GEOTECHNICAL ENGINEERING INVESTIGATION
PROPOSED QUICK QUACK CAR WASH
SIERRA COLLEGE BOULEVARD AND BRACE ROAD
LOOMIS, CALIFORNIA

PROJECT NO. 032-18048
OCTOBER 26, 2018

Prepared for:

MS. SUSIE BURKART-SMITH
QUICK QUACK CAR WASH
1380 LEAD HILL BOULEVARD, SUITE 260
ROSEVILLE, CALIFORNIA 95661

Prepared by:

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GEOTECHNICAL ENGINEERING • ENVIRONMENTAL ENGINEERING
CONSTRUCTION TESTING & INSPECTION

October 26, 2018

KA Project. No. 032-18048

Ms. Susie Burkart-Smith
Quick Quack Car Wash
1380 Lead Hill Boulevard, Suite 260
Roseville, California 95661

RE: Geotechnical Engineering Investigation
Proposed Quick Quack Car Wash
Sierra College Boulevard and Brace Road
Loomis, California

Dear Ms. Burkart-Smith:

In accordance with your request, we have completed a Geotechnical Engineering Investigation for the above-referenced site. The results of our investigation are presented in the attached report.

If you have any questions or if we may be of further assistance, please do not hesitate to contact our office at (916) 564-2200.

Respectfully submitted,
KRAZAN & ASSOCIATES, INC.

REGISTERED PROFESSIONAL ENGINEER
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INTRODUCTION

This report presents the results of our Geotechnical Engineering Investigation for the proposed Quick Quack Car Wash to be located at the northwest corner of Sierra College Boulevard and Brace Road in Loomis, Placer County, California. Discussions regarding site conditions are presented herein, together with conclusions and recommendations pertaining to site preparation, Engineered Fill, utility trench backfill, drainage and landscaping, foundations, concrete floor slabs and exterior flatwork, retaining walls, pavement design and soil cement reactivity.

A site plan showing the approximate boring locations is presented following the text of this report. A description of the field investigation, boring logs, and the boring log legend are presented in Appendix A. Appendix A contains a description of the laboratory testing phase of this study, along with the laboratory test results. Appendices B and C contain guides to earthwork and pavement specifications. When conflicts in the text of the report occur with the general specifications in the appendices, the recommendations in the text of the report have precedence.

PURPOSE AND SCOPE

This investigation was conducted to evaluate the soil and groundwater conditions at the site, to make geotechnical engineering recommendations for use in design of specific construction elements, and to provide criteria for site preparation and Engineered Fill construction.

Our scope of services included the following:

- A site reconnaissance by a member of our engineering staff to evaluate the surface conditions at the project site.
- A field investigation consisting of drilling 5 borings to depths ranging from approximately 10 to 22 feet for evaluation of the subsurface conditions at the project site. Several of the borings were terminated due to auger refusal in weathered rock.
- Performing laboratory tests on representative soil samples obtained from the borings to evaluate the physical and index properties of the subsurface soils.

- Evaluation of the data obtained from the investigation and an engineering analysis to provide recommendations for use in the project design and preparation of construction specifications.

- Preparation of this report summarizing the results, conclusions, recommendations, and findings of our investigation.

PROPOSED CONSTRUCTION

We understand that design of the proposed development is currently underway; structural load information and other final details pertaining to the structures are unavailable. On a preliminary basis, it is understood that development will consist of a new Quick Quack Car Wash. It is anticipated the building will be a single-story structure supported on conventional foundations with concrete-slab-on-grade. Footing loads are anticipated to be light to moderate. On-site paved areas and landscaping are also planned for the development.

In the event, these structural or grading details are inconsistent with the final design criteria, the Soils Engineer should be notified so that we may update this writing as applicable.

SITE LOCATION AND SITE DESCRIPTION

The site is rectangular in shape encompasses approximately 1.45 acres. The site is located at the northwest corner of Sierra College Boulevard and Brace Road in Loomis, Placer County, California. Commercial developments are located south and east of the site. The remainder of the site is predominately surrounded by vacant land and forest land.

Presently, the site predominately consists of a vacant lot. Small and mature oak trees are located throughout northern and western portions the site. Portions of the site are covered by a sparse to moderate weed growth and the surface soils have a loose consistency. Several end-dump piles of fill soil are located throughout the site. The site is relatively level to gently sloping with approximately 5 to 7 feet of relief across the site.

GEOLOGIC SETTING

The subject property is located within the Western Sierra Nevada Metamorphic Belt, easterly of the San Joaquin Valley within the Sierra Nevada Geomorphic Province of California. The Western Sierra Nevada Metamorphic Belt is about 180 miles long and 20 to 40 miles wide, and lies between the Sierra Nevada batholith on the east and overlapping unmetamorphosed Tertiary strata on the west. The metamorphic belt in the vicinity of the subject site is divided into structural blocks bounded by northwesterly trending faults of the Foothills Fault System. The subject site is indicated to lie within the easterly portion of the structural blocks, which consists of Mesozoic granitic rocks and Dioritic rock within the project site vicinity.

Based on mapping and historical seismicity, the seismicity of the Sierra Nevada Foothills has been generally considered low by the scientific community. However, on August 1, 1975, a 5.7 Richter magnitude earthquake occurred near Oroville within the northern Sierra Nevadas. Surface rupture along the Cleveland Hill Fault (part of the Foothills Fault System) was associated with the 1975 Oroville earthquake. As a result of this event, numerous studies were undertaken to further evaluate the seismicity of the Sierra Nevada Foothills. Of particular note, are the geologic and seismicity studies conducted to evaluate the proposed Auburn Dam site. Based on these studies, the scientific community concluded that seismic events in the Sierra Nevada Foothills are associated with very small, geologically infrequent, incremental displacements having minor geomorphic surface expression. The site is not within an Earthquake Fault Zone (Special Studies Zone).

FIELD AND LABORATORY INVESTIGATIONS

Subsurface soil conditions were explored by drilling 5 borings to depths ranging from approximately 10 to 22 feet below existing site grade, using a truck-mounted drill rig. The borings were terminated in decomposed weathered rock. In addition, 2 bulk subgrade samples were obtained from the site for laboratory R-value testing. The approximate boring and bulk sample locations are shown on the site plan. During drilling operations, penetration tests were obtained at regular intervals to evaluate the soil consistency and to obtain information regarding the engineering properties of the subsoils. Soil samples were retained for laboratory testing. The soils encountered were continuously examined and visually classified in accordance with the Unified Soil Classification System. A more detailed description of the field investigation is presented in Appendix A.

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, gradation, shear strength, consolidation potential, expansion potential, R-value and moisture-density relationships 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 results of the laboratory tests are summarized in Appendix A. This information, along with the field observations, was used to prepare the final boring logs in Appendix A.

SOIL PROFILE AND SUBSURFACE CONDITIONS

Based on our findings, the subsurface conditions encountered appear typical of those found in the geologic region of the site. In general, the surface soils consisted of approximately 6 to 12 inches of very loose silty sand and silty sand with trace clay. These soils are disturbed, have low strength characteristics, and are highly compressible when saturated.

Beneath the loose surface soils, approximately 1½ to 4 feet of fill material was encountered. In addition, several end-dump piles of fill soil were located within the site. The fill material predominately consisted of gravelly silty sand with trace clay. The thickness and extent of fill material was determined based on limited test borings and visual observation. Thicker fill may be present at the site. Limited testing was performed on the fill soils during the time of our field and laboratory investigations. Preliminary testing on the fill materials suggest that fill soils have varying strength characteristics ranging from loosely placed to compacted.

Below the loose surface soils and fill material, approximately 2 to 3 feet of medium dense to very dense silty sand with trace clay was encountered. Field and laboratory tests suggest that these soils are moderately strong and slightly compressible. Penetration resistance ranged from 33 blows per foot to greater than 50 blows per 6 inches. Dry densities ranged from 107 to 125 pcf. A representative soil sample consolidated approximately 3½ percent under a 2 ksf load when saturated. A representative soil sample had an angle of internal friction of 40 degrees. Representative samples of the clayey soils had expansion indices of 0.

Below approximately 4 to 5 feet, layers of predominately medium dense to very dense silty sand with trace clay, decomposed granite or decomposed diorite were encountered. Some of the soils were weakly cemented in parts. Penetration resistance ranged from 25 blows per foot to greater than 50 blows per 6 inches. Dry densities ranged from 115 to 136 pcf. These soils/weathered rock had slightly stronger strength characteristics than the upper soils and extended to the termination depth of our borings. Several of the borings were terminated due to refusal in weathered rock.

For additional information about the soils encountered, please refer to the logs of borings in Appendix A.

GROUNDWATER

Test boring locations were checked for the presence of groundwater during and immediately following the drilling operations. Perched groundwater was encountered at depths of 7½ to 12 feet within our borings. Weathered rock was encountered below 5 to 8 feet in the test borings.

It should be recognized that water table elevations may fluctuate with time, being dependent upon seasonal precipitation, irrigation, land use, 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.

CONCLUSIONS AND RECOMMENDATIONS

Based on the findings of our field and laboratory investigations, along with previous geotechnical experience in the project area, the following is a summary of our evaluations, conclusions, and recommendations.

Administrative Summary

In brief, the subject site and soil conditions, with the exception of the loose surface soils, fill material, gentle slopes, and surrounding development, appear to be conducive to the development of the project. The surface soils are disturbed, have low strength characteristics, and are highly compressible when saturated. Accordingly, it is recommended that the surface soils be recompacted. This compaction effort should stabilize the upper soils and locate any unsuitable or pliant areas not found during our field investigation.

Approximately 1½ to 4 feet of fill material was encountered within the borings drilled throughout the site. In addition, several end-dump piles of fill soil are located within the site. The fill material predominately consisted of gravelly silty sand with trace clay. The thickness and extent of fill material was determined based on limited test borings and visual observation. Thicker fill may be present at the site. Limited testing was performed on the fill soils during the time of our field and laboratory investigations. Preliminary testing on the fill material suggests that the fill soils have varying strength characteristics ranging from loosely placed to compacted. Therefore, it is recommended that fill soils which are not properly compacted and certified be excavated and stockpiled so that the native soils can be properly prepared. The fill material will be suitable for re-use as Engineered Fill provided it is cleansed of excessive organics, debris and is moisture-conditioned as necessary and recompacted to a minimum of 90 percent of maximum density based on ASTM Test Method D1557. Prior to fill placement Krazan & Associates, Inc. should inspect the bottom of the excavation to verify no additional removal will be required.

The project site is underlain by shallow decomposed rock. In order to reduce post-construction differential settlement, it is recommended all structures that are in a soil/rock transition zone, be supported by a minimum of 2 feet of Engineered Fill. The excavation should be extended a minimum of 5 feet beyond structural elements. In lieu of over-excavation, the footings of all connected structures may extend to a minimum embedment of 1-foot into the native decomposed rock.

Buried utilities may be located along the edges of the site. Any buried utilities encountered during construction should be properly removed and/or relocated. The resulting excavations should be backfilled with Engineered Fill.

The site is located in the vicinity of sloping ground. It is recommended that cut and fill slopes be constructed 2:1 (horizontal to vertical) or flatter. In lieu of these slopes, retaining walls may be used. Cut and fill slopes may be revised as recommended by the Soils Engineer upon review of a more definitive site plan.

Several trees are located within the project site and vicinity. If not utilized for the proposed development, tree removal operations should include roots greater than 1 inch in diameter. The resulting excavations should be backfilled with Engineered Fill compacted to a minimum of 90 percent of maximum density based on ASTM Test Method D1557.

After completion of the recommended site preparation, the site should be suitable for shallow footing support. The proposed structure footings may be designed utilizing an allowable bearing pressure of 2,500 psf for dead-plus-live loads. Footings should have a minimum embedment of 18 inches.

<u>Groundwater Influence on Structures/Construction</u>

Perched groundwater was encountered at depths of 7½ to 12 feet during our subsurface investigation. Seasonal perched groundwater may occur during seasonal precipitation. This perched water may likely result from the infiltration of water through the upper sandy soils and perching above the underlying less permeable weathered rock. Therefore, dewatering and/or water-proofing may be required should structures or excavations extend below this depth. If groundwater is encountered, our firm should be consulted prior to dewatering the site. Installation of a standpipe piezometer is suggested prior to construction should groundwater levels be a concern.

In addition to the groundwater level, if earthwork is performed during or soon after periods of precipitation, the subgrade soils may become saturated, pump, or not respond to densification techniques. 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 mixing the soil with an approved lime or cement product. Our firm should be consulted prior to implementing remedial measures to observe the unstable subgrade conditions and provide appropriate recommendations.

Another aspect in the preparation of this property for construction is the determination of areas of possible seasonal springs and the placement of subsurface drainage systems to intercept groundwater away from the planned area of construction. It is recommended that the site be observed by a member of our engineering staff following completion of the site clearing and stripping to evaluate the need for sub-drainage systems. Evaluation should also be performed following completion of rough site grading. This is particularly important for use in evaluating the need for subdrains for pavements. This office should be contacted regarding any future seepage on the property so appropriate mitigation measures can be recommended.

Soil Liquefaction

Soil liquefaction is a state of soil particle suspension, caused by a complete loss of strength when the effective stress drops to zero. Liquefaction normally occurs in soils, such as sands, in which the strength is purely frictional. However, liquefaction has occurred in soils other than clean sands. Liquefaction usually occurs under vibratory conditions, such as those induced by seismic events. Due to the dense nature of the on-site soils and weathered decomposed rock, and the relatively low seismicity of the region, the potential for soil liquefaction is very low. Therefore, no mitigation measures are necessary.

Site Preparation

General site clearing should include removal of vegetation; existing utilities; structures including foundations; basement walls and floors; existing stockpiled soil; trees and associated root systems; rubble; rubbish; and any loose and/or saturated materials. Site stripping should extend to a minimum depth of 2 to 4 inches, or until all organics in excess of 3 percent by volume are removed. Deeper stripping may be required in localized areas. These materials will not be suitable for use as Engineered Fill. However, stripped topsoil may be stockpiled and reuse in landscape or non-structural areas.

Approximately 1½ to 4 of fill material was encountered within the borings drilled throughout the site. In addition, several end-dump piles of fill soil are located within the site. The fill material predominately consisted of gravelly silty sand with trace clay. The thickness and extent of fill material was determined based on limited test borings and visual observation. Thicker fill may be present at the site. Limited testing was performed on the fill soils during the time of our field and laboratory investigations. Preliminary testing on the fill material suggests that the fill soils have varying strength characteristics ranging from loosely placed to compacted. Therefore, it is recommended that fill soils which are not properly compacted and certified be excavated and stockpiled so that the native soils can be properly prepared. The fill material will be suitable for re-use as Engineered Fill provided it is cleansed of excessive organics, debris and is moisture-conditioned as necessary and recompacted to a minimum of 90 percent of maximum density based on ASTM Test Method D1557. Prior to fill placement Krazan & Associates, Inc. should inspect the bottom of the excavation to verify no additional removal will be required.

Shallow decomposed rock was encountered within the project site. In order to reduce post-construction differential settlement, it is recommended that all structures that are in a soil/rock transition zone, be supported by a minimum of 2 feet of Engineered Fill. The excavation should be extended a minimum of 5 feet beyond structural elements. In lieu of over-excavation, the footings of all connected structures may extend to a minimum embedment of 1-foot into the native decomposed rock.

Several trees are located within the project site and vicinity. If not utilized for the proposed development, tree removal operation should include roots greater than 1 inch in diameter. The resulting excavations should be backfilled with Engineered Fill compacted to a minimum of 90 percent of maximum density based on ASTM test Method D1557.

Following stripping, fill removal operations, tree removal operations, and demolition activities, the exposed subgrade in building pad areas should be excavated to a depth of at least 12 inches, worked until uniform and free from large clods, moisture-conditioned as necessary, and recompacted to a minimum of 90 percent of maximum density based on ASTM Test Method D1557. Prior to backfilling, the bottom of the excavation should be proofrolled and observed by Krazan & Associates, Inc. to verify stability. Soft or pliant areas should be excavated to firm native ground.

The site is located in the vicinity of sloping ground. It is recommended that any cut and fill slopes be constructed 2:1 (horizontal to vertical) or flatter. In lieu of the recommended slopes, retaining walls may be used.

Where fills greater than 8 feet are to be constructed on original ground that slopes at inclinations exceeding 6:1 (horizontal to vertical), benches should be cut into the natural slope as the filling operations proceed. Each bench should consist of a level terrace a minimum of 10 feet wide, with the rise to the next bench held for 4 feet or less. Where fills of comparable height will be constructed on ground that slopes at an inclination exceeding 4:1 (horizontal to vertical), a keyway should be provided in addition to the benches. Each keyway should consist of a level trench at least 10 feet wide and at least 2 feet deep, with side slopes not exceeding 1:1 (horizontal to vertical), cut into the natural slope.

The upper soils, during wet winter months, become very moist due to the absorptive characteristics of the soil. Earthwork operations performed during winter months may encounter very moist unstable soils, which may require removal to grade a stable building foundation. Project site winterization consisting of placement of aggregate base and protecting exposed soils during the construction phase should be performed.

A representative of our firm 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 Soils 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 and the Engineered Fill section.

Slope Construction/Reconstruction

Slopes can be reconstructed by placement of Engineered Fill utilizing a keying and benching procedure as described below. Reconstructed slopes should be constructed at an inclination not exceeding 2:1 (horizontal to vertical). Krazan and Associates, Inc. should be retained to review all slope reconstruction plans and specifications prior to initiating the repair work.

General site clearing should include removal of vegetation, any loose and/or saturated materials. Excavations or depressions extending below subgrade levels should be cleaned to firm, undisturbed soil and backfilled with Engineered Fill, placed and recompacted in accordance with the recommendations stated herein.

Where fills greater than 8 feet are to be constructed on original ground that slopes at inclinations steeper than 6:1 (horizontal to vertical), benches should be cut into the existing slope as the filling operations proceed. Each bench should consist of a level terrace a minimum of 10 feet wide, with the rise to the next bench held to 4 feet or less. Where fills of comparable height will be constructed on ground that slopes at an inclination steeper than 4:1 (horizontal to vertical), a keyway should be provided in addition to the benches. Each keyway should consist of a level trench at least 10 feet wide and at least 2 feet deep, with side slopes not exceeding 1:1 (horizontal to vertical), cut into the existing slope. Where fills of comparable height will be constructed on ground that slopes at an inclination steeper than 2:1 (horizontal to vertical), geotextile fabric and retaining structures should be utilized in slope construction where subsequent specific building site investigations warrant.

Site grading near the crowns of the reconstructed slopes should be accomplished such that excessive sheet run-off is prevented.

The completed slopes should be seeded or otherwise vegetated to protect from future erosion. Well vegetated slopes at the recommended configuration should be reasonably protected from typical erosional effects. However, vegetated slopes may not be protected from unusual flow conditions, such as flood events or over-topping of the development's storm drainage system. If erosion control from unusual flow conditions is desired, more substantial erosion protection measures, such as grouted cobble slope facing or manufactured slope protection products should be considered.

Engineered Fill

The on-site, native soils and fill material are predominately silty sand, silty sand with trace clay and decomposed granite. The soils contained varying amounts of gravel. These soils will be suitable for use as Engineered Fill, provided it is cleansed of excessive organics, debris, and fragments larger than 4 inches in maximum dimension. Clayey soils with an expansion index greater than 15 will not be suitable for reuse for fill placement within the upper 18 inches of slab-on-grade and exterior flatwork areas.

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 he has complete control of the project site at that time.

Imported Fill should consist of a well-graded, slightly cohesive, fine silty sand or sandy silt soil, with relatively impervious characteristics when compacted. This material should be approved by the Soils Engineer prior to use and should typically possess the following characteristics:

Percent Passing No. 200 Sieve	20 to 50
Plasticity Index	10 maximum
UBC Standard 29-2 Expansion Index	15 maximum

Fill soils should be placed in lifts approximately 6 inches thick, moisture-conditioned as necessary, and compacted to achieve at least 90 percent of maximum density based on ASTM Test Method D1557. Additional lifts should not be placed if the previous lift did not meet the required dry density or if soil conditions are not stable.

Drainage and Landscaping

Within building and paved areas, cut and fill slopes should not exceed 2:1 (horizontal to vertical). The ground surface should slope away from building pad and pavement areas toward appropriate drop inlets or other surface drainage devices. In accordance with Section 1804 of the 2016 California Building Code, it is recommended that the ground surface adjacent to foundations be sloped a minimum of 5 percent for a minimum distance of 10 feet away from structures, or to an approved alternative means of drainage conveyance. Swales used for conveyance of drainage and located within 10 feet of foundations should be sloped a minimum of 2 percent. Impervious surfaces, such as pavement and exterior concrete flatwork, within 10 feet of building foundations should be sloped a minimum of 1 percent away from the structure. Drainage gradients should be maintained to carry all surface water to collection facilities and off-site. These grades should be maintained for the life of the project.

Grade the site to prevent water/run-off flow over the face of cut and fill slopes. To accomplish this, use asphalt berms, brow ditches, or other measures to intercept and slowly redirect flow. Plant all disturbed areas with erosion-resistant vegetation suited to the area. As an alternative, jute netting or geotextile erosion control mats may be considered for control of erosion. Slopes should be inspected periodically for erosion and repaired immediately if detected. Where only 1 drainage terrace is necessary, it should be located at mid-height of the slope. Brow ditches and drainage terraces should be cleaned before the start of each rainy season and, if necessary, after each rainstorm.

Slots or weep holes should be placed in drop inlets or other surface drainage devices in pavement areas to allow free drainage of adjoining base course materials. Cutoff walls should be installed at pavement edges adjacent to vehicular traffic areas; these walls should extend to a minimum depth of 12 inches below pavement subgrades to limit the amount of seepage water that can infiltrate the pavements. Where cutoff walls are undesirable, subgrade drains can be constructed to transport excess water away from planters to drainage interceptors. If cutoff walls can be successfully used at the site, construction of subgrade drains is considered unnecessary.

Utility Trench Backfill

Utility trenches should be excavated according to accepted engineering practices following OSHA (Occupational Safety and Health Administration) standards by a Contractor experienced in such work. The responsibility for the safety of open trenches should be borne by the Contractor. Traffic and vibration adjacent to trench walls should be reduced; cyclic wetting and drying of excavation side slopes should be avoided. Depending upon the location and depth of some utility trenches, groundwater flow into open excavations could be experienced, especially during or shortly following periods of precipitation.

Utility trench backfill placed in or adjacent to buildings and exterior slabs should be compacted to at least 90 percent of maximum density based on ASTM Test Method D1557. The utility trench backfill placed in pavement areas should be compacted to at least 90 percent of maximum density based on ASTM Test Method D1557. Pipe bedding should be in accordance with pipe manufacturer's recommendations.

Sandy and gravelly soil conditions were encountered at the site. These cohesionless soils have a tendency to cave in trench wall excavations. Shoring or sloping back trench sidewalls may be required within these sandy and gravelly soils.

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.

Foundations - Conventional

After completion of the recommended site preparation, the site should be suitable for shallow footing support. The proposed structures may be supported on a shallow foundation system bearing on the undisturbed native soil, decomposed rock, or on Engineered Fill. Spread and continuous footings can be designed for the following maximum allowable soil bearing pressures:

Load	Allowable Loading
Dead Load Only	1,875 psf
Dead-Plus-Live Load	2,500 psf
Total Load, including wind or seismic loads	3,325 psf

The footings should have a minimum embedment depth of 18 inches below pad subgrade (soil grade), adjacent exterior grade or 12 inches into the weathered rock. The footings should have a minimum width of 12 inches, regardless of load.

The total soil movement is not expected to exceed 1 inch. Differential soil movement should be less than ½ inch. 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. It is recommended that footings be reinforced by at least one No. 4 reinforcing bar in both top and bottom.

Resistance to lateral footing displacement can be computed using an allowable friction factor of 0.4 acting between the base of foundations and the supporting subgrade. Lateral resistance for footings can alternatively be developed using an allowable equivalent fluid passive pressure of 350 pounds per cubic foot acting against the appropriate vertical footing faces. The frictional and passive resistance of the soil may be combined without reduction in determining the total lateral resistance. A ⅓ increase in the above value may be used for short duration, wind, or seismic loads. All of the above earth pressures are unfactored and are, therefore, not inclusive of factors of safety.

Floor Slabs and Exterior Flatwork

In areas where moisture-sensitive floor coverings will be utilized, concrete slab-on-grade floors should be underlain by a water vapor retarder. The water vapor retarder should be installed in accordance with accepted engineering practice. The water vapor retarder should consist of a vapor retarder sheeting underlain by a minimum of 3 inches of compacted, clean, gravel of ¾-inch maximum size. To aid in concrete curing an optional 2 to 4 inches of granular fill may be placed on top of the vapor retarder. The granular fill should consist of damp clean sand with at least 10 to 30 percent of the sand passing the 100 sieve. The sand should be free of clay, silt or organic material. Rock dust which is manufactured sand from rock crushing operations is typically suitable for the granular fill. This granular fill material should be compacted.

The exterior floors should be poured separately in order to act independently of the walls and foundation system. All fills required to bring the building pads to grade should be Engineered Fills.

Moisture within the structure may be derived from water vapors, which were transformed from the moisture within the soils. This moisture vapor can travel through the vapor membrane and penetrate the slab-on-grade. This moisture vapor penetration can affect floor coverings and produce mold and mildew in the structure. To reduce moisture vapor intrusion, it is recommended that a vapor retarder be installed. It is recommended that the utility trenches within the structure be compacted, as specified in our report, to reduce the transmission of moisture through the utility trench backfill. Special attention to the immediate drainage and irrigation around the building is recommended. Positive drainage should be established away from the structure and should be maintained throughout the life of the structure. Ponding of water should not be allowed adjacent to the structure. Over-irrigation within landscaped areas adjacent to the structure should not be performed. In addition, ventilation of the structure (i.e. ventilation fans) is recommended to reduce the accumulation of interior moisture.

Lateral Earth Pressures and Retaining Walls

Walls retaining horizontal backfill and capable of deflecting a minimum of 0.1 percent of its height at the top may be designed using an equivalent fluid active pressure of 31 pounds per square foot per foot of depth. Walls that are incapable of this deflection or walls that are fully constrained against deflection may be designed for an equivalent fluid at-rest pressure of 52 pounds per square foot per foot per depth. Expansive soils should not be used for backfill against walls. The wedge of non-expansive backfill material should extend from the bottom of each retaining wall outward and upward at a slope of 2:1 (horizontal to vertical) or flatter. The stated lateral earth pressures do not include the effects of hydrostatic water pressures generated by infiltrating surface water that may accumulate behind the retaining walls; or loads imposed by construction equipment, foundations, or roadways. All of the above earth pressures are unfactored and are, therefore, not inclusive of factors of safety.

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.

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 reduce surface drainage into the wall drain system. The aggregate should conform to Class 2 permeable materials graded in accordance with Section 68-2.02F(3) of the CalTrans Standard Specifications (2010). 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.

Drainage pipes should be placed with perforations down and should discharge in a non-erosive manner away from foundations and other improvements. The pipes should be placed no higher than 6 inches above the heel of the wall in the centerline of the drainage blanket and should have a minimum diameter of 4 inches. Collector pipes may be either slotted or perforated. Slots should be no wider than ⅛ inch in diameter, while perforations should be no more than ¼ inch in diameter. If retaining walls are less than 6 feet in height, the perforated pipe may be omitted in lieu of weep holes on 4 feet maximum spacing. The weep holes should consist of 4-inch diameter holes (concrete walls) or unmortared head joints (masonry walls) and not be higher than 18 inches above the lowest adjacent grade. Two 8-inch square overlapping patches of geotextile fabric (conforming to Section 88-1.02 of the CalTrans Standard Specifications for "edge drains") should be affixed to the rear wall opening of each weep hole to retard soil piping.

R-Value Test Results and Pavement Design

Two subgrade soil samples were obtained from the project site for R-value testing at the locations shown on the attached site plan. The samples were tested in accordance with the State of California Materials Manual Test Designation 301. Results of the tests are as follows:

Sample	Depth	Description	R-Value at Equilibrium
1	12-24"	Silty Sand (SM)	59
2	12-24"	Silty Sand (SM)	58

The test results are moderate and indicate moderate subgrade support characteristics under dynamic traffic loads. The following table shows the recommended pavement sections for various traffic indices.

Traffic Index	Asphaltic Concrete	Class II Aggregate Base*	Compacted Subgrade**
4.0	2.0"	4.0"	12.0"
4.5	2.5"	4.0"	12.0"
5.0	2.5"	4.0"	12.0"
5.5	3.0"	4.0"	12.0"
6.0	3.0"	4.0"	12.0"
6.5	3.5"	4.0"	12.0"
7.0	4.0"	4.0"	12.0"
7.5	4.0"	4.0"	12.0"

**** 95% compaction based on ASTM Test Method D1557 or CAL 216***
***** 90% compaction based on ASTM Test Method D1557 or CAL 216***

If traffic indices are not available, an estimated (typical value) index of 4.5 may be used for light automobile traffic, and an index of 7.0 may be used for light truck traffic.

The following recommendations are for light-duty and heavy-duty Portland Cement Concrete Pavement Sections based on the design procedures developed by the Portland Cement Association.

PORTLAND CEMENT PAVEMENT
LIGHT DUTY

Traffic Index	Portland Cement Concrete***	Class II Aggregate Base*	Compacted Subgrade**
4.5	5.0"	--	12.0"

HEAVY DUTY

Traffic Index	Portland Cement Concrete***	Class II Aggregate Base*	Compacted Subgrade**
7.0	6.5"	--	12.0"

** 95% compaction based on ASTM Test Method D1557 or CAL 216*
*** 90% compaction based on ASTM Test Method D1557 or CAL 216*
****Minimum compressive strength of 3000 psi*

It is recommended that any uncertified fill material encountered within pavement areas be removed and/or recompacted. The fill materials should be moisture-conditioned to near optimum moisture and recompacted to a minimum of 90 percent of maximum density based on ASTM Test Method D1557. As an alternative, the Owner may elect not to recompact the existing fill within paved areas. However, the Owner should be aware that the paved areas may settle which may require annual maintenance. At a minimum, it is recommended that the upper 12 inches of subgrade soil be moisture-conditioned as necessary and recompacted to a minimum of 90 percent of maximum density based on ASTM Test Method D1557.

Seismic Parameters – 2016 California Building Code

The Site Class per Section 1613 of the 2016 California Building Code (2016 CBC) and Table 20.3-1 of ASCE 7-10 is based upon the site soil conditions. It is our opinion that a Site Class D is most consistent with the subject site soil conditions. For seismic design of the structures based on the seismic provisions of the 2016 CBC, we recommend the following parameters:

Seismic Item	Value	CBC Reference
Site Class	D	Section 1613.3.2
Site Coefficient F_a	1.418	Table 1613.3.3 (1)
S_s	0.477	Section 1613.3.1
S_{MS}	0.677	Section 1613.3.3
S_{DS}	0.451	Section 1613.3.4
Site Coefficient F_v	1.915	Table 1613.3.3 (2)
S_1	0.242	Section 1613.3.1
S_{M1}	0.464	Section 1613.3.3
S_{D1}	0.310	Section 1613.3.4

Soil Cement Reactivity

Excessive sulfate in either the soil or native water may result in an adverse reaction between the cement in concrete (or stucco) and the soil. HUD/FHA and CBC have developed criteria for evaluation of sulfate levels and how they relate to cement reactivity with soil and/or water.

Soil samples were obtained from the site and tested in accordance with State of California Materials Manual Test Designation 417. The sulfate concentrations detected from these soil samples were less than 150 ppm and are below the maximum allowable values established by HUD/FHA and CBC. Therefore, no special design requirements are necessary to compensate for sulfate reactivity with the cement.

Compacted Material Acceptance

Compaction specifications are not the only criteria for acceptance of the site grading or other such activities. However, the compaction test is the most universally recognized test method for assessing the performance of the Grading Contractor. The numerical test results from the compaction test cannot be used to predict the engineering performance of the compacted material. Therefore, the acceptance of compacted materials will also be dependent on the stability of that material. The Soils Engineer has the option of rejecting any compacted material regardless of the degree of compaction if that material is considered to be unstable or if future instability is suspected. A specific example of rejection of fill material passing the required percent compaction is a fill which has been compacted with an in situ moisture content significantly less than optimum moisture. This type of dry fill (brittle fill) is susceptible to future settlement if it becomes saturated or flooded.

Testing and Inspection

A representative of Krazan & Associates, Inc. should be present at the site during the earthwork activities to confirm that actual subsurface conditions are consistent with the exploratory fieldwork. This activity is an integral part of our service, as acceptance of earthwork construction is dependent upon compaction testing and stability of the material. This representative can also verify that the intent of these recommendations is incorporated into the project design and construction. Krazan & Associates, Inc. will not be responsible for grades or staking, since this is the responsibility of the Prime Contractor.

LIMITATIONS

Soils Engineering is one of the newest divisions of Civil Engineering. This branch of Civil Engineering is constantly improving as new technologies and understanding of earth sciences advance. Although your site was analyzed using the most appropriate and most current techniques and methods, undoubtedly there will be substantial future improvements in this branch of engineering. In addition to advancements in the field of Soils Engineering, physical changes in the site, either due to excavation or fill placement, new agency regulations, or possible changes in the proposed structure after the soils report is completed may require the soils report to be professionally reviewed. In light of this, the Owner should be aware that there is a practical limit to the usefulness of this report without critical review. Although the time limit for this review is strictly arbitrary, it is suggested that 2 years be considered a reasonable time for the usefulness of this report.

Foundation and earthwork construction is characterized by the presence of a calculated risk that soil and groundwater conditions have been fully revealed by the original foundation investigation. This risk is derived from the practical necessity of basing interpretations and design conclusions on limited sampling of the earth. The recommendations made in this report are based on the assumption that soil conditions do not vary significantly from those disclosed during our field investigation. If any variations or undesirable conditions are encountered during construction, the Soils Engineer should be notified so that supplemental recommendations may be made.

The conclusions of this report are based on the information provided regarding the proposed construction. If the proposed construction is relocated or redesigned, the conclusions in this report may not be valid. The Soils Engineer should be notified of any changes so the recommendations may be reviewed and re-evaluated.

This report is a Geotechnical Engineering Investigation with the purpose of evaluating the soil conditions in terms of foundation design. The scope of our services did not include any 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 log 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 and a degree of conservatism deemed proper for this project. 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.

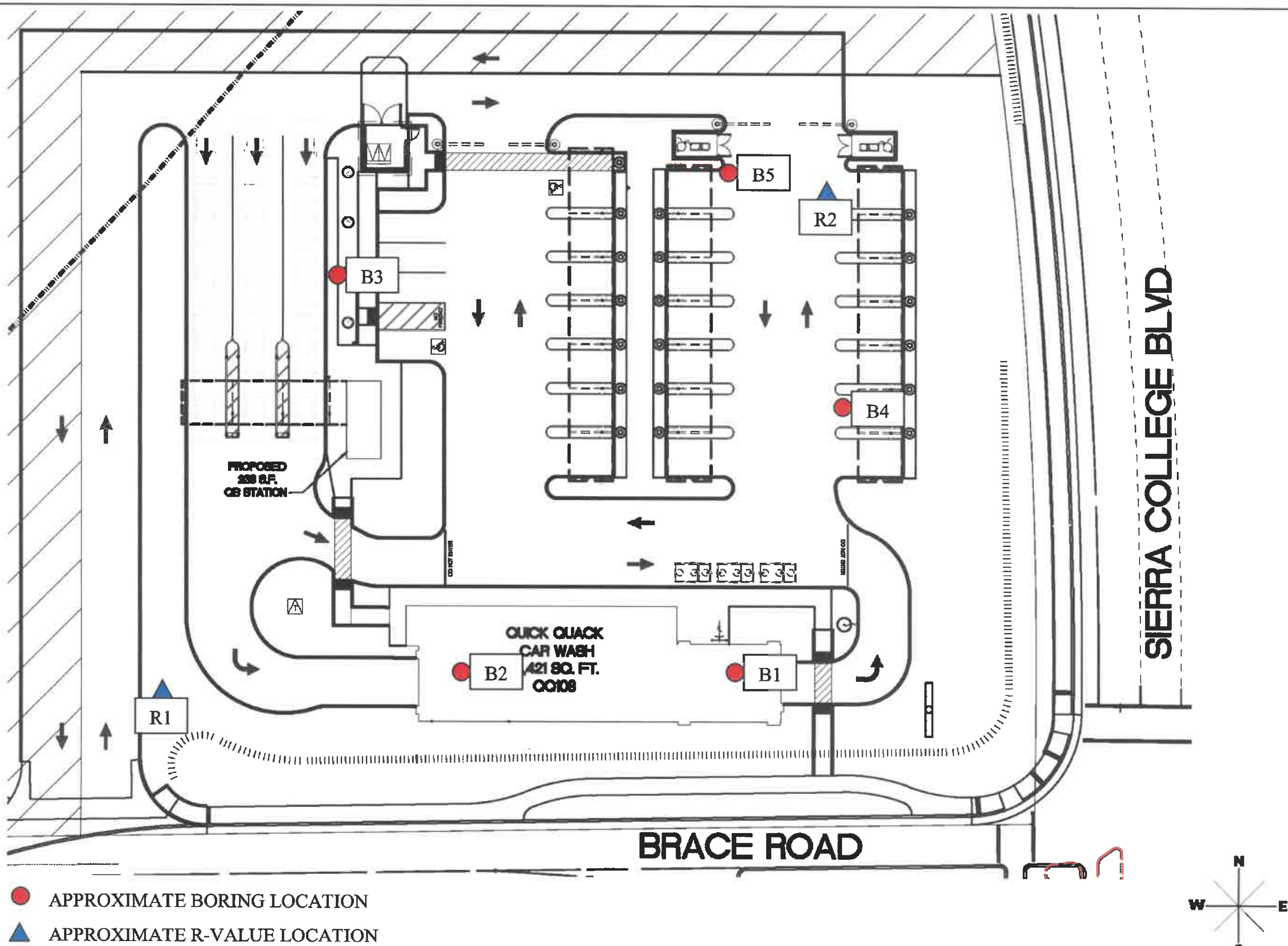
If there are any questions or if we may be of further assistance, please do not hesitate to contact our office at (916) 564-2200.

Respectfully submitted,
KRAZAN & ASSOCIATES, INC.

Steve Nelson
Project Engineer

David R. Jarosz, II
Managing Engineer
RGE No. 2698/RCE No. 60185

SN/DRJ:ht



SITE MAP	Scale: NTS	Date: October 2018	Krazan GEOTECHNICAL ENGINEERING
Quick Quack Car Wash **Sierra College Boulevard and Brace Road** **Loomis, California**	Drawn by: HT	Approved by: DJ	
	Project No. 032-18048	Figure No. 1	

APPENDIX A

FIELD AND LABORATORY INVESTIGATIONS

Field Investigation

The field investigation consisted of a surface reconnaissance and a subsurface exploratory program. Five 4½-inch to 6½-inch exploratory borings were advanced. The boring locations are shown on the site plan.

The soils encountered were logged in the field during the exploration, and with supplementary laboratory test data are described in accordance with the Unified Soil Classification System.

Modified standard penetration tests and standard penetration tests were performed at selected depths. These tests represent the resistance to driving a 2½-inch and 1½-inch diameter split barrel sampler, respectively. The driving energy was provided by a hammer weighing 140 pounds falling 30 inches. Relatively undisturbed soil samples were obtained while performing this test. Bag samples of the disturbed soil were obtained from the auger cuttings. The modified standard penetration tests are identified in the sample type on the boring logs with a full shaded in block. The standard penetration tests are identified in the sample type on the boring logs with half of the block shaded. All samples were returned to our Clovis laboratory for evaluation.

Laboratory Investigation

The laboratory investigation was programmed to determine the physical and mechanical properties of the foundation soil underlying the site. Test results were used as criteria for determining the engineering suitability of the surface and subsurface materials encountered.

In-situ moisture content, dry density, consolidation, direct shear, and sieve analysis tests were completed for the undisturbed samples representative of the subsurface material. Expansion index and R-value tests were completed for select bag samples obtained from the auger cuttings. These tests, supplemented by visual observation, comprised the basis for our evaluation of the site material.

The logs of the exploratory borings and laboratory determinations are presented in this Appendix.

UNIFIED SOIL CLASSIFICATION SYSTEM

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOILS (more than 50% of material is larger than No. 200 sieve size.)		
	Clean Gravels (Less than 5% fines)	
GRAVELS More than 50% of coarse fraction larger than No. 4 sieve size	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
	GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
	Gravels with fines (More than 12% fines)	
	GM	Silty gravels, gravel-sand-silt mixtures
	GC	Clayey gravels, gravel-sand-clay mixtures
	Clean Sands (Less than 5% fines)	
SANDS 50% or more of coarse fraction smaller than No. 4 sieve size	SW	Well-graded sands, gravelly sands, little or no fines
	SP	Poorly graded sands, gravelly sands, little or no fines
	Sands with fines (More than 12% fines)	
	SM	Silty sands, sand-silt mixtures
	SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (50% or more of material is smaller than No. 200 sieve size.)		
SILTS AND CLAYS Liquid limit less than 50%	ML	Inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts with slight plasticity
	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
	OL	Organic silts and organic silty clays of low plasticity
SILTS AND CLAYS Liquid limit 50% or greater	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
	CH	Inorganic clays of high plasticity, fat clays
	OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS	PT	Peat and other highly organic soils

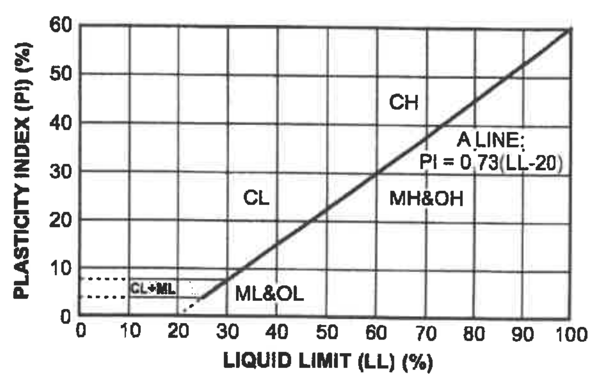
CONSISTENCY CLASSIFICATION

Description	Blows per Foot
Granular Soils	
Very Loose	< 5
Loose	5 – 15
Medium Dense	16 – 40
Dense	41 – 65
Very Dense	> 65
Cohesive Soils	
Very Soft	< 3
Soft	3 – 5
Firm	6 – 10
Stiff	11 – 20
Very Stiff	21 – 40
Hard	> 40

GRAIN SIZE CLASSIFICATION

Grain Type	*Standard Sieve Size*	*Grain Size in Millimeters*
Boulders	Above 12 inches	Above 305
Cobbles	12 to 13 inches	305 to 76.2
Gravel	3 inches to No. 4	76.2 to 4.76
Coarse-grained	3 to ¾ inches	76.2 to 19.1
Fine-grained	¾ inches to No. 4	19.1 to 4.76
Sand	No. 4 to No. 200	4.76 to 0.074
Coarse-grained	No. 4 to No. 10	4.76 to 2.00
Medium-grained	No. 10 to No. 40	2.00 to 0.042
Fine-grained	No. 40 to No. 200	0.042 to 0.074
Silt and Clay	Below No. 200	Below 0.074

PLASTICITY CHART



Log of Boring B1

Project: Quick Quack Car Wash

Project No: 032-18048

Client: Quick Quack Car Wash

Figure No.: A-1

Location: NWC Sierra College Boulevard and Brace Road, Loomis, CA

Logged By: Wayne Andrade

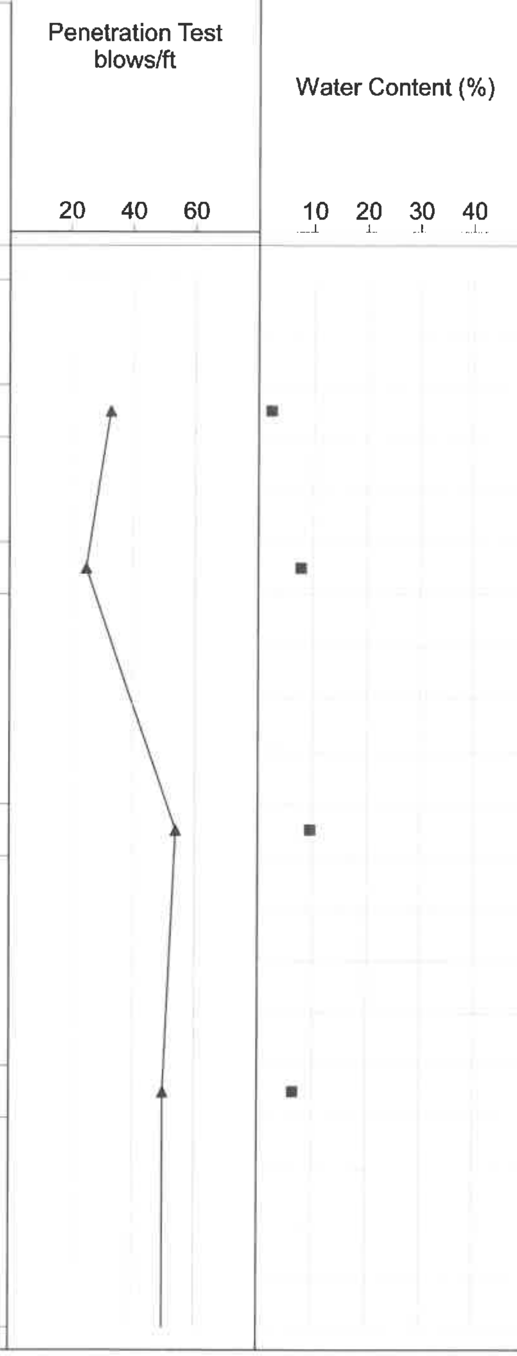
Depth to Water> **Initial:** 14 Feet **At Completion:** 8½ Feet

SUBSURFACE PROFILE

Depth (ft)	Description
0	Ground Surface
0–2	***GRAVELLY SILTY SAND (SM)*** FILL, fine- to coarse-grained with trace CLAY; brown, damp, drills easily
2–8	***SILTY SAND (SM)*** Medium dense, fine- to medium-grained with trace CLAY; brown, moist, drills easily
8–18.5	***DECOMPOSED GRANITE (DG)*** Very dense, highly weathered; black and white, damp, drills hard Saturated below 8½ feet
18.5–	***DECOMPOSED GRANITE (DG)*** Very dense, moderately weathered; black and white, saturated, drills hard

SAMPLE

Depth (ft)	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
2–3	124.7	2.4	■	33
5–6	120.3	7.8	■	25
10–11	113.4	9.6	◢	54
15–16	135.6	6.6	◢	50+
20–			◢	50+



Drill Method: Hollow Stem

Drill Date: 10-16-18

Drill Rig: CME 45C-1

Krazan and Associates

Hole Size: 6½ Inches

Driller: Chris Wyneken

Elevation: 22 Feet

Sheet: 1 of 2

Log of Boring B1

Project: Quick Quack Car Wash | **Project No:** 032-18048

Client: Quick Quack Car Wash | **Figure No.:** A-1

Location: NWC Sierra College Boulevard and Brace Road, Loomis, CA | **Logged By:** Wayne Andrade

Depth to Water> | **Initial:** 14 Feet | **At Completion:** 8½ Feet

SUBSURFACE PROFILE			SAMPLE				Penetration Test blows/ft (20 40 60)	Water Content (%) (10 20 30 40)
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.		
						50+		
22		Auger refusal at 22 feet						
		End of Borehole						
24								
26								
28								
30								
32								
34								
36								
38								
40								

Drill Method: Hollow Stem | **Drill Date:** 10-16-18

Drill Rig: CME 45C-1 | **Krazan and Associates** | **Hole Size:** 6½ Inches

Driller: Chris Wyneken | **Elevation:** 22 Feet

Log of Boring B2

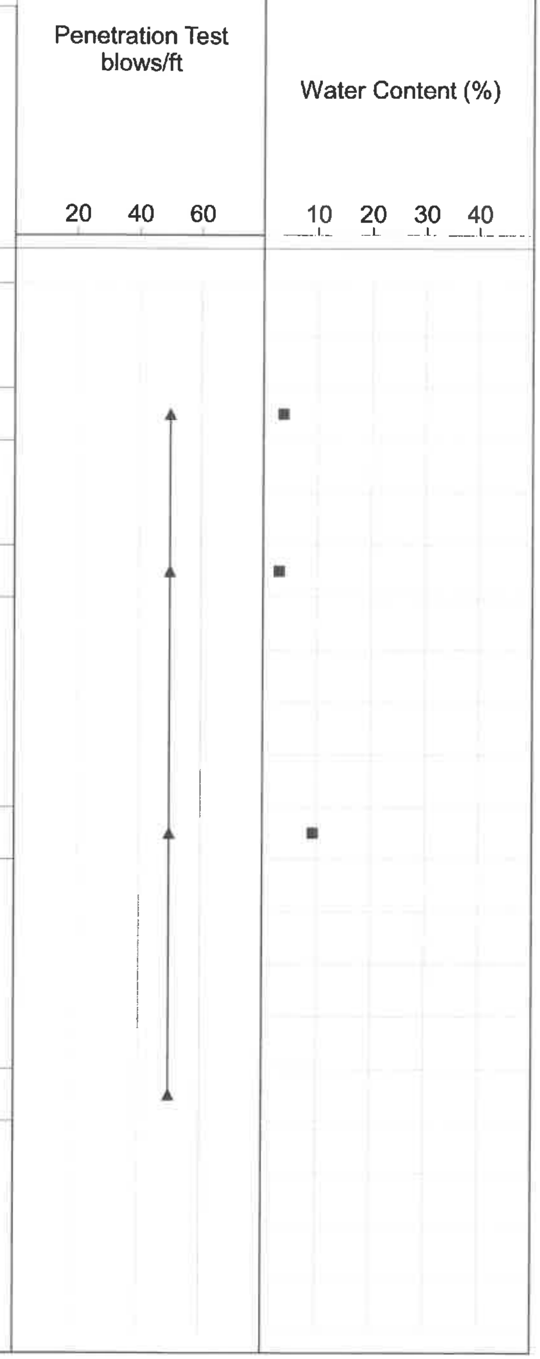
Project: Quick Quack Car Wash | **Project No:** 032-18048

Client: Quick Quack Car Wash | **Figure No.:** A-2

Location: NWC Sierra College Boulevard and Brace Road, Loomis, CA | **Logged By:** Wayne Andrade

Depth to Water> **Initial:** 10 Feet | **At Completion:** 7½ Feet

SUBSURFACE PROFILE			SAMPLE			
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
		Ground Surface				
0		***GRAVELLY SILTY SAND (SM)*** FILL, fine- to coarse-grained with trace CLAY; brown, damp, drills easily				
2		***SILTY SAND (SM)*** Very dense, fine- to medium-grained with trace CLAY; brown, moist, drills easily	114.1	3.7		50+
4						
6				3.0		50+
		Saturated below 7½ feet				
8		***DECOMPOSED GRANITE (DG)*** Very dense, highly weathered; black and white, saturated, drills hard				
10				9.4		50+
12		***DECOMPOSED GRANITE (DG)*** Very dense, moderately weathered; black and white, saturated, drills hard				
14						
		Auger refusal at 16 feet				50+
16		End of Borehole				
18						
20						



Drill Method: Solid Flight | **Drill Date:** 10-16-18

Drill Rig: CME 45C-1 | **Hole Size:** 4½ Inches

Driller: Chris Wyneken | **Elevation:** 16 Feet

Krazan and Associates

Log of Boring B3

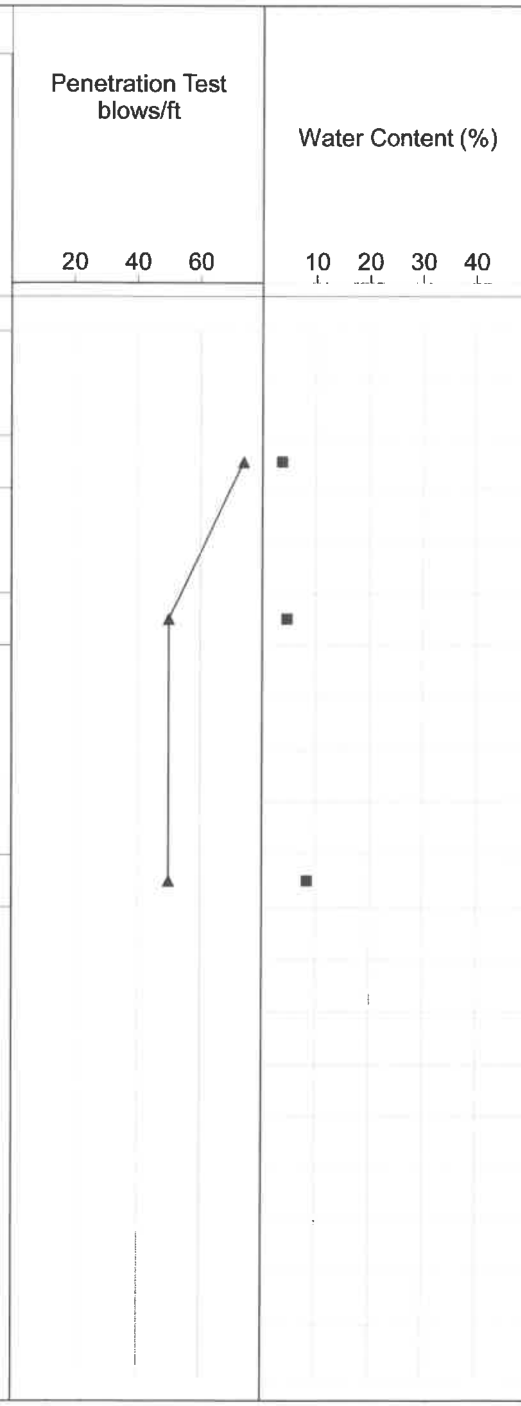
Project: Quick Quack Car Wash
Project No: 032-18048

Client: Quick Quack Car Wash
Figure No.: A-3

Location: NWC Sierra College Boulevard and Brace Road, Loomis, CA
Logged By: Wayne Andrade

Depth to Water> **Initial:** 13½ Feet **At Completion:** 12 Feet

Depth (ft)	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
	Ground Surface				
0–2	***GRAVELLY SILTY SAND (SM)*** FILL, fine- to coarse-grained with trace CLAY; brown, damp, drills easily				
2–5	***SILTY SAND (SM)*** Very dense, fine- to medium-grained with trace CLAY; brown, damp, drills hard	125.2	3.7	■	74
5–9.5	***DECOMPOSED GRANITE (DG)*** Very dense, highly weathered; light brown, damp, drills hard	118.9	4.7	■	50+
9.5–15	***DECOMPOSED GRANITE (DG)*** Very dense, moderately weathered; black and white, saturated, drills hard Saturated below 12 feet	114.8	8.5	■	50+
15	End of Borehole				



Drill Method: Solid Flight
Drill Date: 10-16-18

Drill Rig: CME 45C-1
Krazan and Associates
Hole Size: 4½ Inches

Driller: Chris Wyneken
Elevation: 15 Feet

Sheet: 1 of 1

Log of Boring B4

Project: Quick Quack Car Wash

Project No: 032-18048

Client: Quick Quack Car Wash

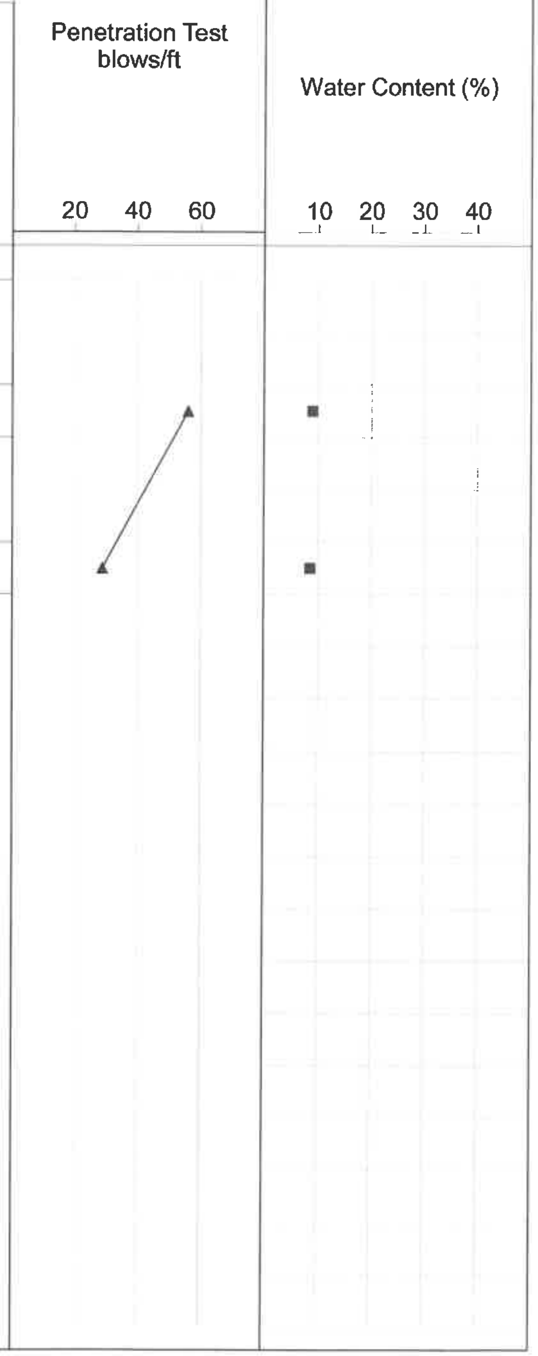
Figure No.: A-4

Location: NWC Sierra College Boulevard and Brace Road, Loomis, CA

Logged By: Wayne Andrade

Depth to Water> **Initial:** 9½ Feet **At Completion:** 8 Feet

Depth (ft)	Symbol	SUBSURFACE PROFILE – Description	SAMPLE – Dry Density (pcf)	SAMPLE – Moisture (%)	SAMPLE – Type	SAMPLE – Blows/ft.
0		Ground Surface				
0–4		***GRAVELLY SILTY SAND (SM)*** FILL, fine- to coarse-grained with trace CLAY; brown, damp, drills easily. Dark brown below 2 feet				
2–3			130.4	9.0		56
4–8		***SILTY SAND (SM)*** Medium dense, fine- to medium-grained with trace CLAY; brown, moist, drills easily				
5–6			122.9	8.6		29
8–10		***DECOMPOSED GRANITE (DG)*** Very dense, highly weathered; black and white, saturated, drills hard				
10		End of Borehole				



Drill Method: Solid Flight

Drill Date: 10-16-18

Drill Rig: CME 45C-1

Krazan and Associates

Hole Size: 4½ Inches

Driller: Chris Wyneken

Elevation: 10 Feet

Sheet: 1 of 1

Log of Boring B5

Project: Quick Quack Car Wash

Project No: 032-18048

Client: Quick Quack Car Wash

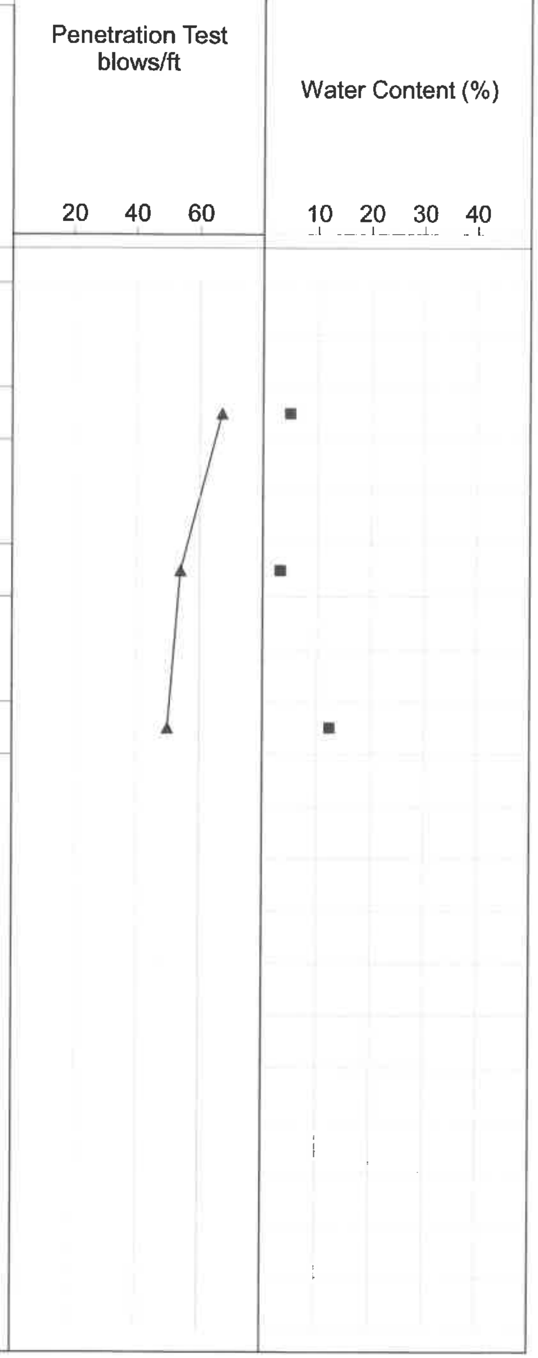
Figure No.: A-5

Location: NWC Sierra College Boulevard and Brace Road, Loomis, CA

Logged By: Wayne Andrade

Depth to Water> **Initial:** 9 Feet **At Completion:** 8 Feet

Depth (ft)	Symbol	Description (Subsurface Profile)	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
0		Ground Surface				
0–1.7		***GRAVELLY SILTY SAND (SM)*** FILL, fine- to coarse-grained with trace CLAY; brown, damp, drills easily				
2–8		***SILTY SAND (SM)*** Very dense, fine- to medium-grained with trace CLAY; light brown, damp, drills hard. Dense and drills firmly below 4 feet	106.9	4.9	■	67
			122.0	3.2	■	54
8–15		***DECOMPOSED GRANITE (DG)*** Very dense, highly weathered; black and white, saturated, drills hard	121.9	12.4	■	50+
15		End of Borehole				



Drill Method: Solid Flight

Drill Date: 10-16-18

Drill Rig: CME 45C-1

Krazan and Associates

Hole Size: 4½ Inches

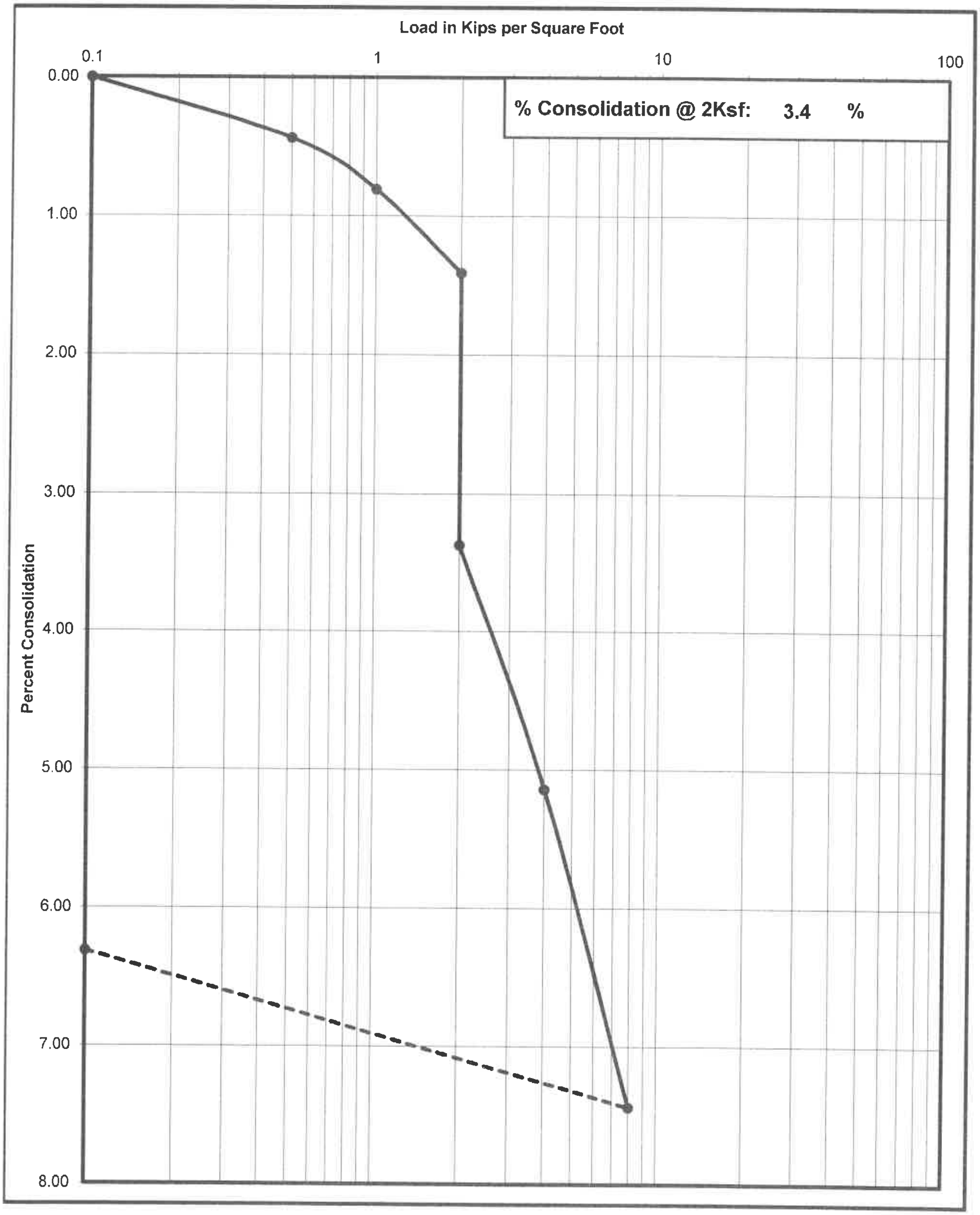
Driller: Chris Wyneken

Elevation: 15 Feet

Sheet: 1 of 1

Consolidation Test

Project No	Boring No. & Depth	Date	Soil Classification
032-18048	B1 @ 2-3'	10/25/2018	SM

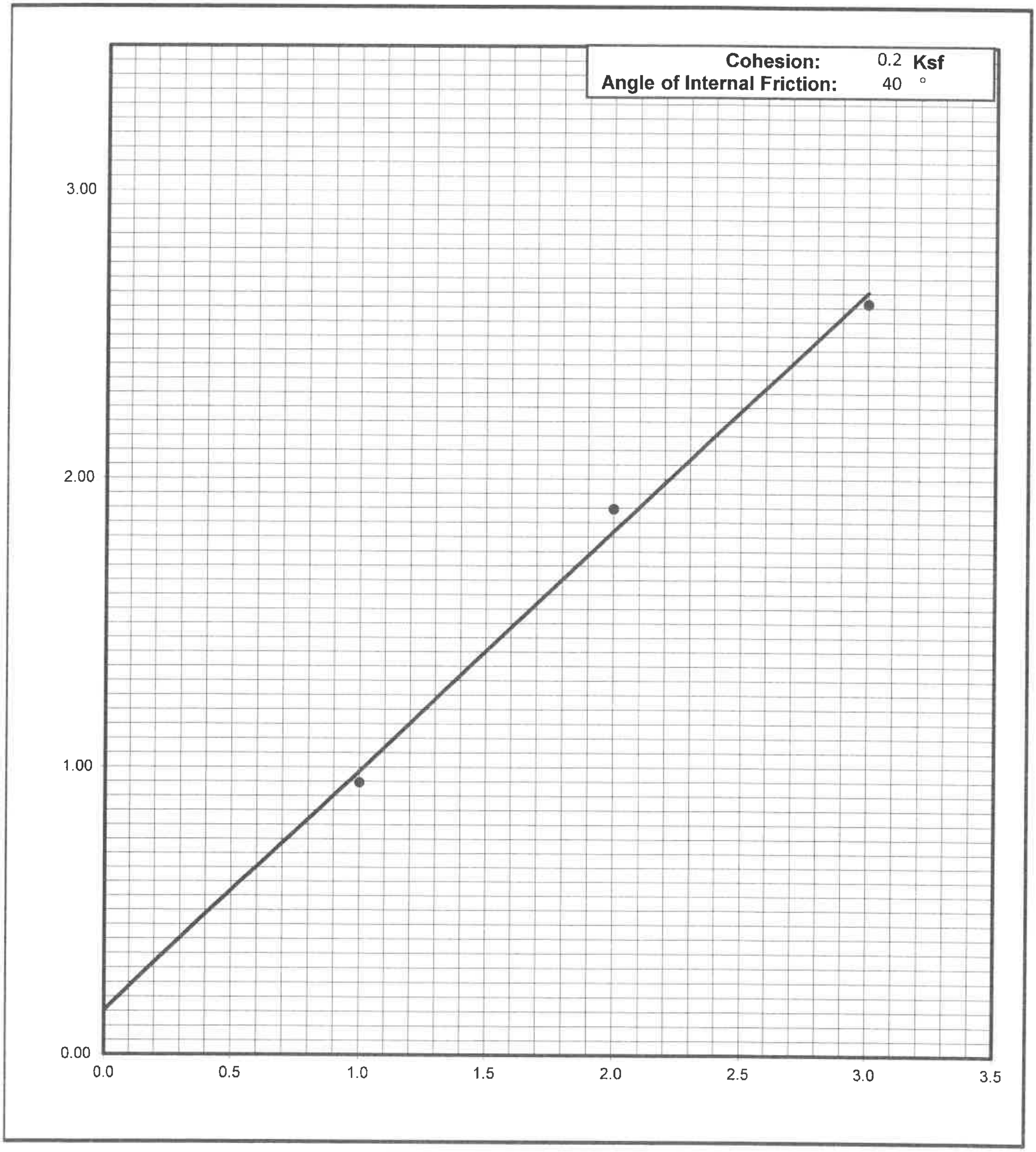


Krazan Testing Laboratory

Shear Strength Diagram (Direct Shear)

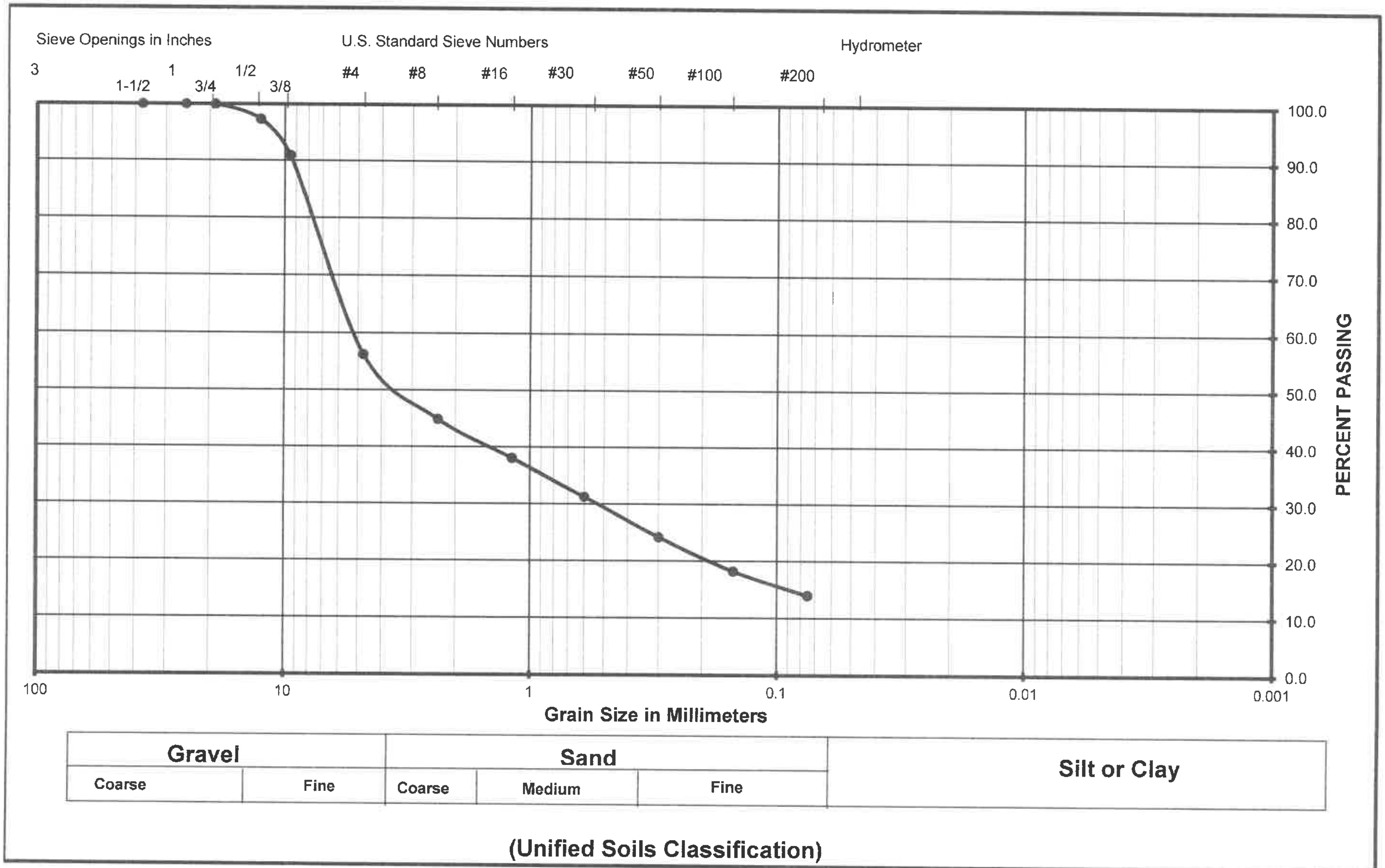
ASTM D - 3080 / AASHTO T - 236

Project Number	Boring No. & Depth	Soil Type	Date
032-18048	B3 @ 2-3'	SM	10/25/2018



Krazan Testing Laboratory

Grain Size Analysis



Project Name	Quick Quack Car Wash
Project Number	032-18048
Soil Classification	SM w/ grvl
Sample Number	B1 @ 2-3'

Krazan Testing Laboratory

Expansion Index Test

ASTM D - 4829/ UBC Std. 18-2

Project Number	: 032-18048
Project Name	: Quick Quack Car Wash
Date	: 10/25/2018
Sample location/ Depth	: 2-5'
Sample Number	: C1/X1
Soil Classification	: SM

Trial #	**1**	**2**	**3**
Weight of Soil & Mold, gms	792.6		
Weight of Mold, gms	370.0		
Weight of Soil, gms	422.6		
Wet Density, Lbs/cu.ft.	127.5		
Weight of Moisture Sample (Wet), gms	300.0		
Weight of Moisture Sample (Dry), gms	277.3		
Moisture Content, %	8.2		
Dry Density, Lbs/cu.ft.	117.8		
Specific Gravity of Soil	2.7		
Degree of Saturation, %	51.4		

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

Expansion Index $_{measured}$ = 0

Expansion Index = 0

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

Krazan Testing Laboratory

Expansion Index Test

ASTM D - 4829/ UBC Std. 18-2

Project Number	: 032-18048
Project Name	: Quick Quack Car Wash
Date	: 10/25/2018
Sample location/ Depth	: 2-5'
Sample Number	: X2
Soil Classification	: SM

Trial #	**1**	**2**	**3**
Weight of Soil & Mold, gms	786.4		
Weight of Mold, gms	367.6		
Weight of Soil, gms	418.8		
Wet Density, Lbs/cu.ft.	126.3		
Weight of Moisture Sample (Wet), gms	300.0		
Weight of Moisture Sample (Dry), gms	277.5		
Moisture Content, %	8.1		
Dry Density, Lbs/cu.ft.	116.8		
Specific Gravity of Soil	2.7		
Degree of Saturation, %	49.5		

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

Expansion Index $_{measured}$ = 0

Expansion Index = 0

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

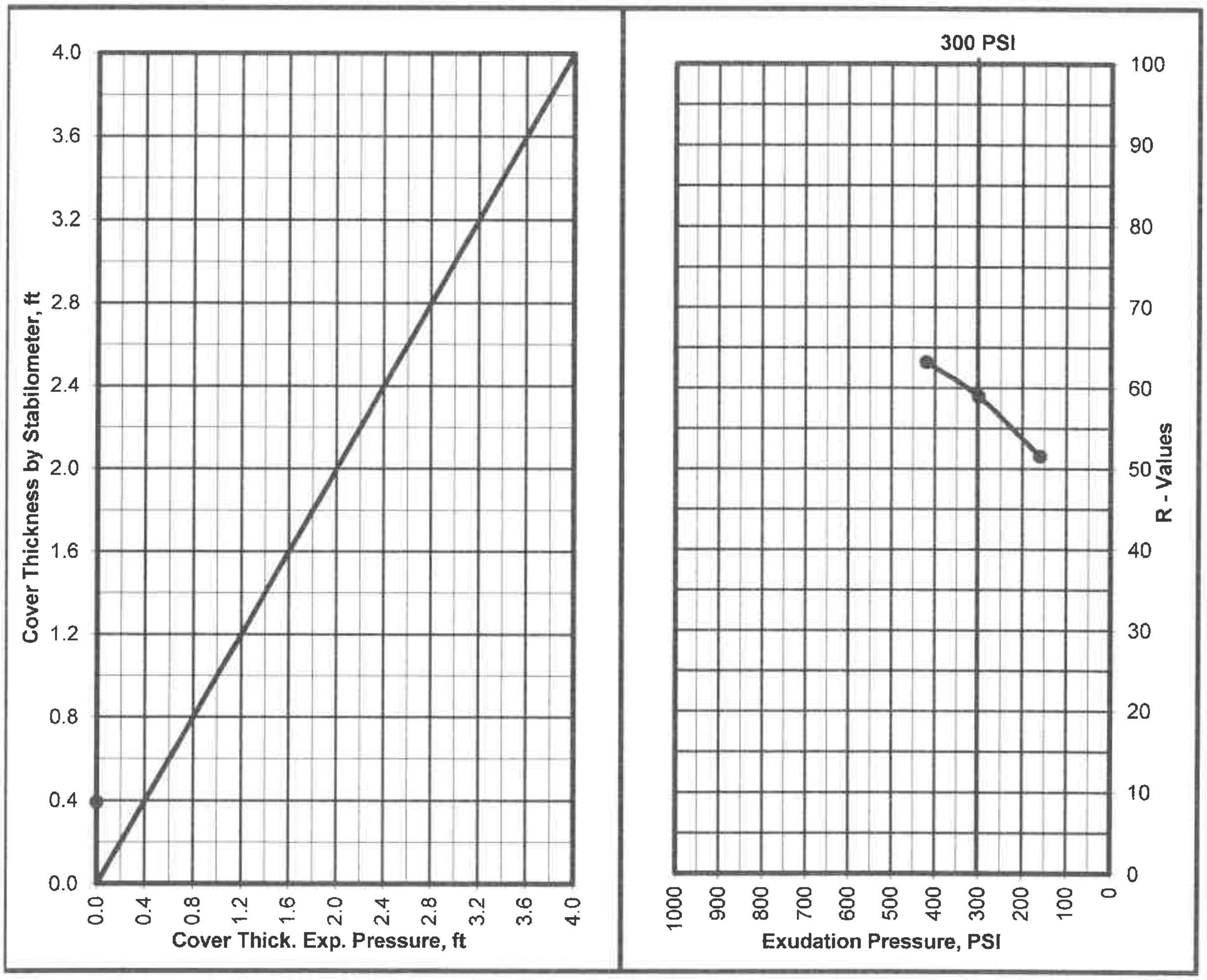
Krazan Testing Laboratory

R - VALUE TEST
ASTM D - 2844 / CAL 301

Project Number	:	032-18048
Project Name	:	Quick Quack Car Wash
Date	:	11/2/2018
Sample Location/Curve Number	:	RV#1
Soil Classification	:	SM

TEST	A	B	C
Percent Moisture @ Compaction, %	8.8	9.3	9.8
Dry Density, lbm/cu.ft.	131.7	130.5	129.6
Exudation Pressure, psi	420	300	160
Expansion Pressure, (Dial Reading)	0	0	0
Expansion Pressure, psf	0	0	0
Resistance Value R	63	59	52

R Value at 300 PSI Exudation Pressure	**59**
R Value by Expansion Pressure (TI =): 5	**Expansion Pressure nil**



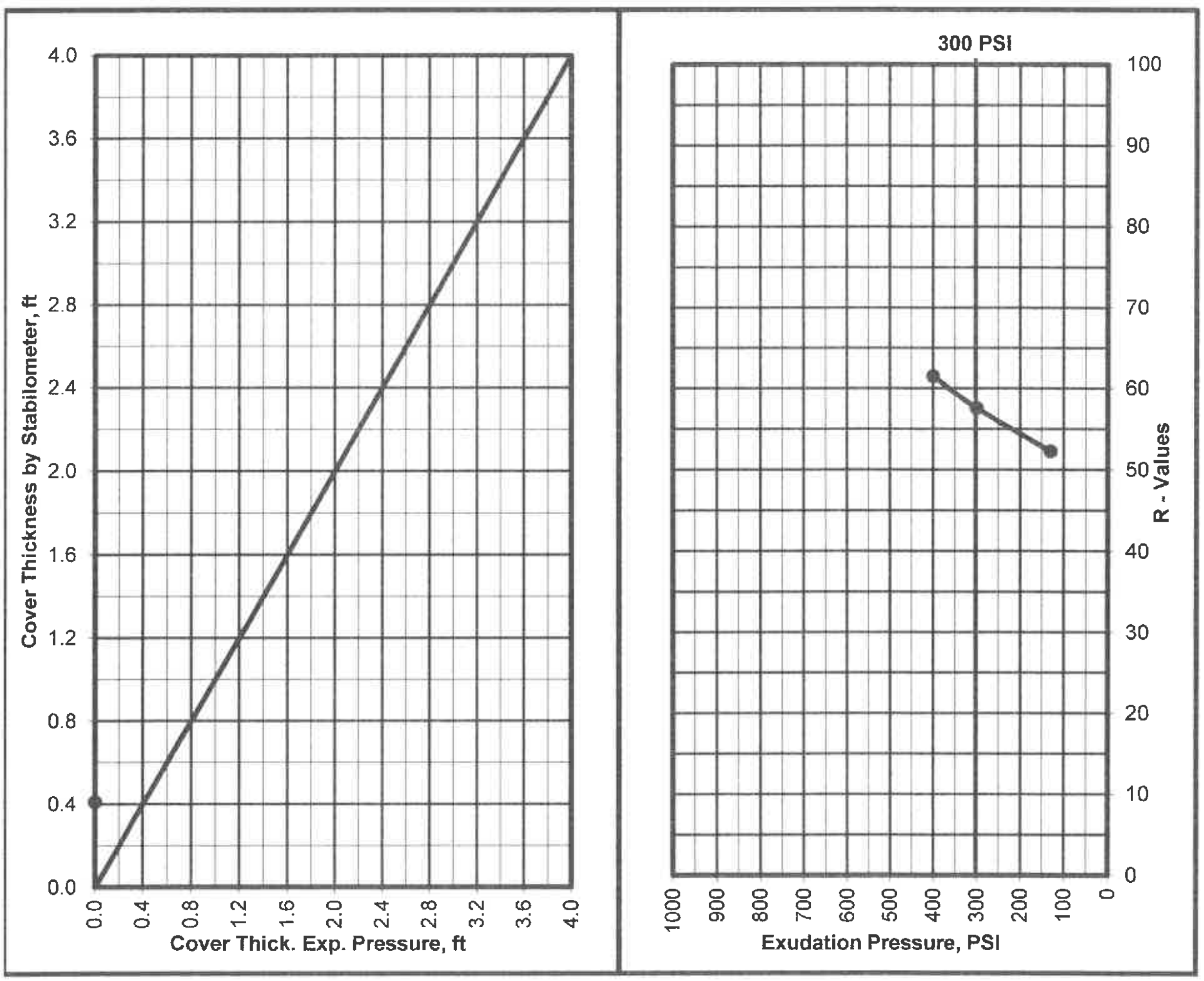
Krazan Testing Laboratory

R - VALUE TEST
ASTM D - 2844 / CAL 301

Project Number	:	032-18048
Project Name	:	Quick Quack Car Wash
Date	:	11/2/2018
Sample Location/Curve Number	:	RV#2
Soil Classification	:	SM

TEST	A	B	C
Percent Moisture @ Compaction, %	8.9	9.3	9.8
Dry Density, lbm/cu.ft.	129.9	128.8	127.9
Exudation Pressure, psi	400	300	130
Expansion Pressure, (Dial Reading)	0	0	0
Expansion Pressure, psf	0	0	0
Resistance Value R	62	58	52

R Value at 300 PSI Exudation Pressure	**58**
R Value by Expansion Pressure (TI =): 5	**Expansion Pressure nil**



Krazan Testing Laboratory

Krazan & ASSOCIATES, INC.

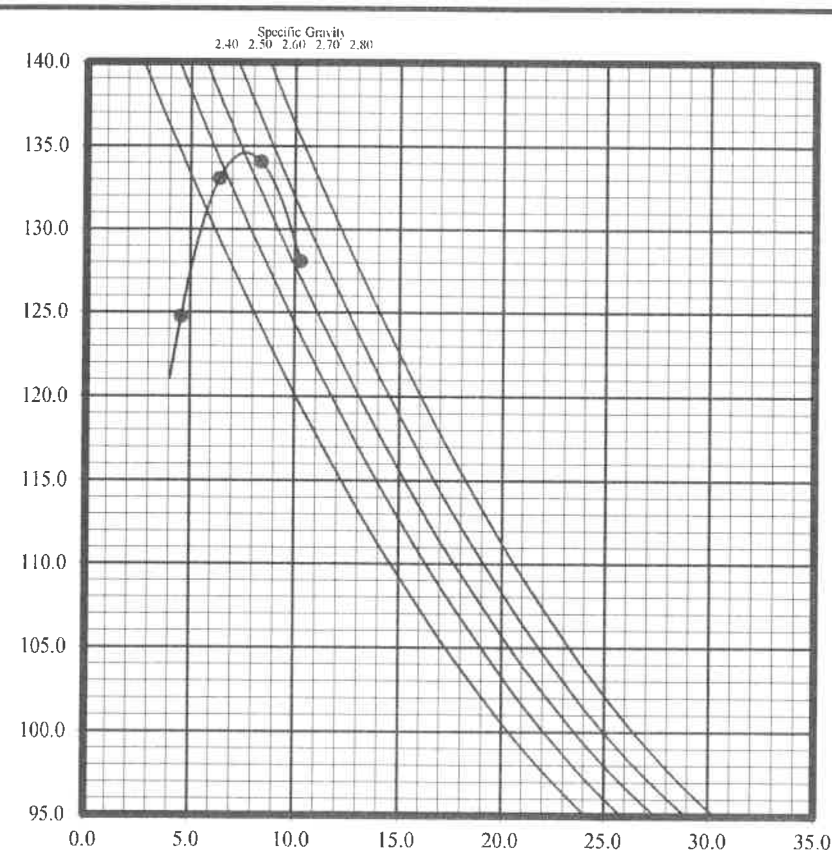
GEOTECHNICAL ENGINEERING ENVIRONMENTAL ENGINEERING CONSTRUCTION TESTING & INSPECTION

Laboratory Compaction Characteristics of Soil using Modified Effort (56,000 ft. - lbf/ft^3)

ASTM D1557

Project Number	032-18048	Sample Number	C1/X1
Project Name	QQCW	Soil Classification	SM
Technician	JG 12182	Soil Description	Brn Silty Sand
Date	10/25/2018	Method	D1557a
Sample Location	0-2.5'		

	1	2	3	4
Mass of Moist Specimen & Mold, gm	4155.6	4211.4	4150.8	3987.4
Mass of Compaction Mold, gm	2017.4	2017.4	2017.4	2017.4
Mass of Moist Specimen, gm	2138.2	2194.0	2133.4	1970.0
Volume of Mold, cu./ft.	0.0333	0.0333	0.0333	0.0333
Wet Density, lbs./cu.ft.	141.6	145.3	141.2	130.4
Mass of Moisture (Wet), gm	200.0	200.0	200.0	200.0
Mass of Moisture (Dry), gm	188.0	184.6	181.4	191.3
Moisture Content (%)	6.4	8.3	10.3	4.5
Dry Density, lbs/cu.ft.	133.1	134.1	128.1	124.7



Maximum Dry Density, lbs.cu.ft.

134.6

Optimum Moisture Content

7.6%

SDS#: -

APPENDIX B

EARTHWORK SPECIFICATIONS

GENERAL

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

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.

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 Krazan and Associates, Inc., hereinafter known 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 readjustments 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 agrees that he 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.

TECHNICAL REQUIREMENTS: All compacted materials shall be densified to a density not less than 90 percent relative compaction based on ASTM Test Method D1557 or CAL-216, as specified in the technical portion of the Soil Engineer's report. The location and frequency of field density tests shall be as 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.

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 soil report.

The Contractor shall make his own interpretation of the data contained in said report, and the Contractor shall not be relieved of liability under the Contract documents 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.

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 windblown materials attributable to his work.

SITE PREPARATION

Site preparation shall consist of site clearing and grubbing and the preparations of foundation materials for receiving fill.

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 or otherwise unsuitable. Such materials shall become the property of the Contractor and shall be removed from the site.

Tree root systems in proposed building areas should be removed to a minimum depth of 3 feet and to such an extent which would permit removal of all roots larger than 1 inch. Tree roots removed in parking areas may be limited to the upper 1½ feet of the ground surface. Backfill of tree root excavations should not be 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.

SUBGRADE PREPARATION: Surfaces to receive Engineered Fill, building or slab loads shall be prepared as outlined above, excavated/scarified to a depth of 12 inches, moisture-conditioned as necessary, and compacted to 90 percent relative compaction.

Loose soil areas, areas of uncertified fill, and/or areas of disturbed soils shall be moisture-conditioned as necessary and recompacted to 90 percent relative compaction. 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 of the fill material.

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.

FILL AND BACKFILL MATERIAL: No material shall be moved or compacted without the presence 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.

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. However, 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 areas shall be surface-compacted to the satisfaction of the Soils Engineer prior to final acceptance.

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 are as specified.

APPENDIX C

PAVEMENT SPECIFICATIONS

1. 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 2010 Standard Specifications of the State of California, Department of Transportation, and the "Materials Manual" is the Materials Manual of Testing and Control Procedures, State of California, Department of Public Works, Division of Highways. The term "relative compaction" refers to the field density expressed as a percentage of the maximum laboratory density as defined in the applicable tests outlined in the Materials Manual.

2. SCOPE OF WORK - This portion of the work shall include all labor, materials, tools, and equipment necessary for, and reasonably incidental to the completion of the pavement shown on the plans and as herein specified, except work specifically noted as "Work Not Included."

3. 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 90 percent. The finished subgrades shall be tested and approved by the Soils Engineer prior to the placement of additional pavement courses.

4. UNTREATED 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 2 material, 1½ inches maximum size. The aggregate base material shall be spread and compacted in accordance with Section 26 of the Standard Specifications. 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. The aggregate base material shall be compacted to a minimum relative compaction of 95 percent.

5. 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 2 material. The aggregate subbase material shall be compacted to a minimum relative compaction of 95 percent, and it shall be spread and compacted in accordance with Section 25 of the Standard Specifications. Each layer of aggregate subbase shall be tested and approved by the Soils Engineer prior to the placement of successive layers.

6. 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. The mineral aggregate shall be Type 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 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° F. The surfacing shall be rolled with a combination of steel wheel and pneumatic rollers, as described in Section 39-6. The surface course shall be placed with an approved self-propelled mechanical spreading and finishing machine.

7. FOG SEAL COAT - The fog seal (mixing type asphaltic emulsion) shall conform to and be applied in accordance with the requirements of Section 37.