REPORT OF

GEOTECHNICAL INVESTIGATION

PROPOSED NEW SINGLE FAMILY RESIDENCE

LOT 1 OF TRACT NO. 9327

AND LOT 1 AND ½ VAC WALK ADJ ON NE OF TRACT NO. 9328

3130 CHARING CROSS ROAD

GLENDALE, CALIFORNIA 91206

FOR

MR. SAM NAZAYIAN

PROJECT NO. 19-523-22

SEPTEMBER 20, 2019

September 20, 2019 19-523-22

Mr. Sam Nazaryan
2048 Ashington Drive
Glendale, California 91206

Subject: Report Of Geotechnical Investigation
Proposed New Single Family Residence
Lot 1 Of Tract N0. 9327
And Lot 1 And ½ VAC Walk Adj On NE Of Tract NO. 9328
3130 Charing Cross Road
Glendale, California 91206

Dear Mr. Nazaryan:

INTRODUCTION

This report presents the results of a geotechnical investigation for the subject project. During the course of this investigation, the engineering properties of the subsurface materials were evaluated in order to evaluate slope stability and to provide recommendations for design and construction of temporary excavations, retaining walls, foundations, and grading. The investigation included geologic mapping, subsurface exploration, soil and bedrock sampling, laboratory testing, engineering and geological evaluation and analysis, consultation and preparation of this report.

During the course of this investigation, the provided topographic survey map prepared by the offices of M&G Civil Engineering & Land Surveying was used as reference. Also used as reference during this investigation, were the Architectural Plans by the offices of DOMUS Design. We have utilized the provided plans as “base map” for preparation of our plan and section drawings contained in this report.

The enclosed Geologic Map & Site Plan; Drawing No. 1, shows the surface geology and approximate locations of the exploratory test pits in relation to the site boundaries and the proposed building and walls. This drawing also shows the approximate locations of the Geologic Cross Sections A-A' and B-B’. Drawing Nos. 2

and 3 show the profiles of the Geologic Cross Sections A-A' and B-B' with respect to the existing and proposed grades.

Figure No. 1 show the Site Vicinity Map. Figure No. 2 shows the Regional Topographic Map. Figure No. 3 shows the Regional Geologic Map.

The attached Appendix I, describes the method of field exploration. Figure Nos. I-1 through I-5 present summaries of the materials encountered at the locations of our exploratory test pits. Figure No. I-6 presents a key to the log of exploratory test pits.

The attached Appendix II describes the laboratory testing procedures. Figure Nos. II-1 and II-2 present the results of direct shear and consolidation tests on selected undisturbed samples.

PROJECT CONSIDERATIONS

It is our understanding that the proposed project will consist of construction of a single family residence on the site. The proposed building is expected to be a 2-story structure over garage at the street level.

It is expected that the finished grades of the proposed garage, building and the backyard will be created through mainly cutting operations in a form of terraces. The resulting vertical cuts on the upslope side of the building pad will be supported by retaining walls with vertical heights ranging from about 5 feet to as much as 18 feet.

The upper most retaining wall supporting the ascending slope and the small wall below in the backyard will be designed as cantilevered systems. The upper most wall will support cuts of soil (fill and native) and bedrock. The walls incorporated into the proposed building will be designed as restrained walls. These walls will support mainly cuts of granitic bedrock. The approximate locations of the proposed building and other improvements are shown on the enclosed Geologic Map & Site Plan; Drawing No. 1. Geologic Cross Sections A-A' and B-B' show the profiles of the proposed improvements (building and walls) with respect to the existing and proposed grades.

The upper most retaining wall will support the ascending slope. This retaining wall will have a freeboard of at least 2 feet and a concrete paved drain (swale) to divert surface water and collect normal erosion debris which will be cleaned after rainy seasons. See the enclosed Cross Section A-A'; Drawing No. 2.

Based on the results of our investigation, it is expected that the planned excavation will be made through minor amount of soil and granitic rock. With no through-going plane of weakness. Therefore, all retaining walls for this project can be designed based on normal lateral earth pressures.

During the course of site grading work, temporary excavation will be made to create the proposed finished grades. Although adequate space is available to make unsupported/open excavation slopes, it may be desirable to use shoring for the high cuts. Use of shoring will eliminate the following;

1. Use of relatively large spread footings required for tall walls;
2. Over-excavation beyond the planned line of excavation; and
3. Subsequent backfilling within the over-excavation zone.

The shoring piles will be incorporated into the new walls and will be part of the permanent structure. The lower portion of the piles below the finished grade will be used for support of the gravity loads of the building and walls through skin friction.

Unsupported/open excavation slopes can be used for all cuts where adequate horizontal spacing (a distance equal to the vertical height of excavation) beyond the planned line of excavation is available. The slopes of the unsupported/open excavation cuts should be made using the gradients as recommended in this report.

Structural loading data was not available during the course of preparation of this report. For the purpose of this investigation, however, it is assumed that maximum concentrated loads will be on the order of 120 kips, combined dead plus frequently applied live loads. The retaining wall footings are expected to have loads of on the order of 9 kips per lineal foot.

ANTICIPATED SITE GRADING WORK

It is expected that the site grading work will involve mainly cutting operations in order to create the proposed finished grades in a form of terraces. Some wall backfilling will also be made within the over-excavated areas. The excavated sandy soils can be used for wall backfilling. Rocks should be broken down to acceptable pieces (less than 4 inches in diameter) for wall backfilling.

The new wall backfill should be constructed and properly benched into bedrock. Therefore, before new fill is placed on the slope below the building pad, any soil on the slope should be shaved until bedrock is exposed.

The new compacted fill for this project will be used for support of grade slabs only. It is anticipated that, at the completion of the site grading work, materials will be exported from the site.

SITE SURFACE CONDITIONS

The project site consists of an trapezoid-shaped double lot located in the Chevy Chase neighborhood in the city of Glendale, Lot 1, Block 2 Tract No. 9327, also known as 3130 Charing Cross Road. There are two adjacent ascending slope lots part of this project; however, the north one is off-limits to development due to Southern California Edison right-of-way and overhead power lines.

There is a developed lot at 3120 Charing Cross Road to the south of the proposed new dwelling on Lot 1. There is also a developed lot to the east at 3235 Buckingham Road.

The southern lot is to be developed with a new multilevel building. We are in receipt of project plans from the project architect Domus Design as well as a topographic survey by M&G, which we have used as basis for our geologic map and cross section drawings.

REGIONAL GEOLOGY

The site is situated in the San Rafael Hills, east of the Verdugo Mountains, part of the Transverse Ranges Geomorphic Province of California. The local rock in this area consists of Cretaceous-age medium-grained crystalline granitic bedrock, known as quartz diorite based on its mineralogy (see Figure No. 3 – Regional Geologic Map).

The site is located approximately two miles north of the inferred location of the Eagle Rock Fault, which extends east-west along the southern foot of the San Rafael Hills (see Figure No. 3- Regional Geologic Map). This fault is an extension of the Verdugo fault, which, according to the Southern California Earthquake Center, is considered active, particularly the northwest portion near Sun Valley. However, neither the fault nor the site is located in an Alquist-Priolo Earthquake Fault zone.

GEOLOGIC AND SOIL CONDITIONS

Our geologic investigation consisted of the excavation, inspection, sampling and geologic logging of five test pits, a review of published geologic maps, and on-site and near-site geologic reconnaissance and mapping. This activity indicates that the area of the proposed new dwelling is underlain by some slough fill along the slopes; a thin veneer of native colluvial/residual soil; overlying granitic bedrock. A geologic map and site plan is provided in Drawing 1, and geologic cross-sections A and B in Drawing 2. Test pit logs are provided in Appendix I. A description of the units and their distribution are as follows:

Fill (Af): Minor surficial fill was noted in the test pits, ranging from 1 to 3 feet in thickness, with the thickest portion near the road, most likely associated with road fill. It consists of gravelly silty sand, loose to moderately compact.

Soil (Qc): Native residual and colluvial soil was encountered in the test pits along the slopes, and generally consists of silty gravelly sand, yellow-brown, with rock fragments, medium dense and moist. It is generally creep-prone, especially along the steeper portion of the site near the street.

Granitic Bedrock (qd): Local bedrock underlying the site consists of medium-grained crystalline quartz diorite. It was found to be weathered, competent, locally hard to very hard, tight, and dense. Regularly occurring joint or foliation patterns were not noted in the bedrock, which is generally free of through-going planes of weakness.

ENGINEERING-GEOLOGIC CONSIDERATIONS

Groundwater was not observed on the site; no seeps or springs were noted on-site, nor does the site have any surface streams passing through it.

The site has relatively shallow bedrock under ground surface throughout the building area. The site does not have gross slope stability issues, no landslides were mapped on this site.

From an engineering-geologic point of view, the proposed new dwelling project can proceed as planned, provided the new structures are founded in granitic bedrock to sufficient depth, and with proper drainage; surface water runoff on the site is controlled; and preventive slope maintenance is regularly performed.

PREVENTIVE SLOPE MAINTENANCE

For all slopes, it is important to reduce the risk of problems relating to slope instability. It is recommended that the owners implement a program of normal slope maintenance. This maintenance program should include annual clean out of drains, elimination of gophers and earth burrowing rodents, maintaining low water consumptive, fire retardant, deep rooted ground cover and proper irrigation.

Hillside properties are typically subject to potential geotechnical hazards including mudslides, spalling of slopes, erosion and concentrated flows. It must be emphasized that responsible maintenance of these slopes, and the property in general, by the owner, using proper methods, can reduce the risk of these hazards significantly.

SEISMIC DESIGN CONSIDERATIONS

In accordance with ASCE-7-16, the project site can be classified as site “C”. The mapped spectral accelerations of S_S=2.059 (short period) and S_1 =0.756 (1-second period) can be used for this project. These parameters corresponds to site Coefficients values of F_a =1.0 and F_V =1.4, respectively.

The seismic design parameters would be as follows:

Sms= Fa (Ss) = 1.0 (2.059) = 2.-59

Sm1=Fv (S1) = 1.4 (0.756) = 1.059

Sds=2/3 (Sms) = 4/5 (2.059) = 1.647, and

Sd1=2/3 (Sm1) = 2/3 (1.059) = 0.706

EVALUATION AND RECOMMENDATIONS

GENERAL

Based on the geotechnical engineering data derived during this investigation, it is believed that the proposed construction may be made as planned. It is anticipated that the planned excavation, in a form of terraces, will be made through minor amount of soil (fill and native) and granitic rock. Bedrock will be exposed at the finished grade. Such materials will provide very good support for the proposed residence and the associated retaining walls through spread footings and piles (where the high cuts are shored).

The resulting vertical cuts on the upslope side of the building pad will be supported by two, single cantilevered retaining walls (less than 5 feet and 12 feet) supporting cuts of minor soil and bedrock with ascending slopes. The upper most retaining wall supporting the ascending slope will have a freeboard of at least 2 feet and a concrete paved drain (swale) to divert surface water and collect normal erosion debris which will be cleaned after rainy seasons. All the other retaining walls will be incorporated into the proposed building and will be designed as restrained walls.
Because of lack of through-going planes of weakness within the rock, all walls for this project can be designed based on normal lateral earth pressures.

During the course of site grading work, temporary excavation will be made to create the proposed finished grades. Although adequate space is available to make unsupported/open excavation slopes, it may be desirable to use shoring for the high cuts. Use of shoring will have the following benefits;

1. Eliminate relatively large spread footings that are normally required for tall walls;
2. Eliminate over-excavation beyond the planned line of excavation; and
3. Eliminate subsequent backfilling within the over-excavation zone.

Where temporary shoring is used, the vertical elements can be incorporated into the new walls and will be part of the permanent structure. The lower portion of the piles below the finished grade will be used for support of the gravity loads of the building and walls through skin friction.

Unsupported/open excavation slopes can be used for all cuts where adequate horizontal spacing (a distance equal to the vertical height of excavation) beyond the planned line of excavation is available. The slopes of the unsupported/open excavation cuts should be made using the gradients as recommended in this report.

The results of our analysis indicated that the subject lot, with the planned grading work, will remain grossly stable with respect to deep-seated slope instability (having a factor of safety of greater than 1.5). See the enclosed engineering calculation sheets.

The soil cover on the upslope of the proposed residence was also found to have a factor of safety of greater than 1.5. Normal erosion, however, can still occur on all permanent slopes. The recommended 2-feet high freeboard is considered to be adequate to retain debris associated with erosion. The freeboard should be cleaned after rainy seasons. The freeboard portion should be designed based on an equivalent fluid pressure of 125 pounds per square foot per foot of depth.

For the purpose of the subject project, it is recommended that all permanent slopes be covered with erosion resistant vegetation. A landscape architect may be consulted for selection of proper ground cover for the subject site.

Grade slabs may be cast directly over bedrock, or properly compacted fill soils. Where grade slabs span between soil and bedrock, the bedrock should be over-excavated by some 12 inches and the excavated materials could be used for the compacted fill (compacted to at least 90 percent relative compaction at optimum moisture content). This will create uniform subgrade conditions beneath grade slabs and reduce the chances of uneven subgrade movements. Because of granular nature of the site materials, soil expansion will not be an issue of this site. The grade slabs for this project, however, should be at least 5 inches thick and be reinforced with # 3 bars placed at every 18 inches on center.

The following sections present our specific recommendations for temporary excavations, site grading, site drainage, foundations, lateral design, grade slabs, retaining walls, and observations during construction.

TEMPORARY EXCAVATION

Unshored Excavations: It is expected that temporary excavations will be made during the course of site grading work to create the proposed finished grades. The excavation will be made through minor amount of native soils and bedrock.

Based upon the engineering characteristics of the subsurface materials, it is our opinion that temporary excavation slopes through soil and massive granitic rock with no through-going plane of weakness may be made in accordance with the following table:

Maximum Depth of Cut (FT)	Maximum Slope Ratio (Horizontal:Vertical)	
	Soil	Bedrock
0-5	1/2:1	Vertical
5-10	1:1	Vertical
>10	1:1	1:1

It is recommended that the Engineering Geologist inspect the cut slopes within larger scale excavations as soon as five feet of bedrock is exposed in order to confirm the results of our findings. Modification to our recommendations may be necessary if variations are noted.

Water should not be allowed to flow over the top of the excavation in an uncontrolled manner. No surcharge should be allowed within a 45-degree line drawn from the bottom of the excavation. Excavation surfaces should be kept moist but not saturated to retard raveling and sloughing during construction.

It would be advantageous, particularly during wet season construction, to place polyethylene plastic sheeting over the slopes. This will reduce the chances of moisture changes within the soil banks and material wash into the excavation.

Cantilevered Soldier Piles: Cantilevered soldier piles can be used as a means of temporary shoring for tall cuts to eliminate large footings, over-excavation and subsequent backfilling. Soldier piles consist of structural steel beams encased in concrete (below the basement garage level) and slurry mix within the exposed depths of excavation.

For the purpose of this project, caisson type shoring piles with reinforcing cages can also be used. The caissons can be incorporated into the retaining walls and be part of the permanent structures. The lower portions of the shoring piles (below the base of the excavation) can be used to provide vertical support through skin friction.

The lateral resistance for cantilevered soldier piles may be assumed to be offered by available passive pressure below the basement level. An allowable passive pressure of 600 pounds per square foot per foot of depth may be used below the basement level for soldier piles having center-to-center spacing of at least 2-1/2 times the pile diameter. Maximum allowable passive pressure should be limited to 6,000 pounds per square foot. The maximum center-to-center spacing of the vertical shafts should be maintained no greater than 12 feet.

For design of temporary support, active pressure on the shoring piles may be computed using an equivalent fluid density of 25 pounds per cubic foot. Uniform surcharge may be computed using an active pressure coefficient of 0.30 times the uniform load.

When using cantilevered soldier piles for temporary shoring, the point of fixity (for the purpose of moment calculations), may be assumed to occur at some 12 inches below the base of the excavation. In order to limit local sloughing, it is recommended that lagging be used where soil is exposed between the soldier piles. All wood members left in ground should be pressure treated. For the purpose of design, lagging pressure should not exceed 400 pounds per square foot.

It should be noted that the recommendations presented in this section are for use in design and for cost estimating purposes prior to construction. The contractor is solely responsible for safety during construction.

GRADING RECOMMENDATIONS

Site grading work for this project will involve mainly cutting operations in order to create the proposed finished grades in a form of terraces. Some wall backfilling will also be made within the over-excavated areas. The excavated materials can be used for wall backfilling. Rocks should be broken down to acceptable pieces (less than 4 inches in diameter) for wall backfilling.

The new wall backfill should be constructed and properly benched into bedrock. Therefore, before new fill is placed on the slope below the building pad, any soil on the slope should be shaved until bedrock is exposed.

The new compacted fill for this project will be used for support of grade slabs only. It is anticipated that, at the completion of the site grading work, materials will be exported from the site.

Prior to placing any fill, the Soil Engineer and Engineering Geologist should observe the excavation bottoms. The areas to receive fill should be scarified and compacted in-place to a relative compaction of at least 90 percent at optimum moisture content.

General guidelines regarding site grading are presented below in an itemized form which may be included in the earthwork specification. It is recommended that all fill be placed under engineering observation and in accordance with the following guidelines:

1. All vegetation should be shaved and removed from the site before site grading work is initiated;

2. Subdrain should be installed behind all retaining walls. All subdrain should be observed and approved by this office before backfilling;

3. The subdrain pipes should be laid at a minimum grade of two percent for self cleaning.

4. The excavated materials from the site may be reused in the areas of new fill. Wall backfill, however, should consist of granular materials.

5. Rocks larger than 4 inches in diameter should be excluded from the areas of compacted fill.

6. Fill material, approved by the Soil Engineer, should be placed in controlled layers. Each layer should be compacted to at least 90 percent of the maximum unit weight as determined by ASTM designation D 1557 for the material used. All new fill should be benched into rock;

7. The fill material shall be placed in layers which, when compacted, shall not exceed 8 inches per layer. Each layer shall be spread evenly and shall be thoroughly mixed during the spreading to insure uniformity of material in each layer.

8. When moisture content of the fill material is too low to obtain adequate compaction, water shall be added and thoroughly dispersed until the moisture content is near optimum.

9. When the moisture content of the fill material is too high to obtain adequate compaction, the fill material shall be aerated by blading or other satisfactory methods until near optimum moisture condition is achieved.

10. Inspection and field density tests should be conducted by the Soil Engineer during grading work to assure that adequate compaction is attained. Where compaction of less than 90 percent is indicated, additional compactive effort should be made with adjustment of the moisture content or layer thickness, as necessary, until at least 90 percent compaction is obtained.

SITE DRAINAGE

Site drainage should be provided to divert roof and surface waters from the property through non-erodible drainage devices to the street. In no case should the surface waters be allowed to pond behind the walls or flow over the slope surfaces in an uncontrolled manner. A minimum surface slope of one and two percent should be maintained in paved and unpaved areas, respectively.

The site drainage recommendations should also include the following:

1. Having positive slope away from the buildings, as recommended above;
2. Installation of roof drains, area drains and catch basins with appropriate connecting lines;
3. Managing landscape watering;
4. Regular maintenance of the drainage devices;
5. Installing waterproofing or damp proofing, whichever appropriate, beneath concrete grade slabs and behind the basement walls.
6. The owners should be familiar with the general maintenance guidelines of the City requirements.

FOUNDATIONS

It is anticipated that, after the planned excavation is made, bedrock will be exposed at the finished grades. The bedrock is expected to provide very good support for the proposed residence and the associated retaining walls through conventional spread footing foundation system. Where shoring piles are used for the tall cuts, the vertical shafts can be used for gravity support of the structures/walls using skin friction.

The retaining wall footings should be at least 24 inches wide and should be established at least 24 inches into bedrock. The footings of the proposed residence should be at least 18 inches wide and should be established at least 18 inches into bedrock.

It should be noted that the above recommended foundation dimensions are the minimum required. The actual foundation dimensions may be greater depending upon the magnitude of the imposed loads.

Properly designed and constructed spread footings established in bedrock may be based on allowable maximum bearing pressure of 4,800 pounds per square foot.

For the purpose of estimating vertical capacity of individual piles, an allowable maximum skin friction value of 750 pounds per square foot may be used for the top 10 feet of the bedrock. The allowable maximum skin friction value can be increased to 950 pounds per square foot for the portion of piles extended deeper than 10 feet into bedrock. Uplift capacity may be assumed one half of the downward capacity.

The above given allowable maximum bearing and skin friction values are for the total of dead, plus frequently applied live loads. For short duration transient loading; wind or seismic forces, the given value may be increased by one third.

For friction pile design, the weight of the shafts can be assumed to be taken by end-bearing, therefore, need not be added to the structural loads. All piles should be concreted as soon as they are excavated and, for safety, should not be left open overnight.

During the course of our field investigation, no caving was experienced in the test holes. On this basis, caving is expected not to occur within drilled holes. If the foundations are excavated with hand tools, proper shoring should be implemented for workmen safety where soil is exposed.

Total and differential settlements of the proposed residence and the associated retaining walls (with foundations established in rock) are expected to be within tolerable limits; less than 3/8 and 1/4 of one inch, respectively. The major portion of the settlements are expected to occur during construction.

LATERAL DESIGN

Lateral resistance at the base of footings in contact with bedrock may be assumed to be the product of the dead load forces and a coefficient of friction of 0.4. Passive pressure on the face of footings or developed against the vertical shafts, may also be used to resist lateral forces. For the purpose of the subject project, a passive pressure of 300 pounds per square foot at the surface of bedrock and increasing at a rate of 300 pounds per square foot per foot of depth to a maximum value of 3,500 pounds per square foot may be used.

It should be noted that, if the individual shafts are spaced at least 2.5 times the pile diameters (isolated shafts) the above given values can be doubled. For the purpose of moment calculations, the point of fixity of the vertical shafts on slope may be taken some 12 inches below the surface of the bedrock.

GRADE SLABS

Grade slabs may be cast directly over bedrock, or properly compacted fill soils. Where grade slabs span between soil and bedrock, the bedrock should be over-excavated by some 12 inches and the excavated materials could be used for the compacted fill (compacted to at least 90 percent relative compaction at optimum moisture content). This will create uniform subgrade conditions beneath grade slabs and reduce the chances of uneven subgrade movements. Because of granular nature of the site materials, soil expansion will not be an issue of this site. The grade slabs for this project, however, should be at least 5 inches thick and be reinforced with # 3 bars placed at every 18 inches on center.

In the areas where moisture sensitive floor covering is used and slab dampness cannot be tolerated, a vapor-barrier should be used beneath the slabs. This normally consists of a 6-mil polyethylene film covered with 2 inches of clean sand.

RETAINING WALLS

As part of the site grading work, retaining walls will be constructed. Such walls are expected to be designed as restrained and cantilevered outside the building. Maximum height of the restrained walls are expected to be on the order of 18 feet.

The vertical heights of the cantilevered retaining walls are expected to range from about 5 feet to 12 feet. Therefore, single walls will be used or this project.

Static design of cantilevered retaining walls supporting cuts of may be based on an equivalent fluid pressure of 30 pounds per square foot per foot of depth. The retaining walls that are restrained against rotation at top should be based on an equivalent fluid pressure of 47 pounds per square foot per foot of depth. See the enclosed supporting engineering calculations.

The cantilevered retaining walls supporting ascending slope should be designed based on an equivalent fluid pressure of 45 pounds per square foot per foot of depth. The freeboard section of the cantilevered retaining wall should be designed based on an equivalent fluid density of 125 pounds per cubic foot.

It is noted that, based on the new Code requirement, the basement walls should be designed not only for static, but also for seismic lateral earth pressures. For the purpose of this project, the magnitude of seismic lateral earth pressure should be maximum at the ground surface and decrease at a rate of 32 pounds per square foot per foot of depth to a value of zero at the base of the retaining wall (see the enclosed supporting engineering calculations). The point of application of the lateral thrust of the seismic pressure should be assumed 0.6 time the wall height, measured from the bottom of the wall.

The above given pressures, assume that hydrostatic pressure will be relieved from the back of the retaining walls through a properly designed and constructed backdrain system. The backdrain system should consist of 4-inch diameter perforated pipes encased in free draining gravel; at least one cubic foot per lineal foot of the pipe.

The retaining walls supporting all ascending slope should have a minimum freeboard of 2 feet and a paved drain to collect minor debris washed down during rainy season. The freeboard should then be cleaned after rainy seasons.

OBSERVATION DURING CONSTRUCTION

The presented recommendations in this report assume that all structural foundations (footings and piles) will be established in bedrock. All foundation excavations should be observed and approved by a representative of this office, before the reinforcing is placed. It is essential to assure that all excavations are made at proper dimensions, are established in the recommended bearing material and are free of loose and disturbed soils. All shoring piles should be inspected by a Grading Deputy.

The project engineering geologist should observe the temporary cut slopes. Modification to our recommendations may be necessary if significant variations are noted in the geologic features of the underlying bedrock.

Site grading work should be made under continuous observation and testing by a representative of this firm. For proper scheduling, please notify this office at least 24 hours before any inspection work is required.

CLOSURE

The findings and recommendations presented in this report were based on the results of our field and laboratory investigations combined with professional engineering experience and judgment. The report was prepared in accordance with generally accepted engineering principles and practice. We make no other warranty, either express or implied.

It is noted that the conclusions and recommendations presented are based on exploration "window" borings and excavations which is in conformance with accepted engineering practice. Some variations of subsurface conditions are common between "windows" and major variations are possible.

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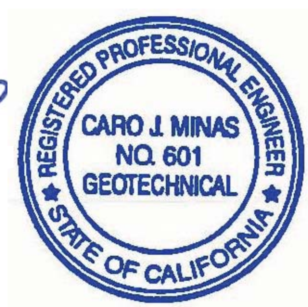
The following Plates and Appendices are attached and complete this report:

Engineering Calculation Sheets
Drawing No. 1 - Geologic Map & Site Plan
Drawing Nos. 2 and 3 - Geologic Cross Sections A-A' and B-B '
Figure No. 1 - Site Vicinity Map
Figure No. 2 - Regional Topographic Map
Figure No. 3 - Regional Geologic Map
Appendix I Method of Field Exploration
Figure Nos. I-1 through I-6
Appendix II Methods of Laboratory Testing
Figure Nos. II-1 and II-2

Respectfully Submitted,
APPLIED EARTH SCIENCES

Caro J. Minas, President
Geotechnical Engineer
GE 601



Shant Minas
Engineering Geologist
EG 2607

CJM/SM/se

Distribution: (3)

Bedrock Strength Parameters

Saturated Unit Weight = γs = 121 pcf

Value of Fiction Angle = ϕ = 38 ^{o}

$$K_o = 1 - \sin(\phi)$$
$$K_o = 1 - \sin 38^o$$
$$K_o = 1 - 0.62$$
$$K_o = 0.38$$

$$\gamma_o = K_o * \gamma$$
$$\gamma_o = 0.38 * 121$$
$$\gamma_o = 46.5$$

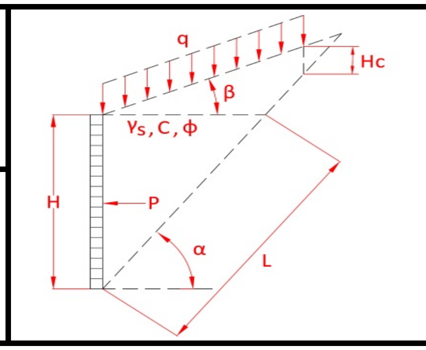
At-Rest Equivalent Fluid Density, $\boxed{\gamma_o = 47 \text{ PCF}}$

AT-REST LATERAL EARTH PRESSURE

Basement Walls

FOR: 3130 Charing Cross Road,	**DATE:** 9/10/19	**PROJECT NO.:** 19-523-22
APPLIED EARTH SCIENCES GEOTECHNICAL . GEOLOGY . ENVIRONMENTAL ENGINEERING CONSULTANTS		**CALC SHEET No. 1**

Bedrock Strength	Unit Weight	γ_s	121	PCF
	Cohesion	C	610	PSF
	Friction Angle	φ	38	º
	Estimated Failure Surface Angle	α	64	º
Retaining Wall Parameters	Height of Wall	H	12	ft.
	Average Inclination of Ground Surface Above Wall	β	25	º
	Assumed Surcharge Load	q	300	PSF



Moblized Strength	Factor of Safety	F.S.	**1.25**	**1.5**	
	Mobilized Cohesion	$C_m = c/F.S.$	488	406.67	PSF
	Mobilized Friction Angle	$\varphi_m = \tan^{-1}(\tan\varphi/F.S.)$	32	28	º
Tension Crack	Coefficient of Lateral Earth Active Pressure	$K_a = \tan^2(45^o-(\varphi_m/2))$	0.31	0.37	
	Height of Tension Crack	$H_c=(2C_m)/[(\gamma_s)(K_a^{0.5})]$	14.6	11.1	ft.

For F.S = 1.25 (Temporary Conditions)	Failure Surface Angle (α > β)	α	59	64	69	º
	Length of Potential Sliding Surface Across Wedge	$L = \dfrac{(H - H_C)\cos\beta}{\sin(\alpha-\beta)}$	-4.14	-3.68	-3.33	ft.
	Weight of Soil in Wedge Above Potential Sliding Area	$W = 0.5\gamma_S\left[HL + \dfrac{H_C(H-H_C)\cos\beta}{\sin(\alpha-\beta)}\right] * \cos\alpha$	-3424	-2590	-1918	lb.
	Additional Lateral Load	$E= (K_a qL\cos\alpha)/(\cos\beta)$	-178.0	-134.6	-99.7	lb.
	Resultant Horizontal Force	$P= (W-c_m L\sin\alpha)(\tan(\alpha-\Phi_m))- c_m L\cos\alpha+E$	-0.3	41.8	181.4	lb.
	Equivalent Fluid Density	$G_h=2P/H^2$	*0.0*	*0.6*	*2.5*	PCF
For F.S = 1.5 (Permanent Conditions)	Failure Surface Angle (α > β)	α	59	64	69	º
	Length of Potential Sliding Surface Across Wedge	$L = \dfrac{(H - H_C)\cos\beta}{\sin(\alpha-\beta)}$	1.49	1.32	1.20	ft.
	Weight of Soil in Wedge Above Potential Sliding Area	$W = 0.5\gamma_S\left[HL + \dfrac{H_C(H-H_C)\cos\beta}{\sin(\alpha-\beta)}\right] * \cos\alpha$	1072	811	601	lb.
	Additional Lateral Load	$E= (K_a qL\cos\alpha)/(\cos\beta)$	76.8	58.1	43.0	lb.
	Resultant Horizontal Force	$P= (W-c_m L\sin\alpha)(\tan(\alpha-\Phi_m))- c_m L\cos\alpha+E$	103.0	63.6	-3.7	lb.
	Equivalent Fluid Density	$G_h=2P/H^2$	*1.4*	*0.9*	*-0.1*	PCF

EFD	For Temporary Wall Design, Use Equivalent Fluid Density	G_h=	25	PCF
	For Permanent Wall Design, Use Equivalent Fluid Density	G_h=	30	PCF

LATERAL EARTH PRESSURE CALCULATIONS

SECTION A-A' - NORTH FACING RETAINING WALLS

FOR: 3130 Charing Cross Road, | **DATE:** 9/10/19 | **PROJECT NO.:** 19-523-22

APPLIED EARTH SCIENCES
GEOTECHNICAL . GEOLOGY . ENVIRONMENTAL ENGINEERING CONSULTANTS

CALC SHEET No. 2

Average Soil Strength Parameters

* FIGURE 2 of Naval Facilities Engineering Command

Saturated Unit Weight ϒ= 121 PCF

Height of Wall H= 22 Ft.

PGA_M= 1.067

$$P_{AE} = \frac{3}{8}\gamma H^2(K_h) \qquad \text{*7.2-78}$$

$$K_h = \frac{\frac{2}{3} * PGA_M}{2}$$

K_h= 2/3 * 1.067 / 2

K_h= 0.36

P_{AE} = 3/8 * 121 * 484 * 0.36

P_{AE} = 7811 lb.

Equivelent Fliud Pressure (EFP)

$$EFP = (\frac{2xP_{AE}}{H^2})$$

EFP= 2 * 7811 / 484

EFP= **32.28** **PCF**

SEISMIC LATERAL EARTH PRESSURE

Retaining Walls

FOR: 3130 Charing Cross Road,	**DATE:** 9/10/19	**PROJECT NO.:** 19-523-22
APPLIED EARTH SCIENCES GEOTECHNICAL . GEOLOGY . ENVIRONMENTAL ENGINEERING CONSULTANTS		**CALC SHEET NO. 3**

FILL STRENGTHS

Saturated Unit Weight	γ_s	126	pcf
Cohesion	C	200	psf
Friction Angle	ϕ	32	o
Slope Angle	α	25	o
Depth of Soil	d	3	ft
Unit Weight of Water	γ_w	62.4	pcf

$$F.S. = \frac{[C + (\gamma_S - \gamma_W) * d * cos^2\alpha * \tan\varphi]}{\gamma_S * d * sin\alpha * cos\alpha}$$

F.S. = 200 + 97.93 / 144.78

F.S. = 2.06 > 1.5 **O.K.**

SURFICIAL SLOPE STABILITY CALCULATIONS

FOR: 3130 Charing Cross Road	**DATE:** 9/10/19	**PROJECT NO.:** 19-523-22

APPLIED EARTH SCIENCES
GEOTECHNICAL . GEOLOGY . ENVIRONMENTAL ENGINEERING CONSULTANTS

CALC SHEET No. 4

Average Soil Strength Parameters

Saturated Unit Weight γ = 121 pcf

C = 610 psf

ϕ = 38 °

Height of Wall

H= 22 ft

Weight of Surcharge Load on Wedge

W_q= 0.3 K

					Driving Force	*Resisting Force*	
SECTION	**A (sf)**	**W (K)**	**L (feet)**	**α (degrees)**	**Wsinαcosα (k)**	**Wcos²αtanϕ (k)**	**CLcosα (k)**
I	118.0	14.3	24.48	64	5.7	2.2	6.5
					5.7	8.7	

F.S. = ∑ RF / ∑ DF = 8.73 / 5.75 = 1.52

FOR FACTOR OF SAFETY = 1.25 (TEMPORARY)

1.25 (DF) = (RF) + UBF

1.25 * 5.75 = 8.73 + UBF

UBF = 7.18 - 8.73 = -1.55 k/lft.

Equivalent Fluid Density $G_h = 2P/H^2$

G_h = -6.4 pcf

Therefore use Recommended value of 25 pcf

FOR FACTOR OF SAFETY = 1.5 (PERMANENT)

1.5 (DF) = (RF) + UBF

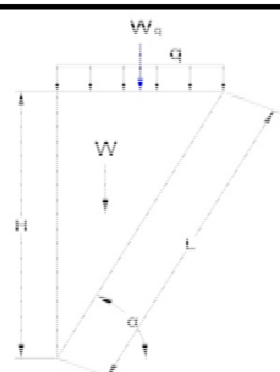
1.5 * 5.75 = 8.73 + UBF

UBF = 8.62 - 8.73 = -0.12 k/lft.

Equivalent Fluid Density $G_h = 2P/H^2$

G_h = -0.5 pcf

Therefore use Recommended value of 30 pcf



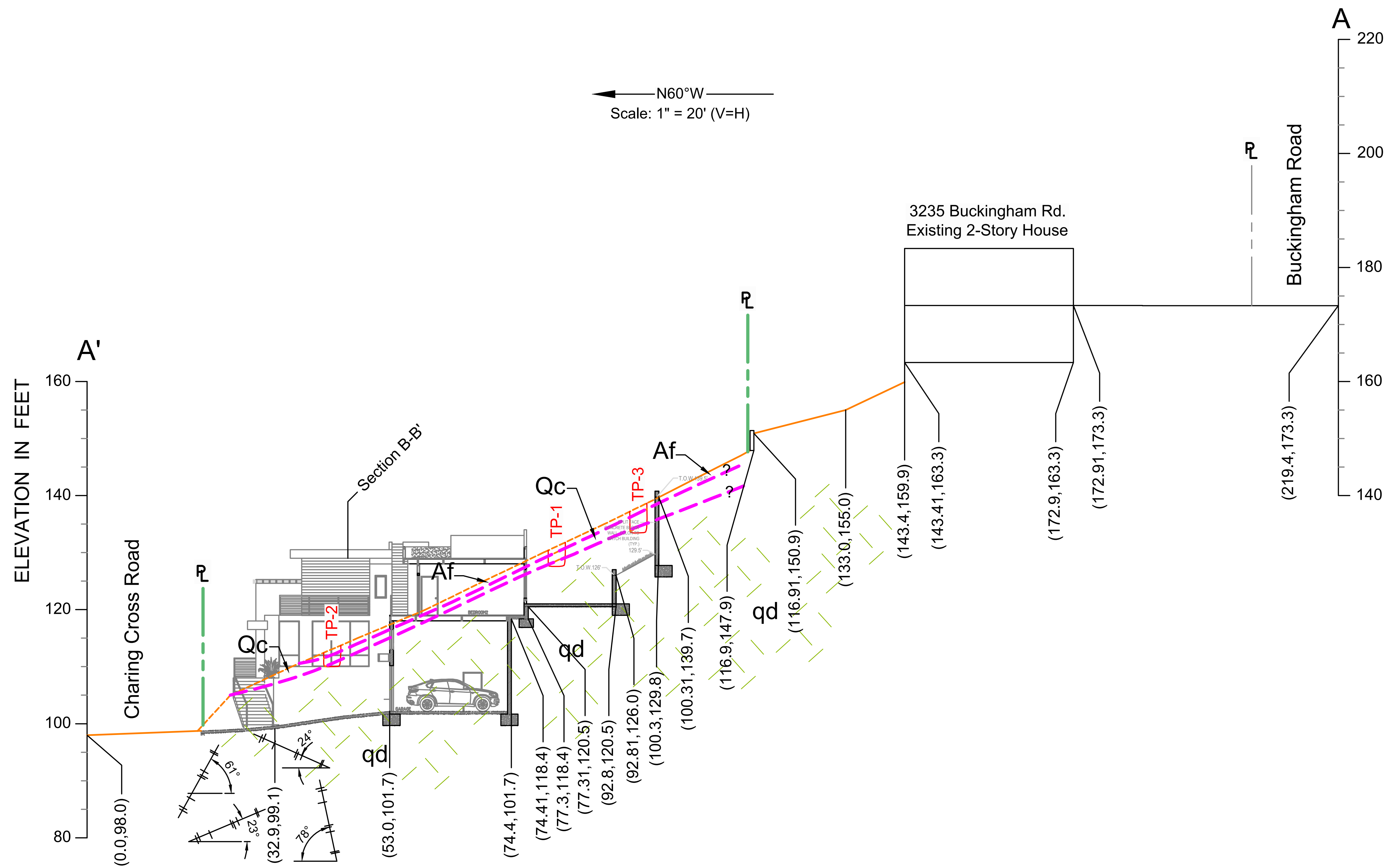
LATERAL EARTH PRESSURE CALCULATIONS
CANTILEVERED SYSTEM

SECTION A-A' - North Facing Basement Walls

FOR: 3130 Charing Cross Road,	**DATE:** 9/10/19	**PROJECT NO.:** 19-523-22

APPLIED EARTH SCIENCES
GEOTECHNICAL . GEOLOGY . ENVIRONMENTAL ENGINEERING CONSULTANTS

TABLE No. 1



LEGEND:

Af = Artificial Fill

Qc = Colluvium (Native Soil)

qd = Granitic Bedrock

TP-5 = Location & Number of Test Pit

= Geological Contact Approximately Located

= Joint Set

SLOPE STABILITY ANALYSIS SECTION A-A'

DESCRIPTION:	Proposed New Single Family Residence	PROJECT No:	19-523-22
FOR:	Mr. Sam Nazaryan	DATE:	09 / 20 / 2019
		DRAWN BY:	VM
ADDRESS:	3130 Charing Cross Road, Glendale, CA 91206	CHECKED BY:	SM
		SHEET No:	1

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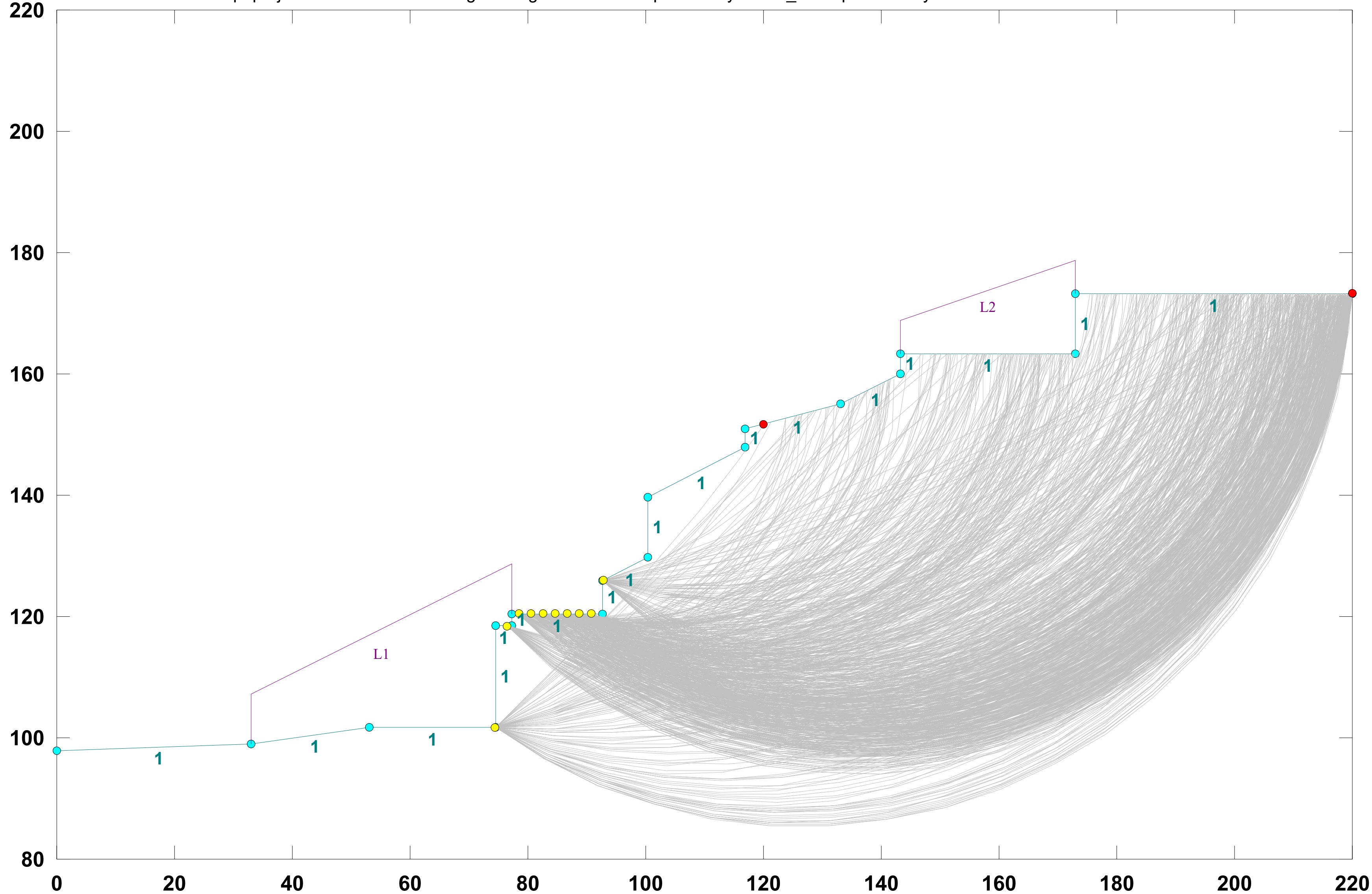
19-523-22_SecAA 3130 Charing Cross Rd_Static

p:\projects-2019\19-523-22\engineering-calculation\slope stability\secaa_static.plt   Run By: Sevada   9/10/2019   04:29PM



19-523-22_SecAA 3130 Charing Cross Rd_Static

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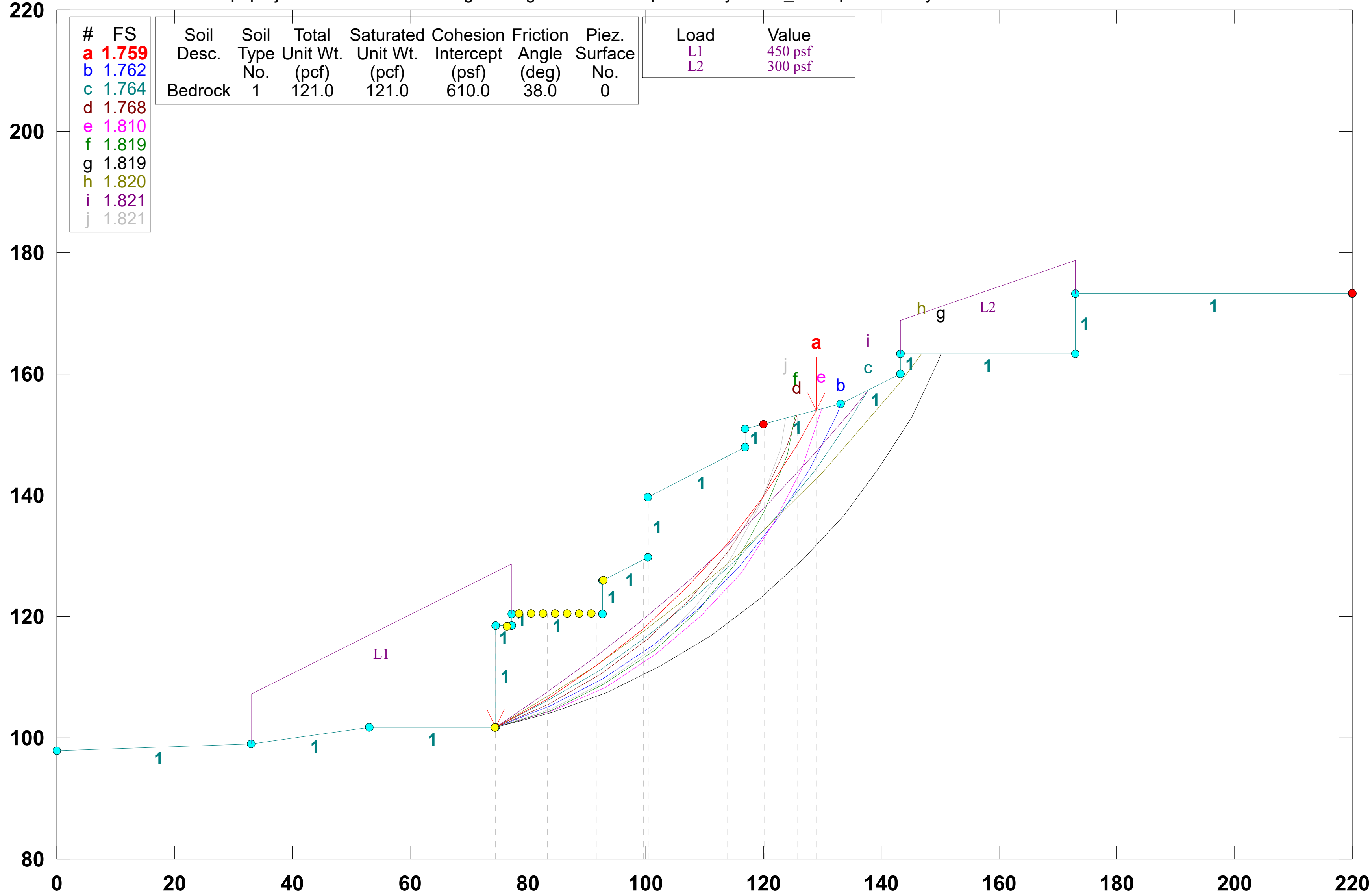

GSTABL7 v.2 FSmin=1.759

Safety Factors Are Calculated By The Modified Bishop Method

***** GSTABL7 *****

** GSTABL7 by Dr. Garry H. Gregory, Ph.D.,P.E.,D.GE **
** Original Version 1.0, January 1996; Current Ver. 2.005.2, Jan. 2011 **
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****
SLOPE STABILITY ANALYSIS SYSTEM
Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
****

Analysis Run Date: 9/10/2019
Time of Run: 04:29PM
Run By: Sevada
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bility\secaa_static.PLT
PROBLEM DESCRIPTION: 19-523-22_SecAA
3130 Charing Cross Rd_Static

BOUNDARY COORDINATES
18 Top Boundaries
18 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	98.00	32.90	99.10	1
2	32.90	99.10	53.00	101.70	1
3	53.00	101.70	74.40	101.70	1
4	74.40	101.70	74.41	118.40	1
5	74.41	118.40	77.30	118.40	1
6	77.30	118.40	77.31	120.50	1
7	77.31	120.50	92.80	120.50	1
8	92.80	120.50	92.81	126.00	1
9	92.81	126.00	100.30	129.80	1
10	100.30	129.80	100.31	139.70	1
11	100.31	139.70	116.90	147.90	1
12	116.90	147.90	116.91	150.90	1
13	116.91	150.90	133.00	155.00	1
14	133.00	155.00	143.40	159.90	1
15	143.40	159.90	143.41	163.30	1
16	143.41	163.30	172.90	163.30	1
17	172.90	163.30	172.91	173.30	1
18	172.91	173.30	220.00	173.30	1

User Specified Y-Origin = 80.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
1 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	121.0	121.0	610.0	38.0	0.00	0.0	0

BOUNDARY LOAD(S)
2 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	32.90	77.31	450.0	0.0
2	143.41	172.91	300.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed
Force Acting On A Horizontally Projected Surface.
A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.
1000 Trial Surfaces Have Been Generated.
100 Surface(s) Initiate(s) From Each Of 10 Points Equally Spaced
Along The Ground Surface Between X = 74.40(ft)

```
                              and  X =  92.81(ft)
Each Surface Terminates Between   X = 120.00(ft)
                              and   X = 220.00(ft)
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is  Y =      0.00(ft)
10.00(ft) Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial
      Failure Surfaces Evaluated. They Are
      Ordered - Most Critical First.
      * * Safety Factors Are Calculated By The Modified Bishop Method * *
      Total Number of Trial Surfaces Attempted =  1000
      Number of Trial Surfaces With Valid FS = 1000
      Statistical Data On All Valid FS Values:
         FS Max =   5.315   FS Min =   1.759   FS Ave =   3.641
         Standard Deviation =    0.782   Coefficient of Variation =   21.47 %
      Failure Surface Specified By  9 Coordinate Points
        Point      X-Surf      Y-Surf
         No.        (ft)        (ft)
          1         74.400      101.700
          2         83.195      106.459
          3         91.582      111.906
          4         99.506      118.005
          5        106.918      124.717
          6        113.771      132.001
          7        120.019      139.808
          8        125.624      148.089
          9        128.952      153.968
      Circle Center At X =    19.314 ; Y =   214.003 ; and Radius =   125.086
             Factor of Safety
            ***    1.759   ***
           Individual data on the    17  slices
                     Water  Water     Tie      Tie     Earthquake
                     Force  Force    Force    Force       Force   Surcharge
Slice  Width   Weight   Top    Bot     Norm     Tan     Hor      Ver    Load
 No.    (ft)    (lbs)  (lbs)  (lbs)    (lbs)   (lbs)   (lbs)   (lbs)   (lbs)
  1      0.0      10.1    0.0     0.0       0.      0.     0.0     0.0      4.5
  2      2.9    5564.5    0.0     0.0       0.      0.     0.0     0.0   1300.5
  3      0.0      19.6    0.0     0.0       0.      0.     0.0     0.0      4.5
  4      5.9   11131.9    0.0     0.0       0.      0.     0.0     0.0      0.0
  5      8.4   11484.8    0.0     0.0       0.      0.     0.0     0.0      0.0
  6      1.2    1198.0    0.0     0.0       0.      0.     0.0     0.0      0.0
  7      0.0      12.6    0.0     0.0       0.      0.     0.0     0.0      0.0
  8      6.7    9942.3    0.0     0.0       0.      0.     0.0     0.0      0.0
  9      0.8    1079.0    0.0     0.0       0.      0.     0.0     0.0      0.0
 10      0.0      19.4    0.0     0.0       0.      0.     0.0     0.0      0.0
 11      6.6   15679.2    0.0     0.0       0.      0.     0.0     0.0      0.0
 12      6.9   13515.5    0.0     0.0       0.      0.     0.0     0.0      0.0
 13      3.1    4987.1    0.0     0.0       0.      0.     0.0     0.0      0.0
 14      0.0      16.3    0.0     0.0       0.      0.     0.0     0.0      0.0
 15      3.1    5053.2    0.0     0.0       0.      0.     0.0     0.0      0.0
 16      5.6    5736.1    0.0     0.0       0.      0.     0.0     0.0      0.0
 17      3.3    1012.8    0.0     0.0       0.      0.     0.0     0.0      0.0
      Failure Surface Specified By 10 Coordinate Points
        Point      X-Surf      Y-Surf
         No.        (ft)        (ft)
          1         74.400      101.700
          2         83.760      105.221
          3         92.699      109.702
          4        101.120      115.096
          5        108.929      121.342
          6        116.041      128.372
          7        122.377      136.109
          8        127.868      144.466
          9        132.453      153.353
         10        133.116      155.055
      Circle Center At X =    45.781 ; Y =   192.179 ; and Radius =    94.897
             Factor of Safety
            ***    1.762   ***
      Failure Surface Specified By 10 Coordinate Points
        Point      X-Surf      Y-Surf
```

No.	(ft)	(ft)
1	74.400	101.700
2	83.370	106.121
3	92.013	111.149
4	100.290	116.761
5	108.161	122.930
6	115.588	129.626
7	122.536	136.818
8	128.972	144.471
9	134.866	152.550
10	137.841	157.281

Circle Center At X = 15.276 ; Y = 233.182 ; and Radius = 144.163

Factor of Safety

*** 1.764 ***

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	74.400	101.700
2	83.637	105.532
3	92.347	110.443
4	100.406	116.364
5	107.697	123.209
6	114.113	130.879
7	119.564	139.262
8	123.970	148.240
9	125.680	153.135

Circle Center At X = 47.186 ; Y = 180.355 ; and Radius = 83.229

Factor of Safety

*** 1.768 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	74.400	101.700
2	84.018	104.438
3	93.173	108.461
4	101.695	113.694
5	109.424	120.039
6	116.217	127.377
7	121.947	135.573
8	126.507	144.473
9	129.812	153.911
10	129.872	154.203

Circle Center At X = 59.234 ; Y = 173.279 ; and Radius = 73.168

Factor of Safety

*** 1.810 ***

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	74.400	101.700
2	83.990	104.533
3	93.050	108.766
4	101.376	114.305
5	108.780	121.026
6	115.098	128.778
7	120.187	137.386
8	123.933	146.658
9	125.464	153.080

Circle Center At X = 60.339 ; Y = 166.958 ; and Radius = 66.756

Factor of Safety

*** 1.819 ***

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	74.400	101.700
2	84.083	104.199
3	93.489	107.593
4	102.537	111.852
5	111.146	116.940
6	119.241	122.811
7	126.751	129.414

```
        8        133.610      136.690
        9        139.758      144.577
       10        145.141      153.005
       11        149.711      161.900
       12        150.272      163.300
   Circle Center At X =    52.720 ; Y =   205.928 ; and Radius =   106.459
          Factor of Safety
         ***    1.819   ***
   Failure Surface Specified By 11 Coordinate Points
     Point      X-Surf      Y-Surf
      No.        (ft)        (ft)
        1         74.400      101.700
        2         83.068      106.686
        3         91.517      112.036
        4         99.731      117.739
        5        107.696      123.786
        6        115.397      130.165
        7        122.820      136.865
        8        129.953      143.874
        9        136.781      151.180
       10        143.293      158.769
       11        146.859      163.300
   Circle Center At X =   -38.704 ; Y =   308.356 ; and Radius =   235.583
          Factor of Safety
         ***    1.820   ***
   Failure Surface Specified By 10 Coordinate Points
     Point      X-Surf      Y-Surf
      No.        (ft)        (ft)
        1         74.400      101.700
        2         82.779      107.158
        3         90.944      112.932
        4         98.883      119.012
        5        106.585      125.390
        6        114.038      132.057
        7        121.232      139.003
        8        128.157      146.218
        9        134.801      153.691
       10        137.701      157.215
   Circle Center At X =   -63.636 ; Y =   322.942 ; and Radius =   260.771
          Factor of Safety
         ***    1.821   ***
   Failure Surface Specified By  9 Coordinate Points
     Point      X-Surf      Y-Surf
      No.        (ft)        (ft)
        1         74.400      101.700
        2         83.955      104.651
        3         92.947      109.027
        4        101.164      114.725
        5        108.414      121.612
        6        114.527      129.527
        7        119.358      138.282
        8        122.795      147.673
        9        123.791      152.653
   Circle Center At X =    59.982 ; Y =   165.336 ; and Radius =    65.249
          Factor of Safety
         ***    1.821   ***
             **** END OF GSTABL7 OUTPUT ****
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19-523-22_SecAA 3130 Charing Cross Rd_Seismic

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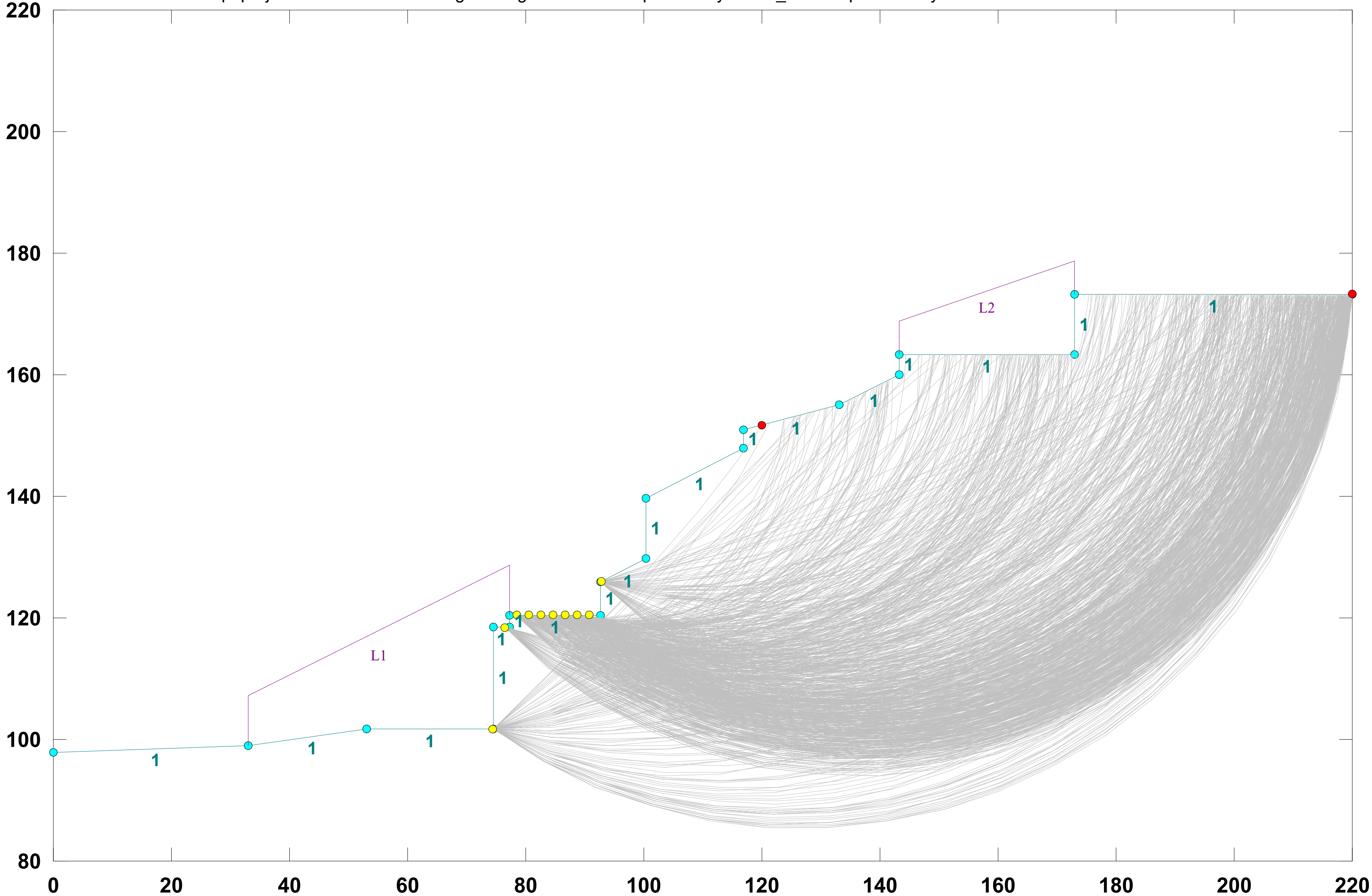

19-523-22_SecAA 3130 Charing Cross Rd_Seismic

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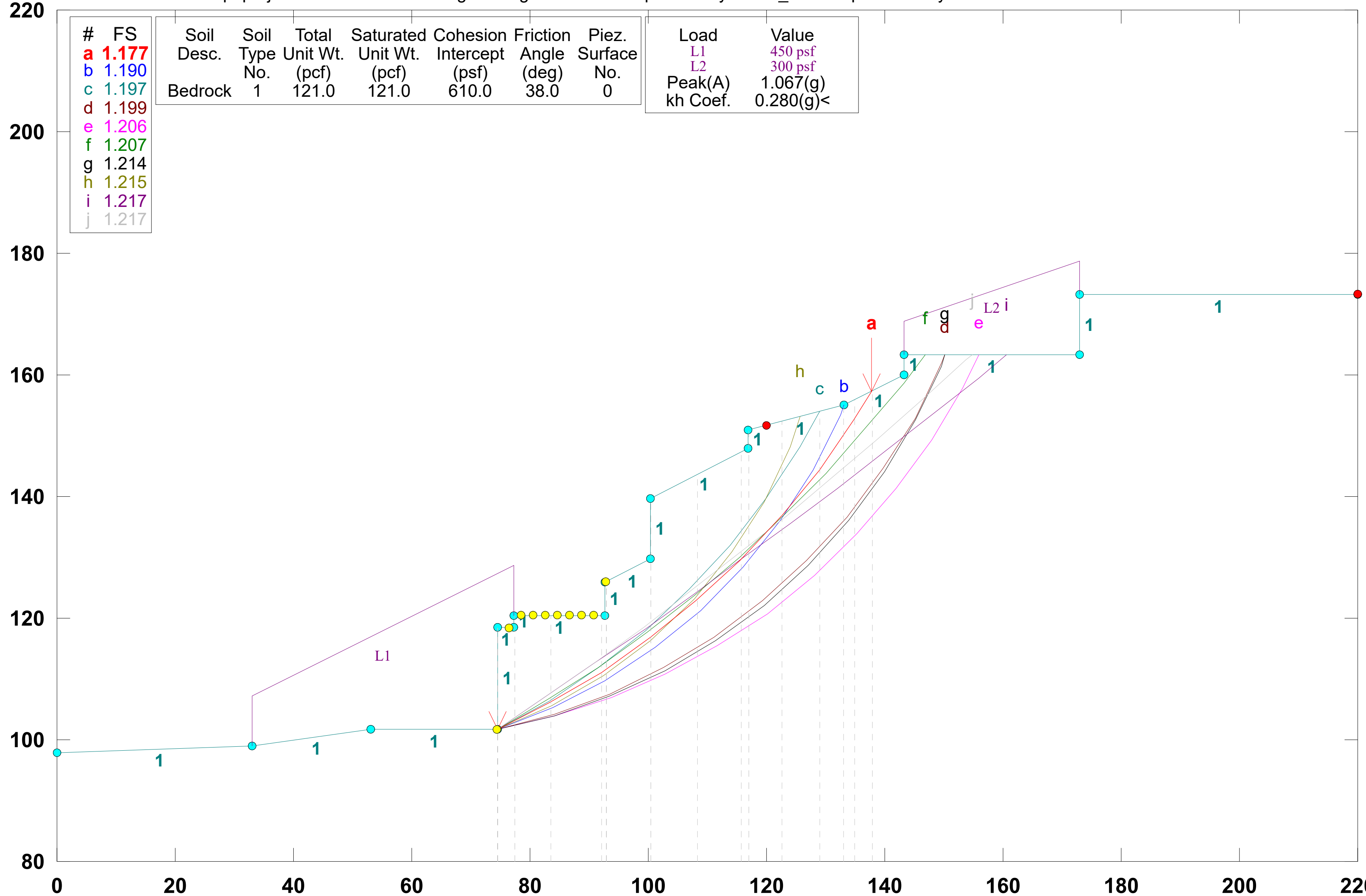

GSTABL7 v.2 FSmin=1.177

Safety Factors Are Calculated By The Modified Bishop Method

```
                         ***  GSTABL7  ***
              ** GSTABL7 by Dr. Garry H. Gregory, Ph.D.,P.E.,D.GE **
    ** Original Version 1.0, January 1996; Current Ver. 2.005.2, Jan. 2011 **
                (All Rights Reserved-Unauthorized Use Prohibited)
    *********************************************************************************
                        SLOPE STABILITY ANALYSIS SYSTEM
           Modified Bishop, Simplified Janbu, or GLE Method of Slices.
           (Includes Spencer & Morgenstern-Price Type Analysis)
           Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
           Nonlinear Undrained Shear Strength, Curved Phi Envelope,
           Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
           Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
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    PROBLEM DESCRIPTION:  19-523-22_SecAA
                          3130 Charing Cross Rd_Seismic
    BOUNDARY COORDINATES
       18 Top   Boundaries
```

18 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	98.00	32.90	99.10	1
2	32.90	99.10	53.00	101.70	1
3	53.00	101.70	74.40	101.70	1
4	74.40	101.70	74.41	118.40	1
5	74.41	118.40	77.30	118.40	1
6	77.30	118.40	77.31	120.50	1
7	77.31	120.50	92.80	120.50	1
8	92.80	120.50	92.81	126.00	1
9	92.81	126.00	100.30	129.80	1
10	100.30	129.80	100.31	139.70	1
11	100.31	139.70	116.90	147.90	1
12	116.90	147.90	116.91	150.90	1
13	116.91	150.90	133.00	155.00	1
14	133.00	155.00	143.40	159.90	1
15	143.40	159.90	143.41	163.30	1
16	143.41	163.30	172.90	163.30	1
17	172.90	163.30	172.91	173.30	1
18	172.91	173.30	220.00	173.30	1

User Specified Y-Origin = 80.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

1 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	121.0	121.0	610.0	38.0	0.00	0.0	0

BOUNDARY LOAD(S)

2 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	32.90	77.31	450.0	0.0
2	143.41	172.91	300.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.
Specified Peak Ground Acceleration Coefficient (A) = 1.067(g)
Specified Horizontal Earthquake Coefficient (kh) = 0.280(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)
Specified Seismic Pore-Pressure Factor = 0.000
A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.
1000 Trial Surfaces Have Been Generated.
100 Surface(s) Initiate(s) From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 74.40(ft) and X = 92.81(ft)
Each Surface Terminates Between X = 120.00(ft) and X = 220.00(ft)
Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 0.00(ft)
10.00(ft) Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Evaluated. They Are Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Total Number of Trial Surfaces Attempted = 1000
Number of Trial Surfaces With Valid FS = 1000
Statistical Data On All Valid FS Values:
FS Max = 2.888 FS Min = 1.177 FS Ave = 2.156
Standard Deviation = 0.384 Coefficient of Variation = 17.82 %
Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	74.400	101.700
2	83.370	106.121
3	92.013	111.149
4	100.290	116.761
5	108.161	122.930

```
             6        115.588      129.626
             7        122.536      136.818
             8        128.972      144.471
             9        134.866      152.550
            10        137.841      157.281
        Circle Center At X =    15.276 ; Y =   233.182 ; and Radius =   144.163
               Factor of Safety
              ***    1.177   ***
             Individual data on the    19  slices
                       Water  Water     Tie     Tie     Earthquake
                       Force  Force    Force   Force       Force   Surcharge
Slice  Width   Weight   Top    Bot     Norm     Tan     Hor     Ver    Load
 No.    (ft)    (lbs)  (lbs)  (lbs)    (lbs)   (lbs)   (lbs)   (lbs)   (lbs)
  1     0.0      10.1    0.0    0.0       0.      0.     2.8     0.0      4.5
  2     2.9    5589.0    0.0    0.0       0.      0.  1564.9     0.0   1300.5
  3     0.0      19.8    0.0    0.0       0.      0.     5.5     0.0      4.5
  4     6.1   11637.9    0.0    0.0       0.      0.  3258.6     0.0      0.0
  5     8.6   12409.5    0.0    0.0       0.      0.  3474.7     0.0      0.0
  6     0.8     864.5    0.0    0.0       0.      0.   242.1     0.0      0.0
  7     0.0      14.0    0.0    0.0       0.      0.     3.9     0.0      0.0
  8     7.5   12375.2    0.0    0.0       0.      0.  3465.1     0.0      0.0
  9     0.0      15.1    0.0    0.0       0.      0.     4.2     0.0      0.0
 10     0.0      21.8    0.0    0.0       0.      0.     6.1     0.0      0.0
 11     7.9   20697.3    0.0    0.0       0.      0.  5795.3     0.0      0.0
 12     7.4   17198.9    0.0    0.0       0.      0.  4815.7     0.0      0.0
 13     1.3    2741.5    0.0    0.0       0.      0.   767.6     0.0      0.0
 14     0.0      22.3    0.0    0.0       0.      0.     6.2     0.0      0.0
 15     5.6   12057.1    0.0    0.0       0.      0.  3376.0     0.0      0.0
 16     6.4    9741.8    0.0    0.0       0.      0.  2727.7     0.0      0.0
 17     4.0    3535.7    0.0    0.0       0.      0.   990.0     0.0      0.0
 18     1.9     941.3    0.0    0.0       0.      0.   263.6     0.0      0.0
 19     3.0     599.2    0.0    0.0       0.      0.   167.8     0.0      0.0
        Failure Surface Specified By 10 Coordinate Points
          Point      X-Surf      Y-Surf
           No.        (ft)        (ft)
             1         74.400      101.700
             2         83.760      105.221
             3         92.699      109.702
             4        101.120      115.096
             5        108.929      121.342
             6        116.041      128.372
             7        122.377      136.109
             8        127.868      144.466
             9        132.453      153.353
            10        133.116      155.055
        Circle Center At X =    45.781 ; Y =   192.179 ; and Radius =    94.897
               Factor of Safety
              ***    1.190   ***
        Failure Surface Specified By  9 Coordinate Points
          Point      X-Surf      Y-Surf
           No.        (ft)        (ft)
             1         74.400      101.700
             2         83.195      106.459
             3         91.582      111.906
             4         99.506      118.005
             5        106.918      124.717
             6        113.771      132.001
             7        120.019      139.808
             8        125.624      148.089
             9        128.952      153.968
        Circle Center At X =    19.314 ; Y =   214.003 ; and Radius =   125.086
               Factor of Safety
              ***    1.197   ***
        Failure Surface Specified By 12 Coordinate Points
          Point      X-Surf      Y-Surf
           No.        (ft)        (ft)
             1         74.400      101.700
             2         84.083      104.199
             3         93.489      107.593
             4        102.537      111.852
```

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     5       111.146     116.940
     6       119.241     122.811
     7       126.751     129.414
     8       133.610     136.690
     9       139.758     144.577
    10       145.141     153.005
    11       149.711     161.900
    12       150.272     163.300
  Circle Center At X =    52.720 ; Y =   205.928 ; and Radius =   106.459
        Factor of Safety
       ***    1.199   ***
  Failure Surface Specified By 12 Coordinate Points
    Point      X-Surf      Y-Surf
     No.        (ft)        (ft)
     1        74.400     101.700
     2        84.167     103.847
     3        93.703     106.856
     4       102.934     110.704
     5       111.784     115.358
     6       120.184     120.784
     7       128.068     126.937
     8       135.371     133.767
     9       142.036     141.222
    10       148.010     149.242
    11       153.246     157.762
    12       156.002     163.300
  Circle Center At X =    55.426 ; Y =   211.684 ; and Radius =   111.608
        Factor of Safety
       ***    1.206   ***
  Failure Surface Specified By 11 Coordinate Points
    Point      X-Surf      Y-Surf
     No.        (ft)        (ft)
     1        74.400     101.700
     2        83.068     106.686
     3        91.517     112.036
     4        99.731     117.739
     5       107.696     123.786
     6       115.397     130.165
     7       122.820     136.865
     8       129.953     143.874
     9       136.781     151.180
    10       143.293     158.769
    11       146.859     163.300
  Circle Center At X =   -38.704 ; Y =   308.356 ; and Radius =   235.583
        Factor of Safety
       ***    1.207   ***
  Failure Surface Specified By 12 Coordinate Points
    Point      X-Surf      Y-Surf
     No.        (ft)        (ft)
     1        74.400     101.700
     2        84.144     103.950
     3        93.617     107.152
     4       102.727     111.276
     5       111.385     116.280
     6       119.505     122.117
     7       127.008     128.727
     8       133.821     136.048
     9       139.876     144.006
    10       145.115     152.524
    11       149.486     161.518
    12       150.143     163.300
  Circle Center At X =    56.706 ; Y =   200.822 ; and Radius =   100.689
        Factor of Safety
       ***    1.214   ***
  Failure Surface Specified By  9 Coordinate Points
    Point      X-Surf      Y-Surf
     No.        (ft)        (ft)
     1        74.400     101.700
     2        83.637     105.532
     3        92.347     110.443
```

```
     4        100.406      116.364
     5        107.697      123.209
     6        114.113      130.879
     7        119.564      139.262
     8        123.970      148.240
     9        125.680      153.135
 Circle Center At X =    47.186 ; Y =   180.355 ; and Radius =    83.229
        Factor of Safety
       ***    1.215   ***
 Failure Surface Specified By 12 Coordinate Points
   Point      X-Surf      Y-Surf
    No.        (ft)        (ft)
     1         74.400      101.700
     2         82.802      107.123
     3         91.149      112.629
     4         99.442      118.218
     5        107.679      123.888
     6        115.860      129.639
     7        123.983      135.471
     8        132.049      141.383
     9        140.055      147.374
    10        148.002      153.445
    11        155.888      159.593
    12        160.547      163.300
 Circle Center At X =  -467.374 ; Y =   950.399 ; and Radius =  1006.881
        Factor of Safety
       ***    1.217   ***
 Failure Surface Specified By 12 Coordinate Points
   Point      X-Surf      Y-Surf
    No.        (ft)        (ft)
     1         74.400      101.700
     2         82.758      107.190
     3         91.027      112.813
     4         99.205      118.568
     5        107.290      124.453
     6        115.280      130.467
     7        123.172      136.609
     8        130.964      142.876
     9        138.656      149.267
    10        146.244      155.780
    11        153.726      162.414
    12        154.693      163.300
 Circle Center At X =  -263.272 ; Y =   624.973 ; and Radius =   622.766
        Factor of Safety
       ***    1.217   ***
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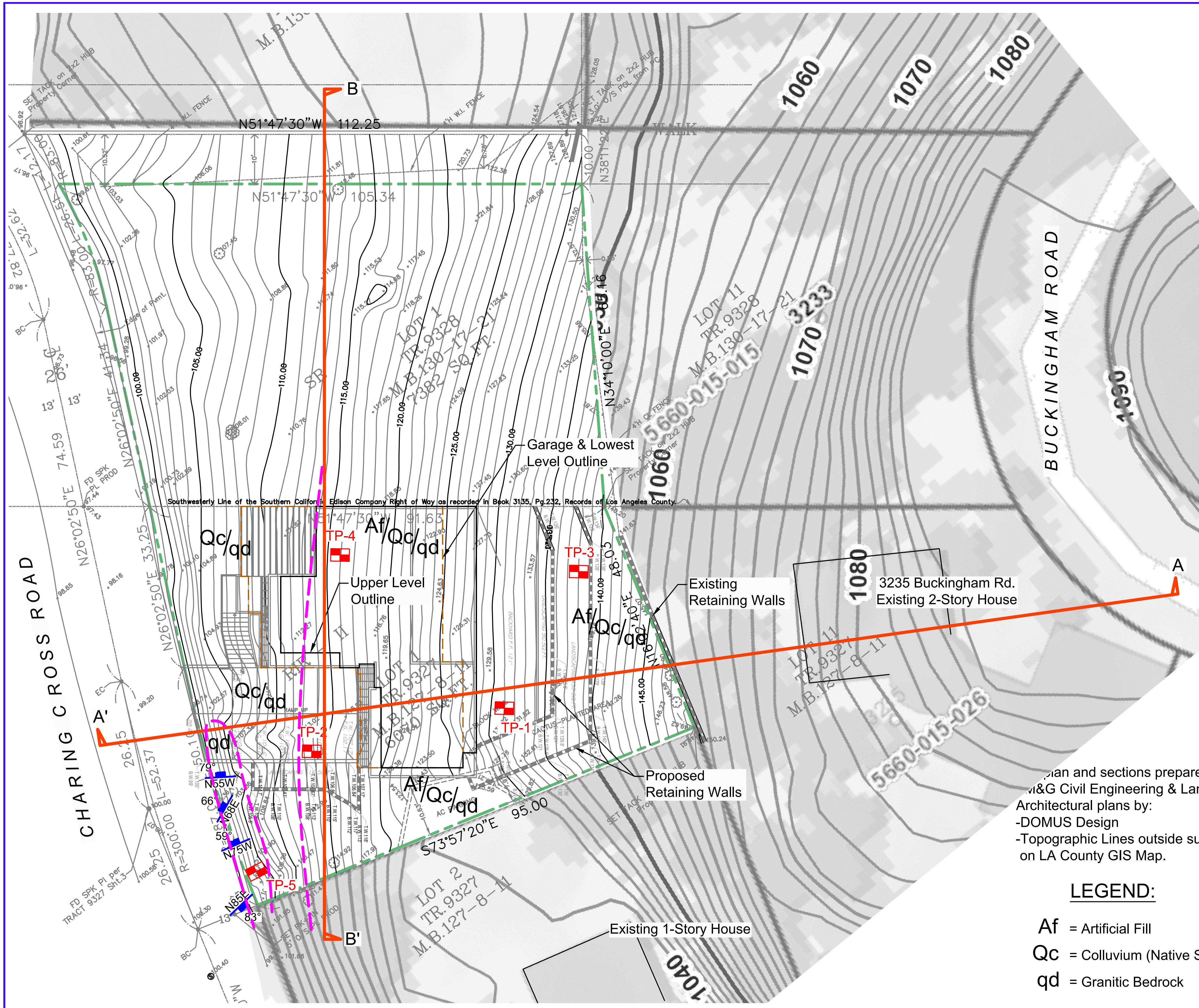

Plan and sections prepared by using survey drawn by:
-M&G Civil Engineering & Land Surveying
Architectural plans by:
-DOMUS Design
-Topographic Lines outside subject property are based on LA County GIS Map.

LEGEND:

Af	= Artificial Fill	TP-5	= Location & Number of Test Pit
Qc	= Colluvium (Native Soil)	80°	= Strike & Dip of Joint
qd	= Granitic Bedrock		= Geological Contact Approximately Located

GEOLOGIC MAP & SITE PLAN

PROJECT No: 19-523-22
DATE: 09 / 20 / 2019
DRAWN BY: VM
CHECKED BY: SM
DRAWING No: 1

DESCRIPTION: Proposed New Single Family Residence
FOR: Mr. Sam Nazaryan
ADDRESS: 3130 Charing Cross Road, Glendale, CA 91206

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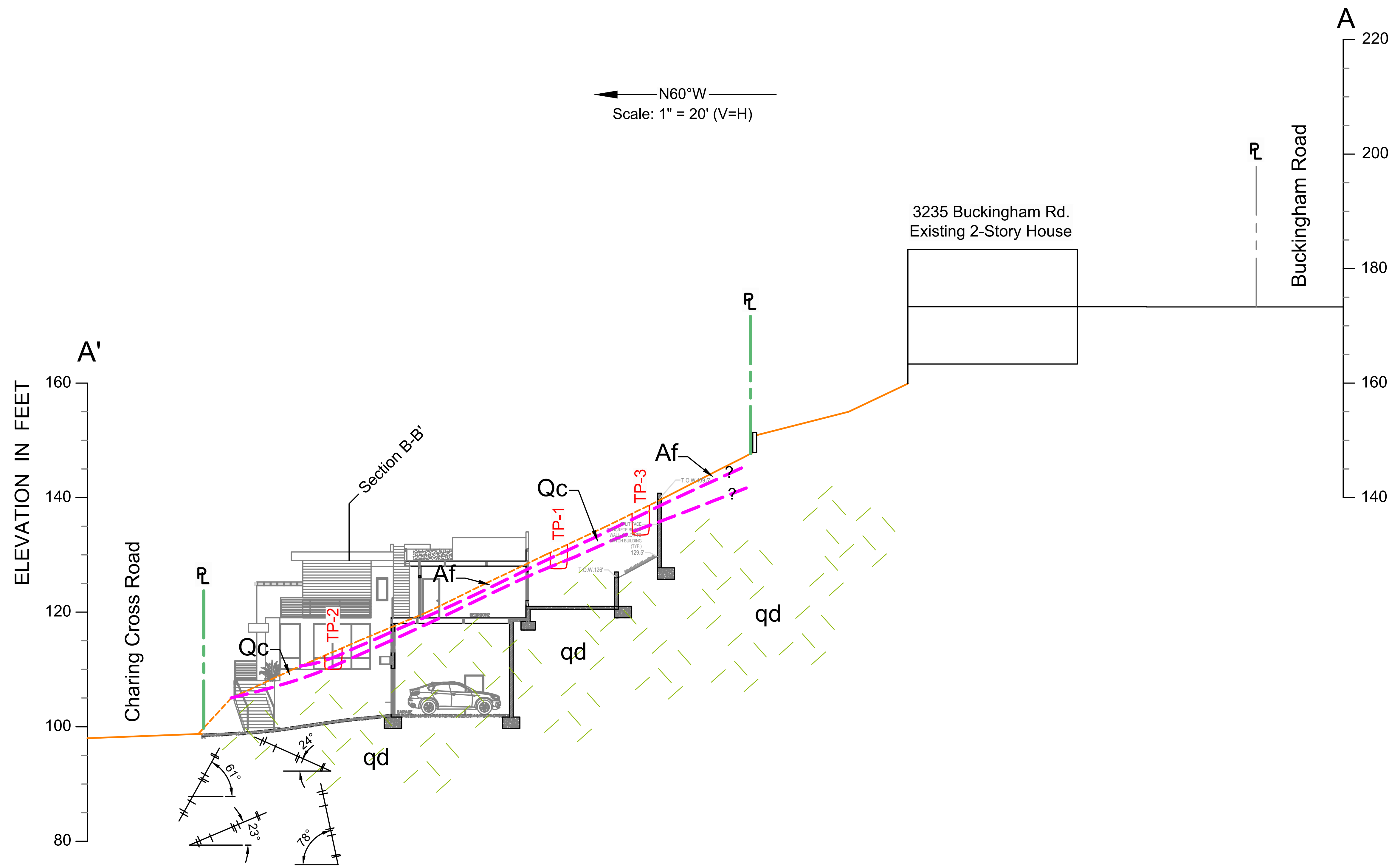


LEGEND:

Af = Artificial Fill
Qc = Colluvium (Native Soil)
qd = Granitic Bedrock

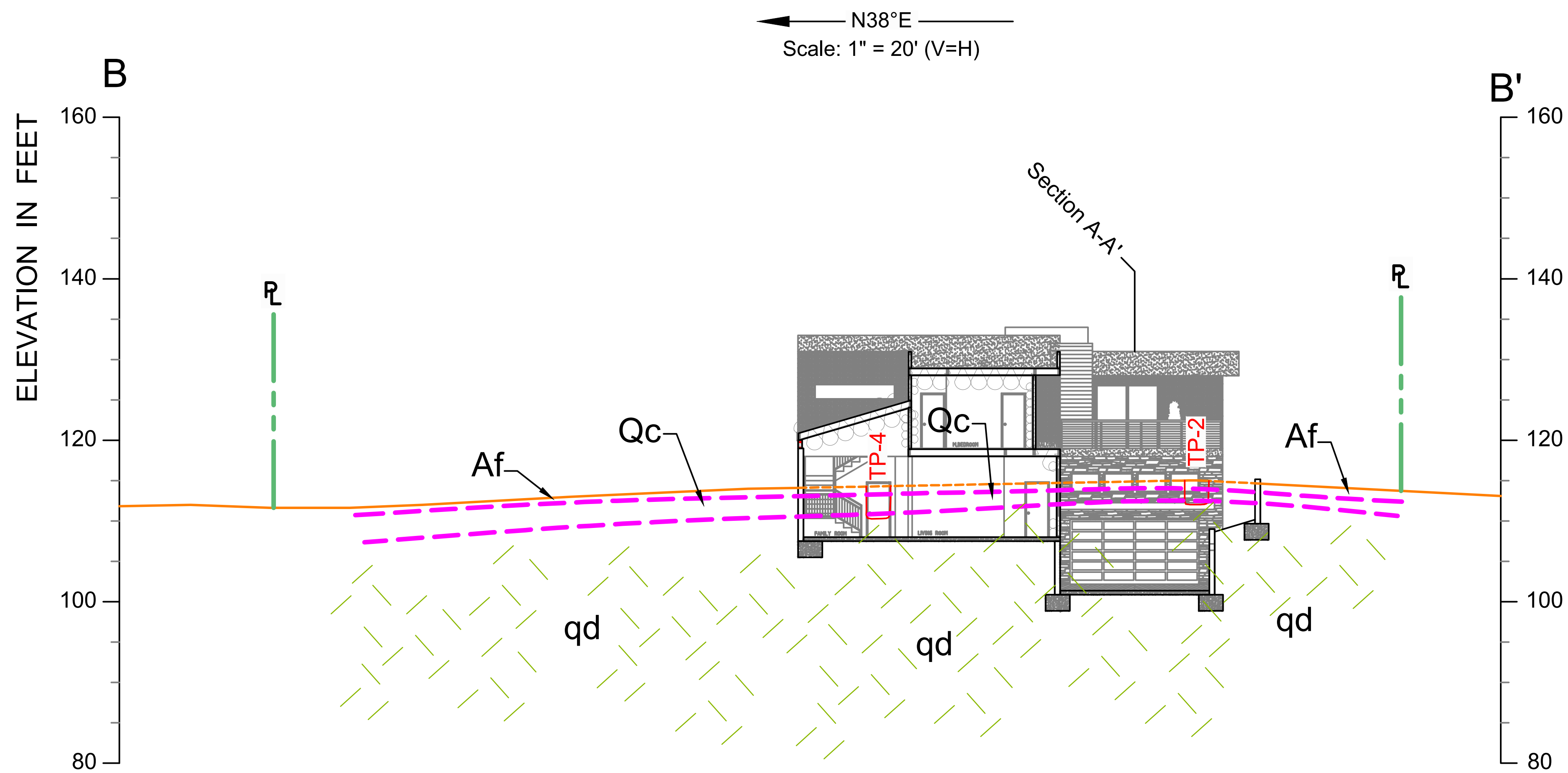
TP-5 = Location & Number of Test Pit

= Geological Contact Approximately Located

= Joint Set

GEOLOGIC CROSS SECTION A-A'

DESCRIPTION:	Proposed New Single Family Residence	PROJECT No:	19-523-22
FOR:	Mr. Sam Nazaryan	DATE:	09 / 20 / 2019
ADDRESS:	3130 Charing Cross Road, Glendale, CA 91206	DRAWN BY:	VM
		CHECKED BY:	SM
Applied Earth Sciences	GEOTECHNICAL . GEOLOGY . ENVIRONMENTAL ENGINEERING CONSULTANTS www.aessoil.com (818) 552-6000	DRAWING No:	2



LEGEND:

Af = Artificial Fill
Qc = Colluvium (Native Soil)
qd = Granitic Bedrock

TP-5 = Location & Number of Test Pit

= Geological Contact
Approximately Located

GEOLOGIC CROSS SECTION B-B'

DESCRIPTION:	Proposed New Single Family Residence	PROJECT No:	19-523-22
FOR:	Mr. Sam Nazaryan	DATE:	09 / 20 / 2019
ADDRESS:	3130 Charing Cross Road, Glendale, CA 91206	DRAWN BY:	VM
		CHECKED BY:	SM
		DRAWING No:	3

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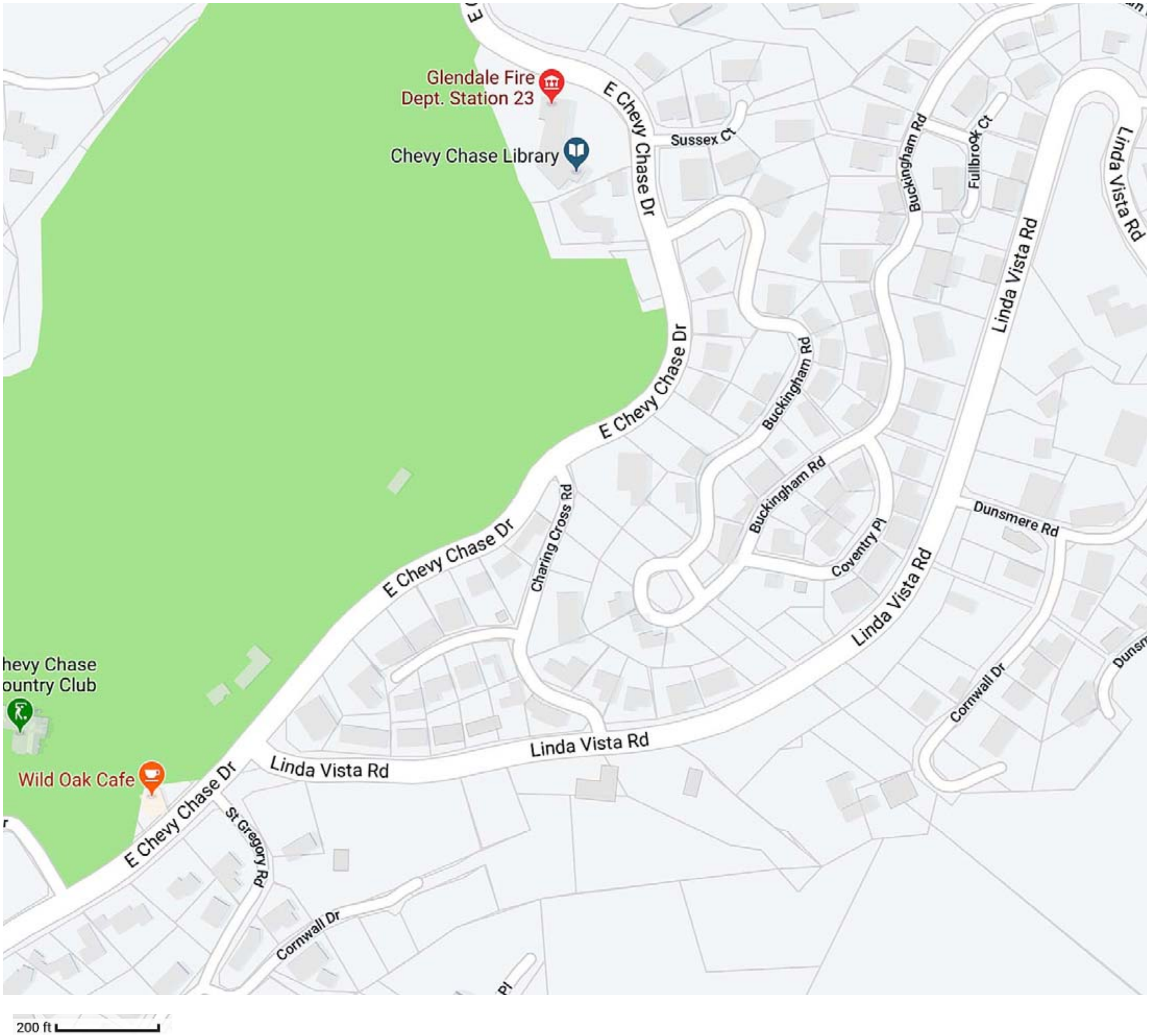

Reference: Portion of Google Maps

SITE VICINITY MAP

Proposed New Single Family Residence

3130 Charing Cross Road, Glendale, CA 91206

FOR	DATE	PROJECT No.
Mr. Sam Nazaryan	09 / 20 / 2019	19-523-22

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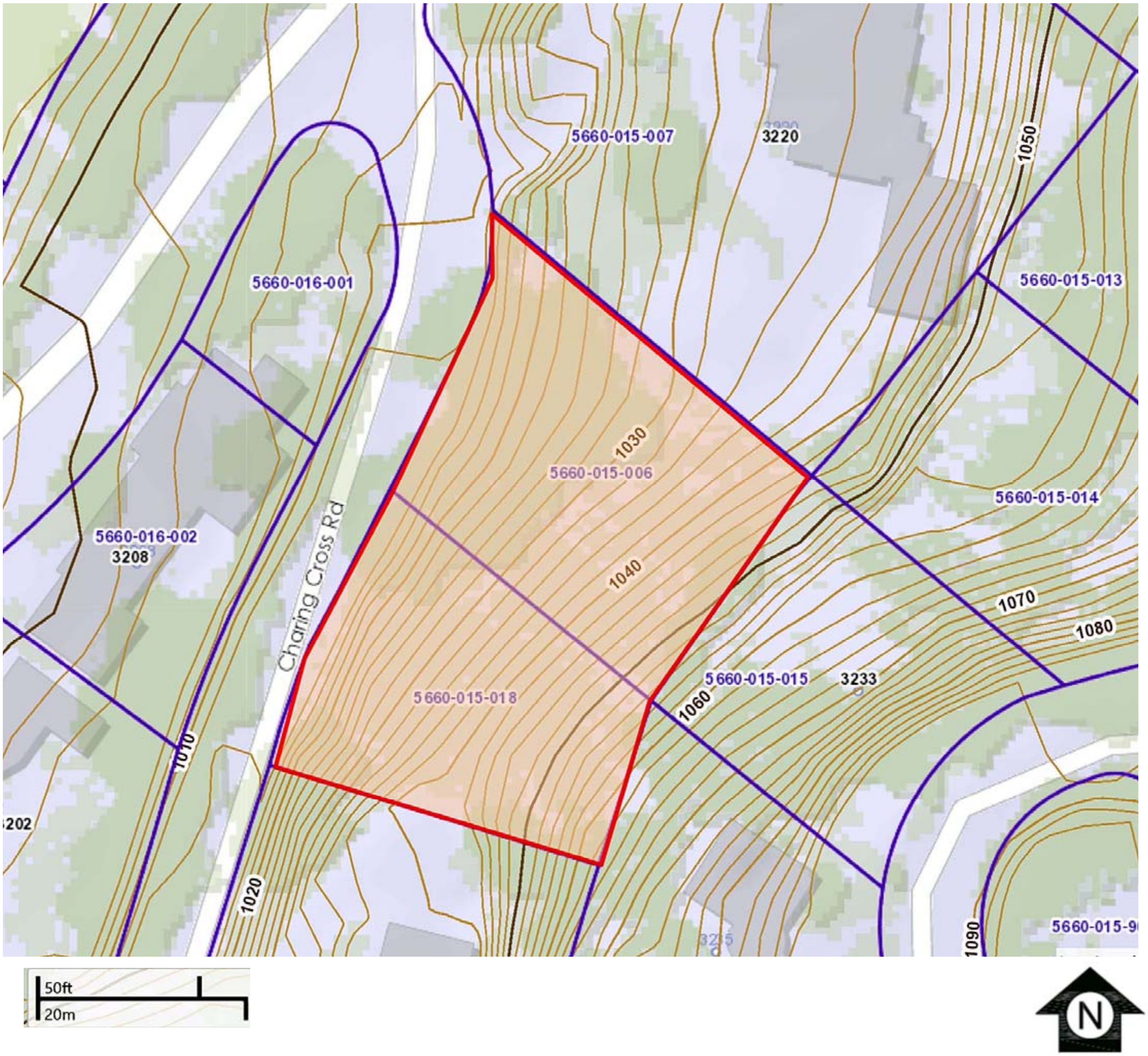
FIGURE No. 1



Reference: Los Angeles County GIS Map

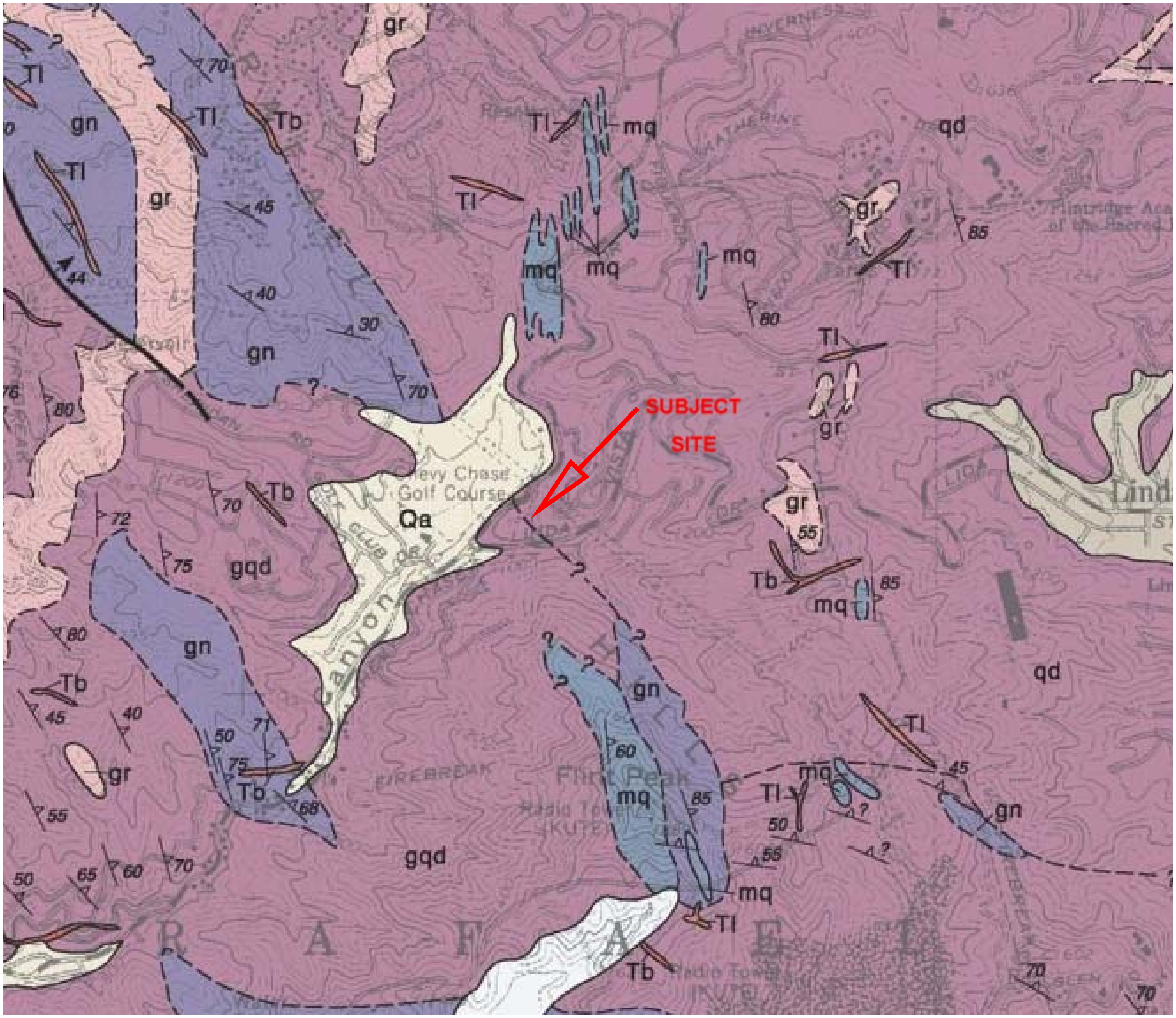
REGIONAL TOPOGRAPHIC MAP

Proposed New Single Family Residence

3130 Charing Cross Road, Glendale, CA 91206

FOR	DATE	PROJECT No.
Mr. Sam Nazaryan	09 / 20 / 2019	19-523-22

APPLIED EARTH SCIENCES GEOTECHNICAL . GEOLOGY . ENVIRONMENTAL ENGINEERING CONSULTANTS	FIGURE No. 2



gqd *Massive to gneissoid quartz diorite, locally includes unmapped biotite-rich gneiss*

N

1 ½ 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

Reference: Dibblee Geologic Map of the Pasadena Quadrangle

REGIONAL GEOLOGIC MAP

Proposed New Single Family Residence

3130 Charing Cross Road, Glendale, CA 91206

FOR Mr. Sam Nazaryan	DATE 09 / 20 / 2019	PROJECT No. 19-523-22
APPLIED EARTH SCIENCES GEOTECHNICAL . GEOLOGY . ENVIRONMENTAL ENGINEERING CONSULTANTS		FIGURE No. 3

APPENDIX I
METHOD OF FIELD EXPLORATION

In order to define the subsurface conditions, five test pits were excavated on the site. The approximate location of the excavated test pits are shown on the enclosed Site Plan. Continuous logs of the subsurface conditions, as encountered in the test pits, were recorded during the field work and are presented on Figure Nos. I-1 through I-5 within this Appendix. These figures also show the number and approximate depths of each of the recovered soil and rock samples.

Relatively undisturbed samples of the subsurface materials were obtained by driving successive drops of a 36-pound metal weight free-falling a vertical distance of about 30 inches. The relatively undisturbed soil and bedrock samples were retained in brass liner rings 2.5 inches in diameter and 1.0 inch in height.

Field investigation for this project was performed on August 23, 2019. The material excavated from the test pits was placed back and compacted upon completion of the field work. Such material may settle. The owner should periodically inspect these areas and notify this office if the settlement creates a hazard to persons or property.

Date: September 4, 2019
Project No: 19-523-22

Figure No. I-1

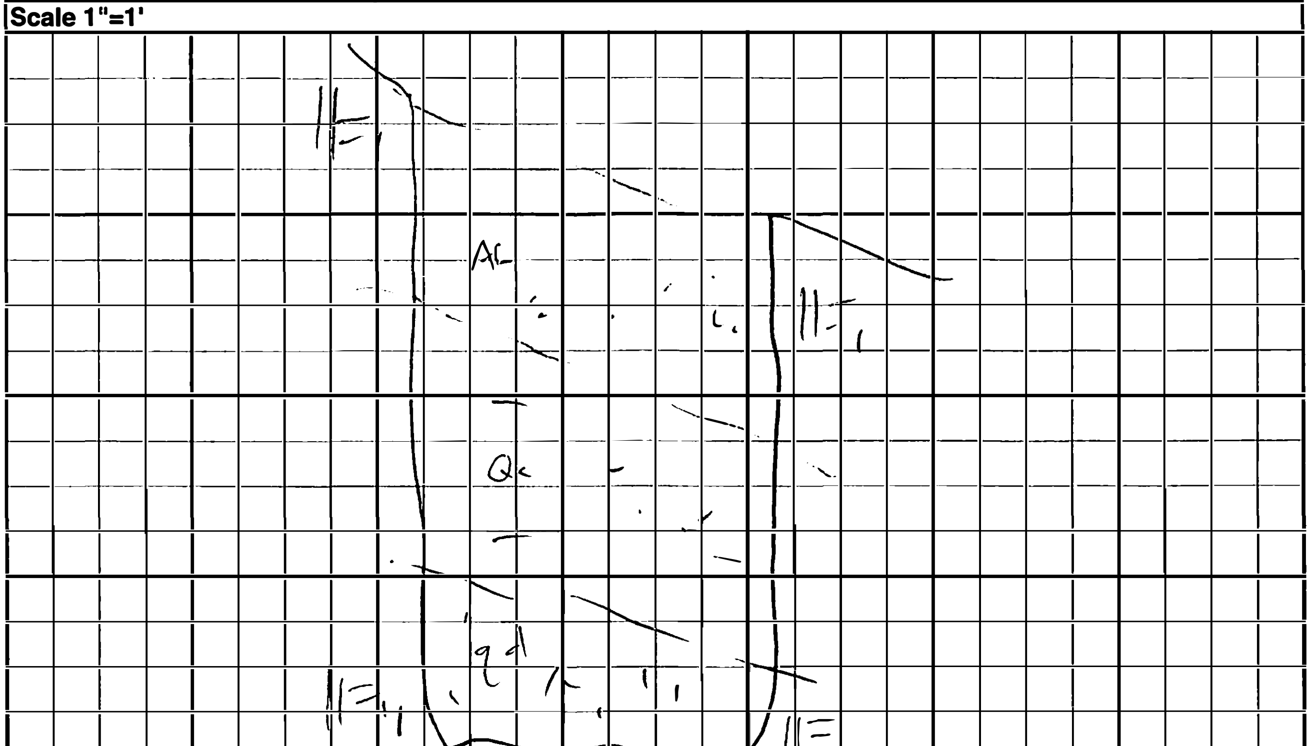
EXPLORATORY TEST PIT NO. 1

PROJECT LOCATION: 3130 Charing Cross Road, Glendale
DATE LOGGED: August 23, 2019

PROJECT TYPE: Proposed SFR
LOGGED BY: MA

DRY DENSITY (PCF)	FIELD MOISTURE (% DRY WEIGHT)	ATTITUDE	BLOWS PER FOOT	GEOLOGIC UNIT	MATERIAL DESCRIPTION (USCS)
				Slough (Af)	0' - 1': slough: light brown to grayish sand with silt (SM), rootlets, moist, some rock fragments, loose, creep prone.
				Soil (Qc)	1' - 2.5': native colluvial soil, tan to light brown fine-grained silty sand (SM), moist, slightly clayey with depth.
				Bedrock Quartz Diorite (qd)	2.5' - 3.5': Quartz Diorite: Medium to coarse grained granitic bedrock, light gray to yellowish brown, moderately weathered, slightly friable, mostly composed of plagioclase along with quartz and black hornblende minerals.
					Total Depth 3.5 Feet. No water, No caving. samples not recovered from TP-1 due to beehives near test pit Test Pit backfilled to surface level after logging.

Scale 1"=1'



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Date: September 4, 2019
Project No: 19-523-22

Figure No. I-2

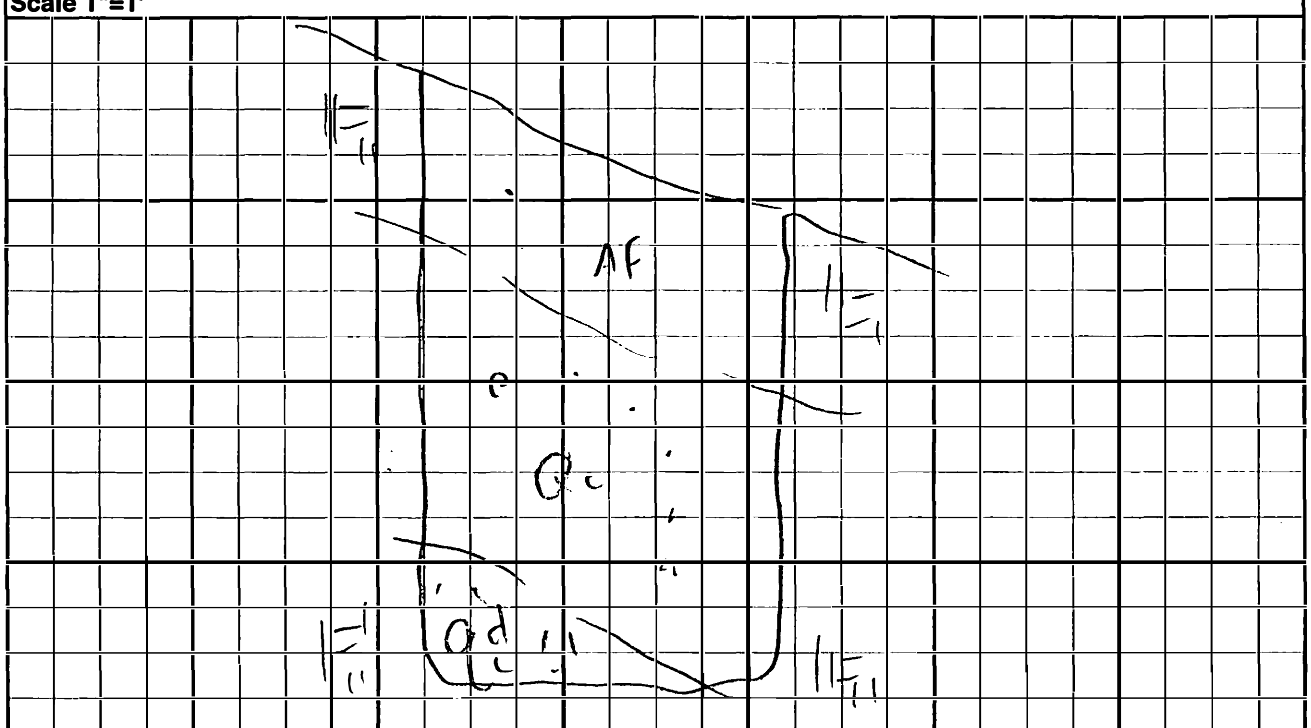
EXPLORATORY TEST PIT NO. 2

PROJECT LOCATION: 3130 Charing Cross Road, Glendale
DATE LOGGED: August 23, 2019

PROJECT TYPE: Proposed SFR
LOGGED BY: MA

DRY DENSITY (PCF)	FIELD MOISTURE (% DRY WEIGHT)	ATTITUDE	BLOWS PER FOOT	GEOLOGIC UNIT	MATERIAL DESCRIPTION (USCS)
				Slough (Af)	0' - 1': slough: light brown to grayish sand with silt (SM), rootlets, moist, some rock fragments, loose, creep prone.
94 @1.5'	3			Soil (Qc)	1' - 2.5': native colluvial soil, tan to light brown fine-grained silty sand (SM), moist, slightly clayey with depth.
				Bedrock Quartz Diorite (qd)	2.5' - 3': Quartz Diorite: Medium to coarse grained granitic bedrock, light gray to yellowish brown, moderately weathered, slightly friable, yellowish aplitic veins
					Total Depth 3 Feet. No water, No caving.
					Test Pit backfilled to surface level after logging and sampling.

Scale 1"=1'



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Date: September 4, 2019
Project No: 19-523-22

Figure No. I-3

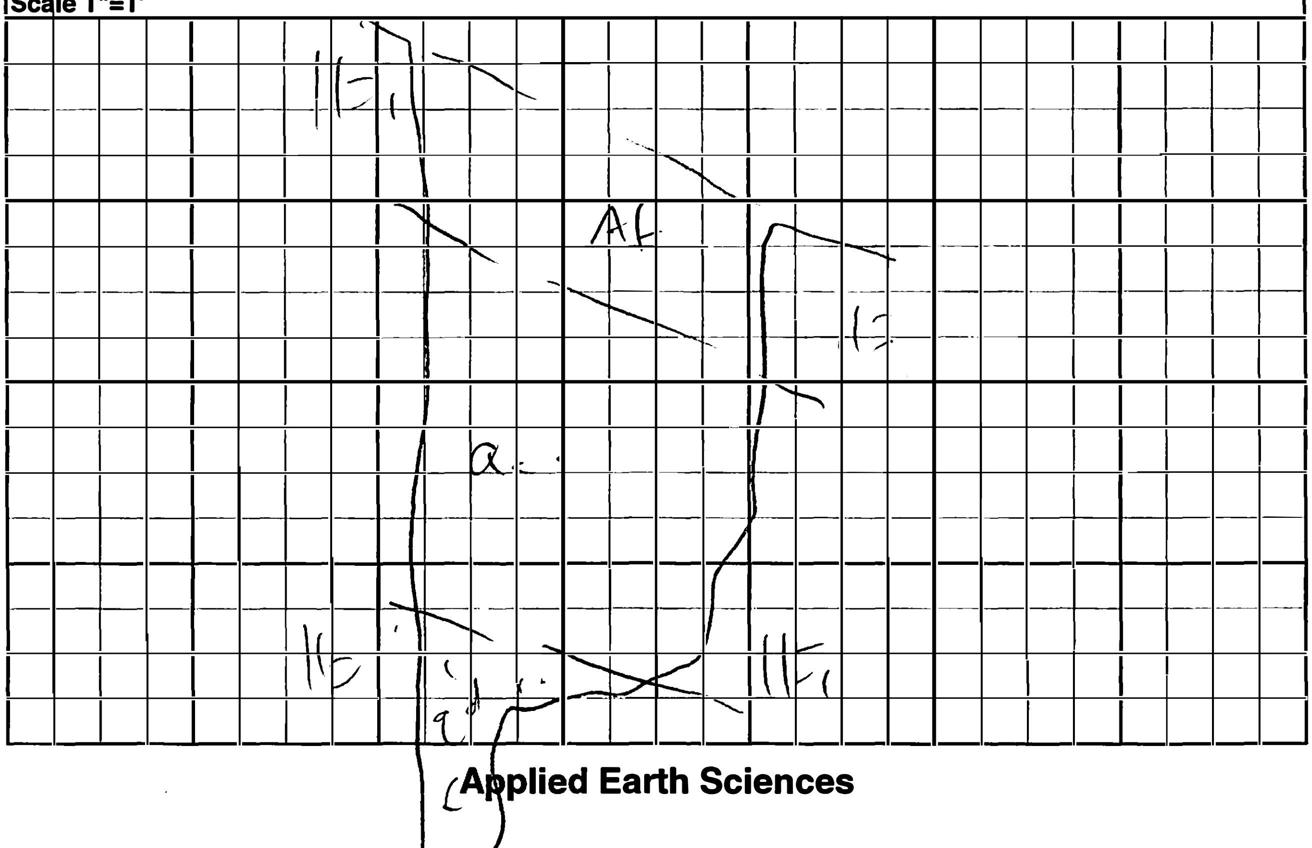
EXPLORATORY TEST PIT NO. 3

PROJECT LOCATION: 3130 Charing Cross Road, Glendale
DATE LOGGED: August 23, 2019

PROJECT TYPE: Proposed SFR
LOGGED BY: MA

DRY DENSITY (PCF)	FIELD MOISTURE (% DRY WEIGHT)	ATTITUDE	BLOWS PER FOOT	GEOLOGIC UNIT	MATERIAL DESCRIPTION (USCS)
109 @1'	4			Slough (Af)	0' - 1': slough: light brown to grayish sand with silt (SM), rootlets, moist, some rock fragments, loose, creep prone.
105 @2.5'	4			Soil (Qc)	1' - 3.5': native colluvial soil, tan to light brown fine-grained silty sand (SM), moist, slightly clayey with depth.
107 @4.5'	5			Bedrock Quartz Diorite (qd)	3.5' - 4.5': Quartz Diorite: Medium to coarse grained granitic bedrock, brownish yellow, moderately weathered, slightly friable, yellowish orange aplitic veins
					Total Depth 4.5 Feet. No water, No caving.
					Test Pit backfilled to surface level after logging and sampling.

Scale 1"=1'



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Date: September 4, 2019
Project No: 19-523-22

Figure No. I-4

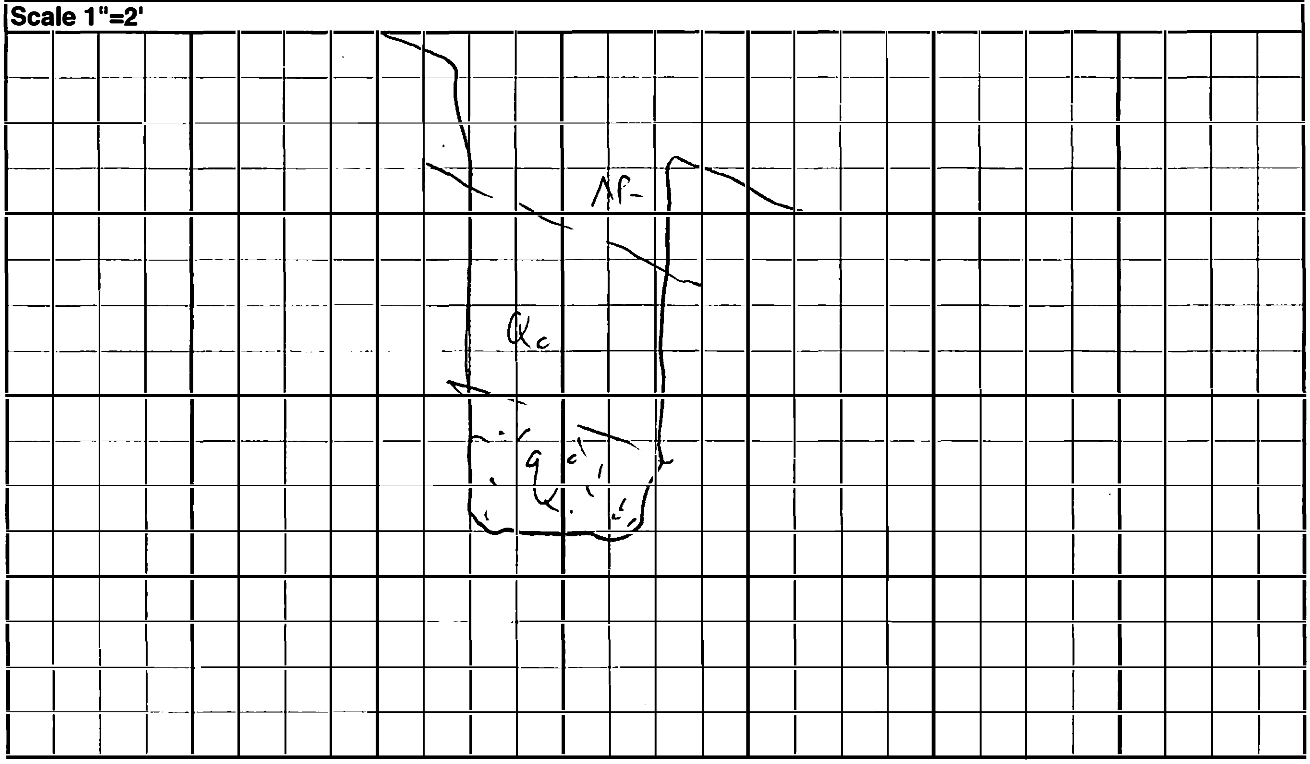
EXPLORATORY TEST PIT NO. 4

PROJECT LOCATION: 3130 Charing Cross Road, Glendale
DATE LOGGED: August 23, 2019

PROJECT TYPE: Proposed SFR
LOGGED BY: MA

DRY DENSITY (PCF)	FIELD MOISTURE (% DRY WEIGHT)	ATTITUDE	BLOWS PER FOOT	GEOLOGIC UNIT	MATERIAL DESCRIPTION (USCS)
114 @1'	5			Slough (Af)	0' - 1': slough: light brown to grayish sand with silt (SM), rootlets, moist, some rock fragments, loose, creep prone.
92 @3'	5			Soil (Qc)	1' - 3.5': native colluvial soil, tan to light brown fine-grained silty sand (SM), moist, slightly clayey with depth.
102 @5'	6			Bedrock Quartz Diorite (qd)	3.5' - 5': Quartz Diorite: Medium to coarse grained granitic bedrock, brownish yellow, moderately weathered, slightly friable, yellowish orange aplitic veins
					Total Depth 5 Feet. No water, No caving.
					Test Pit backfilled to surface level after logging and sampling.

Scale 1"=2'



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Date: September 4, 2019
Project No: 19-523-22

Figure No. I-5

EXPLORATORY TEST PIT NO. 5

PROJECT LOCATION: 3130 Charing Cross Road, Glendale

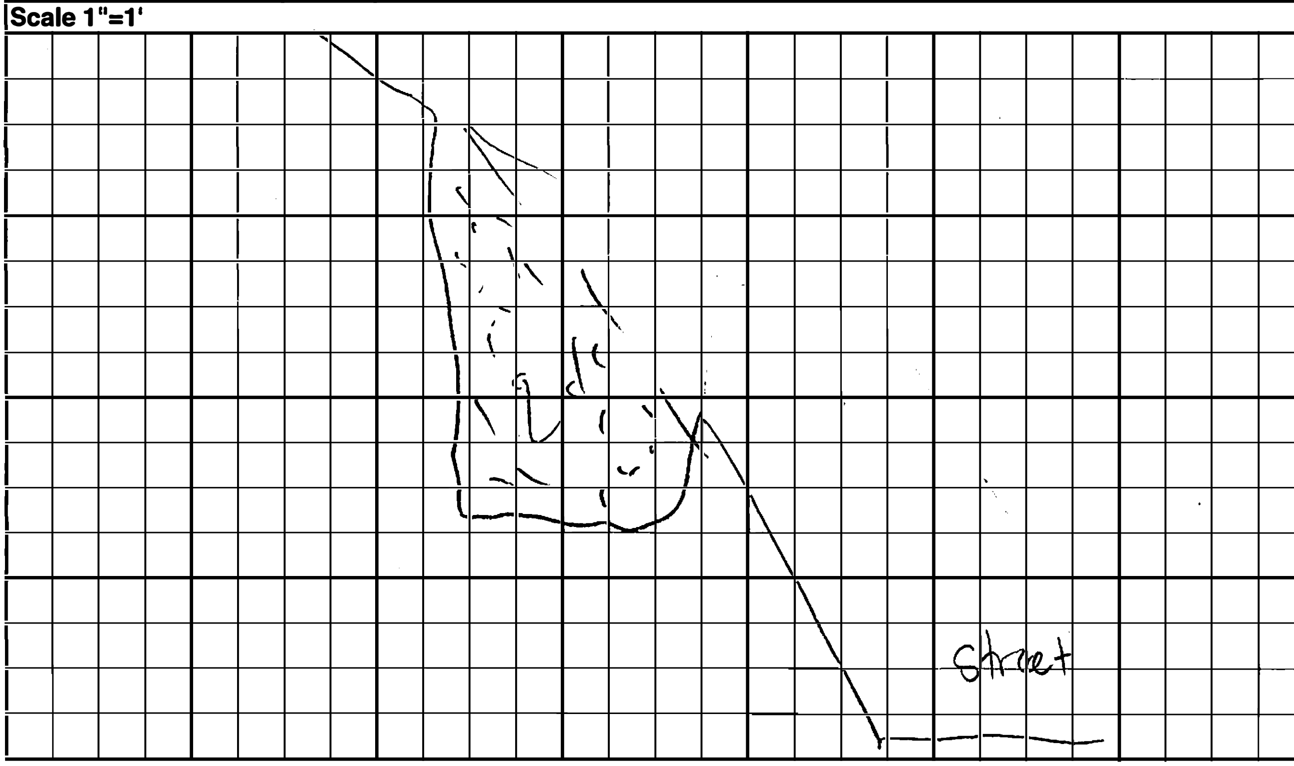
PROJECT TYPE: Proposed SFR

DATE LOGGED: August 23, 2019

LOGGED BY: MA

DRY DENSITY (PCF)	FIELD MOISTURE (% DRY WEIGHT)	ATTITUDE	BLOWS PER FOOT	GEOLOGIC UNIT	MATERIAL DESCRIPTION (USCS)
115	5			Bedrock Quartz Diorite (qd)	0 - 1.5': Quartz Diorite: Medium to coarse grained granitic bedrock, brownish yellow, moderately weathered, slightly friable, highly weathered at surface. Total Depth 1.5 Feet. No water, No caving. Test Pit backfilled to surface level after logging and sampling.

Scale 1"=1'



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MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAME
COARSE GRAINED SOILS (More than 50% of material is LARGER than No. 200 sieve size)	GRAVELS (More than 50% of coarse fraction is LARGER than the No. 4 sieve size)	CLEAN GRAVELS (Little or no fines)	GW	Well graded gravels, gravel - sand mixtures, little or no fines.
			GP	Poorly graded gravels or gravel-sand mixtures, little or no fines.
		GRAVELS WITH FINES (Appreciable amt. of fines)	GM	Silty gravels, gravel-sand-silt mixtures.
			GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS (More than 50% of coarse fraction is SMALLER than the No. 4 sieve size)	CLEAN SANDS (Little or no fines)	SW	Well graded sands, gravelly sands, little or no fines.
			SP	Poorly graded sands or gravelly sands, little or no fines.
		SANDS WITH FINES (Appreciable amt. of fines)	SM	Silty sands, sand-silt mixtures.
			SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS (More than 50% of material is SMALLER than No. 200 sieve size)	SILTS AND CLAYS (Liquid limit LESS than 50)		ML	Organic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
			CL	Organic clay of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
			OL	Organic silts and organic silty clays of low plasticity.
	SILTS AND CLAYS (Liquid limit GREATER than 50)		MH	Organic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
			CH	Organic clays of high plasticity, fat clays.
			OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS			Pt	Peat and other highly organic soils.

BOUNDARY CLASSIFICATIONS: Soils possessing characteristics of two groups are designated by combinations of group symbols.

PARTICLE SIZE LIMITS

SILT OR CLAY	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

NO. 200 NO. 40 NO. 10 NO. 4 3/4 in. 3 in. (12 in.)

U. S. STANDARD SIEVE SIZE

UNIFIED SOIL CLASSIFICATION SYSTEM

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FIGURE No. I-6

APPENDIX II
LABORATORY TESTING PROCEDURES

MOISTURE DENSITY

The moisture-density information provides a summary of soil consistency for each stratum and can also provide a correlation between soils found on this site and other nearby sites. The dry unit weight and field moisture content were determined for each undisturbed sample, and the results are shown on the log of exploratory borings.

SHEAR AND RE-SHEAR TESTS

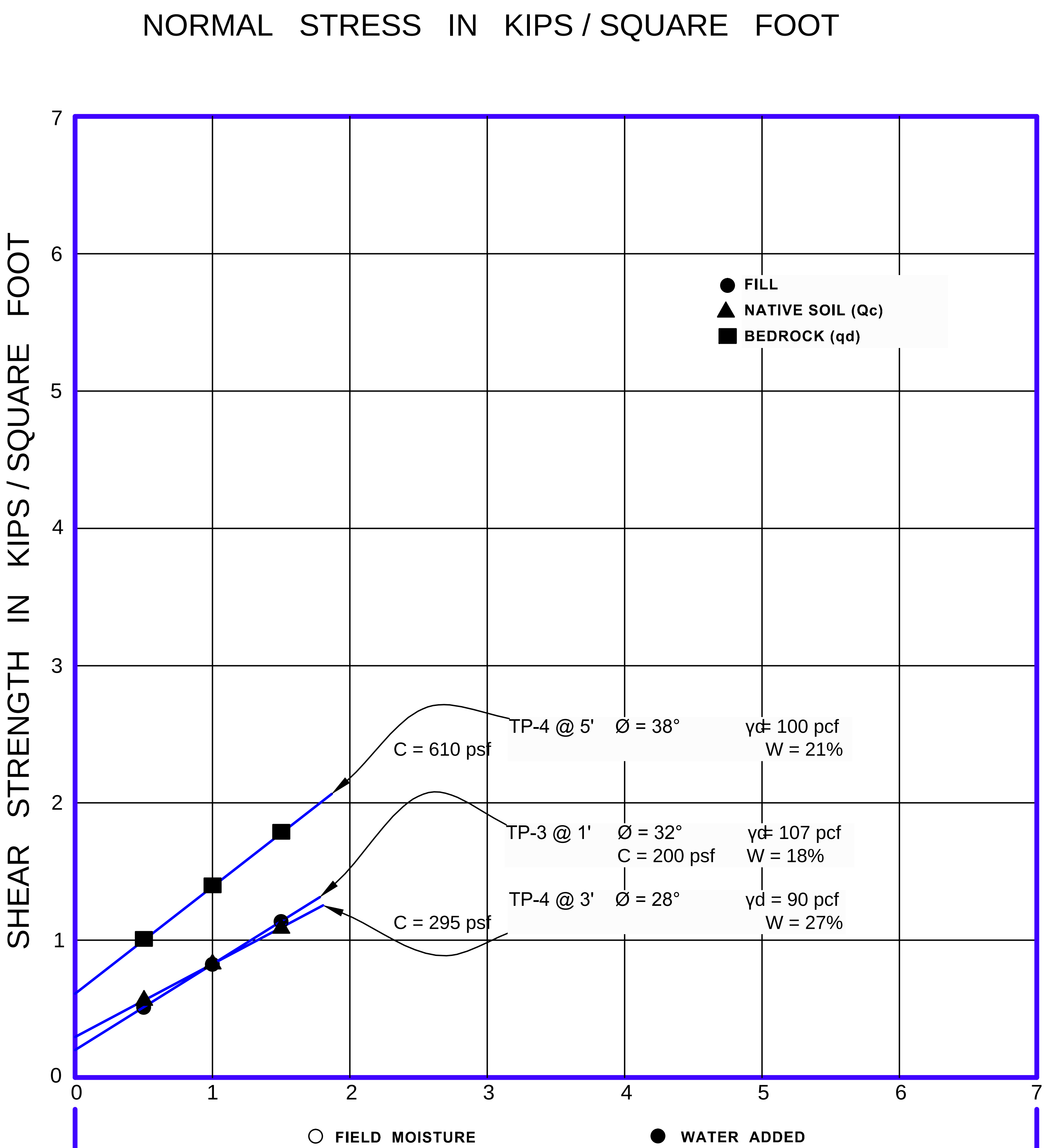
After the samples are pre-soaked overnight under initial confining pressure, a range of normal stresses are applied vertically, and the shear strengths are progressively determined under each load in order to determine the internal angle of friction and the cohesion of the sample. After application of each of the confining pressures, and before the shearing tests, sufficient amount of time is allowed for any excess pore pressure to dissipate. During the course of shear test, the sample is allowed to undergo volume change under a given confining pressure. Under each load, the direct sear tests are continued until the ultimate strength or about 3 percent strain (whichever is lower) is reached. The sample is then allowed to relax to remove the major portion of the viscous component of the shear strength. It should be noted that due to normal disturbance during sampling and laboratory extruding, the measured bedrock strengths are normally significantly lower than the actual values.

In order to determine the strength of the bedrock along bedding, foliation or joint planes or landslide debris strengths, the sample is soaked overnight under initial confining pressure. The sample is then re-sheared several times until the least strengths are obtained. During typical testing, the shearing of the samples are continued until the residual strengths are developed (the shear strengths remain constant, after the peak has been reached, or about 5 percent strain corresponding to approximately 0.100 inches of shearing deformation has occurred). At this point, the tests are stopped. The samples are then pushed back to their original position. The shear test procedure is then repeated along the previously sheared plane. This procedure is repeated several times until constant residual strengths are obtained.

CONSOLIDATION

The apparatus used for the consolidation tests is designed to receive the undisturbed brass ring of soil as it comes from the field. Loads were applied to the test specimen in several increments, and the resulting deformations were recorded at selected time intervals. Porous stones were placed in contact with the top and bottom of the specimen to permit the ready addition or release of water.

Undisturbed specimens were tested at the field and added water conditions. The test results are shown on Figure No. II-2 within this Appendix.



DIRECT SHEAR TESTS

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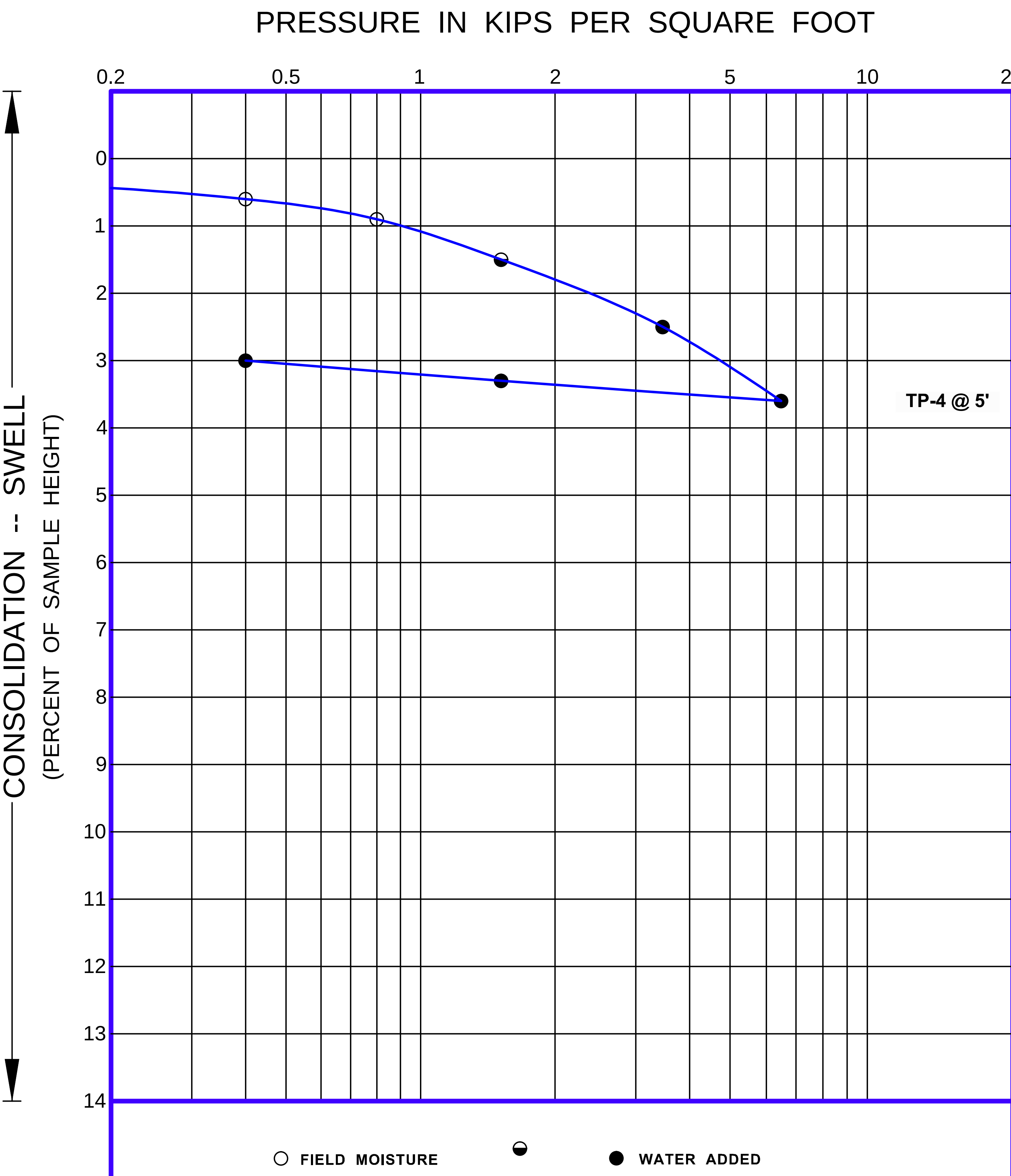

SWELL - CONSOLIDATION TESTS

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FIGURE No. II - 2