APPENDIX B

GEOTECHNICAL ENGINEERING REPORT

Geotechnical Engineering Report

PARKEBRIDGE EAST

Southeast of the Intersection of Highway 80
and Havenparke Circle
Sacramento, California
MPE No. 03743-13

MID PACIFIC ENGINEERING, INC.

January 24, 2025

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Geotechnical Engineering Report
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INTRODUCTION

GENERAL

We have completed a Geotechnical Engineering investigation for the proposed Parkebridge East residential subdivision to be constructed southeast of the intersection of Highway 80 and Havenparke Circle, in Sacramento, California. The purposes of our study were to investigate the site, soil and groundwater conditions across the project site and to prepare Geotechnical Engineering conclusions and recommendations regarding design and construction of the proposed improvements.

SCOPE OF WORK

Our scope of work included the following:

1. Site reconnaissance;
2. Review of available geologic, seismic, soil, and groundwater data and maps containing the site, and historic aerial photos;
3. Review of the preliminary project plans, prepared Cunningham Engineering and dated November 2024, referred to, hereinafter, as the Preliminary Plans;
4. Subsurface investigation, including the drilling and sampling of six (6) exploratory soil borings to the maximum depth of approximately 20 feet below ground surface (bgs);
5. Collection of bulk and relatively undisturbed samples of on-site soils;
6. Laboratory testing of selected soil samples;
7. Engineering analysis; and,
8. Preparation of this report.

This report is specific to the design and construction of the proposed improvements to be located on the project site as it is described in this report. This report should not be used for the design or construction of any other proposed development without review of the proposed improvements by our office.

FIGURES AND ATTACHMENTS

This report contains a Vicinity Map as Figure 1; a Geologic Map as Figure 2; a Site Plan showing the approximate test boring locations as Figure 3; Logs of Soil Borings as Figures 4 through 9. An explanation of the symbols and classification system used on the logs is included as Figure 10. Appendix A contains information of a general nature regarding project concepts, exploratory methods used during the field phase of our investigation, an explanation of laboratory testing accomplished, and laboratory test results. Appendix B contains *Guide Earthwork Specifications* that may be used in the preparation of contract plans and documents.

PROJECT DESCRIPTION

The project site will be developed with 41 single-family residential lots. Based on our previous experience within project vicinity, we understand the buildings are anticipated to be one- and two-story, wood- framed structures, supported on a Post-Tensioned Slab-on-Grade (PT-Slab) foundation system. Associated development will include exterior flatwork, asphalt concrete roadways, sound walls, and construction of underground utilities.

Earthwork, cuts of up to 2 feet and fills of up to 1 foot, are proposed.

FINDINGS

SITE DESCRIPTION

The project site is located southeast of the intersection of Highway 80 and Havenparke Circle, in Sacramento, California. The site is bounded to the north by Highway 80; to the west by Havenparke Circle, beyond which is the existing Parkebridge single-family residential development; to the east by vacant property; and, to the south by the existing Parkebridge single-family residential development, Parkechannel Way, and an existing drainage basin. At the time of our site investigation on January 14, 2025, the site appeared to have recently been disced. A debris pile was observed in the approximate area proposed to support Lot 18. Standing water was observed within on the areas proposed to support Lots 1 through 4. A fence line was observed along the northern site border.

The site topography is essentially level. Review of the Preliminary Plans indicates surface elevations of the site range from approximately +12 to +14 feet relative to mean sea level (msl).

SITE HISTORY

We reviewed historical aerial photographs of the site from Google Earth and *Historicalaerials.com* in 1947, 1957, 1964, 1966, 1984, 1993, 1998, from 2002 through 2016, and from 2018 through 2024. The site is in agricultural use in the 1947 photograph. Review of aerial photographs taken in 1957, 1964, 1966, 1984, 1998, and 2002 through 2007 indicates the site has remained relatively unchanged since 1947. Review of an aerial photograph taken in 2007 indicates earthmoving activities immediately west and south of the site (existing Parkebridge residential development) have taken place. Review of aerial photographs taken between 2018 to 2024 indicates the site has remained relatively unchanged since 2007, with exception of periodic discing at the site and the construction of the Parkebridge residential development that has taken place between 2018 and 2020 adjacent to the site.

SITE GEOLOGY

The California Geological Survey (CGS) *Preliminary Geologic Map of the Lodi 30'x60' Quadrangle, California*, (Figure 2) indicates the majority of the project site is underlain by the Holocene basin deposits (Map Symbol: Qhb), described as fine-grained sediments deposited by standing or slow-moving water in topographic lows. The southwest corner of the site is underlain by the Holocene alluvium (Map Symbol: Qha), described as sand, gravel, and silt.

SUBSURFACE SOIL CONDITIONS

The subsurface soil conditions encountered by our test borings generally consist of fat clays to approximate depths of 2 to 4½ feet bgs, underlain by lean clays and clayey sands to depths of 4 to 7 feet bgs. These strata are underlain predominantly by interbedded layers of silty sands, sandy silts, and poorly graded sands to the maximum depth explored of 20 feet bgs.

For more details regarding the soil conditions at specific locations, please refer to the Logs of Soil Borings on Figures 4 through 9.

Please note that subsurface conditions within the soil borings are representative of the soil conditions at the time of exploration and at the specific location. It should be expected that soil conditions across the site can and will vary laterally and vertically from the soils encountered during our investigation.

GROUNDWATER

Perched groundwater was encountered on January 14, 2025 in two borings, D2 and D4, at depths of 8½ and 16 feet bgs, respectively.

Review of the *Depth to Groundwater Maps* produced by the California Department of Water Resources for the period from 2011 through 2023 indicates that the shallowest and deepest depths to groundwater were 35 feet and 50 feet, respectively.

Groundwater levels may fluctuate beneath the site depending on the time of year and rainfall amounts. Therefore, groundwater conditions presented in this report may not be representative of those which may be encountered during or subsequent to construction.

CONCLUSIONS

FOUNDATION SUPPORT

The surface soils across the site have been disturbed by previous agricultural and discing operations. Thorough re-compaction of the upper soils, which have been disturbed by agricultural discing, will be crucial to providing uniform support for the planned residential structures.

Specific recommendations for processing and re-compaction are presented in the SITE PREPARATION section of this report.

In our opinion, the undisturbed native soils and properly placed engineered fill are capable of supporting the proposed improvements provided the further recommendations regarding site preparation and soils compaction are followed.

EXPANSIVE SOILS

The results of our subsurface exploration indicate the near-surface fat clays are soils with a high expansion potential when tested in accordance with the ASTM D4829 test method (see Figures A1 and A2). These clays, when present within the upper portion of the building pads, are capable of exerting significant expansion pressures on building foundations and exterior flatwork with variations in soil moisture content, which must be considered in design and construction. Specific recommendations to reduce the effects of expansive soil are presented in this report.

Additionally, finished graded subgrades left undeveloped during dry periods may develop desiccation cracks. Desiccation cracking may lead to differential settlement, or heaving upon wetting. To reduce the potential for this condition, finished subgrade may require periodic watering to maintain moist soil conditions prior to constructing foundations, slabs-on-grade, and pavements. Constructing improvements over desiccated subgrade soils should be avoided.

SEISMIC SITE CLASS

Based on the results of our field investigation and our previous experience in the vicinity of the site, it is our opinion that the on-site soils should be designated as Site Class D in determining seismic forces for this project in accordance with Table 1613.3.2 of the 2022 CBC.

SEISMIC CODE PARAMETERS

The 2022 CBC Seismic Design Parameters have been generated using the SEAOC/OSHPD Seismic Design Maps Tool (*https://seismicmaps.org/*). This web-based software application calculates seismic design parameters in accordance with ASCE 7-16 and 2022 CBC. The results indicate a mapped S1 value of 0.255. Per Section 11.4.8, a site-specific ground motion study should be performed in accordance with Section 21.2 of ASCE 7-16 for Site Class D sites with S1 value greater than or equal 0.2.

Supplement 3 to Section 11.4.8 of ASCE 7-16 includes an exception from such analysis for specific structures on Site Class D sites.

EXCEPTION: *A ground motion hazard analysis is not required where the value of the parameters SM1 determined by Eq (11.4-2) is increased by 50% for all applications of SM1 in this*

Standard. The resulting value of the parameter m determined by Eq. (11.4-4) shall be used for all applications of SD1, in this Standard.

The commentary for Section 11 of ASCE 7-16 (Page 534 of Section C11.4.8 of ASCE 7-16) states that "In general, this exception effectively limits the requirements for site-specific hazard analysis to very tall and or flexible structures at Site Class D sites." Based on our understanding of the proposed structures, it is our assumption that the exception in Section 11.4.8 applies to the proposed structures. However, the structural engineer should verify the applicability of this exception.

Based on this exception, the spectral response accelerations presented below were calculated using the site coefficients (Fa and Fv) from Tables 1613.2.3(1) and 16132.3(2) presented in Section 1613.2.3 of the 2022 CBC.

Table 1 - 2022 CBC Seismic Design Parameters*

Latitude: 38.6389° N Longitude: 121.4851° W	ASCE 7-16 Table/Figure	2022 CBC Table/Figure	Factor/ Coefficient	Value
Short-Period MCE at 0.2	Figure 22-1	Figure 1613.2.1(1)	S_S	0.548
1.0 Period MCE	Figure 22-2	Figure 1613.3.1(2)/ Figure 1613.2.1(3)	S_1	0.248
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	1.362
Site Coefficient	Table 11.4-2	Table 1613.2.3(2)	F_v	2.104
Adjusted MCE Spectral Response Parameters	Equation 11.4-1	Equation 16-36/ Equation 16-20	S_{MS}	0.746
	Equation 11.4-2	Equation 16-37/ Equation 16-21	S_{M1}	0.783**
Design Spectral Acceleration Parameters	Equation 11.4-3	Equation 16-38/ Equation 16-22	S_{DS}	0.497
	Equation 11.4-4	Equation 16-39/ Equation 16-23	S_{D1}	0.522**

* Calculated using USGS computer program U.S. Seismic Design Maps and the site latitude and longitude.
** Values calculated by linear interpolation.
MCE – Maximum Considered Earthquake
g – Acceleration due to gravity
** Increased by 50 percent.

Site-specific ground response and ground motion hazard analyses, and/or time history analyses were not part of our work scope.

Liquefaction Potential

Liquefaction is a soil strength and stiffness loss phenomenon that typically occurs in loose, saturated cohesionless sands as a result of strong ground shaking during earthquakes. The potential for liquefaction at a site is usually determined based on the results of a subsurface Geotechnical investigation and the groundwater conditions beneath the site. A full liquefaction analysis was beyond our scope of work performed for this project; however, based on the relative densities of the soils, it is our opinion that the potential for liquefaction occurring beneath this site is low. The site is not located within a State Designated Seismic Hazard Zone for liquefaction (Unevaluated Area).

Excavation Conditions

Based on our field investigation, the native soils on the site should be readily excavatable with conventional earthmoving and trenching equipment typically used in the area. Excavations encountering dense soils will be slower to excavate; although, special trenching and excavation equipment are not anticipated for this project. The on-site excavations will be subject to sloughing and caving when cohesionless or saturated soils are exposed, requiring sloped excavations to reduce the effects of sidewall stabilities.

Excavations deeper than five feet that will be entered by workers should be sloped and/or braced in accordance with current OSHA regulations. 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. If material is stored or heavy equipment is operated near an excavation, stronger shoring would be needed to resist the extra pressure due to the superimposed loads.

Fill Material Suitability

The on-site soils are considered suitable for use as engineered fill provided the materials are free of roots, rubble, organic materials, other deleterious debris and are at a suitable moisture content to achieve the desired degree of compaction. Removal of rubble and debris from on-site soils may require laborers handpicking the fill materials.

PAVEMENT SUBGRADE QUALITY & SUPPORT

Based on our previous experience, the near-surface soils are anticipated to be relatively poor-quality materials for the support of asphalt concrete pavements possessing Resistance ("R-") values of less than 5. It is our opinion that an R-value of 5 for the untreated subgrade is considered appropriate for the design of pavements at this site.

Chemical treatment of the near-surface clay soils would result in a substantial improvement to the support characteristics of the soil subgrade, and reduce the required thickness of the base materials by increasing the R-value. Chemical treatment can also be used to reduce the moisture content of near-saturated soils to facilitate grading operations. Based on our review of the requirements presented in the *City of Sacramento, Design and Procedures Manual, Section 15 – Street Design Standards*, an R-value of 30 should be utilized for the design of pavements constructed on a chemically treated subgrade.

If chemical treatment will be considered, it will be important that the subgrade soils be tested and evaluated after initial grading to determine the most appropriate treatment options based on the exposed soil conditions.

The performance of chemically stabilized soils is very dependent on adequate and uniform mixing of the selected products into the subgrade soils and providing a proper curing period following compaction. An experienced soil stabilization contractor combined with a comprehensive quality control program is essential to achieve the best results with chemically treated subgrades.

Preliminary recommendations for chemical treatment are presented in the PAVEMENT DESIGN section of this report.

SOIL CORROSION POTENTIAL

Two representative soil samples were submitted to Sunland Analytical Lab, Inc. for testing to determine pH, resistivity, and sulfate and chloride concentrations to help evaluate the potential for corrosive attack upon reinforced concrete. Results of the corrosion testing performed by Sunland Analytical Lab are summarized in Table 2.

Table 2 – Soil Corrosivity Testing				
Sample Identification	CA DOT Test #643 Modified (Sm. Cell)		CA DOT 417	CA DOT 422
	pH	Minimum Resistivity	Chloride	Sulfate
D3 (½ – 1½’)	5.53	1,340 Ω-cm	3.7 ppm	21.9 ppm
D4 (½ – 1½’)	5.73	1,390 Ω-cm	18.4 ppm	24.4 ppm

* = Small cell method, Ω-cm = ohm-centimeters, ppm = parts per million

The California Department of Transportation Corrosion Technology Section, Office of Materials and Foundations, Corrosion Guidelines Version 3.2, 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 1,500 ppm, or the pH is 5.5 or less. Based on this criterion, the on-site soils are not considered corrosive to reinforced concrete.

Acidic (low pH) conditions can cause discoloration of the concrete surface resulting in a yellowish or rust color distributed over the concrete surface. Caltrans corrosion guidelines indicate soils with a pH at or below the 5.5 threshold will require the use of Type II modified or Type V cement. The mix is to be a seven-sack mix, with 25% fly ash and a water cement ratio of no more than 0.40. This would result in an increase in cost of the foundations, slab, and flatwork concrete at the site. These are guidelines to help mitigate the low pH onsite soils.

Table 19.3.1.1 – *Exposure Categories and Classes,* American Concrete Institute (ACI) 318-19, Section 19.3, as referenced in Section 1904.1 of the 2022 CBC, indicates the severity of sulfate exposure for the samples tested is *not a concern.*

Mid Pacific Engineering, Inc. are not corrosion engineers. Therefore, to further define the soil corrosion potential at the site, or to determine the need or design parameters for cathodic protection or grounding systems, a corrosion engineer should be consulted.

Import fills, if used for construction, should be sampled and tested to verify the materials have corrosion characteristics within acceptable limits and generally should be similar to the tested on-site soils.

GROUNDWATER

It is possible that perched or seepage water may be present within excavations, as shallow as 5 feet bgs, depending upon the time of year when construction takes place. The need for dewatering of excavations can best be determined during site work when subsurface conditions are fully exposed. Localized dewatering, if required, can likely be accomplished by using sump pumps.

Based on the historical depth to groundwater, the permanent groundwater table should not be a factor in the design and construction of the improvements.

SEASONAL WATER

The near-surface soils will be in a near-saturated condition during and for a significant time following the rainy season due to rainwater being unable to penetrate through the near the surface low permeable soils. Earthwork operations attempted following the onset of the rainy season and prior to prolonged periods of warm dry weather, the near-surface soils will be at a high soil moisture content where significant aeration or chemical-treatment may be required to dry the soils to a moisture content where the specified degree of compaction can be achieved. The contractor should anticipate the additional time and effort necessary to achieve a compactable moisture content.

Seasonal moisture and landscape irrigation will result in high soil moisture contents below interior floor slabs throughout their lifetime. Moisture vapor penetration resistance should be a significant consideration in design and construction of interior floor slabs.

RECOMMENDATIONS

We consider it essential that our office review final site, grading, and structural foundation plans to verify the applicability of the following recommendations, and to provide supplemental recommendations, as conditions dictate.

The recommendations presented below are appropriate for typical construction in the late spring through fall months. The on-site soils likely will be saturated by rainfall in the winter and early spring months and will not be compactable without drying by aeration or the addition of lime (or a similar product) to dry the soils. Should the construction schedule require work during wet conditions, additional recommendations can be provided, as conditions dictate.

SITE CLEARING

Initially, the site should be cleared of debris stockpiles.

Depressions resulting from clearing operations and any other loose, disturbed, soft or otherwise unstable materials should be removed to expose a firm, undisturbed soils prior to backfilling with properly placed and compacted engineered fill to restore the areas back to the required grades.

SURFACE VEGETATION REMOVAL

Following site clearing operations, remaining areas should be stripped of surface vegetation and organically contaminated topsoil; strippings may be stockpiled for later use in landscape areas or disposed of off-site. Strippings should not be used in general fill construction, but may be used in landscaped areas, provided they are kept at least five feet from the building pads, exterior flatwork and pavements, and moisture conditioned and compacted. Strippings should not be used in landscaped berms that will support sound walls, retaining walls, concrete flatwork, or other at-grade structure.

Discing of the organics into the surface soils may be a suitable alternate to stripping, depending on the condition and quantity of the organics at the time of grading. ***The decision to utilize discing in lieu of stripping should be made by the Geotechnical Engineer, or their representative, at the time of earthwork construction***. Prior to discing, if approved, and determined to be acceptable by our onsite representative, vegetation should be mowed and baled or raked off the site. Discing operations, if approved, should be observed by the Geotechnical Engineer, or their representative, and be continuous until the organics are adequately mixed into the surface soils to provide a compactable mixture of soil containing minor amounts of organic matter. Pockets or concentrations of organics will not be allowed.

Site Preparation

Following site clearing and surface vegetation removal activities, the structural areas of the site achieved by cut or left at the grade and areas to receive fill should then be scarified to a depth of 12 inches, uniformly moisture conditioned to achieve at least two percent above optimum moisture content and compacted to at least 90 percent of the ASTM D1557 maximum dry density. Compaction should be performed using a heavy, self-propelled sheepsfoot compactor (minimum Caterpillar 815 or equal size compactor).

If desiccation cracks are present at the time of grading, the site should be moisture conditioned (pre-watered) to close the cracks to within the depth of scarification.

Site compaction should extend at least five feet beyond the proposed structure lines. Compaction of the existing grade must be performed in the presence of our representative who will evaluate the performance of the subgrade under compactive loads and identify any loose or unstable soil conditions that could require additional excavation. We consider it essential that our representative be on-site continuously during site preparation operations for this reason. Loose, soft or saturated soil deposits encountered below the depth of scarification during compaction operations should be removed to expose firm undisturbed soils as identified by our representative and backfilled with engineered fill as recommended in this report.

Difficulty in achieving subgrade compaction or unusual soil instability may be indications of loose fills associated with past subsurface items such as foundations, wells, septic systems, utility lines. Should these conditions exist, the materials should be excavated to check for subsurface structures and the excavations backfilled with engineered fill. We recommend construction bid documents contain a unit price (price per cubic yard) for all excess excavation due to unsuitable materials and replacement with engineered fill.

ENGINEERED FILL CONSTRUCTION

On-site soils will be suitable for engineered fill construction, if free from rubbish, rubble greater than three inches, and organic concentrations.

Imported fill materials, if required, should be approved by our office prior to being transported to the site and be free of particles greater than three inches in maximum dimension.. Also, if import fills are required (other than aggregate base) the contractor should provide appropriate documentation for imported fill materials indicating the materials are free of known contamination and possess similar corrosion characteristics as tested for the project site.

Engineered fill composed of on-site or approved imported soils should be placed in lifts not exceeding six inches in compacted thickness, with each lift being moisture conditioned to at least two percent above the optimum moisture content and uniformly compacted to at least 90 percent relative compaction. The relative compaction and moisture content should be based on the ASTM D1557, maximum dry unit weight and optimum moisture content. Fill materials should be uniformly and thoroughly moisture conditioned to the full depth of each lift. Compactive effort should be applied uniformly across the full width of the fill. Additional passes with the compactor shall be added, as required by the Geotechnical Engineer, to achieve a firm, stable and unyielding subgrade condition.

The upper 12-inches of final building pad subgrades should be brought to at least two percent above the optimum moisture content and uniformly compacted to at least 90 percent of the maximum dry density.

The upper 12-inches of untreated pavement subgrades should be brought to at least the optimum moisture content and uniformly compacted to at least 95 percent of the maximum dry density. Final pavement subgrade preparation and compaction should be performed just prior to placement of aggregate base, after construction of underground utilities is complete. The completed pavement subgrades must be proof-rolled and stable under construction traffic prior to placement of aggregate base. The completed aggregate base section must be proof-rolled and stable under construction traffic prior to placement of asphalt or Portland cement concrete.

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. As a minimum, erosion control measures including placement of straw bale sediment barriers or construction of silt filter fences in areas where surface run-off may be concentrated would be prudent. Slopes should be over-built and cutback to design grades and inclinations.

All earthwork operations should be accomplished in accordance with the recommendations of this section and the appended *Guide Earthwork Specifications*. A representative of the Geotechnical Engineer must be present during site clearing and preparation, grading operations, to perform compaction testing and observe grading to verify compliance with the recommendations of this report.

Utility Trench Backfill

Utility trench backfill within structural building areas should be mechanically compacted as engineered fill in accordance with the following recommendations. We recommend that native soil be used as trench backfill within the perimeter of the building foundations to help minimize soil moisture variations beneath the structures. The native soil backfill should extend at least three feet horizontally beyond perimeter foundation lines. Utility trench backfill should be placed in maximum six-inch lifts, moisture conditioned to near the optimum moisture content and mechanically compacted to at least 90 percent of the maximum dry density as determined by ASTM D1557.

The upper 12 inches of trench backfill in lime-treated structural areas should consist of 95 percent compacted Class 2 aggregate base (AB).

Utility trench backfill should be placed in maximum 12-inch lifts, moisture conditioned to at the optimum moisture content and mechanically compacted to at least 90 percent of the maximum dry density as determined by ASTM D1557.

Trench backfill materials and compaction within existing street right-of-ways should conform to the applicable portions of the current City of Sacramento Standard Specifications, latest edition.

Backfill within existing streets should consist of Class II AB, moisture conditioned to at least optimum moisture content and mechanically compacted to at least 95 percent of ASTM D1557.

We recommend that all underground utilities be designed to allow for a minimum of 12 inches of compacted engineered fill above the utility shading section.

We recommend that our representative be on-site throughout the trench backfill operations to evaluate the moisture content and stability of the backfill materials and test the compacted trench backfill in accordance with the project specifications and the City of Sacramento Standard Specifications, latest edition.

We recommend that underground utility trenches that are aligned nearly parallel with foundations be at least three feet from the outer edge of foundations, wherever possible. As a general rule, trenches should not encroach into the zone extending outward at a 1:1 inclination below the bottom of the foundations. Additionally, trenches parallel to 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.

FOUNDATION DESIGN

Based upon the results of our investigation and our knowledge and experience with similar projects in the area, we recommend the proposed residential structures be supported on post-tensioned (PT) slabs. The PT slabs should be designed utilizing the soil related parameters below.

We are providing design soil values for the analysis of the foundations, and suggested minimums, but only from a Geotechnical Engineering perspective. The project Structural Engineer should determine final post-tensioned slab thickness, foundation design width and depth dimensions and concrete strengths and reinforcing requirements, based on their specific structural design which should include an appropriate factor of safety applied to the overall design based on the risk tolerance of the Builder.

Utilizing soil parameters obtained from our laboratory testing, we have computed the following post-tensioned concrete foundation/floor slab system design parameters. Specific design of post-tensioned foundation/slab systems should be performed by a qualified structural engineer using the geotechnical engineering design parameters provided in Table 4, which were derived from the results of laboratory tests and guidelines contained in the *Post-Tensioning Institute Design Manual (Third Edition).*

Table 3 - PT Slab Design Parameters	
1.	Thornthwaite Moisture Index = -20
2.	Average Edge Moisture Variation Distance (Em): Center Lift = 5.3 feet Edge Lift = 3.2 feet
3.	Plasticity Index = 36
4.	Plastic Limit = 27
5.	Liquid Limit = 65
6.	Percent Clay = 50.5% (≤ 0.002 mm)
7.	Zone = III
8.	Approximate Depth to Constant Moisture = 5.0 feet
9.	Approximate Soil Suction = 3.9 pF
10.	Anticipated Swell (Ym): Center Lift = 0.8 inches Edge Lift = 3.25 inches

The post-tensioned slab foundation should not exert more than 1,000 pounds per square foot (psf) on the building pad soils for the dead plus live load conditions, with a one-third increase to include the short-term effects of seismic or wind forces.

Our experience has been that post-tensioned foundations used in this manner typically consist of a minimum 10-inch thick (uniform) slab deepened to 12 inches at the perimeter. Design of post tensioned foundation/floor slab systems should be accomplished by an experienced Structural Engineering Firm. Although the 10-inch post-tensioned slabs are commonly used in this area, other designs may be applicable. If alternate designs are being considered, additional design recommendations can be provided. The Structural Engineer should determine the need for, and design of, a deeper/thicker, steel reinforced perimeter foundation to help reduce excessive edge lift that may result from eccentricities in design and/or construction.

Due to the presence of expansive soil conditions, moisture conditioning of subgrade soils prior to placement of floor slab concrete is considered essential. Immediately prior to slab concrete placement, the subgrade soils, to a depth of 12 inches, should be brought to a uniform, near-saturated moisture condition by liberal water or sprinkling. ***Slab subgrade moisture condition should be field checked by our representative for each building pad within 48 hours prior to slab placement.***

Moisture protection may be provided by the use of a durable plastic membrane (at least 10-mils thick) placed directly on the compacted soil subgrade, covered with an optional layer of damp, clean sand. The plastic membrane should meet or exceed the minimum specifications for vapor barrier membranes as described in ASTM E1745. Consideration should be given to using a thicker, higher quality membrane for additional moisture protection such as a 15-mil thick Stego vapor barrier or other product. The membrane should be installed so that there are no holes or uncovered areas. All seams should overlap and be sealed with manufacturer-approved tape, continuous at the laps to create vapor tight conditions. All perimeter edges of the membrane, such as pipe penetrations, interior and exterior footings, joints, etc., should be sealed or caulked per manufacturer's recommendations.

Areas adjacent to foundations and exterior flatwork should be landscaped to maintain more uniform soil moisture conditions adjacent to and under the slabs. We recommend that final landscaping plans not allow fallow ground adjacent to concrete slabs. From a Geotechnical standpoint, we consider drip-irrigated landscaping most similar to fallow ground. This type of drought resistant landscaping does little to maintain a high or consistent moisture content in the soils, and results in moisture variations similar to fallow ground. The developer and their landscape designer should balance the benefits and potential impacts of such landscaping on the performance of slabs.

FLOOR SLAB MOISTURE PENETRATION RESISTANCE

Pre-saturation of the subgrade soils prior to slab placement will result in wet floor slab subgrade soils. For this reason, it should be assumed that all slabs in living areas, as well as those intended for moisture-sensitive floor coverings or materials, require protection against moisture or moisture vapor penetration. Standard practice includes the sand/gravel and vapor retarder membrane as suggested above. However, the sand/gravel and plastic membrane offer only a limited, first-line of defense against soil-related moisture. Recommendations contained in this report concerning foundation and floor slab design are presented as *minimum* requirements, only from the geotechnical engineering standpoint.

It is emphasized that the use of a membrane below the slab will not "moisture proof" the slab, nor does it assure that slab moisture transmission levels will be low enough to prevent damage to floor coverings or other building components. If increased protection against moisture vapor penetration of slabs is desired, a concrete moisture protection specialist should be consulted. It is commonly accepted that maintaining the lowest practical water-cement ratio in the slab concrete is one of the most effective ways to reduce future moisture vapor penetration of the completed slabs. The architect and design team should consider all available measures for slab moisture protection.

SOUND WALL FOUNDATION DESIGN

Conventional Shallow Foundations

The proposed sound walls may be supported upon continuous foundations extending at least 30 inches below lowest adjacent soil grade.

Foundations so established may be sized for a maximum allowable soil pressure of 2,000 pounds per square foot (psf). This value can be increased by one-third to consider the short-term effects of seismic or wind forces.

Continuous foundations should be at least 12 inches wide. The weight of the foundation concrete extending below adjacent soil grade may be disregarded in sizing computations.

We recommend that all foundations be adequately reinforced to provide structural continuity, mitigate cracking and permit spanning of local soil irregularities. As a minimum, continuous foundations should contain at least four No. 4 steel reinforcing bars, placed two each, near the top and bottom of the foundations. The project designer should determine the need for additional reinforcement based on structural requirements.

We are providing design soil values for the analysis of the foundations, and suggested minimums for dimensions, but only from a Geotechnical Engineering perspective. The project Structural Engineer should determine final foundation design width and depth dimensions as well as concrete strength and reinforcing requirements, based on their specific structural design, which should include an appropriate factor of safety applied to the overall design.

Resistance to lateral loads will be provided by passive earth pressure and base friction. For footings bearing against compacted fill, allowable passive earth pressures may be considered to be developed at a rate of 200 psf per foot of depth. Allowable base friction may be computed using a friction coefficient of 0.20 between cast-in-place concrete and underlying engineered fill soils or partially cemented soils. A factor of safety of 2.0 was applied to passive earth pressure and 1.5 applied to the friction coefficient. Due to the high expansion potential of the on-site clays, the upper 12 inches of subgrade should be disregarded in computation of passive resistance.

The allowable values of base friction and passive earth pressure may be combined without further reduction. Allowable passive resistance may be increased by one-third to consider the short-term effects of seismic or wind forces.

Passive resistance should be computed below a depth at which at least five feet of soil is present in front of the foundation, as measured horizontally from the exterior edge of the foundation.

Foundation excavations must be observed by a representative of MPE to verify competent and uniform bearing conditions and evaluate the need for any modifications to these recommendations as may be required by specific circumstances. The observations must take place prior to placement of reinforcing steel or forms but following cleaning of the excavations. To account for any re-compaction of foundation bottoms or deepening of foundations that might be required, we suggest bid documents include a unit price for additional compaction or foundation excavation and concrete that may be required.

Pier Foundation System

Alternatively, the proposed soundwalls may be supported on a drilled pier foundation system utilizing the parameters provided in the PIER FOUNDATIONS section of our report.

PIER FOUNDATIONS

Based upon results of our investigation and our experience with similar projects, we anticipate sound walls and pole-mounted lights used near walkways will be supported upon drilled, cast-in-drilled-hole (CIDH) reinforced concrete piers. Piers for support of sound walls and pole-mounted lights should be at least 18 inches in diameter and extend at least six feet below lowest adjacent soil grade. Drilled pier foundations should be structurally isolated from any adjacent concrete flatwork by a felt strip or similar material.

Drilled piers may be sized utilizing a maximum allowable vertical bearing capacity of 2,000 psf and an allowable skin friction of 100 psf for dead plus live loads, which may be applied over the surface of the pier. Those values may be increased by one-third to include short-term wind or seismic forces. The weight of foundation concrete below grade may be disregarded in sizing computations.

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 100 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.

Due to the high expansion potential of on-site clays, the upper 12 inches of skin friction should be neglected unless the pier is completely surrounded by slab concrete or pavements for a distance of at least three feet from the edge of the foundation pier.

Sizing of piers to resist lateral loads can be evaluated using Section 1807.3.2 of the 2022 CBC. A value of 100 pcf as defined in Table 1806.2 of the CBC may be used for the lateral bearing pressure of the on-site soils, as the coefficients S1 and S3 for the non-constrained and constrained conditions, respectively. Per Section 1806.1 of the 2022 CBC, an increase of 1/3 is permitted when using the alternate load combinations in Section 1605.3.2 that include wind or earthquake loads. The upper 12 inches of the subgrade should be neglected for the non-constrained condition.

Reinforcement and concrete should be placed in the pier excavations as soon as possible after excavation is completed 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.

To minimize the amount of sidewall caving, we recommend that a maximum elapsed time of 48 hours between completion of the pier excavation and the start of concrete placement. The bottom of the pier excavations should be free of loose or disturbed soils prior to placement of the concrete. Cleaning of the bearing surface should be verified by the geotechnical engineer prior to concrete placement.

To reduce lateral movement of the drilled shafts, it is necessary to place the concrete for the drilled shafts in intimate contact with the surrounding soil. Any voids or enlargements in the shafts due to excavation or temporary casing installation shall be filled with concrete at the time shaft concrete is placed.

We estimate total settlement for drilled pier foundations using the recommended maximum net allowable bearing pressure and skin friction presented above, should be less than one inch. The settlement estimate is based on the available soil information, our experience with similar structures and soil conditions, and field verification of suitable bearing soils during foundation construction.

It is considered essential that our representative be present during pier drilling to verify adequate depth of penetration into competent bearing soils. Concrete reinforcing steel should not be placed in any pier excavation until approved by our representative.

EXTERIOR FLATWORK (NON-PAVEMENT AREAS)

The on-site soils are expansive clays; therefore, exterior flatwork (including driveways) will experience seasonal movement and some cracking and/or differential vertical off-set. Below are alterative recommendations to help reduce, but not eliminate, seasonal movement and/or cracking of exterior flatwork.

Exterior flatwork subgrades should be properly compacted to at least 88 percent of the maximum ASTM D1557 dry unit weight at a moisture content of at least the optimum moisture content for granular soils, and at least three percent above the optimum moisture content for clay soils and maintained in that condition.

The most effective way to reduce cracking of exterior flatwork due to expansive soil conditions is to remove and replace the upper 12 inches of soils within the flatwork areas with at least 12 inches of granular (non-expansive) soils. Providing a minimum 12-inch layer of non-expansive fill is more costly but would provide more consistent performance, less maintenance, and likely less risk.

Exterior concrete flatwork supported directly on the native clay soils will be subject to seasonal shrink-swell cycles and potential distress. Moisture conditioning of the soil subgrades to an over optimum moisture content prior to concrete placement and use of thickened (turned-down) edges is (based on our experience) the most common and least costly option to help reduce (but not eliminate) the risk.

If the clays are not removed and replaced, we offer the following alternate recommendations to help reduce (but not eliminate) the impact of the clays on the performance of the slabs. Our recommendations are intended to reduce the effects of expansive soil subgrade conditions in exterior concrete flatwork areas. However, seasonal movement of exterior flatwork should be anticipated due to the inability to completely eliminate soil movement in expansive soil areas.

Prior to concrete placement, thorough moisture conditioning of subgrade soils (to an over optimum moisture content) is important to reduce the risk of non-uniform moisture withdrawal from the concrete and the possibility of plastic shrinkage cracks. Where clay soils are present, the moisture content of the subgrade soil prior to concrete placement should be at least 3 to 5 percent above optimum.

We recommend consideration should be given to thickening the outer edges of exterior slabs to at least twice the slab thickness to provide better edge support and to help reduce variations in moisture content beneath the slabs. Consideration also should be given to reinforcing the slabs with steel reinforcing bars for crack control. Slab thickness and concrete strength and reinforcing should be determined by the project designer; however, as a minimum we recommend slabs be at least 4 inches thick. Consideration should be given to the use of thickened, reinforced driveway slabs. A leveling course of crushed gravel or aggregate base may be placed for support of the concrete; however, the gravel should not exceed the depth of the thickened edge.

Areas adjacent to exterior slabs-on-grade should be landscaped and properly irrigated to maintain more uniform soil moisture conditions adjacent to and under the slabs. We recommend that final landscaping plans not allow fallow ground adjacent to exterior concrete flatwork. Areas adjacent to slabs on grade must not be allowed to remain fallow due the seasonal shrink/swell effects of clay soils.

Practices recommended by the Portland Cement Association for proper placement, curing, joint spacing, construction and placement of concrete should be followed during exterior concrete flatwork construction. Uniform moisture conditioning of subgrade soils is important to reduce the risk of non-uniform moisture withdrawal from the concrete and the possibility of plastic shrinkage cracks. Proper moisture conditioning of the subgrade soils is considered essential to the performance of exterior flatwork. Expansion joints should be provided to allow for minor vertical movement of the flatwork. Exterior flatwork should be constructed independent of perimeter building foundations, except at doorways and garage doors where consideration should be given to providing structural ties to reduce the effects of differential movements.

Sidewalks within City of Sacramento right-of-ways should be designed and constructed in accordance with the latest City of Sacramento standards, as applicable.

The most effective way to eliminate cracking of exterior flatwork due to expansive soil conditions is to remove and replace the upper 12 inches of soils within the flatwork areas with at least 12 inches of granular (non-expansive) soils or aggregate base. Providing a minimum 12-inch layer of non-expansive fill is more costly but would provide more consistent performance, less maintenance, and likely less risk.

If the clays are not removed and replaced, we offer the following alternate recommendations to help reduce (but not eliminate) the impact of the clays on the performance of the slabs. The subgrade soils should be uniformly compacted at a moisture content above the optimum and maintained in an over optimum moisture condition (at least three percent above optimum) prior to concrete placement. Consideration also should be given to reinforcing the slabs with rebar or welded wire fabric for crack control and to thickening the edges to double the slab thickness, especially within driveways.

Our recommendations are intended to reduce the effects of expansive soil subgrade conditions in exterior concrete flatwork areas. However, some seasonal movement of exterior flatwork should be anticipated due to the inability to completely eliminate soil movement in expansive soil areas. Uniform moisture conditioning of subgrade soils is important to reduce the risk of non-uniform moisture withdrawal from the concrete and the possibility of plastic shrinkage cracks.

Areas adjacent to new slabs-on-grade should be landscaped to maintain more uniform soil moisture conditions adjacent to and under the slabs. We recommend that final landscaping plans not allow fallow ground adjacent to exterior concrete flatwork. Areas adjacent to slabs on grade should not be allowed to remain fallow due to the drying shrinkage effects of clay soils.

Practices recommended by the Portland Cement Association for proper placement, curing, joint spacing, construction and placement of concrete should be followed during exterior concrete flatwork construction. Flatwork should be independent of the building foundations and felt strips should be used to separate concrete slabs from adjacent existing concrete structures.

PAVEMENT DESIGN

The following pavement sections have been calculated based on specified traffic indices (TI's), minimum pavement section requirements as indicated in the *City of Sacramento, Design and Procedures Manual, Section 15 – Street Design Standards*, and the procedures contained within Chapters 600 to 670 of the *California Highway Design Manual*, Sixth Edition. The project civil engineer should confirm the traffic indices indicated below based on anticipated traffic conditions. We can provide additional section thicknesses for other TI's, as needed.

Table 4 - Pavement Design Alternatives

Traffic Index (TI)	Untreated Subgrades R-value = 5		Lime-Treated Subgrades (a) R-value = 30	
	Type B Asphalt Concrete (inches)	Class 2 Aggregate Base (inches)	Type B Asphalt Concrete (inches)	Class 2 Aggregate Base (inches)
5.0	4 [A,B]	9 [B]	4 [A,B]	6 [B]
6.0	4 [A,B]	13 [B]	4 [A,B]	6 [B]

A = Asphalt concrete thickness includes the Caltrans Safety Factor
B= Minimum Thickness per *City of Sacramento, Design and Procedures Manual*
(a) = Lime-treated subgrade should be at least 12 inches thick and possess a minimum R-value of 30 when testing in accordance with CT 301.

We emphasize that the performance of the 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 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 6 inches of untreated pavement subgrade soils should be compacted to at least 95 percent relative compaction at no less than the optimum moisture content. All aggregate base should be compacted to at least 95 percent of the maximum dry density.

We recommend that all underground utilities be designed to allow for a minimum of 12 inches of compacted engineered fill above the utility shading section.

Portland Cement concrete pavements for driveways or garage slabs should be at least six inches thick and supported on a compacted soil subgrade and at least six inches of compacted Class 2 aggregate base. We suggest the concrete slabs be constructed with thickened edges in accordance with American Concrete Institute (ACI) design standards. Reinforcing for crack control, if desired, should consist of No. 3 reinforcing bars placed on maximum 18-inch centers each way throughout the slab. Reinforcement must be located at mid-slab depth to be effective. Joint spacing and details should conform with the current PCA or ACI guidelines.

Lime Treatment of Pavement Subgrade Soils

The native clay soils are anticipated to react well with the addition of quicklime (high-calcium or dolomitic) and could enhance the support characteristics of the subgrade and allow for a reduction in the aggregate base section. Chemical treatment of subgrade soils as part of the pavement section would be subject to approval by the City/County of Sacramento and should be performed in accordance with Section 24 of the *Caltrans Standard Specifications*.

<u>For estimating purposes only</u>, we recommend a minimum spread rate of at least 4½ pounds of quicklime per square foot of mixing depth (at least 12 inches). Lime-treated subgrades should be compacted to not less than 95 percent of the ASTM D1557 maximum dry density, at a moisture content of at least two percent above the optimum moisture content.

If chemical treatment alternates are selected for use at this site, additional testing should be performed during construction, to verify that the design parameters are achieved in the field. Samples of the laboratory and field-mixed soil and lime should be collected and tested for minimum unconfined compressive strength of 300 pounds per square inch (psi) when tested in accordance with California Test 373 and a minimum Resistance value of 50 when tested in accordance with California Test 301. This additional testing will either verify the design parameters or provide the opportunity to modify the pavement sections or spread rate based upon the test results.

Pavement Drainage

Efficient drainage of all surface water to avoid infiltration and saturation of the supporting aggregate base and subgrade soils is important to pavement performance. Consideration should be given to using full-depth curbs between landscaped areas and pavements to serve as a cut off for water that could migrate into the pavement base materials or subgrade soils.

Geotextile water barriers also could be used to prevent migration of water into pavement base materials, if extruded curbs are used. Proprietary geotextile moisture barriers and curb details should be reviewed and approved by our office prior to construction. Weep holes are recommended in parking lot drop inlets to allow accumulating water moving through the aggregate base to drain from beneath the pavements.

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 foundations. The grade adjacent to structures should be sloped away from foundations at a minimum two percent. Proper control of surface water drainage is essential to the performance of foundations, slabs-on-grade, and pavements. We recommend using full-roof gutters, with downspouts from roof drains connected to rigid non-perforated piping directed to an appropriate drainage point away from structures, or discharging onto paved surfaces leading away from houses and foundations. Concentrated storm water discharge collected from roof downspouts or surface drains should not be allowed to drain on unprotected slopes adjacent to structures. The ground should be graded to drain positively away from all flatwork and building structures. Ponding of surface water should be avoided near foundations and flatwork. Landscape berms, if planned, should not be constructed in such a manner as to promote drainage toward buildings.

All excavations and fill slopes should be protected from concentrated storm water run-off to minimize potential erosion. Control of water over the slopes may be accomplished by constructing V-ditches near the top of slopes, or by grading the area behind the top of slope to drain away from the slope. Ponding of surface water at the top of slope or allowing sheet flow of water over the top of a slope should be avoided.

Construction Testing and Observation

Site preparation should be accomplished in accordance with the recommendations of this report and the attached *Guide Earthwork Specifications*. Representatives of Mid Pacific Engineering, Inc. (MPE) must be present during site clearing, site preparation and all grading operations to observe and test the fill to verify compliance with our recommendations and the job specifications. These services are beyond the scope of work authorized for this investigation.

In the event that MPE is not retained to provide geotechnical engineering observation and testing services during construction, the Geotechnical Engineer retained to provide this service should indicate in writing that they agree with the recommendations of this report, prepare supplemental recommendations as necessary.

A final report by the "Geotechnical Engineer" should be prepared upon completion of the project indicating compliance with or deviations from this report and the project plans and specifications. Please be aware that the title Geotechnical Engineer is restricted in the State of California to a Civil Engineer authorized by the State of California to use the title "Geotechnical Engineer."

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 best 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 our 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 are considered valid for a period of two years after the date of this report. If design and construction begin after two years, the report should be reviewed and updated as necessary by a Geotechnical Engineer.

Mid Pacific Engineering, Inc.

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CE No. 97381

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FIGURES

NOTES: Adapted from *USGS National Topographic Map, Rio Linda-Quadrangle, California-Sacramento County, 7.5-minute series, 2022.*

MPE
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VICINITY MAP

PARKEBRIDGE EAST

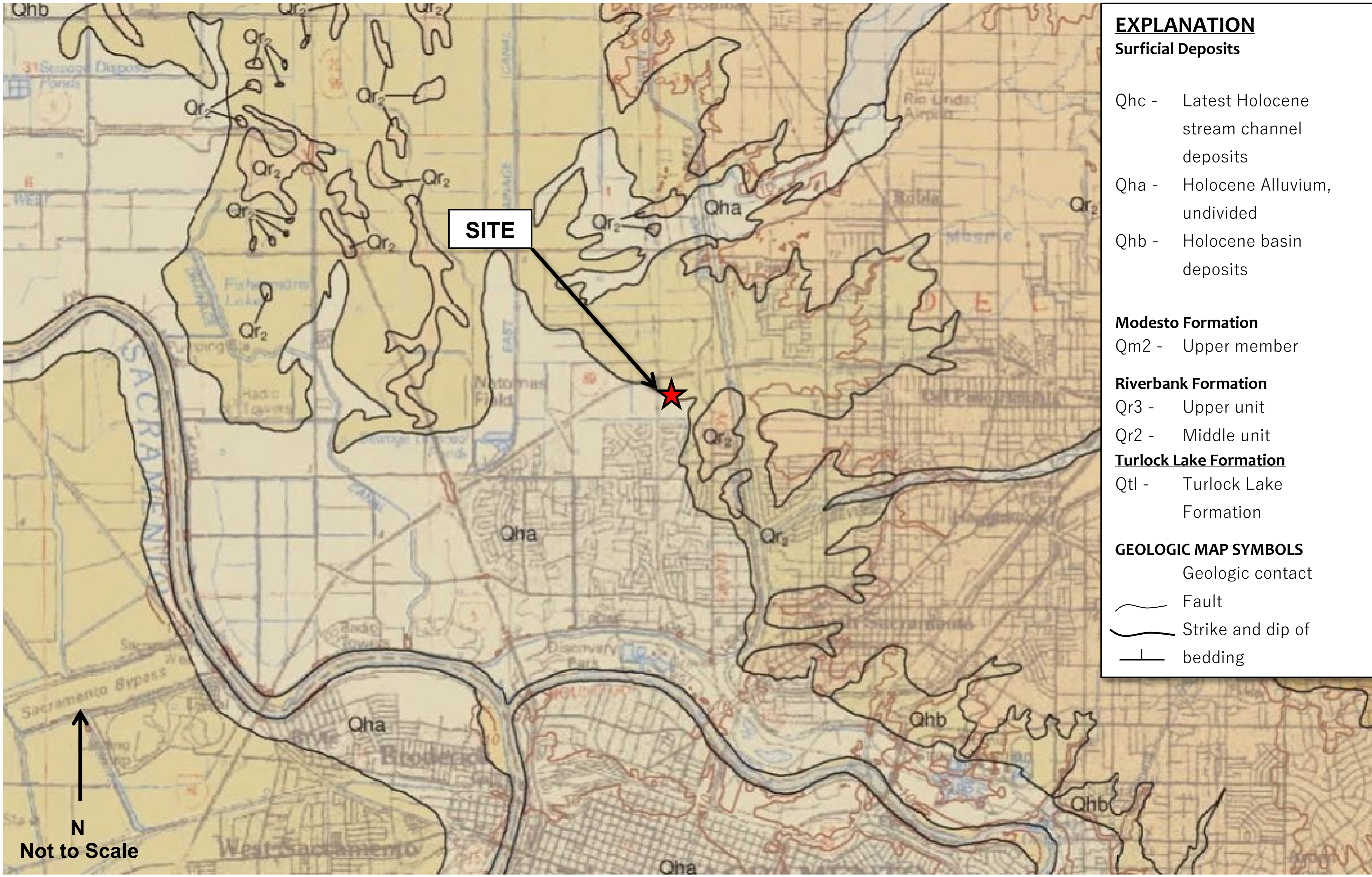
Southeast of the Intersection of Highway 80 and Havenparke Circle

Sacramento, California

FIGURE 1

Date: 01/25

MPE No. 03743-13



Adapted from the *Preliminary Geologic Map of the Sacramento 30 x 60 Minute Quadrangle, California* (Carlos I. Gutierrez, CGS, 2011).

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REGIONAL GEOLOGIC MAP

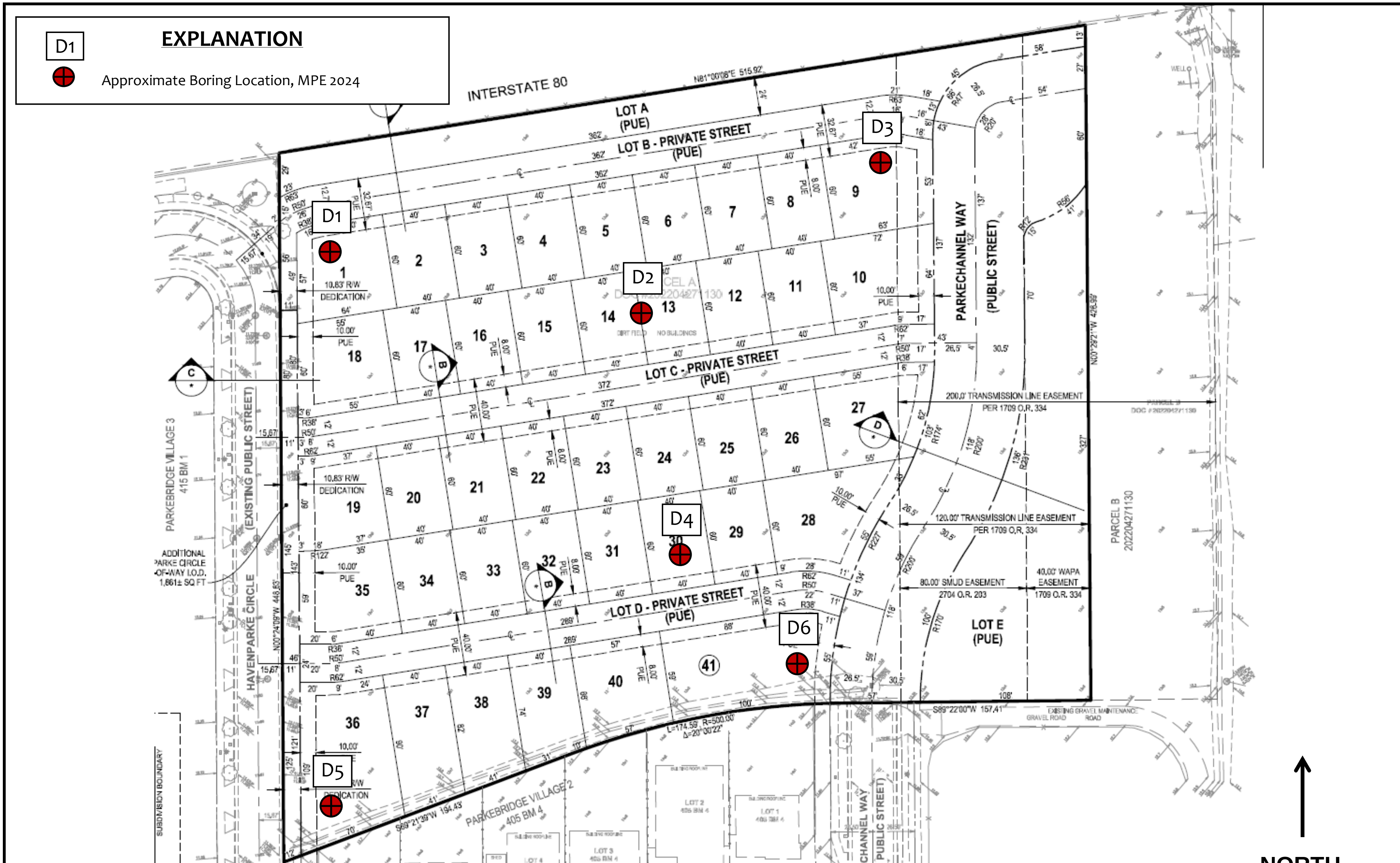
PARKEBRIDGE EAST

Southeast of the Intersection of Highway 80 and Havenparke Circle
Sacramento, California

FIGURE 2

Date: 01/25

MPE No. 03743-13



NORTH
1" – 85'

NOTES: Adapted from *The Tentative Subdivision map for Parkebridge East Subdivision, Sheet TSM-1* prepared by Cunningham Engineering dated July 10, 2024.

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SITE PLAN

PARKEBRIDGE EAST

Southeast of the Intersection of Highway 80 and Havenparke Circle
Sacramento, California

FIGURE 3

Date: 01/25

MPE No. 03743-13

Project: Parkebridge East	LOG OF SOIL BORING D1
Project Location: Southeast of the Intersection of Highway 80 and Havenparke Circle, Sacramento, California	
MPE Number: 03743-13	Sheet 1 of 1

Date(s) Drilled	1/14/2025	Logged By	JMM	Checked By	VVP
Drilling Method	Solid Flight Augers	Drilling Contractor	West Coast Exploration	Total Depth of Drill Hole	9 Feet
Drill Rig Type	Mobile B-24	Diameter(s) of Hole, inches	5 Inches	Approx. Surface Elevation, ft MSL	
Groundwater Depth [Elevation], feet	Not Encountered	Sampling Method(s)	140 Lb Hammer/30" Drop	Drill Hole Backfill	Soil Cuttings
Remarks					

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	BLOWS PER FOOT	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Dark Brown, moist, stiff, fat clay (CH)		D1-1	15	32.5	82	UCC 1.2 tsf
			Olive-Brown, moist, very hard, lean clay (CL)		D1-2	73			
	5								
			Brown, moist, very dense, fine, silty sand (SM)		D1-3	>100			
	10								
	15								
	20								
	25								

Project: Parkebridge East		LOG OF SOIL BORING D2
Project Location: Southeast of the Intersection of Highway 80 and Haveparke Circle, Sacramento, California		
MPE Number: 03743-13		Sheet 1 of 1

Date(s) Drilled	1/14/2025	Logged By	JMM	Checked By	VVP
Drilling Method	Solid Flight Augers	Drilling Contractor	West Coast Exploration	Total Depth of Drill Hole	10 Feet
Drill Rig Type	Mobile B-24	Diameter(s) of Hole, inches	5 inches	Approx. Surface Elevation, ft MSL	
Groundwater Depth [Elevation], feet	Initial: 8½ Feet; Final: 8½ Feet	Sampling Method(s)	140 Lb Hammer/30" Drop	Drill Hole Backfill	Soil Cuttings
Remarks					

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	BLOWS PER FOOT	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
	0–4.5		Dark Brown, moist, very stiff, fat clay (CH)		D2-1	25	23.3	90	
			hard		D2-2	38			
	5		Dark Gray, moist, lean clay (CL)						
			Brown, moist, very dense, fine, sandy silt (ML)						
			wet, very dense		D2-3	76			
	10								
	15								
	20								
	25								

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FIGURE 5

Project: Parkebridge East		LOG OF SOIL BORING D3
Project Location: Southeast of the Intersection of Highway 80 and Havenparke Circle, Sacramento, California		
MPE Number: 03743-13		Sheet 1 of 1

Date(s) Drilled: 1/14/2025	Logged By: JMM	Checked By: VVP
Drilling Method: Solid Flight Augers	Drilling Contractor: West Coast Exploration	Total Depth of Drill Hole: 15 Feet
Drill Rig Type: Mobile B-24	Diameter(s) of Hole, inches: 5 inches	Approx. Surface Elevation, ft MSL:
Groundwater Depth [Elevation], feet: Not Encountered	Sampling Method(s): 140 Lb Hammer/30" Drop	Drill Hole Backfill: Soil Cuttings
Remarks		

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	BLOWS PER FOOT	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
	0–2		Dark Brown, moist, very stiff, fat clay (CH)		D3-1	18	27.2	84	UCC 1.3 tsf
	2–6.5		Dark Gray, moist, medium dense, fine, clayey sand (SC)		D3-2	24			
	6.5–15		Brown, moist, fine, silty sand (SM)						
			very dense, partially cemented		D3-3	>100			
			medium dense, with weakly cemented gravel-size silt fragments		D3-4	32			

Depth scale: 5, 10, 15, 20, 25

Mid Pacific Engineering, Inc .

FIGURE 6

Project: Parkebridge East		LOG OF SOIL BORING D4	
Project Location: Southeast of the Intersection of Highway 80 and Havenparke Circle, Sacramento, California			
MPE Number: 03743-13		Sheet 1 of 1	

Date(s) Drilled	1/14/2025	Logged By	JMM	Checked By	VVP
Drilling Method	Solid Flight Augers	Drilling Contractor	West Coast Exploration	Total Depth of Drill Hole	20 Feet
Drill Rig Type	Mobile B-24	Diameter(s) of Hole, inches	5 inches	Approx. Surface Elevation, ft MSL	
Groundwater Depth [Elevation], feet	Initial: 18½ Feet; Final: 16 Feet	Sampling Method(s)	140 Lb Hammer/30" Drop	Drill Hole Backfill	Soil Cuttings
Remarks					

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE NUMBER	BLOWS PER FOOT	MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
	0	CH	Dark Brown, moist, stiff, fat clay (CH)	D4-1	17	32.1	77	UCC 0.8 tsf
				D4-2	44			
	3	CL	Dark Gray, moist, hard, lean clay (CL)					
	6.5	ML	Light Brown, moist, fine, sandy silt (ML)					
			very dense	D4-3	>100			
	12	SM	Brown, moist, dense, fine, silty sand (SM)	D4-4	43			
	14.5	SP	Brown, moist, dense, fine to medium, poorly graded sand (SP)					
			wet					
			very dense, fine to coarse grained, with fine subrounded gravel	D4-5	>100			
	20							

MPE *Mid Pacific Engineering, Inc .* **FIGURE 7**

Project: Parkebridge East	LOG OF SOIL BORING D5
Project Location: Southeast of the Intersection of Highway 80 and Havenparke Circle, Sacramento, California	
MPE Number: 03743-13	Sheet 1 of 1

Date(s) Drilled	1/14/2025	Logged By	JMM	Checked By	VVP
Drilling Method	Solid Flight Augers	Drilling Contractor	West Coast Exploration	Total Depth of Drill Hole	15 Feet
Drill Rig Type	Mobile B-24	Diameter(s) of Hole, inches	5 inches	Approx. Surface Elevation, ft MSL	
Groundwater Depth [Elevation], feet	Not Encountered	Sampling Method(s)	140 Lb Hammer/30" Drop	Drill Hole Backfill	Soil Cuttings
Remarks					

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE	SAMPLE NUMBER	BLOWS PER FOOT	MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
	0–3		Dark Brown, moist, very stiff, fat clay (CH)		D5-1	21	33.4	80	
					D5-2	32			
	3–6		Olive-Brown, moist, very stiff, lean clay (CL)						
	6–14		Brown, moist, fine, sandy silt (ML)						
			very dense		D5-3	>100			
	14–15		Olive-Gray, moist, medium dense, fine to medium, silty sand (SM)		D5-4	36			

Depth scale: 5, 10, 15, 20, 25

MPE *Mid Pacific Engineering, Inc .* **FIGURE 8**

Project:	Parkebridge East
Project Location:	Southeast of the Intersection of Highway 80 and Havenparke Circle, Sacramento, California
MPE Number:	03743-13

LOG OF SOIL BORING D6

Date(s) Drilled	1/14/2025	Logged By	JMM	Checked By	VVP
Drilling Method	Solid Flight Augers	Drilling Contractor	West Coast Exploration	Total Depth of Drill Hole	9 Feet
Drill Rig Type	Mobile B-24	Diameter(s) of Hole, inches	5 Inches	Approx. Surface Elevation, ft MSL	
Groundwater Depth [Elevation], feet	Not Encountered	Sampling Method(s)	140 Lb Hammer/30" Drop	Drill Hole Backfill	Soil Cuttings
Remarks					

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	BLOWS PER FOOT	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
	0–2		Black, moist, very stiff, fat clay (CH)		D6-1	31	23.2	91	
	2–4		Dark Gray, moist, medium dense, fine, clayey sand (SC)		D6-2	42			
	4–7		Brown, moist, dense, fine, silty sand (SM)						
	7–8		Brown, moist, fine to medium, clayey sand (SC)						
	8–9		Brown, moist, very dense, fine, sandy silt (ML)		D6-3	>100			

MPE

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FIGURE 9

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS		SYMBOL	CODE	TYPICAL NAMES
COARSE GRAINED SOILS (More than 50% of soil > no. 200 sieve size)	GRAVELS (More than 50% of coarse fraction > no. 4 sieve size)	GW		Well graded gravels or gravel - sand mixtures, little or no fines
		GP		Poorly graded gravels or gravel - sand mixtures, little or no fines
		GM		Silty gravels, gravel - sand - silt mixtures
		GC		Clayey gravels, gravel - sand - silt mixtures
	SANDS (50% or more of coarse fraction < no. 4 sieve size)	SW		Well graded sands or gravelly sands, little or no fines
		SP		Poorly graded sands or gravelly sands, little or no fines
		SM		Silty sands, sand - silt mixtures
		SC		Clayey sands, sand clay mixtures
FINE GRAINED SOILS (More than 50% of soil < no. 200 sieve size)	SILTS & CLAYS LL< 50	ML		Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
		CL		Inorganic clays of low to medium plasticity, gravely clays, sandy clays, silty clays, lean clays
		OL		Organic silts and organic silty clays of low plasticity
	SILTS & CLAYS LL ≥ 50	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 silty clays, organic silts
HIGHLY ORGANIC SOILS		Pt		Peat and other highly organic soils
ROCK		RX		Rocks, weathered to fresh
FILL		FILL		Artificially placed fill material

OTHER SYMBOLS

=Bulk Sample.

= Hand Driven Sample

=SPT Sampler

= Initial Water Level

= Final Water Level

= Estimated or gradational material change line

= Observed material change line

Laboratory Tests

- PI = Plasticity Index
- EI =Expansive Index
- UCC = Unconfined Compression Test
- TR = Triaxial Compression Test
- GR = Gradation Analysis (Sieve)
- K = Permeability Test

GRAIN SIZE CLASSIFICATION

CLASSIFICATION	RANGE OF GRAIN SIZES	
	U.S. Standard Sieve Size	Grain Size in Millimeters
BOULDERS	Above 12"	Above 305
COBBLES	12" to 3"	305 to 76.2
GRAVEL coarse (c) fine (f)	3" to No. 4 3" to 3/4" 3/4" to No. 4	76.2 to 4.76 76.2 to 19.1 19.1 to 4.76
SAND coarse (c) Medium (m) fine (f)	No. 4 to No. 200 No. 4 to No. 10 No. 10 to No. 40 No. 40 to No. 200	4.76 to 0.074 4.76 to 2.00 2.00 to 0.420 0.420 to 0.074
SILT & CLAY	Below No. 200	Below 0.074

MPE
Mid Pacific Engineering, Inc.

UNIFIED SOIL CLASSIFICATION SYSTEM
PARKEBRIDGE EAST
Southeast of the Intersection of Highway 80 and Havenparke Circle
Sacramento, California

FIGURE 10
Date: 01/25
MPE No. 03743-13

APPENDICES

APPENDIX A

APPENDIX A

A. GENERAL INFORMATION

The performance of a Geotechnical Engineering Investigation for the proposed Parkebridge East residential subdivision to be constructed southeast of the intersection of Highway 80 and Havenparke Circle, in Sacramento, California, was authorized by Mr. Clifton Taylor on December 11, 2024. Authorization was for an investigation as described in our proposal letters of December 10, 2024, sent to our client, JEN California 25 LLC, whose mailing address is 1478 Stone Point Drive, Suite 100, Roseville, California 95661.

B. FIELD EXPLORATION

On January 14, 2025, six (6) soil borings were drilled at the approximate locations indicated on Figure 2, utilizing a B-24, truck-mounted drill rig equipped with 5- inch diameter, solid flight augers. The borings were drilled to the maximum depth of approximately 20 feet below existing site grades.

At various intervals, relatively undisturbed soil samples were recovered with a 2½-inch O.D., 2-inch I.D. Modified California sampler (ASTM D3550), driven by a 140-pound hammer freely falling 30 inches. The number of blows of the hammer required to drive the 18-inch long sampler each 6-inch interval was recorded with the sum of the blows required to drive the sampler the lower 12-inch interval, or portion thereof, being designated the penetration resistance or "blow count" for that particular drive.

The samples obtained were retained in 2-inch diameter by 6-inch long, thin-walled brass tubes contained within the sampler. Immediately after recovery, the field engineer visually classified the soil in the tubes. The ends of the tubes were sealed to preserve the natural moisture contents. Disturbed bulk samples of the surface materials also were obtained at various locations and depths. Soil samples were taken to our laboratory for additional classification (ASTM D2488) and selection of samples for testing.

The Logs of Soil Borings, Figures 3 through 8, contain descriptions of the soils encountered in each boring. A Boring Legend explaining the Unified Soil Classification System and the symbols used on the logs is contained on Figure 9.

C. LABORATORY TESTING

Selected samples of the soils were tested to determine dry unit weight (ASTM D2937), natural moisture content (ASTM D2216), and unconfined compression strength (ASTM D2166). The results of these tests are included on the boring logs at the depth each sample was obtained.

Two bulk samples of the soils were subjected to an Expansion Index testing (ASTM D4829). The results of the tests are presented on Figures A1 and A2.

One bulk sample of soil was subjected to Atterberg limits (ASTM D4318) and hydrometer (D422) tests. The results of the tests are presented on Figure A3.

Two soil samples were submitted to Sunland Analytical in Rancho Cordova, California, for corrosivity testing in accordance with No. 643 (Modified Small Cell), CT 532, CT 422, and CT 417. The analytical results are presented in the text of the report.

EXPANSION INDEX TEST RESULTS
(ASTM D4829-21)
(UBC 18-2)

Material Description: Dark Brown, fat clay (CH)
Location: D3 (½ – 1½ feet)

Sample Number	Pre-Test Moisture (%)	Post-Test Moisture (%)	Dry Density (pcf)	Expansion Index
D3	15.5	36.6	87	90

CLASSIFICATION OF EXPANSIVE SOIL

EXPANSION INDEX	POTENTIAL EXPANSION
0 - 20	Very Low
21 - 50	Low
51 - 90	Medium
91 - 130	High
Above 130	Very High

MPE	**EXPANSION INDEX TEST RESULTS** **PARKEBRIDGE EAST** Southeast of the Intersection of Highway 80 and Havenparke Circle Sacramento, California	**FIGURE A1** Date: 01/25 MPE No. 03743-13

EXPANSION INDEX TEST RESULTS
(ASTM D4829-21)
(UBC 18-2)

Material Description: Dark Brown, fat clay (CH)
Location: D4 (½ – 1½ feet)

Sample Number	Pre-Test Moisture (%)	Post-Test Moisture (%)	Dry Density (pcf)	Expansion Index
D4	16.5	34.5	90	91

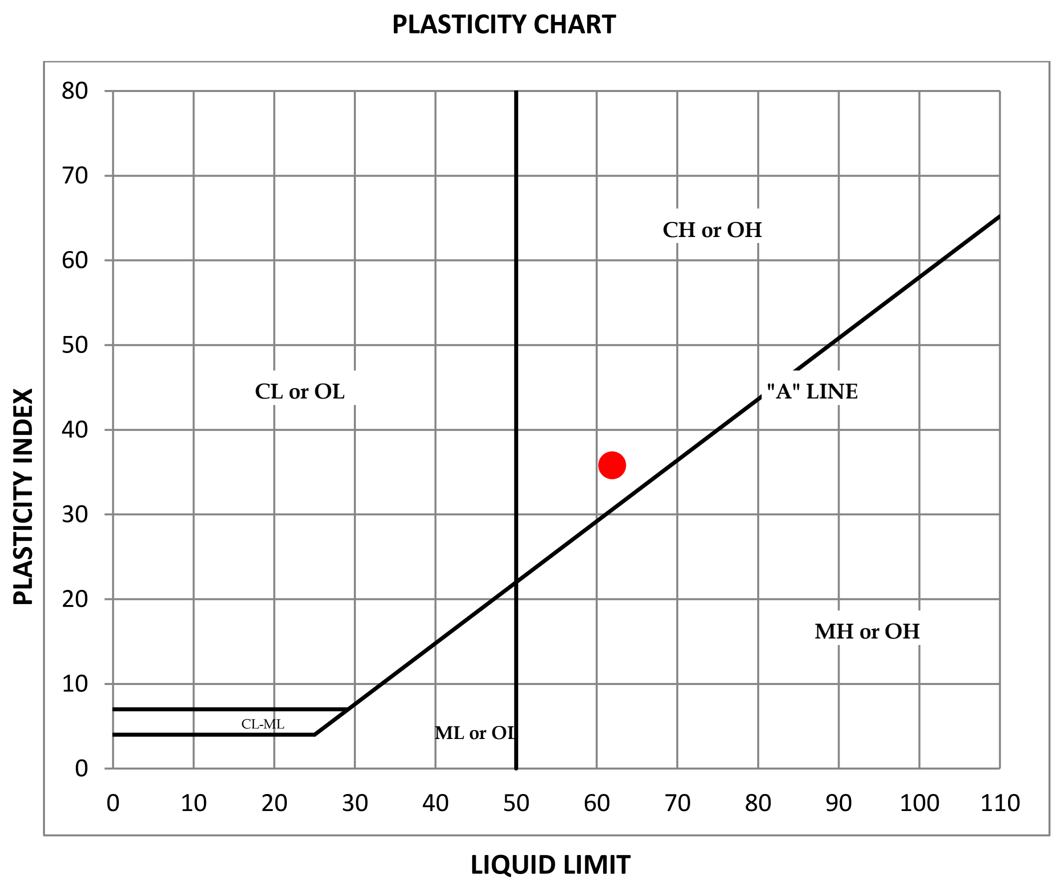
CLASSIFICATION OF EXPANSIVE SOIL

EXPANSION INDEX	POTENTIAL EXPANSION
0 - 20	Very Low
21 - 50	Low
51 - 90	Medium
91 - 130	High
Above 130	Very High

MPE	EXPANSION INDEX TEST RESULTS PARKEBRIDGE EAST Southeast of the Intersection of Highway 80 and Havenparke Circle Sacramento, California	FIGURE A2 Date: 01/25 MPE No. 03743-13

ATTERBERG LIMITS
(ASTM D4318)

Symbol	Sample	Passing # 200 Sieve (%)	Clay Particles (<0.0020 mm) (%)	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)
●	D4 (½’ – 1½’)	97.9	50.5	63	27	36



MPE	**LABORATORY TEST RESULTS** **PARKEBRIDGE EAST** Southeast of the Intersection of Highway 80 and Havenparke Circle Sacramento, California	**FIGURE A3** Date: 01/25 MPE No. 03743-13

APPENDIX B

APPENDIX B

GUIDE EARTHWORK SPECIFICATIONS

PARKEBRIDGE EAST

Southeast of the Intersection of Highway 80 and Havenparke Circle

Sacramento, California

MPE No. 03743-13

PART 1: GENERAL

1.1 SCOPE

A. General Description

This item shall include clearing of all surface and subsurface structures including undocumented fills, stockpiles, underground piping, septic systems, pavements, concrete slabs, foundations, fences, surface debris including all asphalt concrete rubble, concrete rubble, 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, dirt 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 (MPE No. 03743-13; dated January 24, 2025) has been prepared for this site by Mid Pacific Engineering, Inc., Geotechnical Engineers. A copy is available for review at the office of Mid Pacific Engineering, Inc., 840 Embarcadero Drive, Suite 20, Sacramento, California 95605.

B. The information contained in the 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 un-shown 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 un-shown 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 soils free from significant quantities of rubble, rubbish and vegetation, and having been tested and approved by the Geotechnical Engineer prior to use. Clay soils encountered, shall not be used within the upper portion of final building pad subgrades or those grades that will support exterior flatwork, unless lime-treated as recommended in the Geotechnical Engineering Report.

B. Imported fill materials, if required, should be approved by our office prior to being transported to the site, be free of particles greater than three inches in maximum dimension, and possess similar corrosion characteristics previously tested for the site. Import fill shall be clean of contamination with appropriate documentation. All imported materials shall be approved by the Geotechnical Engineer prior to being transported to the site.

C. Materials to be lime stabilized shall be on-site clayey soils free from significant quantities of rubble, rubbish and vegetation and shall have been tested and approved by the Geotechnical Engineer.

D. Lime shall be high-calcium or dolomitic quicklime conforming to Caltrans Section 24 and the definitions in ASTM Designation C977, as applicable. The burden of proof as to quality and suitability of all products used for stabilization shall be upon the Contractor and Supplier and they shall furnish test data and all information necessary as required by the Geotechnical Engineer. Lime from more than one source may be used on the same project but different limes shall not be used or mixed. The lime shall be protected from moisture until used and shall be sufficiently dry to flow freely when handled.

E. Water for use in subgrade stabilization shall be clean and potable and shall be added during mixing, remixing and compaction operations, and during the curing period to keep the cured material moist until covered.

F. Asphalt concrete, aggregate base, aggregate sub-base, and other paving products shall comply with the appropriate provisions of the *State of California (Caltrans) Standard Specifications*, latest editions.

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 PADS AND PAVEMENT AREAS

A. The site shall be cleared of existing structures including but not limited to sol stockpiles, rubbish, rubble, and other deleterious materials. 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 placed and compacted as engineered fills in accordance with these specifications.

B. The exposed subgrade shall be scarified and/or cross-ripping, to depths of twelve inches (12"), moisture-conditioned and compacted as required.

C. Subgrade preparation and compaction shall extend at least five feet (5') beyond the proposed structure lines, or as required by the Geotechnical Engineer based on the exposed soil and site conditions.

D. When the moisture content of the subgrade is below that required to achieve the specified density, and that minimum content recommended in the geotechnical report, water shall be added until the proper moisture content is achieved.

E. When the moisture content of the subgrade is too high to permit the specified compaction to be achieved, the subgrade shall be aerated by blading or other methods until the moisture content is satisfactory for compaction.

F. After the foundations for fill have been cleared, plowed or scarified, they shall be disked or bladed until uniform and free from large clods, brought to the proper moisture content and compacted to not less than ninety percent (90%) of the maximum dry density as determined by the ASTM D1557 Compaction Test. Soil compaction shall be performed using a heavy, self-propelled sheepsfoot compactor.

G. 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.

3.3 PLACING, SPREADING AND COMPACTING FILL MATERIAL

A. Engineered fills 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, and that minimum content recommended in the geotechnical report, 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, engineered fill consisting of granular soils shall be thoroughly moisture conditioned to at least the optimum moisture content and uniformly compacted to at least ninety percent (90%) of maximum dry density as determined by ASTM D1557. On-site clayey soils shall be compacted at a moisture content of at least two percent (2%) above the optimum moisture content. Soils compaction shall be performed using a heavy, self-propelled sheepsfoot compactor, to the satisfaction of our on-site representative. 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 LIME-STABILIZED SUBGRADE CONSTRUCTION

A. Lime-stabilized materials and construction shall be in general conformance with Caltrans Section 24 and the following requirements. In the event of conflict between project requirements, the more stringent requirement shall govern, or as determined by the Geotechnical Engineer. Contract prices and payments shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals for doing all the work involved in constructing the lime-treated subgrade, complete in place, as shown on the plans, specified in these specifications and the special provisions, and as directed by the Geotechnical Engineer.

B. Initial mixing of lime shall be followed by remixing the next day. Additional remix passes shall be performed to provide a uniform soil-lime mixture.

C. Compaction operations shall be undertaken with a heavy, self-propelled, compactor and shall be performed under the presence of our representative who will evaluate the performance of the subgrade under compactive load.

D. The material to be treated shall be placed at a moisture content at least two percent (2%) over optimum moisture and uniformly compacted to at least ninety-two percent (92%) of maximum dry density, as defined by the ASTM D1557 Compaction Test.

E. No equipment or vehicle traffic shall be allowed on the lime treated materials during the first three days after treatment and compaction are completed.

3.5 FINAL SUBGRADE PREPARATION

A. The upper twelve inches (12") of final building pad subgrades shall be brought to a uniform moisture content of at least two percent (2%) above the optimum moisture content, and shall be uniformly compacted to not less than least ninety percent (90%) relative compaction.

B. The upper twelve inches (12") of final exterior flatwork subgrades shall be scarified, brought to at least the three percent (3%) above the optimum moisture content, and uniformly compacted to not less than 88 percent of the maximum dry density, as determined by ASTM D1557.

C. For untreated pavement subgrades, the upper twelve inches (12") of final subgrades supporting pavement sections shall be brought to a uniform moisture content of at least the optimum moisture content and shall be uniformly compacted to at least ninety-five percent (95%) relative compaction, regardless of whether final subgrade elevations are attained by filling, excavation, or are left at existing grades. Pavement subgrades shall be proof-rolled in the presence of the Geotechnical Engineer prior to placement of aggregate base and shall be stable under construction equipment traffic.

3.6 TRENCH BACKFILL

Utility trench backfill shall be placed in lifts of no more than twelve inches (12") in loosethickness. Each lift shall be compacted to at least ninety percent (90%) compaction, as defined by ASTM D1557, except that the upper twelve inches of backfill within pavement areas shall be compacted in accordance with Section 3.5B. The upper twelve inches (12") of trench backfill in previously lime-treated areas shall consist of ninety–five percent (95%) compacted Class 2 Aggregate Base.

3.7 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 shall 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 Project Design Engineer. No deviation from the specifications shall be made except upon written approval of the Geotechnical Engineer or Project Design Engineer.

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