

**GEOTECHNICAL ENGINEERING INVESTIGATION  
PROPOSED M STREET APARTMENTS  
1209 "M" STREET  
BAKERSFIELD, CALIFORNIA**

**PROJECT NO. 022-23210  
FEBRUARY 26, 2024**

**Prepared for:**

**MR. ARTURO AGUILAR  
GOLDEN EMPIRE AFFORDABLE HOUSING, INC.  
601 24TH STREET, SUITE B  
BAKERSFIELD, CALIFORNIA 93301**

**Prepared by:**

**KRAZAN & ASSOCIATES, INC.  
GEOTECHNICAL ENGINEERING DIVISION  
2205 COY AVENUE  
BAKERSFIELD, CALIFORNIA 93307  
(661) 837-9200**



GEOTECHNICAL ENGINEERING • ENVIRONMENTAL ENGINEERING  
CONSTRUCTION TESTING & INSPECTION

February 26, 2024

Project No. 022-23210

Mr. Arturo Aguilar  
Golden Empire Affordable Housing, Inc.  
601 24th Street, Suite B  
Bakersfield, California 93301

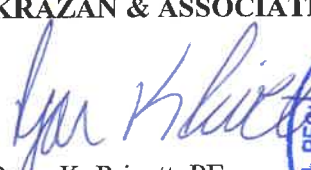
**RE: Geotechnical Engineering Investigation  
Proposed M Street Apartments  
1209 "M" Street  
Bakersfield, California**

Dear Mr. Aguilar:

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 (661) 837-9200.

Respectfully submitted,  
**KRAZAN & ASSOCIATES, INC.**

  
Ryan K. Privett, PE  
Project Engineer  
RCE No. 59372



RKP:dv

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February 26, 2024

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**GEOTECHNICAL ENGINEERING INVESTIGATION  
PROPOSED M STREET APARTMENTS  
1209 "M" STREET  
BAKERSFIELD, CALIFORNIA**

**INTRODUCTION**

This report presents the results of our Geotechnical Engineering Investigation for the proposed M Street Apartments to be located at 1209 "M" Street in Bakersfield, 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, 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 design of specific construction elements, and to provide criteria for site preparation and Engineered Fill construction.

Our scope of services was outlined in our proposal dated December 5, 2023 (KA Proposal No. P1180-23) 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 2 borings to depths ranging from approximately 10 to 15 feet 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**

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 the development will include the construction of a single-story apartment building with four units. It is anticipated the building will be a wood-frame structure supported on shallow conventional footings utilizing concrete slab-on-grade construction. Footing loads are anticipated to be light to moderate. On-site paved areas and landscaping are also planned for the development of the project.

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, SITE HISTORY AND SITE DESCRIPTION**

The site is rectangular in shape and encompasses approximately 0.13 acre. The site is located along the west side of "M" Street, approximately 120 feet north of California Avenue, in Bakersfield, California. The site has a street address of 1209 "M" Street. A parking lot is located east of the site. The remainder of the site is predominately surrounded by residential developments. Review of historical aerial photographs appears to indicate that a structure and a large tree may have been previously located in the central portion of the site.

Presently, the site consists of a vacant lot. The northern and southern site boundaries include chain-link and wood fencing. Concrete curb, gutter and sidewalk trend along the eastern edge of the site. Buried utility lines are located along the edges of the site and extend throughout the site. Trees were observed along the southern site boundary. The ground surface at the site is covered in short grass and weeds and the surface soils have a loose consistency. The site is relatively level with no major changes in grade.

### **GEOLOGIC SETTING**

Geologically, the property is situated on the eastern flank, near the south end of the Great Valley Geomorphic Province. This province is a large northwesterly trending geosyncline or structural trough between the Coast Range Mountains and the Sierra Nevada Mountains. Erosion from both of these mountain systems has resulted in the deposition of immense thickness of sediments in the Valley floor.

Heavily-laden streams from the Sierra Nevada have built very prominent alluvial fans along the margins of the San Joaquin Valley. This has resulted in a rather flat topography in the vicinity of the project site. The site is composed of alluvial deposits which are mostly cohesionless sands and silts.

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The south end of the San Joaquin Valley is surrounded on all sides, excluding the north, by active fault systems (San Andreas, White Wolf-Breckenridge-Kern Canyon and Garlock Faults). Numerous smaller faults exist within the valley floor.

There is on-going seismic activity in the Kern County area, with the most noticeable earthquake being the July 21, 1952 Kern County Earthquake. The initial shock was 7.7 magnitude shake with the epicenter near Wheeler Ridge. Vertical displacements of as much as three feet occurred at the fault line. Estimated average value of the maximum bedrock accelerations from the 1952 event are about 0.25 gravity at the project site.

The closest known faults to the property are subsurface faults located at the Fruitvale Oil Field. These faults cut the older sediments and, although numerous, are not thought to be active in the last two million years.

No evidence was observed that indicated surface faulting has occurred across the property during the Holocene time. Faults not yet identified, however, may exist. The site is not within an Earthquake Fault Zone (special studies zone).

#### **FIELD AND LABORATORY INVESTIGATIONS**

Subsurface soil conditions were explored by drilling 2 borings to depths ranging from approximately 10 to 15 feet below existing site grade, using a truck-mounted drill rig. The approximate boring locations are shown on the site plan. During drilling operations, penetration tests were performed 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, and moisture-density relationships of the materials encountered. In addition, chemical tests were performed to evaluate the soil-cement reactivity. 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 upper soils consisted of 6 to 12 inches of very loose silty sand. These soils are disturbed, have low strength characteristics and are highly compressible when saturated.

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Beneath the loose surface soils, approximately 1½ to 2 feet of fill material was encountered. The fill material predominately consisted of silty sand. 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 indicates that the fill soils have varying strength characteristics ranging from loosely placed to compacted.

Below the fill material, approximately 2½ to 3 feet of loose to medium dense silty sand was encountered. Field and laboratory tests suggest that these soils are moderately strong and slightly compressible. Penetration resistance ranged from 11 to 18 blows per foot. Dry densities ranged from 99 to 105 pcf. A representative soil sample consolidated approximately 2½ percent under a 2 ksf load when saturated. A representative soil sample had an angle of internal friction of 34 degrees.

Below approximately 4 to 5 feet, predominately medium dense sand was encountered. Field and laboratory tests suggest that these soils are moderately strong and slightly compressible. Penetration resistance ranged from 17 to 19 blows per foot. Dry densities ranged from 100 to 110 pcf. These soils had slightly stronger strength characteristics than the upper soils and extended to the termination depth of our borings.

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. Free groundwater was not encountered.

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.

## **GEOLOGIC AND SEISMIC HAZARDS**

Soil liquefaction, a primary geologic/seismic hazard, 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.

To evaluate the liquefaction potential of the site, the following items were evaluated:

- 1) Soil type
- 2) Groundwater depth

- 3) Relative density
- 4) Initial confining pressure
- 5) Intensity and duration of groundshaking

The predominant soils within the project site consist of layers of silty sands and sands. Groundwater was not encountered within the depths explored. In addition, groundwater has been historically encountered at depths greater than 50 feet below site grade within the project site and vicinity since 1951. Therefore, the potential for liquefaction and related settlement is low at this site and no liquefaction mitigation procedures are necessary for this project.

Secondary hazards from earthquakes include rupture, seiche, slope instability, landslides, lateral spreading, and subsidence. Since there are no known faults within the immediate area, ground rupture from surface faulting should not be a potential problem. Seiche, lateral spreading, slope instability, and landslides are not hazards in the area either. In addition, there are no known occurrences of structural or architectural damage due to deep subsidence in the Bakersfield area. The total and differential seismic-induced settlements should be less than 1-inch.

## **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 fill material, upper loose native soils, clean sandy soils, and previous and existing development, appear to be conducive to the development of the project. Beneath the loose surface soils, approximately 1½ to 2 feet of fill material was encountered. The fill material predominately consisted of silty sand. 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 indicates that the fill soils have varying strength characteristics ranging from loosely placed to compacted. Therefore, it is recommended that the fill soils be excavated and stockpiled so that the native soils can be prepared properly. Excavation should extend to a minimum of 5 feet beyond proposed footing lines. The on-site soils will be suitable for reuse as Engineered Fill, provided they are cleansed of excessive organics, debris, and fragments larger than 4 inches in maximum dimension.

In order to reduce the potential for differential settlement and provide uniform support for the planned structures, it is recommended that following stripping, fill removal operations, and demolition activities, the exposed native soil within the building areas be excavated an additional 12 inches, worked until uniform and free from large clods, moisture-conditioned to at or above optimum moisture content, and recompacted to a minimum of 90 percent of maximum density based on ASTM Test Method D1557. In



addition, it is recommended that the proposed structure foundations be supported by minimum of 12 inches of Engineered Fill. Limits of recompaction should extend 5 feet beyond structural elements. Prior to fill placement, the exposed subgrade soils should be proof-rolled and verified by Krazan & Associates, Inc. for stability. Fill material should be compacted to a minimum of 90 percent of maximum density based on ASTM Test Method D1557.

Existing residential structures are located within the project vicinity. In addition, a former residence may have possibly been located on the site. Buried structures, including utilities may be located along the edges of and/or within the project site. Any buried structures, including utilities or loosely backfilled excavations, encountered during construction should be properly removed and/or relocated and the resulting excavations backfilled with Engineered Fill. It is suspected that demolition activities of the existing structures will disturb the upper soils. After demolition activities, it is recommended that these disturbed soils be removed and/or recompacted. This compaction effort should stabilize the upper soils and locate any unsuitable or pliant areas not found during our field investigation.

Trees are and were previously located within portions of the site. Tree removal operations should include 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.

Sandy 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 soils.

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.

#### **Groundwater Influence on Structures/Construction**

Based on our findings and historical records, it is not anticipated that groundwater will rise within the zone of structural influence or affect the construction of foundations and pavements for the project. However, 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.

#### **Site Preparation**

General site clearing should include removal of vegetation; debris; existing utilities; underground storage tanks and related piping; 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

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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.

Approximately 1½ to 2 feet of fill material was encountered. The fill material predominately consisted of silty sand. 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 indicates that the fill soils have varying strength characteristics ranging from loosely placed to compacted. Therefore, it is recommended that the fill soils be excavated and stockpiled so that the native soils can be prepared properly. Excavation should extend to a minimum of 5 feet beyond proposed footing lines.

Existing residential structures are located within the project vicinity. In addition, a former residence may have possibly been located on the site. Buried structures, including utilities may be located along the edges of and/or within the project site. Demolition activities should include proper removal of any buried structures. Any buried structures, including utilities or loosely backfilled excavations, encountered during construction should be properly removed and/or relocated. The resulting excavations should be backfilled with Engineered Fill. It is suspected that demolition activities of the existing structures will disturb the upper soils. Disturbed areas caused by demolition activities should be recompact. Excavations, depressions, or soft and pliant areas extending below planned finish subgrade level 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. Oil wells should be abandoned in accordance with state and federal guidelines. Existing 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 should be removed in accordance with the recommendations of the Soils Engineer. The resulting excavations should be backfilled with Engineered Fill.

In order to reduce the potential for differential settlement and provide uniform support for the planned structures, it is recommended that following stripping, fill removal operations, and demolition activities, the exposed native soil within the proposed building areas should be excavated an additional depth of 12 inches, worked until uniform and free from large clods, moisture-conditioned to at or above optimum moisture content, and recompact to a minimum of 90 percent of maximum density based on ASTM Test Method D1557. In addition, it is recommended that the proposed structure foundations be supported by a minimum of 12 inches of Engineered Fill. Limits of recompact should extend 5 feet beyond structural elements. The on-site soils will be suitable for reuse as Engineered Fill, provided they are cleansed of excessive organics, debris, and fragments larger than 4 inches in maximum dimension. Prior to fill placement, the exposed subgrade soils should be proof-rolled and verified by Krazan & Associates, Inc. to verify stability. Soft or pliant areas encountered should be excavated to firm native ground. Fill material should be compacted to a minimum of 90 percent of maximum density based on ASTM Test Method D1557.

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Following stripping, fill removal operations, and demolition activities, the exposed subgrade in exterior flatwork and pavement areas should be excavated/scarified to a depth of at least 12 inches, worked until uniform and free from large clods, moisture-conditioned to at or above optimum moisture content, and recompacted to a minimum of 90 percent of maximum density based on ASTM Test Method D1557. Limits of recompaction should extend 2 feet beyond structural elements. This compaction effort should stabilize the surface soils and locate any unsuitable or pliant areas not found during our field investigation.

As indicated previously, fill material is located on the site. 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 at or above optimum moisture content 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.

Relatively clean sands were encountered at various locations throughout the site. The possibility exists that site grading operations could expose these soils in areas of proposed buildings, pavements, and/or retaining walls. The Contractor should note that these soils lack the cohesion necessary to stand vertically, even in shallow excavations such as footing trenches. If these conditions are encountered, it will be necessary to over-excavate the affected area(s) to a minimum of 12 inches below the proposed bearing surface. These areas may be backfilled using a mix of the silty sand and sand soils that contains at least 20 percent fines and meeting the requirements for Engineered Fill. This material may be obtained from elsewhere at the site, imported to the site from an approved off-site source, or manufactured through blending of the excavated clean sand with other suitable material containing a higher percentage of fines to result in material meeting the requirements for Engineered Fill.

Trees are and were previously located within portions of the site. Tree removal operations should include 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 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.

### **Engineered Fill**

The upper, on-site, native soils and fill material predominately consisted of silty sand and sand. These soils will be suitable for reuse as Engineered Fill, provided they are cleansed of excessive organics, debris, and fragments larger than 4 inches in maximum dimension. It is recommended that during construction, additional testing be performed on the on-site soils and fill material to evaluate the physical and index properties prior to reuse as Engineered Fill.

Relatively clean sands were encountered at various locations throughout the site. The possibility exists that site grading operations could expose these soils in areas of proposed buildings, pavements, and/or retaining walls. The Contractor should note that these soils lack the cohesion necessary to stand vertically, even in shallow excavations such as footing trenches. If these conditions are encountered, it will be necessary to over-excavate the affected area(s) to a minimum of 12 inches below the proposed bearing surface. These areas may be backfilled using a mix of the silty sand and sand soils that contains at least 20 percent fines and meeting the requirements for Engineered Fill. This material may be obtained from elsewhere at the site, imported to the site from an approved off-site source, or manufactured through blending of the excavated clean sand with other suitable material containing a higher percentage of fines to result in material meeting the requirements for Engineered Fill.

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 material should be predominately non-expansive granular material with a plasticity index less than 10 and an expansion index less than 15. Imported Fill should be free from rocks and lumps greater than 4 inches in maximum dimension. All Imported Fill material should be submitted for approval to the Soils Engineer at least 48 hours prior to delivery to the site.

Fill soils should be placed in lifts approximately 6 inches thick, moisture-conditioned to at or above optimum moisture content, 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**

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

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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.

### **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 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 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.

### **Foundation – Conventional**

After completion of the recommended site preparation, the site should be suitable for shallow footing support. The proposed structure may be supported on a shallow foundation system bearing on a minimum of 12 inches of Engineered Fill. Spread and continuous footings can be designed for the following maximum allowable soil bearing pressures:

| <b>Load</b>                                 | <b>Allowable Loading</b> |
|---|--------------------------|
| 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 depth of 12 inches below pad subgrade (soil grade) or adjacent exterior grade, whichever is lower, for single-story elements, and 18 inches for two-stories. Footings should have a minimum width of 12 inches, regardless of load. However, ultimate design of foundations and reinforcement should be performed by the project Structural Engineer.

The total settlement is not expected to exceed 1 inch. Differential settlement measured across a horizontal distance of 40 feet should be less than  $\frac{1}{2}$  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.

Resistance to lateral footing displacement can be computed using an allowable friction factor of 0.40 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  $\frac{1}{3}$  increase in the above value may be used for short duration, wind, or seismic loads.

#### **Floor Slabs and Exterior Flatwork**

In areas that will utilize moisture-sensitive floor coverings, 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  $\frac{3}{4}$ -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. Exterior finish grades should be sloped a minimum of 2 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 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.

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### **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 35 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 55 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.

The 2022 CBC requires determination of dynamic seismic lateral earth pressures on foundation walls and retaining walls supporting more than 6 feet of backfill height due to design earthquake ground motions. The Site Modified Peak Ground Acceleration ( $PGA_M$ ), based on ASCE7-16 and information from the SEAOC and OSHPD Seismic Design Maps website (<https://seismicmaps.org>), is 0.484. We recommend an incremental seismic lateral pressure of 22 pcf be included in the stability analyses for the retaining wall. The incremental seismic lateral pressure should be applied in a reverse triangular distribution at the back side of the wall.

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.

### **Seismic Parameters – 2022 California Building Code**

The Site Class per Section 1613 of the 2022 California Building Code (2022 CBC) and ASCE 7-16, Chapter 20 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. A site modified peak ground acceleration ( $PGA_M$ ) of 0.484 may be used for seismic analysis. If the project is being designed based on the 2022 CBC and the exception to Item 1 from Section 11.4.8 given in Supplement 3 of ASCE 7-16 is utilized, the value of  $S_{M1}$  (and the resulting values of  $S_{D1}$  and  $T_S$ ) should be increased by 50 percent. For seismic design of the structures based on the seismic provisions of the 2022 CBC, we recommend the following parameters:

| <b>Seismic Item</b>    | <b>Value</b> | <b>CBC Reference</b> |
|------------------------|--------------|----------------------|
| Site Class             | D            | Section 1613.2.2     |
| Site Coefficient $F_a$ | 1.200        | Table 1613.2.3 (1)   |
| $S_s$                  | 0.930        | Section 1613.2.1     |
| $S_{MS}$               | 1.116        | Section 1613.2.3     |
| $S_{DS}$               | 0.744        | Section 1613.2.4     |
| Site Coefficient $F_v$ | 1.963        | Table 1613.2.3 (2)   |

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|                 |       |                  |
|-----------------|-------|------------------|
| S <sub>1</sub>  | 0.337 | Section 1613.2.1 |
| S <sub>M1</sub> | 0.662 | Section 1613.2.3 |
| S <sub>D1</sub> | 0.441 | Section 1613.2.4 |
| T <sub>S</sub>  | 0.593 | 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.

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 (72.8 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.



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## **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.

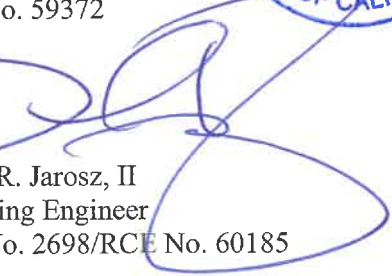
The geotechnical engineering information presented herein is based upon professional interpretation utilizing standard engineering practices and a degree of conservatism deemed proper for this project. It is not warranted that such information and interpretation cannot be superseded by future geotechnical engineering developments. We emphasize that this report is valid for the project outlined above and should not be used for any other sites.

If you have any questions or if we may be of further assistance, please do not hesitate to contact our office at (661) 837-9200.

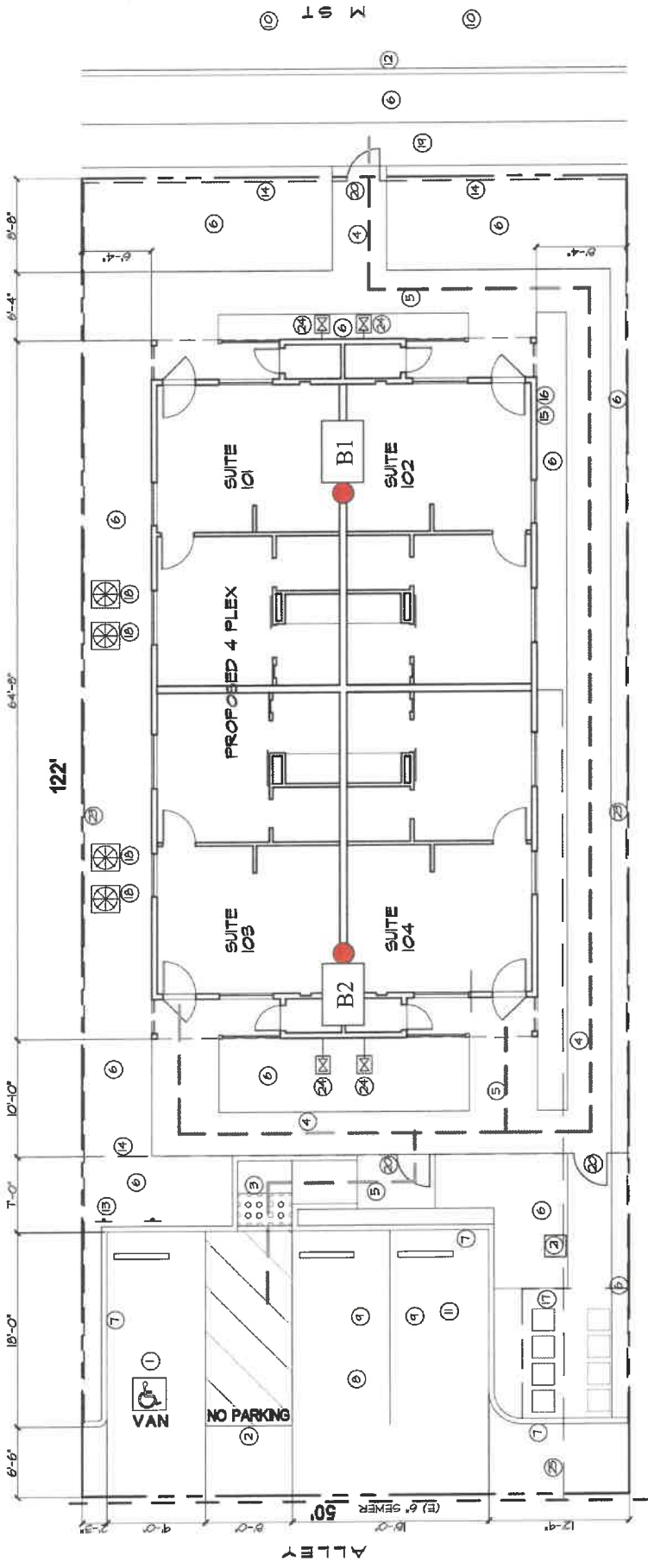
Respectfully submitted,  
**KRAZAN & ASSOCIATES, INC.**

  
Ryan K. Privett, PE  
Project Engineer  
RCE No. 59372



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

RKP/DRJ:dv



● APPROXIMATE BORING LOCATION



|  |                              |                            |
|--|------------------------------|----------------------------|
| <b>SITE MAP</b><br>"M" Street Apartments<br>1209 "M" Street<br>Bakersfield, California | <b>Scale:</b> NTS            | <b>Date:</b> February 2024 |
|  | <b>Drawn by:</b> RKP         | <b>Approved by:</b> RP     |
|  | <b>Project No.</b> 022-23210 | <b>Figure No.</b> 1        |

## **APPENDIX A**

### **FIELD AND LABORATORY INVESTIGATIONS**

#### **Field Investigation**

The field investigation consisted of a surface reconnaissance and a subsurface exploratory program. Two 4½-inch diameter 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 were performed at selected depths. This test represents the resistance to driving a 2½-inch diameter split barrel sampler. 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. 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 determined for the undisturbed samples representative of the subsurface material. These tests, supplemented by visual observation, comprised the basis for our evaluation of the site material.

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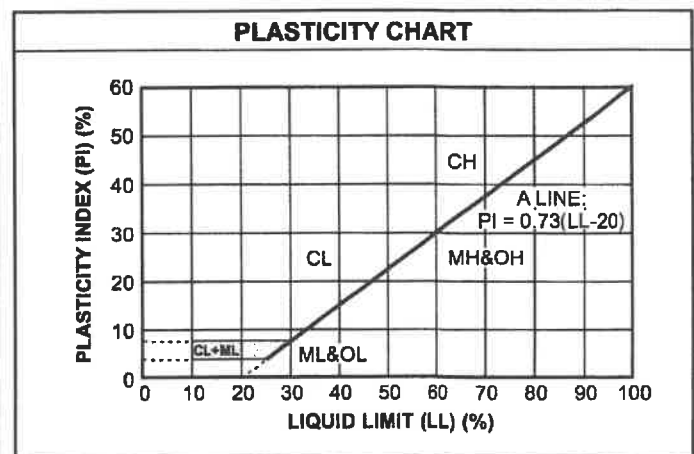
The logs of the exploratory borings and laboratory determinations are presented in this Appendix.

# UNIFIED SOIL CLASSIFICATION SYSTEM

| UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART   |   |    |  |
|--|---|----|--|
| COARSE-GRAINED SOILS<br>(more than 50% of material is larger than No. 200 sieve size.) |   |    |  |
| <b>GRAVELS</b><br>More than 50% of coarse fraction larger than No. 4 sieve size        | Clean Gravels (Less than 5% fines)  |    |  |
|  |    | 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  |
| <b>SANDS</b><br>50% or more of coarse fraction smaller than No. 4 sieve size           | Clean Sands (Less than 5% fines)  |    |  |
|  |    | SW | Well-graded sands, gravelly sands, little or no fines  |
|  |    | SP | Poorly graded sands, gravelly sands, little or no fines  |
|  | Sands with fines (More than 12% fines)  |    |  |
|  |    | SM | Silty sands, sand-silt mixtures  |
| <b>SILTS AND CLAYS</b><br>Liquid limit less than 50%                                   | FINE-GRAINED SOILS<br>(50% or more of material is smaller than No. 200 sieve size.) |    |  |
|  |  | 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  |
|  |   |    |  |
| <b>SILTS AND CLAYS</b><br>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  |
| <b>HIGHLY ORGANIC SOILS</b>  |  | PT | Peat and other highly organic soils  |

| CONSISTENCY CLASSIFICATION |                |
|----------------------------|----------------|
| Description                | Blows per Foot |
| <i>Granular Soils</i>      |                |
| Very Loose                 | < 5            |
| Loose                      | 5 – 15         |
| Medium Dense               | 16 – 40        |
| Dense                      | 41 – 65        |
| Very Dense                 | > 65           |
| <i>Cohesive Soils</i>      |                |
| 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               |



# Log of Boring B1

**Project:** M Street Apartments

**Project No:** 022-23210

**Client:** Golden Empire Affordable Housing, Inc.

**Figure No.:** A-1

**Location:** 1209 M Street, Bakersfield, CA

**Logged By:** Dave Adams

**Depth to Water>**

**Initial:** None

**At Completion:** None

| SUBSURFACE PROFILE |        |  | SAMPLE            |              |      |           | Penetration Test<br>blows/ft |    |    | Water Content (%) |    |    |    |
|--------------------|--------|--|-------------------|--------------|------|-----------|------------------------------|----|----|-------------------|----|----|----|
| Depth (ft)         | Symbol | Description  | Dry Density (pcf) | Moisture (%) | Type | Blows/ft. | 20                           | 40 | 60 | 10                | 20 | 30 | 40 |
| 0                  |        | Ground Surface   |                   |              |      |           |                              |    |    |                   |    |    |    |
| 0                  |        | <b>SILTY SAND (SM)</b><br>FILL, fine- to medium-grained; brown, damp, drills easily              |                   |              |      |           |                              |    |    |                   |    |    |    |
| 2                  |        | <b>SILTY SAND (SM)</b><br>Medium dense, fine- to medium-grained; brown/gray, damp, drills easily | 99.7              | 3.6          |      | 18        |                              |    |    |                   |    |    |    |
| 4                  |        |  |                   |              |      |           |                              |    |    |                   |    |    |    |
| 6                  |        | <b>SAND (SP)</b><br>Medium dense, fine- to coarse-grained; light brown, moist, drills easily     | 100.6             | 7.2          |      | 18        |                              |    |    |                   |    |    |    |
| 8                  |        |  |                   |              |      |           |                              |    |    |                   |    |    |    |
| 10                 |        |  |                   | 1.3          |      | 17        |                              |    |    |                   |    |    |    |
| 12                 |        |  |                   |              |      |           |                              |    |    |                   |    |    |    |
| 14                 |        |  |                   |              |      |           |                              |    |    |                   |    |    |    |
| 16                 |        | End of Borehole  |                   |              |      |           |                              |    |    |                   |    |    |    |
| 18                 |        |  |                   |              |      |           |                              |    |    |                   |    |    |    |
| 20                 |        |  |                   |              |      |           |                              |    |    |                   |    |    |    |

**Drill Method:** Solid flight

**Drill Date:** 12-21-23

**Drill Rig:** CME 45C-4

**Krazan and Associates**

**Hole Size:** 4½ inches

**Driller:** Jim Watts

**Elevation:** 15 feet

**Sheet:** 1 of 1

# Log of Boring B2

**Project:** M Street Apartments

**Project No:** 022-23210

**Client:** Golden Empire Affordable Housing, Inc.

**Figure No.:** A-2

**Location:** 1209 M Street, Bakersfield, CA

**Logged By:** Dave Adams

**Depth to Water>**

**Initial:** None

**At Completion:** None

| SUBSURFACE PROFILE |        |  | SAMPLE            |              |      |           | Penetration Test<br>blows/ft |    |    | Water Content (%) |    |    |    |
|--------------------|--------|--|-------------------|--------------|------|-----------|------------------------------|----|----|-------------------|----|----|----|
| Depth (ft)         | Symbol | Description  | Dry Density (pcf) | Moisture (%) | Type | Blows/ft. | 20                           | 40 | 60 | 10                | 20 | 30 | 40 |
| 0                  |        | Ground Surface   |                   |              |      |           |                              |    |    |                   |    |    |    |
| 2                  |        | <b>SILTY SAND (SM)</b><br>FILL, fine- to medium-grained; dark brown, damp, drills easily |                   |              |      |           |                              |    |    |                   |    |    |    |
| 2                  |        | <b>SILTY SAND (SM)</b><br>Loose, fine- to medium-grained; brown, damp, drills easily     | 105.0             | 2.1          |      | 11        |                              |    |    |                   |    |    |    |
| 4                  |        | <b>SAND (SP)</b><br>Medium dense, fine- to medium-grained; brown, damp, drills easily    |                   |              |      |           |                              |    |    |                   |    |    |    |
| 4                  |        |  | 110.0             | 1.3          |      | 19        |                              |    |    |                   |    |    |    |
| 6                  |        |  |                   |              |      |           |                              |    |    |                   |    |    |    |
| 8                  |        |  |                   |              |      |           |                              |    |    |                   |    |    |    |
| 10                 |        | End of Borehole  |                   |              |      |           |                              |    |    |                   |    |    |    |
| 12                 |        |  |                   |              |      |           |                              |    |    |                   |    |    |    |
| 14                 |        |  |                   |              |      |           |                              |    |    |                   |    |    |    |
| 16                 |        |  |                   |              |      |           |                              |    |    |                   |    |    |    |
| 18                 |        |  |                   |              |      |           |                              |    |    |                   |    |    |    |
| 20                 |        |  |                   |              |      |           |                              |    |    |                   |    |    |    |

**Drill Method:** Solid flight

**Drill Date:** 12-21-23

**Drill Rig:** CME 45C-4

**Krazan and Associates**

**Hole Size:** 4½ inches

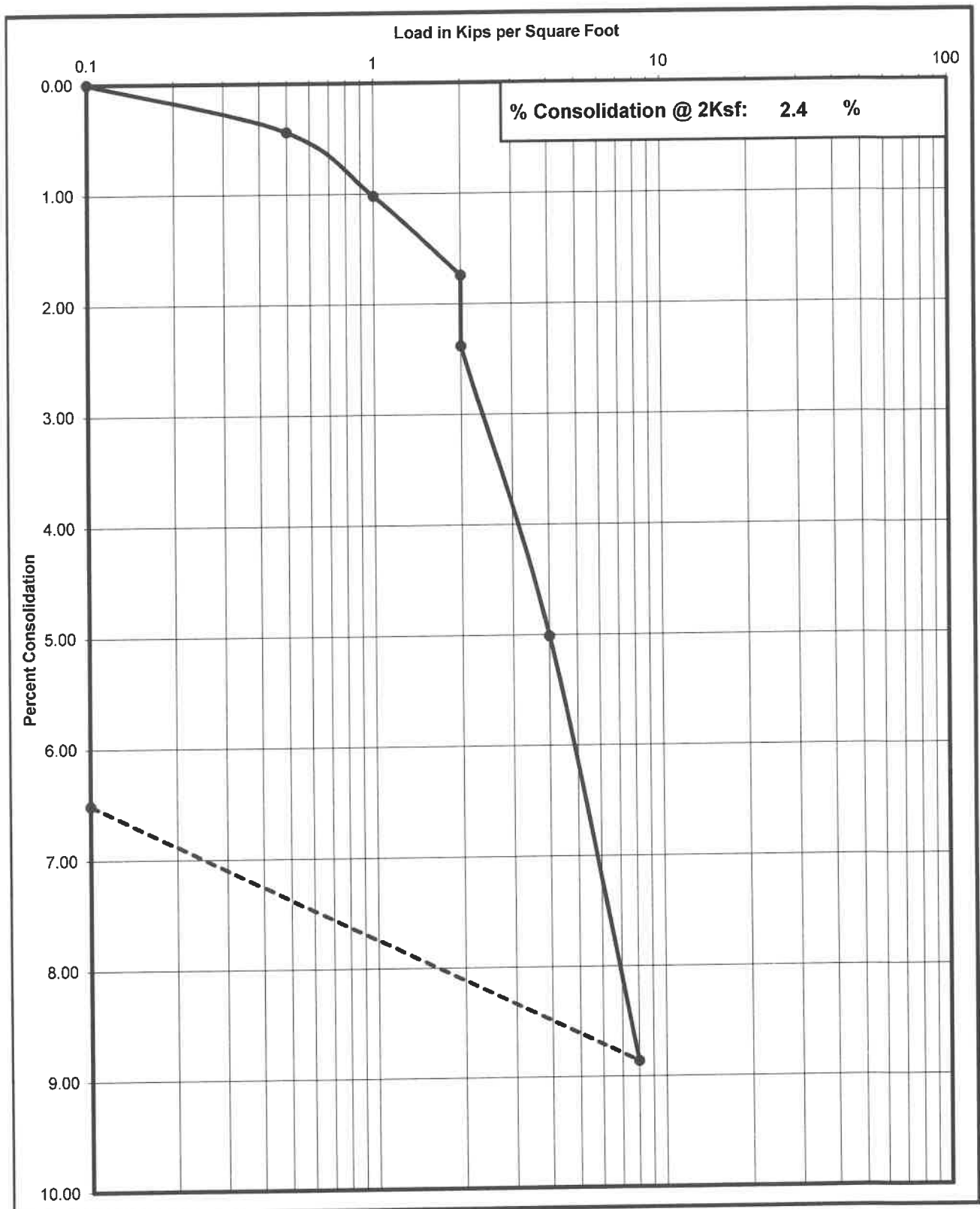
**Driller:** Jim Watts

**Elevation:** 10 feet

**Sheet:** 1 of 1

# Consolidation Test

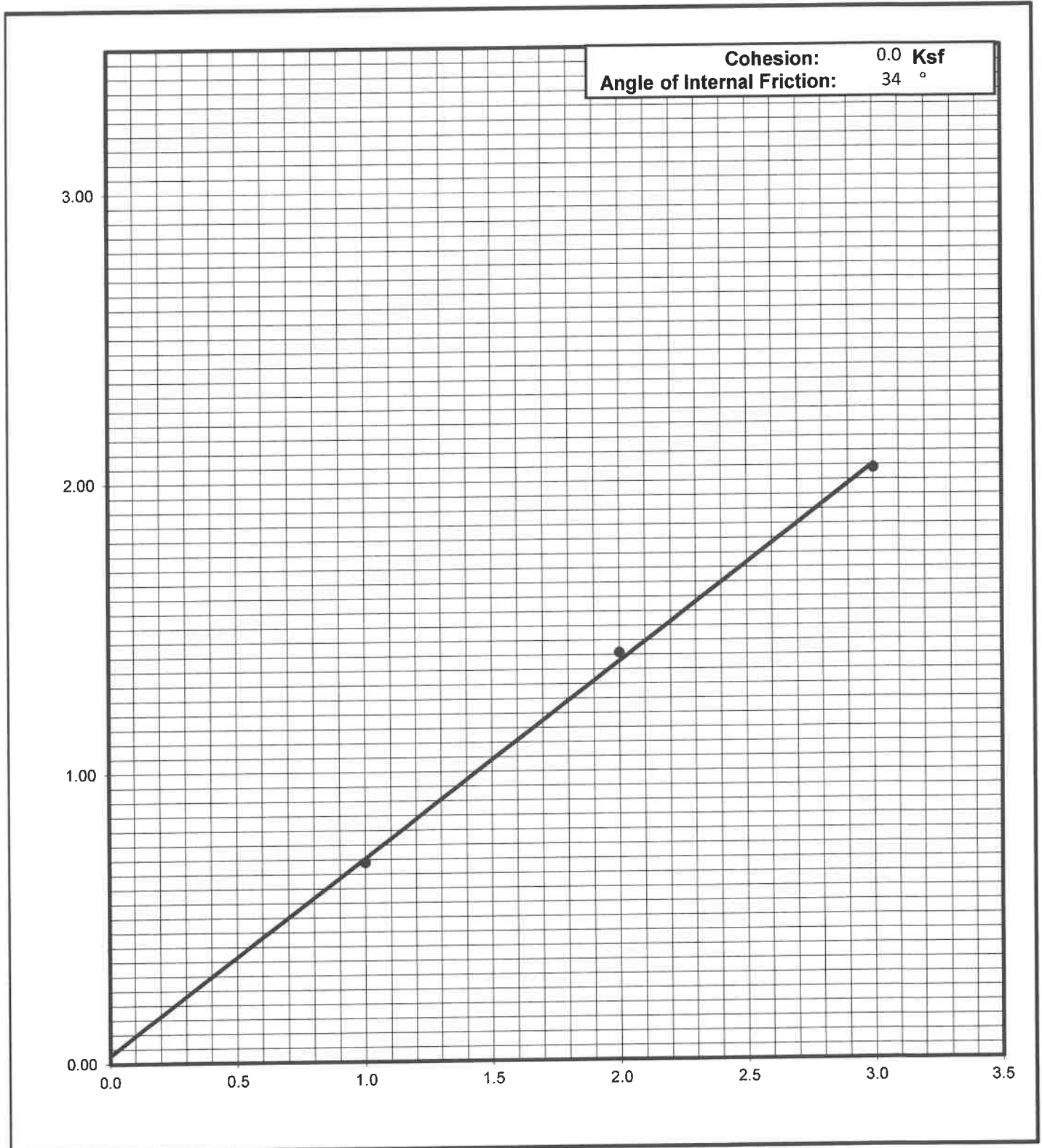
| Project No | Boring No. & Depth | Date      | Soil Classification |
|------------|--------------------|-----------|---------------------|
| 022-23210  | B2 @ 2-3'          | 1/22/2024 | SM                  |



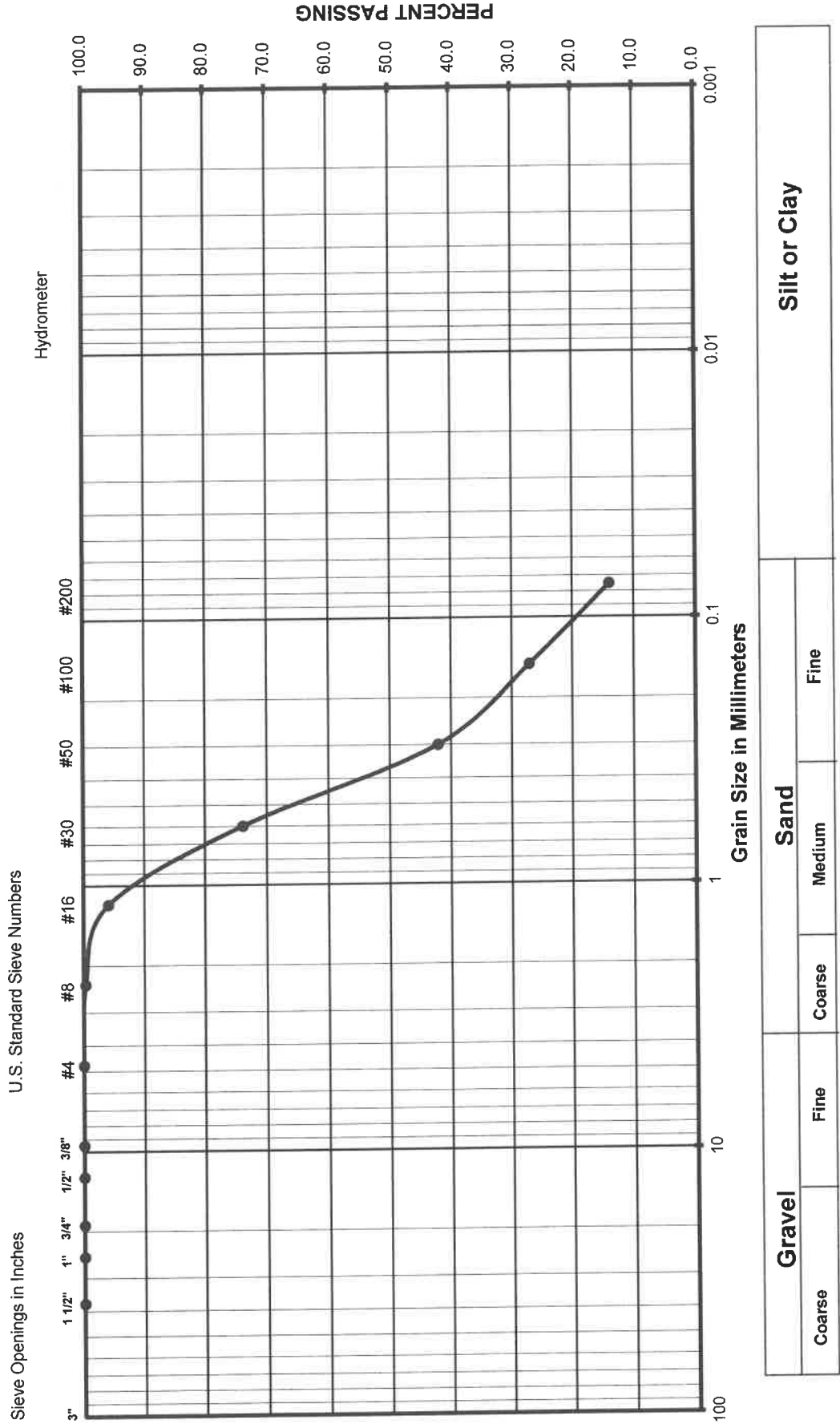


**Shear Strength Diagram (Direct Shear)**  
**ASTM D - 3080 / AASHTO T - 236**

| Project Number | Boring No. & Depth | Soil Type | Date      |
|----------------|--------------------|-----------|-----------|
| 022-23210      | B1 @ 2-3'          | SM        | 1/22/2024 |



# Grain Size Analysis



(Unified Soils Classification)

Project Name: M Street Apartments  
 Project Number: 022-23210  
 Soil Classification: SM  
 Sample Number: B2 @ 2-3'

## **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 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. 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 recompact 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 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 2018 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.