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GEOTECHNICAL INVESTIGATION

San Gabriel High School
Vehicle Maintenance Facility
801 S. Ramona Street
San Gabriel, California 91776

Prepared For:
Alhambra Unified School District
1515 W Mission Road
Alhambra, California 91803

Prepared By:
MTGL, Inc.
2992 La Palma Avenue, Suite A
Anaheim, California 92806

December 9, 2019
Revised June 26, 2020

MTGL Project No. 1494A01
MTGL Log No. 19-2739 (Rev)

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December 9, 2019
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MTGL Project No.: 1494A01
MTGL Log No.: 19-2739

Keith Matsuo
Alhambra Unified School District
1515 W Mission Road
Alhambra, California 91803

Subject: **GEOTECHNICAL INVESTIGATION**
New Vehicle Maintenance Facility
801 South Ramona Street
San Gabriel, California 91776

Dear Mr. Matsuo,

In accordance with your request and authorization, MTGL, Inc., has completed a Geotechnical Investigation for the subject site. We are pleased to present the following report which addresses geotechnical conditions, including a description of the site conditions, results of our field exploration and laboratory testing, and our conclusions and recommendations for grading and foundations design.

The subject project is located at 801 South Ramona Street San Gabriel, California 91776. The site is bounded by Mission Road in the north, South Ramona Street in the east, and the Alhambra Wash in the west. Based upon correspondence, MTGL understands that plans are to construct a single-story vehicle maintenance facility with an accompanying single-story canopy structure. It is our understanding that the structure will have mostly metal walls and roofing with the bottoms of the walls being made of concrete blocks.

Based on our investigation, the site will be suitable for the proposed construction, provided the recommendations presented herein are incorporated into the plans and specifications for the proposed construction. Details related to geologic conditions, site seismicity, site preparation, foundation and pavement design, and construction considerations are also included in the subsequent sections of this report.

MTGL, Inc. appreciates this opportunity to be of continued service and look forward to providing additional consulting services during the planning and construction of the project. Should you have any questions regarding this report, please do not hesitate to contact us at your convenience.

Respectfully submitted,
MTGL, Inc.

Jay Rowerdink, E.I.T
Staff Engineer

Isaac Chun, P.E., G.E.
Vice President | Engineering Manager

Distribution: Sam Sahand at Flewelling & Moody Architects via email: ssahand@flewelling-moody.com

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1.00 INTRODUCTION

In accordance with your request and authorization, MTGL, Inc. (MTGL) has completed this Geotechnical Investigation for the subject site. The following report presents a summary of our findings, conclusions and recommendations based on our investigations, laboratory testing, and engineering analysis

1.01 Planned Construction

Based upon correspondence, MTGL understands that plans are to construct a single-story vehicle maintenance facility with a single-story canopy structure. It is our understanding that the structure will have mostly metal walls and roofing with the bottoms of the walls being made of concrete blocks.

1.02 Scope of Work

The scope of our Geotechnical services included the following:

- Review of literature to obtain background information of regional geology, seismicity and groundwater.
- Examination of aerial photographs
- Contacting of underground service alert to locate on-site utility lines.
- Reconnaissance of the site
- Drilling and sampling of four (4) exploratory borings to a maximum depth of 50 feet utilizing 8-inch hollow stem auger drill rig.
- Logging and sampling of the borings and identification of the various earth materials encountered during the exploration.

1.03 Site Description

The site is an asphalt paved lot that is currently used as a school bus parking and storage area. The approximate site location is shown on the accompanying Site Vicinity Map (Figure 1).

1.04 Field Investigation

Prior to the field investigation, a site reconnaissance was performed by an MTGL engineer to mark the boring locations, as shown on the Boring Location Map (Figure 2), and to evaluate the locations with respect to obvious subsurface utilities and access for the drilling rig. Underground Service Alert was then notified of the marked location for utility clearance.

Our subsurface investigation was performed on November 14, 2019. The subsurface investigation consisted of drilling four (4) hollow stem auger borings (8-inch diameter) to a maximum depth of 50 feet. The drilling was performed with a truck-mounted drill rig equipped with an 8-inch diameter hollow stem auger (HSA). See Appendix B for further discussion of the field exploration including logs of test borings.

Borings were logged and sampled using Modified California Ring (Ring) and Standard Penetration Test (SPT) samplers at selected depth intervals. Samplers were driven into the bottom of the boring with successive drops of a 140-pound weight falling 30 inches. The number of blows required to drive the last 12 inches of the 18-inch Ring and SPT samplers are shown on the boring logs in the "blows/foot" column (Appendix A). SPT was performed on the borings in general accordance with the American Standard Testing Method (ASTM) D1586 Standard Test Method. Representative bulk soil samples were also obtained from our borings.

Each soil sample collected was inspected and described in general conformance with the Unified Soil Classification System (USCS). The soil descriptions were entered on the boring logs. All samples were sealed and packaged for transportation to our laboratory. After completion of drilling, borings were backfilled with soil cuttings and patched with cold patch asphalt.

1.05 Laboratory Testing

Laboratory tests were performed on representative samples to verify the field classification of the recovered samples and to determine the geotechnical properties of the subsurface materials. All laboratory tests were performed in general conformance with ASTM or State of California Standard Test Methods. The results of our laboratory tests are presented in Appendix B of this report.

2.00 FINDINGS

2.01 SITE GEOTECHNICAL CONDITIONS

As shown on the attached boring logs, the proposed project area is underlain by fill approximately 2 feet of loose gravely sand, then underlain by native gravelly sands, and silt to the maximum depth explored of 51 feet. The soil is for the most part dry and in a medium dense to dense condition. No groundwater was encountered during our site investigation.

The borings depths and pertinent data for each boring are presented in the table below.

Boring No.	Depth (feet)	Approximate Fill Thickness (feet)	Groundwater Depth Below Ground Surface (feet)
B-1	50	2	Not Encountered
B-2	20	2	Not Encountered
B-3	20	2	Not Encountered
B-4	20	2	Not Encountered

2.02 SURFACE AND GROUNDWATER

No areas of ponding or standing water were present at the time of our study. Further, no springs or areas of natural seepage were found.

According to the USGS data for historic groundwater conditions in the vicinity of the project, groundwater levels vary between 150 and 250 feet below the surface. Groundwater was not found during the performance of our investigation.

2.03 LIQUEFACTION POTENTIAL AND SEISMIC SETTLEMENTS

Liquefaction is a phenomenon wherein earthquake induced ground vibrations increase the pore pressure in saturated, granular soils until it is equal to the confining, overburden pressure. When this occurs, the soil can completely lose its shear strength and enter a liquefied state. The possibility of liquefaction is dependent upon grain size, relative density, confining pressure, saturation of the soils, strength of the ground motion and duration of ground shaking. In order for liquefaction to occur three criteria must be met: underlying loose, coarse-grained (sandy) soils, a groundwater depth of less than about 50 feet, and a nearby large magnitude earthquake.

The seismic hazard evaluation of the El Monte 7.5 quadrangle (CGS, 2017) indicates the site area is not within a zone of liquefaction or zone of seismic activity. Therefore, a liquefaction analysis was not required for this report.

3.00 CONCLUSIONS

3.01 General Conclusions

Based on our Geotechnical review of the planned construction, it is our opinion that the site is suitable for the proposed construction provided our conclusions are taken into consideration during design, and our recommendations are incorporated into the plans and specifications and implemented during grading and construction.

Given the findings of the investigation, it appears that the site is suitable for the proposed construction. Based on the findings of this investigation, it is our opinion that the proposed development is safe against landslides and settlement provided the recommendations presented in our report are incorporated into the design and construction of the project. The nature and extent of the investigation conducted for the purposes of this declaration are, in our opinion, in conformance with generally accepted practice in this area. Therefore, the proposed project appears to be feasible from a geotechnical standpoint. There appears to be no significant geotechnical constraints onsite that cannot be mitigated by proper planning, design, and sound construction practices. Specific conclusions pertaining to site conditions are summarized below:

- The potential for active (on-site) faulting or landslides is considered low.
- The potential for liquefaction during strong ground motion is low but foundations should be designed to accommodate the anticipated total settlements.

3.02 Earthquake Accelerations and Seismic Design Parameters

The SEAOC/OSHPD Seismic Design Maps application was used to calculate the CBC site specific design parameters as required by the 2016 California Building Code. Based upon the subsurface data, the site can be classified as Site Class D. The spectral acceleration values for 0.2 second and 1 second periods obtained from the computer program and in accordance with the 2016 California Building Code are tabulated below.

SEISMIC DESIGN PARAMETERS

Seismic Design Parameters	2016 CBC Design Values
Site Class	D
Mapped Short Period (0.2 sec) Spectral Response Acceleration, S_S	2.765 g
Mapped 1-Secion Spectral Response Acceleration, S_1	0.955 g
Site Coefficient from Table 1613.5.3(1), F_a	1.0
Site Coefficient from Table 1613.5.3(2), F_v	1.5
MCE 0.2-Second Period Spectral Response Acceleration, S_{MS}	2.765 g
MCE 1-Second Period Spectral Response Acceleration, S_{M1}	1.433 g
Design Spectral Response Acceleration for Short Period, S_{DS}	1.843 g
Design Spectral Response S_{D1}	0.955 g

4.00 RECOMMENDATIONS

Our recommendations are considered minimum and may be superseded by more conservative requirements of the architect, structural engineer, building code, or governing agencies. The foundation recommendations are based on the geotechnical analysis of the onsite soils. Import soils, if necessary, should have a very low expansion potential and should be approved by the Geotechnical Engineer prior to importing to the site. In addition to the recommendations in this section, additional general earthwork and grading specifications are included in Appendix C.

4.01 FOUNDATION DESIGN

Based on the borings drilled at the site to date, subsurface material below the proposed foundation elevations generally consist of uncertified fill which are not suitable for support for the proposed structures. The proposed building can be supported on shallow spread foundations. Shade structures, covered walkways, or other pole-type structures can be supported on cast-in-drilled hole (CIDH) concrete pile foundations.

4.01.1 SHALLOW FOUNDATIONS

The proposed new structures can be supported on spread footings using an allowable bearing capacity of 2,500 psf, bearing on new engineered fill. This allowable bearing pressure may be increased by 20% for each additional foot of width and/or depth, to a maximum value of 4,000 psf. All uncertified fill should be removed and replaced with engineered fill. The allowable bearing capacity may be increased by one-third for transient loads, such as seismic and wind. Footings should be a minimum of 18-inches in width and embedded a minimum of 24-inches below the surrounding grade. Footing settlements of less than 3/4-inch and differential settlements of less than 0.0065 radians are anticipated with foundations bearing on appropriately prepared subgrade. An inch or less of seismically induced settlement is anticipated under dry dynamic loading conditions, under the MCER level of ground shaking.

Footing excavation should be performed using a backhoe bucket fitted with a smooth steel plate welded across the bucket teeth to minimize disturbance during excavation and to provide a smooth bearing surface. The foundation bearing level excavation subgrades should be firm and unyielding, inspected and approved by a qualified Geotechnical Engineer prior to steel placement and concrete placement.

Foundations should be constructed as soon as possible following subgrade approval. The contractor shall be responsible for maintaining the subgrade in its as approved condition (i.e. free of water, debris, etc.) until the footing is constructed.

- Lateral Resistance – Lateral loads will be resisted by friction between the bottoms of footings and passive pressure on the faces of footings and other structural elements below grade. An allowable coefficient of friction of 0.35 can be used. An allowable passive pressure of 300 psf per foot of depth below the ground surface can be used for level ground conditions. The allowable passive pressure should be reduced for sloping ground conditions. The passive pressure can be increased by ⅓ when considering the total of all loads, including wind or seismic forces. The upper 1 foot of soil should not be relied on for passive support unless the ground is covered with pavements or slabs.

- Adjacent Foundations – Surcharge loading from adjacent foundations should be considered where the adjacent foundations are supported on soil above a 1H:1V theoretical influence line projecting upwards from base of the lowest proposed foundation.

4.01.2 CIDH Pile Foundations

Cast-in-Drilled Hole (CIDH) piles should be spaced at least three pile diameters, center to center, and be embedded in compacted fill and/or native soils. The axial downward capacity of piles will be obtained from skin friction. The axial uplift resistance of piles will be obtained by skin friction and the weight of the pile. An allowable skin friction of 500 psf can be used. Lateral loads will be resisted by passive pressure on the piles. An allowable passive pressure of 300 psf per foot of embedment acting on twice the pile diameter can be used, based on a lateral deflection up to ½ inch at the ground surface and level ground conditions. The uplift and passive pressure values can be increased by ⅓ when considering the total of all loads, including wind or seismic forces. The upper 1 foot of soil should not be relied on for passive support unless the ground is covered with pavements or slabs.

4.02 Excavation Characteristics

Our exploratory borings were advanced with some difficulty, but no oversize materials were encountered in our subsurface investigation. Accordingly, we expect that all earth materials will excavate readily with conventional heavy-duty grading equipment and oversized materials are not expected.

Shrinkage is the decrease in volume of soil upon removal and recompaction expressed as a percentage of the original in-place volume, which will account for changes in earth volumes that will occur during grading. Our estimate for shrinkage of the onsite fill and native soils are expected to range from 15 to 20 percent.

4.03 Site Clearing Recommendations

All existing structures, surface vegetation, trash, debris, asphalt concrete, Portland cement concrete and underground pipes, foundations and utilities should be cleared and removed from the proposed construction site. Underground facilities such as utilities, foundation, slabs, pipes or underground storage tanks may exist at the site. Removal of underground tanks is subject to state law as regulated by the County, City and/or Fire Department. If storage tanks containing hazardous or unknown substances are encountered, the proper authorities must be notified prior to any attempts at removing such objects. Ground penetration radar could be used to survey the existing underground structures.

Any water wells, if encountered during construction, should be exposed and capped in accordance with the requirements of the regulating agencies. Depressions resulting from the removal of foundations of existing buildings, underground tanks and pipes, buried obstructions and/or tree roots should be backfilled with properly compacted material.

4.04 Site Grading Recommendations

All fill materials should be compacted to at least 90 percent of maximum dry density as determined by ASTM Test Method D1557. Fill materials should be placed in loose lifts, no greater than 8 inches prior to applying compactive effort. All engineered fill materials should be moisture- conditioned and processed as necessary to achieve a uniform moisture content that is near optimum moisture content and within moisture limits required to achieve adequate bonding between lifts.

4.05 Site Overexcavation

If a shallow foundation system supported by engineered fill is selected for the structure support, then site over excavation should be performed as follows. Structural plans, grading plans and foundation elevations were not available at the time of our investigation. Therefore, once formal plans are prepared and available for review, this office should review these plans from a geotechnical viewpoint, comment on any changes, and revise the recommendations of this report as necessary.

All existing structures, foundations, slabs, utilities, vegetation, asphalt paving, trash and debris should be cleared from the grading area and removed completely from the site. Any existing utilities or conduits that extend beyond the limits of the proposed construction area should be removed completely or abandoned in place and plugged with a non-shrink cement grout.

Prior to placement of compacted fills, all non-engineered fills and loose, porous, or compressible soils will need to be overexcavated down to competent ground. Based on our exploratory borings, non-engineered fills were encountered in the upper 2 feet at the site.

4.05.1 STRUCTURAL AREAS

It is recommended that the existing soils within proposed new structures be over excavated to a minimum depth of 2 feet below the bottom of the proposed footings. The required horizontal limits of the over excavated area shall be defined as the area extending from the edge of the perimeter of the structure for a distance of 5 feet. Shoring, slot cuts, and/or underpinning of any existing buildings or improvements within close proximity to the grading area may be required prior to performing any overexcavations or removals.

4.06.2 NON-STRUCTURAL AREAS

Non-structural areas such as equipment pads, sidewalks, and other miscellaneous flatwork areas including all paved areas will require a minimum depth of 3 feet of removal and recompaction below the lowest adjacent grade. Processing for hardscape areas should extend a minimum distance of 2 feet outside the hardscape limits.

The exposed soils beneath all overexcavation and in cut areas not otherwise requiring over-excavation should be scarified to a minimum depth of 12 inches, moisture conditioned and compacted to a minimum of 90% relative compaction.

The above recommendations are based on the assumption that soils encountered during field exploration are representative of soils throughout the site. The overexcavation depths must be verified, and adjusted if necessary, at the time of grading. The overexcavated materials may be moisture conditioned and re-compacted as engineered fill

4.06 FILL MATERIALS

Removed and/or overexcavated soils may be moisture-conditioned to near optimum moisture content and recompacted as engineered fill, except for soils containing detrimental amounts of organic material. Our subsurface investigation indicates that the near surface materials are generally at or below its optimum moisture content. The fill materials should be compacted to a minimum of 90% of the maximum dry density per ASTM D-1557.

Imported materials shall be free from vegetable matter and other deleterious substances, shall not contain rocks or lumps of a greater dimension than 4 inches, and shall be approved by the geotechnical consultant. Soils of poor gradation, expansion, or strength properties shall be placed in areas designated by the geotechnical consultant or shall be mixed with other soils providing satisfactory fill material.

4.07 CONCRETE SLABS ON GRADE, MISCELLANEOUS FLATWORK, AND PAVERS

A minimum of 5 inches thickness should be designed for structural concrete slab on grade within heavy use areas of buildings using a minimum concrete strength design of 4,500 psi. Concrete slabs on grade for miscellaneous flatwork and lightly loaded building areas may be designed with a minimum thickness of 5.0 inches for normal loading conditions. However, if heavier loads are anticipated, a modulus of subgrade reaction of 120 pounds per cubic inch may be used for design when the slabs are supported by compacted fill.

All slabs and flatwork should be reinforced with a minimum of #4 bars, 24-inches on center, each direction, placed at the mid-height of the slab. The structural engineer may require heavier reinforcement. Control joints should be constructed to create squares or rectangles with a maximum spacing of 15 feet on large slab areas.

Vehicular concrete pavers should be designed with over 1-inch sand and over 8 inches of Aggregate Base type II over 24 inches minimum subgrade compacted to at least 90% of maximum dry density.

4.08 PREWETTING RECOMMENDATIONS

Prior to placing concrete slabs and flatwork, the underlying soils should be brought to near optimum moisture content for a depth of 12 inches prior to the placement of concrete. The geotechnical consultant should perform in-situ moisture tests to verify that the appropriate moisture content has been achieved a maximum of 24 hours prior to the placement of concrete or moisture barriers.

Once the slab subgrade soil has been pre-wetted and compacted, the soil should not be allowed to dry prior to concrete placement. If the subgrade soil is dry, the moisture content of the soil should be restored prior to placement of concrete and re-tested.

Proper moisture conditioning and compaction of subgrade soils prior to placement is very important prior to concrete placement. Even with proper site preparation, some soil moisture changes of the subgrade soils supporting the concrete flatwork due to edge effects (shrink/swell) may occur. Drying and/or wetting of subgrade soils adjacent to landscaped areas or open fields may increase the potential of shrink/swell effects beneath concrete flatwork areas.

4.09 CORROSIVITY

Soluble sulfate tests indicate that subsurface soils have a moderately corrosive to concrete and highly corrosive to metals. We recommend that the concrete be designed to resist a moderate exposure category. Our recommendations for concrete exposed to sulfate-containing soils are presented below.

RECOMMENDATIONS FOR CONCRETE EXPOSED TO SULFATE CONTAINING SOILS

Sulfate Exposure Severity	Class	Water soluble sulfate (SO_4) in soil (% by wt)	Sulfate (SO_4) in water (ppm)	Max Water to Cement Ratio by Weight	Minimum Compressive Strength (psi)	Cement Type	Calcium Chloride Admixture
Negligible	S0	0.00 - 0.10	0 - 150	N/A	2,500	N/A	No Restriction
Moderate	***S1***	***0.10 - 0.20***	***150 - 1,500***	***0.50***	***4,000***	***II/V***	***No Restriction***
Severe	S2	0.20 - 2.00	1,500 - 10,000	0.45	4,500	V	Not Permitted
Very Severe	S3	Over 2.00	Over 10,000	0.45	4,500	V Plus Pozzolan	Not Permitted

Corrosivity testing consisting of soils reactivity (pH) and resistivity (ohms-cm) were also tested on representative soils. The test results indicate that the soils have a soil reactivity pH of 6.8 and a resistivity of 1200 ohms-cm. A neutral or non-corrosive soil has a reactivity value ranging from 5.5 to 8.4. Generally, soils that could be considered corrosive to metal have resistivities less than 3,000 ohms. Those soils with resistivity values of less than 1000 ohms-cm can be considered extremely corrosive.

Based on our test results, it is our opinion that the underlying soils at the site have a potential for corrosivity to metals. Protection of buried pipes utilizing coatings on all underground pipes; clean backfills and a cathodic protection system can be effective in controlling corrosion. MTGL Inc. does not practice corrosion engineering. A qualified corrosion consultant should be consulted, if required.

4.10 Construction Considerations

4.07.1 Moisture Sensitive Soils/Weather Related Concerns

The upper soils encountered at this site may be sensitive to disturbances caused by construction traffic and to changes in moisture content. During wet weather periods, increases in the moisture content of the soil can cause significant reduction in the soil strength and its support capabilities. In addition, soils that become excessively wet may be slow to dry and thus significantly delay the progress of the grading operations. Therefore, it will be advantageous to perform earthwork and foundation construction activities during the dry season. Much of the on-site soils may be susceptible to erosion during periods of inclement weather. As a result, the project Civil Engineer/Architect and Grading Contractor should take appropriate precautions to reduce the potential for erosion during and after construction.

4.10.2 Drainage and Groundwater Considerations

According to the USGS, historic high groundwater levels in the immediate vicinity are approximately 100 to 150 feet below grade. Since this is well below the anticipated depths of grading, the installation of subdrains is not expected to be necessary.

Water should not be allowed to collect in the foundation excavation, on floor slab areas, or on prepared subgrades of the construction area either during or after construction. Undercut or excavated areas should be sloped to facilitate removal of any collected rainwater, groundwater, or surface runoff. Positive site drainage should be provided to reduce infiltration of surface water around the perimeter of the structure and beneath the floor slabs. The grades should be sloped away from the structure and surface drainage should be collected and discharged such that water is not permitted to infiltrate the backfill and floor slab areas.

4.10.3 Utility Trenches

All Cal/OSHA construction safety orders should be observed during all underground work. All utility trench backfill within street right of way, utility easements, under or adjacent to sidewalks, driveways, or building pads should be observed and tested by the geotechnical consultant to verify proper compaction. Trenches excavated adjacent to foundations should not extend within the footing influence zone defined as the area within a line projected at a 1:1 (horizontal to vertical) drawn from the bottom edge of the footing. Trenches crossing perpendicular to foundations should be excavated and backfilled prior to the construction of the foundations. The excavations should be backfilled in the presence of the geotechnical engineer and tested to verify adequate compaction beneath the proposed footing.

Utilities should be bedded and backfilled with clean sand or approved granular soil to a depth of at least 1-foot over the pipe. The bedding materials shall consist of sand, gravel, crushed aggregate, or native, free draining soils with a sand equivalence of not less than 30. The bedding should be uniformly watered and compacted to a firm condition for pipe support.

The remainder of the backfill shall be typical on-site soil or imported soil which should be placed in lifts not exceeding 8 inches in thickness, watered or aerated to near optimum moisture content, and mechanically compacted to at least 90% of maximum dry density (ASTM D1557).

4.10.4 Site Drainage

The site should be drained to provide for positive drainage away from structures in accordance with the building code and applicable local requirements. Unpaved areas should slope no less than 2% away from structure. Paved areas should slope no less than 1% away from structures. Concentrated roof and surface drainage from the site should be collected in engineered, non-erosive drainage devices and conducted to a safe point of discharge. The site drainage should be designed by a civil engineer.

4.11 Geotechnical Observation/Testing of Earthwork Operations

The recommendations provided in this report are based on preliminary design information and subsurface conditions as interpreted from the investigation. Our preliminary conclusion and recommendations should be reviewed and verified during site grading and revised accordingly if exposed Geotechnical conditions vary from our preliminary findings and interpretations. The Geotechnical consultant should perform Geotechnical observation and testing during the following phases of grading and construction:

- Additional subsurface exploration and analysis following demolition of existing structures.
- During site grading and overexcavation.
- During foundation excavations and placement.
- During drilling of pile foundations.
- During excavation and backfilling of all utility trenches.
- During processing and compaction of the subgrade for the access and parking areas and prior to construction of pavement sections.
- When any unusual or unexpected Geotechnical conditions are encountered during any phase of construction.

5.00 BUILDING CODE SECTION 111 STATEMENT

If constructed in accordance with the recommendations and quality control observation and testing provided by MTGL Inc. and with the requirements of the Los Angeles County Building Code Section 111, will be safe against hazards from settlements, slippage, and landslides. The proposed development will also have no adverse effects on the stability of adjacent offsite properties. The nature and extent of this declaration are, in the opinion of this firm, in conformance with generally accepted practice in the area, and do not constitute a guarantee or warranty, neither expressed nor implied.

6.00 LIMITATIONS

The findings, conclusions, and recommendations contained in this report are based on the site conditions as they existed at the time of our investigation, and further assume that the subsurface conditions encountered during our investigation are representative of conditions throughout the site. Should subsurface conditions be encountered during construction that are different from those described in this report, this office should be notified immediately so that our recommendations may be re-evaluated.

This report was prepared for the exclusive use and benefit of the owner, architect, and engineer for evaluating the design of the facilities as it relates to geotechnical aspects. It should be made available to prospective contractors for information on factual data only, and not as a warranty of subsurface conditions included in this report.

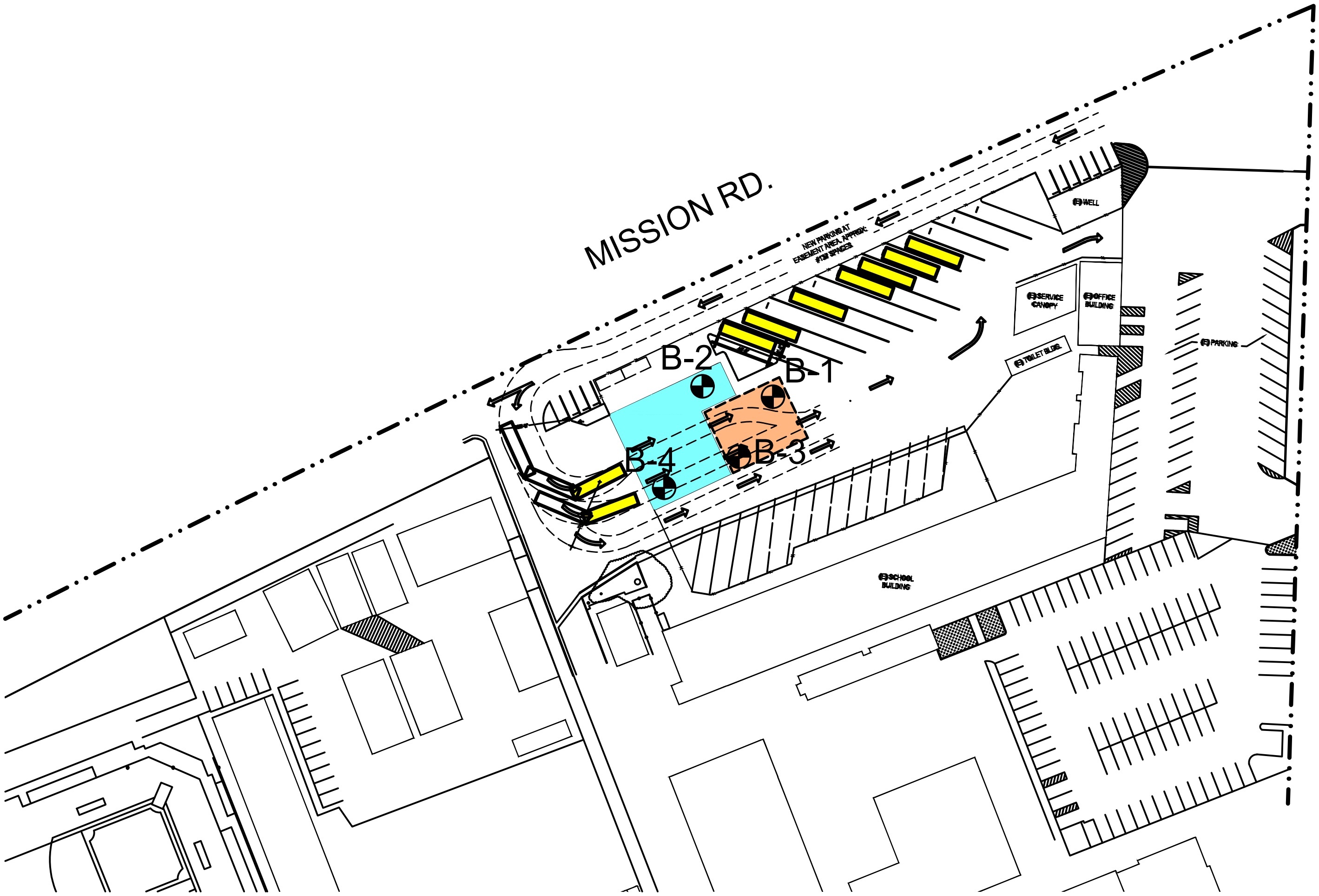
Our investigation was performed using the standard of care and level of skill ordinarily exercised under similar circumstances by reputable soil engineers and geologists currently practicing in this or similar localities. No warranty, express or implied, is made as to the conclusions and professional advice included in this report.

This firm does not practice or consult in the field of safety engineering. We do not direct the Contractor's operations, and we are not responsible for their actions. The contractor will be solely and completely responsible for working conditions on the job site, including the safety of all persons and property during performance of the work. This responsibility will apply continuously and will not be limited to our normal hours of operation.

The findings of this report are considered valid as of the present date. However, changes in the conditions of a site can occur with the passage of time, whether they are due to natural events or to human activities on this or adjacent sites. In addition, changes in applicable or appropriate codes and standards may occur, whether they result from legislation or the broadening of knowledge.

Additional subsurface exploration will be required once demolition of the existing structure has occurred. Accordingly, this report may become invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and revision as changed conditions are identified.

FIGURES



LEGEND

B-1 BORING LOCATION

N

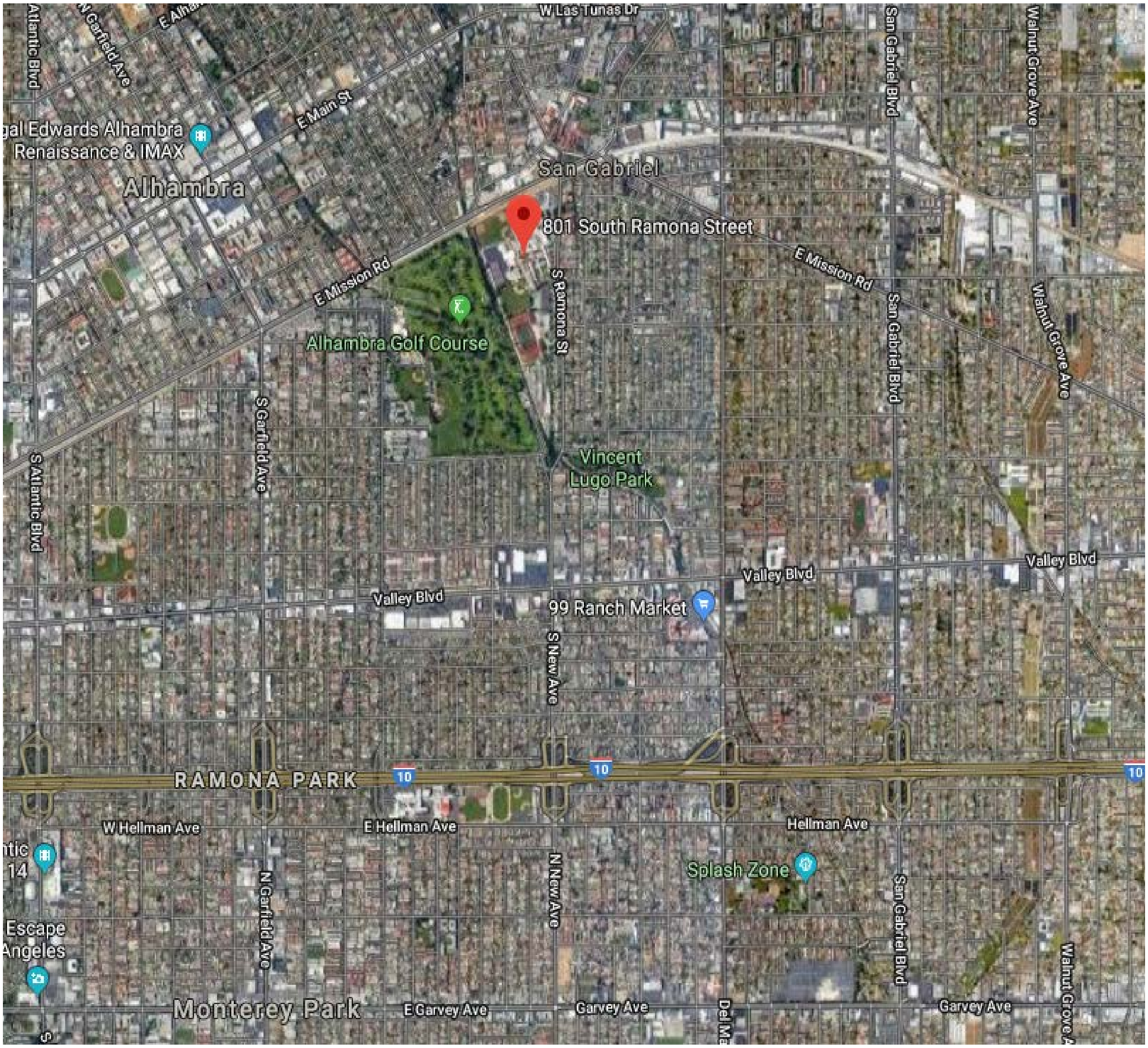
BORING LOCATION MAP

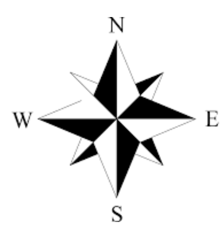
SAN GABRIEL HIGH SCHOOL NEW MAINTENANCE FACILITY

801 S. RAMONA ST.
SAN GABRIEL, CA 91776

MTGL

Project Number:	N/A
Scale:	Not to Scale
Date:	11/18/19
Figure No.	2





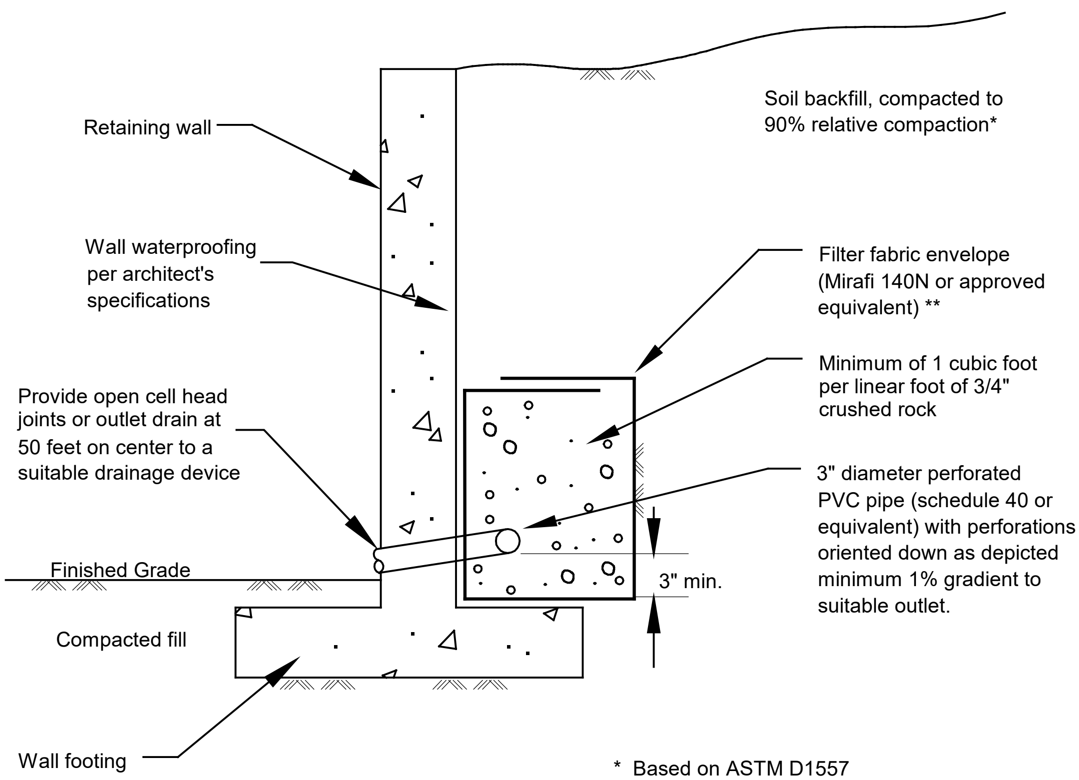
Source: Google Maps

SITE VICINITY MAP

San Gabriel High School Maintenance Facility
801 S. Ramona St
San Gabriel, CA 91776

MTGL

Project Number:	1494A01
Scale:	Not to Scale
Date:	12/9/19
Figure No.	1



* Based on ASTM D1557

** If class 2 permeable material (See gradation to left) is used in place of 3/4" - 1 1/2" gravel. Filter fabric may be deleted. Class 2 permeable material compacted to 90% relative compaction. *

SPECIFICATIONS FOR CLASS 2 PERMEABLE MATERIAL (CAL TRANS SPECIFICATIONS)

Sieve Size	% Passing
1"	100
3/4"	90-100
3/8"	40-100
No.4	25-40
No.8	18-33
No.30	5-15
No.50	0-7
No.200	0-3

RETAINING WALL DRAINAGE DETAIL

Figure 3

APPENDIX A

FIELD EXPLORATION

APPENDIX A

FIELD EXPLORATION PROGRAM

The subsurface conditions for this Geotechnical Investigation were explored by excavating six (4) hollow-stem-auger exploratory borings with an 8-inch. All drive samples were obtained by SPT or California Tube Sampler. The approximate locations of the borings are shown on the Boring Location Map (Figure 2). The field exploration was performed under the supervision of our Geotechnical Engineer who maintained a continuous log of the subsurface soils encountered and obtained samples for laboratory testing.

Subsurface conditions are summarized on the accompanying Logs of Borings. The logs contain factual information and interpretation of subsurface conditions between samples. The stratum indicated on these logs represents the approximate boundary between earth units and the transition may be gradual. The logs show subsurface conditions at the dates and locations indicated and may not be representative of subsurface conditions at other locations and times.

Identification of the soils encountered during the subsurface exploration was made using the field identification procedure of the Unified Soils Classification System (ASTM D2488). A legend indicating the symbols and definitions used in this classification system and a legend defining the terms used in describing the relative compaction, consistency or firmness of the soil are attached in this appendix. Bag samples of the major earth units were obtained for laboratory inspection and testing, and the in-place density of the various strata encountered in the exploration was determined

The exploratory borings were located in the field by using cultural features depicted on a preliminary site plan provided by the client. Each location should be considered accurate only to the scale and detail of the plan utilized.

The exploratory borings were backfilled with cement grout and patched with cold patch asphalt concrete where appropriate.

UNIFIED SOIL CLASSIFICATION SYSTEM

No. 200 U.S. Standard Sieve is the smallest particle visible	Coarse-grained soils >1/2 of materials is larger than #200 sieve	GRAVELS are more than half of coarse fraction larger than #4 sieve	Clean Gravels (less than 5% fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
			Gravels with fines	GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
		SANDS are more than half of coarse fraction larger than #4 sieve	Clean Sands (less than 5% fines)	GM	Silty Gravels, poorly-graded gravel-sand-silt mixtures
			Sands with fines	GC	Clayey Gravels, poorly-graded gravel-sand-clay mixtures
	Fine-grained Soils >1/2 of materials is smaller than #200 sieve	SILTS AND CLAYS Liquid Limit Less than 50		SW	Well-graded sands, gravelly sands, little or no fines
				SP	Poorly-graded sands, gravelly sands, little or no fines
				SM	Silty Sands, poorly-graded sands-gravel-clay mixtures
				SC	Clayey Sands, poorly-graded sand-gravel-silt mixtures
				ML	Inorganic clays of low to med plasticity, gravelly, sandy, silty, or lean clays
		SILTS AND CLAYS Liquid Limit Greater than 50		CL	Inorganic clays of low to med plasticity, gravelly, sandy, silty, or lean clays
				OL	Organic silts and clays of low plasticity
				MH	Inorganic silts, micaceous or diatomaceous fine sands or silts
				CH	Inorganic clays of high plasticity, fat clays
				OH	Organic silts and clays of medium to high plasticity
Highly Organic Soils				PT	Peat, humus swamp soils with high organic content

GRAIN SIZE					SIZE PROPORTION
Description		**Sieve Size**	**Grain Size**	**Approximate Size**	Trace – Less than 5%
Boulders		>12”	>12”	Larger than basketball-sized	Few – 5% to 10%
Cobbles		3”- 12”	3”- 12”	Fist-sized to basketball-sized	Little – 15% to 20%
Gravel	Coarse	¾”- 3”	¾”- 3”	Thumb-sized	Some – 30% to 45%
	Fine	#4 - ¾”	0.19” - 0.75”	Peat-sized to thumb-sized	Mostly – 50% to 100%
Sand	Coarse	#10 - #4	0.079” - 0.19”	Rock salt-sized to pea-sized	**MOISTURE CONTENT**
	Medium	#40 - #10	0.017” - 0.079”	Sugar-sized to rock salt-sized	Dry – Absence of moisture
	Fine	#200 - #40	0.0029” - 0.017”	Flour-sized to sugar-sized	Moist – Damp but not visible
Fines		Passing #200	<0.0029”	Flour-sized or smaller	Wet – Visible free water

CONSISTENCY FINE GRAINED SOILS			RELATIVE DENSITY COARSE GRAINED SOILS		
Apparent Density	**SPT (Blows/Foot)**	**Mod CA Sampler (Blows/Foot)**	**Apparent Density**	**SPT (Blows/Foot)**	**Mod CA Sampler (Blows/Foot)**
Very Soft	<2	<3	Very Loose	<4	<5
Soft	2-4	3-6	Loose	4-10	5-12
Firm	5-8	7-12	Medium Dense	11-30	13-35
Stiff	9-15	13-25	Dense	31-50	36-60
Very Stiff	16-30	26-50	Very Dense	>50	>60
Hard	>30	>50			

Project: **San Gabriel HS Maintenance Facility**
Project Location: **801 S. Ramona St, San Gabriel, CA 91776**
Project Number: **1494A01**

Key to Log of Boring
Sheet 1 of 1

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	REMARKS AND OTHER TESTS
1	2	3	4	5	6	7	8	9	10	11

COLUMN DESCRIPTIONS

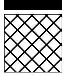
1 Elevation (feet): Elevation (MSL, feet).
2 Depth (feet): Depth in feet below the ground surface.
3 Sample Type: Type of soil sample collected at the depth interval shown.
4 Sample Number: Sample identification number.
5 Sampling Resistance, blows/ft: Number of blows to advance driven sampler one foot (or distance shown) beyond seating interval using the hammer identified on the boring log.
6 Material Type: Type of material encountered.
7 Graphic Log: Graphic depiction of the subsurface material encountered.
8 MATERIAL DESCRIPTION: Description of material encountered. May include consistency, moisture, color, and other descriptive text.
9 Water Content, %: Water content of the soil sample, expressed as percentage of dry weight of sample.
10 Dry Unit Weight, pcf: Dry weight per unit volume of soil sample measured in laboratory, in pounds per cubic foot.
11 REMARKS AND OTHER TESTS: Comments and observations regarding drilling or sampling made by driller or field personnel.

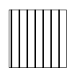
FIELD AND LABORATORY TEST ABBREVIATIONS

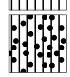
CHEM: Chemical tests to assess corrosivity
COMP: Compaction test
CONS: One-dimensional consolidation test
LL: Liquid Limit, percent
PI: Plasticity Index, percent
SA: Sieve analysis (percent passing No. 200 Sieve)
UC: Unconfined compressive strength test, Qu, in ksf
WA: Wash sieve (percent passing No. 200 Sieve)

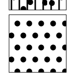
MATERIAL GRAPHIC SYMBOLS


Asphaltic Concrete (AC)


AF


SILT, SILT w/SAND, SANDY SILT (ML)


Silty SAND (SM)

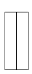

Well graded SAND (SW)

TYPICAL SAMPLER GRAPHIC SYMBOLS


Auger sampler

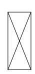

Bulk Sample

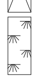

3-inch-OD California w/ brass rings


Grab Sample

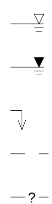

2.5-inch-OD Modified California w/ brass liners


Pitcher Sample


2-inch-OD unlined split spoon (SPT)


Shelby Tube (Thin-walled, fixed head)

OTHER GRAPHIC SYMBOLS


Water level (at time of drilling, ATD)
Water level (after waiting)
Minor change in material properties within a stratum
Inferred/gradational contact between strata
Queried contact between strata

GENERAL NOTES

1: Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive, and actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests.
2: Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.

\\SERVER5\Data\SHARED\ENGINEERING\Soil AC Reports\Reports\1494A01 San Gabriel HS Maintenance Facility\1494A01 SGHS Maintenance Facility Boring Logs.bg4[master 2 lab).tpl]

Date(s) Drilled **11/14/19**	Logged By **Jay Rowerdink**	Checked By **P.N.**
Drilling Method **Hollow Stem Auger**	Drill Bit Size/Type **8" Hollow Stem Auger**	Total Depth of Borehole **51.5**
Drill Rig Type **CME-75**	Drilling Contractor **Martini Drilling**	Approximate Surface Elevation **406**
Groundwater Level and Date Measured **Not Encountered**	Sampling Method(s) **California, SPT**	Hammer Data **140 lbs**
Borehole Backfill **Soil Cuttings**	Location **As shown Figure 2, Boring Location Plan**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	REMARKS AND OTHER TESTS
406	0				Asphalt		Surface- 3" AC			
					Fill		Gravelly Sand, Light Brown, Trace Silt, Loose			
					SW		Gravelly Sand (SW), light brown, medium dense, moist			
401	5			48			dense	13.3	122	
396	10			35						
391	15			50/6"			very dense			
					SM		Silty Sand, light brown, dense			
386	20			46						
381	25			51			very dense	7.0	110	
376	30									

Project: **San Gabriel HS Maintenance Facility**
Project Location: **801 S. Ramona St, San Gabriel, CA 91776**
Project Number: **1494A01**

Log of Boring B-1
Sheet 2 of 2

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	REMARKS AND OTHER TESTS
376	30			23			very dense			
					ML		Sandy Silt, light brown, moist, very stiff			
371	35			73			hard	13.3	122	
366	40			20						
361	45			41				21.4	106	
356	50			36						
							End of Boring as Planned at 51.5 feet			
351	55									
346	60									
341	65									

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Project: **San Gabriel HS Maintenance Facility** Project Location: **801 S. Ramona St, San Gabriel, CA 91776** Project Number: **1494A01**	Log of Boring B-2 **Sheet 1 of 1**

Date(s) Drilled **11/14/19**	Logged By **Jay Rowerdink**	Checked By **P.N.**
Drilling Method **Hollow Stem Auger**	Drill Bit Size/Type **8" Hollow Stem Auger**	Total Depth of Borehole **21.5**
Drill Rig Type **CME-75**	Drilling Contractor **Martini Drilling**	Approximate Surface Elevation **406**
Groundwater Level and Date Measured **Not Encountered**	Sampling Method(s) **California, SPT**	Hammer Data **140 lbs**
Borehole Backfill **Soil Cuttings**	Location **As shown Figure 2, Boring Location Plan**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	REMARKS AND OTHER TESTS
406	0				Asphalt		Surface- 4" AC			
					Fill		Gravelly Sand, light brown, loose			
					SW		Gravelly Sand (SW), light brown, medium dense			
401	5			25						
396	10			50/5"			very dense	1.7	137	
391	15			34						
					SM		Silty Sand (SM), dense, light brown, moist			
386	20			51				12.6	117	
							End of Boring as Planned at 21.5 feet			
381	25									
376	30									

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Project: **San Gabriel HS Maintenance Facility**	# Log of Boring B-3
Project Location: **801 S. Ramona St, San Gabriel, CA 91776**	**Sheet 1 of 1**
Project Number: **1494A01**	

Date(s) Drilled **11/14/19**	Logged By **Jay Rowerdink**	Checked By **P.N.**
Drilling Method **Hollow Stem Auger**	Drill Bit Size/Type **8" Howllow Stem Auger**	Total Depth of Borehole **21.5**
Drill Rig Type **CME-75**	Drilling Contractor **Martini Drilling**	Approximate Surface Elevation **406**
Groundwater Level and Date Measured **Not Encountered**	Sampling Method(s) **California, SPT**	Hammer Data **140 lbs**
Borehole Backfill **Soil Cuttings**	Location **As shown Figure 2, Boring Location Plan**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	REMARKS AND OTHER TESTS
406	0				Asphalt		Surface- 3.5" AC			
					Fill		Gravely Sand, light brown, loose			
					SW		Gravelly Sand (SW), light brown, medium dense, moist			R-Value = 77
401	5			43				3.0	125	
396	10			53						
391	15			50/5"	SM		Silty Sand (SM), very dense, light brown, moist	8.7	127	
386	20			66						
							End of Boring as Planned at 21.5 feet			
381	25									
376	30									

Project: **San Gabriel HS Maintenance Facility**	Log of Boring B-4
Project Location: **801 S. Ramona St, San Gabriel, CA 91776**	**Sheet 1 of 1**
Project Number: **1494A01**	

Date(s) Drilled **11/14/19**	Logged By **Jay Rowerdink**	Checked By **P.N.**
Drilling Method **Hollow Stem Auger**	Drill Bit Size/Type **8" Hollow Stem Auger**	Total Depth of Borehole **21.5**
Drill Rig Type **CME-75**	Drilling Contractor **Martini Drilling**	Approximate Surface Elevation **406**
Groundwater Level and Date Measured **Not Encountered**	Sampling Method(s) **California, SPT**	Hammer Data **140 lbs**
Borehole Backfill **Soil Cuttings**	Location **As shown Figure 2, Boring Location Plan**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	REMARKS AND OTHER TESTS
406	0				Asphalt		Surface- 4" AC			
					Fill		Gravely Sand, loose, light brown, moist			
					SW		Gravelly Sand (SW), light brown, dense, moist			
401	5			23						Fines = 12.6%
396	10			98				4.7	120	
					SM		Silty Sand (SM), very dense, light brown, moist			
391	15			90						
386	20			50/3"						
							End of Boring as Planned at 21.5 feet			
381	25									
376	30									

APPENDIX B

LABORATORY TESTING

APPENDIX B

LABORATORY TESTING PROCEDURES

1. Maximum Density Optimum Moisture Content

   Maximum density tests were performed on a representative bag sample of the near surface soils in accordance with ASTM D1557.

2. Resistance Value Testing

   R-Value testing was completed in substantial compliance with Caltrans Test Method 301. Graphical plots of our tests are included in this appendix.

3. Sieve Analysis

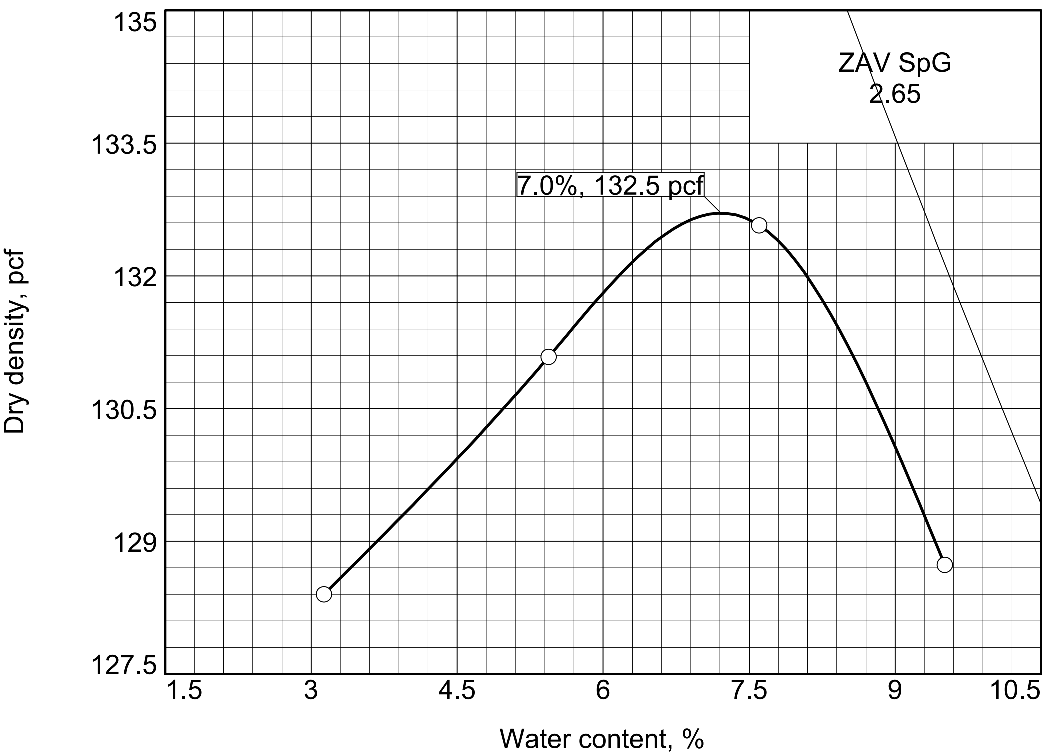
   Tests were performed to determine the particle size distribution of selected soil samples. These tests were performed in accordance with ASTM Test Method D 422. Test results are presented in this appendix.

4. Corrosion

   Chemical testing was performed on representative samples to determine the corrosion potential of the onsite soils. Testing consisted of pH, chlorides (CTM 422), soluble sulfates (CTM 417), and resistivity (CTM 643).

Sample Location	Sample Description	pH	Soluble Sulfates (ppm)	Chloride Content (ppm)	Resistivity (ohm-cm)
B-1 @ 0-5 ft	Silty Sand	6.8	197	94	1,200

COMPACTION TEST REPORT



Curve No.
874

Test Specification:
ASTM D 1557-12 Method C Modified

Preparation Method MOIST
Hammer Wt. 10 lb.
Hammer Drop 18 in.
Number of Layers five
Blows per Layer 56
Mold Size 0.075 cu. ft.
Test Performed on Material Passing 3/4 in. **Sieve**

NM ______ **LL** ______ **PI** ______
Sp.G. (ASTM D 854) 2.65
%>3/4 in. ______ **%<No.200** ______
USCS (SM) **AASHTO** ______
Date Sampled 11/14/19
Date Tested 11/25/19
Tested By RS

TESTING DATA

	1	2	3	4	5	6
WM + WS	10937.0	11134.0	11285.0	11228.0		
WM	6432.0	6432.0	6432.0	6432.0		
WW + T #1	306.2	327.6	338.2	317.8		
WD + T #1	296.9	310.7	314.3	290.2		
TARE #1	0.0	0.0	0.0	0.0		
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	3.1	5.4	7.6	9.5		
DRY DENSITY	128.4	131.1	132.6	128.7		

TEST RESULTS

Maximum dry density = 132.5 pcf

Optimum moisture = 7.0 %

Material Description

MD OLIVE BRN SITLY SAND W GRAVEL

Remarks:
SAMPLED BY: JR

Project No. 1494A01 **Client:**
Project: SAN GABRIEL HS

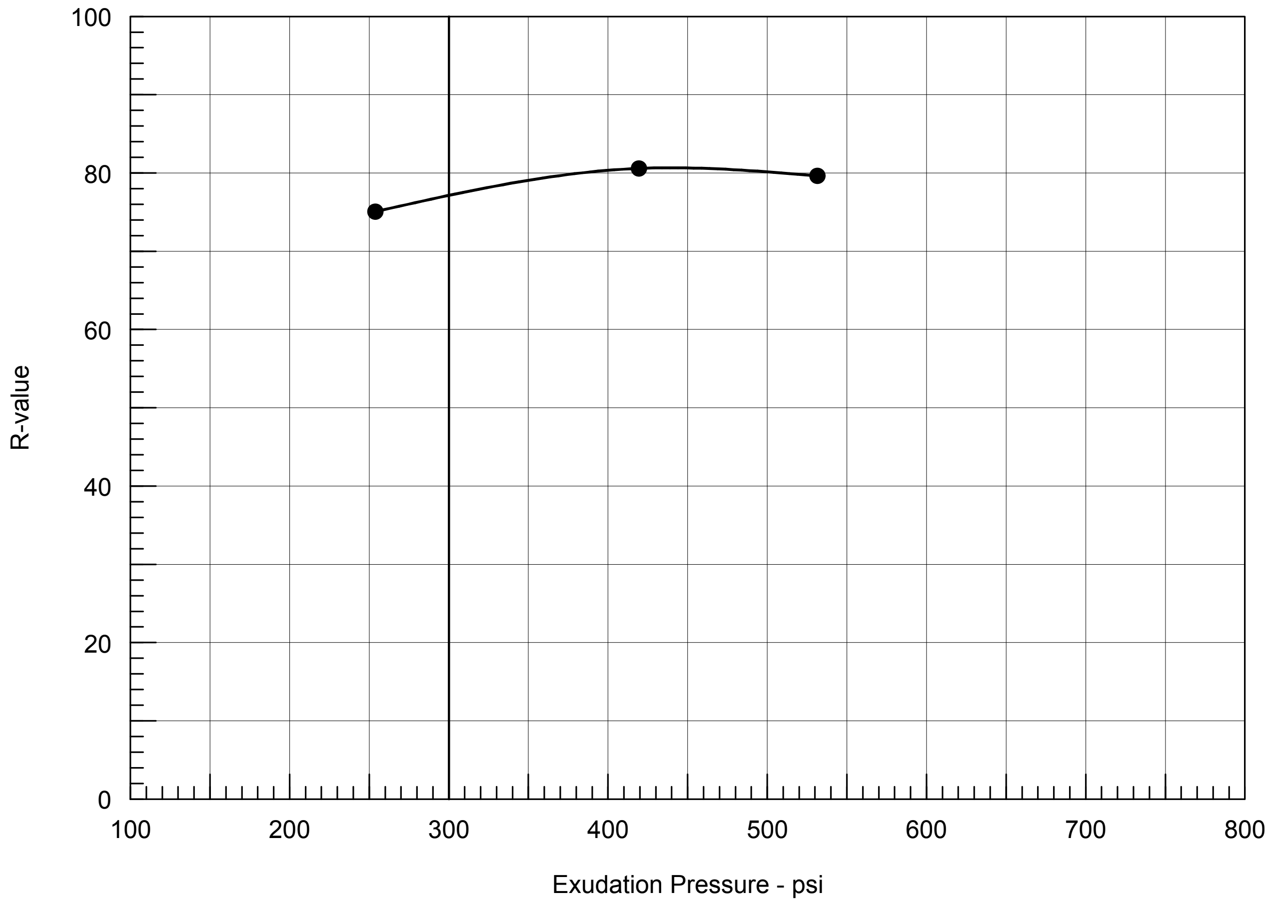
○ **Location:** B2 @ 0-5' **Sample Number:** 874

Checked by: CF
Title: LAB SUPER

MTGL, Inc.

Anaheim, CA

R-VALUE TEST REPORT



Resistance R-Value and Expansion Pressure - ASTM D2844

No.	Compact. Pressure psi	Density pcf	Moist. %	Expansion Pressure psi	Horizontal Press. psi @ 160 psi	Sample Height in.	Exud. Pressure psi	R Value	R Value Corr.
1	350	127.5	8.7	0.00	23	2.42	254	76.4	75.1
2	350	128.8	8.0	0.00	18	2.40	532	80.9	79.6
3	350	127.7	8.2	0.00	17	2.42	419	81.6	80.6

Test Results	Material Description
R-value at 300 psi exudation pressure = 77.1	MD BRN SILTY SAND W GRAVEL

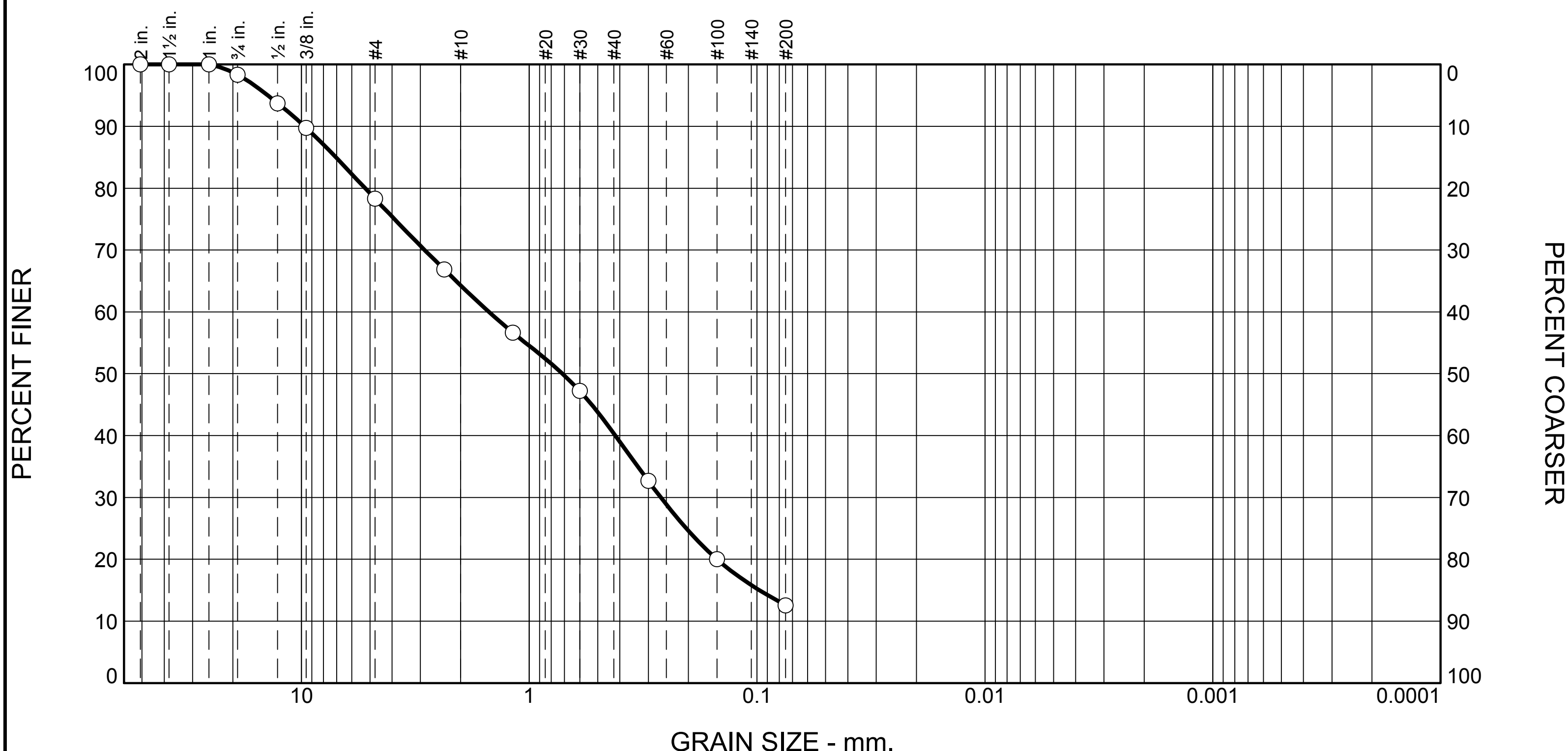
Project No.: 1494A01
Project: SAN GABRIEL HS
Location: B3 @0-5'
Sample Number: 874
Date: 12/3/2019

Tested by: RS
Checked by: CF
Remarks:
SAMPLED BY: JR

R-VALUE TEST REPORT

MTGL, Inc.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	1.6	20.1	14.0	24.0	27.7	12.6	

Test Results (ASTM C 136 & ASTM C 117)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
2.0	100.0		
1.5	100.0		
1	100.0		
3/4	98.4		
1/2	93.7		
3/8	89.8		
#4	78.3		
#8	66.9		
#16	56.7		
#30	47.2		
#50	32.7		
#100	20.0		
#200	12.6		

* (no specification provided)

Material Description

LT BRN SILTY SAND W TRACE GRAVEL

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= (SM) AASHTO (M 145)=

Coefficients

D_{90}= 9.6807 D_{85}= 7.0483 D_{60}= 1.5018
D_{50}= 0.7132 D_{30}= 0.2645 D_{15}= 0.0976
D_{10}= C_u= C_c=

Remarks

SAMPLED BY: JR
F.M.=3.10

Date Received: **Date Tested:** 11/26/19
Tested By: RS
Checked By: CF
Title: LAB SUPER

Location: B4 @ 5'
Sample Number: 874
Date Sampled: 11/14/19

MTGL, Inc.
Anaheim, CA

Client:
Project: SAN GABRIEL HS
Project No: 1494A01

APPENDIX C

STANDARD GRADING SPECIFICATIONS

APPENDIX C

GENERAL EARTHWORK AND GRADING SPECIFICATIONS

These specifications present general procedures and requirements for grading and earthwork as shown on the approved grading plans, including preparation of areas to be filled, placement of fill, installation of subdrains, and excavations. The recommendations contained in the attached geotechnical report are a part of the earthwork and grading specifications and shall supersede the provisions contained herein in the case of conflict. Evaluations performed by the Consultant during the course of grading may result in new recommendations, which could supersede these specifications, or the recommendations of the geotechnical report.

EARTHWORK OBSERVATION AND TESTING

Prior to the start of grading, a qualified Geotechnical Consultant (Geotechnical Engineer and Engineering Geologist) shall be employed for the purpose of observing earthwork procedures and testing the fills for conformance with the recommendations of the geotechnical report and these specifications. It will be necessary that the Consultant provide adequate testing and observation so that he may determine that the work was accomplished as specified. It shall be the responsibility of the Contractor to assist the Consultant and keep them apprised of work schedules and changes so that he may schedule his personnel accordingly.

It shall be the sole responsibility of the Contractor to provide adequate equipment and methods to accomplish the work in accordance with applicable grading codes or agency ordinances, these specifications, and the approved grading plans.

Maximum dry density tests used to determine the degree of compaction will be performed in accordance with the American Society for Testing and Materials Test Method (ASTM) D1557.

PREPARATION OF AREAS TO BE FILLED

Clearing and Grubbing: All brush, vegetation and debris shall be removed or piled and otherwise disposed of.

Processing: The existing ground which is determined to be satisfactory for support of fill shall be scarified to a minimum depth of 6-inches. Existing ground, which is not satisfactory, shall be overexcavated as specified in the following section.

Overexcavation: Soft, dry, spongy, highly fractured, or otherwise unsuitable ground, extending to such a depth that surface processing cannot adequately improve the condition, shall be overexcavated down to firm ground, approved by the Consultant.

Moisture conditioning: Overexcavated and processed soils shall be watered, dried-back, blended, and mixed as required to have a relatively uniform moisture content near the optimum moisture content as determined by ASTM D1557.

Recompaction: Overexcavated and processed soils, which have been mixed, and moisture conditioned uniformly shall be recompacted to a minimum relative compaction of 90 percent of ASTM D1557.

Benching: Where soils are placed on ground with slopes steeper than 5:1 (horizontal to vertical), the ground shall be stepped or benched. Benches shall be excavated in firm material for a minimum width of 4 feet.

FILL MATERIAL

General: Material to be placed as fill shall be free of organic matter and other deleterious substances and shall be approved by the Consultant.

Oversize: Oversized material defined as rock, or other irreducible material with a maximum dimension greater than 12-inches, shall not be buried or placed in fill, unless the location, material, and disposal methods are specifically approved by the Consultant. Oversize disposal operations shall be such that nesting of oversized material does not occur, and such that the oversize material is completely surrounded by compacted or densified fill. Oversize material shall not be placed within 10 feet vertically of finish grade or within the range of future utilities or underground construction, unless specifically approved by the Consultant.

Import: If importing of fill material is required for grading, the import material shall meet the general requirements.

FILL PLACEMENT AND COMPACTION

Fill Lifts: Approved fill material shall be placed in areas prepared to receive fill in near-horizontal layers not exceeding 6-inches in compacted thickness. The Consultant may approve thicker lifts if testing indicates the grading procedures are such that adequate compaction is being achieved with lifts of greater thickness. Each layer shall be spread evenly and shall be thoroughly mixed during spreading to attain uniformity of material and moisture in each layer.

Fill Moisture: Fill layers at a moisture content less than optimum shall be watered and mixed, and wet fill layers shall be aerated by scarification or shall be blended with drier material. Moisture conditioning and mixing of fill layers shall continue until the fill material is at uniform moisture content at or near optimum.

Compaction of Fill: After each layer has been evenly spread, moisture conditioned, and mixed, it shall be uniformly compacted to not less than 90 percent of maximum dry density in accordance with ASTM D1557. Compaction equipment shall be adequately sized and shall be either specifically designed for soil compaction or of proven reliability, to efficiently achieve the specified degree of compaction.

Fill Slopes: Compacting on slopes shall be accomplished, in addition to normal compacting procedures, by backrolling of slopes with sheepsfoot rollers at frequent increments of 2 to 3 feet as the fill is placed, or by other methods producing satisfactory results. At the completion of grading, the relative compaction of the slope out to the slope face shall be at least 90 percent in accordance with ASTM D1557.

Compaction Testing: Field tests to check the fill moisture and degree of compaction will be performed by the consultant. The location and frequency of tests shall be at the consultant's discretion. In general, these tests will be taken at an interval not exceeding 2 feet in vertical rise, and/or 1,000 cubic yards of fill placed. In addition, on slope faces, at least one test shall be taken for each 5,000 square feet of slope face and/or each 10 feet of vertical height of slope.

SUBDRAIN INSTALLATION

Subdrain systems, if required, shall be installed in approved ground to conform to the approximate alignment and details shown on the plans or herein. The subdrain location or materials shall not be changed or modified without the approval of the Consultant. The Consultant, however, may recommend and, upon approval, direct changes in subdrain line, grade, or materials. All subdrains should be surveyed for line and grade after installation and sufficient time shall be allowed for the surveys, prior to commencement of fill over the subdrain.

EXCAVATION

Excavations and cut slopes will be examined during grading. If directed by the Consultant, further excavation or overexcavation and refilling of cut areas, and/or remedial grading of cut slopes shall be performed. Where fill over cut slopes are to be graded, unless otherwise approved, the cut portion of the slope shall be made and approved by the Consultant prior to placement of materials for construction of the fill portion of the slope.

APPENDIX D

REFERENCES

APPENDIX D

REFERENCES

1. BNI / Public Works Standards, Inc. (2018), Standard Specifications for Public Works Construction (Greenbook), 2018 Edition.

2. California Building Standards Commission (2016), Title 24 - California Building Standards Code, 2016 Edition.

3. California Geologic Survey (2017), Earthquake Zones of Required Investigation, El Monte 7.5 Minute Quadrangle, dated June 15, 2017 (Revised).

4. California Geologic Survey (1998), Seismic Hazard Zone Report for the El Monte 7.5 Minute Quadrangle, SHZR 024.

5. Department of Water Resources (2020), Water Data Library Groundwater Levels, http://wdl.water.ca.gov/waterdatalibrary/

6. SEAOC/OSHPD Seismic Design Maps Application (2020), https://seismicmaps.org/