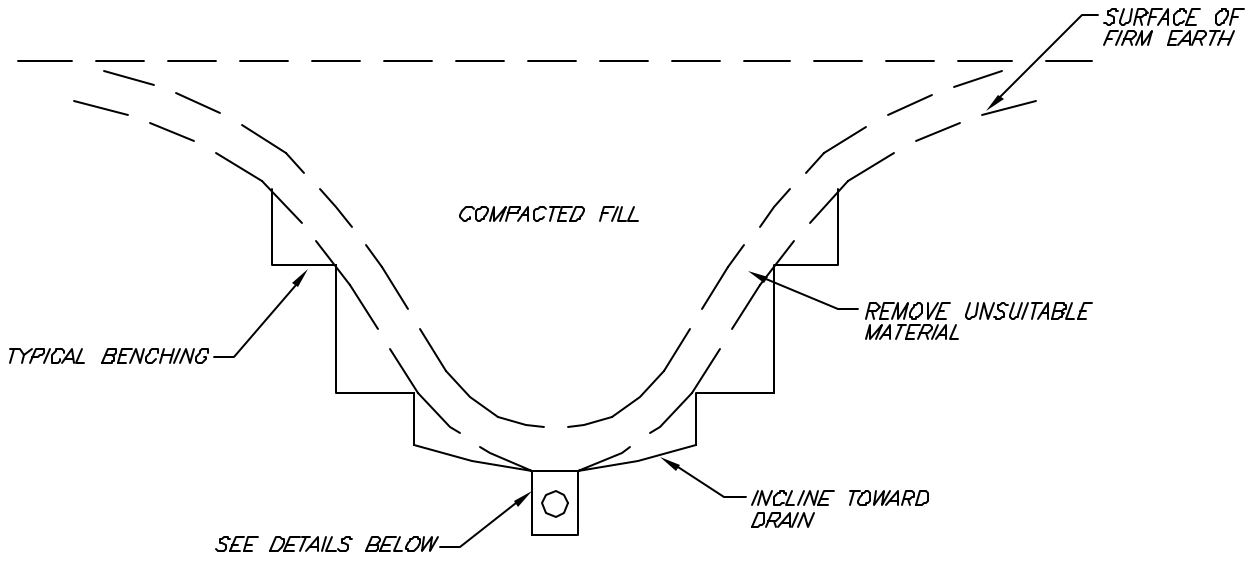
SIEVE SIZE	PERCENTAGE
1"	100
3/4"	90–100
3/8"	40–100
NO. 4	25–40
NO. 30	5–15
NO. 50	0–7
NO. 200	0–3

**APPROVED PIPE TYPE:

SCHEDULE 40 POLYVINYL CHLORIDE (P.V.C.) OR APPROVED EQUAL. MINIMUM CRUSH STRENGTH 1000 PSI.

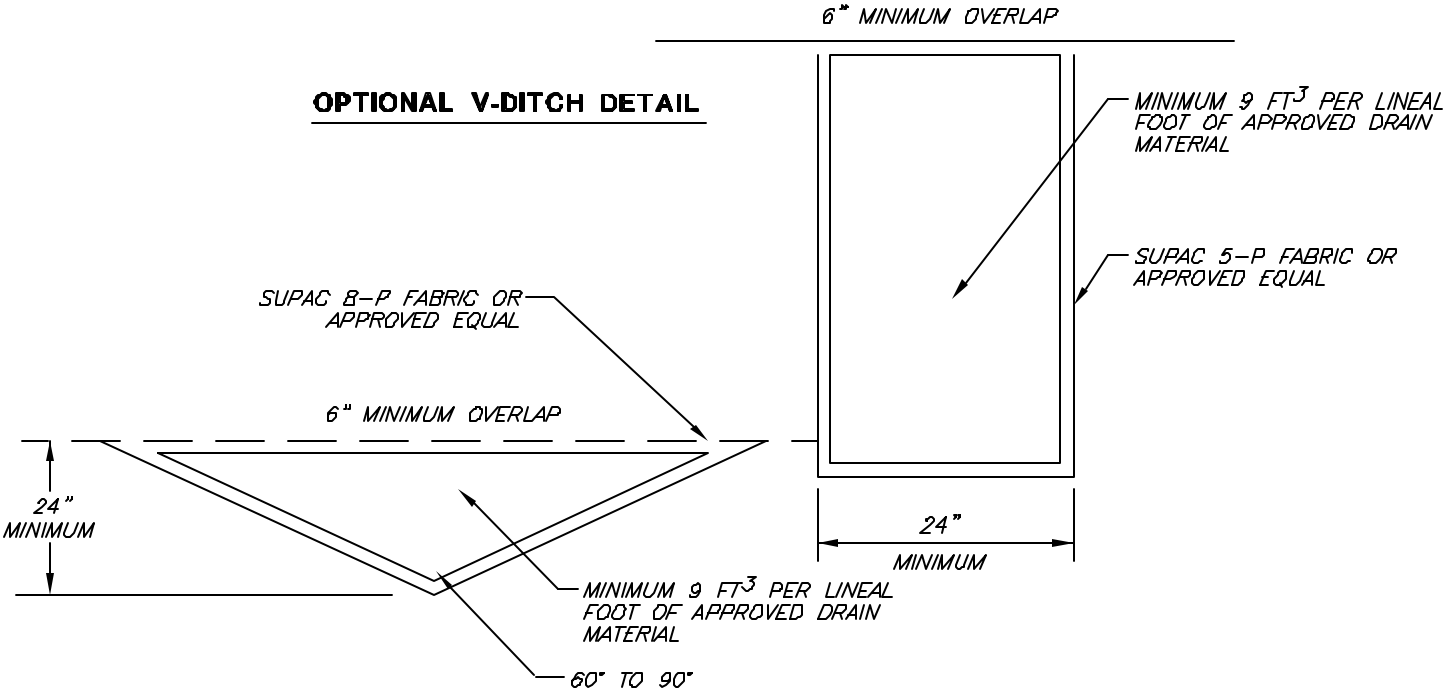
TYPICAL BACKDRAIN DETAIL

SALEM Engineering Group, Inc.



TRENCH DETAIL

OPTIONAL V-DITCH DETAIL



DRAIN MATERIAL TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUAL:

SIEVE SIZE	PERCENTAGE PASSING
1-1/2"	88-100
1"	5-40
3/4"	0-17
3/8"	0-7
NO.:200	0-3

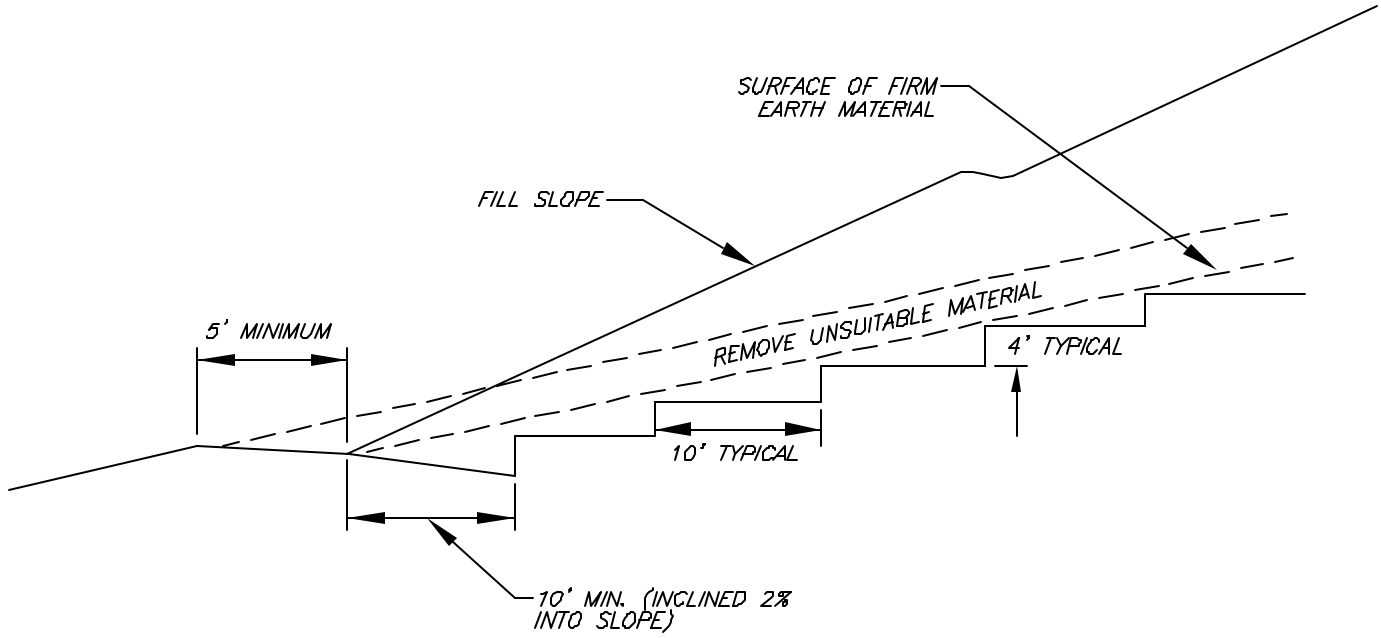
ADD MINIMUM 4" DIAMETER APPROVED PERFORATED PIPE WHEN GRADIENT IS LESS THAN 2%

APPROVED PIPE TO BE SCHEDULE 40 POLY-VINYL-CHLORIDE (P.V.C.) OR APPROVED EQUAL. MINIMUM CRUSH STRENGTH 1000 psi.

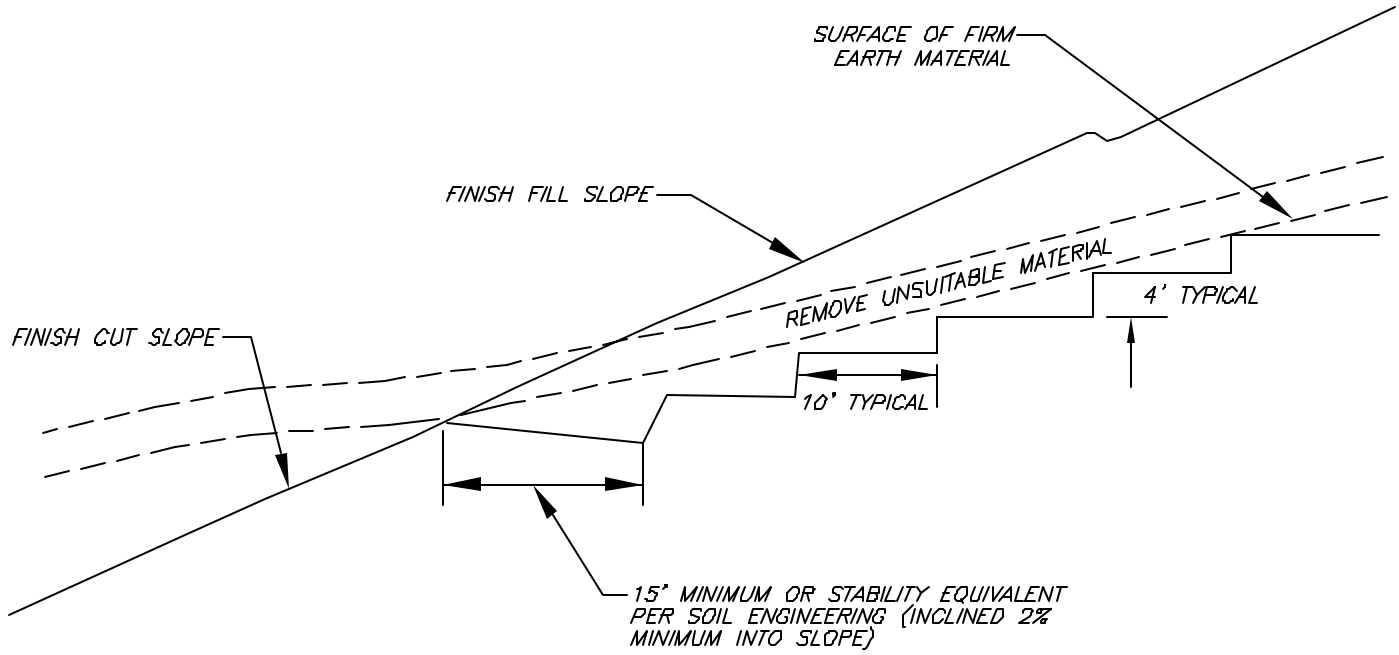
GEOFABRIC SUBDRAIN DETAIL

SALEM Engineering Group, Inc.

BENCHING FILL OVER NATURAL

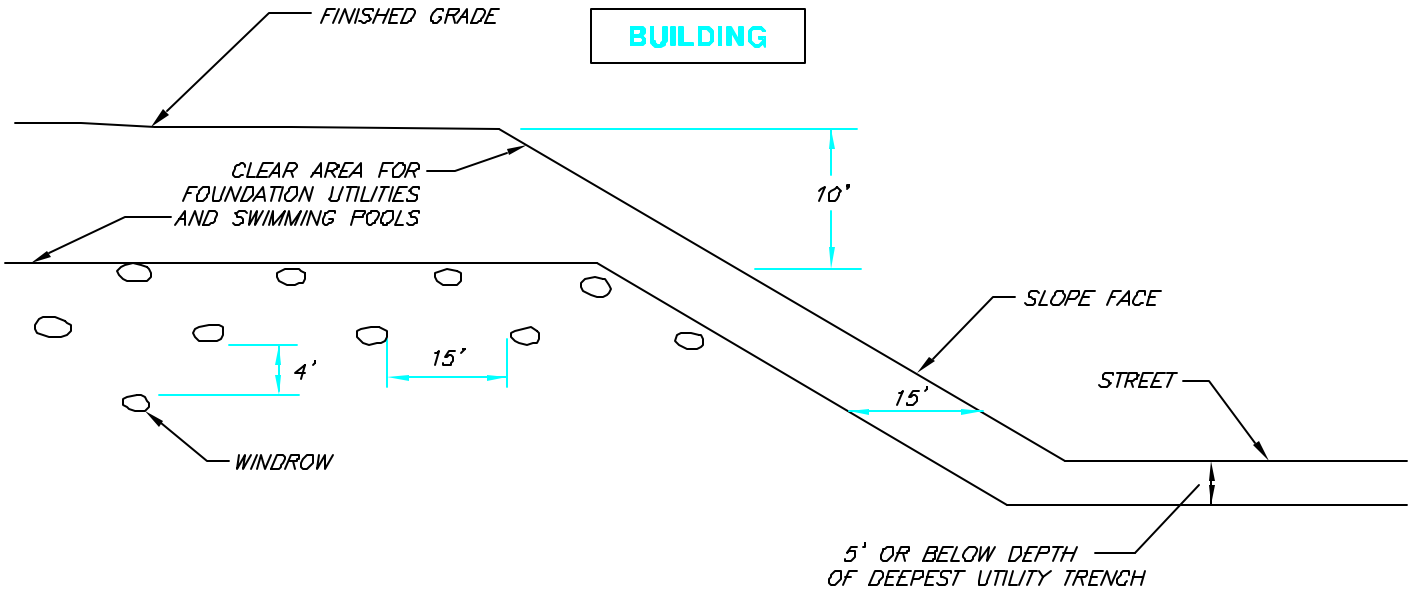


BENCHING FILL OVER CUT

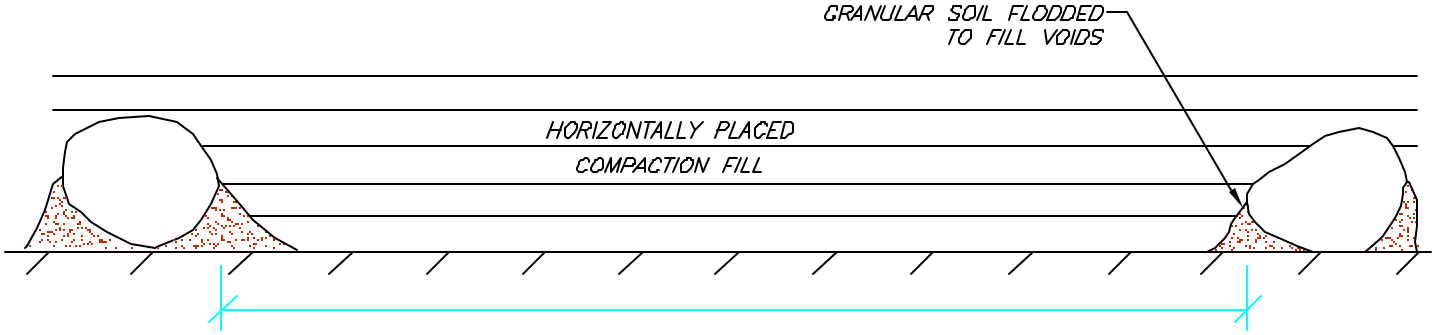


BENCHING FOR COMPACTED FILL DETAIL

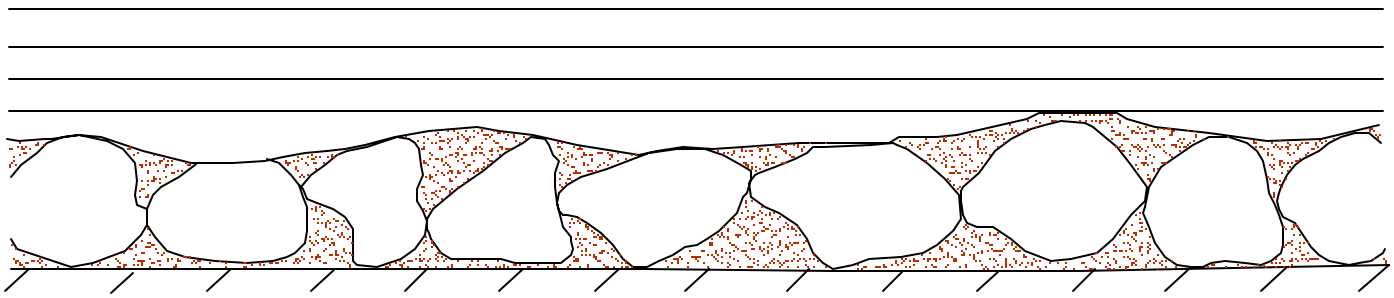
SALEM Engineering Group, Inc.



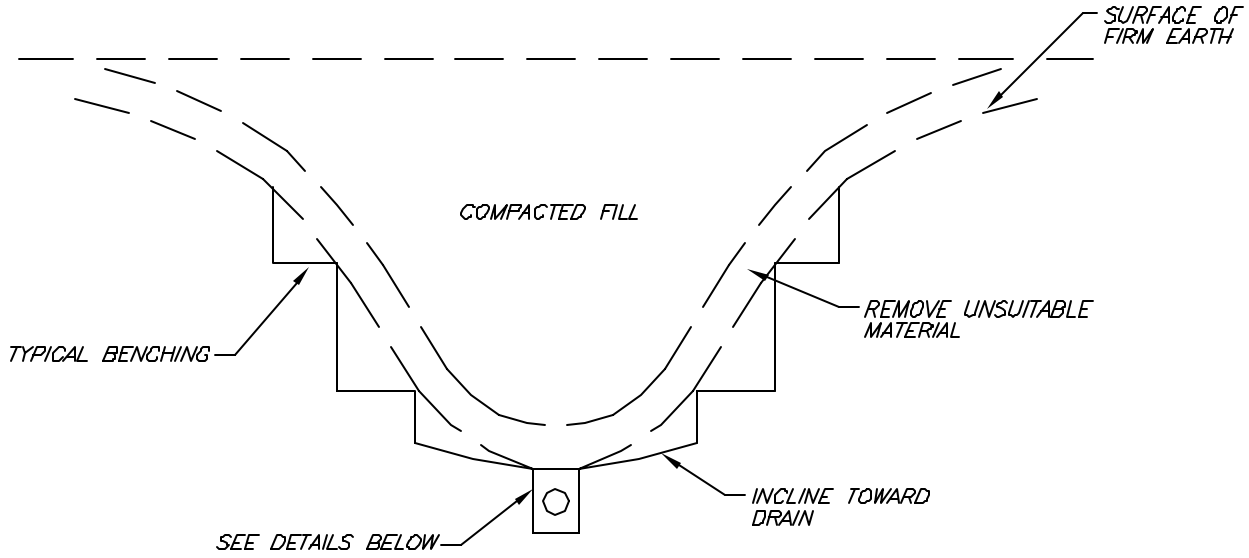
TYPICAL WINDROW DETAIL (EDGE VIEW)



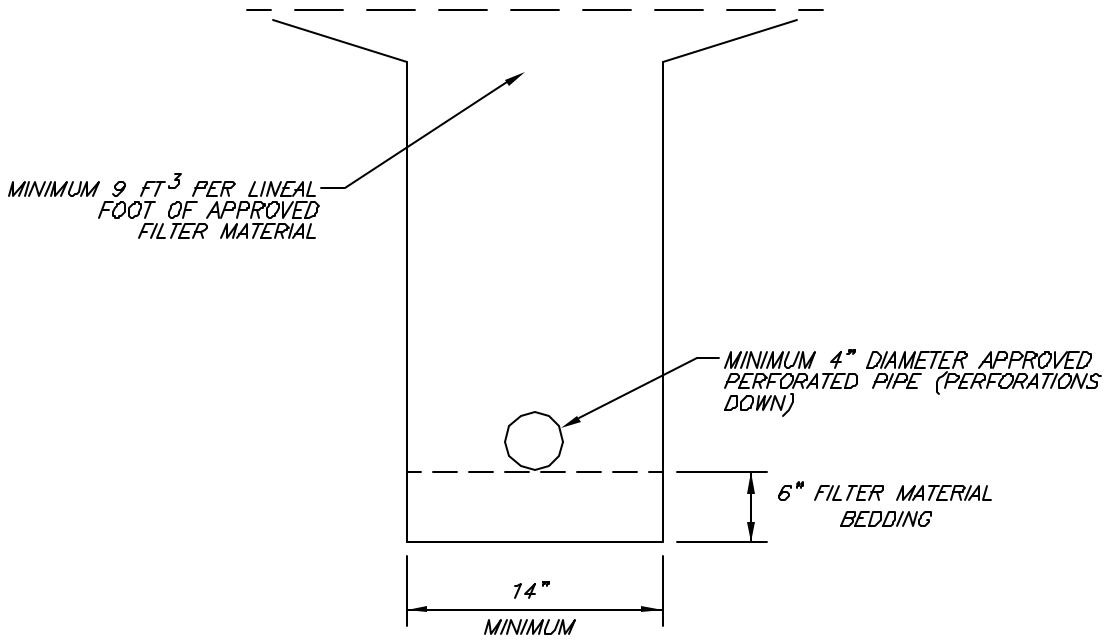
PROFILE VIEW



	ROCK DISPOSAL DETAIL	SALEM Engineering Group, Inc.



TRENCH DETAIL



FILTER MATERIAL TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUAL:

SIEVE SIZE	PERCENTAGE
1"	100
3/4"	90–100
3/8"	40–100
NO. 4	25–40
NO. 30	5–15
NO. 50	0–7
NO. 200	0–3

APPROVED PIPE TO BE SCHEDULE 40 POLY-VINYL-CHLORIDE (P.V.C.) OR APPROVED EQUAL. MINIMUM CRUSH STRENGTH 1000 psi.

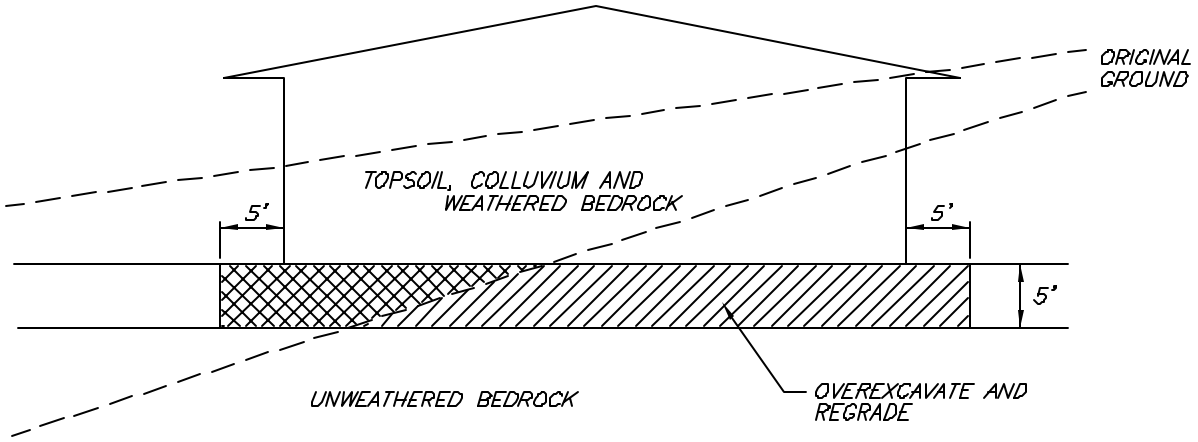
PIPE DIAMETER TO MEET THE FOLLOWING CRITERIA. SUBJECT TO FIELD REVIEW BASED ON ACTUAL GEOTECHNICAL CONDITIONS ENCOUNTERED DURING GRADING.

LENGTH OF RUN	PIPE DIAMETER
UPPER 500'	4"
NEXT 1000'	6"
> 1500'	8"

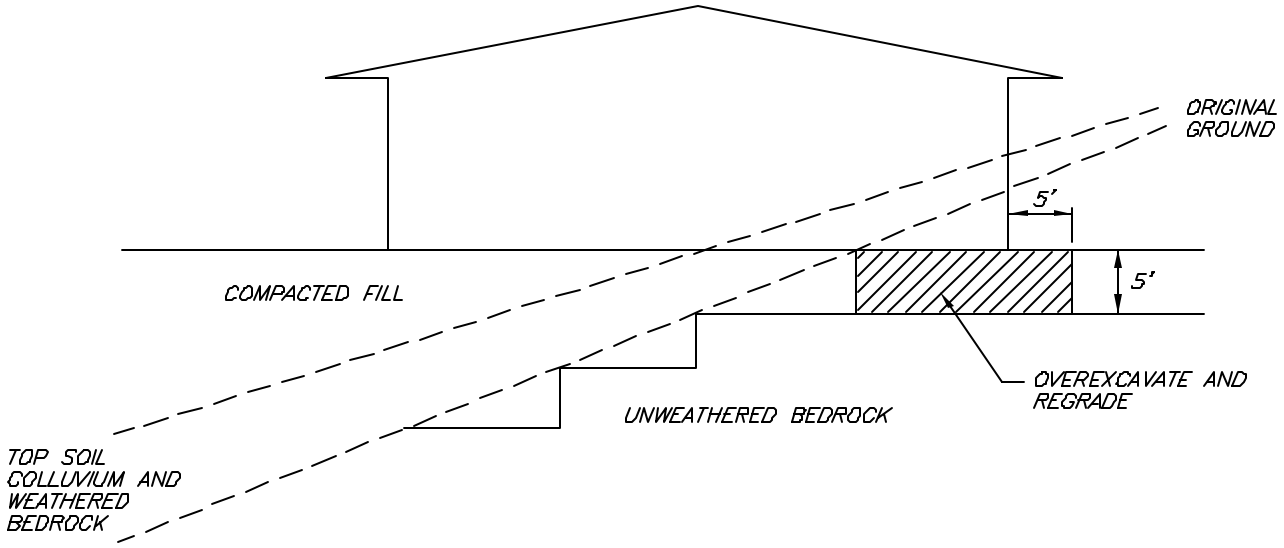
TYPICAL CANYON SUBDRAIN DETAIL

SALEM Engineering Group, Inc.

CUT LOT



CUT/FILL LOT (TRANSITION)



TRANSITION LOT DETAIL

SALEM Engineering Group, Inc.