Geotechnical Engineering Report
ALICE BIRNEY ELEMENTARY SCHOOL IMPROVEMENTS

6251 13th St

Sacramento, California 95831

Prepared for:

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1.0 INTRODUCTION

We have completed a geotechnical engineering study for the proposed play fields with surrounded fence and associated pavement areas to be constructed at the existing Alice Birney Public Waldorf TK-8 School campus located at 6251 13th street in Sacramento, California. The purposes of our work have been to explore the existing site, soil and groundwater conditions, and to provide geotechnical engineering conclusions and recommendations for the design and construction of the proposed construction and associated improvements.

1.1 Scope of Work

Our scope of work included the following tasks:

1. A site reconnaissance;
2. Review of previous geotechnical reports prepared by our firm in the vicinity;
3. Review of United States Geological Survey (USGS) topographic map, historical aerials, and available groundwater information relevant to the site;
4. Subsurface exploration, including six soil borings to depths ranging from approximately 10 to 21½ feet below the ground surface;
5. Laboratory testing of selected soil samples;
6. Engineering analyses; and,
7. Preparation of this report.

1.2 Related Experience and Supplemental Information

- LPA, *Alice Birney TK-8 Public Waldorf School Fencing Feasibility Study* conceptual plan (dated July 18, 2023)
- Wallace-Kuhl & Associates, Inc., 2010, *Geotechnical Engineering Report*, prepared for Steve Jones Park Improvements (WKA No. 7884.40P, dated January 15, 2010), located about 2.4 miles southeast of the site.
- Wallace-Kuhl & Associates, Inc., 2010, *Geotechnical Engineering Report*, prepared for Reichmuth Park Improvements (WKA No. 7884.27P, dated March 31, 2009), located about 0.5 miles east of the site.

1.3 Figures and Attachments

This report contains a Vicinity Map as Figure 1, a Site Plan showing the approximate boring locations as Figure 2, the Logs of Soil Borings as Figures 3 through 8. An explanation of the symbols and classification system used on the logs is contained in Figure 9. Appendix A contains information of a general nature regarding project concepts, exploratory methods used during the field exploration phase of our investigation, and laboratory test results.

The following figures and attachments are included with this report:

- A Vicinity Map showing the location of the site is included as Figure 1;
- A Site Plan showing the approximate locations of the borings in Figure 2;
- Logs of Soil Borings are presented in Figures 3 through 8;
- An explanation of the symbols and classification system used on the logs appears in Figure 9.

Appendix A contains general information regarding project concepts, exploratory methods used during our study, and laboratory test results not included on the boring log.

1.4 Proposed Development

We understand the project will include the replacement of the entire six-foot high fence perimeter with associated gates, two playgrounds and associated asphalt and concrete pavements. Grading plans were not available to us, however, we anticipate maximum excavations on the order of five feet for foundation of fence, gate poles and playground foundations.

2.0 FINDINGS

2.1 Site Description

The subject site encompasses the Alice Birney Elementary School campus which is located at 6251 13th Street in Sacramento, California (Figure 1). The campus is on an approximately 10-acre parcel identified as Sacramento County Assessor Parcel Number 024-0401-028-0000. The project site is bounded to the north by 43rd Avenue; to the east by residential single-family houses, beyond which is 14th Street; to the south by residential houses; and to the west by 13th Street.

At the time of our field explorations on September 29, 2023, the site was developed with an existing grass-covered play area, trees and a chain-link fence along the perimeter of the property.

Surface elevation of the site is approximately +20 to +24 feet North American Vertical Datum of 1988 (WGS84) and the elevation estimates are based on Google Earth.

2.2 Historical Aerial Photograph Review

We reviewed historical aerial photographs from 1947, 1957, 1964, 1966, 1984, 1993, 1998, 2002 through 2020. Review of the photographs from 1947 and 1957 indicate the site to be undeveloped and grass covered. Review of the photographs from 1964 reveal the campus present. The photographs from 2014 show the addition of 7th and 8th grade buildings. Photographs from 2014 through 2020 reveals the site is in a similar condition as it was during our field work in September 2023.

2.3 Soil Conditions

On September 29, 2023, six exploratory borings (B1 through B6) were performed at the project site to approximate depths of 10 to 21½ feet BGS. The approximate locations are shown in the attached Site Plan (Figure 2). Borings B1, B2, and B5 discovered surficial loose sand and silt soils while the surficial soil at the location of borings B3, and B4 was a dense sand. Boring B6 discovered approximately four feet of very stiff silt.

Below the surficial soils, borings B1, B2, B4 and B5 discovered medium dense to dense sandy soils while borings B3 and B6 discovered dense sandy silts and a medium stiff clayey silts, respectively.

For soil conditions at a particular location, refer to the attached Logs of Soil Borings shown in Figures 3 through 8.

2.4 Groundwater

Groundwater was not encountered within the borings performed on September 29, 2023 to the explored depths of about 10 to 21½ feet BGS.

To supplement our study, we reviewed available groundwater elevation data obtained from a California Department of Water Resources (DWR) monitoring well as identified as State Well Number

08N04E36L001M, located about one mile southeast of the site. The ground surface elevation at the well is +7.5 NAVD88, which is about ten feet lower than the subject site. Groundwater measurements obtained from the well indicate a "high" groundwater elevation of +8.5 feet NAVD88 (about 1-foot BGS at the well) occurred on March 7, 1977 and April 15, 2020, and a "low" groundwater elevation of approximately -21 feet (about 28 feet below BGS at the well) occurred in October 5, 1987.

TABLE 1
GROUNDWATER SUMMARY

DWR Well Number	Ground Surface Elevation, NGVD29 (feet)	Latest Measurement	Maximum Groundwater Elevation (feet)	Groundwater Depth (feet bgs)
08N04E24M001M	+27.53	11/26/2001	28.03	22.17

Note: NGVD29 – National Geodetic Vertical Datum of 1929

According to DWR, SGMA Data Viewer website, ground elevation at the well is about seven feet higher than the project site shown in Figure 2. Elevation of the borings are about +19 to +24 feet based on the Google Earth in World Geodetic System 84 (WGS84) datum. Due to proximity of the property to the Sacramento River, groundwater levels in this area fluctuate with the water levels of the river.

3.0 CONCLUSIONS

3.1 2022 CBC and ASCE 7-16 Seismic Design Parameters

The 2022 California Building Code (CBC) currently references the American Society of Civil Engineers (ASCE) Standard 7-16 for seismic design. The seismic design parameters provided in Table 1 were developed based on a Site Classification D, and the latitude and longitude for the site using the web interface developed by the *Structural Engineers Association of California* (SEAOC) and *California's Health Care Access and Information (HCAI)*.

Since S_1 is greater than 0.2g, the coefficient values F_v, S_{M1}, and S_{D1} presented in Table 1 below are valid for this project, provided the requirements in Exception for Site Class D of ASCE 7-16, Supplement 3, Section 11.4.8 apply. If not, a site-specific ground motion hazard analysis is required. This should be verified by the project structural engineer.

Table 1: 2022 CBC/ASCE 7-16 Seismic Design Parameters

Latitude: 38.5138° N Longitude: 121.5090° W	ASCE 7-16 Table/Figure	2022 CBC Table/Figure	Factor/Coefficient	Value
0.2-second Period MCE	Figure 22-1	Figure 1613.2.1(1)	S_S	0.60 g
1.0-second Period MCE	Figure 22-2	Figure 1613.2.1(3)	S_1	0.26 g
Soil Class	Table 20.3-1	Section 1613.2.2	Site Class	D
Site Coefficient	Table 11.4-1	Table 1613.2.3(1)	F_a	1.32
Site Coefficient	Table 11.4-2	Table 1613.2.3(2)	F_v	2.08*
Adjusted MCE Spectral Response Parameters	Equation 11.4-1	Equation 16-20	S_{MS}	0.79 g
	Equation 11.4-2	Equation 16-21	S_{M1}	0.54 g*
Design Spectral Acceleration Parameters	Equation 11.4-3	Equation 16-22	S_{DS}	0.53 g
	Equation 11.4-4	Equation 16-23	S_{D1}	0.36 g*
Seismic Design Category	Table 11.6-1	Section 1613.2.5(1)	Risk Category I through IV	D
	Table 11.6-2	Section 1613.2.5(2)	Risk Category I through IV	D

Notes: MCE = Maximum Considered Earthquake
g = gravity
* The value is valid provided the requirements in Exception for Site Class D of ASCE 7-16, Supplement 3, Section 11.4.8 is met. If not, a site-specific ground motion hazard analysis is required.

3.2 Soil Expansion Potential

Our borings encountered near-surface sand and silt soils. Based on our experience with similar soils, it is our opinion that these soils are capable of exerting low to negligible expansion pressures on foundation, exterior flatwork, and pavements.

3.3 Bearing Capacity

In our opinion, the native soils can support the proposed improvements. Our experience in the area also indicates that engineered fills composed of native soils or approved import soils that are placed and compacted in accordance with general engineering practices will be suitable for support of the proposed improvements.

3.4 Pavement Subgrade Quality

Our borings revealed the near-surface sand and silt soils which are good quality materials for the support of asphalt concrete pavements. We have provided pavement sections based on a Resistance ("R") value of 15 associated with these soils.

3.5 Groundwater Effect on Development

Groundwater was not encountered in the explored 10 to 21½ feet BGS of the borings performed at the school site on September 29, 2023. Review of available groundwater data revealed the groundwater elevation at nearby monitoring wells has ranged from 7 to 22 feet below the existing ground surface during the last 48 years. Groundwater levels at the site should be expected to fluctuate throughout the year based on variations in seasonal precipitation, local pumping, and other factors. Locally perched shallower groundwater may be encountered.

Based on current explorations performed at the site and historical groundwater data, we do not anticipate excavations within about 10 feet of the existing ground surface to encounter permanent groundwater, although locally perched water could be encountered and require localized dewatering (depending on the time of year). If perched is encountered, the use of sumps or submersible pumps could be used as methods to lower the groundwater level.

3.6 Excavation Conditions

The surface and near-surface soils at the site should be readily excavatable with conventional earthmoving and trenching equipment. Based on our borings, excavations associated with building foundations, shallow trenches for utilities, and other excavations less than five feet deep associated with the proposed construction, should stand vertically for short periods of time (i.e. less than one day) required for construction. However, cohesionless, saturated or disturbed soils, if encountered, may result in caving or sloughing; therefore, the contractor should be prepared to brace or shore the excavations, if necessary.

Excavations or trenches exceeding five feet in depth that will be entered by workers should be sloped, braced or shored to conform to current California Occupational Safety and Health Administration (Cal/OSHA) requirements. The contractor must provide an adequately constructed and braced shoring system in accordance with federal, state and local safety regulations for individuals working in an excavation that may expose them to the danger of moving ground.

Temporarily sloped excavations should be constructed no steeper than a one and half horizontal to one vertical (1½H:1V) inclination. Temporary slopes likely will stand at this inclination for the short-term duration of construction, provided significant pockets of loose and/or saturated granular soils are not encountered. Flatter slopes would be required if these conditions are encountered. Permanent soil excavation and embankment slopes should be constructed no steeper than two horizontal to one vertical (2H:1V).

Excavated materials should not be stockpiled directly adjacent to an open excavation to prevent surcharge loading of the excavation sidewalls. Excessive truck and equipment traffic should be avoided near excavations. If material is stored or heavy equipment is stationed and/or operated near an excavation, a shoring system must be designed to resist the additional pressure due to the superimposed loads.

3.7 Material Suitability for Engineered Fill Construction

The existing on-site native soils encountered at the boring locations are considered suitable for use as engineered fill construction, provided these materials do not contain significant quantities of organics, rubble and deleterious debris, and are at a proper moisture content capable of achieving the desired degree of compaction.

3.8 Preliminary Soil Corrosion Potential

One sample of near-surface soil was submitted to Sunland Analytical of Rancho Cordova, California, for testing to determine pH, chloride and sulfate concentrations, and minimum resistivity to help evaluate the potential for corrosive attack upon buried concrete. The results of the corrosivity testing are summarized below in Table 2. Copies of the test reports are presented in Figure A3 and A4.

TABLE 2: SOIL CORROSIVITY TESTING

Analyte	Test Method	Sample Identification	
		B2 (0-5’)	B6 (0-5’)
pH	CA DOT 643 Modified*	6.06	6.09

TABLE 2: SOIL CORROSIVITY TESTING			
Analyte	Test Method	Sample Identification	
		B2 (0-5')	B6 (0-5')
Minimum Resistivity	CA DOT 643 Modified*	3,480 Ω-cm	1,470 Ω-cm
Chloride	CA DOT 422	7.3 ppm	10.7 ppm
Sulfate	CA DOT 417	20.4 ppm	6.5 ppm

Notes: * = Small cell method; Ω-cm = Ohm-centimeters; ppm = Parts per million

The California Department of Transportation Corrosion and Structural Concrete Field Investigation Branch, Corrosion Guidelines (Version 3.2, dated May 2021), considers a site to be corrosive to foundation elements if one or more of the following conditions exists for the representative soil and/or water samples taken: has a chloride concentration greater than or equal to 500 ppm, sulfate concentration greater than or equal to 1500 ppm, or the pH is 5.5 or less.

Table 19.3.1.1 – Exposure Categories and Classes, of American Concrete Institute (ACI) 318-19, Section 19.3 – Concrete Durability Requirements, as referenced in Section 1904.1 of the 2022 CBC, indicates the severity of sulfate exposure for the sample tested is Exposure Class S0 (water-soluble sulfate concentration in contact with concrete is moderate and injurious sulfate attack is not a concern). The project Structural Engineer should evaluate the requirements of ACI 318-19 and determine their applicability to the site.

Soil Resistivities for B2 and B6 are 3,480 and 1,470 ohm-centimeters, respectively. The results for B6 with 1,470 ohm-centimeters is considered highly corrosive whereas B2 is considered moderately corrosive to ferrous and other metals.

Universal Engineering Sciences are not corrosion engineers. Therefore, if it is desired to further define the soil corrosion potential at the site, a Corrosion Engineer should be consulted.

4.0 RECOMMENDATIONS

4.1 General

The recommendations in this report are based on assumed excavations and fills on the order of about 3 ½ feet for the development of the site. We consider it essential that our office review grading and structural foundation plans to verify the applicability of the following recommendations, to verify that the intent of our recommendations has been incorporated into the construction documents, and to provide supplemental recommendations, if necessary.

The recommendations presented below are appropriate for typical construction in the spring through fall months. The on-site soils likely will be saturated by rainfall in the winter and spring months and will not be compactable without drying by aeration or chemical treatment. Soils present beneath existing slabs and pavements will be wet regardless of the time of year of construction. Should the construction schedule require work to continue during the wet months, additional recommendations can be provided, as conditions dictate.

Site preparation should be accomplished in accordance with the provisions of this report and the appended specifications. A representative of the Geotechnical Engineer should be present during all earthwork operations to evaluate compliance with the recommendations and the guide specifications included in this report. The Geotechnical Engineer of Record referenced herein is the Geotechnical Engineer that is retained to provide geotechnical engineering observation and testing services during construction.

4.2 Site Clearing

Existing improvements to be abandoned, including but not limited to: existing pavements, foundations (if encountered), and underground utilities, should be completely removed from the site. Areas of new construction should also be cleared of vegetation and irrigation systems. Excavations to remove these items should extend to undisturbed native soils. All trees/large brush designated for removal should include the root ball and roots ½ inch or larger in size.

Where practical, the clearing should extend a minimum of five feet beyond the limits of the proposed structural areas of the site which include the new building, pavements and slab-on-grade concrete.

Depressions resulting from removal of underground structures (e.g., foundations, utilities, etc.) should be cleaned of loose soil and properly backfilled in accordance with the recommendations of this report.

Existing pavements and flatwork (asphalt concrete and concrete), if any, that are not incorporated into the new design should be broken up and removed from the site. Alternatively, pulverized asphalt and Portland cement concrete rubble and any underlying aggregate base may be used as fill provided it is processed into fragments less than three inches in largest dimension, is mixed with soil to form a compactable mixture, and approved by the Owner.

Soils containing excessive organic soils should be removed and not used within the pavements, slabs, and building areas. For this project, the acceptable organic content is less than four percent (4%) organics by weight as determined by ASTM D2974 (Organic Content by Ignition Method). In our opinion, soils having excessive organic matter contents should be removed to expose undisturbed native soils with acceptable organic contents.

Soils containing organic material may be used in landscape areas. However, the landscape architect should have the final decision as to the placement of soils containing organic material in landscape areas.

Where encountered, any loose, soft or saturated soils should be cleaned out to firm native soil and backfilled with engineered fill in accordance with the recommendations in this report. It is important that the Geotechnical Engineer's representative be present for a sufficient time during clearing operations to verify adequate removal of the surface and subsurface items, as well as the proper backfilling of resulting excavations.

4.3 Subgrade Preparation

Site clearing is expected to disturb the upper one to two feet of the site, and deeper disturbance will result where deeper underground utilities are removed or piers supporting pole mounted structures are removed. Subgrade preparation of the subgrade soils should include all soil that has been disturbed and/or areas where existing structures are removed to provide a uniform layer of engineered fill for support of the planned structures.

Following site clearing and stripping operations, *playground area* should be scarified to a depth of at least 12 inches, moisture conditioned to approximately the optimum moisture content and uniformly compacted to not less than 90 percent of the ASTM D1557 maximum dry density. Scarification and recompaction should extend at least five feet beyond the perimeter of buildings and two feet beyond the outer edge of pavements.

Unstable areas may require a layer of geotextile reinforcement at the time of construction. The need for geotextile reinforcement should be determined by the Geotechnical Engineer once the final subgrade has been exposed.

Compaction of all subgrade soils should be performed using a heavy, self-propelled, sheepsfoot compactor capable of achieving the required compaction and must be performed in the presence of the Geotechnical Engineer's representative who will evaluate the performance of subgrade under compactive load. Difficulty in achieving subgrade compaction may be an indication of loose, soft or unstable soil conditions that could require additional excavation. If these conditions exist, additional subgrade stabilization recommendations may be required at the time of construction.

The upper 12 inches of pavement subgrades should be uniformly compacted to at least 95 percent relative compaction at a moisture content of at least the optimum moisture content, regardless of whether final grade is established by excavation, engineered fill or left at grade. Additional recommendations regarding pavement subgrades are provided in the Pavement Design section of this report.

4.4 Engineered Fill Construction

On-site soils are suitable for engineered fill construction in structural areas provided the materials do not contain rubbish, rubble greater than three inches, and significant organic concentrations. Imported fill materials, if required, should be compactable, granular soils with an Expansion Index of 20 or less, and contain no particles greater than three inches in maximum dimension. Imported soils should be approved by our office prior to being transported to the site. In addition, if required for fire lane or vehicular pavement areas, imported fill within the upper three feet of pavement areas should possess an R-value of at least 20. Also, if import fills are required (other than aggregate base), the contractor must provide appropriate documentation that the import is clean of known contamination per Department of Toxic Substances Control (DTSC) and within acceptable corrosion limits.

Engineered fill should be placed in lifts that do not exceed six inches in compacted thickness. Native or imported materials should be thoroughly moisture conditioned to the approximate optimum moisture content and uniformly compacted to at least 90 percent of the ASTM D1557 maximum dry density.

The upper 12 inches of final building pad subgrades, including adjacent exterior flatwork areas and non-vehicular traffic areas, should be compacted to at least 90 percent relative compaction at approximately the optimum moisture content.

The upper six inches of pavement subgrades should be uniformly compacted to at least 95 percent of the maximum dry density at a moisture content of at approximately the optimum moisture content and must be stable under construction traffic prior to placement of aggregate base.

Permanent excavation and fill slopes should be constructed no steeper than two horizontal to one vertical (2:1) and should be vegetated as soon as practical following grading to minimize erosion. Slopes should be over-built and cutback to design grades and inclinations.

4.5 Utility Trench Backfill

Utility trench backfill within structural areas (building, slabs and pavements) should be mechanically compacted as engineered fill in accordance with the following recommendations. Bedding and initial backfill around and over the pipe should conform to the pipe manufacturers recommendations and applicable sections of the governing agency standards.

Utility trench backfill should be placed in maximum 12-inch-thick lifts (compacted thickness), moisture conditioned to at least two percent above the optimum moisture content and mechanically compacted to at least 90 percent of the ASTM D1557 maximum dry density.

Utility trench backfill within the upper six inches of final pavement subgrades should be compacted to at least 95 percent of the maximum dry density.

Utility trench backfill should be continuously observed and tested during construction.

All underground utility trenches aligned nearly parallel with foundations should be at least five feet from the outer edge of foundations, wherever possible. If this is not practical, the trenches should not encroach into a zone extending at a one horizontal to one vertical (1:1) inclination below the bottom of the foundations.

Additionally, trenches parallel to existing foundations should not remain open longer than 72 hours. The intent of these recommendations is to prevent loss of both lateral and vertical support of foundations, resulting in possible settlement.

4.6 Foundation Design

Based on our understanding of the project, it is our opinion that the proposed improvements can be supported on shallow conventional foundations. Lateral forces due to wind and earthquake exerted to the canopy or other structures may require a drilled pier foundation. A summary of each foundation design is described as follows.

4.6.1 Conventional Spread Footings

Structures may be supported upon spread foundation that extend at least 18 inches below lowest adjacent soil grade. Isolated spread foundations should maintain a minimum 24 inches in plan dimension. Foundations bearing in undisturbed or recompacted native soils, engineered fill, or a combination of those materials may be sized for maximum allowable "net" soil bearing pressure of 2,500 pounds per square foot (psf) for dead plus live loads, with a 1/3 increase for total loads including wind or seismic forces. The weight of the foundation concrete extending below lowest adjacent soil grade may be disregarded in sizing computations.

All foundations should be adequately reinforced to provide structural continuity, mitigate cracking, and permit spanning of local soil irregularities. The structural engineer should determine final foundation reinforcing requirements.

Resistance to lateral displacement of shallow foundations may be computed using an allowable friction factor of 0.30 multiplied by the effective vertical load on each foundation. Additional lateral resistance may be achieved using an allowable passive earth pressure against the vertical projection of the foundation equal to an equivalent fluid pressure of 250 psf per foot of depth. These two modes of resistance should not be added unless the frictional component is reduced by 50 percent since mobilization of the passive resistance requires some horizontal movement, effectively reducing the frictional resistance.

4.6.2 Canopy Pier Foundations

Based on our experience with similar projects, we anticipate the canopy structures may be supported on drilled piers. Drilled piers should be no less than 18 inches in diameter and should extend at least five feet below the existing ground surface.

Drilled piers may be sized utilizing an allowable end-bearing capacity of 5,000 psf or allowable skin friction of 500 psf for dead plus live loads, which may be applied over the surface of the pier. This value may be increased by one-third to include the short-term wind or seismic forces. The weight of foundation concrete below grade may be disregarded in sizing computations for the end-bearing condition.

Uplift resistance of pier foundations may be computed using the following resisting forces, where applicable: 1) weight of the pier concrete (150 pounds per cubic foot), and 2) the allowable skin friction of 750 psf applied over the shaft area of the pier. Increased uplift resistance can be achieved by increasing the diameter of the pier or increasing the depth.

The upper 12 inches of skin friction should be disregarded unless the pier is completely surrounded by concrete or pavements for a distance of at least three feet from the edge of the foundation pier.

Lateral resistance of pier foundations may be evaluated by applying a passive earth pressure of equivalent to a fluid pressure of 300 psf per foot of depth.

Sizing of drilled piers to resist lateral loads can be evaluated using Section 1807.1 of the 2019 CBC. An allowable lateral soil bearing pressure of 300 psf per foot of depth may be used for to calculate CBC parameters S_1 (equation 18-1) and S_3 (equations 18-2 and 18-3) based on the design-specific embedment depth.

The structural engineer should determine if reinforcement of the piers is required and determine the reinforcing requirements. The bottom of the pier excavations should not contain loose or disturbed soils prior to placement of the concrete and reinforcement (if required). Cleaning of the bearing surface should be verified by the Geotechnical Engineer's representative prior to concrete placement. Concrete and reinforcement (if required) should be placed in the pier excavations as soon as possible, after the excavations are completed. The intent of this recommendation is to minimize the chances of sidewall caving into the excavations. Although we do not anticipate excessive sloughing of the sidewalls during pier construction, we recommend that the pier contractor be prepared to case the pier holes if conditions require.

If the drilled piers are constructed in the "dry" (with dry being less than two inches of water at the base of the excavation), the concrete may be placed by the free-fall method, using a short hopper or back-chute to direct the concrete flow out of the truck into a vertical stream of flowing concrete with a relatively small diameter. The stream is directed to avoid hitting the sides of the excavation or any reinforcing cages. For the free-fall method of concrete placement, we recommend the concrete mix be designed with a slump of five to seven inches.

4.7 Exterior Flatwork Construction (Non-Pavement)

Exterior flatwork should be underlain by at least four inches of Class 2 aggregate base compacted to at least 95 percent relative compaction. Exterior flatwork concrete should be at least four inches thick. Consideration should be given to thickening the edges of the slabs at least twice the slab thickness where wheel traffic is expected over the slabs. Expansion joints should be provided to allow for minor vertical movement of the flatwork. Exterior flatwork should be constructed independent of other structural elements by the placement of a layer of felt material between the flatwork and the structural element. Doweling of new flatwork into existing improvements (i.e., adjacent buildings, existing flatwork, etc.) is not recommended. The slab designer should determine the final thickness, strength and joint spacing of exterior slab-on-grade concrete. The slab designer should also determine if slab reinforcement for crack control is required and determine final slab reinforcing requirements.

Areas adjacent to exterior flatwork should be landscaped to maintain more uniform soil moisture conditions adjacent to and under flatwork. We recommend final landscaping plans not allow fallow ground adjacent to exterior concrete flatwork.

Practices recommended by the Portland Cement Association (PCA) for proper placement, curing, joint depth and spacing, construction, and placement of concrete should be followed during exterior concrete flatwork construction.

4.8 Site Drainage

Final site grading should be accomplished to provide positive drainage of surface water away from structures and prevent ponding of water adjacent to the foundations. The grade adjacent to the relocated structures should be sloped away from foundations at a minimum two percent slope for a distance of at least five feet, where possible. Ponding of surface water should not be allowed adjacent to the structure or exterior concrete flatwork.

4.9 Pavement Design

We are providing several pavement design alternative designs based on the soil conditions encountered at the site, our experience, and using design Traffic Indices (TIs) considered appropriate for the proposed construction.

Based on our experience in the area, we used a Resistance ("R") value of 25 for untreated pavement subgrades. Pavement sections presented in Table 4 have been calculated using the above R-values and traffic indices (TIs) assumed to be appropriate for this project. The procedures used for pavement design are in general conformance with Chapters 600 to 670 of the *California Highway Design Manual*, 7th Edition. The project civil engineer should determine the appropriate traffic index for pavements based on anticipated traffic conditions. If needed, we can provide additional pavement sections for different traffic indices.

Table 3: Pavement Design Alternatives

Traffic Index (TI)	Pavement Use	Untreated Subgrades R-value = 20		
		Asphalt Concrete (inches)	Class 2 Aggregate Base (inches)	Portland Cement Concrete (inches)
4.5	Automobile Parking	3*	5	--
		4	4	5
6.5	Emergency Vehicle Traffic	--	--	--
		4	12	--
		4.5	10	6

* = Asphalt concrete thickness contains the Caltrans safety factor.

We emphasize that the performance of pavement is critically dependent upon uniform and adequate compaction of the soil subgrade, as well as all engineered fill and utility trench backfill within the limits of the pavements. We recommend that final pavement subgrade preparation (i.e., scarification, moisture conditioning and compaction) be performed after underground utility construction is completed and just prior to aggregate base placement.

The upper six inches of pavement subgrade soils should be compacted to at least 95 percent relative compaction at no less than two percent above the optimum moisture content, maintained in a moist condition and protected from disturbance. All aggregate bases should be compacted to at least 95 relative compaction.

It has been our experience that pavement failures may occur where a non-uniform or disturbed subgrade soil condition is created. Subgrade disturbances can result if pavement subgrade preparation is performed prior to underground utility construction and/or if a significant time period passes between subgrade preparation and placement of aggregate base. Therefore, we recommend that final pavement subgrade preparation (i.e., scarification, moisture conditioning, and compaction) be performed just prior to aggregate base placement.

In the summer heat, high axle loads coupled with shear stresses induced by sharply turning tire movements can lead to failure in asphalt concrete pavements. Therefore, PCC pavements should be used in areas subjected to concentrated heavy wheel loading, such as entryways, in front of trash enclosures, and/or within loading areas. Alternate PCC pavement sections have been provided above in Table 3.

We suggest concrete slabs be constructed with thickened edges in accordance with American Concrete Institute (ACI) design standards, latest edition. Reinforcing for crack control, if desired, should be provided in accordance with ACI guidelines. At a minimum, we recommend No. 3 reinforcing bars at 18 inches on center for crack control. Reinforcement must be located at mid-slab depth to be effective. Joint spacing and details should conform to the current PCA or ACI guidelines. PCC should achieve a minimum compressive strength of 3,500 pounds per square inch at 28 days.

All pavement materials and construction methods of structural pavement sections should conform to the applicable provisions of the *Caltrans Standard Specifications*, latest edition.

4.10 Geotechnical Engineering Construction Observation Services

Site preparation should be accomplished in accordance with the recommendations of this report. Representatives of the Geotechnical Engineer should be present during site preparation and all grading operations to observe and test the fill to verify compliance with our recommendations and the job specifications. Testing frequency will depend on how the site is graded and should be determined during the rough grading operations. These services are beyond the scope of work authorized for this investigation.

If Universal Engineering Sciences is not retained to provide geotechnical engineering observation and testing services during construction, the Geotechnical Engineer retained to provide these services should indicate in writing that they agree with the recommendations of this report or prepare supplemental recommendations as necessary. A final report by the Geotechnical Engineer providing construction testing services should be prepared upon completion of the project.

4.11 Additional Services

Our firm should be retained to review the final plans and specifications to determine if the intent of our recommendations has been implemented in those documents. We would be pleased to submit a proposal to provide these services upon request.

5.0 LIMITATIONS

Our recommendations are based upon the information provided regarding the proposed project, combined with our analysis of site conditions revealed by the field exploration and laboratory testing programs. We have used our engineering judgment based upon the information provided and the data generated from our investigation. This report has been prepared in substantial compliance with generally accepted geotechnical engineering practices that exist in the area of the project at the time the report was prepared. No warranty, either express or implied, is provided.

If the proposed construction is modified or re-sited; or, if it is found during construction that subsurface conditions differ from those we encountered at the boring locations, we should be afforded the opportunity to review the new information or changed conditions to determine if our conclusions and recommendations must be modified.

We emphasize that this report is applicable only to the proposed construction and the investigated site, and should not be utilized for construction on any other site.

The conclusions and recommendations of this report are considered valid for a period of two years. If design is not completed and construction has not started within two years of the date of this report, the report must be reviewed and updated if necessary.

Universal Engineering Sciences (UES)

Roozbeh Afshar, PhD, PE
Principal Engineer

Kristie Stromgren, E.I.T
Staff Engineer

6.0 REFERENCES

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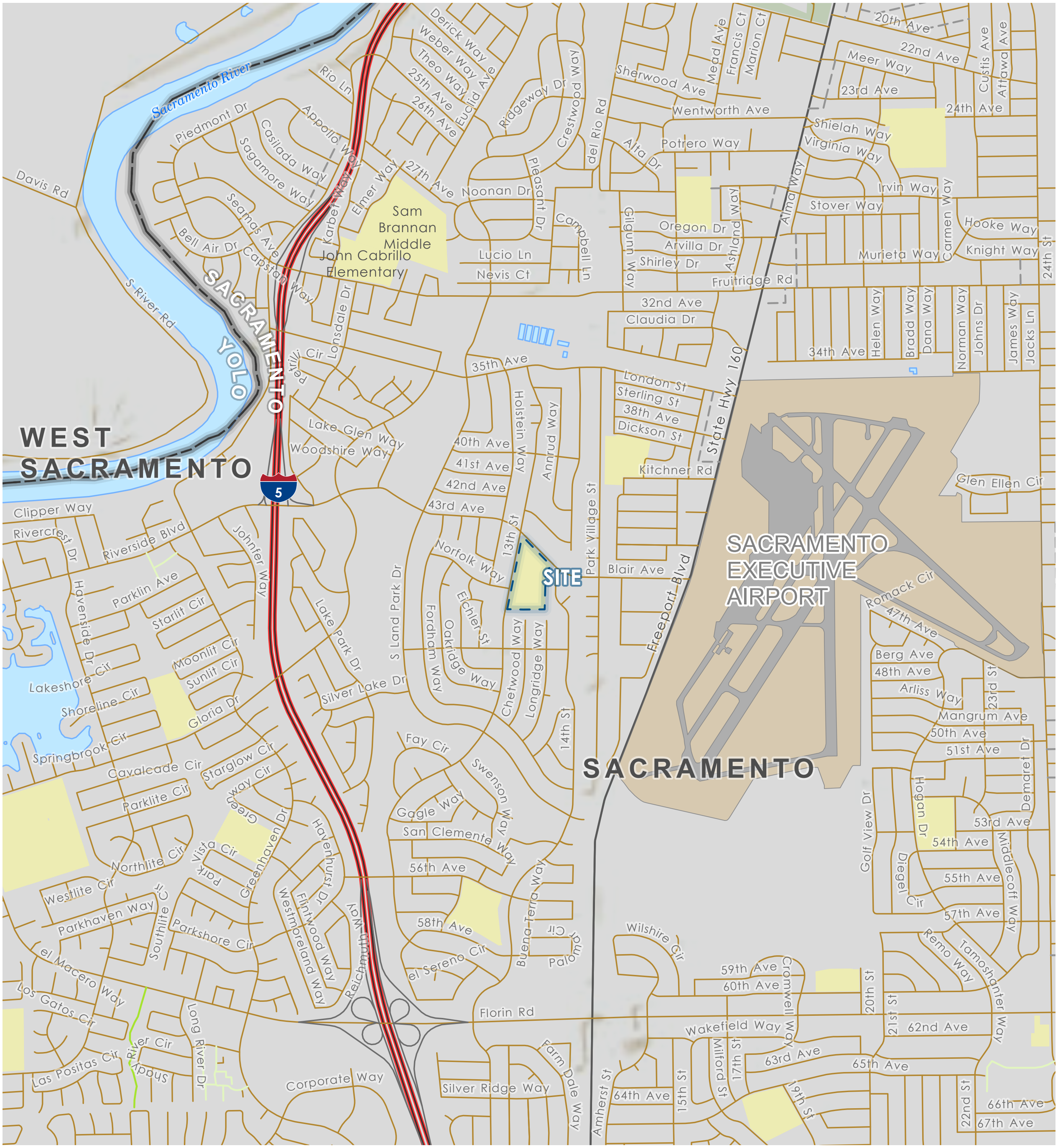
FIGURES



N

0 150
Feet

Spatial Data provided by Esri, NOAA, and USGS.
Projection: NAD 1983 2011 StatePlane California II FIPS 0402 Ft US

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VICINITY MAP

ALICE BIRNEY ELEMENTARY SCHOOL

Sacramento, California

FIGURE	1
DRAWN BY	KS
CHECKED BY	HC
PROJECT MGR	DA
DATE	12/2023
4630.2300090.0016	

Approximate Site Boundary

Approximate Boring Locations

N

0 75 150

Feet

Aerial imagery provided by Esri.
Projection: NAD 1983 2011 StatePlane California II FIPS 0402 Ft US

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SITE PLAN

ALICE BIRNEY ELEMENTARY SCHOOL

Sacramento, California

FIGURE	2
DRAWN BY	KS
CHECKED BY	RA
PROJECT MGR	RA
DATE	12/2023
4630.2300090.0016	

Project: Alice Birney Elementary School
Project Location: Sacramento, CA
Project Number: 4630.2300090.0016

LOG OF SOIL BORING B1

Date(s) Drilled	9/29/23	Logged By	JB	Checked By	RA
Drilling Method	Solid Flight Auger	Drilling Contractor	Cal-Nev Geo Exploration	Total Depth of Drill Hole	11.5 feet
Drill Rig Type	CME 55 HD Crawler Drill	Diameter(s) of Hole, inches	6"	Approx. Surface Elevation, ft WSG84	22.0
Groundwater Depth [Elevation], feet	[]	Sampling Method(s)	2.0" Modified California with 6-inch sleeve	Drill Hole Backfill	Soil Cuttings
Remarks	Bulk (0'-5')			Driving Method and Drop	140lb auto. hammer with 30" drop

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Brown to dark brown, moist, loose, SAND (SP) with silt						
20					B1- Bulk (0'-5') B1-1I	9	13.0	101	
			Light brown, moist, medium dense, SAND (SP)						
	5				B1-2I	15			
15									
			Yellowish-brown, moist, vey dense, sandy SILT (ML)						
	10		decreased sand		B1-3	55			

Boring terminated at 11½ feet below ground surface
No groundwater was encountered.

BORING LOG 4630.2300091.0016 - ALICE BIRNEY ELEMENTARY SCHOOL.GPJ WKA.GDT 12/13/23 5:30 PM

UES™

FIGURE 3

Project: Alice Birney Elementary School **Project Location:** Sacramento, CA **Project Number:** 4630.2300090.0016	**LOG OF SOIL BORING B2** Sheet 1 of 1

Date(s) Drilled	**9/29/23**	Logged By	**JB**	Checked By	**RA**
Drilling Method	**Solid Flight Auger**	Drilling Contractor	**Cal-Nev Geo Exploration**	Total Depth of Drill Hole	**10.0 feet**
Drill Rig Type	**CME 55 HD Crawler Drill**	Diameter(s) of Hole, inches	**6"**	Approx. Surface Elevation, ft WSG84	**24.0**
Groundwater Depth [Elevation], feet	**[]**	Sampling Method(s)	**2.0" Modified California with 6-inch sleeve**	Drill Hole Backfill	**Soil Cuttings**
Remarks	**Bulk (0'-5'), CR**			Driving Method and Drop	**140lb auto. hammer with 30" drop**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: SAMPLE NUMBER	SAMPLE DATA: NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
			Brown, moist, loose, SAND (SM) with silt		B2-1I	7	13.0	121	UC=0.92 tsf
					B2- Bulk (0'-5')				
20	5		Brown to yellowish-brown, moist, medium dense, fine SAND (SP)		B2-2I	15			
15	10		Light brown, moist, very dense, fine to medium SAND (SP) with silt		B2-3	84			

Boring terminated at 10 feet below ground surface
No groundwater was encountered.

BORING LOG 4630.2300091.0016 - ALICE BIRNEY ELEMENTARY SCHOOL.GPJ WKA.GDT 12/13/23 5:30 PM

UES™

FIGURE 4

Project: Alice Birney Elementary School
Project Location: Sacramento, CA
Project Number: 4630.2300090.0016

LOG OF SOIL BORING B3

Date(s) Drilled	9/29/23	Logged By	JB	Checked By	RA
Drilling Method	Solid Flight Auger	Drilling Contractor	Cal-Nev Geo Exploration	Total Depth of Drill Hole	11.5 feet
Drill Rig Type	CME 55 HD Crawler Drill	Diameter(s) of Hole, inches	6"	Approx. Surface Elevation, ft WSG84	23.0
Groundwater Depth [Elevation], feet	[]	Sampling Method(s)	2.0" Modified California with 6-inch sleeve	Drill Hole Backfill	Soil Cuttings
Remarks	Bulk (0'-5')			Driving Method and Drop	140lb auto. hammer with 30" drop

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Light to medium brown, moist, dense, fine SAND (SM) with silt						
20					B3-Bulk (0'-5') B3-1I	43			
	5		increasing silt		B3-2I	31	11.0	117	
15									
	10		Light brown, moist, hard, sandy SILT (ML)		B3-3	35			

Boring terminated at 11½ feet below ground surface
No groundwater was encountered.

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FIGURE 5

Project: Alice Birney Elementary School	**LOG OF SOIL BORING B4**
Project Location: Sacramento, CA	Sheet 1 of 1
Project Number: 4630.2300090.0016	

Date(s) Drilled	9/29/23	Logged By	JB	Checked By	RA
Drilling Method	Solid Flight Auger	Drilling Contractor	Cal-Nev Geo Exploration	Total Depth of Drill Hole	20.0 feet
Drill Rig Type	CME 55 HD Crawler Drill	Diameter(s) of Hole, inches	6"	Approx. Surface Elevation, ft WSG84	21.0
Groundwater Depth [Elevation], feet	[]	Sampling Method(s)	2.0" Modified California with 6-inch sleeve	Drill Hole Backfill	Soil Cuttings/Neat Cement
Remarks	Bulk (0'-5')			Driving Method and Drop	140lb auto. hammer with 30" drop

ELEVATION, feet	DEPTH, feet	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE NUMBER	NUMBER OF BLOWS	MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
21	0	Light to medium brown, moist, dense, SAND (SM) with silt (hand auger from surface to approximately 2 feet)	B4-Bulk (0'-5')				
			B4-1I	41			
		decreasing silt	B4-2I	40			
	13.5	Brown, moist, very dense, clayey SAND (SP)	B4-3	53			
	18.5	Brown with orange mottling, moist, very hard, fine sandy SILT (ML) with gravels	B4-4	69			

Boring terminated at 20 feet below ground surface
No groundwater was encountered.

BORING LOG 4630.2300091.0016 - ALICE BIRNEY ELEMENTARY SCHOOL.GPJ WKA.GDT 12/13/23 5:30 PM

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FIGURE 6

Project: Alice Birney Elementary School	LOG OF SOIL BORING B5
Project Location: Sacramento, CA	
Project Number: 4630.2300090.0016	Sheet 1 of 1

Date(s) Drilled	9/29/23	Logged By	JB	Checked By	RA
Drilling Method	Solid Flight Auger	Drilling Contractor	Cal-Nev Geo Exploration	Total Depth of Drill Hole	10.0 feet
Drill Rig Type	CME 55 HD Crawler Drill	Diameter(s) of Hole, inches	6"	Approx. Surface Elevation, ft WSG84	19.0
Groundwater Depth [Elevation], feet	[]	Sampling Method(s)	2.0" Modified California with 6-inch sleeve	Drill Hole Backfill	Soil Cuttings
Remarks	Bulk (0'-5')			Driving Method and Drop	140lb auto. hammer with 30" drop

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: SAMPLE NUMBER	SAMPLE DATA: NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
			Brown, moist, loose, fine to medium SAND (SM) with silt						
					B5-1I	6			
					B5-Bulk (0'-5')				
15			Brown, moist, dense, fine to medium SAND (SM) with silt and clay		B5-2I	43			
	5								
10			possible oxidation-reduction, moist, silty fine sand		B5-3	45			
	10		Boring terminated at 10 feet below ground surface No groundwater was encountered.						

BORING LOG 4630.2300091.0016 - ALICE BIRNEY ELEMENTARY SCHOOL.GPJ WKA.GDT 12/13/23 5:30 PM

UES™

FIGURE 7

Project: Alice Birney Elementary School
Project Location: Sacramento, CA
Project Number: 4630.2300090.0016

LOG OF SOIL BORING B6

Date(s) Drilled	9/29/23	Logged By	JB	Checked By	RA
Drilling Method	Solid Flight Auger	Drilling Contractor	Cal-Nev Geo Exploration	Total Depth of Drill Hole	21.5 feet
Drill Rig Type	CME 55 HD Crawler Drill	Diameter(s) of Hole, inches	6"	Approx. Surface Elevation, ft WSG84	20.0
Groundwater Depth [Elevation], feet	[]	Sampling Method(s)	2.0" Modified California with 6-inch sleeve	Drill Hole Backfill	Soil Cuttings/Neat Cement
Remarks	Bulk (0'-5'), CR			Driving Method and Drop	140lb auto. hammer with 30" drop

ELEVATION, feet	DEPTH, feet	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE NUMBER	NUMBER OF BLOWS	MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
	0	Light to medium brown with black mottling, moist, very stiff, SILT (ML) with fine sand	B6-Bulk (0'-5') B6-1I	21			
15	5	Light to medium brown, very moist, medium stiff, CLAY (CL) with fine sand	B6-2I	7	37.0	83	TX
10	10		B6-3	9	22.0		AL
		Medium brown, very moist, stiff, sandy CLAY (CL)					
5	15		B6-4	12			
		Medium brown, very moist, medium dense, fine to medium SAND (SM) with silt					
0	20		B6-5	23			

Boring terminated at 21½ feet below ground surface
No groundwater was encountered.

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FIGURE 8

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D2487)

MAJOR DIVISIONS		USCS[4]	CODE	CHARACTERISTICS
COARSE GRAINED SOILS (More than 50% of soil > no. 200 sieve size)	GRAVELS[1] (More than 50% of coarse fraction > no. 4 sieve size)	GW		Well-graded gravels or gravel - sand mixtures, trace or no fines
		GP		Poorly graded gravels or gravel - sand mixtures, trace or no fines
		GM		Silty gravels, gravel - sand - silt mixtures, containing little to some fines[2]
		GC		Clayey gravels, gravel - sand - clay mixtures, containing little to some fines[2]
	SANDS[1] (50% or more of coarse fraction < no. 4 sieve size)	SW		Well-graded sands or sand - gravel mixtures, trace or no fines
		SP		Poorly graded sands or sand - gravel mixtures, trace or no fines
		SM		Silty sands, sand - gravel - silt mixtures, containing little to some fines[2]
		SC		Clayey sands, sand - gravel - clay mixtures, containing little to some fines[2]
FINE GRAINED SOILS (50% or more of soil < no. 200 sieve size)	SILTS & CLAYS LL < 50	ML		Inorganic silts, gravely silts, and sandy silts that are non-plastic or with low plasticity
		CL		Inorganic lean clays, gravelly lean clays, sandy lean clays of low to medium plasticity[3]
		OL		Organic silts, organic lean clays, and organic silty clays
	SILTS & CLAYS LL ≥ 50	MH		Inorganic elastic silts, gravelly elastic silts, and sandy elastic silts
		CH		Inorganic fat clays, gravelly fat clays, sandy fat clays of medium to high plasticity
		OH		Organic fat clays, gravelly fat clays, sandy fat clays of medium to high plasticity
HIGHLY ORGANIC SOILS		PT		Peat
ROCK		RX		Rocks, weathered to fresh
FILL		FILL		Artificially placed fill material

OTHER SYMBOLS

= Drive Sample: 2-1/2" O.D. Modified California sampler
= Drive Sampler: no recovery
= SPT Sampler
= Initial Water Level
= Final Water Level
= Estimated or gradational material change line
= Observed material change line

Laboratory Tests

CR = Corrosion
PI = Plasticity Index
EI = Expansion Index
UCC = Unconfined Compression Test (TSF)
TR = Triaxial Compression Test
GR = Gradational Analysis (Sieve/Hydro)
FC = Wash (Fines Content)
PP = Pocket Penetrometer Test (TSF)
PID = Photo Ionization Detector Test (PPM)
RV = Resistance ("R") Value

REF = Refusal (>50 blows in 6 inches)

GRAIN SIZE CLASSIFICATION

CLASSIFICATION	RANGE OF GRAIN SIZES	
	U.S. Standard Sieve Size	Grain Size in Millimeters
BOULDERS (b)	Above 12"	Above 300
COBBLES (c)	12" to 3"	300 to 75
GRAVEL (g) coarse fine	3" to No. 4 3" to 3/4" 3/4" to No. 4	75 to 4.75 75 to 19 19 to 4.75
SAND coarse medium fine	No. 4 to No. 200 No. 4 to No. 10 No. 10 to No. 40 No. 40 to No. 200	4.75 to 0.075 4.75 to 2.00 2.00 to 0.425 0.425 to 0.075
SILT & CLAY	Below No. 200	Below 0.075

Trace - Less than 5 percent
Few - 5 to 10 percent
Little - 15 to 25 percent
Some - 35 to 45 percent
Mostly - 50 to 100 percent

* Percents as given in ASTM D2488

NOTES:

1. Coarse grained soils containing 5% to 12% fines, use dual classification symbol (ex. SP-SM).
2. If fines classify as CL-ML (4<PI<7), use dual symbol (ex. SC-SM).
3. Silty Clays, use dual symbol (CL-ML).
4. Borderline soils with uncertain classification list both classifications (ex. CL/ML).

UES™

UNIFIED SOIL CLASSIFICATION SYSTEM
ALICE BIRNEY ELEMENTARY SCHOOL
Sacramento, California

FIGURE	9
DRAWN BY	KS
CHECKED BY	HC
PROJECT MGR	RA
DATE	10/2023
4630.2300090.0016	

APPENDIX A

A. GENERAL INFORMATION

The performance of a geotechnical engineering study for the proposed Alice Birney Elementary School improvements project in Sacramento, California was authorized by Chris Ralston with Sacramento City Unified School District on August 15, 2023. Authorization was for a study as described in our proposal letter also dated August 15, 2023 sent to Mr. Ralston whose mailing address 425 First Avenue in Sacramento, California 95818; telephone (916) 278-2333.

The project architectural consultant is LPA Design Studios whose mailing address is 431 I Street, Suite 107, in Sacramento, California 95814; telephone (916) 287-2400.

For the purpose of our study, we made reference to the Fencing Feasibility Study, dated July 18, 2023, prepared by LPA Design Studios.

B. FIELD EXPLORATIONS

As part of our study for the proposed improvements, our field exploration included the drilling and sampling of six borings (B1 through B6) at the approximate locations shown on Figure 2.

The borings were performed on September 29, 2023 to depths ranging from about 10 to 21½ feet below existing site grades utilizing a CME-55 track-mounted drilling rig equipped with six-inch-diameter solid flight augers, provided by V&W Drilling of Galt, California. At various intervals, soil samples were recovered with a 2-inch outside diameter (O.D.) and modified California split-spoon sampler. The sampler was driven by an automatic 140-pound hammer freely falling 30 inches. The number of blows of the hammer required to drive the 18-inch-long samplers each six-inch interval was recorded. The sum of the blows required to drive the sampler the lower 12-inch interval, or portion thereof, is designated the penetration resistance or "blow count" for that particular drive.

The modified California samples were retained in 2-inch diameter by 6-inch long, thin-walled brass tubes contained within the sampler. After recovery, the field representative visually classified the soil recovered in the tubes. After the samples were classified, the ends of the tubes were sealed to preserve the natural moisture contents.

Descriptions of the soils encountered in the boring locations are presented on Figures 3 through 8. An explanation of the Unified Soil Classification System symbols used in the descriptions is presented on Figure 9.

In addition to the driven samples, representative bulk samples of near-surface soils also were collected and retained in plastic bags. Driven and bulk samples were taken to our laboratory for additional soil classification and selection of samples for testing.

C. LABORATORY TESTING

Selected soil samples were tested to determine in-situ dry unit weight (ASTM D2937), and moisture content (ASTM D4643). The results of these tests are included on the boring logs at the depth each sample was obtained.

One representative soil sample was subjected to Atterberg Limits Test (ASTM D4318). The results of this test are presented in Figure A1.

One representative sample of near-surface soil were subjected to Resistance ("R") value testing in accordance with California Test 301. The results of the R-value test are presented in Figure A2.

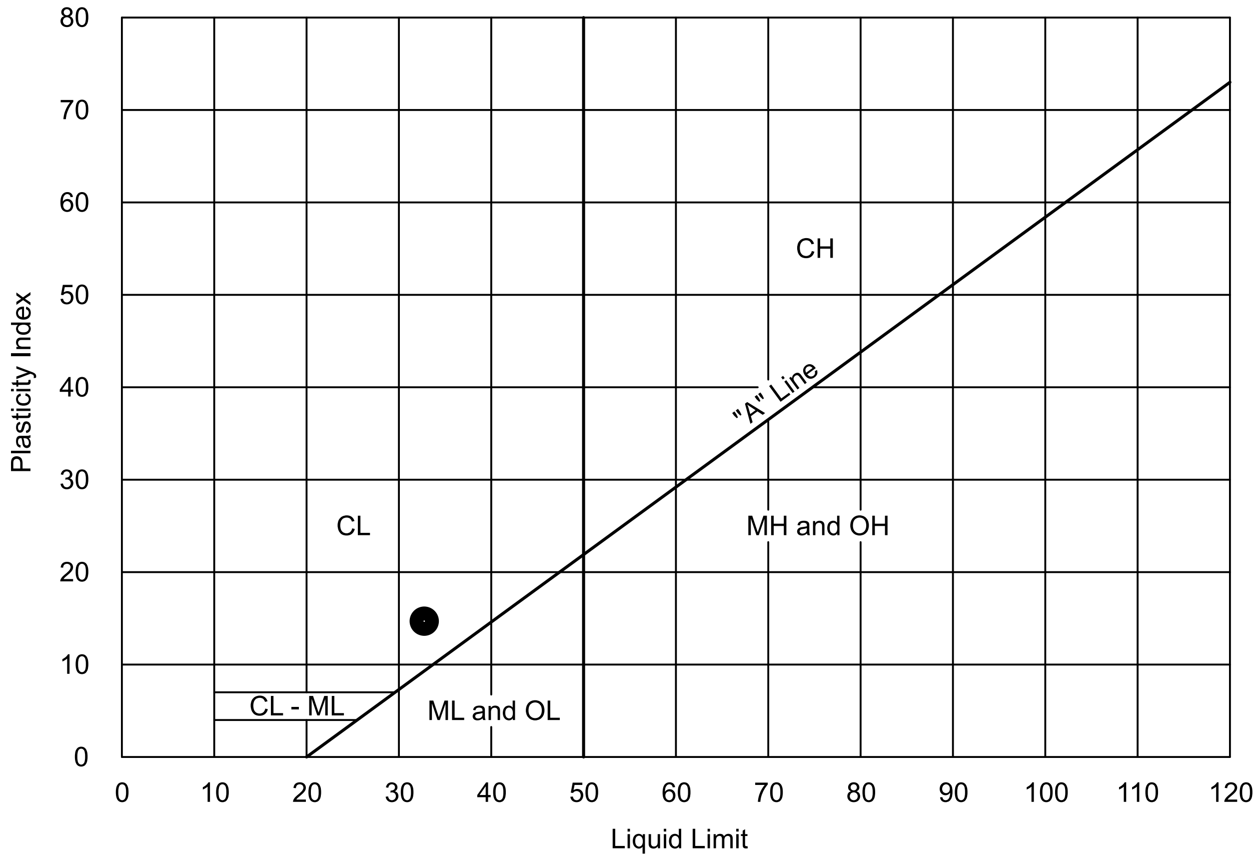
One sample of the near-surface soil was submitted to Sunland Analytical to determine the soil pH, minimum resistivity (California Test 643), Sulfate concentration (California Test 417) and Chloride concentration (California Test 422). The results of these tests are presented in Figures A3.

APPENDIX A

GENERAL PROJECT INFORMATION, LABORATORY TESTING AND RESULTS

ATTERBERG LIMITS

ASTM D4318

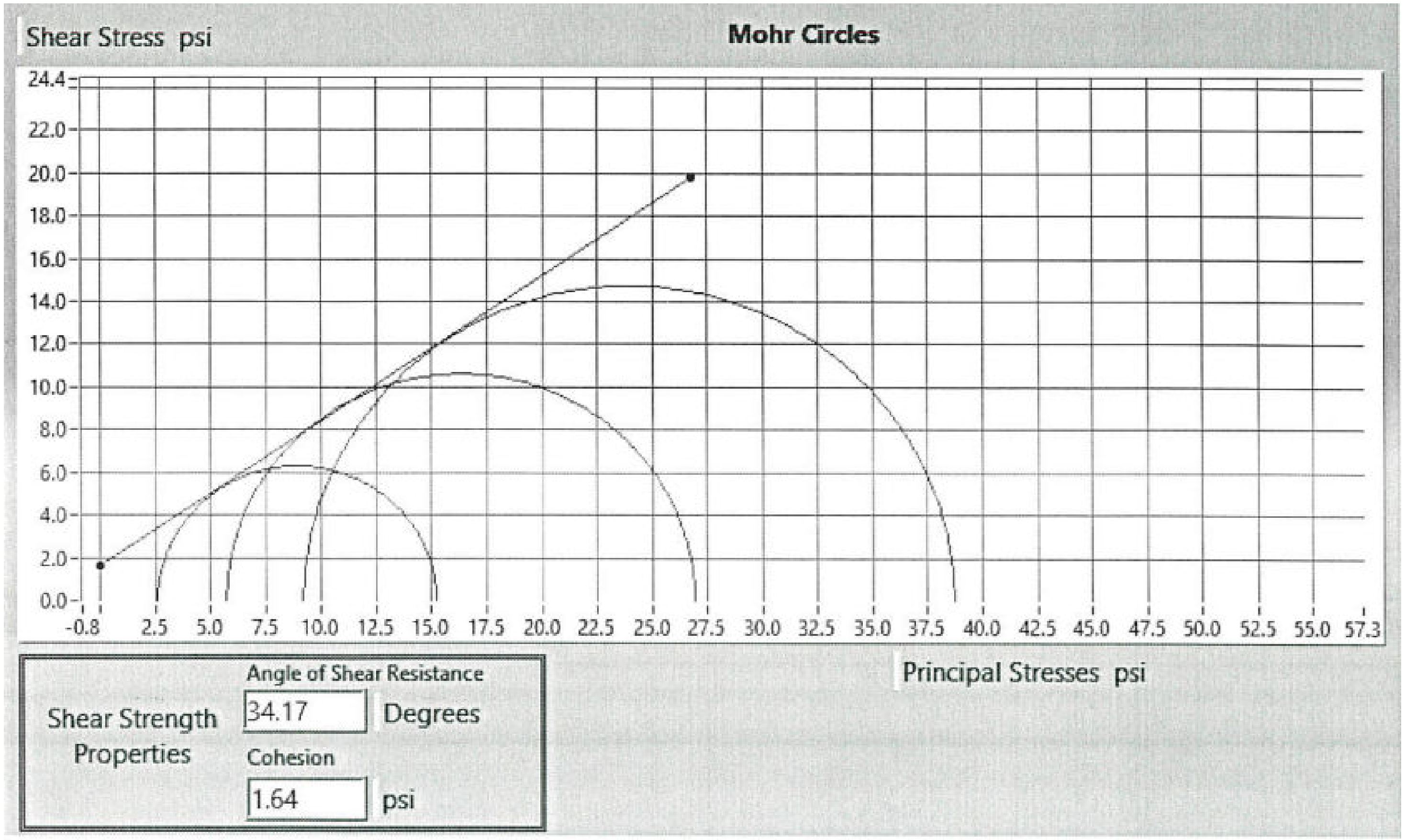


KEY SYMBOL	LOCATION	SAMPLE DEPTH	ATTERBERG LIMITS		PASSING No. 200 SIEVE (%)	UNIFIED SOIL CLASSIFI-CATION SYMBOL
			LIQUID LIMIT (%)	PLASTICITY INDEX (%)		
●	B6	10	32	15	---	CL

UES™	**ATTERBERG LIMITS** ALICE BIRNEY ELEMENTARY SCHOOL Sacra□en□o, California	FIGURE A1 DRAWN BY: KS CHECKED BY: RA PROJECT MGR: RA DATE: 10/2023 4730.2300090.0016

TRIA□IAL COMPRESSION TEST

ASTM D4767



SAMPLE NO. : B6-2I

SAMPLE CONDITION : Undi□□rbed

SAMPLE DESCRIPTION : li□□□o □edi□□ brown, cla□wi□□ □and

DRY DENSITY (PCF) : 85 INITIAL
MOISTURE (□) : 36.7
FINAL MOISTURE (□) : 34.7

ANGLE OF INTERNAL FRICTION (□) : 34
COHESION (PSI) : 1.64

UES™

TRIAXIAL COMPRESSION TEST RESULTS

ALICE BIRNEY ELEMENTARY SCHOOL

Sacra□en□o, California

FIGURE	A2
DRAWN BY	KS
CHECKED BY	RA
PROJECT MGR	RA
DATE	11□2023
4630.2300090.0016	

Sunland Analytical

11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 10/18/2023
Date Submitted 10/13/2023

To: Kristie Stromgren
Univeral Engineering Sciences
3050 Industrial Blvd
West Sacramento, CA 95691

From: Gene Oliphant, Ph.D. \ Randy Horney RA
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 4630.2300090.0016 Site ID : B2-BULK 0-5FT.
Thank you for your business.

* For future reference to this analysis please use SUN # 90766-188275.

EVALUATION FOR SOIL CORROSION

Soil pH	6.06		
Minimum Resistivity	3.48	ohm-cm (x1000)	
Chloride	7.3 ppm	00.00073	%
Sulfate	20.4 ppm	00.00204	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422m

UES	CORROSION TEST RESULTS	FIGURE	A3
	ALICE BIRNEY ELEMENTARY SCHOOL	DRAWN BY	KS
	Sacramento, California	CHECKED BY	RA
		PROJECT MGR	RA
		DATE	10/2023
		4630.2300090.0016	

Sunland Analytical

11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 10/18/2023
Date Submitted 10/13/2023

To: Roozbeh Foroozan
Universal Engineering Science
3050 Industrial Blvd
West Sacramento, CA 95691

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 4630.2300090.0016 Site ID : B6-BULK 0-5FT.
Thank you for your business.

* For future reference to this analysis please use SUN # 90768-188277.

EVALUATION FOR SOIL CORROSION

Soil pH	6.09		
Minimum Resistivity	1.47 ohm-cm (x1000)		
Chloride	10.7 ppm	00.00107	%
Sulfate	6.5 ppm	00.00065	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422m

CORROSION TEST RESULTS

ALICE BIRNEY ELEMENTARY SCHOOL

Sacramento, California

FIGURE	A4
DRAWN BY	KS
CHECKED BY	RA
PROJECT MGR	RA
DATE	10/2023
4630.2300090.0016	

APPENDIX B

GUIDE EARTHWORK SPECIFICATIONS

APPENDIX B

GUIDE EARTHWORK SPECIFICATIONS

ALICE BIRNEY ELEMENTARY SCHOOL IMPROVEMENTS

Sacramento, California

UES No. 4630.2300090.0016

PART 1: GENERAL

1.1 SCOPE

A. General Description

This item shall include all clearing of all existing structures and substructures, above- and below-ground utilities, pavements, trees, shrubbery, and associated items; preparation of surfaces to be filled, filling, spreading, compaction, observation and testing of the fill; and all subsidiary work necessary to complete the grading of the building area to conform with the lines, grades and slopes as shown on the accepted Drawings.

B. Related Work Specified Elsewhere

1. Trenching and backfilling for sanitary sewer system: Section ______.
2. Trenching and backfilling for storm drain system: Section ______.
3. Trenching and backfilling for underground water, natural gas, and electric supplies: Section ______.

C. Geotechnical Engineer

Where specific reference is made to "Geotechnical Engineer" this designation shall be understood to include either him or his representative.

1.2 PROTECTION

A. Adequate protection measures shall be provided to protect workers and passers-by at the site. Streets and adjacent property shall be fully protected throughout the operations.

B. In accordance with generally accepted construction practices, the Contractor shall be solely and completely responsible for working conditions at the job site, including safety of all persons and property during performance of the work. This requirement shall apply continuously and shall not be limited to normal working hours.

C. Any construction review of the Contractor's performance conducted by the Geotechnical Engineer is not intended to include review of the adequacy of the Contractor's safety measures, in, on or near the construction site.

D. Adjacent streets and sidewalks shall be kept free of mud, soil, or similar nuisances resulting from earthwork operations.

E. Surface drainage provisions shall be made during the period of construction in a manner to avoid creating a nuisance to adjacent areas.

F. The site and adjacent influenced areas shall be watered as required to suppress dust nuisance.

1.3 GEOTECHNICAL REPORT

A. A Geotechnical Engineering Report (UES No. 4630.2300090.0016; dated November 5, 2023) has been prepared for this site by Universal Engineering Sciences (UES) of West Sacramento, California; telephone (916) 372-1434; facsimile (916) 372-2565. A copy is available for review at the office of UES.

B. The information contained in this report was obtained for design purposes only. The Contractor is responsible for any conclusions he/she may draw from this report; should the Contractor prefer not to assume such risk, he/she should employ their own experts to analyze available information and/or to make additional borings upon which to base their conclusions, all at no cost to the Owner.

1.4 EXISTING SITE CONDITIONS

The Contractor shall be acquainted with all site conditions. If unshown active utilities are encountered during the work, the Architect shall be promptly notified for instructions. Failure to notify will make the Contractor liable for damage to these utilities arising from Contractor's operations subsequent to the discovery of such unshown utilities.

1.5 SEASONAL LIMITS

Fill material shall not be placed, spread or rolled during unfavorable weather conditions. When the work is interrupted by heavy rains, fill operations shall not be resumed until field tests indicate that the moisture contents of the subgrade and fill materials are satisfactory.

PART 2: PRODUCTS

2.1 MATERIALS

A. All fill shall be of approved local materials from required excavations, supplemented by imported fill, if necessary. Approved local materials are defined as local granular soils free from significant quantities of rubble, rubbish and vegetation, and having been tested and approved by the Geotechnical Engineer prior to use. Clods, rocks or hard lumps exceeding three inches (3”) in final size shall not be allowed in the upper two feet (2') of any fill supporting pavements and building.

B. Concrete rubble three inches (3”) or smaller in maximum dimension, and clean aggregate and aggregate base materials remaining from former construction on the site, when approved by the Geotechnical Engineer, may be used in fill construction.

C. Imported fill materials shall be approved by the Geotechnical Engineer; they shall meet the above requirements; shall have plasticity indices not exceeding fifteen (15), when tested in accordance with ASTM D4318; and shall be of three-inch (3”) maximum particle size.

D. Capillary barrier material under floor slabs shall be provided to the thickness shown on the Drawings. This material shall be clean, crushed rock of one inch (1") maximum size, with no material passing a Number four (#4) sieve.

E. Asphalt concrete, aggregate base, aggregate subbase, and other paving products shall comply with the appropriate provisions of the *State of California (Caltrans) Standard Specifications*, latest edition.

PART 3: EXECUTION

3.1 LAYOUT AND PREPARATION

Lay out all work, establish grades, locate existing underground utilities, set markers and stakes, set up and maintain barricades and protection of utilities--all prior to beginning actual earthwork operations.

3.2 CLEARING, GRUBBING AND PREPARING BUILDING PAD

A. All vegetation to be removed, oversized rubble, rubbish; uncompacted fill, loose and/or saturated materials; underground utilities to be relocated or abandoned within three feet (3') of original or final grade (whichever is lower), and utility trench backfill shall be removed and disposed of so as to leave the areas that have been disturbed with a neat and finished appearance, free from unsightly debris. Trees and shrubs designated to be removed shall include the entire rootball and all roots larger than one-half inch (½") in diameter. Excavations and depressions resulting from the removal of such items, as well as any existing excavations or loose soil deposits, as determined by the Geotechnical Engineer, shall be cleaned out to firm, undisturbed soil and backfilled with suitable materials in accordance with these specifications.

B. Following site clearing, construction areas shall be excavated to a depth of at least two feet (2') below existing grade. The exposed subgrade shall be thoroughly scarified to a depth of at least twelve inches (12"), thoroughly moisture conditioned to at least the optimum moisture content and uniformly compacted to at least ninety percent (90%) of the ASTM D1557 maximum dry density. Over-excavation operations shall extend at least five feet (5') beyond the perimeter building foundations and pavements, where possible. Where the bottom of required building pad excavations is too wet or too unstable to compact or receive fill soils, the Geotechnical Engineer will provide recommendations to help stabilize the bottom of the excavation.

C. Excavations and depressions resulting from the removal of such items, as well as any existing excavations or loose soil deposits, as determined by the Geotechnical Engineer, shall be cleaned out to firm, undisturbed soil and backfilled with suitable materials in accordance with these specifications.

D. Compaction operations shall be performed in the presence of the Geotechnical Engineer who will evaluate the performance of the materials under compactive load. Unstable soil deposits, as determined by the Geotechnical Engineer, shall be excavated to expose a firm base and grades restored with engineered fill in accordance with these specifications.

E. The Contractors bid shall include a cost per cubic yard for removal of unsuitable materials from building areas and replacement with engineered fill, as necessary.

3.3 PLACING, SPREADING AND COMPACTING FILL MATERIAL

A. The selected soil fill material shall be placed in layers which when compacted shall not exceed six inches (6") in thickness. Each layer shall be spread evenly and shall be thoroughly mixed during the spreading to promote uniformity of material in each layer.

B. When the moisture content of the fill material is below that required to achieve the specified density, water shall be added until the proper moisture content is achieved.

C. When the moisture content of the fill material is too high to permit the specified degree of compaction to be achieved, the fill material shall be aerated by blading or other methods until the moisture content is satisfactory.

D. After each layer has been placed, mixed and spread evenly, it shall be thoroughly compacted to at least ninety percent (90%) as determined by the ASTM D1557 Compaction Test. Compaction shall be undertaken with equipment capable of achieving the specified density and shall be accomplished while the fill material is at the required moisture content. Each layer shall be compacted over its entire area until the desired density has been obtained.

E. The filling operations shall be continued until the fills have been brought to the finished slopes and grades as shown on the accepted Drawings.

3.4 FINAL SUBGRADE PREPARATION

The upper twelve inches (12") of final building pad subgrades and the upper six inches (6") of all final subgrades supporting pavement sections shall be brought to a uniform moisture content, and shall be uniformly compacted to not less than:

building pad	90%
pavement areas	95%

as determined by the ASTM D1557 Compaction Test, regardless of whether final subgrade elevations are attained by filling, excavation or are left at existing grades.

3.5 TESTING AND OBSERVATION

A. Grading operations shall be observed by the Geotechnical Engineer, serving as the representative of the Owner.

B. Field density tests shall be made by the Geotechnical Engineer after compaction of each layer of fill. Additional layers of fill shall not be spread until the field density tests indicate that the minimum specified density has been obtained.

C. Earthwork shall not be performed without the notification or approval of the Geotechnical Engineer. The Contractor shall notify the Geotechnical Engineer at least two (2) working days prior to commencement of any aspect of the site earthwork.

D. If the Contractor should fail to meet the technical or design requirements embodied in this document and on the applicable plans, the Contractor shall make the necessary readjustments until all work is deemed satisfactory, as determined by the Geotechnical Engineer and the Architect/Engineer. No deviation from the specifications shall be made except upon written approval of the Geotechnical Engineer or Architect/Engineer.