GEOTECHNICAL ENGINEERING INVESTIGATION
PROPOSED COMMERCIAL BUILDING
NORTH OF NEVADA CITY HIGHWAY AND GATES PLACE
GRASS VALLEY, CALIFORNIA

PROJECT NO. 032-23046
DECEMBER 29, 2023

Prepared for:

MR. MATT MCWHIRTER
MCWHIRTER REALTY PARTNERS, LLC
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PARK CITY, UTAH 84098

Prepared by:

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GEOTECHNICAL ENGINEERING DIVISION
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December 29, 2023 Project No. 032-23046

Mr. Matt McWhirter
McWhirter Realty Partners, LLC
3100 Pinebrook Road, Suite 2600 A
Park City, Utah 84098

RE: Geotechnical Engineering Investigation
Proposed Commercial Building
North of Nevada City Highway and Gates Place
Grass Valley, California

Dear Mr. McWhirter:

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.

REGISTERED PROFESSIONAL ENGINEER
GEORGE P. HATTRUP
GE 2353
GEOTECHNICAL
STATE OF CALIFORNIA

Respectfully submitted,
KRAZAN & ASSOCIATES, INC.

George P. Hattrup

George P. Hattrup
Senior Geotechnical Engineer
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GPH:ht

TABLE OF CONTENTS

December 29, 2023 Project No. 032-23046

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INTRODUCTION

This report presents the results of our Geotechnical Engineering Investigation for the proposed commercial building to be located along the northeast side of Nevada City Highway, approximately 300 feet north of Gates Place in Grass Valley, 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 sections, seismic design parameters, 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 also 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 the design of specific construction elements, and to provide criteria for site preparation and foundation construction.

Our scope of services was outlined in our proposal dated October 24, 2023 (KA Proposal No. P687-23) and 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 five borings to depths of 4 to 7 feet, where practical drilling refusal was encountered, for evaluation of the subsurface conditions at the project site.
- 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

Based on the information provided, which included a preliminary site plan, it is understood that the project will consist of constructing a new single-story commercial building with a footprint area of approximately 4,500 square feet. It is anticipated that the structure will have a wood frame with a concrete slab-on-grade floor and shallow conventional foundations. Foundation loads are expected to be relatively light. Onsite paved areas, exterior concrete flatwork, various underground utilities, and landscaping are also planned for the development of the project. Based on the topography at the project site, cuts and fills should be generally be less than approximately 4 feet in order to achieve the desired finished grade for the planned site improvements.

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

SITE LOCATION AND SITE DESCRIPTION

The project site consists of a L-shaped parcel with an area of approximately one acre, which is located approximately 300 feet north-northeast of the intersection of Nevada City Highway and Gates Place in Grass Valley, California. The property is currently undeveloped and historical Google Earth Images indicate that site conditions have remained largely unchanged since at least 1998, other than the amount of vegetative growth at the site. The site is covered with a moderate to heavy growth of wild grass and weeds, along with some bushes, trees, and cobbles and boulders up to approximately 12 inches in size. The ground surface generally slopes gently downward to the south.

GEOLOGIC SETTING

The subject property is located within the northern part of the Western Sierra Nevada Metamorphic Belt, east of the Sacramento Valley and 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 or belts bounded by northwesterly trending faults of the Foothills Fault System. The subject site is indicated to lie within the western margin of the Central Belt or eastern margin of the Smartville Complex, which are comprised of Jurrasic and Triassic volcanics, meta-sedimentary, and ultramafic rocks.

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. There are three traces of the Foothills Fault System that have been mapped within 20 miles of the project site, which are considered to be potentially active. The nearest fault trace is located approximately 10 miles to the south, another fault trace is located approximately 13 miles to the east, and the third fault trace is located approximately 16 miles to the southwest.

The nearest active earthquake fault zones with respect to the project site include the Mohawk Valley (approximately 41 miles northeast), the Polaris (approximately 46 miles east-northeast), the West Tahoe-Dollar Point (approximately 51 miles east), the Hunting Creek-Berryessa (approximately 78 miles west-southwest), and the Bartlett Springs (approximately 80 miles west-southwest). Perhaps the most well-known fault, the San Andreas, is located approximately 124 miles to the southwest.

There are no active fault traces in the project vicinity. Accordingly, the project area is not within an Earthquake Fault Zone (Special Studies Zone) and will not require a special site investigation by an Engineering Geologist. However, it is anticipated that the project site will be subject to some ground shaking during a design seismic event and a peak earthquake ground acceleration adjusted for site class effects (PGA_M) of 0.3g is considered applicable.

Secondary hazards from earthquakes include rupture, seiche, landslides, liquefaction, and seismic settlement. Since there are no known faults within the immediate area, ground rupture from surface faulting should not be a potential problem. Seiche and landslides are not hazards in the area either. Taking into account the seismic setting and the shallow depth to rock at the project site, the risk of liquefaction (sudden loss of shear strength in a saturated cohesionless soil) or significant seismic settlement occurring during a design seismic event is considered negligible.

FIELD AND LABORATORY INVESTIGATIONS

Subsurface soil conditions were explored by drilling four borings to depths of 4 to 7 feet below the existing site grade using a truck-mounted drill rig. Practical drilling refusal was encountered at these depths to the presence of cobbles or weathered rock. In addition, one bulk sample of the subgrade was obtained from the site for laboratory R-value testing. The approximate boring and bulk sample locations are shown on the attached site plan, Figure 1. During drilling operations, penetration tests were performed at regular intervals to evaluate the soil and consistency of weathered rock 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, expansion, and R-value of the materials encountered. In addition, chemical tests were performed to evaluate the corrosivity of the soils for buried concrete. 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 clayey sand/sandy clay with gravel. 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 loose to medium dense clayey sand/sandy clay with gravel was encountered. Field and laboratory tests suggest that these soils are moderately strong and slightly compressible. Penetration resistance was on the order of 35 blows per foot. Dry density was on the order of 89 pcf. A representative soil sample consolidated approximately 3½ percent under a 2 ksf load when saturated. A representative sample had an expansion index of 19 and a plasticity index of 15.

Below 2 to 5 feet, predominately very dense clayey sand/sandy clay or weathered rock were encountered. The soils were intermixed with gravel, cobbles and boulders. Field and laboratory tests suggest that these soils/rock are moderately strong and slightly compressible. Penetration resistance was greater than 50 blows per 6 inches. Dry densities ranged from 72 to 99 pcf. A representative soil sample had an internal angle of friction of 27 degrees. These soils/rock had slightly stronger strength characteristics than the upper soils and extended to the termination depth of our borings. The borings were terminated at depths of 4 to 7 feet due to auger refusal.

For additional information about the soils encountered, please refer to the boring logs and laboratory test data in Appendix A.

GROUNDWATER

Test boring locations were checked for the presence of groundwater during and immediately following the drilling operations. No groundwater was encountered in the borings within the maximum depth explored of 7 feet below the existing ground surface at the project site. However, it is anticipated that following periods of rainfall and melting snow, water that infiltrates the soils may migrate downslope on top of the weathered rock surface. Thus, shallow perched groundwater at the site is expected to be a seasonal condition.

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 very loose surface soils and the moderate shrink/swell potential of the on-site clayey soils, appear to be conducive to the development of the project. Based on our field exploration, the upper 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 surface soils and locate any unsuitable or pliant areas not found during our field investigation.

Fill material was not apparent within our test borings. However, fill material may be encountered between or beyond the boring locations. Verification of the extent of fill, if any, should be determined during site grading. It is recommended that fill material that has not been properly compacted and certified be excavated and stockpiled so that the native soils can be properly prepared. Clayey soils with an expansion index greater than 15 will not be suitable for reuse as non-expansive Engineered Fill, unless they are lime-treated. However, they should be suitable to reuse as General Engineered Fill, provided this material is cleansed of excessive organics and debris and moisture-conditioned to a minimum of 2 percent above optimum moisture content.

We are not aware of any historical structural or civil improvements within the area of the planned improvements at the project site. However, if applicable, demolition activities should include proper removal of any buried structures encountered, including underground utilities, irrigation lines, and/or septic systems within the area of the planned improvements. It is suspected demolition activities will disturb the upper soils. Disturbed areas caused by demolition activities should be excavated to firm native ground and backfilled with Engineered Fill.

Where applicable, tree and shrub removal operations should include removing concentrations of roots and any isolated roots greater than 1 inch in diameter. The resulting excavations should be cleaned to firm native ground and backfilled with Engineered Fill compacted to a minimum of 90 percent of maximum density based on ASTM Test Method D1557.

The near-surface on-site clayey soils have a moderate shrink/swell potential. To reduce potential soil movement related to shrink/swell of the clayey soils, it is recommended that slab-on-grade and exterior flatwork areas be supported by at least 12 inches of non-expansive Engineered Fill. The non-expansive fill material should be a well-graded silty sand or sandy silt soil. A clean sand or very sandy soil is not acceptable for this purpose. A clean sandy soil will allow the surface water to drain into the expansive soils below, which may result in soil swelling. The replacement soils and/or upper 12 inches of Imported Fill soils should meet the specifications as described under the subheading Engineered Fill. The replacement soils should extend at least 5 feet beyond the building perimeter. The non-expansive replacement soils should be compacted to at least 90 percent of relative compaction based on ASTM

Test Method D1557. The exposed native soils in the excavation should not be allowed to dry out and should be kept continually moist, prior to backfilling. In addition, it is recommended that slab-on-grade, continuous footings and slabs be reinforced to reduce cracking and vertical off-set.

As an alternative to the use of non-expansive soils, the upper 12 inches of soil supporting slab-on-grade and exterior flatwork areas can consist of lime-treated clayey soils. The lime-treated soils should be recompacted to a minimum of 90 percent of maximum density. Preliminary application rate of lime should be 5 percent by dry weight; however, additional sampling and testing should be done prior to construction to verify this. The lime material should be calcium oxide, commonly known as quick-lime. The clayey soils should be at least 2 percent above optimum moisture during the mixing operations.

After completion of the site preparation as recommended below, the site should be suitable for shallow footing support. The proposed structure footings may be design utilizing an allowable bearing pressure of 2,500 psf for dead-plus-live loads. Isolated spread or continuous footings should have a minimum embedment of 18 inches. An allowable modulus of subgrade reaction of 65 pci may be used to design structural concrete slabs-on-grade or mat foundations that are supported on at least 12 inches of non-expansive engineered fill or lime-treated clayey soils.

Groundwater Influence on Structures/Construction

During our field investigation groundwater was not encountered. However, due to relatively shallow weathered rock in the vicinity of the site, perched groundwater may be encountered at shallow depths during or following periods of precipitation. Therefore, dewatering and/or waterproofing 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 standpipe piezometers 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.

One 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.

Site Preparation

General site clearing should include removal of vegetation; trees and associated root systems; existing utilities; structures including foundations; existing stockpiled soil; 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 reused in landscape or non-structural areas.

Fill material was not apparent within our test borings. However, fill material may be encountered between or beyond the boring locations. Verification of the extent of fill should be determined during site grading. It is recommended that fill material that has not been properly compacted and certified be excavated and stockpiled so that the native soils can be properly prepared. The fill soils will be suitable for reuse as General Engineered Fill, provided they are cleansed of excessive organics, debris, and fragments greater than 4 inches in maximum dimension. However, supplemental testing will be required on the fill material during construction to verify its suitability for re-use as non-expansive Engineered Fill.

Any buried structures encountered during construction should be properly removed and the resulting excavations backfilled with Engineered Fill, compacted to a minimum of 90 percent of maximum density based on ASTM Test Method D1557. Excavations, depressions, or soft and pliant areas extending below planned finished subgrade levels should be cleaned to firm, undisturbed soil and backfilled with Engineered Fill. In general, any septic tanks, debris pits, cesspools, or similar structures should be entirely removed. Concrete footings should be removed to an equivalent depth of at least 3 feet below proposed footing elevations or as recommended by the Soils Engineer. Any other buried structures encountered, should be removed in accordance with the recommendations of the Geotechnical Engineer. The resulting excavations should be backfilled with Engineered Fill.

Where applicable, tree and shrub removal operations should include removing concentrations of roots and any isolated roots greater than 1 inch in diameter. The resulting excavations should be cleaned to firm native ground and backfilled with Engineered Fill compacted to a minimum of 90 percent of maximum density based on ASTM Test Method D1557.

It is recommended that following stripping, demolition and fill removal operations, the upper 12 inches of native soils within the proposed building areas be excavated, worked until uniform and free from large clods, moisture-conditioned to a minimum of 2 percent above optimum moisture content, and recompacted to a minimum of 90 percent of maximum density based on ASTM Test Method D1557. Over-excavation should extend to a minimum of 5 feet beyond structural elements. Prior to backfilling, the bottom of the excavation should be proof rolled and observed by Krazan & Associates, Inc. to verify stability. This compaction effort should stabilize the surface soils and locate any unsuitable or pliant areas not found during our field investigation. Soft or pliant areas should be excavated to firm native ground.

Weathered rock may be present at a relatively shallow depth within some parts of the project site. In order to reduce post-construction differential settlement, it is recommended that native soils that are in cuts extending into weathered rock and/or in a soil/rock transition zone be cut a minimum of 12 inches below the proposed bottoms of footings. The excavation(s) should be extended a minimum of 5 feet beyond structural elements. In lieu of over-excavation, the footings of all connected structures may be embedded a minimum of 12 inches into the native weathered rock.

It is recommended that the upper 12 inches of soil within proposed slab-on-grade and exterior flatwork areas consist of non-expansive or lime-treated Engineered Fill. The intent is to support slab-on-grade and exterior flatwork areas with 12 inches of non-expansive or lime-treated fill. The fill placement serves two functions: 1) it provides a uniform amount of soil, which will more evenly distribute the soil pressures and 2) it reduces moisture content fluctuation in the clayey material beneath the building area. The non-expansive fill material should be a well-graded silty sand or sandy silt soil. A clean sand or very sandy soil is not acceptable for this purpose. A sandy soil will allow the surface water to drain into the expansive clayey soil below, which may result in soil swelling. Imported Fill should be approved by the Soils Engineer prior to placement. The fill should be placed as specified as Engineered Fill.

It is recommended the buildings be constructed a minimum horizontal distance of ⅓ the slope height or 10 feet away from the edge of slopes, whichever is greater. Permanent cut and fill slopes inclined at 2:1 (horizontal to vertical) or flatter should be grossly stable. Cut and fill slopes may be revised as recommended by the Geotechnical Engineer upon review of more definitive plans.

During periods of wet weather, the upper soils will become very moist due to the absorptive characteristics of the soil. Earthwork operations performed during winter or early spring 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 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 and the Engineered Fill section.

Slope Protection

Site grading near slopes and embankments, including any retaining walls and wing walls, should be accomplished such that excessive sheet run-off is prevented. The completed slopes should be seeded or otherwise vegetated to protect from 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 a flood event. 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.

Within the side of embankments facing water flow, it is recommended that rock rip rap or concrete paving be used to prevent erosion. Rip rap or paving should be inspected regularly, to be sure that they are not dislodged or damaged. Eroded areas should be promptly repaired and reseeded or protected by rip rap or paving. As an alternative to the rip rap or paving, erosion control geotextile material, such as Mirafi 700X or similar, may be installed for erosion control. This geotextile protection system is often used to guard against erosion.

Engineered Fill

Based on our test borings, the upper, on-site soils consist predominately of sandy clays and clayey sands with varying amounts of gravel and cobbles. These soils will not be suitable to use as non-expansive fill material. However, these clayey soils will be suitable for reuse as General Engineered Fill, within pavement areas and below 12 inches from the finished subgrade surface in slab-on-grade areas, provided they are cleansed of excessive organics, debris, and fragments larger than 4 inches in maximum dimension, and moisture-conditioned to at least two (2) percent above optimum moisture.

As an alternative to using onsite or imported fill materials that are non-expansive, the onsite clayey soils can be used as Engineered Fill within the upper 12 inches below slab-on-grade and exterior flatwork areas, provided they are lime-treated. The Expansion Index (ASTM D4829) of lime treated clayey soil should not be greater than 15. On a preliminary basis, the application rate of lime to meet this requirement is estimated to be 5 percent by dry weight. The clayey soils should be at least 2 percent above optimum moisture content during mixing operations. Additional testing is recommended to determine the appropriate application rate of lime prior to placement.

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, silty sand with relatively impervious characteristics when compacted. This material should be approved by Krazan prior to use and should typically possess the following characteristics:

Percent Passing 1.5" Sieve	100
Percent Passing No. 4 Sieve	70 to 100
Percent Passing No. 200 Sieve	20 to 50
Plasticity Index (ASTM D4318)	10 maximum
Expansion Index (ASTM D4829)	15 maximum

Fill soils should be placed in lifts approximately 6 inches thick, moisture-conditioned to a minimum of 2 percent above optimum moisture content, and compacted to achieve at least 90 percent 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

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 2022 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.

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.

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.

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 minimized; 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.

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.

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.

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 undisturbed native soils, Engineered Fill or weathered rock. Isolated spread and continuous footings can be designed for the following maximum allowable soil bearing pressures:

Load	Allowable Loading
Dead Load Only	1,850 psf
Dead-Plus-Live Load	2,500 psf
Total Load, including wind or seismic loads	3,350 psf

The footings should have a minimum embedment depth of 18 inches below pad subgrade (soil grade) or adjacent exterior grade, whichever is lower. Continuous footings should have a minimum width of 12 inches and isolated spread footings should have a minimum width of 24 inches, regardless of load.

The footing excavations should not be allowed to dry out any time prior to pouring concrete. It is recommended that continuous footings be reinforced with at least two No. 4 reinforcing bars at both the top and bottom of the footings.

The total movement is not expected to exceed 1 inch. Differential 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 movement may occur if the foundation soils are flooded or saturated.

Resistance to lateral footing displacement can be computed using an allowable friction factor of 0.3 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 240 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.

Floor Slabs and Exterior Flatwork

To reduce post-construction soil movement beneath floor slabs and exterior flatwork in expansive soils, it is recommended that mitigation measures be performed. For conventional slab-on-grade on expansive soils, it is recommended that the upper 12 inches of soil beneath the slabs-on-grade or exterior flatwork areas consist of non-expansive Engineered Fill.

In areas that will utilize moisture-sensitive floor coverings or where moisture-sensitive materials will be stored, 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, which will act as a capillary break. 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.

It is recommended that concrete floor slabs be reinforced with at least No. 3 reinforcing bars placed at 18 inches on-center, or No. 4 reinforcing bars placed 24 inches on-center, in each direction within the slabs middle third, to reduce crack separation and possible vertical offset at the cracks. Thicker floor slabs with increased concrete strength and reinforcement should be designed wherever heavy concentrated loads, heavy equipment, or machinery is anticipated.

The exterior floors should be poured separately in order to act independently of the walls and foundation system. Exterior finish grades should be sloped a minimum of 1 to 1½ percent away from all interior slab areas to preclude ponding of water adjacent to the structures. 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 capillary break 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 45 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 65 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 1:1 (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.

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 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 CalTrans Standard Specifications (2018). 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 center line of the drainage blanket and should have a minimum diameter of four 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 CalTrans Standard Specifications for "edge drains") should be affixed to the rear wall opening of each weep hole to retard soil piping.

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.

R-Value Test Results and Pavement Design

One subgrade soil sample was obtained from the project site for evaluation and laboratory R-value testing at the location shown on the site plan. The sample was tested in accordance with the State of California Materials Manual Test Designation 301. The results of these tests are as follows:

Sample	Depth	Description	R-Value at Equilibrium
RV1	8" – 30"	Clayey Silty Sand (SM/SC) w/ gravel	58

The results of our laboratory testing program indicate that the onsite subgrade soils, when properly compacted, will provide moderate support characteristics under dynamic traffic loads. Based on the clayey soils encountered in our borings, it is recommended the pavement section be designed based on an R-value of 30. The following tables show the recommended minimum pavement sections for various traffic indices based on a subgrade R-value of at least 30.

RECOMMENDED PAVEMENT SECTIONS

Traffic Index	Asphalt Concrete	Class 2 Aggregate Base*	Class 2 Aggregate Subbase*	Compacted Subgrade** (R-Value ≥ 30)
4.0	2.0"	5.0"	---	12.0"
4.5	2.5"	5.5"	---	12.0"
5.0	2.5"	6.5"	---	12.0"
5.0	2.5"	4.0"	4.0"	12.0"
5.5	3.0"	7.0"	---	12.0"
5.5	3.0"	4.0"	4.0"	12.0"
6.0	3.0"	8.5"	---	12.0"
6.0	3.0"	4.0"	5.0"	12.0"
6.5	3.5"	9.0"	---	12.0"
6.5	3.5"	4.5"	5.0"	12.0"
7.0	4.0"	9.5"	---	12.0"
7.0	4.0"	5.0"	5.0"	12.0"
7.5	4.5"	10.0"	---	12.0"
7.5	4.5"	5.0"	5.5"	12.0"

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

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 2 Aggregate Base*	Compacted Subgrade**
4.5	6.0"	4.0"	12.0"

HEAVY DUTY

Traffic Index	Portland Cement Concrete***	Class 2 Aggregate Base*	Compacted Subgrade**
7.0	7.0"	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***
******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 material 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 – 2022 California Building Code

The Site Class per Section 1613 of the 2022 California Building Code (2022 CBC) and Chapter 20 of ASCE 7-16 is based upon the site subsurface conditions. It is our opinion that a Site Class C is most consistent with the subject site conditions. For seismic design of the structures based on the seismic provisions of the 2022 CBC, we recommend the following parameters:

Seismic Item	Value	CBC Reference
Site Class	C	Section 1613.2.2
Site Coefficient F_a	1.272	Table 1613.2.3 (1)
S_s	0.569	Section 1613.2.1
S_{MS}	0.724	Section 1613.2.3
S_{DS}	0.483	Section 1613.2.4
Site Coefficient F_v	1.5	Table 1613.2.3 (2)
S_1	0.235	Section 1613.2.1

S_{M1}	0.353	Section 1613.2.3
S_{D1}	0.235	Section 1613.2.4
T_S	0.487	Section 1613.2

* Based on Equivalent Lateral Force (ELF) Design Procedure being used.

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.

A shallow soil sample was obtained from the site (Boring B2 at 2 to 3 feet) and tested in accordance with State of California Materials Manual Test Designation 417. The sulfate concentration detected in the soil sample was 0.0016 percent (16 ppm), which is below the maximum allowable values established by HUD/FHA and CBC. Therefore, no special design requirements should be necessary to compensate for sulfate reactivity with the cement.

The soil sample referenced above was also tested to evaluate the soluble chloride content, which was 24 ppm, indicating that there is a low soluble chloride content. In addition, a soil reactivity (pH) of 6.2 was determined.

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 Geotechnical 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

Geotechnical 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 in accordance with the current standard of practice, undoubtedly there will be substantial future improvements in this branch of engineering. In addition to advancements in the field of Geotechnical 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 Geotechnical 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 building is relocated or redesigned, the conclusions in this report may not be valid. The Geotechnical 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 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.

George P. Hattrup
Senior Geotechnical Engineer
RGE No. 2353/RCE No. 43979

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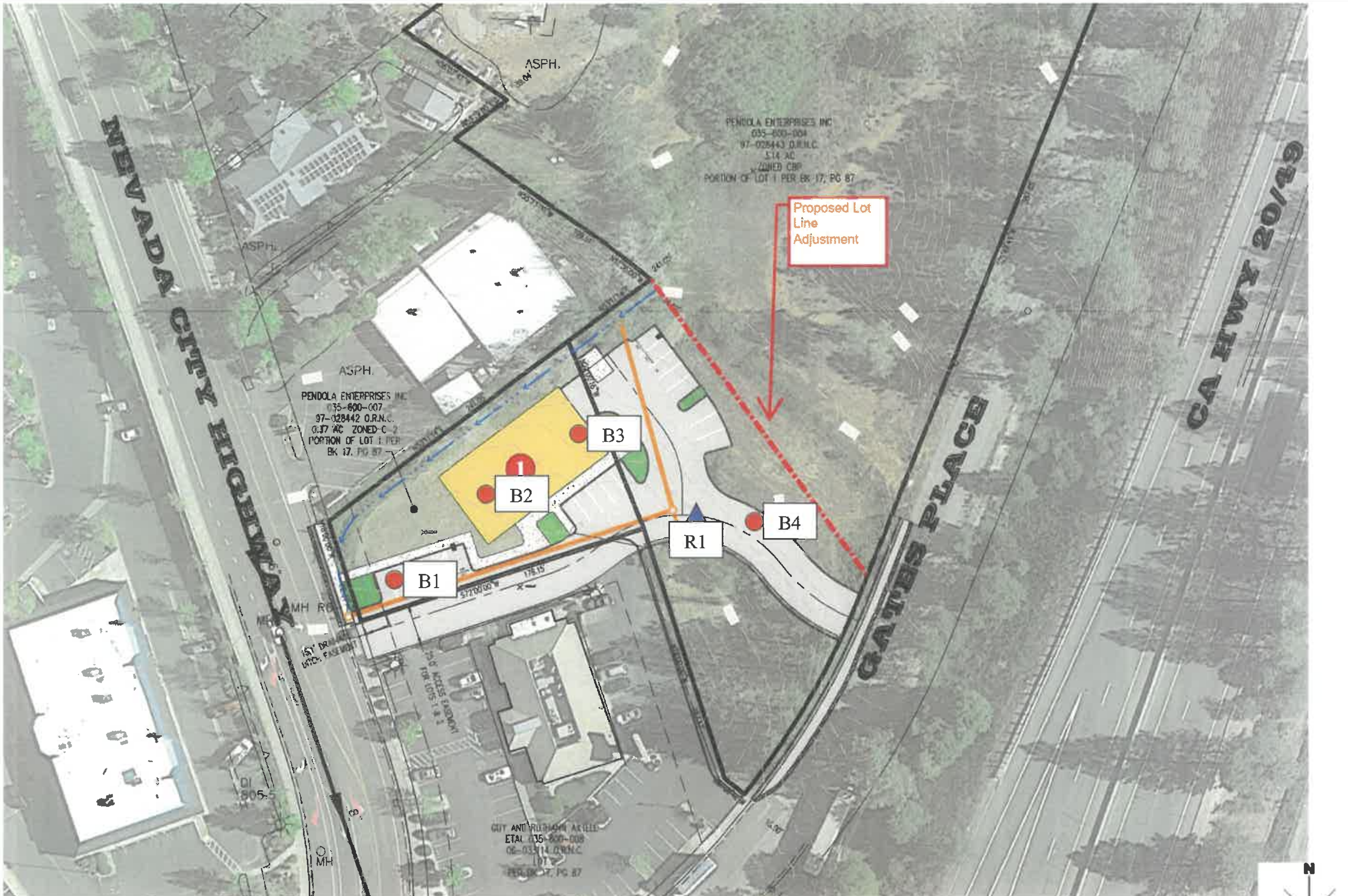
Managing Engineer
RGE No. 2698/RCE No. 60185

GPH/DRJ:ht



APPROXIMATE BORING LOCATION

APPROXIMATE R-VALUE LOCATION

SITE MAP	Scale: NTS	Date: January 2024
Commercial Building **Nevada City Highway and Gates Place** **Grass Valley, California**	Drawn by: HT	Approved by: DJ
	Project No. 032-23046	Figure No. 1

Krazan
GEOTECHNICAL ENGINEERING

APPENDIX A

FIELD AND LABORATORY INVESTIGATIONS

Field Investigation

The field investigation consisted of a surface reconnaissance and a subsurface exploratory program. Four 4½-inch diameter exploratory borings were advanced for this geotechnical investigation. 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 were performed at selected depths. These tests represent the resistance to driving a 2½-inch inside diameter split barrel sampler. The driving energy was provided by an auto-hammer weighing 140 pounds and 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 block. 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 on the undisturbed samples representative of the subsurface materials. In addition, an Atterberg Limits test, an Expansion Index test, and an R-value test were performed on 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 test results are presented in this Appendix.

UNIFIED SOIL CLASSIFICATION SYSTEM

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

Major Division	Symbol	Description
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

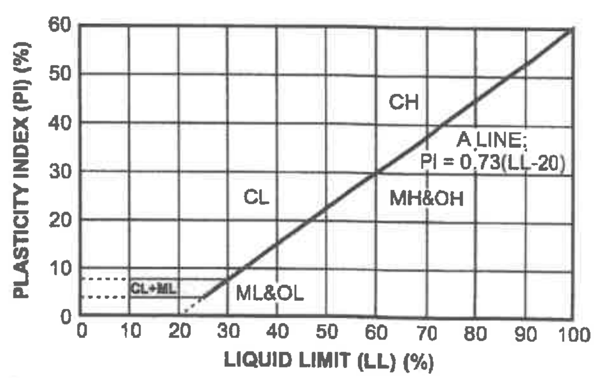
CONSISTENCY CLASSIFICATION

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 0.42
Fine-grained	No. 40 to No. 200	0.42 to 0.074
Silt and Clay	Below No. 200	Below 0.074

PLASTICITY CHART



Log of Boring B1

Project: Commercial Building | **Project No:** 032-23046

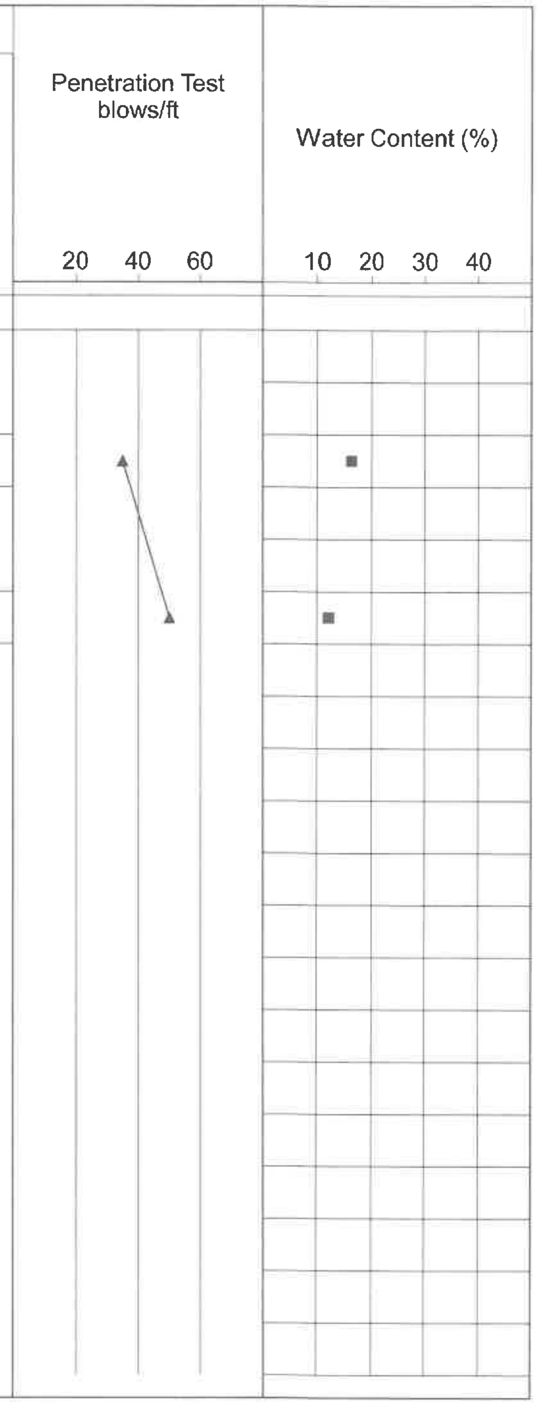
Client: McWhirter Realty Partners, LLC | **Figure No.:** A-1

Location: Nevada City Highway and Gates Place, Grass Valley, California | **Logged By:** Dave Adams

Depth to Water> | **Initial:** None | **At Completion:** None

SUBSURFACE PROFILE / SAMPLE

Depth (ft)	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
0	Ground Surface				
0–2	***CLAYEY SAND/SANDY CLAY (SC/CL)*** Very loose, fine- to coarse-grained with GRAVEL; brown, moist, drills easily. Loose below 12 inches. Medium dense below 2 feet				
2–3		89.6	16.2	■	35
5	Very dense with angular COBBLE below 5 feet				
5–6		92.8	12.1	■	50+
7	Auger refusal at 7 feet				
7	End of Borehole				



Drill Method: Solid Flight | **Drill Date:** 11-30-23

Drill Rig: CME 45C-4 | **Krazan and Associates** | **Hole Size:** 4½ Inches

Driller: Jim Watts | **Elevation:** 7 Feet

Sheet: 1 of 1

Log of Boring B2

Project: Commercial Building
Project No: 032-23046

Client: McWhirter Realty Partners, LLC
Figure No.: A-2

Location: Nevada City Highway and Gates Place, Grass Valley, California
Logged By: Dave Adams

Depth to Water> **Initial:** None **At Completion:** None

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.		
		Ground Surface						
0	▨	***CLAYEY SAND/SANDY CLAY (SC/CL)*** Very loose, fine- to coarse-grained with GRAVEL; brown, moist, drills easily						
		Medium dense below 12 inches						
2		Very dense with angular COBBLE below 2 feet	98.8	16.6	■	50+	▲	■
		Auger refusal at 4 feet						
4		End of Borehole						
6								
8								
10								
12								
14								
16								
18								
20								

Drill Method: Solid Flight
Drill Date: 11-30-23

Drill Rig: CME 45C-4
Krazan and Associates
Hole Size: 4½ Inches

Driller: Jim Watts
Elevation: 4 Feet

Log of Boring B3

Project: Commercial Building | **Project No:** 032-23046

Client: McWhirter Realty Partners, LLC | **Figure No.:** A-3

Location: Nevada City Highway and Gates Place, Grass Valley, California | **Logged By:** Dave Adams

Depth to Water> **Initial:** None **At Completion:** None

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.		
		Ground Surface						
0–4		***CLAYEY SAND/SANDY CLAY (SC/CL)*** Very loose, fine- to coarse-grained with GRAVEL; brown, moist, drills easily. Medium dense below 6 inches. Very dense with large COBBLE and BOULDERS below 2 feet. Auger refusal at 4 feet	72.2	16.0		50+	▲	■
4		End of Borehole						

Drill Method: Solid Flight | **Drill Date:** 11-30-23

Drill Rig: CME 45C-4 | **Krazan and Associates** | **Hole Size:** 4½ Inches

Driller: Jim Watts | **Elevation:** 4 Feet

Log of Boring B4

Project: Commercial Building
Project No: 032-23046

Client: McWhirter Realty Partners, LLC
Figure No.: A-4

Location: Nevada City Highway and Gates Place, Grass Valley, California
Logged By: Dave Adams

Depth to Water> **Initial:** None **At Completion:** None

Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.	Penetration Test blows/ft (20 40 60)	Water Content (%) (10 20 30 40)
		Ground Surface						
0–4		***CLAYEY SAND/SANDY CLAY (SC/CL)*** Very loose, fine- to coarse-grained with GRAVEL; brown, moist, drills easily Medium dense below 12 inches Very dense with angular COBBLE below 18 inches Auger refusal at 4 feet						
2–3					■	50+	▲	
4		End of Borehole						

Depth scale: 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20

Drill Method: Solid Flight
Drill Date: 11-30-23

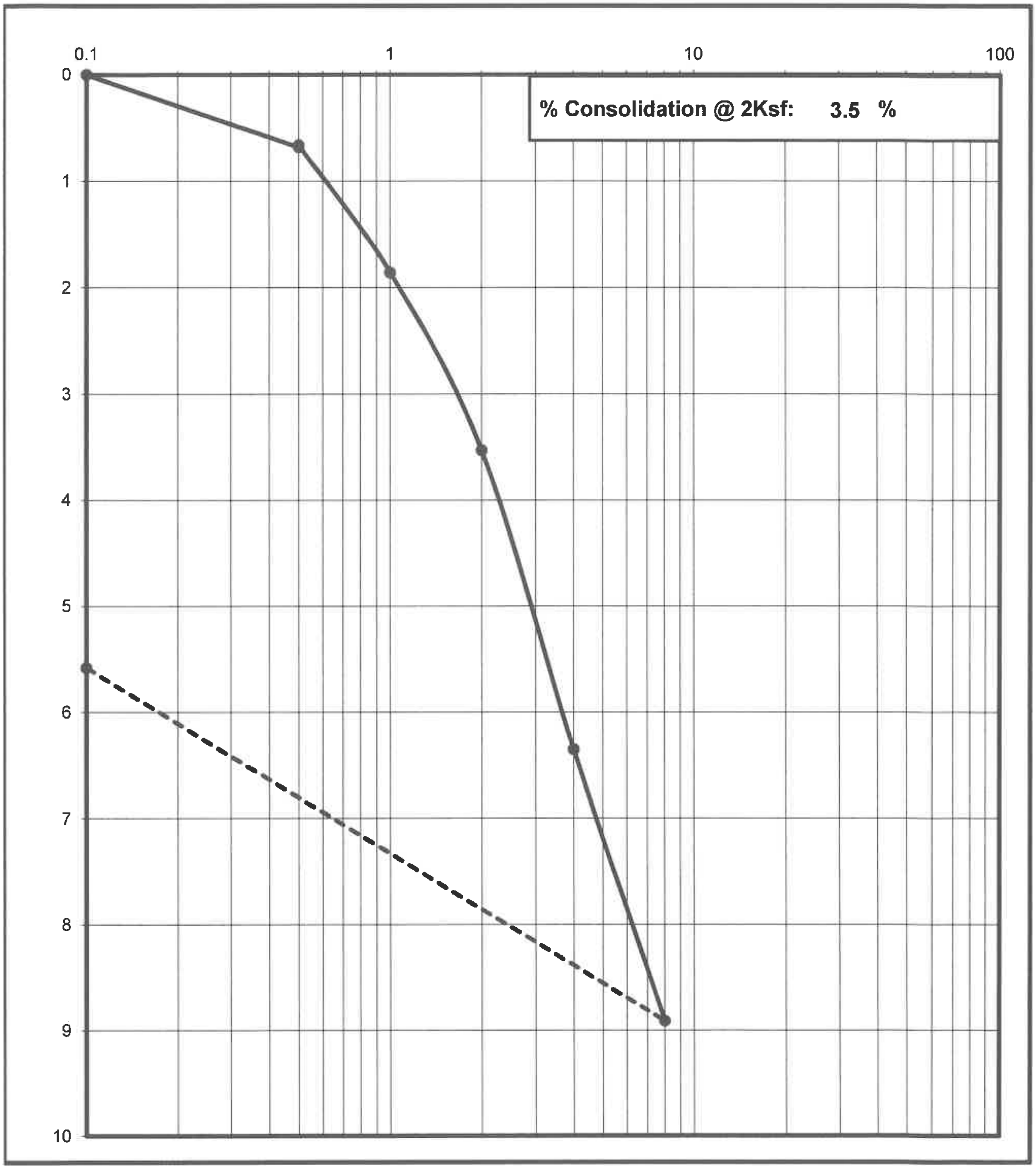
Drill Rig: CME 45C-4
Krazan and Associates
Hole Size: 4½ Inches

Driller: Jim Watts
Elevation: 4 Feet

Sheet: 1 of 1

Consolidation Test

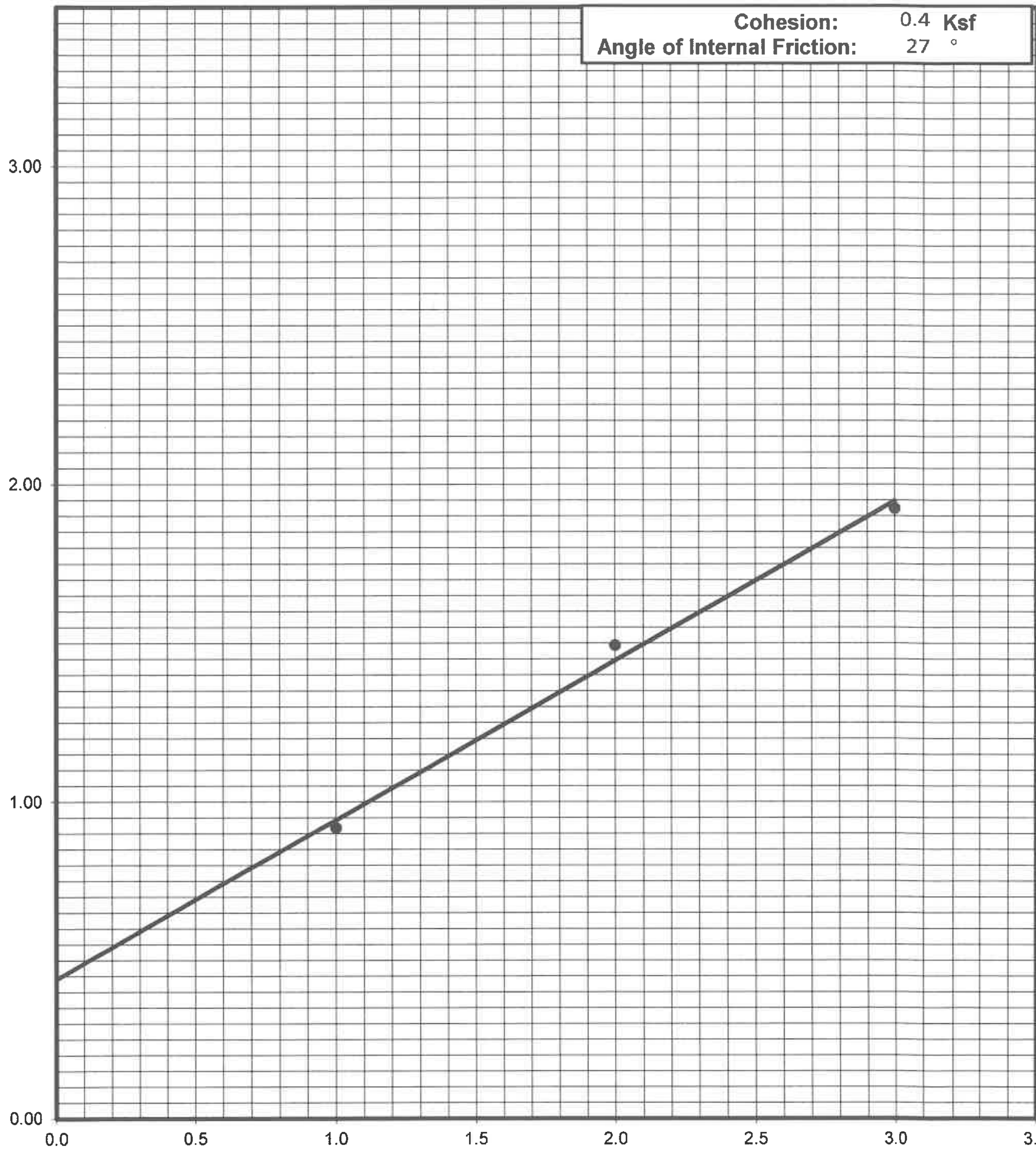
Project No	Boring No. & Depth	Date	Soil Classification
032-23046	B1 @ 2-3'	12/13/2023	SC/CL w/ grvl



Krazan Testing Laboratory

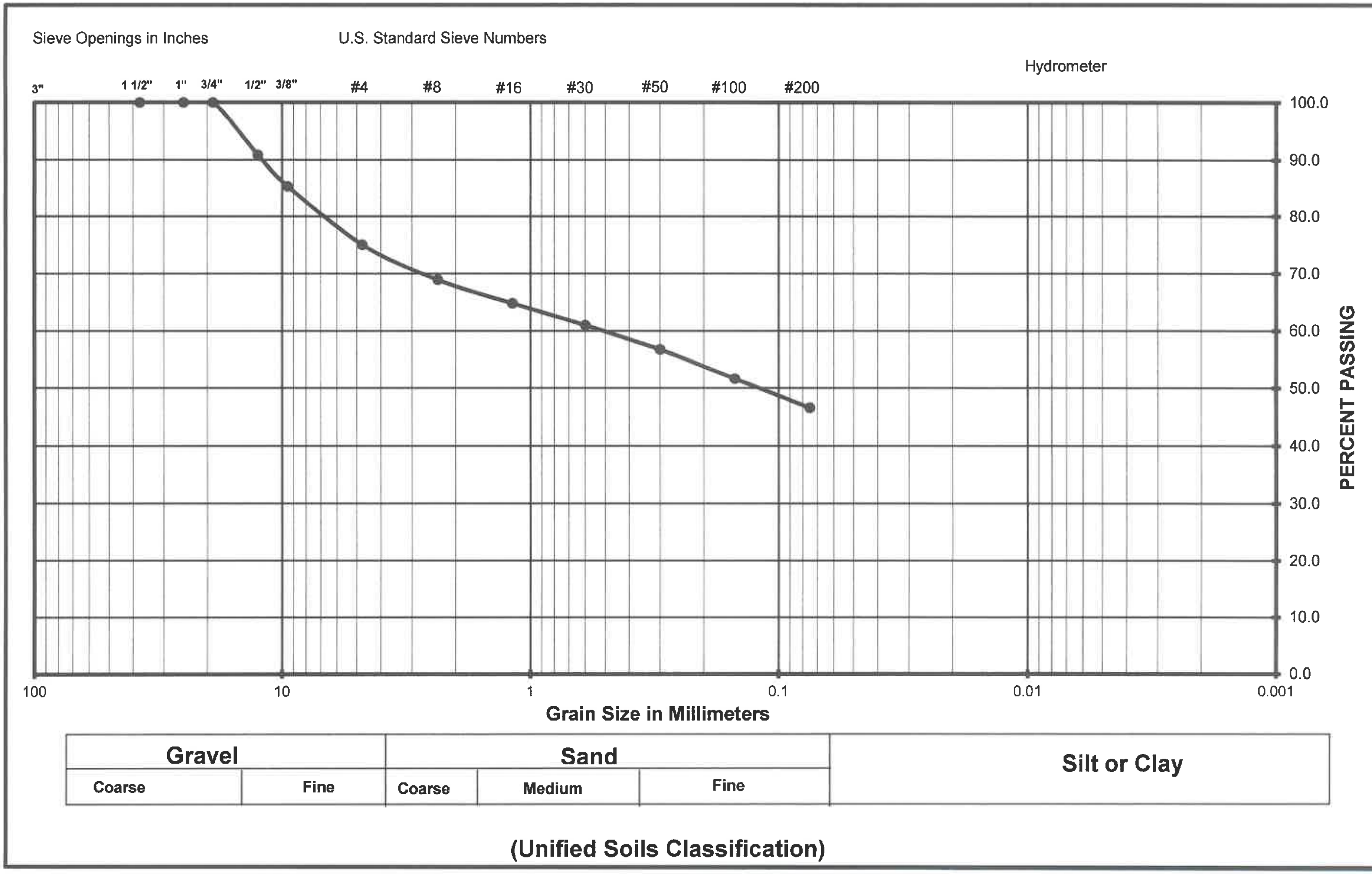
Shear Strength Diagram (Direct Shear)
ASTM D - 3080 / AASHTO T - 236

Project Number	Boring No. & Depth	Soil Type	Date
032-23046	B2 @ 2-3'	SC/CL w/ grvl	12/13/2023



Krazan Testing Laboratory

Grain Size Analysis



Project Name	Commercial Building
Project Number	032-23046
Soil Classification	SC/CL w/ grvl
Sample Number	B1 @ 2-3'

Krazan Testing Laboratory

Expansion Index Test

ASTM D - 4829

Project Number	: 032-23046
Project Name	: Commercial Building
Date	: 11/30/2023
Sample location/ Depth	: 1-3'
Sample Number	: RV1
Soil Classification	: SC/CL w/ gravel

Trial #	**1**	**2**	**3**
Weight of Soil & Mold, gms	742.7		
Weight of Mold, gms	366.8		
Weight of Soil, gms	375.9		
Wet Density, Lbs/cu.ft.	113.4		
Weight of Moisture Sample (Wet), gms	200.0		
Weight of Moisture Sample (Dry), gms	178.7		
Moisture Content, %	11.9		
Dry Density, Lbs/cu.ft.	101.3		
Specific Gravity of Soil	2.7		
Degree of Saturation, %	48.5		

Time	Inital	30 min	1 hr	6hrs	12 hrs	24 hrs
Dial Reading	0	--	--	--	--	0.0191

Expansion Index $_{measured}$ = 19.1

Expansion Index = 19

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

Plasticity Index of Soils

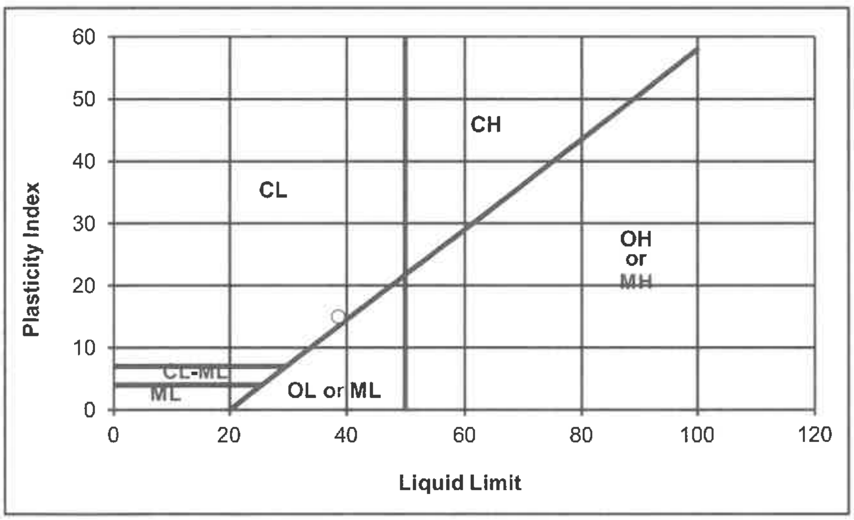
ASTM D4318/AASHTO T89 T90/CT 204

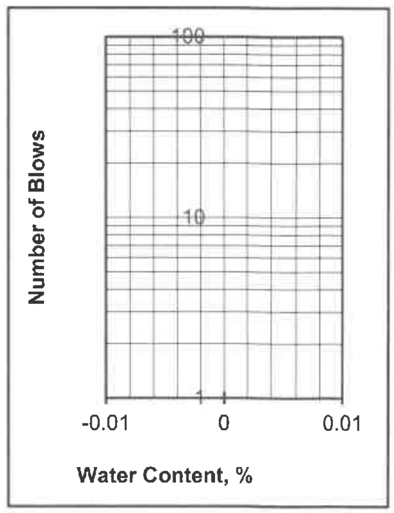
Project: **Commercial Building**
Project Number: **032-23046**
Date Sampled: 11/30/2023 Date Tested: 12/12/2023
Sampled By: DA Tested By: JM
Sample Number: X1 Verified By: JG
Sample Location: B1 @ 1-2'
Sample Description: SC/CL w/ grvl

	Plastic Limit			Liquid Limit		
Trial Number	1	2	3	1	2	3
Weight of Wet Soil & Tare (g)	40.02	34.70		39.30	40.49	
Weight of Dry Soil & Tare (g)	36.78	32.64		33.96	32.97	
Weight of Tare (g)	23.71	23.80		20.19	13.32	
Weight of water (g)	3.24	2.06		5.34	7.52	
Weight of Dry Soil (g)	13.07	8.84		13.77	19.65	
Water Content (% of dry wt.)	24.8%	23.3%		38.8%	38.3%	
Number of Blows				25	25	

Plastic Limit : 24 **Liquid Limit : 39**

Plasticity Index : 15
Unified Soil Classification : CL **Requirement:**
Approx. % of Material Retained on # 40 Sieve:





Departures from Outlined Procedure:

Unusual Conditions, Other Notes:

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 Geotechnical Engineer and/or Testing Agency. Attainment of design grades when achieved shall be certified by the project Civil Engineer. Both the Geotechnical 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 Geotechnical Engineer and the Civil Engineer. No deviation from these specifications shall be made except upon written approval of the Geotechnical Engineer, Civil Engineer or project Architect.

No earthwork shall be performed without the physical presence or approval of the Geotechnical Engineer. The Contractor shall notify the Geotechnical 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 compacted to a density not less than 90 percent relative compaction based on ASTM Test Method D1557 or CTM-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 Geotechnical 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 Geotechnical 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 Geotechnical 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 Geotechnical 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 18 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 Geotechnical 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 Geotechnical Engineer. Material from the required site excavation may be utilized for construction site fills provided prior approval is given by the Geotechnical Engineer. All materials utilized for constructing site fills shall be free from vegetation or other deleterious matter as determined by the Geotechnical 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 Geotechnical Engineer.

Both cut and fill areas shall be surface-compacted to the satisfaction of the Geotechnical 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 Geotechnical 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 asphalt 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 refers to the 2022 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. 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. ASPHALT CONCRETE SURFACING - Asphalt 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 and the asphalt concrete mix 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 compaction of asphalt concrete shall be performed as described in Section 39-2.01. 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 asphalt emulsion) shall conform to and be applied in accordance with the requirements of Section 37.