APPENDIX E

GEOTECHNICAL ENGINEERING REPORT

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Geotechnical Engineering Report

Proposed McDonalds Restaurant
2109 E Santa Clara Avenue
Santa Ana, California 92705

Prepared for:
McDonald's USA
18565 Jamboree Road, Ste. 850
Irvine, CA 92612

November 4, 2021

Project No.: 4230.2100035.0000

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Ms. Christine Cho
McDonalds USA
18565 Jamboree Road, Ste. 850
Irvine, CA 92612

Subject: Geotechnical Engineering Report
Proposed McDonald's Restaurant
2109 E Santa Clara Avenue,
Santa Ana, California 92705

Dear Ms. Cho:

In accordance with your request and authorization, we are presenting the results of our geotechnical investigation for the proposed project located at 2109 E Santa Clara Avenue in the city of Santa Ana, California 92705. 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. This report was prepared in accordance with the requirements of the 2019 California Building Code.

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,

UNIVERSAL ENGINEERING SCIENCES

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Distribution: one PDF document via email to Addressee

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1. INTRODUCTION

This report presents the results of our geotechnical engineering evaluation performed for the proposed single story at-grade McDonald's restaurant and parking lot at 2109 E Santa Clara Avenue, Santa Ana, California (Figure 1, Site Location Map). 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 structures.

2. SITE DESCRIPTION AND PROPOSED DEVELOPMENT

The project site is located at 2109 E Santa Clara Avenue in the City of Santa Ana, California as shown on Figure 1. At the time of exploration, the subject site was a residential plot with two houses and two detached garages. It is our understanding that the proposed project consists of the development of a single story at-grade McDonald's restaurant and parking lot. The approximate site coordinates are latitude 33.76749°N and longitude 117.83683°W and is located at approximately 188 feet above Mean Sea Level (MSL).

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 geologic maps, topographic maps, and aerial photographs relevant to the subject site in preparation of this report. The list of documents reviewed is presented in the "References" section of this report.

3.2. 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 2019 California Building Code
- Evaluation of current and historic high groundwater conditions at the site and potential impact on the existing structures and site development
- Evaluation of project feasibility and suitability of on-site soils for foundation support
- Evaluation of foundation design parameters including soil bearing capacity, lateral resistance, friction coefficient, and seismic considerations
- Evaluation of the potential for the on-site materials to corrode buried concrete and metals

3.3. Field Exploration

The field exploration consisted of excavating five (5) 8-inch-diameter exploratory borings at various locations within the subject site on October 8, 2021. The borings were advanced to depths ranging from 5 to 21.5 feet below the existing grade. The drilling operation was performed using a hollow-stem auger drill rig. The borings were backfilled with the soil cuttings at the end of field exploration.

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

3.4. Geotechnical Laboratory Testing

Laboratory tests were performed on selected samples obtained from the borings in order to aid in the soil classification and to evaluate the engineering properties of the foundation soils. Laboratory tests included in-situ moisture and density, #200 sieve wash, sieve analysis, Atterberg limits, direct shear tests, Expansion Index, consolidation, corrosion testing, and R-values. The detailed laboratory test results are presented in Appendix B.

4. SITE GEOLOGY AND SUBSURFACE CONDITIONS

4.1. Regional Geologic Setting

According to the preliminary geologic map of the Santa Ana Quadrangle (Morton, 2003), the project site is underlain by undifferentiated young alluvial deposit (map symbol: Qyf) that typically consists of unconsolidated to slightly consolidated, undissected to slightly dissected boulders, cobbles, gravels, sands, and silt deposits issued from a confined valley or canyon.

4.2. Subsurface Earth Materials

Earth materials encountered during our subsurface investigation consists of fill overlaying the young alluvial fan deposits (Qyf). In general, the soil consists of light brown to brown, dry to damp, medium dense to very dense, clayey and silty sands.

4.3. Groundwater

Groundwater was not encountered during our subsurface investigation to a maximum depth of 21.5 feet below the existing grade. Based on our review of nearby well data (Well337646N1178432W002), the highest groundwater level is reportedly situated at a depth of approximately 214 feet below the ground surface, which was recorded on March 12th, 2021. Historic high groundwater is 30 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 findings, we note that the potential for groundwater to impact the proposed improvements is considered low.

5. GEOLOGIC HAZARDS AND FINDINGS

5.1. Surface Fault Rupture

The subject site is not located within a State of California Alquist-Priolo Earthquake Fault Zone (formerly known as a Special Studies Zone) (CGS, 2018). No active faults are known to underlie or project towards the site. It is our opinion that the likelihood of fault rupture occurring at the site during the design life of the proposed improvements is low.

5.2. Liquefaction and Seismic Settlement Potential

Liquefaction occurs when the pore pressures generated within a soil mass approach the effective overburden pressure. Liquefaction of soils may be caused by cyclic loading such as that imposed by ground shaking during earthquakes. The increase in pore pressure results in a loss of strength, and the soil then can undergo both horizontal and vertical movements, depending on the site conditions. Other phenomena associated with soil liquefaction include sand boils, ground oscillation, and loss of foundation bearing capacity. Liquefaction is generally known to occur in loose, saturated, relatively clean, fine-grained cohesionless soils at depths shallower than approximately 50 feet. Factors to consider in the evaluation of soil liquefaction potential include groundwater conditions, soil type, grain size distribution, relative density, degree of saturation, and both the intensity and duration of ground motion.

The current standard of practice, as outlined in the “Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Liquefaction in California” and “Special Publication 117A, Guidelines for Evaluating and Mitigating Seismic Hazards in California” requires liquefaction analysis to a depth of 50 feet below the lowest portion of the proposed structure. Liquefaction typically occurs in areas where the soils below the water table are composed of poorly consolidated, fine to medium-grained, primarily sandy soil. In addition to the requisite soil conditions, the ground acceleration and duration of the earthquake must also be of a sufficient level to induce liquefaction.

A review of the State of California Seismic Hazard Zone Map for the Orange Quadrangle indicates the site is not located within an area identified as having a potential for liquefaction. Additionally, based on the lack of shallow ground water, and uniform soil stratum, the potential for liquefaction to impact the proposed improvements is considered low.

5.3. Landslides

Based on our review of the referenced geologic maps, literature, topographic maps, aerial photographs, and our subsurface evaluation, no landslides or related features underlie or are adjacent to the subject site. Due to the relatively level and limited gradient changes of the site and surrounding areas, the potential for landslides at the project site is considered low to negligible.

5.4. Flooding

The Federal Emergency Management Agency (FEMA) has prepared flood insurance rate maps (FIRMs) for use in administering the National Flood Insurance Program. Based on our review of the FEMA (2008) flood map, the site is outside the 0.2% annual chance (500-year) floodplain.

5.5. Tsunamis and Seiches

Tsunamis are waves generated by massive landslides near or under sea water. The site is not located on any State of California – County of Orange Tsunami Inundation Map for Emergency Planning. The potential for the site to be adversely impacted by earthquake-induced tsunamis is considered to be negligible because the site is located approximately 19 kilometers (12.0 miles) inland from the Pacific Ocean shore, at an elevation exceeding the maximum height of potential tsunami inundation.

Seiches are standing wave oscillations of an enclosed water body after the original driving force has dissipated. The potential for the site to be adversely impacted by earthquake-induced seiches is considered to be low due to the lack of any significant enclosed bodies of water located in the vicinity of the site.

6. GEOTECHNICAL ENGINEERING FINDINGS

6.1. Rippability

Based on our subsurface exploration of the site, the near-surface materials should be generally excavatable with heavy-duty earthwork equipment in good working condition.

6.2. Caving Potential

In general, the near surface sandy soils have a low to moderate potential for caving. We recommend that the geotechnical engineer should be notified immediately if severe caving conditions are encountered during excavations to provide further mitigation recommendations.

6.3. Expansive Soils

Expansive soils are characterized by their ability to undergo significant volume changes (shrink or swell) due to variations in moisture content the onsite fill consists of sandy silt within the soils encountered near the ground surface. Generally, this material exhibits “very low” expansion potential.

6.4. Corrosive Soils

The potential for the on-site materials to corrode buried steel and concrete improvements was evaluated. Laboratory testing was performed on representative soil samples to evaluate pH, minimum resistivity, and soluble chloride and sulfate contents. General recommendations to address the corrosion potential of the on-site soils are provided below. Imported fill materials, if used, should be tested to evaluate whether their corrosion potential is more severe than those assumed.

6.4.1. Sulfate Exposure

Laboratory tests indicate that the potential of sulfate attack on concrete in contact with the on-site soils is “negligible” or “S0” exposure in accordance with ACI 318, Table 19.3.1.1. Therefore, restriction on the type of cement, water to cement ratio, and compressive strength is not required from a geotechnical standpoint. Ferrous Metals

The results of the laboratory chemical tests performed on a sample of soil collected within the site indicate that the on-site soils are moderately corrosive to ferrous metals. Consequently, metal structures which will be in direct contact with the soil (i.e., underground metal conduits, pipelines, metal sign posts, etc.) and/or in close proximity to the soil (wrought iron fencing, etc.) may be subject to corrosion. The use of special coatings or cathodic protection around buried metal structures has been shown to be beneficial in reducing corrosion potential. Additional provisions will be required to address high chloride contents of the soil per the 2019 CBC to protect the concrete reinforcement. The laboratory testing program performed for this project does not address the potential for corrosion to copper piping. In this regard, a corrosion engineer should be consulted to perform more detailed testing and develop appropriate mitigation measures (if necessary).

6.5. Infiltration Testing

Two (2) preliminary percolation tests were performed on October 9, 2021, to evaluate the potential of infiltrating stormwater into the site soils and determine a preliminary design infiltration rate for initial design of the planned BMPs. The borings are shown on the attached Figure 2 – Site Plan and Boring Location Map, were excavated to depth of 5 feet below the existing grade. The infiltration test data was utilized to determine the preliminary design infiltration rates as provided in Table A below.

Table A: Preliminary Design Infiltration Rates Summary

Boring No.	Depth Below Existing Grade (feet)	Observed Infiltration Rates (inches/hour)
P-1	5	0.22
P-2	5	0.18

Based on our preliminary infiltration testing, we note that infiltration of stormwater into the site soils is deemed not feasible. Therefore, alternate means of storing and disposing of stormwater should be evaluated by the project civil engineer. Our percolation testing data is presented within Appendix C, Infiltration Test Result.

7. GEOTECHNICAL CONCLUSIONS AND RECOMMENDATIONS

7.1. General Conclusion

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

The following is a summary of the geotechnical considerations for this project:

- Groundwater was not encountered during subsurface investigation, and it is not expected to impact the proposed development.

- Infiltration of stormwater into the site soils is deemed not feasible based on our preliminary testing.

- The site is not subject to liquefaction and associated liquefaction settlement due to the lack of shallow groundwater and uniform soil stratum.
- The potential for landslide, flooding, tsunami and seiches to impact the proposed improvement is considered low.
- The site is not located within an AP Zone, however, it is subject to intense ground shaking during a seismic event.
- The onsite near-surface soils are expected to exhibit a very low expansion potential.
- The onsite near-surface soils are considered to have negligible exposure to sulfate, however, are moderately corrosive to ferrous metals.
- We recommend that new foundations be embedded into engineered fill material.

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.

7.2. Site Preparation and Earthwork

In general, earthwork should be performed in accordance with the recommendations presented in this report. UES should be contacted for questions regarding the recommendations or guidelines presented herein.

7.2.1. General Grading Recommendations

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.

7.2.2. Remedial Grading

Based on our field exploration and engineering analysis, we recommend that the new building foundations be supported on 2 feet of engineered fill material. On this basis, we recommend that the building pad be excavated to 2 feet below the bottom of the footings. The excavation should extend laterally a minimum of 2 feet from the edge of the new footings.

Pavement and/or sidewalk areas should be over-excavated to a depth of at least 12 inches below the bottom of the pavement section (i.e., aggregate base) whichever is lower. Deeper removals may be required in areas where soft, saturated, or unsuitable materials are encountered.

For trash enclosure and site walls foundations, we recommend that the foundations be supported on competent engineered fill.

The extent and depths of removal should be evaluated by soil engineer in the field based on the materials exposed. Additional removals may be recommended if loose or soft soils are exposed during grading.

7.2.3. Materials for Fill

On-site soils are suitable to be reused for compaction effort. However, the underlying alluvium 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 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 UES prior to importing or filling.

7.2.4. Compacted Fill

Prior to placement of compacted fill, the contractor should request an evaluation of the exposed excavation bottom by UES. Unless otherwise recommended, the exposed ground surface should then be scarified to a depth of approximately 6 inches and watered or dried, as needed, to achieve generally consistent moisture contents of 2 percent above 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.

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 2 percent above 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 ASTM D1557. Successive lifts should be treated in a like manner until the desired finished 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.

7.2.5. Temporary Excavations

Temporary excavations for the demolition, earthwork, footings, and utility trenches are expected to be up to 4 feet in height. Due to relatively loose condition of shallow onsite soils, temporary, unsurcharged excavation sides should be sloped no steeper than an inclination of 1H: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. UES 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.

UES should observe the excavations 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.

7.3. Seismic Design Parameters

Our recommendations for seismic design parameters have been developed in accordance with 2019 CBC and ASCE 7-16 (ASCE, 2016) standards. The applicable site class is D based on the results of our field investigation. Table B: 2019 California Building Code Design Parameters presents the seismic design parameters for the site in accordance with 2019 CBC.

Table B: 2019 California Building Code Design Parameters

Design Parameters	Value
Site Class	D
Mapped Spectral Acceleration Parameter at Period of 0.2-Second, S_s	1.324 g
Mapped Spectral Acceleration Parameter at Period 1-Second, S_1	0.472 g
Site Coefficient, F_a	1.0
Site Coefficient, F_v	1.83
Adjusted MCE_R Spectral Response Acceleration Parameter at Short Period, S_{MS}	1.324 g
1-Second Period Adjusted MCE_R[1] Spectral Response Acceleration Parameter, S_{M1}	0.864
Short Period Design Spectral Response Acceleration Parameter, S_{DS}	0.883
1-Second Period Design Spectral Response Acceleration Parameter, S_{D1}	0.576
Peak Ground Acceleration, PGA_M	0.609g
Seismic Design Category	D

Notes: Since the Site Class is designated as D and the S1 value is greater than or equal to 0.2, the 2019 CBC requires either a site-specific seismic hazard analysis per Section 21.2 of ASCE 7-16 or the application of Exception 2 of Section 11.4.8 of ASCE 7-16. The project structural engineer should apply all requirements of Section 11.4.8 of ASCE 7-16.

7.4. Foundation Recommendations

A shallow foundation system may be used for support of the proposed building, provided that all the footings are placed on engineered fill prepared as described in the “Remedial Grading” section of this report.

Our geotechnical foundation design parameters are presented in Table C: Geotechnical Design Parameters for Foundation, below.

Table C: Geotechnical Design Parameters for Foundation

Design Parameters	Values
Bearing Material	• Engineering Fill • See Remedial Grading section of this report.
Minimum Footing Dimensions	• At least 12 inches in width and at least 18 inches in depth.
Allowable Bearing Pressure	• An allowable bearing capacity of 2,500 psf may be used for the design of foundations found on engineered fill. • For miscellaneous and lightly-loaded auxiliary foundations such as trash enclosures, an allowable bearing pressure of 1,800 pounds per square foot (psf) may be used. • For light pole foundations that are embedded a minimum of 4 feet below the finish grade, an allowable bearing capacity of 3,000 psf may be used. • The allowable bearing values may be increased by one-third for transient loads from wind or earthquake.
Estimated Static Settlement	• Less than 1 inches total settlement with differential settlement estimated to be less than 0.5 inch over a span 30 feet.
Allowable Coefficient of Friction Below Footings	0.35
Unfactored Lateral Passive Resistance	250 pcf (equivalent fluid pressure) Maximum allowable of 2,500 psf

As mentioned above, the structural building loads are not provided to us at this time and since the settlement criteria may control the design, the allowable bearing pressure for the proposed foundation may be revisited for the final design, once loading data becomes available.

7.5. Concrete Slab-On-Grade

At minimum the building slab-on-grade should be at least 5 inches in thickness and should be reinforcement with a minimum of No. 4 bars spaced at 18 inches on-center. Final design of the slab should be provided by the project structural engineer.

All concrete slabs-on-grade should be supported on vapor retarder. The design of the slab and the installation of the vapor retarder should comply with the most recent revisions of ASTM E 1643 and ASTM E 1745. The vapor retarder should comply with ASTM E 1745 Class A requirements. At minimum, the vapor retarder should consists of 15 mil Stegowrap or equivalent.

Where a vapor retarder is used, a low-slump concrete should be used to minimize possible curling of the slabs. Sand above the vapor retarder is outside of UES purview and should be in accordance with the structural engineer's recommendation.

UES does not practice in the field of moisture vapor transmission evaluation and mitigation. Therefore, it is recommended that a qualified consultant be engaged to evaluate the general and specific moisture vapor transmission paths and any impact on the proposed construction. The qualified consultant should provide recommendations for mitigation of potential adverse impacts of moisture vapor transmission on various components of the structure. Where dampness would be objectionable, it is recommended that the floor slabs should be waterproofed. A qualified waterproofing consultant should be retained in order to recommend a product or method which would provide protection for concrete slabs-on-grade.

The recommendations presented above are intended to reduce the potential for cracking of slabs; however, even with the incorporation of the recommendations presented herein, slabs may still exhibit some cracking. The occurrence of concrete shrinkage cracks is independent of the supporting soil characteristics.

7.6. 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.

Based on an R-value test result of 17 and an assumed TI's of 4, 5.5 and 7, we have determined the minimum structural sections as provided within Table C below. The assumed R-value should be verified during rough grading by UES prior to placement of the aggregate base.

Table D – Recommended Minimum HMA and Base Section Thicknesses

Location	Parking Stalls	Drive Aisle	Firelane / Truck Driveway
Traffic Index	**4.0**	**5.5**	**7.0**
HMA Thickness (in)	4.0	4.0	6.0
Aggregate Base Thickness (in)	4.0	8.0	10.0

Prior to construction of the pavement sections provided above, the subgrade for the proposed pavement should be moisture conditioned to a depth of 12 inches and compacted to achieve 95 percent. The aggregate base section should then be placed, moisture conditioned to near optimum moisture content and compacted to achieve 95 percent relative compaction. The HMA section should be in accordance with the City of Santa Ana requirements and should be compacted to 95 percent relative compaction.

A representative of UES should be onsite to observe and test the subgrade, base and HMA sections.

7.7. Drainage Control

Proper surface drainage is critical to the future performance of the project. Saturation of a soil can cause it to lose internal shear strength and increase its compressibility, resulting in a change in the designed engineering properties. Proper site drainage should be always maintained. All site drainage, with the exception of any required to disposed of onsite by stormwater regulations, should be collected and transferred to the street in non-erosive drainage devices.

The proposed structure should be provided with roof drainage. Discharge from downspouts, roof drains and scuppers should not be permitted on unprotected soils within five feet of the building perimeter. Drainage should not be allowed to pond anywhere on the site, and especially not against any foundation or retaining wall. Drainage should not be allowed to flow uncontrolled over any descending slope. Planters which are located within a distance equal to the depth of a retaining wall should be sealed to prevent moisture adversely affecting the wall. Planters which are located within five feet of a foundation should be sealed to prevent moisture affecting the earth materials supporting the foundation.

8. DESIGN REVIEW AND CONSTRUCTION MONITORING

Geotechnical review of plans and specifications is of paramount importance in engineering practice. The poor performance of many structures has been attributed to inadequate geotechnical review of construction documents. Additionally, observation of excavations will be important to the performance of the proposed development. The following sections present our recommendations relative to the review of construction documents and the monitoring of construction activities.

8.1. Plans and Specifications

The design plans and specifications should be reviewed by UES prior to bidding and construction, as the geotechnical recommendations may need to be reevaluated in the light of the actual design configuration and loads. This review is necessary to evaluate whether the recommendations contained in this report and future reports have been properly incorporated into the project plans and specifications. Based on the work already performed, this office is best qualified to provide such review.

8.2. Construction Monitoring

Site preparation, removal of unsuitable soils, assessment of imported fill materials, fill placement, foundation installation, and other site grading operations should be observed and tested. The substrata exposed during the construction may differ from that encountered in the test excavations. Continuous observation by a representative of UES during construction allows for evaluation of the soil conditions as they are encountered and allows the opportunity to recommend appropriate revisions where necessary.

The project engineer should be notified prior to exposure of subgrades. It is critically important that the engineer be provided with an opportunity to observe all exposed subgrades prior to burial or covering.

9. 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 UES has no control.

UES'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 UES to observe foundation excavations for the proposed construction. If parties other than UES 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. UES 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 UES 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, UES 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 UES from any liability resulting from the use of this report by any unauthorized party.

UES 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.

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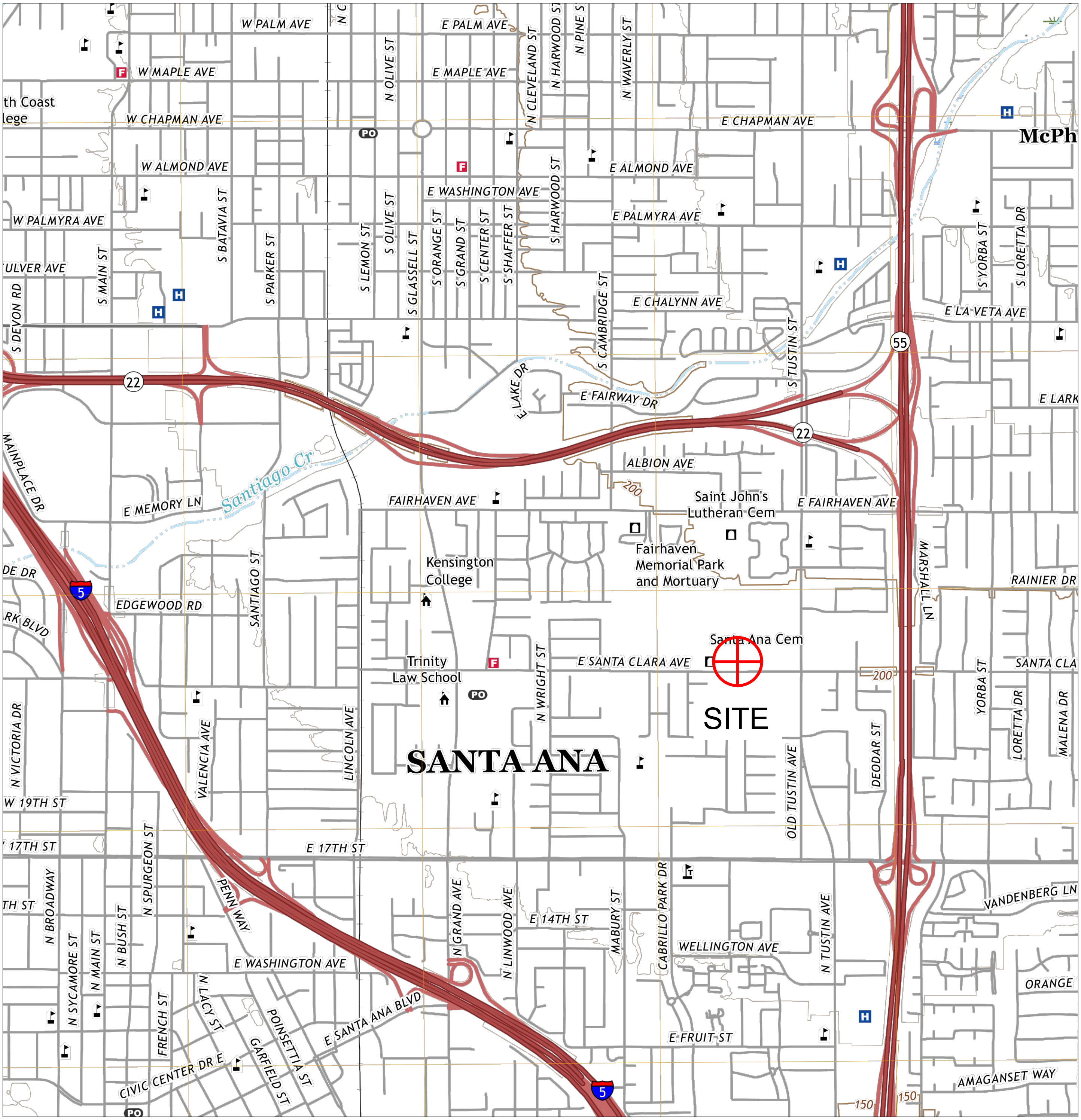
FIGURES



APPROXIMATE SITE LOCATION

SCALE IN FEET

0 1000' 2000'

REFERENCE: USGS "Orange 7.5-Minute Quadrangle" (2018)

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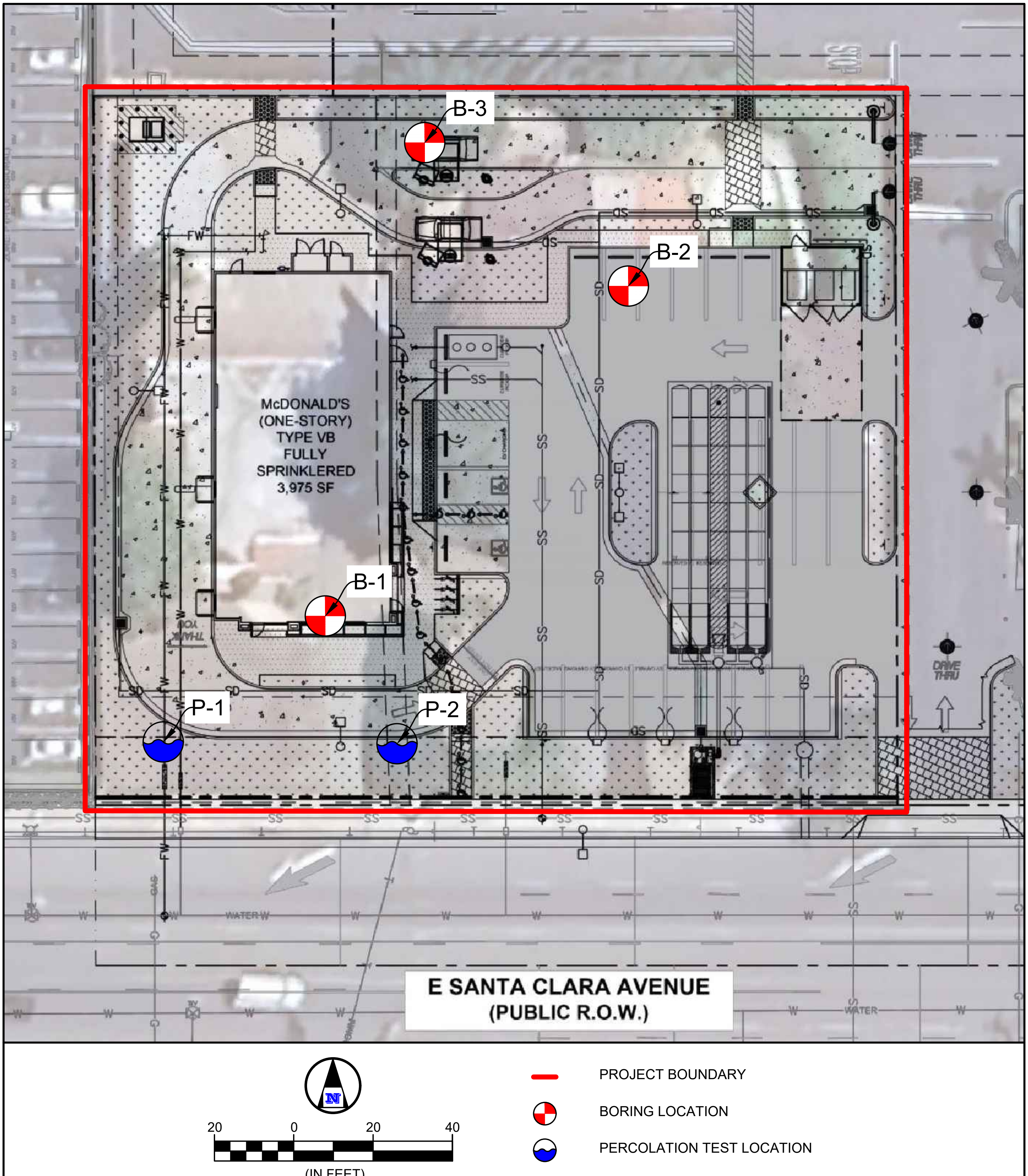
SITE VICINITY LOCATION MAP		
McDonald's 2109 E Santa Clara Ave Santa Ana, California		
PROJECT NO. 4230.2100035.0000	REPORT DATE October 2021	FIGURE 1



UES

Exploration Map

Santa Ana McDonalds

2109 Santa Clara Avenue

Orange County, California

Date: 08-21-2023

Job No: 4230.2100035.0000

Figure 2

APPENDIX A
Field Exploration and Boring Logs

Appendix A
Field Exploration and Boring Logs

General

The subsurface exploration program for the proposed project consisted of logging five 8-inch diameter exploratory borings conducted at the site on October 8, 2021. The borings were advanced to a maximum depth of 21.5 feet below the existing grade. The drilling operation was performed using a limited access track-mounted CME-75 hollow-stem-auger drill rig.

Drilling and Sampling

The Boring Logs are presented in the following pages. The log also shows the boring number and drilling date. The borings were logged by a geologist 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.

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BORING NUMBER B-1

CLIENT McDonald's USA

PROJECT NAME McDonalds Santa Ana Subsurface Investigations

PROJECT NUMBER 4230.2100035.0000

PROJECT LOCATION Santa Ana, CA

DATE STARTED 10/8/21 **COMPLETED** 10/8/21

GROUND ELEVATION 192 ft MSL **HOLE SIZE** 8 inches

DRILLING CONTRACTOR Choice Drilling

GROUND WATER LEVELS:

DRILLING METHOD HSA

AT TIME OF DRILLING ---

LOGGED BY GD **CHECKED BY** NS

AT END OF DRILLING ---

NOTES Backfilled with native clippings. No groundwater encountered.

AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		(SC) CLAYEY SAND trace gravel, light brown, dry to damp, medium dense, fine grained										
			GB	100								
			MC	100	11-16-16 (32)	1.0	111	4	25	14	11	
5		some gravel	SPT	100	5-5-6 (11)							35
		(SC) CLAYEY SAND WITH GRAVEL, dark yellow brown, dry, medium dense, fine grained	MC	100	11-12-15 (27)	1.5	113	5				44
10			SPT	100	9-6-7 (13)							
		no recovery	MC	0	50							
15		(SM) SILTY SAND WITH GRAVEL, light brown, dry, very dense. One big chunk of bedrock.	SPT	100	5-20-30 (50)							17
		no recovery	MC	0	33-25-35 (60)							
20		no recovery	SPT	0	50							

Bottom of borehole at 21.5 feet.

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BORING NUMBER B-2

CLIENT McDonald's USA
PROJECT NAME McDonalds Santa Ana Subsurface Investigations
PROJECT NUMBER 4230.2100035.0000
PROJECT LOCATION Santa Ana, CA
DATE STARTED 10/8/21 **COMPLETED** 10/8/21
GROUND ELEVATION 192 ft MSL **HOLE SIZE** 8 inches
DRILLING CONTRACTOR Choice Drilling
GROUND WATER LEVELS:
DRILLING METHOD HSA
AT TIME OF DRILLING ---
LOGGED BY GD **CHECKED BY** NS
AT END OF DRILLING ---
NOTES Backfilled with native clippings. No groundwater encountered.
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		(SC) CLAYEY SAND, light brown, dry to damp, stiff, fine grained										
			GB	100								
			MC	100	7-10-12 (22)	0.5	103	5				
5		trace gravel, medium dense										
			SPT	100	5-4-5 (9)							
			MC	100	7-17-19 (36)	1.0	114	4				
10												
			SPT	100	5-8-8 (16)							

Bottom of borehole at 11.5 feet.

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BORING NUMBER B-3

CLIENT	McDonald's USA	**PROJECT NAME**	McDonalds Santa Ana Subsurface Investigations
PROJECT NUMBER	4230.2100035.0000	**PROJECT LOCATION**	Santa Ana, CA
DATE STARTED	10/8/21 **COMPLETED** 10/8/21	**GROUND ELEVATION**	192 ft MSL **HOLE SIZE** 8 inches
DRILLING CONTRACTOR	Choice Drilling	**GROUND WATER LEVELS:**	
DRILLING METHOD	HSA	**AT TIME OF DRILLING**	---
LOGGED BY	GD **CHECKED BY** NS	**AT END OF DRILLING**	---
NOTES	Backfilled with native clippings. No groundwater encountered.	**AFTER DRILLING**	---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		(SC-SM) SILTY, CLAYEY SAND, light brown, dry, loose, fine grained										
			GB	100								
		trace gravel	MC	100	3-4-5 (9)	0.5						
5		medium dense, some gravel	SPT	100	20-15-20 (35)		117	3				
		loose, some gravel	MC	100	4-3-4 (7)							
10		(SM) SILTY SAND WITH GRAVEL, dark yellow brown, damp, loose, fine grained	SPT	100	9-11-13 (24)	1.5	112	4				
		loose, no gravel	MC	100	3-4-4 (8)							16
15		(SP-SM) POORLY GRADED SAND WITH SILT AND GRAVEL, light red with brown, damp, dense, fine to coarse grained sands	SPT	100	17-18-34 (52)		115	2				

Bottom of borehole at 16.5 feet.

GEOTECH BH COLUMNS - GINT STD US LAB.GDT - 10/29/21 08:37 - I:\PROJECTS\GEOTECHNICAL\2021\4230.2100035.0000 MCDONALDS SANTA ANA SUBSURFACE INVESTIGATIONS\APPENDIX A - BORING LOGS\SANTA ANA MCDONALDS LOGS.GPJ

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BORING NUMBER P-1

CLIENT McDonald's USA
PROJECT NAME McDonalds Santa Ana Subsurface Investigations
PROJECT NUMBER 4230.2100035.0000
PROJECT LOCATION Santa Ana, CA
DATE STARTED 10/8/21 **COMPLETED** 10/8/21
GROUND ELEVATION 192 ft MSL **HOLE SIZE** 8 inches
DRILLING CONTRACTOR Choice Drilling
GROUND WATER LEVELS:
DRILLING METHOD HSA
AT TIME OF DRILLING ---
LOGGED BY GD **CHECKED BY** NS
AT END OF DRILLING ---
NOTES Backfilled with native clippings. No groundwater encountered.
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		(SC) CLAYEY SAND, light brown, fine grain	GB	100								
5												49
		Bottom of borehole at 5.0 feet.										

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BORING NUMBER P-2

CLIENT McDonald's USA
PROJECT NAME McDonalds Santa Ana Subsurface Investigations
PROJECT NUMBER 4230.2100035.0000
PROJECT LOCATION Santa Ana, CA
DATE STARTED 10/8/21 **COMPLETED** 10/8/21
GROUND ELEVATION 192 ft MSL **HOLE SIZE** 8 inches
DRILLING CONTRACTOR Choice Drilling
GROUND WATER LEVELS:
DRILLING METHOD HSA
AT TIME OF DRILLING ---
LOGGED BY GD **CHECKED BY** NS
AT END OF DRILLING ---
NOTES Backfilled with native clippings. No groundwater encountered.
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		(SC) CLAYEY SAND, light brown, fine grain	GB	100								36
5		Bottom of borehole at 5.0 feet.										

APPENDIX B
Laboratory Testing

Appendix B
Laboratory Testing

ASTM D 2488 - Classification

Soils were visually and texturally classified in accordance with the Unified Soil Classification System (USCS) in general accordance with ASTM D 2488. Soil classifications are indicated on the logs of the exploratory borings in Appendix A.

ASTM D 2937- In-Place Moisture and Density Tests

The moisture content and dry density of relatively undisturbed samples obtained from the exploratory borings were evaluated in general accordance with ASTM D 2937. The test results are presented on the logs of the exploratory borings in Appendix A.

ASTM D 422 - Gradation Analysis

Gradation analysis tests were performed on selected representative soil samples in general accordance with ASTM D 422. These test results were utilized in evaluating the soil classifications in accordance with the USCS.

ASTM D 1140 - 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 B- 1: ASTM D 1140 - Wash Sieve.

B- 1: ASTM D 1140 - Wash Sieve

Boring No.	Depth (feet)	Percent Passing #200
B-1	5.0	34.5
B-1	7.5	43.7
B-1	15.0	16.5
B-3	10.0	15.5
P-1	5.0	48.6
P-2	5.0	36.1

ASTM D 4318 - Atterberg Limit

Tests were performed on selected representative fine-grained soil samples to evaluate the liquid limit, plastic limit, and plasticity index in general accordance with ASTM D 4318. These test results were utilized to evaluate the soil classification in accordance with the Unified Soil Classification System (USCS). The test results and classifications are shown in B- 2: ASTM D 4318 - Atterberg Limit

B- 2: ASTM D 4318 - Atterberg Limit

Boring No.	Depth (feet)	Atterberg Limits		
		Liquid Limit	Plastic Limit	Plasticity Index
B-1	2.5	25	14	11

ASTM D 3080 - Direct Shear Tests

A direct shear test was performed on relatively undisturbed sample in general accordance with ASTM D 3080 to evaluate the shear strength characteristics of the selected material. The results are shown on B- 3: ASTM D 3080 Direct Shear Test Results.

B- 3: ASTM D 3080 Direct Shear Test Results

Boring No.	Depth (feet)	Remolded	Peak		Ultimate	
			C (psf)	Phi (deg)	C (psf)	Phi (deg)
B-1	2.5	YES	140	30	150	29

ASTM D 4829 – Expansion Index of Soils

An expansion index (EI) test was performed on relatively undisturbed sample in general accordance with ASTM D 4829 to evaluate the expansion potential of the selected material. The results are shown on B- 4: ASTM D 4829 Expansion Index of Soils .

B- 4: ASTM D 4829 Expansion Index of Soils

Boring No.	Depth (feet)	EI value	Potential Expansion
B-1	0-5	13	Very Low

ASTM D2435 - Consolidation Test

A Consolidation tests was performed on a selected driven soil sample in general accordance with the latest version of ASTM D2435. The sample was inundated during testing to represent adverse field conditions. The percent consolidation for each load cycle was recorded as a ratio of the amount of vertical compression to the original height of the sample.

Soil Corrosivity

Soil pH and resistivity tests were performed by **Project X** on a representative soil sample in general accordance with the latest version of ASTM D4972 and ASTM G187, respectively.

The chloride content of the selected sample was evaluated in general accordance with the latest version of ASTM D4327.

The sulfate content of the selected samples was evaluated in general accordance with the latest version of ASTM D4327. The test results are presented on B- 5: Corrosivity Test Results.

B- 5: Corrosivity Test Results

		ASTM D 4327	ASTM D 4327	ASTM G 187	ASTM D4972
Boring No.	Depth (ft)	Water Soluble Sulfate (ppm)	Water Soluble Chloride (ppm)	Minimum Resistivity (ohm-cm)	pH
B-3	<5	28.6	5.9	34,840	8.9

ASTM D 2844 – Resistance R-Value and Expansion Pressure of Compacted Soils

The resistance value, or R-value, for site soils was evaluated in general accordance with California Test (CT) 301. The sample was prepared and evaluated for exudation pressure and expansion pressure. The equilibrium R-value is reported as the lesser or more conservative of the two calculated results.

B- 6: R-Value Test Results

Boring No.	Depth (feet)	R-Value
B-1	0-5	17

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SUMMARY OF LABORATORY RESULTS

CLIENT McDonald's USA **PROJECT NAME** McDonalds Santa Ana Subsurface Investigations

PROJECT NUMBER 4230.2100035.0000 **PROJECT LOCATION** Santa Ana, CA

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class-ification	Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
B-1	2.5	25	14	11			SC	4.4	111.1		
B-1	5.0				12.5	34.5	SC				
B-1	7.5				12.5	43.7	SC	5.0	113.2		
B-1	15.0				25	16.5	SM				
B-2	2.5							5.0	102.7		
B-2	7.5							4.0	113.5		
B-3	5.0							2.7	116.7		
B-3	10.0							3.8	112.2		
B-3	12.5				9.5	15.5	SM				
B-3	15.0							1.9	115.3		
P-1 bulk	0-5				25	48.6	SC				
P-2 bulk	0-5				25	36.1	SC				

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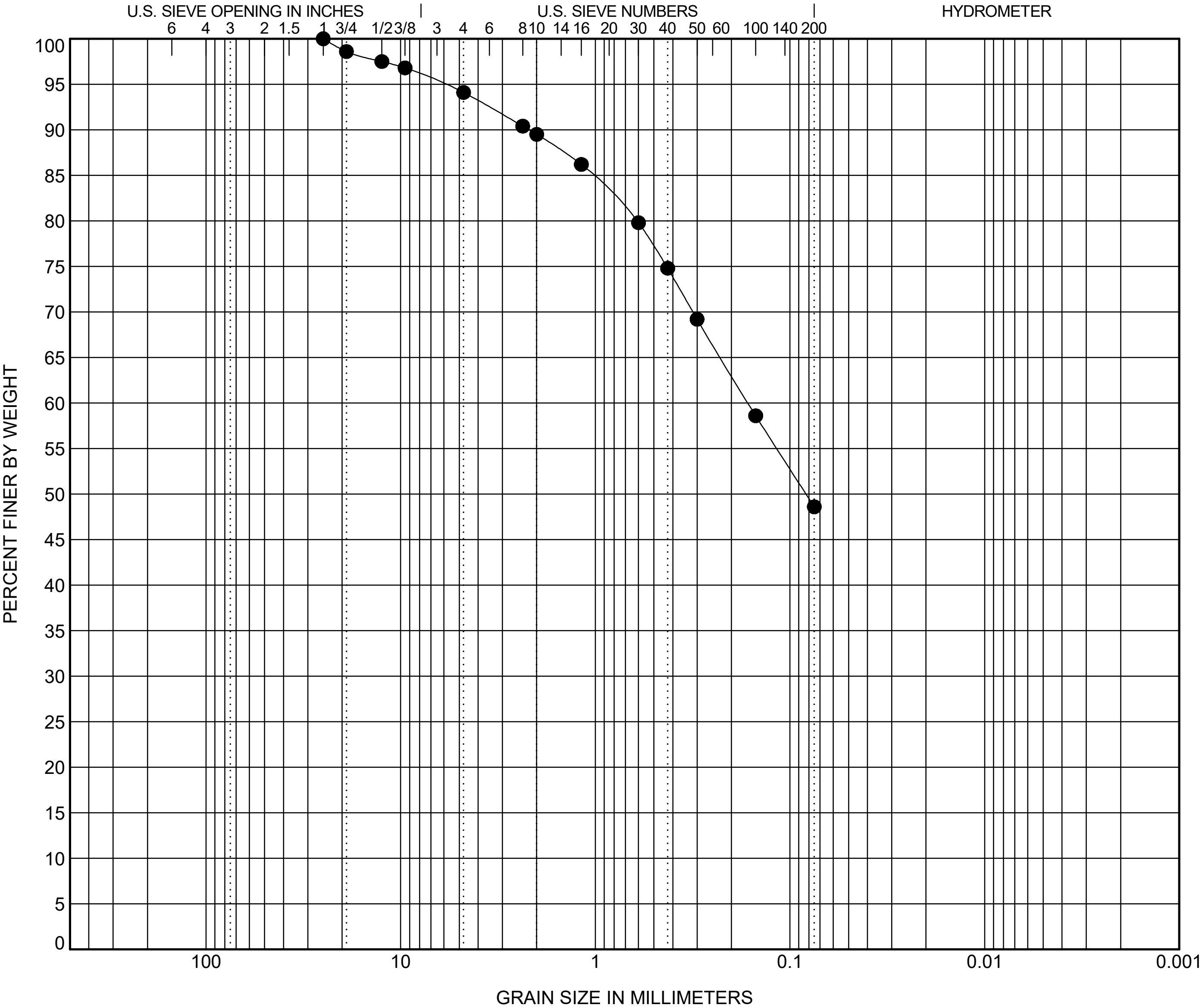
GRAIN SIZE DISTRIBUTION

CLIENT McDonald's USA
PROJECT NAME McDonalds Santa Ana Subsurface Investigations
PROJECT NUMBER 4230.2100035.0000
PROJECT LOCATION Santa Ana, CA



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	Classification	LL	PL	PI	Cc	Cu
●	**P-1**	**5.0**	**(SC) CLAYEY SAND *trace gravel**					

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**P-1**	**5.0**	**25**	**0.164**			**5.9**	**45.5**	**48.6**	

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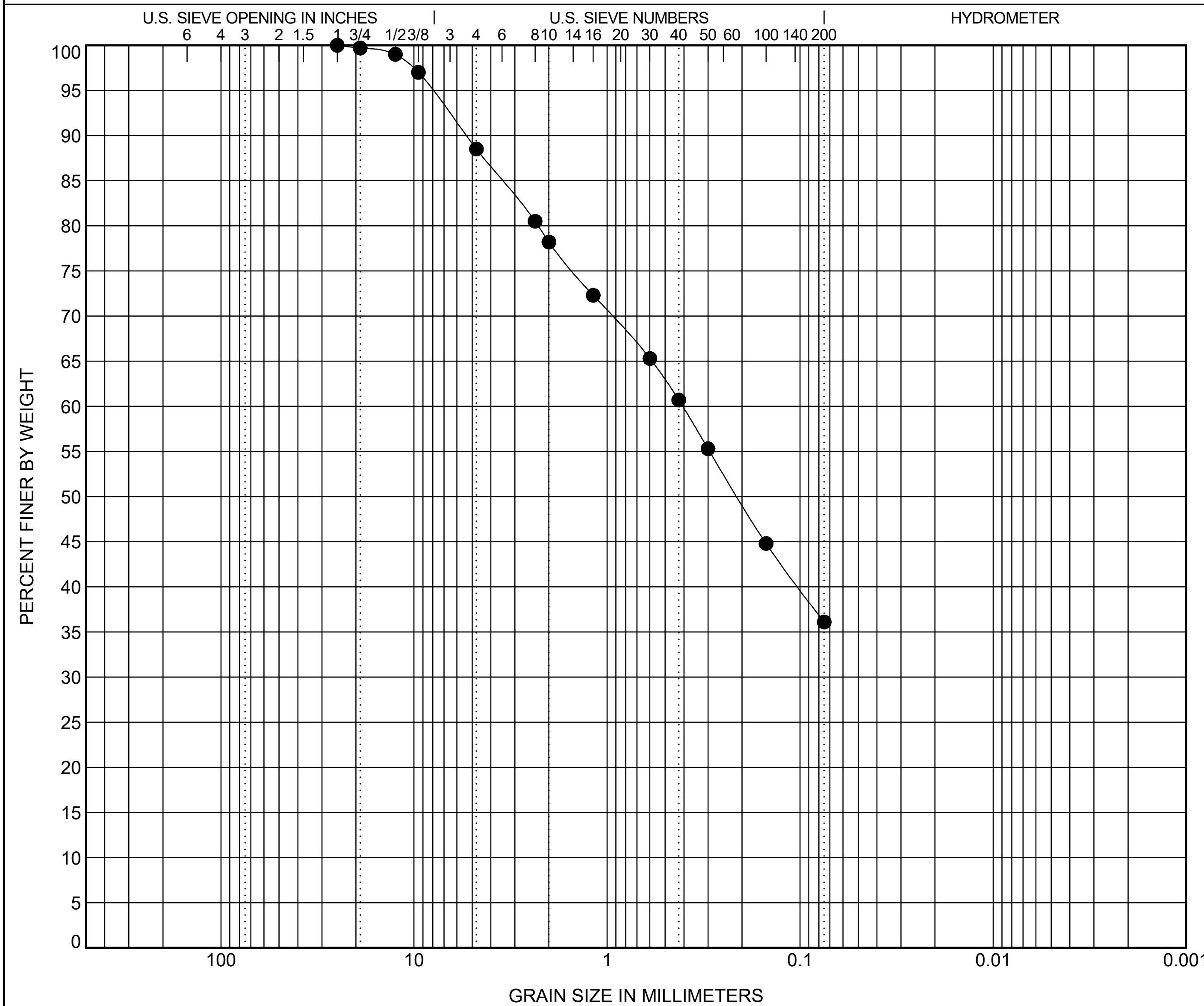
GRAIN SIZE DISTRIBUTION

CLIENT McDonald's USA **PROJECT NAME** McDonalds Santa Ana Subsurface Investigations

PROJECT NUMBER 4230.2100035.0000 **PROJECT LOCATION** Santa Ana, CA



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	Classification	LL	PL	PI	Cc	Cu
●	**P-2**	**5.0**	**(SC) CLAYEY SAND *trace gravel**					

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**P-2**	**5.0**	**25**	**0.406**			**11.5**	**52.4**	**36.1**	

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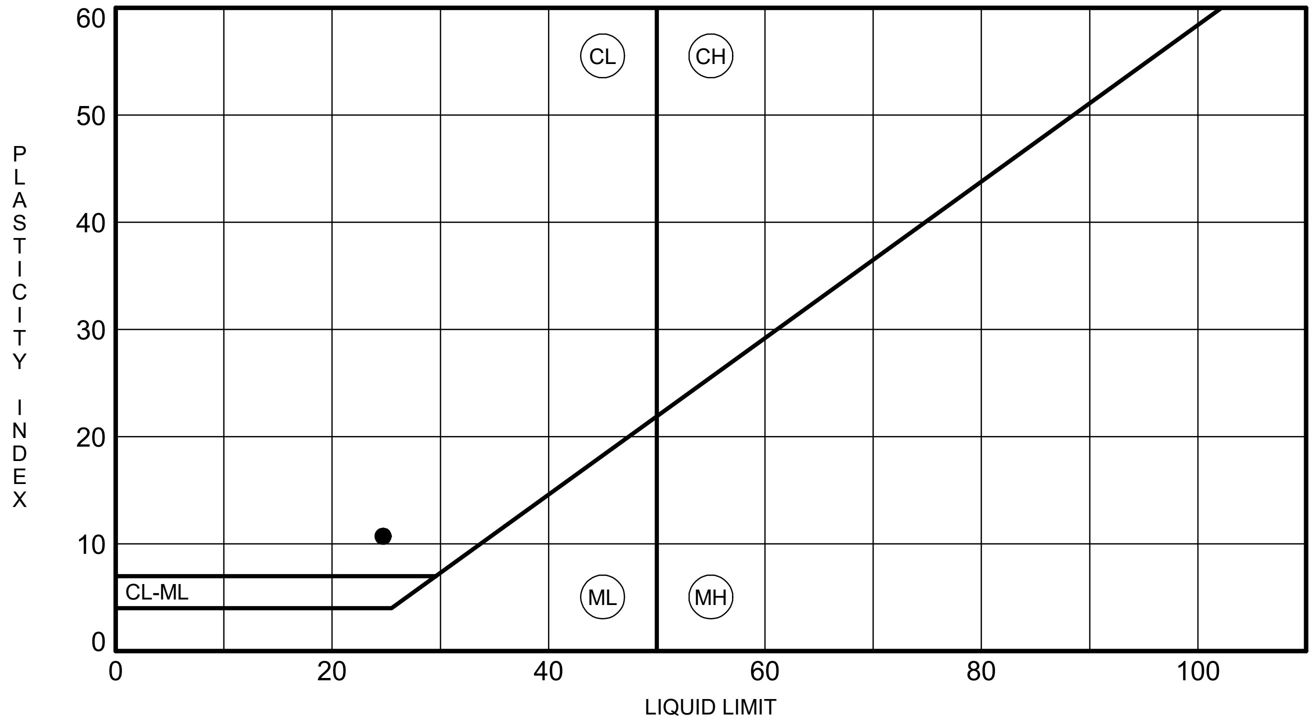
ATTERBERG LIMITS' RESULTS

CLIENT McDonald's USA

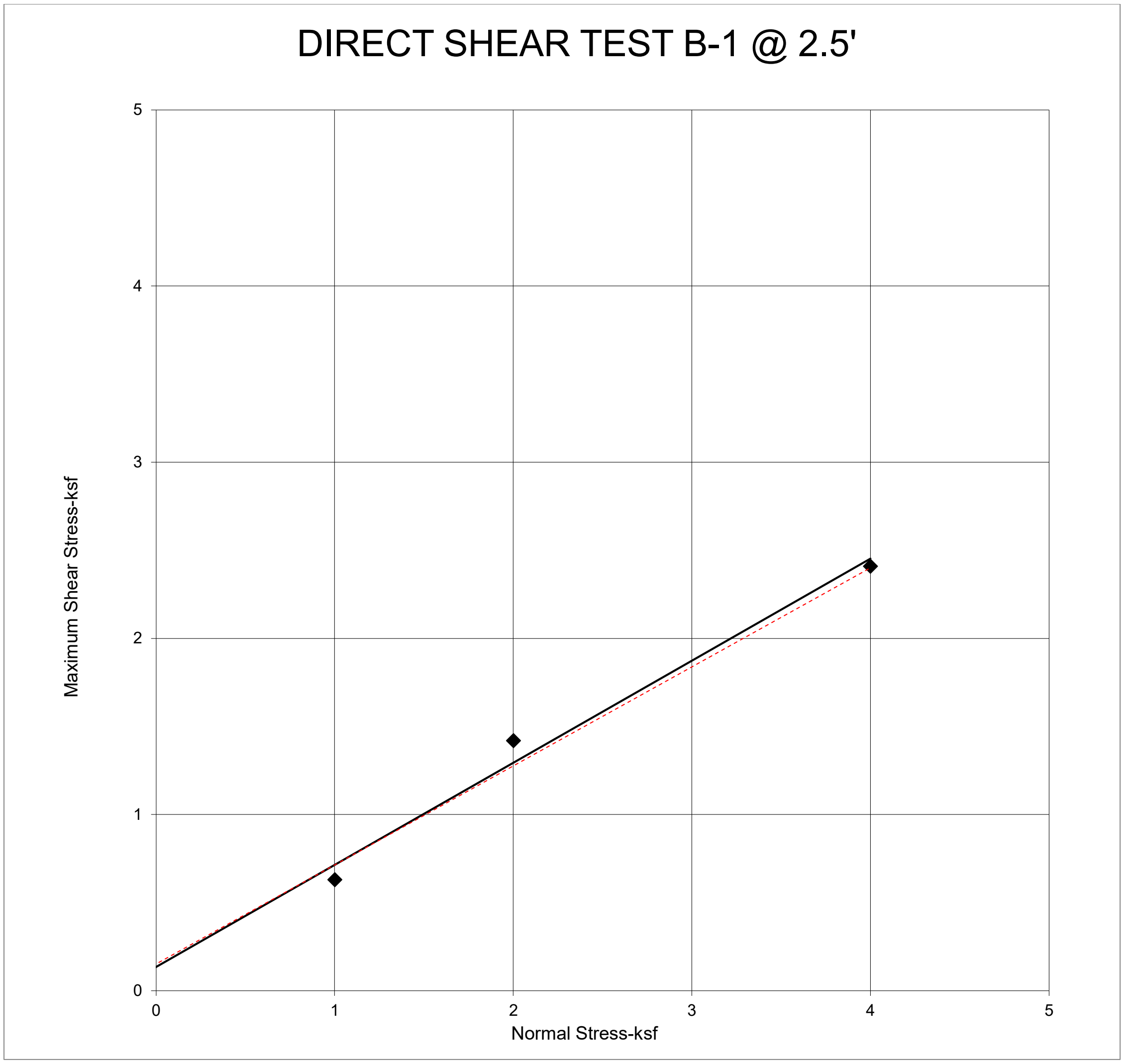
PROJECT NAME McDonalds Santa Ana Subsurface Investigations

PROJECT NUMBER 4230.2100035.0000

PROJECT LOCATION Santa Ana, CA



	BOREHOLE	DEPTH	LL	PL	PI	Fines	Classification
●	**B-1**	**2.5**	**25**	**14**	**11**		**(SC) CLAYEY SAND trace gravel**



Sample No.	Sample Depth (ft)	Normal Stress (ksf)	Maximum Shear Stress (ksf)	Wet Density (pcf)	Moisture Content (%)	Dry Density (pcf)	Final Moisture Content (%)	
B-1	**2.5**	1.0	0.63	116.0	4.4	111.1	25.2	
B-1	**2.5**	2.0	1.42	116.0	4.4	111.1	25.0	
B-1	**2.5**	4.0	2.41	116.0	4.4	111.1	24.7	

Sample Type: Remolded **Test Condition:** Saturated Sample Description: Light Brown Clayey Sand (SC)

Peak Test Results

Cohesion (psf):	140
Friction Angle (degrees):	30
Shear Rate (in/min)	0.0025

Residual Test Results

Cohesion (psf):	150
Friction Angle (degrees):	29
Shear Rate (in/min)	0.0025

McDonald's - Santa Ana

Project No.

4230.2100035.0000

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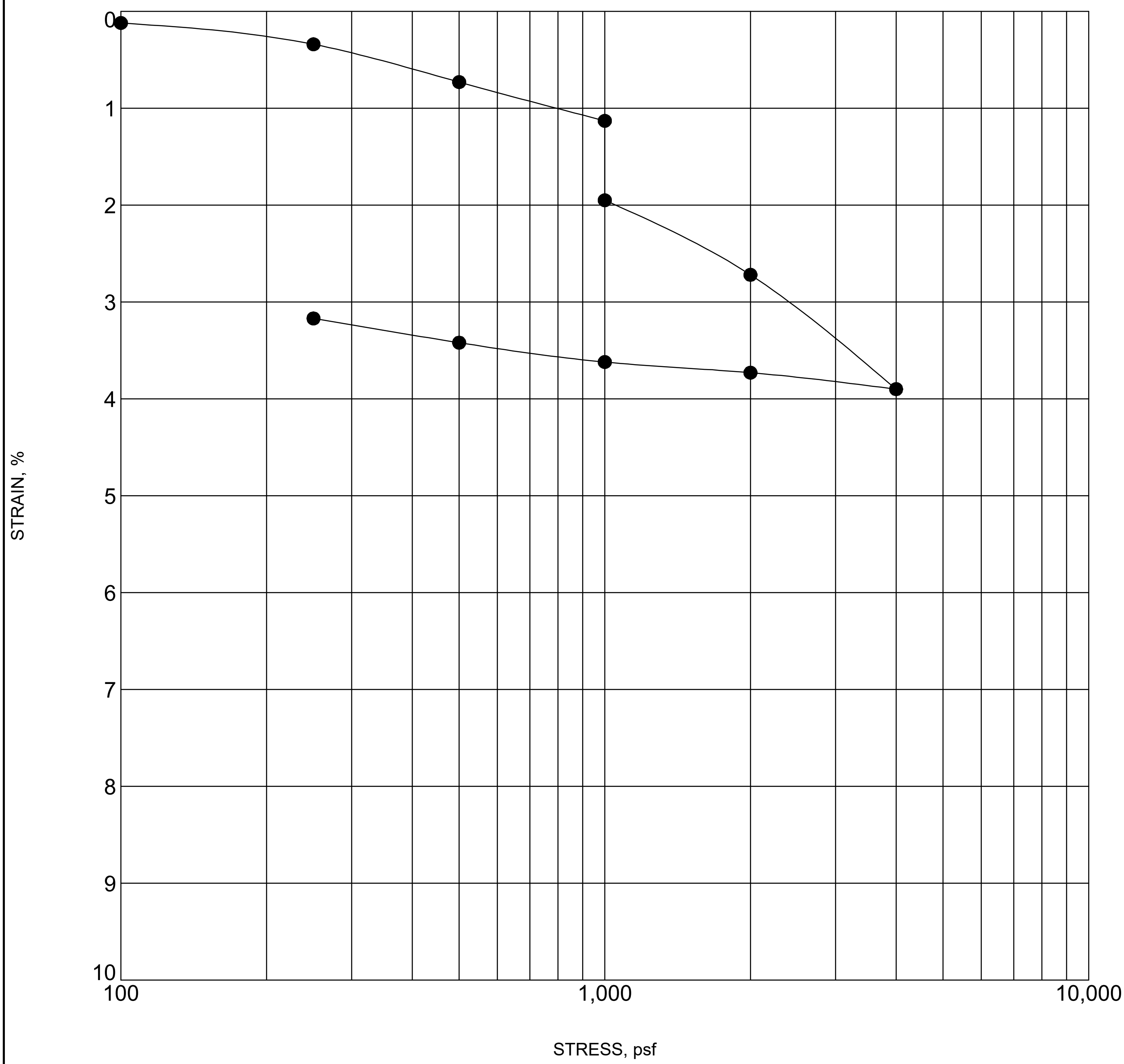
CONSOLIDATION TEST

CLIENT McDonald's USA

PROJECT NAME McDonalds Santa Ana Subsurface Investigations

PROJECT NUMBER 4230.2100035.0000

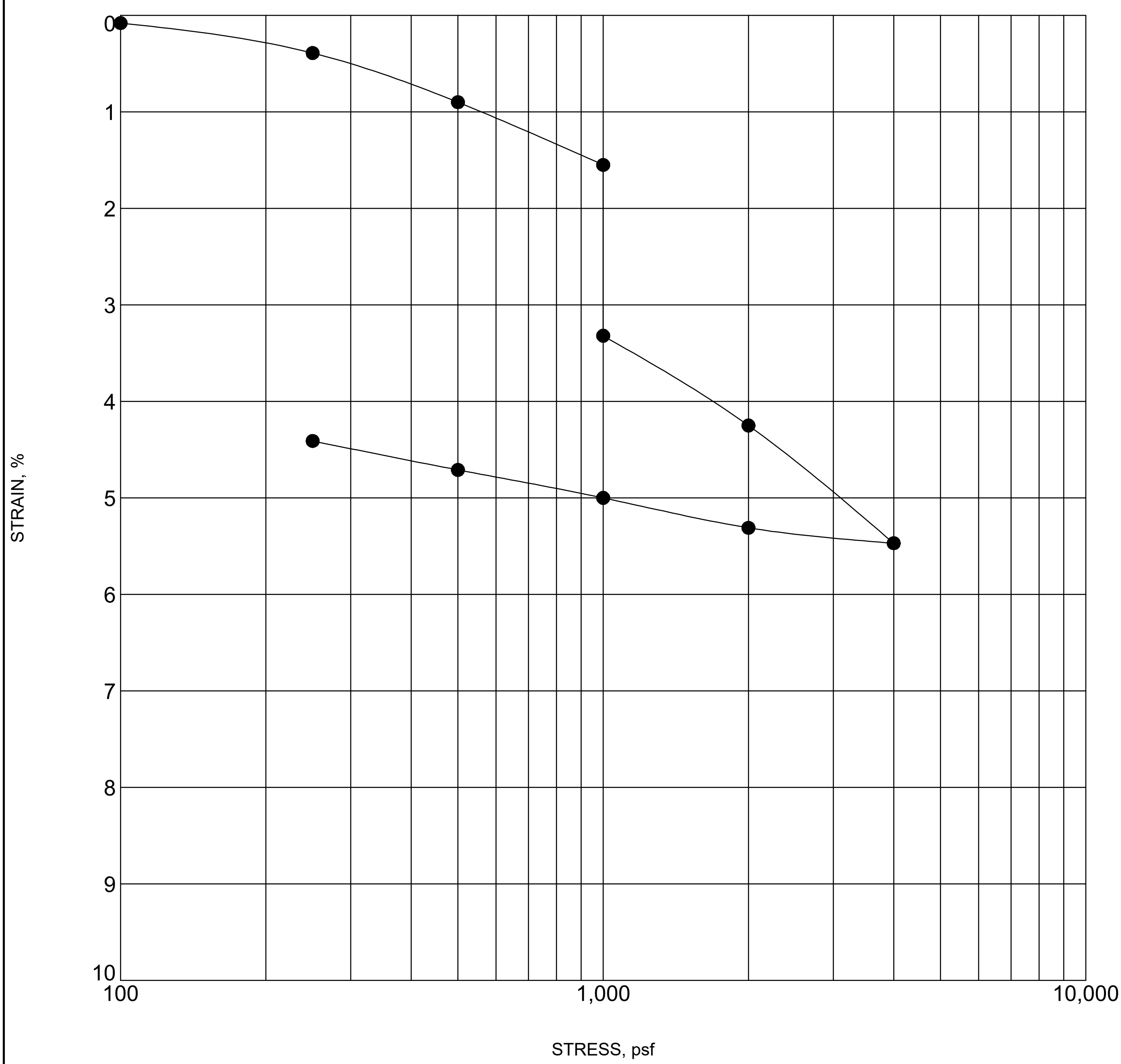
PROJECT LOCATION Santa Ana, CA



	BOREHOLE	DEPTH	Classification	γ_d	MC%
●	**B-3**	**5.0**	**(SC-SM) SILTY, CLAYEY SAND with gravel**	**113.3**	**2.7**

CONSOLIDATION TEST

CLIENT McDonald's USA
PROJECT NAME McDonalds Santa Ana Subsurface Investigations
PROJECT NUMBER 4230.2100035.0000
PROJECT LOCATION Santa Ana, CA



	BOREHOLE	DEPTH	Classification	γ_d	MC%
●	**B-3**	**15.0**	**(SP-SM) POORLY GRADED SAND WITH SILT and gravel**	**113.5**	**1.9**

Soil Analysis Lab Results

Client: Universal Engineering
Job Name: Santa Ana - McDonald's
Client Job Number: 4230.2100035.0000
Project X Job Number: S211018C
October 19, 2021

	Method	ASTM D4327		ASTM D4327		ASTM G187		ASTM D4972
Bore# / Description	**Depth**	**Sulfates** SO_4^{2-}		**Chlorides** Cl^-		**Resistivity** As Rec'd	Minimum	**pH**
	(ft)	(mg/kg)	(wt%)	(mg/kg)	(wt%)	(Ohm-cm)	(Ohm-cm)	
B-3 Bulk	0-5	28.6	0.0029	5.9	0.0006	34,840	6,030	8.9

Cations and Anions, except Sulfide and Bicarbonate, tested with Ion Chromatography
mg/kg = milligrams per kilogram (parts per million) of dry soil weight
ND = 0 = Not Detected | NT = Not Tested | Unk = Unknown
Chemical Analysis performed on 1:3 Soil-To-Water extract
PPM = mg/kg (soil) = mg/L (Liquid)

APPENDIX C

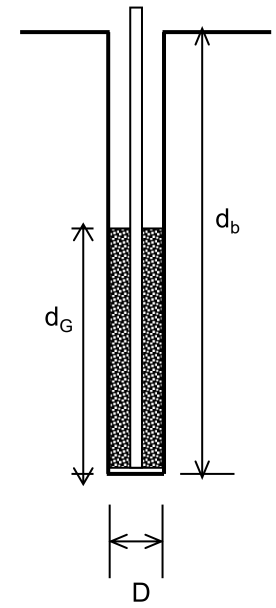
Infiltration Test Result

Appendix C

Percolation testing was performed on October 9, 2021 in conformance with Porchet Method (Inverse Borehole Method). Our field data and associated calculations are attached to this Appendix D for reference.

PERCOLATION TEST DATA

Project No.: 4230.2100035.0000
Project Name: McDonalds Santa Ana Subsurface Investigations
Test Date: October 9, 2021
Test Boring No.: **P-1**
Diameter of Boring (D): 0.67 feet
Depth of Boring (d_b): 5.0 feet



Sandy Soil Criteria Test

Time of Testing			Water Level Measurements			
Start Time T_i	Stop Time T_f	Time Interval ΔT (min)	Initial depth to water d_1 (feet)	Final depth to water d_2 (feet)	Initial depth to water d_1 (inch)	Greater than or Equal to 6"? (Yes/No)
7:19 AM	7:29 AM	10.00	1.79	3.02	14.76	Yes
7:47 AM	7:57 AM	10.00	1.02	2.72	20.40	Yes

Time of Testing			Water Level Measurements		Water Level Calculations			Infiltration Rate Calculations	
Start Time T_i	Stop Time T_f	Time Interval ΔT (min)	Initial depth to water d_1 (feet)	Final depth to water d_2 (feet)	Initial height of water column d_i (feet)	Final height of water column d_f (feet)	Drop of water column $\Delta d = d_i - d_f$ (inch)	Tested Infiltration Rate *K (observed)* (inch/hr)	Infiltration Rate w/ Factor of Safety of 2 *K (design)* (inch/hr)
Percolation Test									
8:14 AM	8:44 AM	30.00	1.46	1.93	3.54	3.07	5.64	0.54	0.27
8:45 AM	9:15 AM	30.00	1.45	1.91	3.55	3.09	5.52	0.53	0.26
9:16 AM	9:46 AM	30.00	1.52	2.02	3.48	2.98	6.00	0.59	0.29
9:47 AM	10:17 AM	30.00	1.56	1.95	3.44	3.05	4.68	0.46	0.23
10:18 AM	10:48 AM	30.00	1.55	1.92	3.45	3.08	4.44	0.43	0.22
10:49 AM	11:19 AM	30.00	1.52	1.92	3.48	3.08	4.80	0.46	0.23
11:20 AM	11:50 AM	30.00	1.50	1.90	3.50	3.10	4.80	0.46	0.23
11:51 AM	12:21 PM	30.00	1.50	1.89	3.50	3.11	4.68	0.45	0.22
12:22 PM	12:52 PM	30.00	1.50	1.89	3.50	3.11	4.68	0.45	0.22
12:53 PM	1:23 PM	30.00	1.50	1.88	3.50	3.12	4.56	0.44	0.22
1:23 PM	1:53 PM	30.00	1.50	1.88	3.50	3.12	4.56	0.44	0.22
1:54 PM	2:24 PM	30.00	1.50	1.88	3.50	3.12	4.56	0.44	0.22

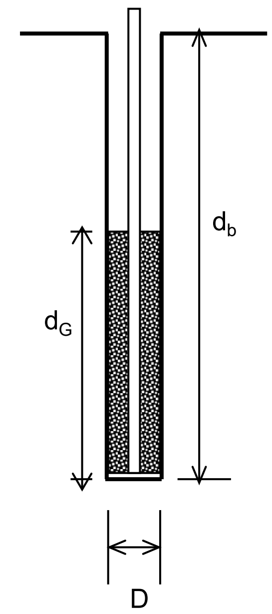
***Infiltration Rate: 0.22 (inch/hr)**

Reference: County of Orange Technical Guidance Document (TGD), dated December 20, 2013

*Based on the last dropped obtained in the final 30 minutes

PERCOLATION TEST DATA

Project No.: 4230.2100035.0000
Project Name: McDonalds Santa Ana Subsurface Investigations
Test Date: October 9, 2021
Test Boring No.: **P-2**
Diameter of Boring (D): 0.67 feet
Depth of Boring (d_b): 5.0 feet



Sandy Soil Criteria Test

Time of Testing			Water Level Measurements			
Start Time T_i	Stop Time T_f	Time Interval ΔT (min)	Initial depth to water d_1 (feet)	Final depth to water d_2 (feet)	Initial depth to water d_1 (inches)	Greater than or Equal to 6"? (Yes/No)
7:22 AM	7:32 AM	10.00	1.07	1.32	3.00	Yes
		0.00			0.00	Yes

Time of Testing			Water Level Measurements		Water Level Calculations			Infiltration Rate Calculations	
Start Time T_i	Stop Time T_f	Time Interval ΔT (min)	Initial depth to water d_1 (feet)	Final depth to water d_2 (feet)	Initial height of water column d_i (feet)	Final height of water column d_f (feet)	Drop of water column $\Delta d = d_i - d_f$ (inches)	Tested Infiltration Rate *K (observed)* (inch/hr)	Infiltration Rate w/ Factor of Safety of 2 *K (design)* (inch/hr)
Percolation Test									
7:22 AM	7:52 AM	30.00	1.07	1.42	3.93	3.58	4.20	0.36	0.12
7:53 AM	8:32 AM	39.00	1.06	1.42	3.94	3.58	4.32	0.28	0.14
8:28 AM	8:58 AM	30.00	1.04	1.45	3.96	3.55	4.92	0.42	0.21
8:59 AM	9:29 AM	30.00	1.09	1.43	3.91	3.57	4.08	0.35	0.17
9:30 AM	10:00 AM	30.00	1.12	1.42	3.88	3.58	3.60	0.31	0.15
10:02 AM	10:32 AM	30.00	1.10	1.47	3.90	3.53	4.44	0.38	0.19
10:33 AM	11:33 AM	60.00	1.09	1.47	3.91	3.53	4.56	0.20	0.10
11:04 AM	11:34 AM	30.00	1.09	1.47	3.91	3.53	4.56	0.39	0.20
11:36 AM	12:00 PM	24.00	1.07	1.42	3.93	3.58	4.20	0.45	0.22
12:08 PM	12:38 PM	30.00	1.09	1.46	3.91	3.54	4.44	0.38	0.19
12:39 PM	1:09 PM	30.00	1.11	1.47	3.89	3.53	4.32	0.37	0.19
1:10 PM	1:40 PM	30.00	1.10	1.46	3.90	3.54	4.32	0.37	0.19

***Infiltration Rate:** **0.18** **(inch/hr)**

Reference: County of Orange Technical Guidance Document (TGD), dated December 20, 2013
*Based on the last dropped obtained in the final 30 minutes