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Geotechnical Evaluation Report

Administrative Office Tank Replacement
Westminster School District
14121 Cedarwood Street
Westminster, California

Prepared for:
Westminster School District
14121 Cedarwood Street
Westminster, CA 92683

January 16, 2026
Project No.: 250866.1

TWINING

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Mr. Scott Harvey
Executive Director, Facilities Planning & MOT
Westminster School District
14121 Cedarwood Avenue
Westminster, CA 92683

Subject: **Geotechnical Evaluation Report**
Administrative Office Tank Replacement
Westminster School District
14121 Cedarwood Street
Westminster, California

Dear Mr. Harvey,

In accordance with your request and authorization, we are presenting the results of our geotechnical investigation for the Administrative Office Tank Replacement project for the Westminster School District in Westminster, California. The purpose of this investigation has been to evaluate the subsurface conditions at the site and to provide geotechnical engineering recommendations for the proposed construction.

Based on our findings, the proposed project is geotechnically feasible, provided that the recommendations in this report are incorporated into the design and are implemented during construction of the project.

We appreciate the opportunity to be of service on this project. Should you have any questions regarding this report or if we can be of further service, please do not hesitate to contact the undersigned.

Respectfully submitted,
TWINING, INC.





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Figure 1 – Site Location Map
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Appendix A – Field Exploration
Appendix B – Laboratory Testing

1. INTRODUCTION

This report presents the results of our geotechnical engineering evaluation performed for the tank replacement project located at the Westminster School District administrative office facility in Westminster, California. The purpose of this study has been to evaluate the subsurface conditions at the site and to provide geotechnical recommendations related to the design and construction of the proposed project.

2. SITE DESCRIPTION AND PROPOSED DEVELOPMENT

The project site is located at district administrative offices at 14121 Cedarwood Street in Westminster, California. The approximate site coordinates are latitude 33.757737°N and longitude 117.996094°W. The site is generally flat and sits at an approximate elevation of 41 feet above mean sea level (MSL), according to Google Earth mapping. The project location is shown on Figure 1 – Site Location map.

We understand that the project consists of the removal of two existing underground gasoline storage tanks and the replacement with a single tank. The existing tanks are approximately 6,100- and 10,000-gallon in size, and the new tank will be approximately 16,000 gallons. The new tank will be approximately 31 feet in length, 8 feet in diameter, and have a bottom depth of roughly 12 feet below the ground surface. Excavations for the tank installation will be up to approximately 13 feet in depth for the placement of 1 foot of pea gravel beneath the tank. Included in the project is the construction of a new electrical transformer, utility trenches, and new site pavements.

An environmental engineering report to evaluate the presence of contaminated site soils and groundwater has been prepared by Farallon Consulting, LLC (Farallon).

3. SCOPE OF WORK

To prepare this report, we have performed the following tasks:

3.1. Literature Review

We reviewed readily available background data including in-house geophysical data, geologic maps, topographic maps, and aerial photographs relevant to the subject site in preparation of this report. The list of literature reviewed is presented in the “References” section of this report.

3.2. Field Exploration

The field exploration consisting of five soil borings was conducted at the site on November 24, 2025. The borings were advanced to maximum depths of approximately 31.5 feet below the existing ground surface (bgs) using a truck-mounted 8-inch-diameter hollow-stem auger.

Drive samples of the soils were obtained from the borings using a Standard Penetration Test (SPT) sampler without room for liner and a modified California split-spoon sampler. Bulk samples were collected from the upper 5-foot soil cuttings. The samples were transported to Twining’s geotechnical engineering laboratory in Long Beach, California for examination and testing.

The approximate locations of the borings are shown on Figure 2 – Site Plan and Boring Location Map. Detailed exploration information of soils borings is presented in Appendix A - Field Exploration.

3.3. Geotechnical Laboratory Testing

Laboratory tests were performed on selected samples obtained from the borings to aid in the soil classification and to evaluate the engineering properties of site soils. The following tests were performed in general accordance with ASTM and Caltrans standards:

- In-situ moisture and density (ASTM D2937),
- #200 Wash (ASTM D1140),
- Maximum Density – Optimum Moisture Content (ASTM D1557)
- Atterberg Limits (ASTM D4318),
- Direct shear (ASTM D3080),
- R-Value (ASTM D2844), and
- Corrosivity (Caltrans test methods CT417, CT422, and CT 643).

Detailed laboratory test procedures and results are presented in Appendix B – Laboratory Testing.

3.4. Engineering Analyses and Report Preparation

We compiled and analyzed the data collected from our site reconnaissance, subsurface evaluation, and laboratory testing, and prepared this report to present our conclusions and recommendations, including:

- Evaluation of general subsurface conditions and description of types, distribution, and engineering characteristics of subsurface materials;
- Evaluation of site-specific seismic design parameters in accordance with 2025 California Building Code;
- Evaluation of current and historical groundwater conditions at the site and potential impact on the existing structures;
- Evaluation of project feasibility and suitability of on-site soils for earthwork, including site preparation and excavation, and requirements for placement of compacted fill;
- Development of general recommendations for shoring systems and for temporary slopes as appropriate for the project site;
- Recommendations for pavement structural sections.
- Evaluation of the potential for the on-site materials to corrode buried concrete and metals.

4. SITE GEOLOGY AND UBSURFACE CONDITIONS

According to the Geologic map of the San Bernardino and Santa Ana 30’ x 60’ quadrangle (USGS, 2006), the project site is underlain by slightly to moderately consolidated silt, sand, and coarse-grained sand to bouldery alluvial-fan deposits having moderately dissected surfaces (map symbol: Qyfa). A portion of the geologic map is reproduced as Figure 3 - Regional Geologic Map.

4.1. Subsurface Materials

Our subsurface investigation was performed within asphalt-paved areas adjacent to the existing tank removal area, and beneath the proposed electrical equipment pad. Earth

materials encountered within the 4 borings performed around the perimeter of the existing tanks consisted of up to approximately 5 feet of artificial fill, underlain by alluvial deposits to the full depth of exploration. The boring location performed away from the tank and beneath the proposed equipment pad was underlain by alluvial deposits below the pavement surface to the full depth of exploration.

The fill materials encountered generally consisted of silty sand below the pavement grade, underlain by poorly graded gravel. The gravel observed is anticipated to be part of the backfill materials for the existing tanks.

Alluvial deposits generally consisted of alternating layers of silty sand and clayey sand within the upper 20 feet, and sandy lean clay or silty sand below 20 feet to full depth of exploration.

In general, the soils encountered were moist to depths of approximately 7 to 8 feet bgs and become wet or saturated at deeper depths. The consistency of the coarse-grained layers are generally loose, and the clay layers are generally soft to medium stiff.

4.2. Groundwater

Based on Seismic Hazard Zone Report prepared for the Anaheim and Newport Quadrangle by the California Geologic Survey (CGS), groundwater mapping records show that the historic high groundwater elevation at the site is approximately 5 feet bgs or shallower. Groundwater was encountered within our exploratory borings at depths ranging between approximately 6 and 9 feet below the ground surface.

Groundwater conditions may vary across the site due to stratigraphic and hydrologic conditions and may change over time as a consequence of seasonal and meteorological fluctuations, or of activities by humans at this and nearby sites.

Based on our observations during our subsurface exploration and our site research, we recommend that the groundwater depth be assumed at a depth of 5 feet below the existing ground surface for the design and construction of this project.

5. GEOTECHNICAL ENGINEERING RECOMMENDATIONS

Based on the results of our literature review and the field exploration, laboratory testing, and engineering analyses, it is our opinion that the proposed construction is feasible from a geotechnical standpoint, provided that the recommendations in this report are incorporated into the design plans and are implemented during construction.

5.1. General Considerations

Geotechnical engineering recommendations presented in this report for the proposed project are based on our understanding of the proposed development, subsurface conditions encountered during our field exploration, the results of laboratory testing on soil samples taken from the site, and our engineering analyses.

Our geotechnical engineering analyses performed for this report were based on the earth materials encountered during the subsurface exploration for the site. If the design substantially changes, then our geotechnical engineering recommendations would be subject to revision based on our evaluation of the changes. The following sections present our conclusions and recommendations pertaining to the engineering design for this project.

5.2. Temporary Excavations

Based on our observed pea gravel layers in our borings, the existing tanks are likely buried in pea gravel. Therefore, excavations within the pea gravel may result in a cave-in condition and the equipment shall maintain a safe distance away from this area. We recommend the actual extents of pea gravel be determined once the existing pavements have been removed.

Temporary excavations for the tank removal and utility trenches are expected to be up to approximately 14 feet in height. We anticipate that unsurcharged excavations with vertical side slopes up to 4 feet high will generally be stable; however, minor sloughing of relatively loose, cohesionless sandy materials encountered at the site should be expected.

Where the space is available, temporary, unsurcharged excavation sides over 4 feet in height should be sloped no steeper than an inclination of 1.5H:1V (Horizontal:Vertical). Where sloped excavations are created, the tops of the slopes should be barricaded so that vehicles and storage loads do not encroach within 10 feet of the top of the excavated slopes. A greater setback may be necessary when considering heavy vehicles, such as concrete trucks and cranes. Twining should be advised of such heavy vehicle loadings so that specific setback requirements can be established. If the temporary construction slopes are to be maintained during the rainy season, berms are recommended to be graded along the tops of the slopes in order to prevent runoff water from entering the excavation and eroding the slope faces.

Excavations should not undermine the footings of existing adjacent structures. Where space for sloped excavations is not available, temporary shoring may be utilized. Temporary shoring should be implemented as recommended in the Temporary Shoring section of this report.

Personnel from Twining should observe the excavation so that any necessary modifications based on variations in the encountered soil conditions can be made. All applicable safety requirements and regulations, including CalOSHA requirements, should be met.

5.3. Temporary Shoring

Where sloped excavation is not feasible, temporary cantilever shoring consisting of soldier piles and lagging should be implemented.

The shoring design should be provided by a California Registered Civil Engineer experienced in the design and construction of shoring under similar conditions. Once the final excavation and shoring plans are complete, the plans and the design should be reviewed by Twining for conformance with the design intent and recommendations. Further, the shoring system should satisfy applicable requirements of CalOSHA.

5.3.1. Lateral Pressures

For design of cantilevered shoring, a triangular distribution of lateral earth pressure may be used. It should be assumed that hydrostatic pressure build up will not occur, but that saturated soil conditions will be present below a depth of 5 feet, if dewatering of the excavation is performed. With a level surface behind the cantilevered shoring, the soil can be assumed to exert an equivalent fluid pressure of **43 pcf** for the upper 5 feet below ground surface, and **83 pcf** below 5 feet bgs.

Any surcharge (live, including traffic, or dead load) located within a 1:1 plane drawn upward from the base of the shored excavation, including adjacent structures, should be added to the lateral earth pressures. The lateral contribution of a uniform surcharge load located immediately behind the temporary shoring may be calculated by multiplying the vertical

surcharge pressure by 0.36. Lateral load contributions of surcharges located at a distance behind the shored wall may be provided once the load configurations and layouts are known. As a minimum, a 300 psf vertical uniform surcharge is recommended to account for nominal construction and/or traffic loads.

5.3.2. Soldier Pile Design

Adequate structural steel I-beams may be used as soldier piles. Installation of soldier piles may be achieved by drilling method or vibratory method. Based on the elevation of the groundwater at the site, we recommend the vibratory method to accommodate for the likelihood of caving/collapse of drilled shafts. Steel plate or wood lagging should be placed between the soldier piles to support the vertical cut.

The soldier piles should be designed in accordance with the geotechnical parameters presented in Table 1. Soldier piles should be spaced no closer than 2.5D on center, where D is the diameter of the drilled shaft for the soldier piles.

Table 1 – Geotechnical Design Parameters for Steel Soldier Piles

The lateral resistance of an isolated soldier pile drilled into the on-site soils can be calculated using unfactored lateral passive equivalent fluid pressure (EFP) from 0 to 5 feet below the ground surface (above the groundwater table)	300 pcf
The lateral resistance of an isolated soldier pile drilled into the on-site soils can be calculated using unfactored lateral passive equivalent fluid pressure (EFP) deeper than 5 feet (below groundwater table)	160 pcf
Increase (multiplier) of the ultimate lateral passive resistance due to arching (this value is applicable for soldier piles that are spaced no closer than 2.5 diameters on center)	2.0

The allowable downward capacity of a soldier pile below the excavated level may be estimated using an allowable skin friction of 200 psf for area of pile in contact with native soil.

Drilling of the soldier pile shafts can be accomplished using conventional drilling equipment. Caving and collapse of drilled shafts should be anticipated during drilling. In the event of soil caving, it may be necessary to use casing and/or drilling mud to permit the installation of the soldier piles. Drilled holes for soldier piles should not be left open overnight. The drilled shaft should be backfilled with concrete below the bottom depth of the planned excavation and controlled-low-strength-material (CLSM) specified by the shoring engineer immediately after the drilling of the hole and soldier beam is in place. The concrete and CLSM material should be pumped to the bottom of the drilled shaft using the tremie method to displace water in the hole.

5.4. Site Preparation and Earthwork

After removal of the underground storage tanks, the excavated pit should be backfilled in accordance with the recommendations presented in this report. We understand that no structure other than pavement will be placed above the new tank. Twining should be contacted with questions regarding the recommendations or guidelines presented herein.

5.4.1. Site Preparation

Site preparation should begin with the removal of utility lines, asphalt, concrete, vegetation, and other deleterious debris from areas to be graded. Tree stumps and roots should be removed to such a depth that organic material is generally not present. Clearing and grubbing should extend to the outside edges of the proposed excavation and fill areas. We recommend that unsuitable materials such as organic matter or oversized material be selectively removed and disposed offsite. The debris and unsuitable material generated during clearing and grubbing should be removed from areas to be graded and disposed at a legal dump site away from the project area.

Pea gravel is anticipated to be encountered within the excavation pit. Pea gravel may be thoroughly mixed at a 1:1 proportion with clean site coarse-grained soils for backfill purpose, if desired.

5.4.2. Construction Dewatering

As previously discussed, groundwater was encountered at 7 feet bgs in our exploratory borings and should be assumed to be as high as 5 feet bgs during the construction of the project. Dewatering consisting of sump pumps in the excavation should be performed to remove free water at the surface of the bottom of the excavation. The groundwater level should be maintained below the bottom of excavation when the pea gravel below the tank is placed. Disposal of pumped water should be performed in accordance with the Orange County requirements and/or guidelines of the Regional Water Quality Control Board.

5.4.3. Over-Excavation and Subgrade Preparation

<u>New Fuel Tank</u>

Upon dewatering of the excavation, and based on the soil conditions observed, we anticipate that excavation bottoms may be excessively wet and unstable. On this basis, we recommend that a minimum of 1 foot of pea gravel be placed and compacted to provide support for the new tank. The tank should be backfilled in accordance with the tank manufacturer's recommendations. Bottom treatment should be monitored and approved by a Twining representative in the field.

<u>Equipment Pad and Minor Foundations</u>

Overexcavations should extend at least 12 inches below the footing bottom elevations. The overexcavation should extend laterally 2 feet beyond the edge of the footings where space is available. The excavation bottoms should be verified for competency and scarified a minimum of 8 inches and recompacted in place. The scarified and/or newly placed engineered fill soils should be moisture conditioned to achieve generally consistent moisture contents within approximately 2 percent above the optimum moisture content and be compacted to at least 90 percent relative compaction in accordance with the latest version of ASTM Test Method D1557.

<u>New Pavement Areas</u>

Subgrade soils beneath new pavement should be scarified 12 inches below the bottom of the design pavement section and recompacted in place. The scarified and/or newly placed engineered fill soils should be moisture conditioned to achieve generally consistent moisture contents within approximately 2 percent above the optimum moisture content and be compacted to at least 95 percent relative compaction in accordance with the latest version of ASTM Test Method D1557.

5.4.4. Materials for Fill

On-site soils with an organic content of less than 3 percent by volume (or 1 percent by weight) are suitable for use as fill. Soil material to be used as fill should not contain contaminated materials, rocks, or lumps over 4 inches in largest dimension, and not more than 40 percent should be larger than ¾ inch. Utility trench backfill material should not contain rocks or lumps over 3 inches in largest dimension. Larger chunks, if generated during excavation, may be broken into acceptably-sized pieces or may be disposed offsite.

We anticipated that import material will be needed to backfill the excavated pit. Any imported fill material should consist of "very low" expansion potential (that is, expansion index of 20 or less) granular soil. Import material should also have low corrosion potential (chloride content less than 500 parts per million [ppm], soluble sulfate content of less than 0.1 percent, and pH of 5.5 or higher). Materials to be used as fill should be evaluated by a Twining representative prior to importing or filling.

Backfill material around the new tank should conform to the manufacturer's recommendations.

5.4.5. Compacted Fill

Prior to placement of compacted fill above the groundwater table, the contractor should request an evaluation of the exposed excavation bottom by Twining. Unless otherwise recommended, the exposed ground surface should then be scarified to a depth of approximately 8 inches and watered or dried, as needed, to achieve generally consistent moisture contents at or near the optimum moisture content. The scarified materials should then be compacted to 90 percent relative compaction in accordance with the latest version of ASTM Test Method D1557.

Fill materials should be moisture conditioned to near optimum moisture content prior to placement. The optimum moisture content will vary with material type and other factors. Moisture conditioning of fill soils should be generally consistent within the soil mass. Prior to placement of additional compacted fill material following a delay in the grading operations, the exposed surface of previously compacted fill should be prepared to receive fill. Preparation may include scarification, moisture conditioning, and recompaction.

Compacted fill should be placed in horizontal lifts of approximately 6 to 8 inches in loose thickness. Prior to compaction, each lift should be watered or dried as needed to achieve near optimum moisture condition, mixed, and then compacted by mechanical methods, using sheepsfoot rollers, multiple wheel pneumatic tired rollers, or other appropriate compacting rollers, to a relative compaction of 90 percent as evaluated by the latest version of ASTM D1557. Within pavement areas, the upper 12 inches of subgrade soil should be compacted to 95 percent relative compaction evaluated by ASTM D1557. Successive lifts should be treated in a like manner until the desired finished grades are achieved.

5.5. Soil Expansion and Collapse Potential

Laboratory expansion index testing indicates the surficial soils at the site have a very low expansion potential. Based on our field exploration and laboratory testing results, the soils

encountered have a negligible collapse potential. Our recommendations for subgrade preparation and foundation excavation have incorporated these findings.

5.6. Soil Corrosivity

Laboratory testing was performed on two representative sample of on-site soils to evaluate pH and electrical resistivity, as well as chloride and sulfate contents. The pH and electrical resistivity tests were performed in accordance with California Test 643, and the sulfate and chloride tests were performed in accordance with California Tests 417 and 422, respectively. These laboratory test results are presented in Appendix B.

Based on Caltrans (2025) criteria, soils may be classified as a corrosive environment if one of more of the following conditions exist: a Chloride concentration of 500 ppm or greater, a sulfate concentration of 1500 ppm or greater, or a pH of 5.5 or less.

5.6.1. Reinforced Concrete

Laboratory tests indicate that the potential for sulfate attack on concrete in contact with the on-site soils is negligible in accordance with ACI 318, Table 4.3.1. As a minimum, we recommend that Type I or II cement and a water-cement ratio of no greater than 0.5 be used on the project.

Test results also indicate that the potential for chloride attack of reinforcing steel in concrete structures and pipes in contact with soil is negligible.

5.6.2. Metallic

Laboratory resistivity testing indicates that the on-site near-surface soils are not considerred corrosive to buried ferrous metals. A corrosion specialist may be consulted regarding suitable types of piping and appropriate protection for underground metal conduits, if needed.

5.7. Drainage Control

The control of surface water is essential to the satisfactory performance of the site improvements. Surface water should be controlled so that conditions of uniform moisture are maintained beneath the improvements, even during periods of heavy rainfall. The following recommendations are considered minimal:

- Ponding and areas of low flow gradients should be avoided.
- If bare soil within 5 feet of the structure is not avoidable, then a gradient of 5 percent or more should be provided sloping away from the improvement. Corresponding paved surfaces should be provided with a gradient of at least 1 percent.
- The remainder of the unpaved areas should be provided with a drainage gradient of at least 2 percent.
- Positive drainage devices, such as graded swales, paved ditches, and/or catch basins should be employed to accumulate and to convey water to appropriate discharge points.

5.8. Utility Trench Backfill

Trench excavations to receive backfill shall be free of trash, debris or other unsatisfactory materials at the time of backfill placement. Prior to placement of compacted fill, the exposed excavation bottoms should be observed by Twining.

On-site soils with an organic content of less than 3 percent by volume (or 1 percent by weight) are suitable for use as fill. Soil material to be used as fill should not contain contaminated materials, rocks, or lumps over 4 inches in largest dimension, and not more than 40 percent larger than ¾ inch. Utility trench backfill material should not contain rocks or lumps over 3 inches in largest dimension. Larger chunks, if generated during excavation, may be broken into acceptably sized pieces or may be disposed of offsite.

Any imported fill material should consist of granular soil having a “very low” expansion potential (that is, expansion index of 20 or less). Import material should also have low corrosion potential (that is, chloride content less than 500 parts per million [ppm], soluble sulfate content of less than 0.1 percent, and pH of 5.5 or higher). Materials to be used as fill should be evaluated by a Twining representative prior to importing or filling.

Fill materials should be moisture conditioned to approximately 2 percent above optimum moisture content prior to placement. The optimum moisture content will vary with material type and other factors. Moisture conditioning of fill soils should be generally consistent within the soil mass. Continue to place the compacted fill in horizontal lifts of approximately 6 to 8 inches in loose thickness. Prior to compaction, each lift should be watered or dried as needed, mixed, and then compacted by mechanical methods to a relative compaction of 90 percent as evaluated by the latest version of ASTM D1557. Successive lifts should be treated in a like manner until the desired finish grades are achieved. Within pavement areas, the upper 12 inches of subgrade soil should be compacted to 95 percent relative compaction evaluated by ASTM D1557.

5.9. Shallow Foundation Recommendations

Based upon the excavation/over-excavation and backfill recommendations, proposed structures may be supported on isolated footings designed in accordance with the geotechnical recommendations presented below. Structural design of foundations should be performed by the structural engineer and should conform to the 2025 California Building Code.

5.9.1. Bearing Capacity and Settlement

Proposed new footings should be placed on the subgrade prepared in accordance with the requirements described in Section 5.4. Geotechnical parameters presented in Table 2 may be used in the footing design. Twining should be contacted for footing loads, allowable bearing pressures, and settlements that are outside the indicated applicable ranges.

5.9.2. Lateral Resistance

Lateral loads may be resisted by footing base friction and by the passive resistance of the soils based on recommendations provided in Table 2. The total lateral resistance can be taken as the sum of the friction at the base of the footing and passive resistance. The upper one foot of passive resistance should be neglected when calculating the lateral resistance.

Table 2 - Geotechnical Design Parameters for Shallow Foundations

Minimum Footing Dimensions	• Width: 18 inches • Minimum embedment: 12 inches measured from the lowest adjacent grade to the bottom of the footing. • Minimum thickness: 6 inches
Assumed Maximum Vertical Static Loads on Foundations	• Rectangular Footing: 124 kilo-pounds (kips)
Net Allowable Bearing Pressure	• An allowable bearing pressures of 2,000 pounds per square foot (psf) may be used for isolated spread footings. • The allowable bearing values correspond to a factor of safety of three. • The allowable bearing values may be increased by one-third to for transient loads from wind or earthquake.
Estimated Static Settlement	• Total settlement: less than 1 inch of static settlement. • Differential settlement: less than ½ inches over a horizontal distance of 30 feet between similarly loaded footings. • The majority static settlement is expected to compete upon initial application of loading.
Allowable Coefficient of Friction Below Footings	0.38, corresponding to a factor of safety of 1.5.
Allowable Lateral Passive Resistance	• 275 pounds per cubic foot (pcf) equivalent fluid pressure (EFP), to a maximum pressure of 2,500 psf, corresponding to a factor of safety of two. • The upper one foot of passive resistance should be neglected. • The allowable passive resistance value may be increased by one-third for transient loads such as wind or earthquake loads. • Since full passive resistance requires sufficient movement to mobilize, when combined with base shear, the passive resistance should be reduced to half for displacement compatibility.

5.10. Modulus of Subgrade Reaction

The modulus of subgrade reaction k for design of combined footing or slabs-on-grade supported on at least 1 feet of engineered fill may be obtained from the following equation.

$$K = k_1 \left(\frac{B+1}{2B}\right)^2 \left(\frac{2L+B}{3L}\right)$$

where: k1 = modulus for a 1-foot by 1-foot plate = 150 pounds per cubic inch (pci);
B = width of combined footing or slab in feet; and
L = length of combined footing or slab in feet.

5.11. Preliminary Flexible Pavement Design

Our pavement structural design is in accordance with Chapter 600 of the Caltrans Highway Design Manual, which is based on a relationship between the gravel equivalent (GE) of the pavement structural materials, the traffic index (TI), and the R-value of the underlying subgrade soil.

It is noted that backfill of excavated pit may comprising predominately imported soil. Therefore, the recommended pavement structural sections may not be adequate. Twining can provide additional pavement design evaluation based on imported soil material up on request during construction.

As preliminary, we assumed an R-value of 30 for the subgrade material based on our laboratory testing results for asphalt pavement structural calculations with assumed TI since no traffic study data is available to us. On this basis, Table 2 provides recommended minimum thicknesses for hot mix asphalt (HMA) and aggregate base sections for different traffic indices.

Table 3 – Recommended Minimum HMA and Base Section Thicknesses

Traffic Index	5.0	6.0	7.0
HMA Thickness (in)	4.0	4.5	6.0
Aggregate Base Thickness (in)	6.0	6.0	6.0

5.12. Rigid Pavement Design

The rigid pavements for the project should be constructed according to ACI 330-25 Guide for Design and Construction of Concrete Parking Lots. We have designed the pavement section with the assumption that the driveway areas will be constructed using Jointed Plain Concrete Pavement (JPCP) pavement, and that a TI 6.5 will be applicable. We have assumed a modulus of subgrade reaction value equal to 150 pci, an aggregate base section of 6 inches, a modulus of subgrade reaction for the aggregate base section equal to 200 pci, a minimum concrete compressive strength of 4,000 psi, a modulus of rupture (MOR) value of 500 psi, and a traffic category of C due to the anticipated weight of fire trucks. Based on Chapter 3 of ACI 330-25, we recommend JPCP thickness of 6.5 inches underlain by 6 inches of compacted aggregate base for a 20-year design life.

To ensure the validity of the recommended pavement sections, the subgrade preparation guidelines outlined in Section 5.4 of our geotechnical report must be followed. Laboratory test results indicate that the native subgrade soil predominantly consists of silty sand (SM). The following steps are recommended for rigid pavement construction:

- Scarify the exposed surface of the subgrade soil to a depth of at least 12 inches.
- Moisture-condition the subgrade to approximately 2 percent above the optimum moisture content and compact it to at least 95 percent of the maximum dry density as determined by the latest version of ASTM D 1557.
- Place a 6-inch aggregate base course layer and compact it to a minimum of 95 percent of the maximum dry density, evaluated according to the latest version of ASTM D 1557.
- Place 6.5 inches of Jointed Plain Concrete Pavement (JPCP) above the aggregate base. The thickness can be reduced by 1 inch if dowels are used at all transverse joints, in accordance with ACI 330-25
- Ensure transverse joints are placed at a maximum spacing of 15 feet.

6. GENERAL SITE GRADING RECOMMENDATIONS

Site grading operations should conform with applicable local building and safety codes and to the rules and regulations of those governmental agencies having jurisdiction over the subject construction.

The grading contractor is responsible to notify governmental agencies, as required, and a representative of Twining at the start of site cleanup, at the initiation of grading, and any time that grading operations are resumed after an interruption. Each step of the grading should be evaluated in a specific area by a representative of Twining and, where required, should be approved by the applicable governmental agencies prior to proceeding with subsequent work.

The following site grading recommendations should be regarded as minimal. The site grading recommendations should be incorporated into the project plans and specifications.

1. Prior to grading, existing vegetation, trash, surface structures and debris should be removed and disposed off-site at a legal dumpsite. Any existing utility lines, or other subsurface structures, which are not to be utilized should be removed, destroyed, or abandoned in compliance with current governmental regulations and with concurrence from Twining, Inc.

2. Subsequent to clearing and grubbing, and prior to initial grading, a reasonable search should be made for subsurface obstructions and/or possible loose fill or detrimental soil types. This search should be conducted by the contractor, with advice from and under the observation of a representative of Twining, Inc.

3. Fill should be spread in 6- to 8-inch lifts and should be moisture conditioned and compacted in accordance with the recommendations presented in the Site Preparation and Earthwork section of this report. All undocumented fill or unsuitable soils within the building areas should be removed and compacted under observation and testing of a representative of Twining.

4. The exposed subgrade and/or excavation bottom should be observed and evaluated by a representative of Twining for conformance with the intent of the recommendations presented in this report and prior to any further processing or fill placement. It should be understood that the actual encountered conditions may warrant excavation and/or subgrade preparation beyond the extent recommended and/or anticipated in this report.

5. On-site inorganic granular soils that are free of debris or contamination and are not greater than 6 inches in largest dimension are considered suitable for placement as compacted fill. A representative of Twining, Inc. should provide guidance for suitability and placement of on-site clay fill materials.

6. Observation and field tests shall be performed during grading by a representative of Twining, Inc. in order to assist the contractor in obtaining the proper moisture content and required degree of compaction. Where less than the required degree of compaction is indicated, additional compactive effort and any necessary adjustments in the moisture content of the soil should be made to obtain the required compaction.

7. To evaluate the presence of satisfactory materials at design elevations, footing excavations should be observed to be clean of loosened soil and debris before placing steel or concrete and probed for soft areas. If soft or loose soils or unsatisfactory materials are encountered, these materials should be removed and replaced with compacted fill.

8. In the event that underground facilities such as pipes or underground storage tanks are encountered during grading, the appropriate authorities, property owners, and regulatory authorities should be notified. Removal of underground storage tanks is regulated by city or county health departments and/or by the fire department. In the event that tanks containing unknown substances are encountered, no attempts should be made to remove such objects until their contents have been ascertained and directions issued by competent professionals or regulators. Septic tanks should be removed entirely. Cesspools or seepage pits should be pumped of their contents and removed in their entirety. Water wells should be capped in accordance with the requirements of the appropriate regulatory agencies.

9. Wherever, in the opinion of a representative of Twining, Inc., an unsatisfactory condition is being created in any area, whether by cutting or filling, then the work should not proceed in that area until the condition has been corrected.

7. LIMITATIONS

The recommendations and opinions expressed in this report are based on information obtained from our field exploration for the site. In the event that any of our recommendations conflict with recommendations provided by other design professionals, we should be contacted to aid in resolving the discrepancy.

Due to the limited nature of our field explorations, conditions not observed and described in this report may be present on the site. Uncertainties relative to subsurface conditions can be reduced through additional subsurface exploration. Additional subsurface evaluation and laboratory testing can be performed upon request. It should be understood that conditions different from those anticipated in this report may be encountered during excavation operations, for example, the presence of unsuitable soil, and that additional effort may be required to mitigate them.

Site conditions, including groundwater elevation, can change with time as a result of natural processes or the activities of man at the subject site or at nearby sites. Changes to the applicable laws, regulations, codes, and standards of practice may occur as a result of government action or the broadening of knowledge. The findings of this report may, therefore, be invalidated over time, in part or in whole, by changes over which Twining has no control.

Twining's recommendations for this site are, to a high degree, dependent upon appropriate quality control of foundation construction. Accordingly, the recommendations are made contingent upon the opportunity for Twining to observe foundation excavations for the proposed construction. If parties other than Twining are engaged to provide such services, such parties must be notified that they will be required to assume complete responsibility as the geotechnical engineer of record and the engineering geologist of record for the geotechnical phase of the project by concurring with the recommendations in this report and/or by providing alternative recommendations.

This document is intended to be used only in its entirety. No portion of the document, by itself, is designed to completely represent any aspect of the project described herein. Twining should be contacted if the reader requires additional information or has questions regarding the content, interpretations presented, or completeness of this document.

This report has been prepared for the exclusive use by the client and its agents for specific application to the proposed design and construction of the project described herein. Any party other than the client who wishes to use this report for an adjacent or nearby project, shall notify Twining of such intended use. Land use, site conditions, or other factors may change over time, and additional work may be required with the passage of time. Based on the intended use of this

report and the nature of the project, Twining may require that additional work be performed and that an updated report be issued. Non-compliance with any of these requirements by the client or any other party will release Twining from any liability resulting from the use of this report by any unauthorized party.

Twining has endeavored to perform its evaluation using the degree of care and skill ordinarily exercised under similar circumstances by reputable geotechnical professionals with experience in this area in similar soil conditions. No other warranty, either expressed or implied, is made as to the conclusions and recommendations contained in this report.

8. SELECTED REFERENCES

American Society of Civil Engineers, 2021, Minimum Design Loads and Associated Criteria for Buildings and Other Structures: ASCE Standard ASCE/SEI 7-22, ISBN 9780784483497.

ASTM, current latest version, “Soil and Rock: American Society for Testing and Materials,” vol. 4.08 for ASTM test methods D-420 to D-4914; and vol. 4.09 for ASTM test methods D-4943 to highest number.

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California Department of Conservation, California Geological Survey, 2008, Guidelines for

California Department of Transportation, 2025, Corrosion Guidelines, Version 3.2, July 2025.

Evaluation and Mitigation of Seismic Hazards in California: Special Publication 117A, 98 pp.

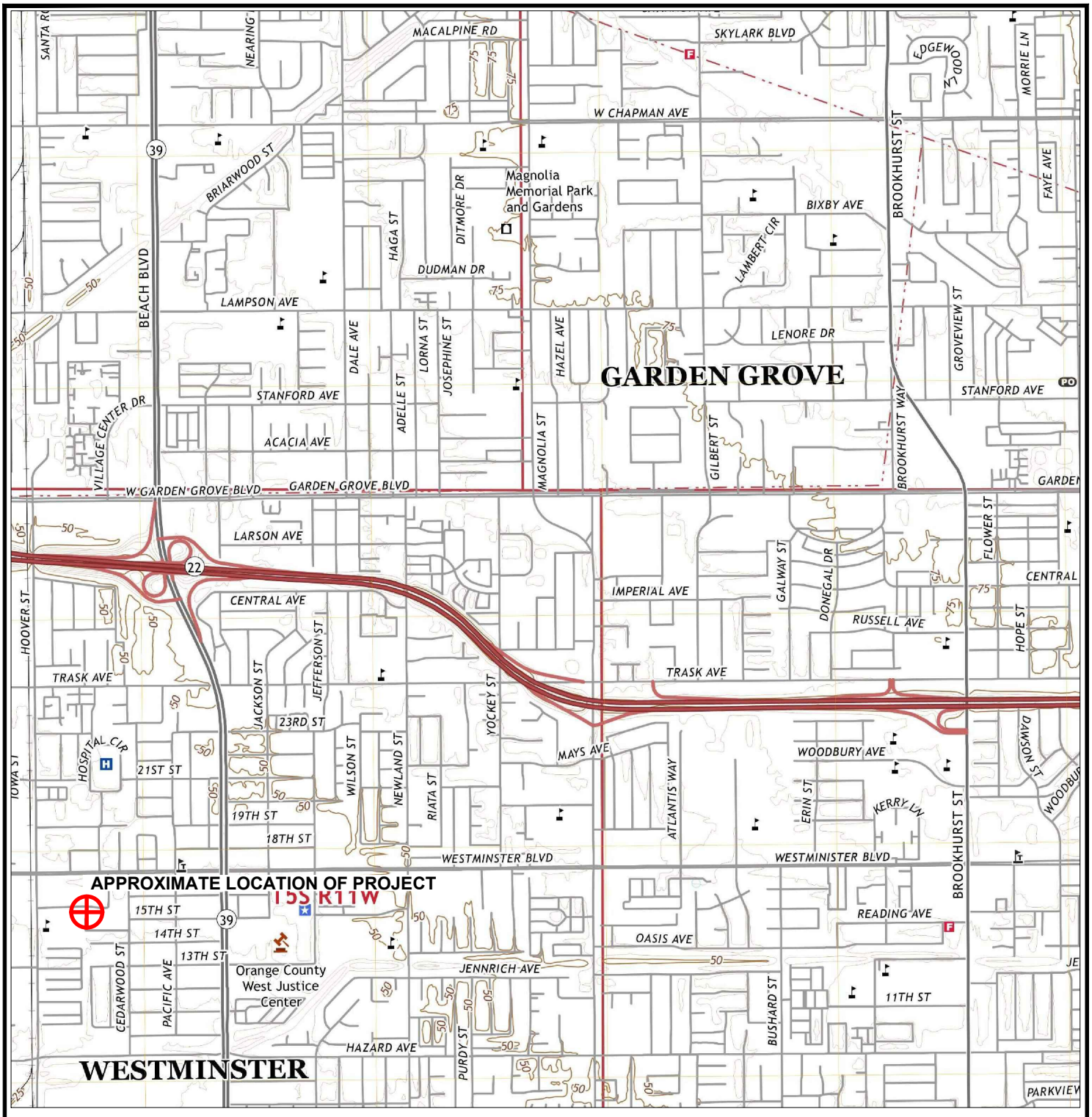
California Geological Survey (CGS), 2018, Earthquake Fault Zones, a Guide for Government Agencies, Property Owners / Developers, and Geoscience Practitioners for Assessing Fault Rupture Hazards in California, California Geological Survey Special Publication 42, 93 pp.

California Geological Survey, 1997, Seismic Hazard Zone Report for the Anaheim and Newport 7.5-Minute Quadrangle, Los Angeles and Orange Counties, California, Seismic Hazard Zone Report 03.

Morton, D.M. and Miller, F.K., 2006, Geologic map of the San Bernardino and Santa Ana 30' x 60' quadrangles, California, U.S. Geological Survey, Open-File Report OF-2006-1217, 1:100,000.

United States Geological Survey, 2022, Anaheim Quadrangle: 7.5 Minute Series (Topographic), scale 1:24,000.

FIGURES



APPROXIMATE LOCATION OF PROJECT

SCALE IN FEET

0 2000 4000

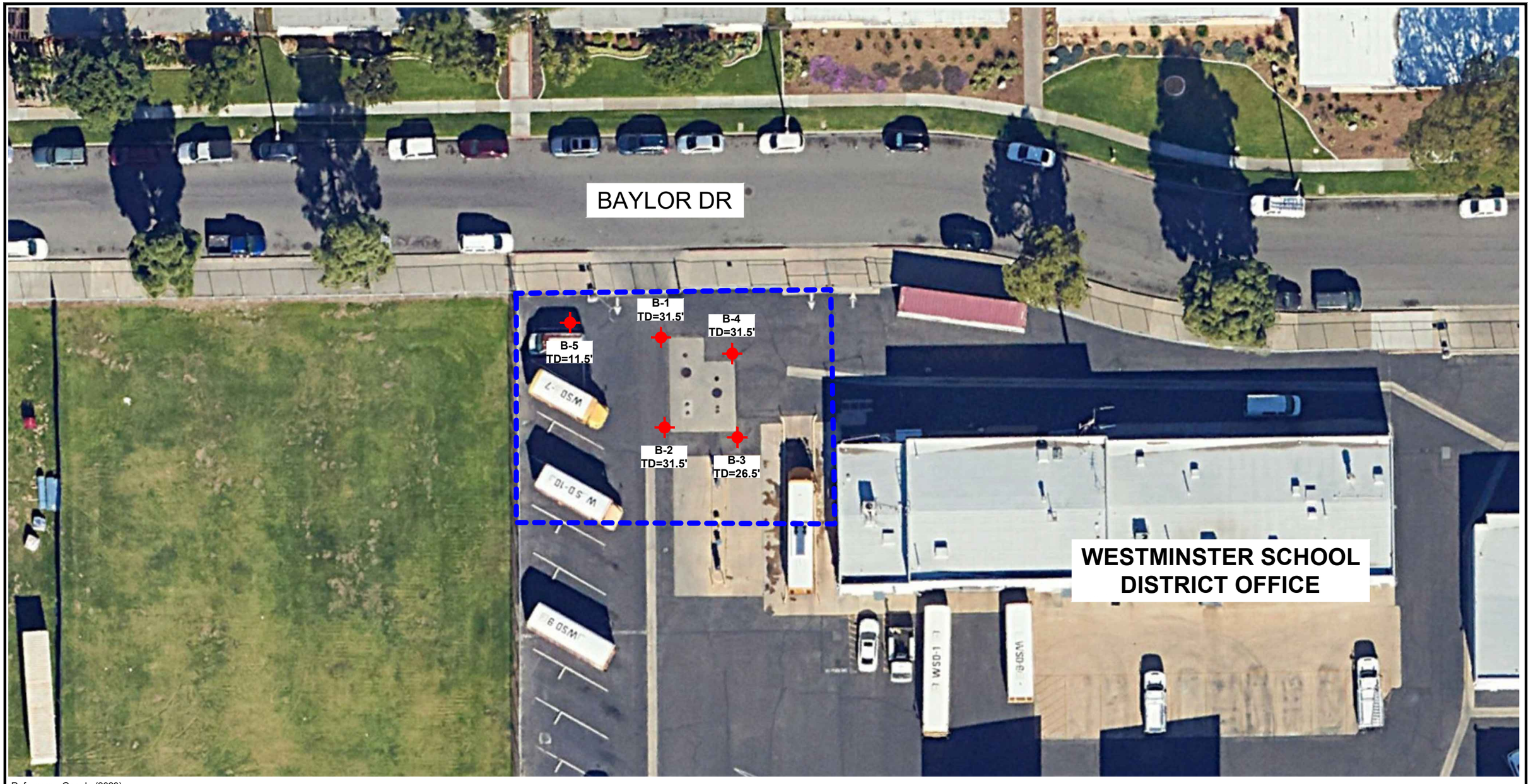
REFERENCE: USGS (2022)

TWINING

SITE LOCATION MAP

WESTMINSTER SCHOOL DISTRICT OFFICE
14121 CEDARWOOD ST
WESTMINSTER, CA

PROJECT NO.	REPORT DATE	FIGURE 1
250866.1	January 2026	



Reference: Google (2023)

SCALE IN FEET

0 30′ 60′

NOTE: ALL DIMENSIONS AND LOCATIONS ARE APPROXIMATE

LEGEND

B-1
TD=31.5' — APPROXIMATE LOCATION OF BORING BY TWINING
TOTAL DEPTH IN FEET

APPROXIMATE LIMITS OF PROJECT

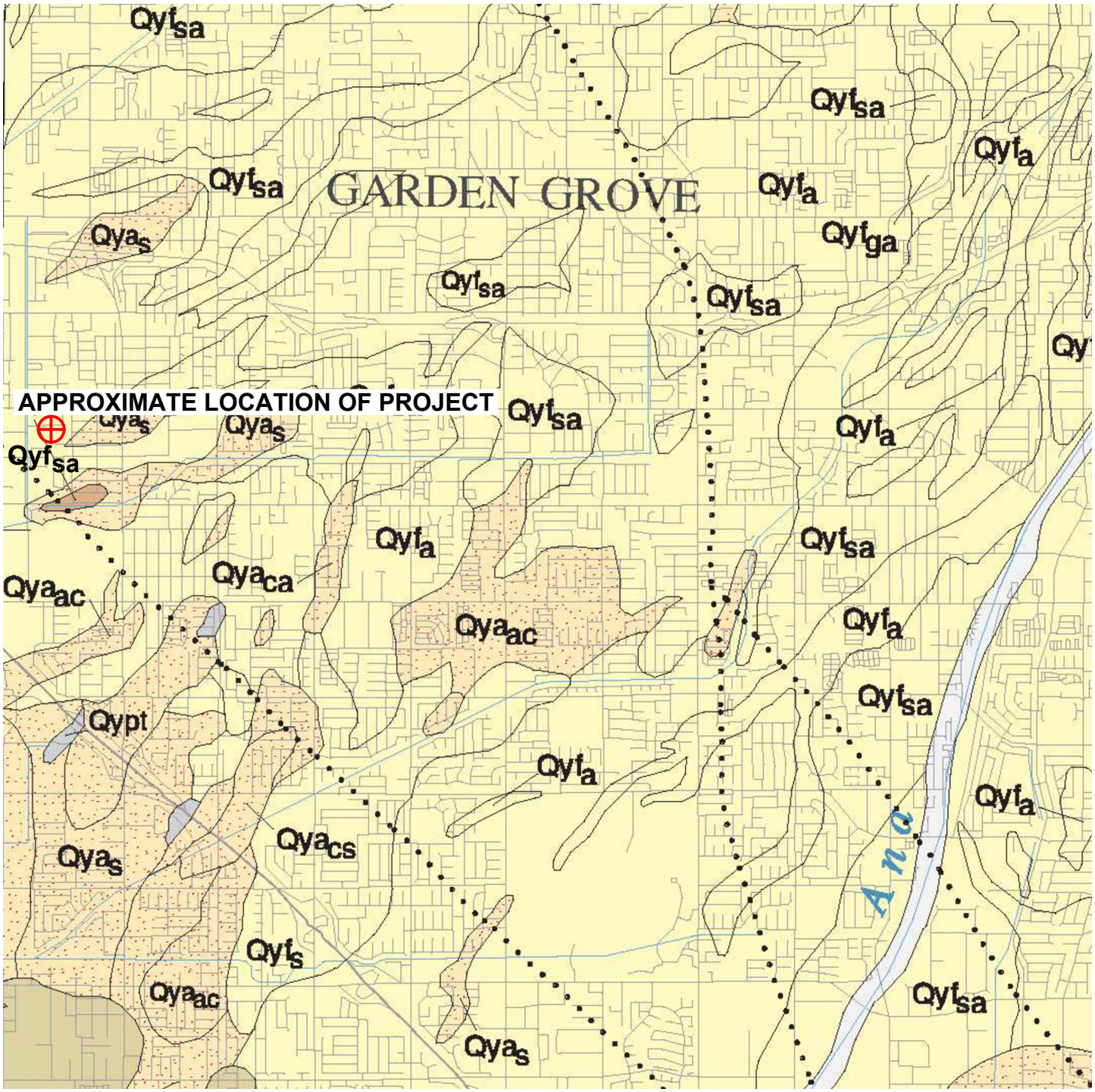
TWINING

N

SITE PLAN AND BORING LOCATION MAP

WESTMINSTER SCHOOL DISTRICT OFFICE
14121 CEDARWOOD ST
WESTMINSTER, CA

PROJECT No.	REPORT DATE	
250866.1	January 2026	FIGURE 2



LEGEND

Qw	Very young wash deposits	Qvof	Very old alluvial-fan deposits
Qyf	Young alluvial-fan deposits	⊕	Approximate Location of Project
Qya	Young axial-channel deposits		
Qof	Old paralic deposits		

N

APPROXIMATE SCALE IN FEET

0 4000 8000

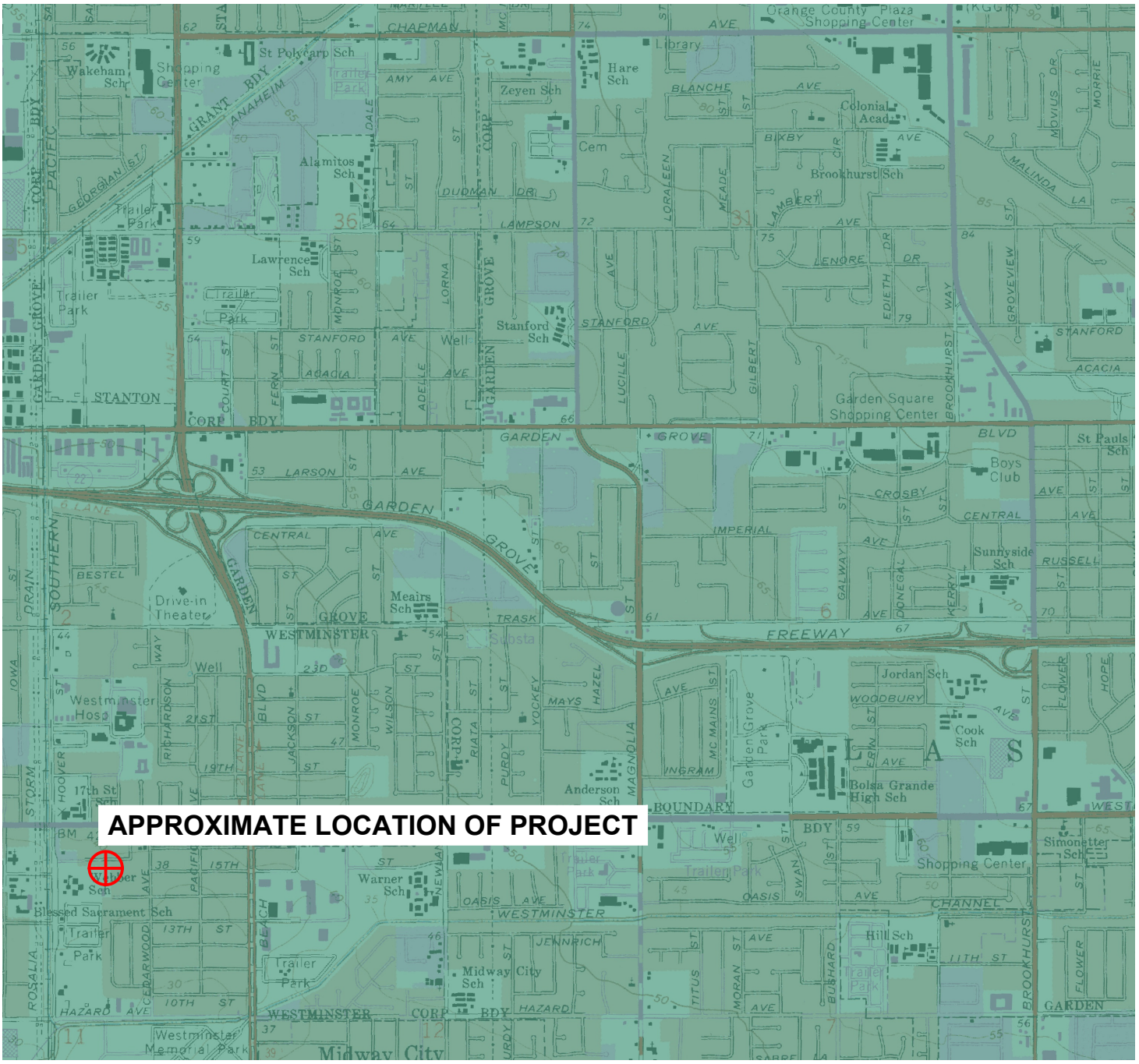
REFERENCE: USGS (2006)

TWINING

GEOLOGIC MAP

WESTMINSTER SCHOOL DISTRICT OFFICE
14121 CEDARWOOD ST
WESTMINSTER, CA

PROJECT NO.	REPORT DATE	FIGURE
250866.1	January 2026	FIGURE 3



MAP EXPLANATION

EARTHQUAKE FAULT ZONES

Earthquake Fault Zones
Zone boundaries are delineated by straight-line segments; the boundaries define the zone encompassing active faults that constitute a potential hazard to structures from surface faulting or fault creep such that avoidance as described in Public Resources Code Section 2621.5(a) would be required.

Active Fault Traces
Faults considered to have been active during Holocene time and to have potential for surface rupture: Solid Line in Black or Red where Accurately Located; Long Dash in Black or Solid Line in Purple where Approximately Located; Short Dash in Black or Solid Line in Orange where Inferred; Dotted Line in Black or Solid Line in Rose where Concealed; Query (?) indicates additional uncertainty. Evidence of historic offset indicated by year of earthquake-associated event or C for displacement caused by fault creep.

SEISMIC HAZARD ZONES

Liquefaction Zones
Areas where historical occurrence of liquefaction, or local geological, geotechnical and ground water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

Earthquake-Induced Landslide Zones
Areas where previous occurrence of landslide movement, or local topographic, geological, geotechnical and subsurface water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

OVERLAPPING EARTHQUAKE FAULT AND SEISMIC HAZARD ZONES

Overlap of Earthquake Fault Zone and Liquefaction Zone
Areas that are covered by both Earthquake Fault Zone and Liquefaction Zone.

Overlap of Earthquake Fault Zone and Earthquake-Induced Landslide Zone
Areas that are covered by both Earthquake Fault Zone and Earthquake-Induced Landslide Zone.

Note: Mitigation methods differ for each zone – AP Act only allows avoidance; Seismic Hazard Mapping Act allows mitigation by engineering/geotechnical design as well as avoidance.

APPROXIMATE SCALE IN FEET

0 2000 4000

REFERENCE: CGS (1998)

TWINING

SEISMIC HAZARD ZONES MAP

WESTMINSTER SCHOOL DISTRICT OFFICE
14121 CEDARWOOD ST
WESTMINSTER, CA

PROJECT NO.	REPORT DATE	FIGURE
250866.1	January 2026	FIGURE 4

Appendix A
Field Exploration

TWINING

Appendix A
Field Exploration

General

The subsurface exploration program for the proposed project consisted of drilling and logging three 8-inch diameter exploratory borings conducted at the site on November 24, 2025. The soil borings were advanced to maximum depths of 31.5 feet below existing grade. The drilling operation was performed using a truck-mounted hollow-stem-auger drill rig, and a hand auger performed by Baja Exploration of Escondido, California.

Drilling and Sampling

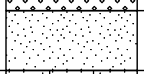
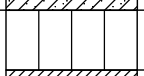
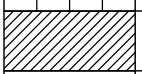
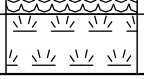
The boring logs and explanation of the logs are attached to this appendix. The boring logs describe the earth materials encountered, samples obtained, and show the field and laboratory tests performed. The log also shows the boring number, drilling date, and the name of the logger and drilling subcontractor. The borings were logged by an engineer using the Unified Soil Classification System. The boundaries between soil types shown on the logs are approximate because the transition between different soil layers may be gradual. Drive and bulk samples of representative earth materials were obtained from the borings.

Disturbed samples were obtained using a Standard Penetration Sampler (SPT). This sampler consists of a 2-inch O.D., 1.4-inch I.D. split barrel shaft that is advanced into the soil at the bottom of the drilled hole a total of 18 inches. The number of blows required to drive the sampler the final 12 inches is presented on the boring logs. Soil samples obtained by the SPT were retained in plastic bags.

A California modified sampler was used to obtain drive samples of the soil encountered. This sampler consists of a 3-inch outside diameter (O.D.), 2.4-inch inside diameter (I.D.) split barrel shaft that was driven a total of 12-inches into the soil at the bottom of the boring by a safety hammer weighing 140 pounds at a drop height of approximately 30 inches. The soil was retained in brass rings for laboratory testing. Additional soil from each drive remaining in the cutting shoe was usually discarded after visually classifying the soil. The number of blows required to drive the sampler the final 12 inches is presented on the boring logs.

Upon completion of the borings, the boreholes were backfilled with soil from the cuttings and the borehole surfaces were restored to its original conditions.

UNIFIED SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		(LITTLE OR NO FINES)		GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
		(APPRECIABLE AMOUNT OF FINES)		GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	SAND AND SANDY SOILS	CLEAN SANDS		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		(LITTLE OR NO FINES)		SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SANDS WITH FINES		SM	SILTY SANDS, SAND - SILT MIXTURES
		(APPRECIABLE AMOUNT OF FINES)		SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 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, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

COARSE-GRAINED SOILS

Relative Density	SPT (blows/ft)	Relative Density (%)
Very Loose	<4	0 - 15
Loose	4 - 10	15 - 35
Medium Dense	10 - 30	35 - 65
Dense	30 - 50	65 - 85
Very Dense	>50	85 - 100

FINE-GRAINED SOILS

Consistency	SPT (blows/ft)
Very Soft	<2
Soft	2 - 4
Medium Stiff	4 - 8
Stiff	8 - 15
Very Stiff	15 - 30
Hard	>30

NOTE: SPT blow counts based on 140 lb. hammer falling 30 inches

Sample Symbol	Sample Type	Description
	California Modified	2.4 in. I.D., 3.0 in. O.D. driven sampler
	SPT	1.4 in I.D., 2.0 in. O.D. driven sampler
	Bulk	Retrieved from soil cuttings
	Thin-Walled Tube	Pitcher or Shelby Tube

LABORATORY TESTING ABBREVIATIONS

ATT	Atterberg Limits
C	Consolidation
CORR	Corrosivity Series
DS	Direct Shear
EI	Expansion Index
GS	Grain Size Distribution
K	Permeability
MAX	Moisture/Density (Modified Proctor)
O	Organic Content
RV	Resistance Value
SE	Sand Equivalent
SG	Specific Gravity
TX	Triaxial Compression
UC	Unconfined Compression

TWINING

EXPLANATION FOR LOG OF BORINGS

Twining, Inc.
4811 Airport Plaza Dr Suite 220
Long Beach, CA 90815

Westminster School District Office UST Removal

14121 Cedarwood St, Westminster, CA

B-1

Drilling Co.:	Baja Exploration	Project No.:	250866.1	Comments: Groundwater was encountered at approximately 9-feet. Boring was backfilled with neat cement. Surface was patched with asphalt concrete.
Logged By:	DJL	Date Drilled:	11/24/2024	
Checked By:	AM	Boring Depth:	30'	
Equipment:	CME-95	Boring Elevation:	37.9'	
Hammer Type:	Auto	Latitude, Longitude:	33.757785, -117.996135	
Drilling Method:	8-inch Hollow Stem Auger	▽ Water Level At Time Of Drilling	9 ft	
		Cave-in At Time Of Drilling	N/A	

Depth (ft)	Samples: Bulk / Grab	Samples: Driven	Blow Counts/6"	Graphic Log	USCS	Visual Classifications and Remarks	Lab Results: Moisture Content (%)	Lab Results: Dry Density (PCF)	Lab Results: % Fines	Lab Results: Atterberg Limits (LL-PL-PI)
						Approximately 6-inches of asphalt over 6-inches of base				
					SM	**Fill**: (SM) Silty SAND, olive gray, slightly moist to moist, fine sand			26.9	
						-- some fine gravel				
5			3 3 3			**Alluvium**: (SM) Silty SAND, loose, gray, slightly moist to moist, fine sand, iron oxide staining				
▽										
10			2 3 4			-- loose, very moist to wet	28.6	97.2		
15			6 3 7		SP-SM	(SP-SM) Poorly Graded SAND with Silt, loose, grayish brown, very moist to wet, fine to medium sand			9.5	
20			3 5 4		CL	(CL) Sandy LEAN CLAY, medium stiff, gray, very moist to wet, fine sand, iron oxide staining, micaceous	26.3	95.2		
25			2 3 6			-- stiff				
30			7 7 8			-- stiff, no sample recovery				

TWINING

Westminster School District Office UST Removal

14121 Cedarwood St, Westminster, CA

B-2

Drilling Co.:	Baja Exploration	Project No.:	250866.1	Comments: Groundwater was encountered at approximately 6.9-feet. Boring was backfilled with neat cement. Surface was patched with asphalt concrete.
Logged By:	DJL	Date Drilled:	11/24/2025	
Checked By:	AM	Boring Depth:	31.5'	
Equipment:	CME-95	Boring Elevation:	39.2'	
Hammer Type:	Auto	Latitude, Longitude:	33.757702, -117.996136	
Drilling Method:	8-inch Hollow Stem Auger	▽ Water Level At Time Of Drilling	6.9 ft	
		Cave-in At Time Of Drilling	N/A	

Depth (ft)	Samples: Bulk / Grab	Samples: Driven	Blow Counts/6"	Graphic Log	USCS	Visual Classification and Remarks	Lab Results: Moisture Content (%)	Lab Results: Dry Density (PCF)	Lab Results: % Fines	Lab Results: Atterberg Limits (LL-PL-PI)
						Approximately 5.5-inches of asphalt over 5.5-inches of base				
					SM	**Fill**: (SM) Silty SAND, medium brown, slightly moist, fine sand,				
					GP	(GP) Poorly Graded GRAVEL, slightly moist, some fine sand				
5			3 4 5		SM	**Alluvium**: (SM) Silty SAND, loose, medium brown, moist, fine to medium sand, some fine gravel	16.1	106.6		
▽										
10			2 2 3			-- loose, grayish brown, very moist to wet, iron oxide staining			23.2	
15			4 5 6			-- loose, gray, very moist	22.9	103.5		
20			Push Push 3		CL	(CL) LEAN CLAY with Sand, soft, olive gray, very moist, fine sand, iron oxide staining			71.1	
25			4 6 6		SM	(SM) Silty SAND, loose, gray, very moist, fine sand, iron oxide staining	23.4	102.9		
30			4 4 4		CL	(CL) Sandy LEAN CLAY, medium stiff, olive gray, very moist, fine sand				

TWINING

Westminster School District Office UST Removal

14121 Cedarwood St, Westminster, CA

B-3

Drilling Co.:	Baja Exploration	Project No.:	250866.1	Comments: Groundwater was encountered at approximately 9-feet. Boring was backfilled with neat cement. Surface was patched with asphalt concrete.
Logged By:	DJL	Date Drilled:	11/24/2025	
Checked By:	AM	Boring Depth:	26.5'	
Equipment:	CME-95	Boring Elevation:	39.2'	
Hammer Type:	Auto	Latitude, Longitude:	33.757696, -117.99606	
Drilling Method:	8-inch Hollow Stem Auger	▽ Water Level At Time Of Drilling	9 ft	
		Cave-in At Time Of Drilling	N/A	

Depth (ft)	Samples: Bulk / Grab	Samples: Driven	Blow Counts/6"	Graphic Log	USCS	Visual Classification and Remarks	Lab Results: Moisture Content (%)	Lab Results: Dry Density (PCF)	Lab Results: % Fines	Lab Results: Atterberg Limits (LL-PL-PI)
						Approximately 4-inches of asphalt over 4.5-inches of base				
					SM	**Fill**: (SM) Silty SAND, medium brown, slightly moist to moist, fine to medium sand				
					GP	(GP) Poorly Graded GRAVEL, brown to gray, slightly moist, some fine sand				
5		☒	1 2 2		SM	**Alluvium**: (SM) Silty SAND, loose, grayish brown, slightly moist to moist, fine sand, iron oxide staining				
▽										
10		▲	2 3 4			-- loose, very moist to wet, micaceous	27.9	96.5		
15		☒	2 2 2		SC	(SC) Clayey SAND, loose, olive gray, very moist to wet, fine sand, iron oxide staining, micaceous				
20		▲	7 9 10		SM	(SM) Silty SAND, medium dense, olive gray, very moist, fine sand, micaceous	23.6	101.2		
25		☒	2 2 3		CL	(CL) Sandy LEAN CLAY, medium stiff, olive gray, very moist, fine sand, iron oxide staining, micaceous				

TWINING

Westminster School District Office UST Removal

14121 Cedarwood St, Westminster, CA

B-4

Drilling Co.:	Baja Exploration	Project No.:	250866.1	Comments: Groundwater was encountered at approximately 9-feet. Boring was backfilled with neat cement. Surface was patched with asphalt concrete.
Logged By:	DJL	Date Drilled:	11/24/2025	
Checked By:	AM	Boring Depth:	31.5'	
Equipment:	CME-95	Boring Elevation:	37.9'	
Hammer Type:	Auto	Latitude, Longitude:	33.757769, -117.996065	
Drilling Method:	8-inch Hollow Stem Auger	▽ Water Level At Time Of Drilling	9 ft	
		Cave-in At Time Of Drilling	N/A	

Depth (ft)	Samples: Bulk / Grab	Samples: Driven	Samples: Blow Counts/6"	Graphic Log	USCS	Visual Classification and Remarks	Lab Results: Moisture Content (%)	Lab Results: Dry Density (PCF)	Lab Results: % Fines	Lab Results: Atterberg Limits (LL-PL-PI)
						Approximately 6-inches of asphalt over 6-inches of base				
					SM	**Fill**: (SM) Silty SAND, medium brown, slightly moist to moist, fine sand, some clay				
					GP	(GP) Poorly Graded GRAVEL, brown to gray, slightly moist, some fine sand			19.6	NP
5			5 5 4		SM	**Alluvium**: (SM) Silty SAND, loose, medium, slightly moist to moist, fine sand, iron oxide staining	9.5	100.9		
▽ 10			1 2 3		SC	(SC) Clayey SAND, loose, gray, very moist to wet, fine sand, iron oxide staining, micaceous				
15			4 5 6		SM	(SM) Silty SAND, loose, gray, moist to very moist, fine sand, micaceous	23.8	101.6		
20			4 3 2		CL	(CL) Sandy LEAN CLAY, medium stiff, olive gray, moist to very moist, fine sand, iron oxide staining, micaceous				
25			3 3 5			-- medium stiff, moist to very moist	22.1	102.1		
30			3 4 7			-- stiff				

TWINING

Westminster School District Office UST Removal

14121 Cedarwood St, Westminster, CA

B-5

Drilling Co.:	Baja Exploration	Project No.:	250866.1	Comments: Groundwater was encountered at approximately 8-feet. Boring was backfilled with neat cement. Surface was patched with asphalt concrete.
Logged By:	DJL	Date Drilled:	11/24/2025	
Checked By:	AM	Boring Depth:	11.5'	
Equipment:	CME-95	Boring Elevation:	40.8'	
Hammer Type:	Auto	Latitude, Longitude:	33.75779, -117.99623	
Drilling Method:	8-inch Hollow Stem Auger	▽ Water Level At Time Of Drilling	8 ft	
		Cave-in At Time Of Drilling	N/A	

Depth (ft)	Samples: Bulk / Grab	Samples: Driven	Samples: Blow Counts/6"	Graphic Log	USCS	Visual Classification and Remarks	Lab Results: Moisture Content (%)	Lab Results: Dry Density (PCF)	Lab Results: % Fines	Lab Results: Atterberg Limits (LL-PL-PI)
						Approximately 4-inches of asphalt over 6-inches of base				
	■				SP-SM	**Alluvium**: (SP-SM) Poorly Graded SAND with Silt, tan to brown, slightly moist to moist, fine sand			8.2	
5		▲	4 6 6		CL	(CL) Sandy LEAN CLAY, stiff, grayish brown, wet, fine sand, iron oxide staining	36.3	86.3		
▽										
10		⊠	3 3 6			-- stiff				

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Appendix B
Laboratory Testing

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Appendix B
Laboratory Testing

Laboratory Moisture Content and Density Tests

The moisture content and dry densities of driven samples obtained from the exploratory borings were evaluated in general accordance with the latest version of ASTM D 2937. The test results are presented on the logs of the exploratory borings in Appendix A and are also summarized in Table B-1.

Table B-1
Laboratory Moisture Content and Dry Density

Boring No.	Depth (feet)	Moisture Content (%)	Dry Unit Weight (pcf)
B-1	10	28.6	97.2
B-1	20	26.3	95.2
B-2	5	16.1	106.6
B-2	15	22.9	103.5
B-2	25	23.4	102.9
B-3	10	27.9	96.5
B-3	20	23.6	101.2
B-4	5	9.5	100.9
B-4	15	23.8	101.6
B-4	25	22.1	102.1
B-5	5	363	86.3

Maximum Density and Optimum Moisture

Modified Proctor testing was performed on near-surface soils to determine the maximum dry density and optimum water content for compaction. The tests were performed in accordance with ASTM D 1557 Method A. Test results are presented on laboratory graphs attached to this appendix.

Wash Sieve

The amount of fines passing the No. 200 sieve was evaluated by the wash sieve. The test procedure was in general accordance with ASTM D 1140. The results are presented in Table B-2.

Table B-2
No. 200 Wash Sieve Results

Boring No.	Depth (feet)	Percent Passing #200
B-1	1 – 5	26.9
B-1	15	9.5
B-2	10	23.2
B-2	20	71.1
B-4	1 – 5	19.6
B-5	1 – 5	8.2

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Atterberg Limits

Plasticity index testing was performed on selected samples obtained from the borings to evaluate plasticity characteristics and to aid in the classification of the soil. The tests were performed in general accordance with ASTM D 4318. The results are presented on Table B-3, Atterberg Limits.

Table B-3
Atterberg Limits Results

Boring No.	Depth (feet)	Liquid Limit	Plastic Limit	Plasticity Index
B-4	1 – 5	NP	NP	NP

NP = Non-Plastic

Corrosivity

Soil pH and resistivity tests were performed by Anaheim Test Laboratories on a representative soil sample in general accordance with the latest version of California Test Method 643. The chloride content of the selected sample was evaluated in general accordance with the latest version of California Test Method 422.

The sulfate content of the selected samples was evaluated in general accordance with the latest version of California Test Method 417. The test results are presented on Table B-4.

Table B-4
Corrosivity Test Results

Boring No.	Depth (feet)	pH	Water Soluble Sulfate (ppm)	Water Soluble Chloride (ppm)	Minimum Resistivity (ohm-cm)
B-2	1 – 5	7.7	168	49	11,000
B-5	1 – 5	7.6	135	34	4,300

Expansion Index

The expansion index of a select soil sample was evaluated in general accordance with ASTM D 4829. The specimen was molded under a specified compactive energy at approximately 50 percent saturation. The prepared 1-inch thick by 4-inch diameter specimen was loaded with a surcharge of 144 pounds per square foot (psf) and was inundated with tap water. Readings of volumetric swell were made for a period of 24 hours. The result of expansion index test is presented in Table B-5.

Table B-5
Expansion Index

Boring No.	Depth (feet)	Expansion Index	Expansion Potential
B-1	1-5 bulk	1	Very Low

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Proctor Report

Report No: PTR:W01-25-37266-S02
Date of Issue: 1/13/2026 **Issue No: 1**

Customer: Westminster School District
14121 Cedarwood Avenue
Westminster, CA, 92683

Project: Westminster School District Admin Offices Fuel Tank Replacement
14121 Cedarwood Street
Westminster, California

Project No.: 250866.1
Permit No.:
HCAI:
DSA File #:
DSA AP #:

Jurisdiction:
Distribution:

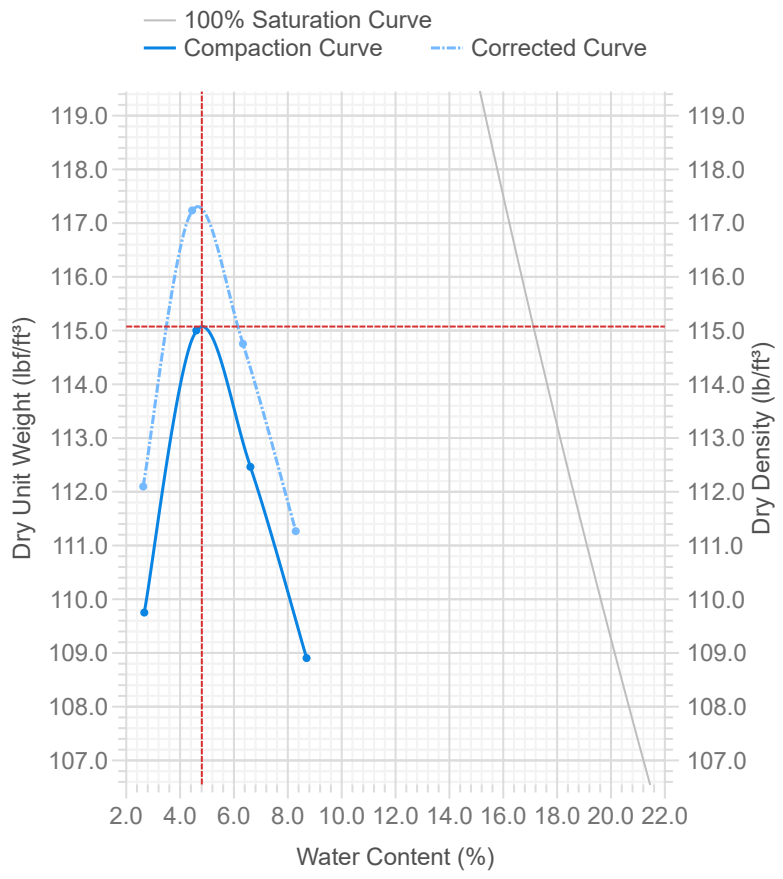
Twining utilizes the "Binary Statement for Simple Acceptance Rule" (ILAC G8:09/2019) for statements of conformity.

Approved Signatory: Adrian Moreno (Project Engineer)

Sample Details

Sample ID:	W01-25-37266-S02	**Field Sample ID:**	
Date Sampled:	11/24/2025	**Sampled By:**	Twining Consulting
Source:	Onsite		
Material:	Subgrade		
Specification:	Report Only		
Sampling Method:	ASTM D 75		
Sampling Location:	B-2		
Sampling Depth:	1-5 ft	**Material Description:**	Silty Sand
Tested By:	Brian Vollnogle	**Date Tested:**	12/5/2025

Dry Unit Weight - Water Content Relationship



Test Results

ASTM D1557

Mod. Maximum Dry Unit Weight (lbf/ft³):	**115.1**
Mod. Optimum Water Content (%):	**4.8**
Test Portion As-received Water Content (%):	2
Retained on No.4 Sieve (%):	6
Passing No.4 Sieve (%):	94
Method:	A
Preparation Method:	Moist
Rammer Type:	Automatic
Test Portion Specific Gravity:	2.70
Determined By:	Estimated
Tested By:	Brian Vollnogle
Date Tested:	12/5/2025

ASTM D4718

Corrected Maximum Dry Unit Weight (lbf/ft³):	**117.3**
Corrected Optimum Water Content (%):	**4.6**
Oversize Specific Gravity:	2.70
Oversize Particles (%):	6

Remarks:

Results relate only to the items tested/inspected. All reports remain the property of Twining. This report shall not be reproduced, except in full, without our prior written approval.

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Proctor Report

Report No: PTR:W01-25-37266-S03
Date of Issue: 1/13/2026 **Issue No: 1**

Customer: Westminster School District
14121 Cedarwood Avenue
Westminster, CA, 92683

Project: Westminster School District Admin Offices Fuel Tank Replacement
14121 Cedarwood Street
Westminster, California

Project No.: 250866.1
Permit No.:
HCAI:
DSA File #:
DSA AP #:

Jurisdiction:
Distribution:

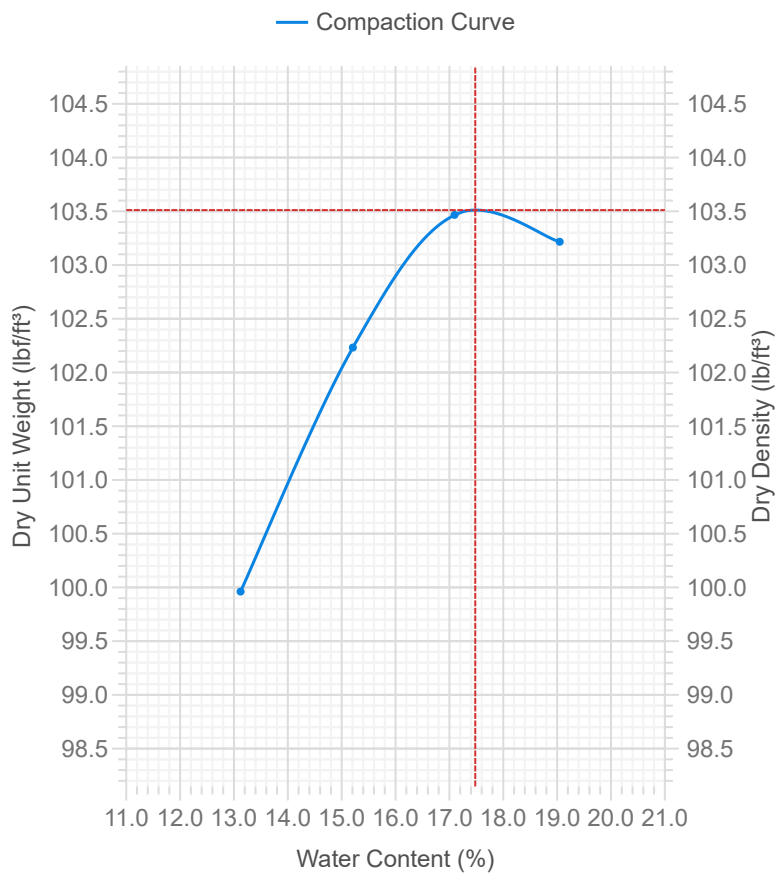
Twining utilizes the "Binary Statement for Simple Acceptance Rule" (ILAC G8:09/2019) for statements of conformity.

Approved Signatory: Adrian Moreno (Project Engineer)

Sample Details

Sample ID:	W01-25-37266-S03	**Field Sample ID:**	
Date Sampled:	11/24/2025	**Sampled By:**	Twining Consulting
Source:	Onsite		
Material:	Onsite Soil		
Specification:	Report Only		
Sampling Method:	ASTM D 75		
Sampling Location:	B-5		
Sampling Depth:	1-5	**Material Description:**	Poorly Graded Sand with Silt
Tested By:	Brian Vollnogle	**Date Tested:**	12/4/2025

Dry Unit Weight - Water Content Relationship



Test Results

ASTM D1557

Mod. Maximum Dry Unit Weight (lbf/ft³):	**103.5**
Mod. Optimum Water Content (%):	**17.5**
Retained on No.4 Sieve (%):	0
Passing No.4 Sieve (%):	100
Method:	A
Preparation Method:	Moist
Rammer Type:	Automatic
Determined By:	Estimated
Tested By:	Brian Vollnogle
Date Tested:	12/4/2025

Remarks:

Results relate only to the items tested/inspected. All reports remain the property of Twining. This report shall not be reproduced, except in full, without our prior written approval.

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Direct Shear Test Report

Report No: MAT:W01-25-37266
Printed Date: 1/13/2026 **Issue No: 1**

Customer:	Westminster School District 14121 Cedarwood Street Westminster, CA 92683	**Project No:**	250866.1
Project:	Admin Office Fuel Tank Removal 14121 Cedarwood Street Westminster, California	**Permit No:** **OSHPD:** **DSA File #:** **DSA AP #:**	
Jurisdiction: **Distribution List:**		**Approved by:**	Daniel Lee Staff Geologist

Sample Details

Sampled By:	DJL	**Date Received:**	11/24/2025
Date Sampled:	11/24/2025	**Received By:**	Twining, Inc.
Sample Location:	B-2	**Material Description:**	Silty Sand
Sample Depth:	5 feet	**Source:**	Client
Sampling Method:	California Modified	**Test Method:**	ASTM D3080

Test Details

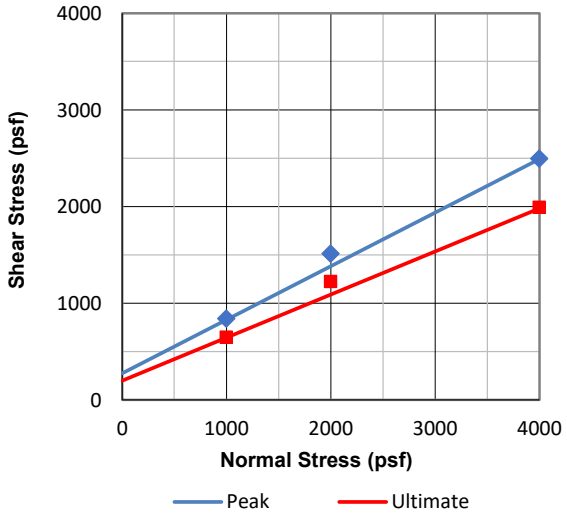
Preparation: Rings **% Compaction:** **Shear Rate:** Slow: .005 (in/min)

Tested By: B. Vollnogle **Date Tested:** 12/5/2025

Specimen #	Wet Density (pcf)	Dry Density (pcf)	Initial Moisture (%)	Final Moisture (%)
1	123.8	106.6	16.1	17.7
2	123.8	106.6	16.1	17.8
3	123.8	106.6	16.1	18.9

Specimen #	Load (psf)	Peak (psf)	Ultimate (psf)
1	1000	840	648
2	2000	1512	1224
3	4000	2496	1992

	Peak	Ultimate
Friction Angle (degrees):	29	24
Cohesion, C (psf):	275	200



Compliance:

Comments

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Direct Shear Test Report

Report No: MAT:W01-25-37266
Printed Date: 1/13/2026 **Issue No: 1**

Customer:	Westminster School District 14121 Cedarwood Street Westminster, CA 92683	**Project No:**	250866.1
Project:	Admin Office Fuel Tank Removal 14121 Cedarwood Street Westminster, California	**Permit No:** **OSHPD:** **DSA File #:** **DSA AP #:**	
Jurisdiction: **Distribution List:**		**Approved by:**	Daniel Lee Staff Geologist

Sample Details

Sampled By:	DJL	**Date Received:**	11/24/2025
Date Sampled:	11/24/2025	**Received By:**	Twining, Inc.
Sample Location:	B-3	**Material Description:**	Silty Sand
Sample Depth:	10 feet	**Source:**	Client
Sampling Method:	California Modified	**Test Method:**	ASTM D3080

Test Details

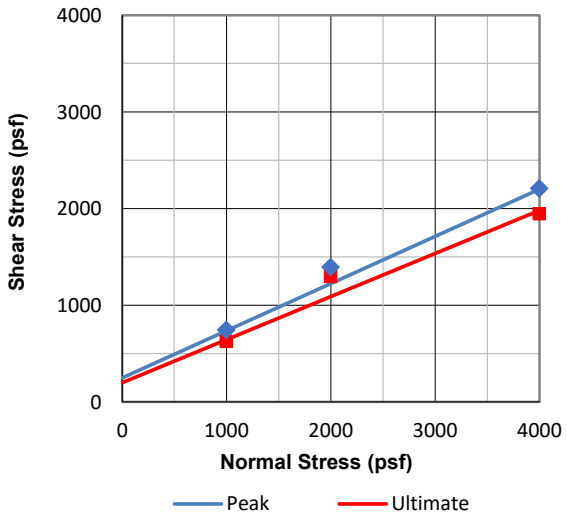
Preparation: Rings **% Compaction:** **Shear Rate:** Slow: .005 (in/min)

Tested By: B. Vollnogle **Date Tested:** 12/3/2025

Specimen #	Wet Density (pcf)	Dry Density (pcf)	Initial Moisture (%)	Final Moisture (%)
1	123.4	96.5	27.9	28.7
2	123.4	96.5	27.9	26.2
3	123.4	96.5	27.9	22.6

Specimen #	Load (psf)	Peak (psf)	Ultimate (psf)
1	1000	744	624
2	2000	1392	1296
3	4000	2208	1944

	Peak	Ultimate
Friction Angle (degrees):	26	24
Cohesion, C (psf):	250	200



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Report No: MAT:W01-25-37266
Printed Date: 1/13/2026 **Issue No:** 1

Customer:	Westminster School District 14121 Cedarwood Street Westminster, CA 92683	**Project No:**	250866.1
Project:	Admin Office Fuel Tank Removal 14121 Cedarwood Street Westminster, California	**Permit No:** **OSHPD:** **DSA File #:** **DSA AP #:**	
Jurisdiction: **Distribution List:**		**Approved by:**	Daniel Lee Staff Geologist

Sample Details

Sampled By:	DJL	**Date Received:**	11/24/2025
Date Sampled:	11/24/2025	**Received By:**	Twining, Inc.
Sample Location:	B-3	**Material Description:**	Silty Sand
Sample Depth:	20 feet	**Source:**	Client
Sampling Method:	California Modified	**Test Method:**	ASTM D3080

Test Details

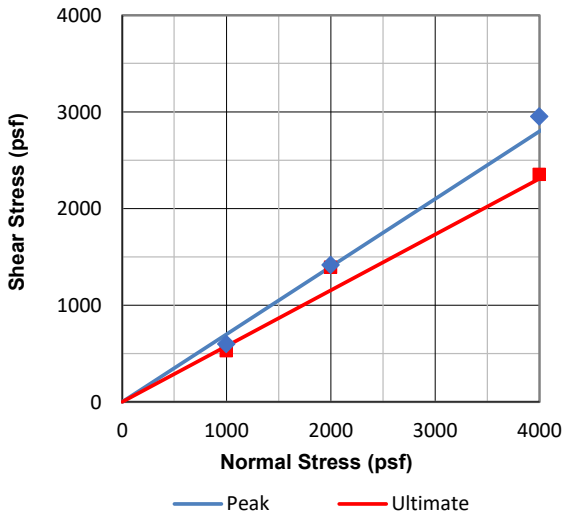
Preparation: Rings **% Compaction:** **Shear Rate:** Slow: .005 (in/min)

Tested By: B. Vollnogle **Date Tested:** 12/4/2025

Specimen #	Wet Density (pcf)	Dry Density (pcf)	Initial Moisture (%)	Final Moisture (%)
1	125.1	101.2	23.6	23.4
2	125.1	101.2	23.6	24.2
3	125.1	101.2	23.6	24.6

Specimen #	Load (psf)	Peak (psf)	Ultimate (psf)
1	1000	600	528
2	2000	1416	1392
3	4000	2952	2352

	Peak	Ultimate
Friction Angle (degrees):	35	30
Cohesion, C (psf):	0	0



Compliance:

Comments

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Direct Shear Test Report

Report No: MAT:W01-25-37266
Printed Date: 1/13/2026 **Issue No:** 1

Customer:	Westminster School District 14121 Cedarwood Street Westminster, CA 92683	**Project No:**	250866.1
Project:	Admin Office Fuel Tank Removal 14121 Cedarwood Street Westminster, California	**Permit No:** **OSHPD:** **DSA File #:** **DSA AP #:**	
Jurisdiction: **Distribution List:**		**Approved by:**	Daniel Lee Staff Geologist

Sample Details

Sampled By:	DJL	**Date Received:**	11/24/2025
Date Sampled:	11/24/2025	**Received By:**	Twining, Inc.
Sample Location:	B-5	**Material Description:**	Poorly Graded Sand with Silt
Sample Depth:	1-5 feet	**Source:**	Client
Sampling Method:	Bulk	**Test Method:**	ASTM D3080

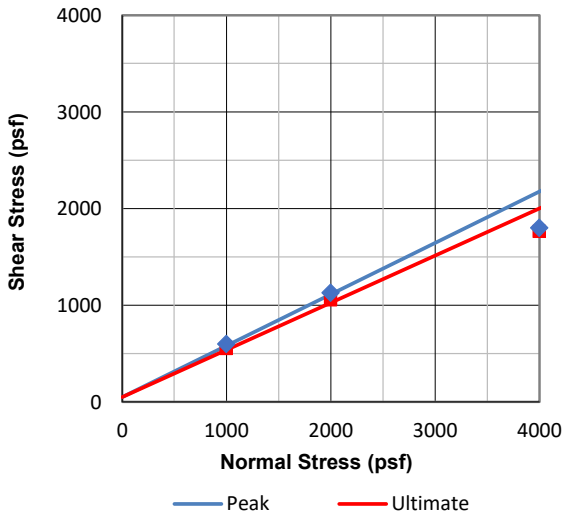
Test Details

Preparation:	Remolded	**% Compaction:**	90%	**Shear Rate:**	Slow: .005 (in/min)
Tested By:	B. Vollnogle			**Date Tested:**	12/8/2025

Specimen #	Wet Density (pcf)	Dry Density (pcf)	Initial Moisture (%)	Final Moisture (%)
1	109.5	93.2	17.5	24.0
2	109.5	93.2	17.5	23.6
3	109.5	93.2	17.5	23.9

Specimen #	Load (psf)	Peak (psf)	Ultimate (psf)
1	1000	600	552
2	2000	1128	1056
3	4000	1800	1764

	Peak	Ultimate
Friction Angle (degrees):	28	26
Cohesion, C (psf):	50	50



Compliance:

Comments

Sample remolded to 90% relative compaction.

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