



CHRISTIAN WHEELER
ENGINEERING

REPORT OF PRELIMINARY GEOTECHNICAL INVESTIGATION

**PROPOSED MASON RESIDENCE
SUNSET CLIFFS BOULEVARD
SAN DIEGO, CALIFORNIA**

PREPARED FOR

**CHRIS AND LOUISE MASON
c/o CHRIS NIRSHL
766 LAGUNA DRIVE
CARLSBAD, CALIFORNIA 92008**

PREPARED BY

**CHRISTIAN WHEELER ENGINEERING
3980 HOME AVENUE
SAN DIEGO, CALIFORNIA 92105**



CHRISTIAN WHEELER
ENGINEERING

August 25, 2023

Chris and Louise Mason
c/o Chris Nirshl
766 Laguna Drive
Carlsbad, California 92008

CWE 2230146.01

**Subject: Report of Preliminary Geotechnical Investigation
Proposed Mason Residence, Sunset Cliffs Boulevard, San Diego, California**

Dear Mr. and Mrs. Mason:

In accordance with your request and our proposal dated March 17, 2023, we have completed a preliminary geotechnical investigation for a proposed single-family home and detached garage to be constructed at the subject property. We are presenting herewith a report of our findings and recommendations.

It is our opinion that no geotechnical conditions exist at or in the vicinity of the subject property that would preclude the construction of the proposed development as presently proposed. The main geotechnical conditions affecting the proposed construction are potentially compressible fill soils and the uppermost portions of the old paralic deposits underlying the site. These conditions are described hereinafter.


If you have any questions after reviewing this report, please do not hesitate to contact our office. This opportunity to be of professional service is sincerely appreciated.

Respectfully submitted,
CHRISTIAN WHEELER ENGINEERING


Daniel B. Adler, RCE #36037

DRR:drr:dba
cc: nirschl77@comcast.net




David R. Russell, CEG #2215

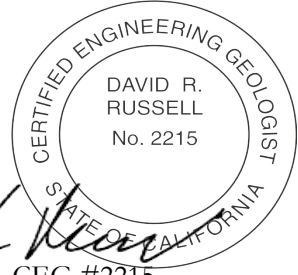


TABLE OF CONTENTS

	Page
Introduction and Project Description.....	1
Scope of Services.....	2
Findings.....	3
Site Description.....	3
Site History.....	4
General Geology and Subsurface Conditions.....	4
Geologic Setting and Soil Description.....	4
Artificial Fill.....	4
Old Paralic Deposits.....	4
Point Loma Formation.....	5
Geologic Structure.....	5
Groundwater.....	5
Tectonic Setting.....	6
Bluff Edge.....	7
Bluff Erosion.....	8
Landslide Potential and Bluff Stability.....	10
General.....	10
Stability Analysis.....	10
Strength Parameters.....	11
Method of Analysis.....	11
Results of Static Stability Analysis.....	12
Results of Pseudo-Static Stability Analysis.....	12
Recommended Bluff Top Setback.....	12
Geologic Hazards.....	13
Seismic Safety Study.....	13
Strong Ground Motion.....	13
Surface Rupture.....	13
Liquefaction.....	13
Tsunamis.....	13
Seiches.....	14
Flooding.....	14
Other Potential Geologic Hazards.....	14
Conclusions.....	14
Recommendations.....	15
Grading and Earthwork.....	15
General.....	15
Pregrade Meeting.....	15
Observation of Grading.....	15
Clearing and Grubbing.....	15
Site Preparation.....	15
Processing of Fill Areas.....	15
Compaction and Method of Filling.....	16
Surface Drainage.....	16
Grading Plan Review.....	16
Foundations.....	17
General.....	17
Shallow Foundations.....	17
Bearing Capacity.....	17

TABLE OF CONTENTS

	Page
Footing Reinforcing	17
Lateral Load Resistance.....	18
Special Conditions.....	18
Foundation Excavation Observation	18
Settlement Characteristics	18
Expansive Characteristics	18
Foundation Plan Review	18
Soluble Sulfates.....	19
Seismic Design Factors	19
On-Grade Slabs	20
General.....	20
Interior Floor Slabs	20
Under-Slab Vapor Retarders	20
Exterior Concrete Flatwork.....	20
Earth Retaining Walls	21
Foundations	21
Passive Pressure.....	21
Active Pressure.....	21
Waterproofing and Wall Drainage Systems.....	21
Backfill.....	21
Limitations.....	22
Review, Observation and Testing.....	22
Uniformity of Conditions	22
Change in Scope.....	22
Time Limitations	22
Professional Standard	23
Client's Responsibility.....	23
Field Explorations	23
Laboratory Testing.....	24

ATTACHMENTS

TABLES

Table I	Proximal Fault Zones, Page 7
Table II	Seismic Design Factors – 2022 CBC, Page 19

FIGURES

Figure 1	Site Vicinity Map, Follows Page 1
----------	-----------------------------------

PLATES

Plates 1A & 1B	Existing and Proposed Site Plan & Geotechnical Maps
Plates 2-4	Geologic Cross Sections

ATTACHMENTS

Plates 5A & 5B Coastal Bluff Retreat Analysis
Plate 6 Typical Cantilever Retaining Wall Drainage Systems

APPENDICES

Appendix A Logs of Subsurface Explorations
Appendix B Laboratory Test Results
Appendix C Bluff Stability Analyses
Appendix D References
Appendix E Recommended Grading Specifications-General Provisions



CHRISTIAN WHEELER
ENGINEERING

PRELIMINARY GEOTECHNICAL INVESTIGATION

PROPOSED MASON RESIDENCE

SUNSET CLIFFS BOULEVARD

SAN DIEGO, CALIFORNIA

INTRODUCTION AND PROJECT DESCRIPTION

This report presents the results of a preliminary geotechnical investigation performed for the proposed construction of a new single-family residence and detached garage at the lot identified as Assessor's Parcel Number 532-010-06-00, an unoccupied lot which is located adjacent to and east of Sunset Cliffs Boulevard in the Point Loma area of San Diego. Figure Number 1, presented on the following page, provides a vicinity map showing the location of the property.

It is our understanding that the subject project will consist of construction of a two-story, single-family residence with attached decks to the west and east sides of the house, to be located in the central portion of the lot. A detached, two-car garage is proposed to be located in the eastern portion of the lot. The proposed structures are anticipated to be of conventional, wood-frame construction, to be supported by conventional shallow foundations, and to incorporate on-grade, concrete floor slabs. Grading to accommodate the proposed construction is expected to be limited to cuts and fills of less than 5 feet from existing site grades.

To assist in the preparation of this report, we were provided with a topographic survey of the site and adjacent area prepared by Jennings Land Surveying (revised February 11, 2023) and a set of preliminary architectural plans prepared by project architect, Mr. Chris Nirschl (undated). We have also reviewed previous geotechnical reports prepared by our firm for sites in the immediate vicinity of the subject site. A copy of the Topographic Survey and Proposed Site Plan have been used as the base maps for our Existing Site Plan & Geologic Map and Proposed Site Plan & Geologic Map, and are included herein as Plate Nos.1A and 1B, respectively.

This report has been prepared for the exclusive use of Chris and Louise Mason, and their design consultants, for specific application to the project described herein. Should the project be modified, the conclusions and recommendations presented in this report should be reviewed by Christian Wheeler Engineering for

SITE VICINITY

© OpenStreetMap contributors



MASON RESIDENCE, APN 532-010-06-00
SUNSET CLIFFS BOULEVARD
SAN DIEGO, CALIFORNIA



CHRISTIAN WHEELER
ENGINEERING

DATE: AUGUST 2023

JOB NO.: 2230146.01

BY: SD

FIGURE NO.: 1

conformance with our recommendations and to determine whether any additional subsurface investigation, laboratory testing and/or recommendations are necessary. Our professional services have been performed, our findings obtained and our recommendations prepared in accordance with generally accepted engineering principles and practices. This warranty is in lieu of all other warranties, expressed or implied.

SCOPE OF SERVICES

Our preliminary geotechnical investigation consisted of a surface reconnaissance, subsurface exploration, obtaining soil samples, laboratory testing, analysis of field and laboratory data, and review of relevant, readily available geologic literature, and preparation of this report. In consideration of the conditions at the site, the proposed construction, and site access constraints, the following services were provided as part of our investigation.

- Obtaining a boring permit to conduct the proposed subsurface exploration from the County of San Diego.
- Drilling one small diameter boring at the site with a conventional, truck-mounted drill rig in order to explore the subsurface conditions of the site and to obtain samples for laboratory testing.
- Backfilling the boring hole using a grout/bentonite mix as required by the County of San Diego Department of Environmental Health.
- Excavating 2 hand-dug test pits to further explore the existing soil conditions and collect soil samples.
- Backfilling the test pits with the removed soil. It should be noted that the soil was not mechanically compacted and will have to be removed and replaced as compacted fill during future site construction.
- Evaluating, by laboratory tests and our past experience with similar soil types, the engineering properties of the various soil strata that may influence the proposed construction, including bearing capacities, expansive characteristics, and settlement potential.
- Describing the general geology at the site including possible geologic hazards that could have an effect on the proposed construction, and provide the seismic design parameters in accordance with the 2022 edition of the California Building Code. A liquefaction analysis is not within the scope of this investigation.
- Identifying the location of the “edge of bluff” to the west of the site in accordance with the City of San Diego Coastal Bluffs and Beaches Guidelines. This included geologic mapping of the bluff and beach bench to the west of the subject site by engineering geologists from our firm.

- Performing computer-assisted slope stability analyses of the proposed lot configuration and bluff in order to quantify the minimum global factor-of-safety of the proposed site development and to determine the approximate location of the 1.5-factor of safety line.
- Researching the historical rate of erosion of the top of bluff to the west of the subject site.
- Recommending a minimum setback, based on the geologic and geotechnical conditions, from the edge of the bluff for the proposed improvements, in accordance with the City of San Diego Coastal Bluffs and Beaches Guidelines.
- Discussing potential construction difficulties that may be encountered due to soil conditions, groundwater or geologic hazards, and provide geotechnical recommendations to mitigate identified construction difficulties.
- Providing site preparation and grading recommendations for the anticipated work, as necessary.
- Providing design recommendations for shored and unshored temporary cut slopes.
- Providing earth retaining wall design recommendations.
- Providing foundation recommendations for the type of construction anticipated and develop soil engineering design criteria for the recommended foundation designs.
- Providing design parameters for restrained and unrestrained retaining walls.
- Providing this preliminary geotechnical report presenting the results of our investigation, including plot plans showing the location of our subsurface explorations, excavation logs, laboratory test results, and our conclusions and recommendations for the proposed project.

FINDINGS

SITE DESCRIPTION

The subject site is an unoccupied residential lot, identified as Assessor's Parcel Number 532-010-06-00, which is located adjacent to and east of Sunset Cliffs Boulevard in the Point Loma area of San Diego, California. For the purposes of this report, the subject site is assumed to face west towards Sunset Cliffs Boulevard, when in actuality it faces west-southwest. The site is bound to the north and south by similarly developed residential lots, to the east by an alley, and to the west by Sunset Cliffs Boulevard. Topographically, the site generally gently descends in a westerly direction from the alley in the east, down to Sunset Cliffs Boulevard to the west. According to the topographic survey provided (Jennings Land Surveying, 2023), on-site elevations range from 67 feet above Mean Sea Level (MSL) along the western property line to 85 feet along the east property line.

Adjacent and to the west of the site, Sunset Cliffs Boulevard is a 60-foot wide right-of way. Located west of the right-of-way is a relatively narrow recreational parkland space. Further west, the topography descends steeply down an approximately 70-foot-high coastal bluff to a rocky shelf below and the Pacific Ocean. In general, the adjacent and nearby bluffs consist of natural slopes with steep, irregular inclinations.

SITE HISTORY

To understand the development history of the parcel, we have reviewed available historical aerial photographs and topographic maps from US. Navy (1928), National Environmental Title Research, LLC (2023) and the United States Geological Survey Historical Topographic Map Explorer (2023).

Based upon our research, it appears the site and general vicinity was mass graded around the late 1920's and developed with low density multi-family housing. Original grading operations in the general vicinity appear limited to cuts and fills of a few feet. In the late 1950's and early 1960's the original housing in the general vicinity was entirely demolished and the surrounding parcels were redeveloped with new single-family residences. By 1972 the adjacent parcels had been developed. The subject site does not appear to have been occupied since the demolition of the original structures in the late 1950's and early 1960's.

GENERAL GEOLOGY AND SUBSURFACE CONDITIONS

GEOLOGIC SETTING AND SOIL DESCRIPTION: The subject site is located in the Coastal Plains Physiographic Province of San Diego County. Based upon the findings of our subsurface exploration and review of readily available, pertinent geologic and geotechnical literature, it was determined that the site is underlain by a relatively thin veneer of man-placed artificial fill soils, Quaternary-age sedimentary deposits referred to locally as old paralic deposits, and Cretaceous-age sedimentary deposits of the Point Loma Formation. Old paralic deposits over Point Loma Formation materials were also exposed in the coastal bluff. These materials are described below.

ARTIFICIAL FILL (Qaf): Artificial fill soils were encountered underlying the entire site and in all subsurface explorations, generally extending to a maximum depth of about 4 to 5 feet below existing grade. Deeper fill soils may exist in areas of the site not investigated. The fill materials consisted of dark brown to dark reddish brown, damp, very loose to loose, silty sand (SM). The fill soils were judged to have very low Expansion Index (EI<20).

OLD PARALIC DEPOSITS (Qop₆): Quaternary-age old paralic deposits were encountered underlying the artificial fill in all subsurface explorations. The old paralic deposit materials extended to a maximum

depth of about 37 feet below existing grade (boring B-1. The old paralic deposit materials consisted of reddish to orangish brown, damp to moist, medium dense to dense, silty sand (SM). Trace amounts of rounded gravels were also encountered. The old paralic deposits were judged to have very low Expansion Index ($EI < 20$).

POINT LOMA FORMATION (Kp): Cretaceous-age sedimentary deposits of the Point Loma Formation underlie the old paralic deposits and fill materials on-site. These materials were encountered in boring B-1 at a depth of about 37 feet below existing site grades and underlie the entirety of the site at depths varying from approximately 25 to 40 feet. Encountered in our boring and observed along the nearby coastal bluff, the Point Loma Formation consists of interbedded gray and yellow to yellowish-brown, damp to moist, hard, lean clays (CL) and sandy silts (ML), and very dense, silty sands (SM).

GEOLOGIC STRUCTURE: As part of our investigation, bedding observations and measurements were taken at the bottom of the bluff in the Point Loma Formation. The bedding strikes at $N15^{\circ}W$ and dips approximately 6° degrees to the east-northeast, into the coastal bluff. Our review of the published “Geologic Map of the San Diego 30’x60’ Quadrangle, California” by Kennedy and Tan (2008) indicates our bedding observations and measurements are in general conformance with the mapped geologic structure of the Point Loma Formation in the vicinity of the subject site. The old paralic deposits generally display faint bedding dipping up to a few degrees ($< 2^{\circ}$) to the west and southwest in the vicinity of the site. The geologic contact between the Point Loma Formation and the younger overlying paralic deposits is an unconformity that gently dips to the west up to a few degrees in the vicinity of the subject site. It is our opinion that the bedding of the Point Loma Formation is generally favorable with respect to global stability of the bluff. Furthermore, it is our opinion that the geologic structure is generally neutral to favorable and the proposed development is low risk.

GROUNDWATER: A minor amount of seepage was encountered in boring B-1 at 37 feet below existing grade on the geologic contact between the old paralic deposits and the Point Loma Formation. It is our opinion that the seepage is likely due to water infiltrating through the paralic deposit materials and perching on the very dense and very low permeable Point Loma Formation. It is our opinion that the seepage does not present a significant or adverse groundwater condition and should not affect the proposed development. We do not expect any further adverse groundwater related conditions during or after construction. However, it should be recognized that minor groundwater seepage problems might occur after construction and landscaping are completed, even at a site where none were present before construction. These are usually minor phenomena and are often the result of an alteration in drainage patterns and/or an increase in irrigation water. Based on the anticipated construction and the permeability of the on-site soils, it is our opinion that any seepage problems that may

occur will be minor in extent. Furthermore, it is our opinion that these problems can be most effectively corrected on an individual basis if and when they occur.

TECTONIC SETTING: No active faults are known to traverse the subject site. A fault was observed in the coastal bluff to the southwest of the subject site. The fault was observed and measured at a bearing of N35°E, and the fault plane dips 72° to the southeast. The northwest block was upthrown relative to the downthrown southeast block. Projecting continuance of this fault indicates it may cross the western portion of the subject site, however it is not projected to underlie the proposed structures. Furthermore, it was observed that the fault offsets only the Cretaceous-aged sediments of the Point Loma Formation and does not offset the overlying Quaternary-aged old paralic deposits. Therefore, it is our opinion that this is a concealed Pre-Holocene fault and that the fault is not considered active. It is also our opinion that this fault does not present an unacceptable risk for the proposed development. Classification of active and Pre-Holocene faults is described below.

It should be noted that much of Southern California, including the San Diego County area, is characterized by a series of Quaternary-age fault zones that consist of several individual, en echelon faults that generally strike in a northerly to northwesterly direction. Some of these fault zones (and the individual faults within the zone) are classified as “active” according to the criteria of the 2018 revision of *‘Special Publication 42, Earthquake Fault Zones’* by the California Geologic Survey (CGS). The CGS use the following three-tier fault classification system:

- *‘Holocene-active faults’*; Faults with displacement within the Holocene epoch (the last 11,700 years). Commonly referred to as active faults.
- *‘Pre-Holocene faults’*; Faults with displacement with the Pleistocene epoch (between 11,700 to 2.6 million years ago), but not within the Holocene epoch. Previously terminology by the CGS referred to these faults as *‘potentially active’*, however this terminology is being phased out.
- *‘Age-undetermined faults’*; Faults with displacement unconstrained by dating methods or limitations in stratigraphic resolution.

Faults older than Quaternary-age (older than the Pleistocene epoch) are not specifically defined in Special Publication 42, however, it is generally accepted that faults showing no movement during the Quaternary period (up to 2.6 million years) may be considered to be *‘inactive’*.

Projects near *Holocene-active faults* are regulated by the Alquist-Priolo Earthquake Fault Zoning Act of 1972. The Act prohibits the development of structures for human occupancy across the surface trace of an active fault in

California, with certain exceptions. Faults determined by the CGS as *sufficiently active* and *well-defined* are identified on Alquist-Priolo regulatory maps as *Active Fault Traces* and bounded by buffers called *Earthquake Fault Zones*. Sites within these zones are required to undergo fault hazard studies as part of the geotechnical investigation. Review of the local Alquist-Priolo regulatory maps indicates that the subject site is not underlain by a known active fault and is not within an Earthquake Fault Zone.

A review of available geologic maps indicates that the Rose Canyon Fault Zone is the closest active fault zone and is located approximately 3.4 miles southeast, east and northeast of the subject site. Other active fault zones in the region that could possibly affect the site include the Coronado Bank, San Diego Trough and San Clemente Fault Zones to the southwest, the Newport-Inglewood and Palos Verdes Fault Zones to the northwest, and the Elsinore, Earthquake Valley, San Jacinto, and San Andreas Fault Zones to the northeast. A portion of these fault zones are summarized in Table I below.

TABLE I: PROXIMAL FAULT ZONES

Fault Zone	Distance
Rose Canyon	3.4 mi
Coronado Bank	6 mi
Newport-Inglewood	8 mi
San Diego Trough	17 mi
San Clemente	38 mi
Elsinore (Julian)	40 mi
Earthquake Valley	45 mi
Palos Verde	52 mi
San Jacinto (Anza)	59 mi
San Andreas	81 mi

BLUFF EDGE: The edge of the bluff (for development purposes) is defined in the City of San Diego document titled “Coastal Bluffs and Beaches Guidelines.” Where a traditional or “simple” coastal bluff is present, the “coastal bluff edge” is defined in the document as “the seaward-most termination of the top of a sensitive coastal bluff where the downward gradient of the land surface begins to increase more or less continuously until it reaches the general gradient of the coastal bluff face.” Additionally, “Where a sea cave (a natural cavity or recess beneath the surface of the earth that is formed by or a result of marine erosion) or overhang exists, the coastal bluff edge shall be either the simple bluff edge or a line following the landward most point of the sea cave projected to the ground surface above, whichever is more landward.”

Based on our reconnaissance of the coastal bluff, the edge of the coastal bluff to the west of the site is defined as “the seaward-most termination of the top of a sensitive coastal bluff” (Simple Bluff scenario). We

have identified the bluff edge location and have plotted the line of the bluff edge on Existing and Proposed Site Plan and Geotechnical Maps, Plate Nos. 1A and 1B of this report. We have also plotted the bluff edge on the Geologic Cross Sections, Plate Nos. 2, 3 and 4. Furthermore, we have also plotted the 40-foot setback line from the bluff edge on all plates. The proposed construction will not encroach on the 40-foot setback from the bluff edge and complies with section 143.0143(f) of the City of San Diego Municipal Code.

BLUFF EROSION: Coastal bluff recession is a process which is presently occurring in much of coastal San Diego County. Typically, coastal recession occurs through three modes which include: 1) undercutting of the base of the cliff by wave action and subsequent block falls of the overlying materials; 2) undercutting of the old paralic deposits or other surficial material, initiated by water seepage conditions at the formational contact, and subsequent slumping of the overlying materials; and 3) deep-seated rotational-type failures.

The Cretaceous-aged sediments of the Point Loma Formation that comprise the lower and middle bluff face to the west of the site are “overconsolidated”, stand well at steep inclinations, and have a relatively slow rate of erosion. However, the Quaternary-age paralic deposits that comprise the upper bluff areas are only slightly consolidated, tend to erode back to a stable angle of repose of approximately 35 to 40 degrees when they become oversteepened, and can experience relatively rapid erosion during unfavorable conditions. Today, the inclination of the upper bluff face to the west of the subject site is considered to be moderately sloped, as compared to other regional coastal bluffs where the paralic deposits that comprise the upper bluff regions are often near vertical and thus considered more likely to experience accelerated rates of erosion over the short term. Although difficult to quantify, it appears that the moderate inclination of the upper coastal bluff to the west of the site, which is indicative of recently higher rates of erosion of the upper bluff, is the result of local drainage down the face of the bluff during heavy rainfall events and, in isolated areas, pedestrian traffic along the face of the bluff.

Historically, the mode of recession of the coastal bluff in the vicinity of the subject site appears to be manifested both as small to moderate block falls caused by erosion along the fractures and joints in the Point Loma Formation and by subaerial erosion of the old paralic deposits and other surficial materials caused by severe storm conditions, drainage conditions, or the activities of man. Bluff recession in the vicinity of the site has also occurred along a series of sea caves and arches along the Sunset Cliffs area, which appear to be controlled by regional patterns of structural defects (joints, fractures, and faults).

The rate of erosion along the coastal bluff in the vicinity of the site has typically been variable with periods of very little recession alternating with episodes in which the lower bluff areas are rapidly eroded during periods of high storm activities and when substantial surficial erosion occurs as the result of increased natural and

channeled drainage. The Shoreline Erosion Assessment and Atlas of the San Diego Region prepared by the California Department of Boating and Waterways and San Diego Association of Governments in 1991 indicates that the relative shoreline risk assessment in the area is moderate.

In order to quantify the rate of bluff edge retreat of the coastal bluff west of the subject site, we have obtained and reviewed a copy of the County of San Diego aerial photograph E1 of Packet #66, which was taken in 1928 by the US. Navy. Original and enlarged copies of these photographs were reviewed to identify the former location of the edge of bluff to the west of the site. Rather than scaling the enlarged photographs to compare the locations of the former (1928) edge of bluff to its current location, the referenced 1953 City of San Diego 200-scale topographic map sheet 202-1689 was utilized to compare the former and current locations of the bluff edge to the west of the site. It is our professional opinion and judgment that based on the clarity of the edge of bluff shown on the 1953 topographic map and the definitive scaling of such map, the use of this map to measure historical bluff edge retreat results in a higher level of precision than if such measurements were made utilizing the above described 1928 aerial photographs.

By plotting the locations of our cross sections A-A', B-B' and C-C' on an enlarged (1"=50') copy of the above described 1953 topographic map, the 1953 edge of bluff was measured to be 86 feet, 95 feet, and 113 feet west of the site's western property line in those cross sections, respectively. Today, the edge of bluff is 79 feet, 86 feet, and 99 feet west of the site's western property line in the cross sections A-A', B-B', and C-C', respectively. This comparison indicates that over the last 70 years, the edge of bluff to the west of the site has recessed up to 7 feet, 9 feet, and 14 feet along cross sections A-A', B-B', and C-C', respectively. This amount of retreat correlates with a mean annual rate of retreat of 0.10 feet/year, 0.13 feet/year, and 0.20 feet/year along A-A', B-B', and C-C', respectively. Our analyses are illustrated on Plate 5A, the Coastal Bluff Retreat Analysis.

This greatest of these mean annual rates of retreat (0.20 feet/year) corresponds to approximately 15 feet of bluff edge erosion over the next 75 years. This amount of potential bluff edge erosion is less than the minimum bluff edge setback recommended herein. A line depicting the projected bluff edge recession over a period of the next 75 years is presented on Plate Nos. 1A and 1B of this report.

We have also included as Plate 5B a historical, aerial photographic timeline of the evolution of the coastline in the vicinity of the site. The data source is the California Coastal Records Projects, which is a series of photographs of the coastline taken in 1972, 1979, 2002, 2004, 2010 and 2013. These oblique angle photographs were taken from a helicopter and vary in quality and resolution depending on the camera technology at the time each photograph was taken. Due to multiple factors such as resolution, angle and

lighting, we are not able to measure the amount of bluff recession, and so analysis of these photographs only provides a qualitatively supplement to our bluff retreat analysis and opinions on the rate of bluff recession in the vicinity of the site. It is our opinion that over the 41-year period from 1972 to 2013, we can see a recession of the bluff edge that corresponds reasonably with the aforementioned recession rates from our analysis of the 1953 topographic map and site topographic survey.

It should be understood that the mean annual rates of bluff top retreat utilized in our bluff recession analyses represent average rates of bluff top/sea cliff retreat. As such, year to year variations in the rate of bluff top recession should not only be anticipated but also expected. However, it is our professional opinion and judgment that the horizontal extent of bluff edge retreat over the design life of the proposed residence will be appreciably less than the bluff top setback recommendations contained herein.

LANDSLIDE POTENTIAL AND BLUFF STABILITY

GENERAL: The Relative Landslide Susceptibility and Landslide Distribution Map of the Point Loma Quadrangle prepared by the California Division of Mines and Geology (Tan, 1995) indicates that the majority of the site is situated within Relative Landslide Susceptibility Area 3-1. Area 3-1 is considered to be “generally susceptible” to slope failures. The western portion of the site as well as the adjacent roadway and bluff areas, however, are situated within Relative Landslide Susceptibility Area 4-1. Area 4 is considered to be a “most susceptible” to slope failures; Subarea 4-1 includes slopes considered to be generally outside of the limits of known landslides but contain “oversteepened high coastal bluffs which are subject to active sea-wave erosion” (Tan, 1995). Based on our investigation, the site was found to be underlain at shallow depths by medium dense to dense old paralic deposits over very dense, well-consolidated Point Loma Formation. As part of our scope of services, we have prepared a quantitative slope stability analysis of the existing bluff areas off-site to the west.

STABILITY ANALYSIS: To analyze the stability of the site and proximal bluff areas, three cross-sections were drawn perpendicular to the bluff face from north to south across the site. These cross-sections, labeled as A-A', B-B', and C-C' are presented on Plate Nos. 2, 3 and 4 of this report.

The results of the stability analyses are presented in Appendix C. As described above in the “Geologic Setting and Soil Description” section of this report, the existing bluff is comprised of Cretaceous-age materials of the Point Loma Formation and Quaternary-age old paralic deposits.

Our slope (bluff) stability analyses have been performed incorporating circular-type modes of failure observed during historic bluff failures within the earth materials that underlie the site and bluff areas that display favorable (into-slope) bedding orientations. Given the favorable bedding orientation of the materials of Point Loma Formation, the modeling of block-type failure mechanisms was not considered necessary or performed during our bluff stability analyses. As presented herein, the minimum factors-of-safety that are considered stable are 1.5 for static slope (bluff) stability analyses and 1.1 for pseudo-static slope (bluff) stability analyses.

STRENGTH PARAMETERS: The strength parameters for the materials comprising the bluff were estimated based on the results of direct shear testing and our experience with similar soil types in the vicinity of the site. The results of our direct shear testing are presented in Appendix B of this report. Since the materials of the Point Loma Formation that underlie the site were observed to display into-slope bedding orientations, our stability analyses have been performed incorporating isotropic soil strength parameters for the Point Loma Formation.

The unit weights of the earth materials that underlie the subject site and adjacent areas utilized in our stability analyses were chosen based on the results of our laboratory testing and our experience with similar materials in the vicinity of the subject site. It is our professional opinion that the strength parameters and unit weights presented below and utilized in our stability analyses provide for conservative slope stability analyses.

Soil Type	Unit Weight, γ	Phi, φ	Cohesion, c
Artificial Fill (Qaf)	120 pcf	30°	100 psf
Old Paralic Deposits (Qop)	120 pcf	33°	200 psf
Point Loma Formation (Kp ₁)	120 pcf	35°	1,250 psf
Point Loma Formation (Kp ₂)	120 pcf	30°	1,500 psf

METHOD OF ANALYSIS: The analyses of the gross stability of the coastal bluff to the west of the site were performed using Version 2 of the GSTABL7© computer program developed by Garry H. Gregory, PE. The program analyzes circular, block, specified, and randomly shaped failure surfaces using the Modified Bishop, Janbu, or Spencer's Methods. The STEDwin© computer program, developed by Harald W. Van Aller, P. E., was used in conjunction with this program for data entry and graphics display.

The proposed topographies of the subject site and adjacent areas were analyzed for circular-type failures originating within lower and mid/upper (at base of paralic deposits) portions of the bluff face and terminating at or landward of the edge of bluff. Each failure analysis was programmed to run at least 3,000 random failure surfaces. As described above, based on the into-slope bedding within the Point Loma

Formation, stability analyses incorporating block-type failure mechanisms are not considered necessary and, as such, were not performed. The most critical failure surfaces from each analysis were accumulated and sorted by value of the factor-of-safety. After the specified number of failure surfaces were successfully generated and analyzed, the ten most critical surfaces were plotted so that the pattern may be studied. Additionally, pseudo-static stability analyses of the bluff were performed modeling each of the above-described stability analyses using kh coefficient equal to 0.15g and considering a factor-of-safety of 1.1 to be generally stable with regards to pseudo-static bluff stability.

RESULTS OF STATIC STABILITY ANALYSIS: The results of our static stability analyses are presented in Appendix C of this report.

Our analyses indicate that the lowest static factors-of-safety against bluff failures of the existing bluff to the west of site are approximately 1.3, 1.0, and 1.0 along cross sections A-A', B-B', and C-C' respectively. It should be noted that our analyses modelled all portions of the bluff face seaward of the small undercut along its base as being removed. It should also be recognized that these results indicate that the strength parameters modelled in our analyses were conservatively estimated.

Following the initial analyses, additional stability analyses were performed to determine the locations along cross sections A-A', B-B', and C-C' where minimum factors-of-safety of 1.5 or higher against failure are exhibited. Our analyses demonstrate that a minimum factor-of-safety of 1.5 or greater is demonstrated along A-A', B-B', and C-C' at distances of 105 feet, 125 feet, and 110 feet from the western edges of A-A', B-B', and C-C', respectively. Plate Nos. 1A and 1B of this report depict where a minimum factor-of-safety of 1.5 or greater are demonstrated along the edge of bluff in the vicinity of cross sections A-A', B-B', and C-C'.

RESULTS OF PSEUDO-STATIC STABILITY ANALYSIS: The results of our pseudo-static stability analyses are presented in Appendix C of this report.

Our analyses demonstrate that a minimum factor-of-safety of 1.1 or greater is demonstrated along A-A', B-B', and C-C' at distances of 90 feet, 115 feet, and 104 feet from the western edges of A-A', B-B', and C-C', respectively. Plate Nos. 1A and 1B of this report depict where a minimum factor-of-safety of 1.1 or greater are demonstrated along the edge of bluff in the vicinity of cross sections A-A', B-B', and C-C'.

RECOMMENDED BLUFF TOP SETBACK: Based on the results of our quantitative bluff stability analyses, the fact that our conservative estimation of future erosion of the edge of bluff to the west of the site is less than the City's standard setback, and the requirements of the City of San Diego Municipal Code, it is

our professional opinion and judgment that the required bluff top setback distance should be 40 feet. The location of this setback is presented on Plate Nos. 1A through 4 of this report.

GEOLOGIC HAZARDS

SEISMIC SAFETY STUDY: As part of our investigation, we have reviewed the City of San Diego Seismic Safety Study. This study is the result of a comprehensive investigation of the city, which rates areas according to geological risk potential (nominal, low, moderate and high), and identifies any potential geotechnical hazards and/or describes geomorphic conditions. The City of San Diego Seismic Safety Study places the western portion of the site in Hazard Category 43, which is assigned to Coastal Bluffs where the geologic structure is generally unfavorable. It should be noted that the geologic structure of the sediments comprising the coastal bluff to the west of Sunset Cliffs Boulevard is considered favorable with regards to the bluff's stability. The Seismic Safety Study places the eastern portion of the site in Hazard Category 52, which is assigned to gently sloping to steep terrain with favorable geologic structure.

STRONG GROUND MOTION: The most likely geologic hazard to affect the site is strong ground motion as a result of movement along one of the major, active fault zones mentioned above. Probable ground shaking levels at the site could range from slight to moderate, depending on such factors as the magnitude of the seismic event and the distance to the epicenter. It is likely that the site will experience the effects of at least one moderate to large earthquake during the life of the proposed improvements. The seismic design factors applicable to the subject site are provided hereinafter in the Seismic Design Factors section of this report. Construction in accordance with the California Building Code and the requirements of the City of San Diego will minimize damage from strong ground motions and mitigate risk to an acceptable level.

SURFACE RUPTURE: Sites susceptible to ground rupture are typically underlain by active fault zones. The site is not underlain by an active fault, nor is it within an Alquist-Priolo Earthquake Fault Zone, and therefore it is our opinion that the site is not considered susceptible to surface rupture.

LIQUEFACTION: The earth materials underlying the site are not considered subject to liquefaction due to such factors as soil density, grain-size distribution, the absence of shallow groundwater conditions.

TSUNAMIS: Tsunamis are great sea waves produced by a submarine earthquakes, submarine landslides, volcanic eruptions or meteorite impacts. According to the Tsunami Hazard Area Map, San Diego County published by the California Geological Survey, dated 2022, the site is located outside of a tsunami inundation

area. Furthermore, based on the bathymetry of the offshore San Diego coastline, the fact that historical tsunamis reaching San Diego have generally been within the normal swell and tidal range, and the minimum elevation of the site of ± 67 feet, it is our professional opinion and judgment that the tsunami risk at the site is low.

SEICHES: Seiches are periodic oscillations in large bodies of water such as lakes, harbors, bays or reservoirs. Due to the site's location, it will not be affected by seiches.

FLOODING: As delineated on the *Flood Insurance Rate Map (FIRM)*, map number 06073C1857H prepared by the Federal Emergency Management Agency, dated December 20, 2019, the site is in Zone X which is labelled as an '*area of minimal flood hazard*'. Areas of minimal flood hazards are located outside of the boundaries of both the 100-year and 500-year flood zones.

OTHER POTENTIAL GEOLOGIC HAZARDS: Other potential geologic hazards such as volcanoes and naturally occurring asbestos should be considered to be negligible or nonexistent.

CONCLUSIONS

It is our professional opinion that no geotechnical conditions exist at or in the general vicinity of the subject property that would preclude the construction of the proposed residence, garage and associated improvements, provided the recommendations presented herein are followed. The main geotechnical consideration affecting the proposed construction is potentially compressible fill soils underlying the site. These materials were encountered in all our subsurface explorations and extend to a maximum depth of about 5 feet below existing grade. However, deeper artificial fill may exist in areas of the site not investigated. It is recommended that potentially compressible fill soils to support settlement-sensitive structures and improvements be removed during grading operations and replaced as properly compacted structural fill soils.

The site is located in an area that is relatively free of geologic hazards that have an unacceptable level of risk or significant detrimental effect on the proposed construction. The most likely geologic hazard that could affect the site is ground shaking due to seismic activity along one of the regional active faults. However, construction in accordance with the requirements of the most recent edition of the California Building Code and the local governmental agencies should provide a level of life-safety suitable for the type of development proposed.

RECOMMENDATIONS

GRADING AND EARTHWORK

GENERAL: All grading should conform to the guidelines presented in the current edition of the California Building Code, the minimum requirements of the City of San Diego, and the recommended Grading Specifications and Special Provisions attached hereto, except where specifically superseded in the text of this report.

PREGRADE MEETING: It is recommended that a pregrade meeting including the grading contractor, the client, and a representative from Christian Wheeler Engineering be performed, to discuss the recommendations of this report and address any issues that may affect grading operations.

OBSERVATION OF GRADING: Continuous observation by the Geotechnical Consultant is essential during the grading operation to confirm conditions anticipated by our investigation, to allow adjustments in design criteria to reflect actual field conditions exposed, and to determine that the grading proceeds in general accordance with the recommendations contained herein.

CLEARING AND GRUBBING: Site preparation should begin with the removal from the site of any existing vegetation and other deleterious materials from areas of the site to receive the proposed improvements and/or fill materials.

SITE PREPARATION: Existing fill soils and any loose old paralic deposits not excavated to achieve finish pad grades should be removed to the contact with competent native materials. Based on our subsurface explorations, the maximum removal depth is expected to be about 5 feet below existing grade. Deeper removals may be necessary in areas of the site not investigated. The horizontal limits of the removals should include all areas that will support settlement-sensitive improvements such as structures, patios and walkways, and new fills. The removals should extend to the property lines; however, no removals are recommended beyond property lines. All areas cleaned out of unsuitable soils should be approved by the geotechnical engineer or his representative prior to replacing any of the excavated soils. The excavated materials can be replaced as properly compacted fill in accordance with the recommendations presented in the "Compaction and Method of Filling" section of this report.

PROCESSING OF FILL AREAS: Prior to placing any new fill soils in areas that have been cleaned out to receive fill and have been approved by the Geotechnical Consultant or his representative, the exposed soils

should be scarified to a depth of about 12 inches, moisture conditioned, and compacted as described hereinafter.

COMPACTION AND METHOD OF FILLING: In general, all structural fill placed at the site should be compacted to a relative compaction of at least 90 percent of its maximum laboratory dry density as determined by ASTM Laboratory Test D1557. Fills should be placed at or slightly above optimum moisture content, in lifts six to eight inches thick, with each lift compacted by mechanical means. Fills should consist of approved earth material, free of trash or debris, roots, vegetation, or other materials determined to be unsuitable by the Geotechnical Consultant. Fill material should be free of rocks or lumps of soil in excess of three inches in maximum dimension.

Utility trench backfill within five feet of the proposed structure and beneath all concrete flatwork or pavements should be compacted to a minimum of 90 percent of its maximum dry density.

SURFACE DRAINAGE: The drainage around the proposed improvements should be designed to collect and direct surface water away from proposed improvements and the top of slopes toward appropriate drainage facilities. Rain gutters with downspouts that discharge runoff away from the structure into controlled drainage devices are recommended.

The ground around the proposed improvements should be graded so that surface water flows rapidly away from the improvements without ponding. In general, we recommend that the ground adjacent to structure slope away at a gradient of at least 5 percent for a minimum distance of 10 feet. If the minimum distance of 10 feet cannot be achieved, an alternative method of drainage runoff away from the building at the termination of the 5 percent slope will need to be used. Swales and impervious surfaces that are located within 10 feet of the building should have a minimum slope of 2 percent. It is essential that new and existing drainage patterns be coordinated to produce proper drainage.

Drainage patterns provided at the time of construction should be maintained throughout the life of the proposed improvements. Site irrigation should be limited to the minimum necessary to sustain landscape growth. Over watering should be avoided. Should excessive irrigation, impaired drainage, or unusually high rainfall occur, zones of wet or saturated soil may develop.

GRADING PLAN REVIEW: The final grading plan, if one is required, should be submitted to this office for review in order to ascertain that no additional recommendations are needed due to changes in the

anticipated construction. Our firm should be notified of changes to the proposed project that could necessitate revisions of or additions to the information contained herein.

FOUNDATIONS

GENERAL: Based on our findings and engineering judgment, the proposed structures and associated improvements may be supported by conventional shallow continuous and isolated spread footings founded in newly compacted fill. The following recommendations are considered the minimum based on the anticipated soil conditions after site preparation as recommended in this report is performed, and are not intended to be lieu of structural considerations. All foundations should be designed by a qualified professional.

SHALLOW FOUNDATIONS: Spread footings supporting the proposed structures should extend at least 18 inches below lowest adjacent finish pad grade. Continuous and isolated footings should have a minimum width of 12 inches and 24 inches, respectively. Spread footings supporting the proposed miscellaneous exterior improvements should be embedded at least 12 inches below lowest adjacent finish pad grade. Continuous and isolated footings supporting exterior improvements should have a minimum width of 12 inches and 18 inches, respectively. Retaining wall footings should have a minimum embedment depth of 18 inches below lowest adjacent finished pad grade and a minimum width of 24 inches. Retaining walls and site walls located at property lines should also extend at least 6 inches into competent native deposits. Footings located adjacent or within slopes should be extended to a depth such that a minimum horizontal distance of 7 feet exists between the leading bottom of the footing and the face of the slope. For retaining walls exceeding 5 feet in retained height, the minimum setback should be increased to 10 feet.

BEARING CAPACITY: Spread footings supporting the proposed structures and exterior improvements with a minimum embedment depth of 24 inches and minimum width of 12 inches may be designed for an allowable soil bearing pressure of 2,000 pounds per square foot (psf). This value may be increased by 600 psf for each additional foot of embedment depth and 400 psf for each additional foot of width, up to a maximum of 4,000 psf. The bearing values may also be increased by one-third for combinations of temporary loads such as those due to wind or seismic loads.

FOOTING REINFORCING: Reinforcement requirements for foundations should be provided by a structural designer. However, based on the expected soil conditions, we recommend that the minimum reinforcing for continuous footings consist of at least two No. 5 bars positioned near the bottom of the footing and two No. 5 bars positioned near the top of the footing.

LATERAL LOAD RESISTANCE: Lateral loads against foundations may be resisted by friction between the bottom of the footing and the supporting soil, and by the passive pressure against the footing. The coefficient of friction between concrete and soil may be considered to be 0.30. The passive resistance may be considered to be equal to an equivalent fluid weight of 300 pounds per cubic foot. These values are based on the assumption that the footings are poured tight against undisturbed soil. If a combination of the passive pressure and friction is used, the friction value should be reduced by one-third.

SPECIAL CONDITIONS: The bottom of footings located in areas of the site where site preparation cannot be performed or property line foundation excavations should be moisture conditioned and compacted to at least 95 percent of its maximum laboratory dry density as determined by ASTM Laboratory Test D1557. These footings may be designed for an allowable soil bearing pressure of 1,000 pounds per square foot (psf). The bearing value may also be increased by one-third for combinations of temporary loads such as those due to wind or seismic loads.

FOUNDATION EXCAVATION OBSERVATION: All footing excavations should be observed by Christian Wheeler Engineering prior to placing of forms and reinforcing steel to determine whether the foundation recommendations presented herein are followed and that the foundation soils are as anticipated in the preparation of this report. All footing excavations should be excavated neat, level, and square. All loose or unsuitable material should be removed prior to the placement of concrete.

SETTLEMENT CHARACTERISTICS: The anticipated total and differential settlement is expected to be less than about 1 inch and ½ inch over forty feet, respectively, provided the recommendations presented in this report are followed. It should be recognized that minor cracks normally occur in concrete slabs and foundations due to concrete shrinkage during curing or redistribution of stresses, therefore some cracks should be anticipated. Such cracks are not necessarily an indication of excessive vertical movements.

EXPANSIVE CHARACTERISTICS: The prevailing foundation soils are expected to have a low expansive potential (EI between 21 to 50). The recommendations within this report reflect these conditions.

FOUNDATION PLAN REVIEW: The final foundation plan and accompanying details and notes should be submitted to this office for review. The intent of our review will be to verify that the plans used for construction reflect the minimum dimensioning and reinforcing criteria presented in this section and that no additional criteria are required due to changes in the foundation type or layout. It is not our intent to review structural plans, notes, details, or calculations to verify that the design engineer has correctly applied the geotechnical design values. It is the responsibility of the design engineer to properly design/specify the

foundations and other structural elements based on the requirements of the structure and considering the information presented in this report.

SOLUBLE SULFATES: The water-soluble sulfate content of selected soil samples from the site was determined in accordance with California Test Method 417. The results of these tests indicate that the soil samples had soluble sulfate contents of 0.004 and 0.008 percent. A soluble sulfate content of less than 0.1 percent is considered to have a negligible potential for causing adverse effects on concrete and structural steel materials of the proposed footings. However, it should be recognized that the sulfate content of surficial soils may increase with time due to soluble sulfate in the irrigation water or fertilized use.

It should be understood Christian Wheeler Engineering does not practice corrosion engineering. If a corrosivity analysis is considered necessary, we recommend that the client retain an engineering firm that specializes in this field to consult with them on this matter. The results of our corrosion testing should only be used as a guideline to determine if additional testing and analysis is necessary.

SEISMIC DESIGN FACTORS

The seismic design factors applicable to the subject site are provided below. The seismic design factors were determined in accordance with the 2022 California Building Code. The site coefficients and adjusted maximum considered earthquake spectral response acceleration parameters are presented in the following Table II.

TABLE II: SEISMIC DESIGN FACTORS

Site Coordinates: Latitude	32.7201°
Longitude	-117.2565°
Site Class	C
Site Coefficient F_a	1.2
Site Coefficient F_v	1.5
Spectral Response Acceleration at Short Periods S_s	1.199 g
Spectral Response Acceleration at 1 Second Period S_1	0.415 g
$S_{MS}=F_a S_s$	1.439 g
$S_{M1}=F_v S_1$	0.622 g
$S_{DS}=2/3 * S_{MS}$	0.959 g
$S_{D1}=2/3 * S_{M1}$	0.415 g

Probable ground shaking levels at the site could range from slight to moderate, depending on such factors as the magnitude of the seismic event and the distance to the epicenter. It is likely that the site will experience the effects of at least one moderate to large earthquake during the life of the proposed improvements.

ON-GRADE CONCRETE SLABS

GENERAL: It is our understanding that the floor system of the proposed structures will consist of a concrete slab-on-grade. The following recommendations are considered the minimum slab requirements based on the soil conditions and are not intended in lieu of structural considerations. These recommendations assume that the site preparation recommendations contained in this report are implemented.

INTERIOR FLOOR SLABS: The minimum slab thickness should be 5 inches (actual) and the slab should be reinforced with at least No. 4 bars spaced at 12 inches on center each way. Slab reinforcement should be supported on chairs such that the reinforcing bars are positioned at mid-height in the floor slab. The slab reinforcement should extend down into the perimeter footings at least 6 inches.

UNDER-SLAB VAPOR RETARDERS: Steps should be taken to minimize the transmission of moisture vapor from the subsoil through the interior slabs where it can potentially damage the interior floor coverings. Local industry standards typically include the placement of a vapor retarder, such as plastic, in a layer of coarse sand placed directly beneath the concrete slab. Two inches of sand are typically used above and below the plastic. The vapor retarder should be at least 15-mil Stegowrap® or similar material with sealed seams and should extend at least 12 inches down the sides of the interior and perimeter footings. The sand should have a sand equivalent of at least 30, and contain less than 10% passing the Number 100 sieve and less than 5% passing the Number 200 sieve. The membrane should be placed in accordance with the recommendation and consideration of ACI 302, "Guide for Concrete Floor and Slab Construction" and ASTM E1643, "Standards Practice for Installation of Water Vapor Retarder Used in Contact with Earth or Granular Fill Under Concrete Slabs." It is the flooring contractor's responsibility to place floor coverings in accordance with the flooring manufacturer specifications.

EXTERIOR CONCRETE FLATWORK: Exterior concrete slabs on grade should have a minimum thickness of 5 inches and be reinforced with at least No. 4 bars placed at 18 inches on center each way (ocew). Driveway slabs should have a minimum thickness of 5 inches and be reinforced with at least No. 4 bars placed at 12 inches ocw. Driveway slabs should be provided with a thickened edge at least 18 inches deep and 6 inches wide. All slabs should be provided with weakened plane joints in accordance with the American Concrete Institute (ACI) guidelines. Special attention should be paid to the method of concrete curing to reduce the potential for excessive shrinkage cracking. It should be recognized that minor cracks occur normally in concrete slabs due to shrinkage. Some shrinkage cracks should be expected and are not necessarily an indication of excessive movement or structural distress.

EARTH RETAINING WALLS

FOUNDATIONS: Foundations for any proposed retaining walls should be constructed in accordance with the recommendations for shallow foundations presented previously in this report.

PASSIVE PRESSURE: The passive pressure for the anticipated foundation soils may be considered to be 300 pounds per square foot per foot of depth. The upper foot of embedment should be neglected when calculating passive pressures, unless the foundation abuts a hard surface such as a concrete slab. The passive pressure may be increased by one-third for seismic loading. The coefficient of friction for concrete to soil may be assumed to be 0.30 for the resistance to lateral movement. When combining frictional and passive resistance, the friction should be reduced by one-third.

ACTIVE PRESSURE: The active soil pressure for the design of “unrestrained” and “restrained” earth retaining structures with level backfill may be assumed to be equivalent to the pressure of a fluid weighing 39 and 59 pounds per cubic foot, respectively. These pressures do not consider any other surcharge. If any are anticipated, this office should be contacted for the necessary increase in soil pressure. These values are based on a granular and drained backfill condition. It is anticipated that backfill soils will have to be imported.

Seismic lateral earth pressures may be assumed to equal an inverted triangle starting at the bottom of the wall with the maximum pressure equal to $9.2H$ pounds per square foot (where H = wall height in feet) occurring at the top of the wall.

WATERPROOFING AND WALL DRAINAGE SYSTEMS: The need for waterproofing should be evaluated by others. If required, the project architect should provide (or coordinate) waterproofing details for the retaining walls. The design values presented above are based on a drained backfill condition and do not consider hydrostatic pressures. Unless hydrostatic pressures are incorporated into the design, the retaining wall designer should provide a detail for a wall drainage system. Typical retaining wall drain system details will be provided as Plate No. 6 for informational purposes. Additionally, outlet points for the retaining wall drain system should be coordinated with the project civil engineer.

BACKFILL: Retaining wall backfill soils should be compacted to at least 90 percent relative compaction. Expansive or clayey soils should not be used for backfill material. It is anticipated that backfill soils will have to be imported. The wall should not be backfilled until the masonry has reached an adequate strength.

LIMITATIONS

REVIEW, OBSERVATION AND TESTING

The recommendations presented in this report are contingent upon our review of final plans and specifications. Such plans and specifications should be made available to the geotechnical engineer and engineering geologist so that they may review and verify their compliance with this report and with the California Building Code.

It is recommended that Christian Wheeler Engineering be retained to provide continuous soil engineering services during the earthwork operations. This is to verify compliance with the design concepts, specifications or recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated prior to start of construction.

UNIFORMITY OF CONDITIONS

The recommendations and opinions expressed in this report reflect our best estimate of the project requirements based on an evaluation of the subsurface soil conditions encountered at the subsurface exploration locations and on the assumption that the soil conditions do not deviate appreciably from those encountered. It should be recognized that the performance of the foundations and/or cut and fill slopes may be influenced by undisclosed or unforeseen variations in the soil conditions that may occur in the intermediate and unexplored areas. Any unusual conditions not covered in this report that may be encountered during site development should be brought to the attention of the geotechnical engineer so that he may make modifications if necessary.

CHANGE IN SCOPE

This office should be advised of any changes in the project scope or proposed site grading so that we may determine if the recommendations contained herein are appropriate. This should be verified in writing or modified by a written addendum.

TIME LIMITATIONS

The findings of this report are valid as of this date. Changes in the condition of a property can, however, occur with the passage of time, whether they be due to natural processes or the work of man on this or

adjacent properties. In addition, changes in the Standards-of-Practice and/or Government Codes may occur. Due to such changes, the findings of this report may be invalidated wholly or in part by changes beyond our control. Therefore, this report should not be relied upon after a period of two years without a review by us verifying the suitability of the conclusions and recommendations.

PROFESSIONAL STANDARD

In the performance of our professional services, we comply with that level of care and skill ordinarily exercised by members of our profession currently practicing under similar conditions and in the same locality. The client recognizes that subsurface conditions may vary from those encountered at the locations where our borings, surveys, and explorations are made, and that our data, interpretations, and recommendations be based solely on the information obtained by us. We will be responsible for those data, interpretations, and recommendations, but shall not be responsible for the interpretations by others of the information developed. Our services consist of professional consultation and observation only, and no warranty of any kind whatsoever, express or implied, is made or intended in connection with the work performed or to be performed by us, or by our proposal for consulting or other services, or by our furnishing of oral or written reports or findings.

CLIENT'S RESPONSIBILITY

It is the responsibility of the Client, or his representatives, to ensure that the information and recommendations contained herein are brought to the attention of the structural engineer and architect for the project and incorporated into the project's plans and specifications. It is further their responsibility to take the necessary measures to ensure that the contractor and his subcontractors carry out such recommendations during construction.

FIELD EXPLORATIONS

Three subsurface explorations were made on April 14 and 19, 2023 at the locations indicated on the Existing and Proposed Site Plan and Geotechnical Maps, included herewith as Plate No. 1A and 1B, respectively. These explorations consisted of one boring drilled utilizing a truck mounted drill rig (IR A-300), and two hand-dug test pits. The fieldwork was conducted under the observation and direction of our engineering geology personnel.

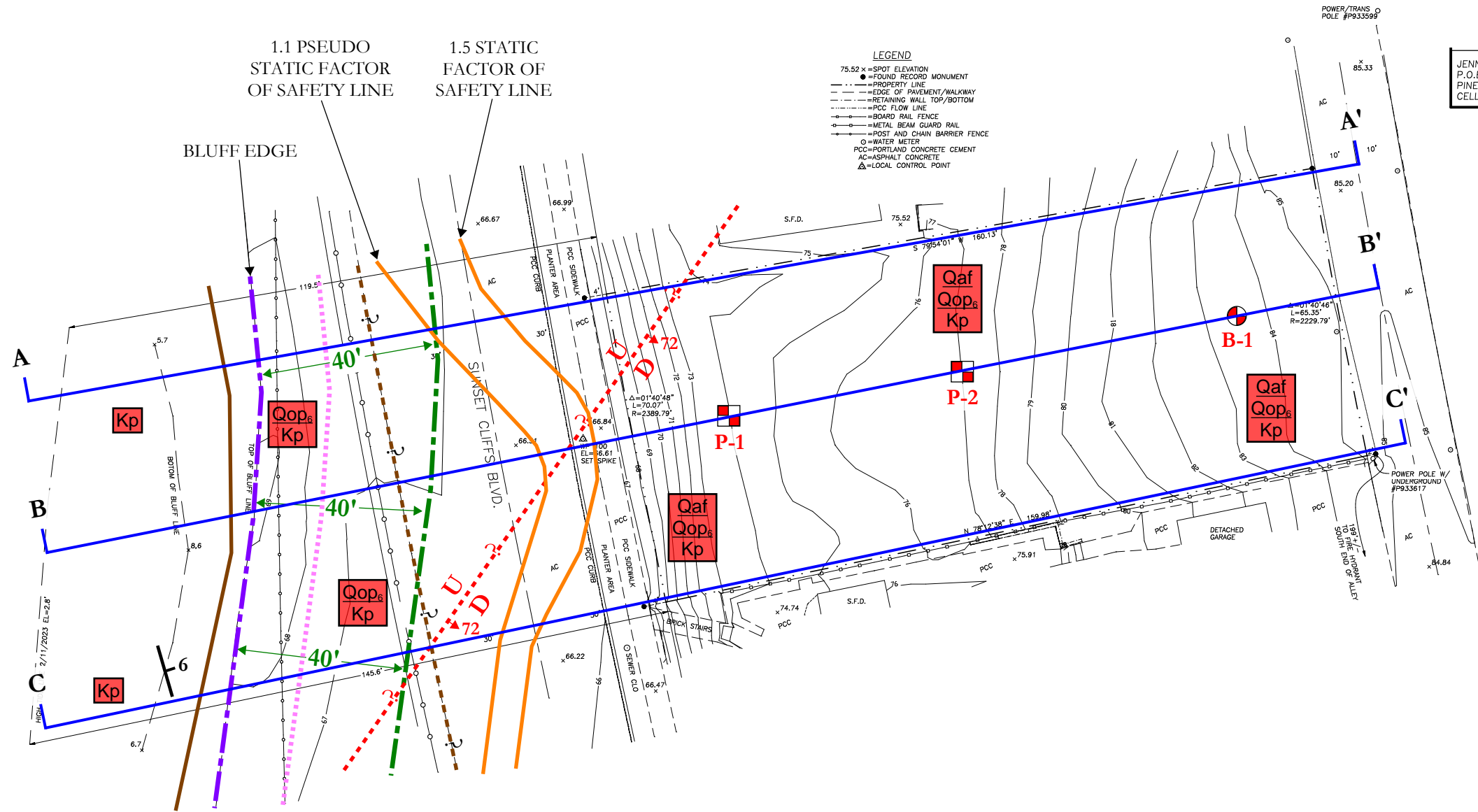
The explorations were carefully logged when made. The logs are presented in Appendix A. The soils are described in accordance with the Unified Soils Classification System. In addition, a verbal textural description,

the wet color, the apparent moisture, and the density or consistency is provided. The relative density of granular soils is given as very loose, loose, medium dense, dense or very dense. The consistency of silts or clays is given as either very soft, soft, medium stiff, stiff, very stiff, or hard.

Relatively undisturbed drive samples were collected using a modified California sampler. The sampler, with an external diameter of 3.0 inches, is lined with 1-inch long, thin brass rings with inside diameters of approximately 2.4 inches. The sample barrel was driven into the ground with the weight of a 140-pound hammer free falling 30 inches in general accordance with ASTM D 3550-17. The number of blows per foot of driving, or as indicated, is presented on the boring logs as an index to the relative resistance of the sampled materials. The samples were removed from the sample barrel in the brass rings, and sealed. Disturbed bulk and standard penetration test samples of the earth materials encountered were also collected. Samples were transported to our laboratory for testing.

LABORATORY TESTING

Laboratory tests were performed in accordance with the generally accepted American Society for Testing and Materials (ASTM) test methods or suggested procedures. A brief description of the tests performed and the subsequent results are presented in Appendix B.

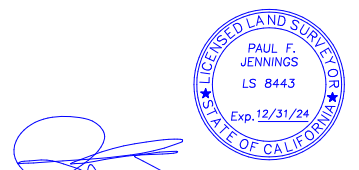


JENNINGS LAND SURVEYING
 P.O. BOX 376
 PINE VALLEY, CA 91962
 CELL: 619-933-1981

DATE OF FIELD SURVEY: AUGUST 8, 2015
 BY: P. JENNINGS AND J. REISIG
 DRAWN BY: P. JENNINGS ON AUGUST 10, 2015
 JOB NO: 15-033 REV. 2/11/2023

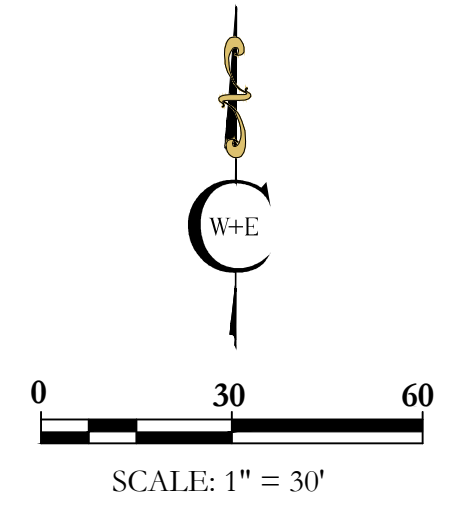
TOPOGRAPHIC SURVEY

THIS MAP REPRESENTS A TOPOGRAPHIC SURVEY PERFORMED BY ME UNDER THE PROVISIONS OF THE PROFESSIONAL LAND SURVEYOR'S ACT IN THE CITY OF SAN DIEGO, STATE OF CALIFORNIA, AT THE REQUEST OF MARGARET PALLACK IN AUGUST, 2015. ADDITIONAL BLUFF SURVEY PERFORMED ON FEBRUARY 11, 2023 AT THE REQUEST OF TURNKEY BUILDERS.



PAUL F. JENNINGS
 MY REGISTRATION EXPIRES ON 12-31-2024

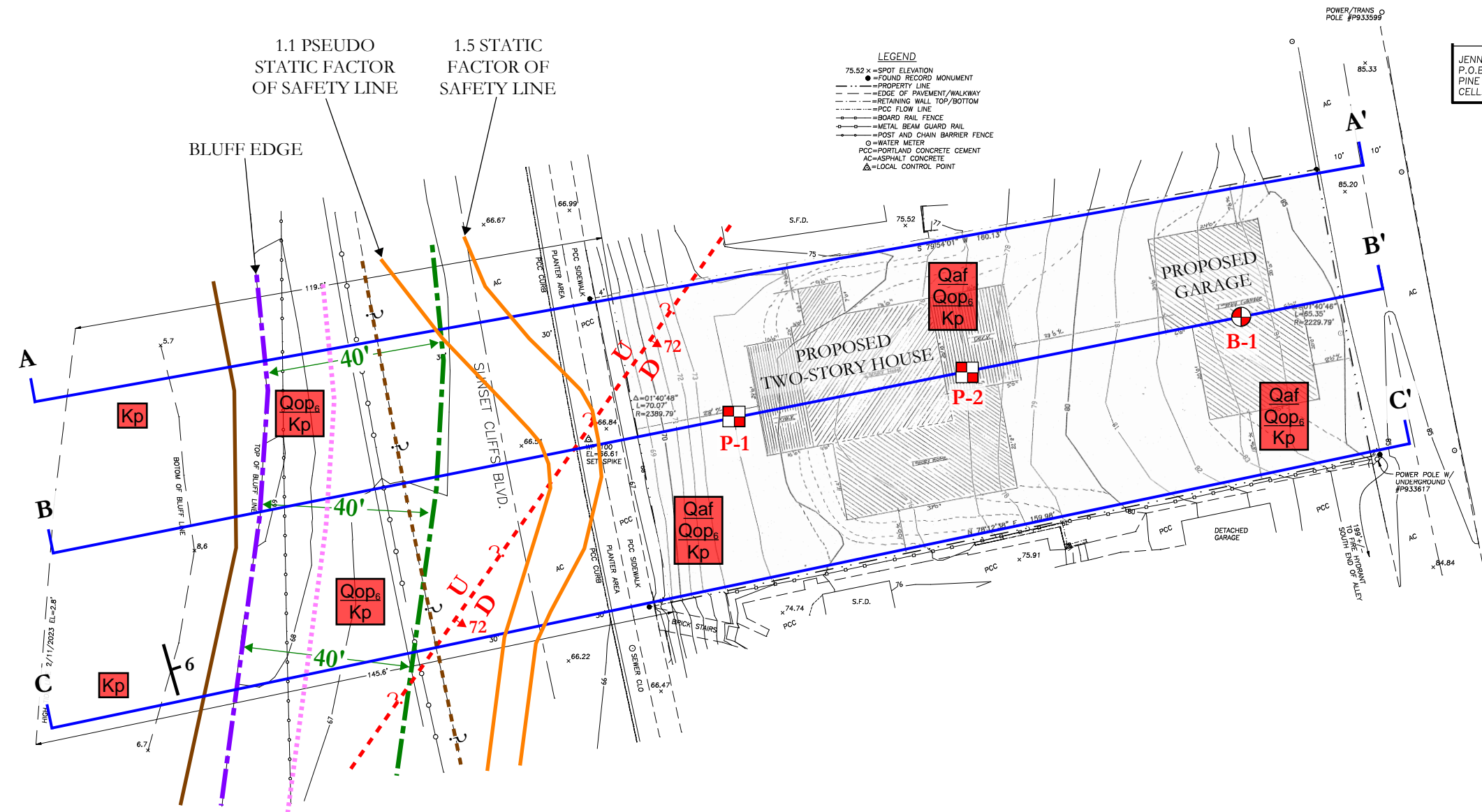
CWE LEGEND	
	B-1 APPROXIMATE BORING LOCATION
	P-2 APPROXIMATE TEST PIT LOCATION
	CROSS SECTION LOCATION
	BLUFF EDGE
	40' SETBACK LINE FROM BLUFF EDGE
	PROJECTED 75-YEAR RESSION OF EDGE OF BLUFF
	INFERRED PROJECTION OF CONCEALED PRE-HOLOCENE FAULT OBSERVED IN BLUFF, relative offset shown by "D" and "U" on downthrown and upthrown sides respectively, fault plane dip as indicated
	ARTIFICIAL FILL over OLD PARALAC DEPOSITS, UNIT 6 over POINT LOMA FORMATION
	OLD PARALAC DEPOSITS, UNIT 6 over POINT LOMA FORMATION
	POINT LOMA FORMATION
	GEOLOGIC CONTACT
	BEDDING STRIKE AND DIP IN POINT LOMA FORMATION



EXISTING SITE PLAN AND GEOLOGIC MAP

MASON RESIDENCE, APN 532-010-06-00 SUNSET CLIFFS BOULEVARD, SAN DIEGO, CA	
DATE: MAY 2023	REPORT NO.: 2230146.01
BY: JMM	PLATE NO.: 1A





JENNINGS LAND SURVEYING
P.O. BOX 376
PINE VALLEY, CA 91962
CELL: 619-933-1981

DATE OF FIELD SURVEY: AUGUST 8, 2015
BY: P.JENNINGS AND J.REISIG
DRAWN BY: P.JENNINGS ON AUGUST 10, 2015
JOB NO: 15-033 REV. 2/11/2023

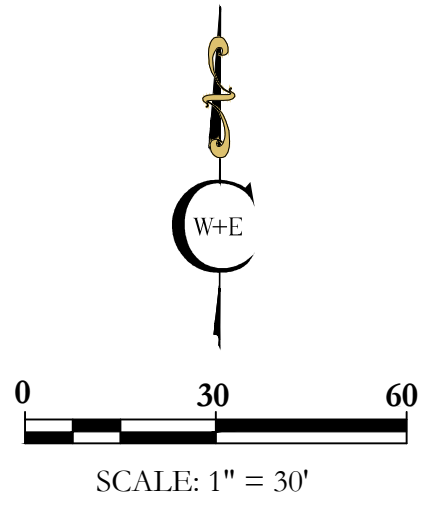
TOPOGRAPHIC SURVEY

THIS MAP REPRESENTS A TOPOGRAPHIC SURVEY PERFORMED BY ME UNDER THE PROVISIONS OF THE PROFESSIONAL LAND SURVEYOR'S ACT IN THE CITY OF SAN DIEGO, STATE OF CALIFORNIA, AT THE REQUEST OF MARGARET PALLACK IN AUGUST, 2015. ADDITIONAL BLUFF SURVEY PERFORMED ON FEBRUARY 11, 2023 AT THE REQUEST OF TURNKEY BUILDERS.



PAUL F. JENNINGS
MY REGISTRATION EXPIRES ON 12-31-2024

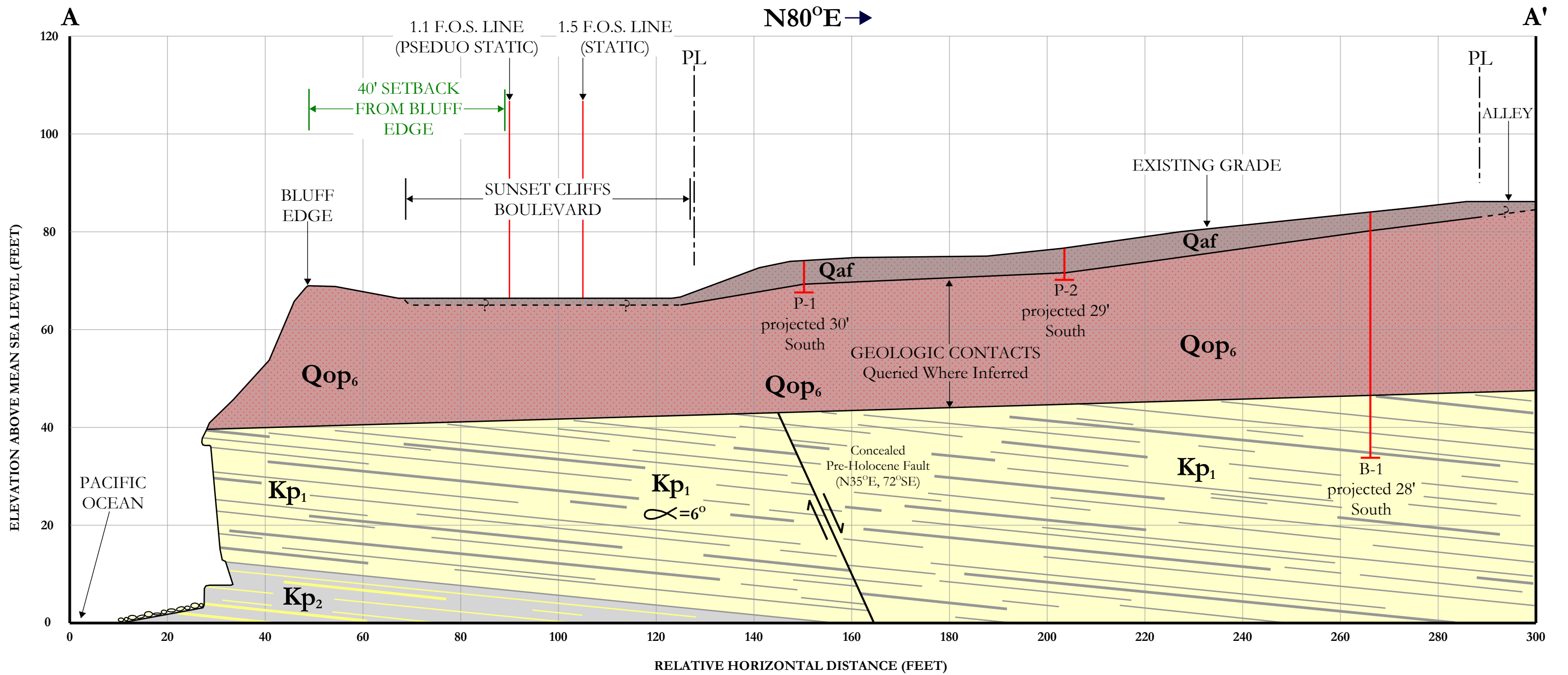
CWE LEGEND	
	B-1 APPROXIMATE BORING LOCATION
	P-2 APPROXIMATE TEST PIT LOCATION
	CROSS SECTION LOCATION
	BLUFF EDGE
	40' SETBACK LINE FROM BLUFF EDGE
	PROJECTED 75-YEAR RESSION OF EDGE OF BLUFF
	INFERRED PROJECTION OF CONCEALED PRE-HOLOCENE FAULT OBSERVED IN BLUFF, relative offset shown by "D" and "U" on downthrown and upthrown sides respectively, fault plane dip as indicated
	ARTIFICIAL FILL over OLD PARALAC DEPOSITS, UNIT 6 over POINT LOMA FORMATION
	OLD PARALAC DEPOSITS, UNIT 6 over POINT LOMA FORMATION
	POINT LOMA FORMATION
	GEOLOGIC CONTACT
	BEDDING STRIKE AND DIP IN POINT LMA FORMATION



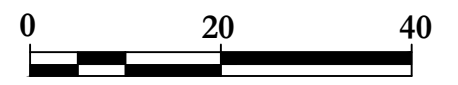
PROPOSED SITE PLAN AND GEOLOGIC MAP

MASON RESIDENCE, APN 532-010-06-00 SUNSET CLIFFS BOULEVARD, SAN DIEGO, CA	
DATE: MAY 2023	REPORT NO.: 2230146.01
BY: JMM	PLATE NO.: 1B





CWE LEGEND	
Qaf	ARTIFICIAL FILL
Qop₆	OLD PARALIC DEPOSITS, UNIT 6
Kp₁	POINT LOMA FORMATION (predominantly sandstone facies with interbedded siltstone)
Kp₂	POINT LOMA FORMATION (predominantly claystone facies with interbedded siltstone)

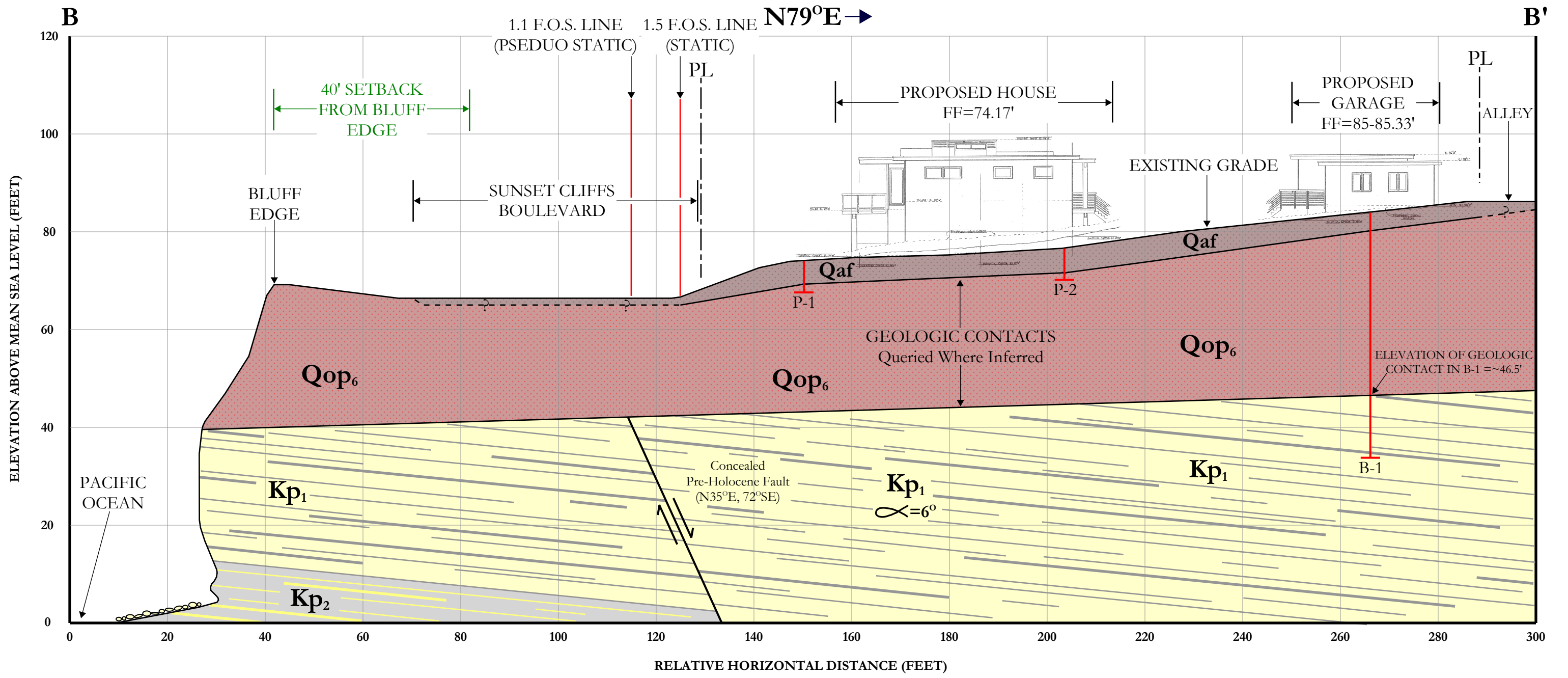


SCALE: 1" = 20'

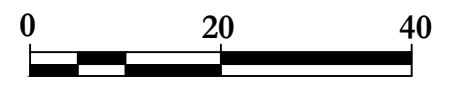
GEOLOGIC CROSS-SECTION A-A'

MASON RESIDENCE, APN 532-010-06-00 SUNSET CLIFFS BOULEVARD, SAN DIEGO, CA	
DATE: AUGUST 2023	REPORT NO.: 2230146.01
BY: JMM	PLATE NO.: 2





CWE LEGEND	
Qaf	ARTIFICIAL FILL
Qop₆	OLD PARALIC DEPOSITS, UNIT 6
Kp₁	POINT LOMA FORMATION (predominantly sandstone facies with interbedded siltstone)
Kp₂	POINT LOMA FORMATION (predominantly claystone facies with interbedded siltstone)

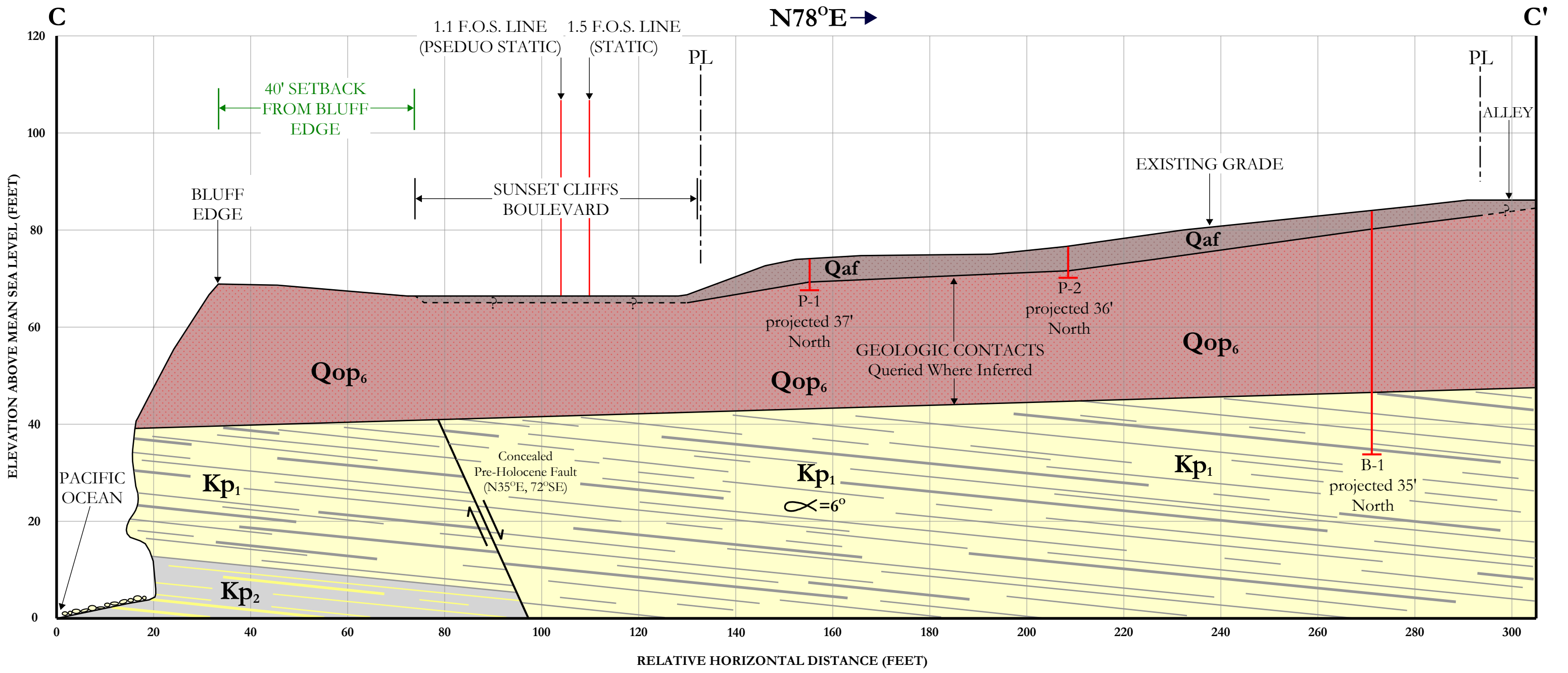


SCALE: 1" = 20'

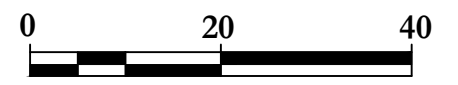
GEOLOGIC CROSS-SECTION B-B'

MASON RESIDENCE, APN 532-010-06-00 SUNSET CLIFFS BOULEVARD, SAN DIEGO, CA	
DATE: AUGUST 2023	REPORT NO.: 2230146.01
BY: JMM	PLATE NO.: 3





CWE LEGEND	
Qaf	ARTIFICIAL FILL
Qop₆	OLD PARALIC DEPOSITS, UNIT 6
Kp₁	POINT LOMA FORMATION (predominantly sandstone facies with interbedded siltstone)
Kp₂	POINT LOMA FORMATION (predominantly claystone facies with interbedded siltstone)



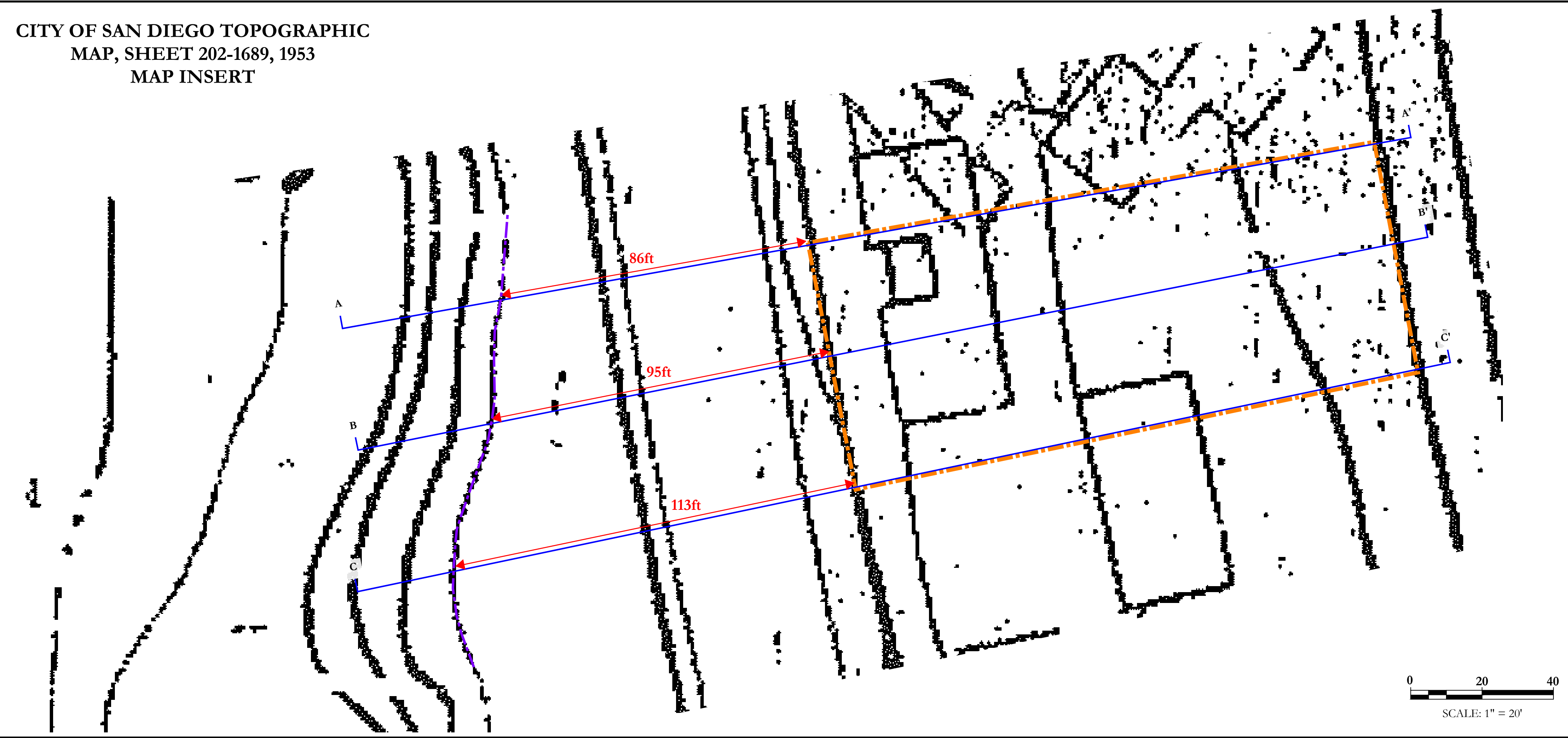
SCALE: 1" = 20'

GEOLOGIC CROSS-SECTION C-C'

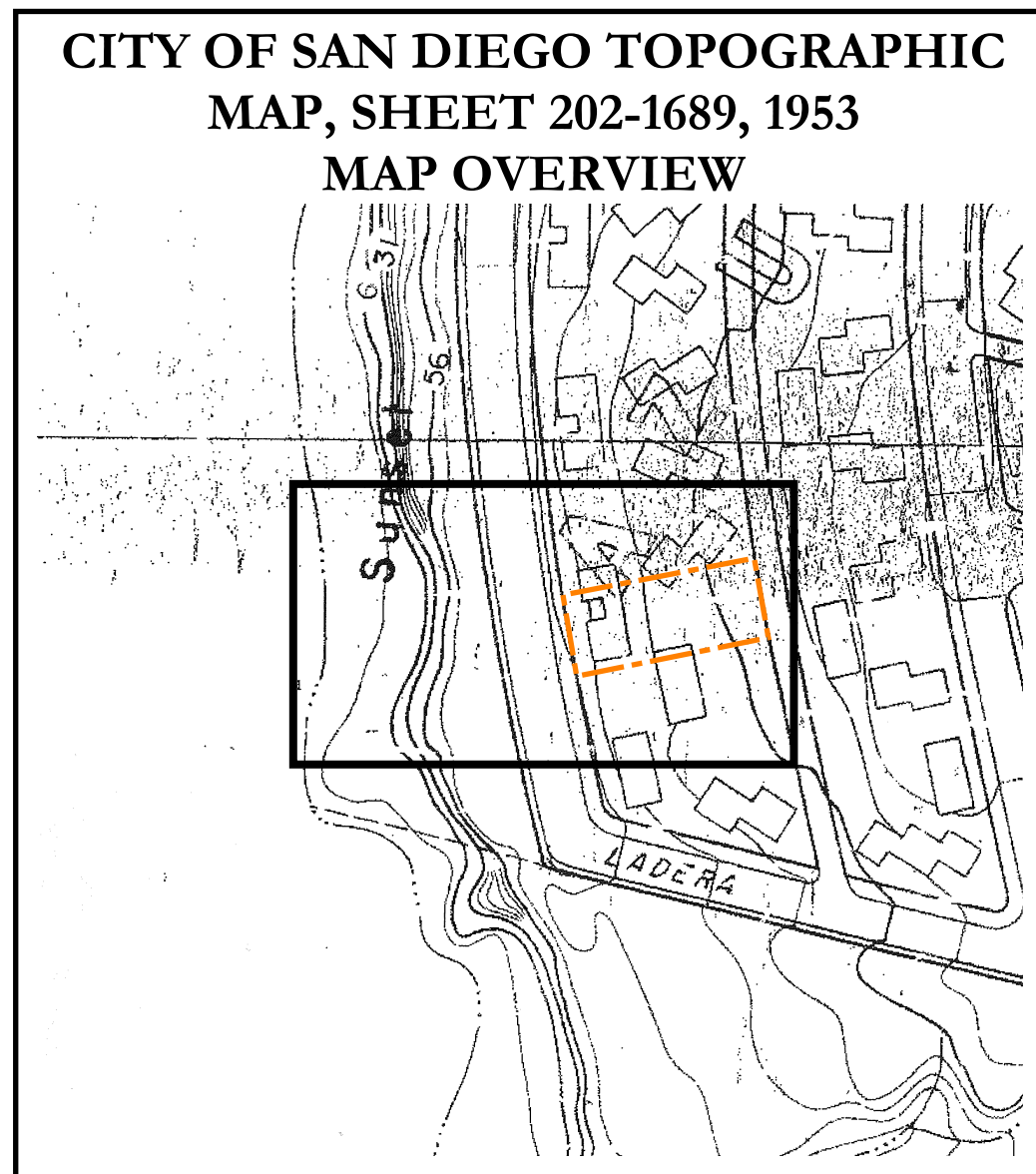
MASON RESIDENCE, APN 532-010-06-00 SUNSET CLIFFS BOULEVARD, SAN DIEGO, CA	
DATE: AUGUST 2023	REPORT NO.: 2230146.01
BY: JMM	PLATE NO.: 4



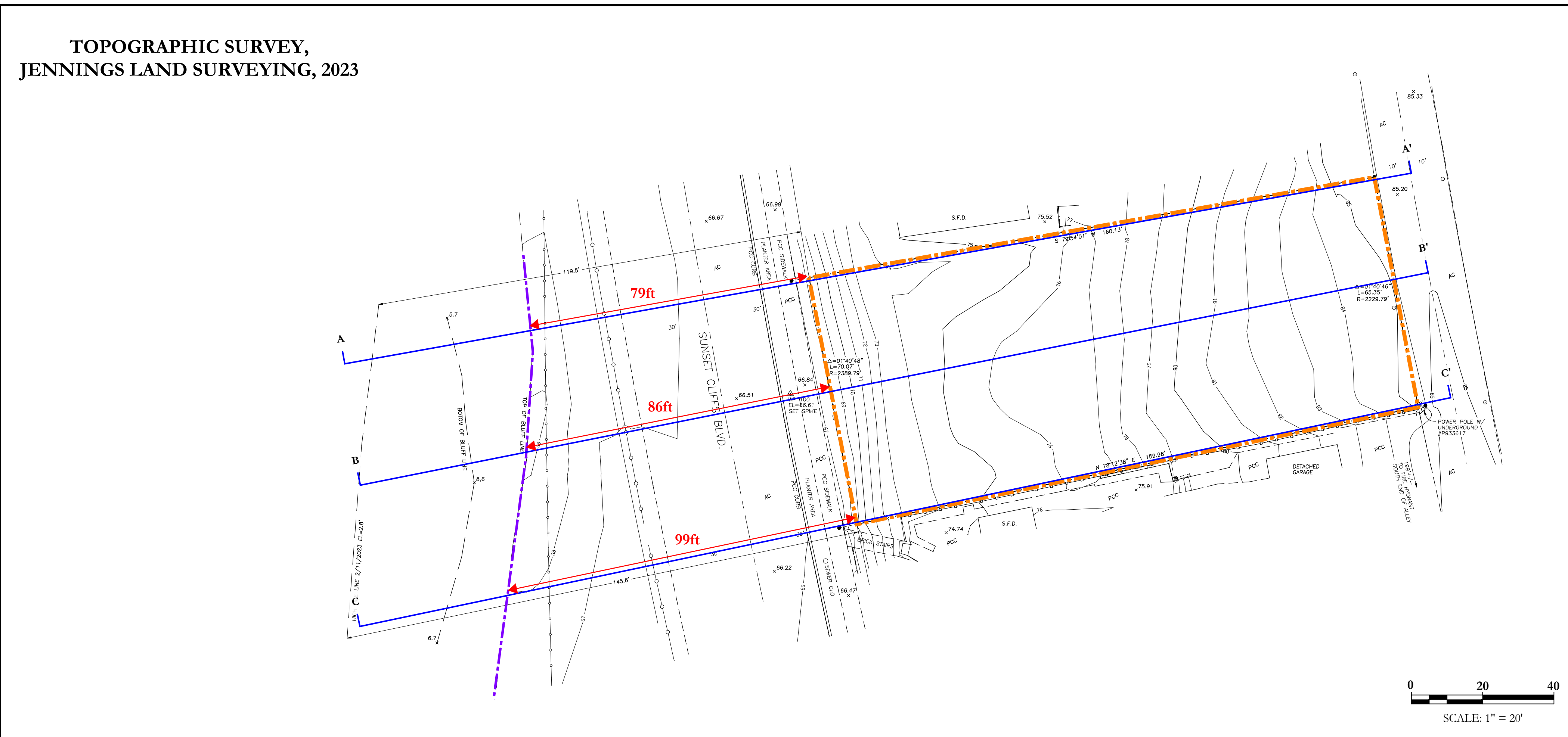
CITY OF SAN DIEGO TOPOGRAPHIC
MAP, SHEET 202-1689, 1953
MAP INSERT



CITY OF SAN DIEGO TOPOGRAPHIC
MAP, SHEET 202-1689, 1953
MAP OVERVIEW



TOPOGRAPHIC SURVEY,
JENNINGS LAND SURVEYING, 2023

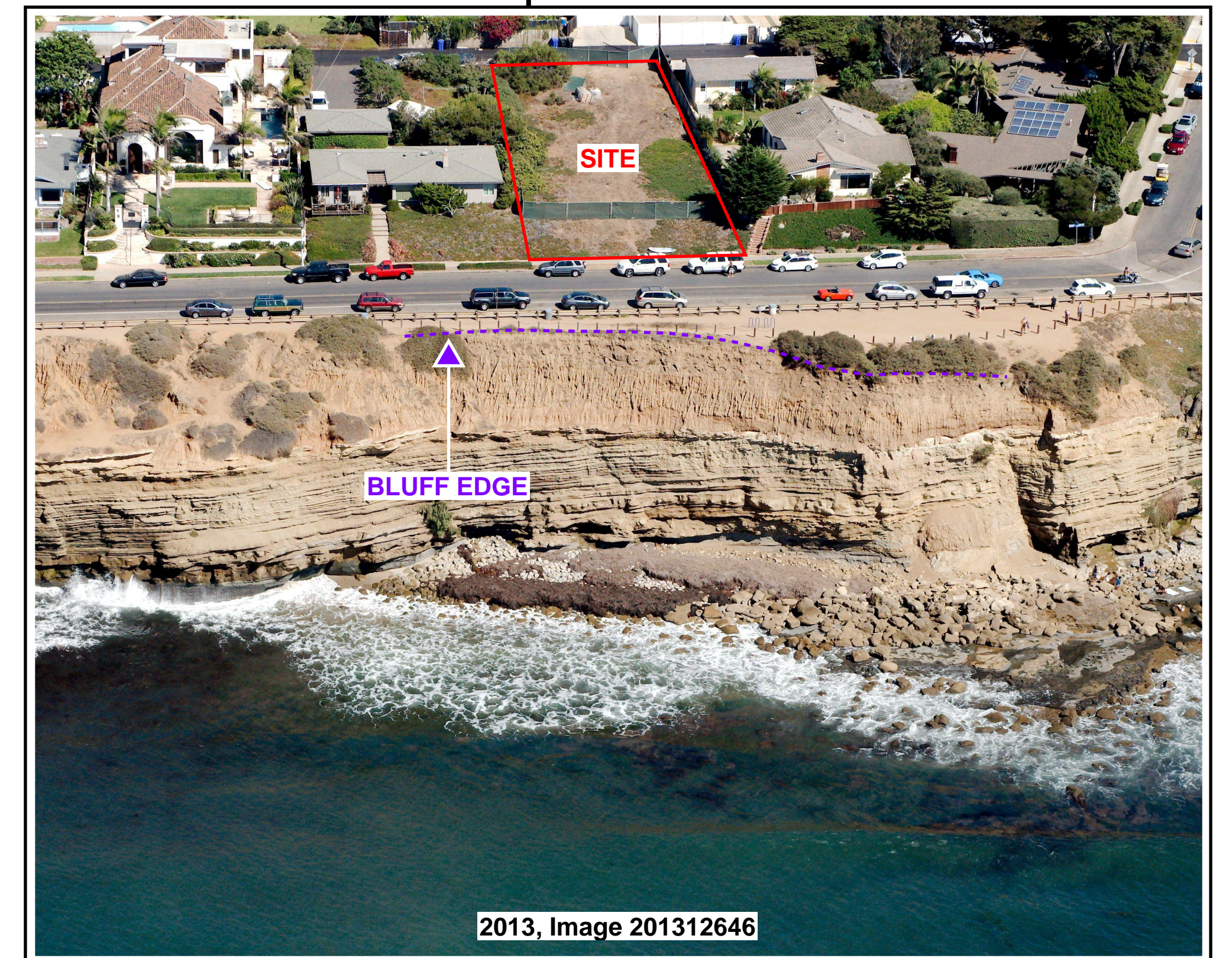
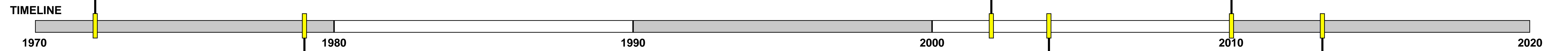
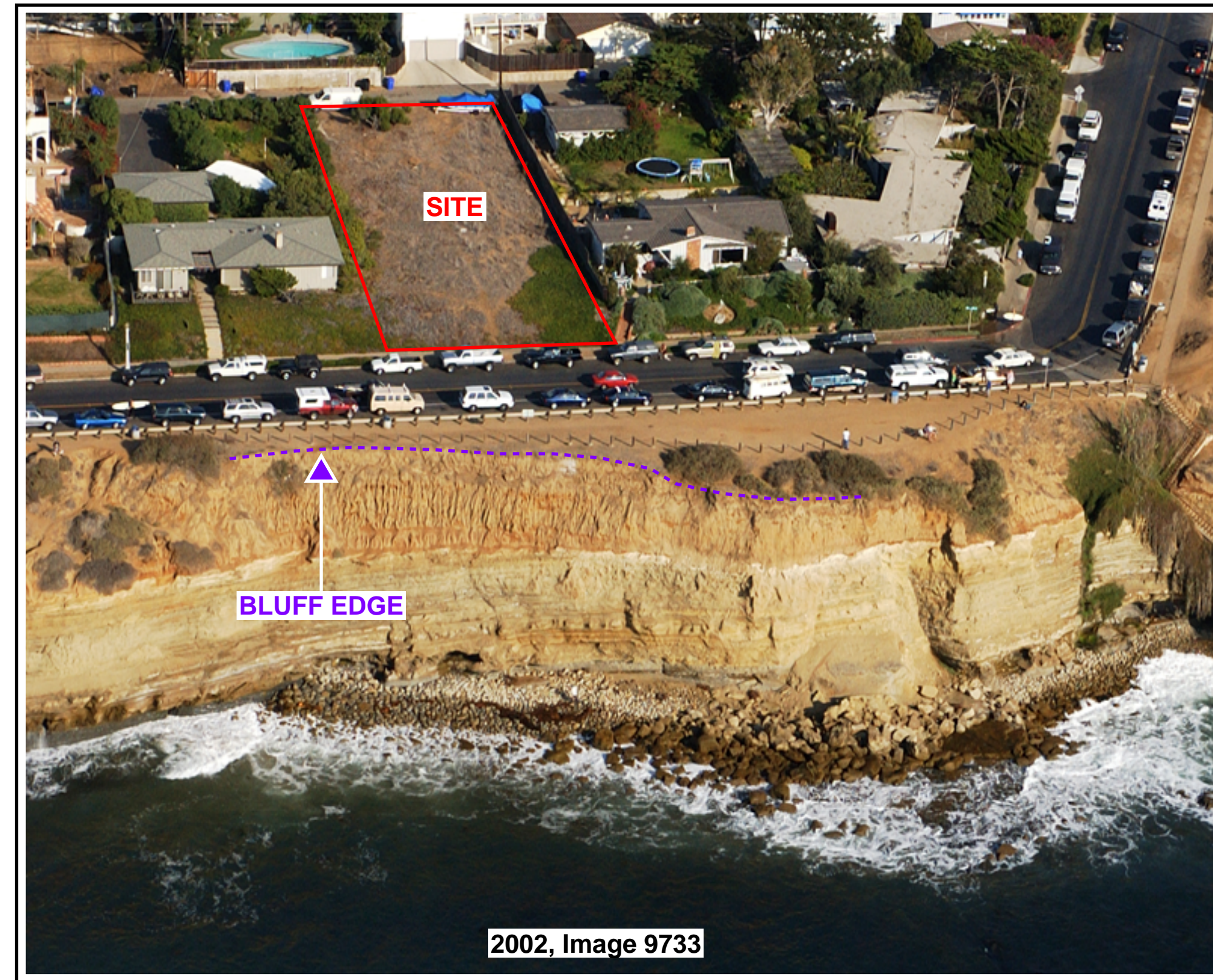


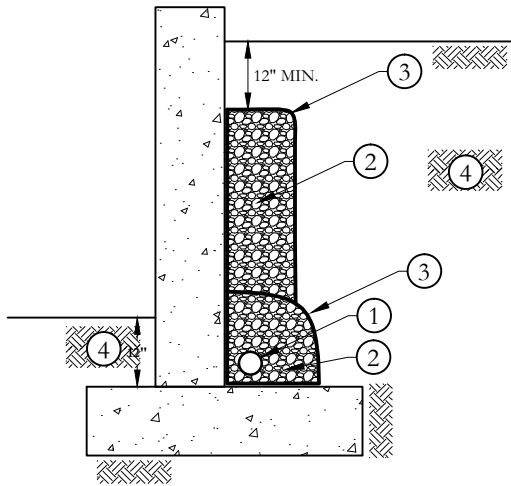
CWE LEGEND	
	SITE PROPERTY LINES
	CROSS SECTION LOCATION
	BLUFF EDGE

COASTAL BLUFF RETREAT ANALYSIS

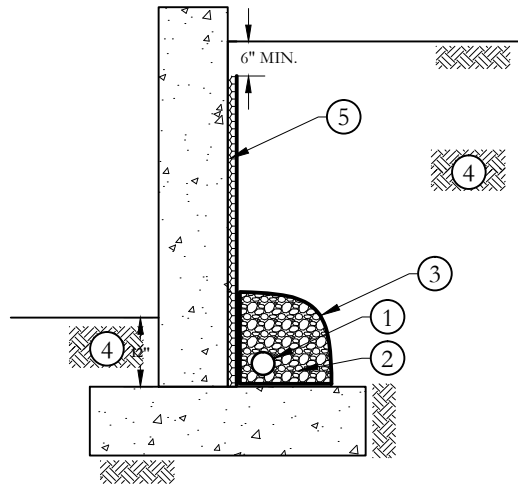
MASON RESIDENCE, APN 532-010-06-00 SUNSET CLIFFS BOULEVARD, SAN DIEGO, CA	
DATE: JULY 2023	REPORT NO: 2230146.01
BY: JMM	PLATE NO: 5A



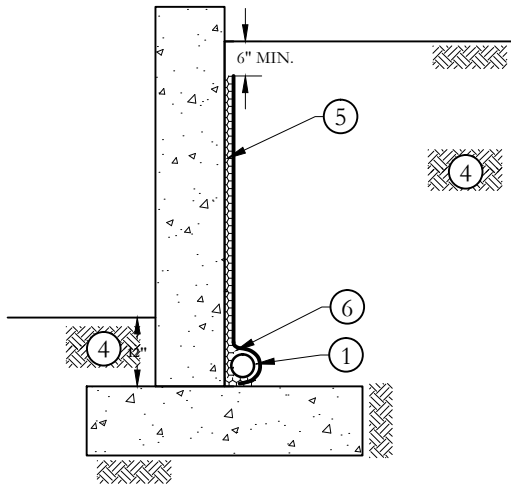




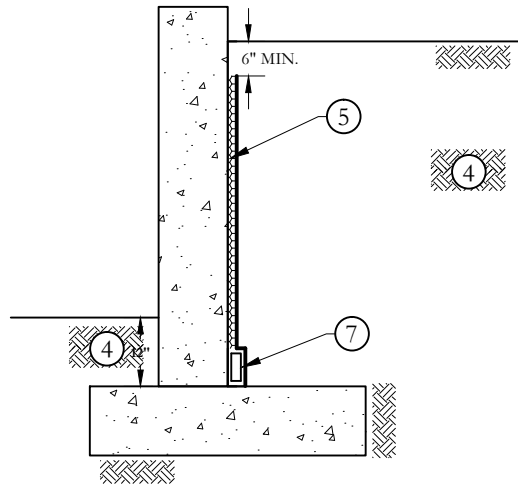
1 DETAIL



2 DETAIL



3 DETAIL



4 DETAIL

NOTES AND DETAILS

GENERAL NOTES:

- 1) THE NEED FOR WATERPROOFING SHOULD BE EVALUATED BY OTHERS.
- 2) WATERPROOFING TO BE DESIGNED BY OTHERS (CWE CAN PROVIDE A DESIGN IF REQUESTED).
- 3) EXTEND DRAIN TO SUITABLE DISCHARGE POINT PER CIVIL ENGINEER.
- 4) DO NOT CONNECT SURFACE DRAINS TO SUBDRAIN SYSTEM.

DETAILS:

- | | |
|---|---|
| <ul style="list-style-type: none"> ① 4-INCH PERFORATED PVC PIPE ON TOP OF FOOTING, HOLES POSITIONED DOWNWARD (SDR 35, SCHEDULE 40, OR EQUIVALENT). ② ¾ INCH OPEN-GRADED CRUSHED AGGREGATE. ③ GEOFABRIC WRAPPED COMPLETELY AROUND ROCK. ④ PROPERLY COMPACTED BACKFILL SOIL. ⑤ WALL DRAINAGE PANELS (MIRADRAIN OR EQUIVALENT) PLACED PER MANUFACTURER'S REC'S. | <ul style="list-style-type: none"> ⑥ UNDERLAY SUBDRAIN WITH AND CUT FABRIC BACK FROM DRAINAGE PANELS AND WRAP FABRIC AROUND PIPE. ⑦ COLLECTION DRAIN (TOTAL DRAIN OR EQUIVALENT) LOCATED AT BASE OF WALL DRAINAGE PANEL PER MANUFACTURER'S RECOMMENDATIONS. |
|---|---|

CANTILEVER RETAINING WALL
DRAINAGE SYSTEMS

MASON RESIDENCE, APN 532-010-06-00
SUNSET CLIFFS BOULEVARD
SAN DIEGO, CALIFORNIA

DATE: AUGUST 2023

JOB NO.: 2230146.01

BY: SD

PLATE NO.: 6



CHRISTIAN WHEELER
ENGINEERING

Appendix A

Logs of Subsurface Explorations

LOG OF TEST BORING B-1

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk
SPT	Standard Penetration Test	DR	Drive Ring
ST	Shelby Tube		
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Cbl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential	SD	Sample Density

Date Logged: 4/14/23 Equipment: IR A-300
 Logged By: JM Auger Type: 8 inch Hollow Stem
 Existing Elevation: 83.5' Drive Type: 140lbs/30", Safety Hammer
 Proposed Elevation: Unknown Depth to Water: 37'

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0			SM	Artificial Fill (Qaf): Dark brown to dark reddish-brown, damp, very loose to loose, SILTY SAND.							
5			SM	Old Paralic, Unit 6 (Qop6): Reddish-brown to orangish-brown, damp to moist, medium dense to dense, fine- to medium-grained, SILTY SAND.	29	Cal					SD MD SO4
10				Dense.	58	Cal					
15				Moderate to strong cementation, trace rounded gravel at 14.5'-15', fine- to coarse-grained, SAND at 14.5'-15'.	50/4"	Cal					SD
20				Brown, very weak cementation.	38	Cal					
25				Strong cementation, trace manganese dendrites.	50/5.5"	Cal					DS
30				Continued on A-2	50/3"	Cal					SD

Notes:

Symbol Legend

- Groundwater Level During Drilling
- Groundwater Level After Drilling
- Apparent Seepage
- No Sample Recovery
- Non-Representative Blow Count (rocks present)

MASON RESIDENCE
 APN 532-010-06-00, SUNSET CLIFFS BOULEVARD
 SAN DIEGO, CALIFORNIA

DATE: AUGUST 2023 JOB NO.: 2230146.01
 BY: SD APPENDIX: A-1



CHRISTIAN WHEELER
 ENGINEERING

LOG OF TEST BORING B-1 (Cont.)

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk
SPT	Standard Penetration Test	DR	Drive Ring
ST	Shelby Tube		
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Cbl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential	SD	Sample Density

Date Logged: 4/14/23 Equipment: IR A-300
 Logged By: JM Auger Type: 8 inch Hollow Stem
 Existing Elevation: 83.5' Drive Type: 140lbs/30", Safety Hammer
 Proposed Elevation: Unknown Depth to Water: 37'

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
30			SM	Very Old Paralac, Unit 6 (Qvop6): Brown, damp to moist, dense, fine- to medium-grained, SILTY SAND. Slight gravels & shell fragments.	50/3.5"	Cal					SD
35				Slight seepage above contact.							
40			ML/ CL	Point Loma Formation (Kp): Gray and yellowish-brown to yellow, damp, interbedded lenses of very dense, SANDY SILT and SANDY CLAY. ±6" thick lenses.	50/3"	Cal					DS
45					50/3" 50/3"	Cal* Cal*					HA
50				Terminated at 49 feet, 9 inches. Seepage at 37 feet atop Kp.	50/3" 50/3"	Cal* SPT*					

Notes:

Symbol Legend

- Groundwater Level During Drilling
- Groundwater Level After Drilling
- Apparent Seepage
- No Sample Recovery
- Non-Representative Blow Count (rocks present)

MASON RESIDENCE
 APN 532-010-06-00, SUNSET CLIFFS BOULEVARD
 SAN DIEGO, CALIFORNIA

DATE: AUGUST 2023 JOB NO.: 2230146.01
 BY: SD APPENDIX: A-2



CHRISTIAN WHEELER
 ENGINEERING

LOG OF TEST PIT P-1

Sample Type and Laboratory Test Legend






Cal	Modified California Sampler	CK	Chunk
SPT	Standard Penetration Test	DR	Drive Ring
ST	Shelby Tube		
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Cbl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential	SD	Sample Density

Date Logged: 4/19/23 Equipment: Hand tools
 Logged By: JM Auger Type: N/A
 Existing Elevation: 74' Drive Type: N/A
 Finish Elevation: Unknown Depth to Water: N/A

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0		[Graphic Log: Artificial Fill (Qaf)]	SM	Artificial Fill (Qaf): Dark brown, damp, loose, SILTY SAND.							
0.5											
1											MD
1.5											DS
2											SO4
2.5											
3											
3.5											
4											
4.5											
5		[Graphic Log: Old Paralic Deposits, Unit 6 (Qop6)]	SM	Old Paralic Deposits, Unit 6 (Qop6): Reddish-brown, damp to moist, medium dense, SILTY SAND, weak cementation.							
5.5											
6							CK				SD
6.5						Cal					SD
7				Test pit terminated at 6.5 feet. No groundwater or seepage encountered.							
7.5											

Notes:

Symbol Legend

-  Groundwater Level During Drilling
-  Groundwater Level After Drilling
-  Apparent Seepage
-  No Sample Recovery
-  Non-Representative Blow Count (rocks present)

MASON RESIDENCE, APN 532-010-06-00
 SUNSET CLIFFS BOULEVARD
 SAN DIEGO, CALIFORNIA

DATE: AUGUST 2023 JOB NO.: 2230146.01
 BY: SD APPENDIX: A-3



CHRISTIAN WHEELER
 ENGINEERING

LOG OF TEST PIT P-2

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk
SPT	Standard Penetration Test	DR	Drive Ring
ST	Shelby Tube		
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Cbl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential	SD	Sample Density

Date Logged: 4/19/23 Equipment: Hand tools
 Logged By: JM Auger Type: N/A
 Existing Elevation: 77' Drive Type: N/A
 Finish Elevation: Unknown Depth to Water: N/A

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0			SM	Artificial Fill (Qaf): Dark brown, damp, loose, SILTY SAND.							
0.5											
1											
1.5											
2											
2.5											
3											
3.5											
4											
4.5			SM	Old Paralic Deposits, Unit 6 (Qop6): Reddish-brown, damp to moist, medium dense, SILTY SAND, weak cementation.							
5						CK					SD
5.5											
6											
6.5						Cal					SD
7				Test pit terminated at 6.5 feet. No groundwater or seepage encountered.							
7.5											

Notes:

Symbol Legend

- Groundwater Level During Drilling
- Groundwater Level After Drilling
- Apparent Seepage
- No Sample Recovery
- Non-Representative Blow Count (rocks present)

MASON RESIDENCE, APN 532-010-06-00
 SUNSET CLIFFS BOULEVARD
 SAN DIEGO, CALIFORNIA

DATE: AUGUST 2023 JOB NO.: 2230146.01
 BY: SD APPENDIX: A-4




CHRISTIAN WHEELER
 ENGINEERING

Appendix B

Laboratory Test Results

Laboratory tests were performed in accordance with the generally accepted American Society for Testing and Materials (ASTM) test methods or suggested procedures. Brief descriptions of the tests performed are presented below:

- a) **CLASSIFICATION:** Field classifications were verified in the laboratory by visual examination. The final soil classifications are in accordance with the Unified Soil Classification System and are presented on the exploration logs in Appendix A.
- b) **MOISTURE-DENSITY:** In-place moisture contents and dry densities were determined for selected soil samples in accordance with ATM D 2937. The results are summarized in the boring logs presented in Appendix A.
- c) **MAXIMUM DRY DENSITY AND OPTIMUM MOISTURE CONTENT TEST:** The maximum dry density and optimum moisture content of a selected soil sample were determined in the laboratory in accordance with ASTM D 1557, Method A.
- d) **DIRECT SHEAR:** Direct shear tests were performed on selected samples of the on-site soils in accordance with ASTM D 3080.
- e) **GRAIN SIZE DISTRIBUTION:** The grain size distribution of a selected soil sample was determined in accordance with ASTM C 136 and/or ASTM D 422.
- f) **COLLAPSE POTENTIAL:** Collapse potential test were performed on two selected undisturbed soil samples in accordance with ASTM D 5333.
- g) **SOLUBLE SULFATES:** The soluble sulfate contents of selected soil samples were determined in accordance with California Test Method 417.

 CHRISTIAN WHEELER ENGINEERING	MASON RESIDENCE SUNSET CLIFFS BOULEVARD SAN DIEGO, CALIFORNIA		LAB SUMMARY	
	BY: DBA	DATE: AUGUST 2024	REPORT NO.: 2230146.01	APPENDIX.: B-1

LABORATORY TEST RESULTS

PROPOSED MASON RESIDENCE

SUNSET CLIFFS BOULEVARD

SAN DIEGO, CALIFORNIA

MAXIMUM DRY DENSITY AND OPTIMUM MOISTURE CONTENT (ASTM D1557)

Sample Location	Boring B-1 @ 6'-8'	Test Pit P-1 @ 1'-3'
Sample Description	Reddish brown silty sand (SM)	Reddish brown silty sand (SM)
Maximum Density	124.8 pcf	118.4 pcf
Optimum Moisture	8.5 %	10.2 %

DIRECT SHEAR (ASTM D3080)

Sample Location	Boring B-1 @ 24.5'	Test Pit P-1 @ 1-3'	Test Pit P-1 @ 6-6.5'
Sample Type	Undisturbed	Remolded to 90 %	Undisturbed
Friction Angle	33°	32°	32°
Cohesion	200 psf	200 psf	150 psf

GRAIN SIZE DISTRIBUTION (ASTM D422)

Sample Location	Boring B-1 @ 45-48'
<i>Sieve Size</i>	<i>Percent Passing</i>
#4	100
#8	99
#16	98
#30	93
#50	83
#100	69
#200	56
0.05mm	52
0.005mm	32
0.001	15

COLLAPSE POTENTIAL (ASTM D 5333)

Sample Location	Test Pit P-1 @ 6.5'	Test Pit P-2 @ 6.5'
Initial Moisture Content	4.0 %	4.4 %
Initial Density	103.4 pcf	111.6 pcf
Consolidation Before Water Added	3.1 %	3.3 %
Consolidation After Water Added	6.2 %	5.0 %
Final Moisture	16.9 %	14.1 %

SOLUBLE SULFATES (CALIFORNIA TEST 417)

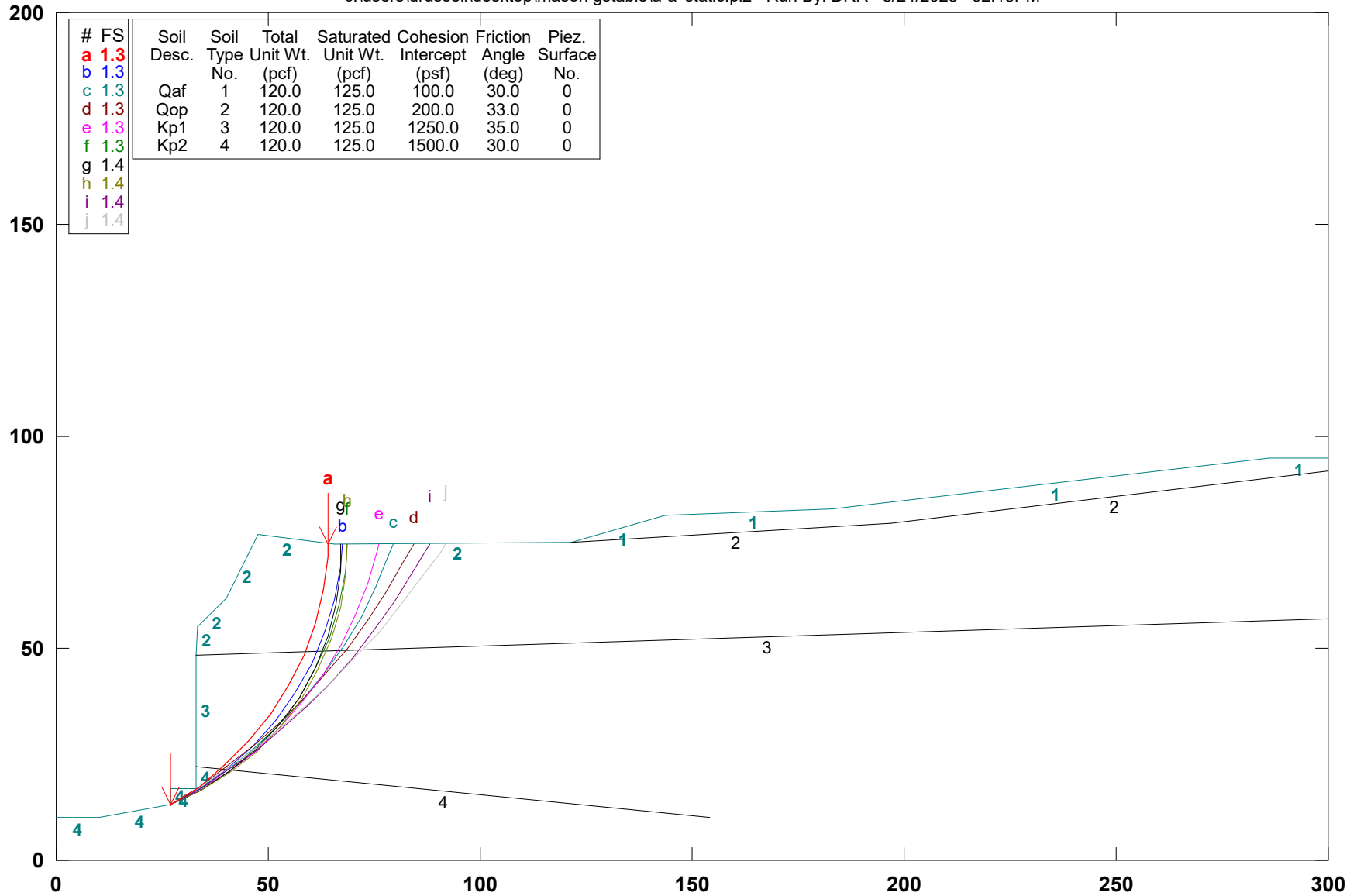
Sample Location	Boring B-1 @ 6'-8'	Test Pit P-1 @ 1'-3'
Soluble Sulfate	0.004 % (SO ₄)	0.008 % (SO ₄)

Appendix C

Bluff Stability Analyses

Mason Residence CWE 2230146.01 A-A' Static

c:\users\drussell\desktop\mason gstable\la-a' static.pl2 Run By: DRR 8/24/2023 02:18PM



GSTABL7 v.2 FSmin=1.3

Safety Factors Are Calculated By The Modified Bishop Method

*** GSTABL7 ***

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.003, June 2002 **
 (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.

Analysis Run Date: 8/24/2023
 Time of Run: 02:18PM
 Run By: DRR
 Input Data Filename: C:\Users\drussell\Desktop\Mason GStable\a-a' static.

Output Filename: C:\Users\drussell\Desktop\Mason GStable\a-a' static.OUT

Unit System: English
 Plotted Output Filename: C:\Users\drussell\Desktop\Mason ble\a-a' static.PLT

PROBLEM DESCRIPTION: Mason Residence CWE 2230146.01
 A-A' Static

BOUNDARY COORDINATES
 15 Top Boundaries
 19 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	10.00	10.00	10.00	4
2	10.00	10.00	27.00	13.00	4
3	27.00	13.00	27.10	17.00	4
4	27.10	17.00	33.00	17.00	4
5	33.00	17.00	33.05	22.00	4
6	33.05	22.00	33.10	48.50	3
7	33.10	48.50	33.20	55.00	2
8	33.20	55.00	40.00	62.00	2
9	40.00	62.00	47.50	77.00	2
10	47.50	77.00	65.50	74.50	2
11	65.50	74.50	121.50	75.00	2
12	121.50	75.00	143.50	81.50	1
13	143.50	81.50	183.00	83.00	1
14	183.00	83.00	286.00	95.00	1
15	286.00	95.00	300.00	95.00	1
16	197.00	79.50	300.00	92.00	2
17	121.50	75.00	197.00	79.50	2
18	33.10	48.50	300.00	57.00	3
19	33.05	22.00	154.00	10.00	4

Default Y-Origin = 0.00(ft)
 Default X-Plus Value = 0.00(ft)
 User Specified Y-Plus Value = 10.00(ft)

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param. (psf)	Pressure Constant (psf)	Piez. Surface No.
1	120.0	125.0	100.0	30.0	0.00	0.0	0
2	120.0	125.0	200.0	33.0	0.00	0.0	0
3	120.0	125.0	1250.0	35.0	0.00	0.0	0
4	120.0	125.0	1500.0	30.0	0.00	0.0	0

A Critical Failure Surface Searching Method, Using A Random
 Technique For Generating Circular Surfaces, Has Been Specified.
 3000 Trial Surfaces Have Been Generated.

300 Surface(s) Initiate(s) From Each Of 10 Points Equally Spaced
 Along The Ground Surface Between X = 27.00(ft)
 and X = 33.00(ft)
 Each Surface Terminates Between X = 60.00(ft)
 and X = 145.00(ft)

Unless Further Limitations Were Imposed, The Minimum Elevation

At Which A Surface Extends Is Y = 0.00(ft)
 8.00(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 Evaluated = 3000
 Statistical Data On All Valid FS Values:
 FS Max = 4.691 FS Min = 1.287 FS Ave = 3.628
 Standard Deviation = 0.661 Coefficient of Variation = 18.23 %
 Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	27.00	13.00
2	33.71	17.35
3	39.92	22.40
4	45.54	28.09
5	50.52	34.35
6	54.80	41.11
7	58.33	48.29
8	61.06	55.81
9	62.97	63.58
10	64.03	71.51
11	64.11	74.69

Circle Center At X = -9.98 ; Y = 77.37 ; and Radius = 74.24

Factor of Safety
 *** 1.287 ***

Individual data on the 19 slices

Slice No.	Width (ft)	Weight (lbs)	Water		Tie Norm (lbs)	Tie Tan (lbs)	Earthquake		
			Force Top (lbs)	Force Bot (lbs)			Force Hor (lbs)	Force Ver (lbs)	Surcharge Load (lbs)
1	0.1	23.6	0.0	0.0	0.	0.	0.0	0.0	0.0
2	5.9	1431.7	0.0	0.0	0.	0.	0.0	0.0	0.0
3	0.0	15.6	0.0	0.0	0.	0.	0.0	0.0	0.0
4	0.0	109.9	0.0	0.0	0.	0.	0.0	0.0	0.0
5	0.1	417.2	0.0	0.0	0.	0.	0.0	0.0	0.0
6	0.5	2340.4	0.0	0.0	0.	0.	0.0	0.0	0.0
7	5.0	23312.5	0.0	0.0	0.	0.	0.0	0.0	0.0
8	1.2	5609.7	0.0	0.0	0.	0.	0.0	0.0	0.0
9	0.1	393.1	0.0	0.0	0.	0.	0.0	0.0	0.0
10	5.5	28103.6	0.0	0.0	0.	0.	0.0	0.0	0.0
11	2.0	10739.7	0.0	0.0	0.	0.	0.0	0.0	0.0
12	3.0	16086.3	0.0	0.0	0.	0.	0.0	0.0	0.0
13	4.3	19792.1	0.0	0.0	0.	0.	0.0	0.0	0.0
14	3.5	13133.4	0.0	0.0	0.	0.	0.0	0.0	0.0
15	0.4	1190.4	0.0	0.0	0.	0.	0.0	0.0	0.0
16	2.4	6435.8	0.0	0.0	0.	0.	0.0	0.0	0.0
17	1.9	3500.3	0.0	0.0	0.	0.	0.0	0.0	0.0
18	1.1	920.8	0.0	0.0	0.	0.	0.0	0.0	0.0
19	0.1	15.4	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	27.00	13.00
2	33.96	16.95
3	40.44	21.63
4	46.38	26.99
5	51.70	32.97
6	56.34	39.49
7	60.24	46.48
8	63.35	53.84
9	65.65	61.51
10	67.10	69.37
11	67.47	74.52

Circle Center At X = -5.71 ; Y = 78.71 ; and Radius = 73.40

Factor of Safety
 *** 1.312 ***

Failure Surface Specified By 12 Coordinate Points

Point	X-Surf	Y-Surf
-------	--------	--------

No.	(ft)	(ft)
1	27.00	13.00
2	33.91	17.03
3	40.51	21.55
4	46.77	26.53
5	52.65	31.95
6	58.13	37.79
7	63.17	44.00
8	67.76	50.55
9	71.85	57.42
10	75.45	64.57
11	78.51	71.96
12	79.40	74.62

Circle Center At X = -25.13 ; Y = 110.42 ; and Radius = 110.49

Factor of Safety
 *** 1.329 ***

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	27.00	13.00
2	33.72	17.34
3	40.21	22.02
4	46.45	27.03
5	52.42	32.35
6	58.11	37.97
7	63.50	43.88
8	68.59	50.06
9	73.34	56.49
10	77.76	63.16
11	81.83	70.05
12	84.25	74.67

Circle Center At X = -53.49 ; Y = 145.15 ; and Radius = 154.73

Factor of Safety
 *** 1.330 ***

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	27.00	13.00
2	34.08	16.73
3	40.79	21.08
4	47.09	26.01
5	52.92	31.49
6	58.23	37.47
7	62.99	43.90
8	67.15	50.73
9	70.69	57.91
10	73.56	65.38
11	75.76	73.07
12	76.05	74.59

Circle Center At X = -10.81 ; Y = 93.44 ; and Radius = 88.88

Factor of Safety
 *** 1.345 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	27.00	13.00
2	34.15	16.59
3	40.83	20.99
4	46.97	26.12
5	52.46	31.94
6	57.25	38.35
7	61.27	45.26
8	64.45	52.60
9	66.77	60.26
10	68.19	68.13
11	68.58	74.53

Circle Center At X = -0.38 ; Y = 76.41 ; and Radius = 69.07

Factor of Safety
 *** 1.346 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	27.00	13.00
2	34.20	16.50
3	40.91	20.85
4	47.04	25.98
5	52.50	31.83
6	57.20	38.31
7	61.07	45.31
8	64.06	52.73
9	66.12	60.46
10	67.22	68.38
11	67.31	74.52

Circle Center At X = 2.12 ; Y = 73.36 ; and Radius = 65.29
 Factor of Safety
 *** 1.355 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	27.00	13.00
2	34.26	16.37
3	41.05	20.60
4	47.27	25.62
5	52.84	31.36
6	57.67	37.74
7	61.69	44.66
8	64.83	52.02
9	67.05	59.70
10	68.33	67.60
11	68.59	74.53

Circle Center At X = 3.06 ; Y = 74.06 ; and Radius = 65.58
 Factor of Safety
 *** 1.368 ***

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	27.00	13.00
2	33.94	16.98
3	40.65	21.33
4	47.12	26.04
5	53.32	31.09
6	59.24	36.47
7	64.87	42.16
8	70.17	48.15
9	75.15	54.42
10	79.77	60.94
11	84.04	67.71
12	87.94	74.70
13	87.94	74.70

Circle Center At X = -43.13 ; Y = 143.22 ; and Radius = 147.90
 Factor of Safety
 *** 1.379 ***

Failure Surface Specified By 13 Coordinate Points

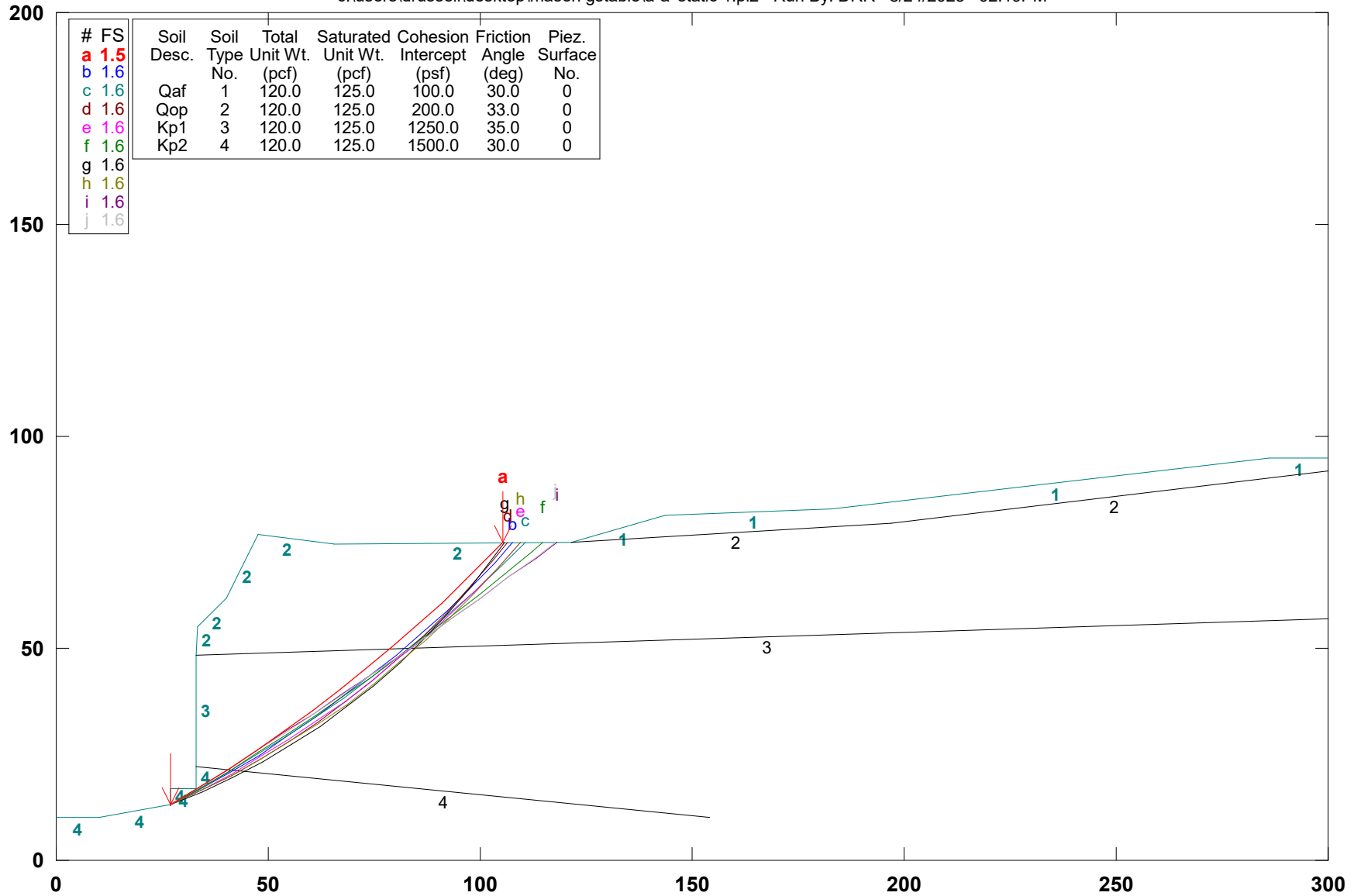
Point No.	X-Surf (ft)	Y-Surf (ft)
1	27.00	13.00
2	33.81	17.20
3	40.44	21.67
4	46.89	26.41
5	53.14	31.40
6	59.19	36.64
7	65.02	42.11
8	70.63	47.82
9	76.00	53.75
10	81.13	59.89
11	86.01	66.22
12	90.63	72.75
13	91.92	74.74

Circle Center At X = -74.16 ; Y = 184.49 ; and Radius = 199.10
 Factor of Safety

*** 1.390 ***
**** END OF GSTABL7 OUTPUT ****

Mason Residence CWE 2230146.01 A-A' Static to 1.5

c:\users\drussell\desktop\mason gstable\A-A' static 1.pl2 Run By: DRR 8/24/2023 02:19PM



GSTABL7 v.2 FSmin=1.5
 Safety Factors Are Calculated By The Modified Bishop Method

*** GSTABL7 ***

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.003, June 2002 **
 (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.

Analysis Run Date: 8/24/2023
 Time of Run: 02:19PM
 Run By: DRR

Input Data Filename: C:\Users\drussell\Desktop\Mason GStable\a-a' static 1.5

Output Filename: C:\Users\drussell\Desktop\Mason GStable\a-a' static 1.OUT

Unit System: English

Plotted Output Filename: C:\Users\drussell\Desktop\Mason ble\a-a' static 1.PLT

PROBLEM DESCRIPTION: Mason Residence CWE 2230146.01
 A-A' Static to 1.5

BOUNDARY COORDINATES
 15 Top Boundaries
 19 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below End
1	0.00	10.00	10.00	10.00	4
2	10.00	10.00	27.00	13.00	4
3	27.00	13.00	27.10	17.00	4
4	27.10	17.00	33.00	17.00	4
5	33.00	17.00	33.05	22.00	4
6	33.05	22.00	33.10	48.50	3
7	33.10	48.50	33.20	55.00	2
8	33.20	55.00	40.00	62.00	2
9	40.00	62.00	47.50	77.00	2
10	47.50	77.00	65.50	74.50	2
11	65.50	74.50	121.50	75.00	2
12	121.50	75.00	143.50	81.50	1
13	143.50	81.50	183.00	83.00	1
14	183.00	83.00	286.00	95.00	1
15	286.00	95.00	300.00	95.00	1
16	197.00	79.50	300.00	92.00	2
17	121.50	75.00	197.00	79.50	2
18	33.10	48.50	300.00	57.00	3
19	33.05	22.00	154.00	10.00	4

Default Y-Origin = 0.00(ft)
 Default X-Plus Value = 0.00(ft)
 User Specified Y-Plus Value = 10.00(ft)

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion (psf)	Friction Intercept (deg)	Pore Pressure Param. (psf)	Pressure Constant	Piez. Surface No.
1	120.0	125.0	100.0	30.0	0.00	0.0	0
2	120.0	125.0	200.0	33.0	0.00	0.0	0
3	120.0	125.0	1250.0	35.0	0.00	0.0	0
4	120.0	125.0	1500.0	30.0	0.00	0.0	0

A Critical Failure Surface Searching Method, Using A Random
 Technique For Generating Circular Surfaces, Has Been Specified.
 3000 Trial Surfaces Have Been Generated.

300 Surface(s) Initiate(s) From Each Of 10 Points Equally Spaced
 Along The Ground Surface Between X = 27.00(ft)
 and X = 33.00(ft)
 Each Surface Terminates Between X = 105.00(ft)
 and X = 145.00(ft)

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 0.00(ft)

8.00(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 Evaluated = 3000

Statistical Data On All Valid FS Values:

FS Max = 4.702 FS Min = 1.508 FS Ave = 3.653

Standard Deviation = 0.638 Coefficient of Variation = 17.47 %

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	27.00	13.00
2	33.84	17.16
3	40.58	21.46
4	47.24	25.90
5	53.80	30.47
6	60.26	35.19
7	66.62	40.04
8	72.88	45.02
9	79.03	50.14
10	85.07	55.38
11	91.01	60.75
12	96.82	66.24
13	102.53	71.85
14	105.45	74.86

Circle Center At X = -166.69 ; Y = 339.35 ; and Radius = 379.50

Factor of Safety

*** 1.508 ***

Individual data on the 23 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force		Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force		Surcharge Load (lbs)
			Top (lbs)	Bot (lbs)			Hor (lbs)	Ver (lbs)	
1	0.1	23.6	0.0	0.0	0.	0.	0.0	0.0	0.0
2	5.9	1518.9	0.0	0.0	0.	0.	0.0	0.0	0.0
3	0.0	17.0	0.0	0.0	0.	0.	0.0	0.0	0.0
4	0.0	111.3	0.0	0.0	0.	0.	0.0	0.0	0.0
5	0.1	420.1	0.0	0.0	0.	0.	0.0	0.0	0.0
6	0.6	2925.3	0.0	0.0	0.	0.	0.0	0.0	0.0
7	6.2	29372.7	0.0	0.0	0.	0.	0.0	0.0	0.0
8	0.3	1511.2	0.0	0.0	0.	0.	0.0	0.0	0.0
9	0.3	1374.0	0.0	0.0	0.	0.	0.0	0.0	0.0
10	6.7	36848.2	0.0	0.0	0.	0.	0.0	0.0	0.0
11	0.3	1603.2	0.0	0.0	0.	0.	0.0	0.0	0.0
12	6.3	36484.7	0.0	0.0	0.	0.	0.0	0.0	0.0
13	6.5	33224.3	0.0	0.0	0.	0.	0.0	0.0	0.0
14	5.2	23694.8	0.0	0.0	0.	0.	0.0	0.0	0.0
15	1.1	4692.4	0.0	0.0	0.	0.	0.0	0.0	0.0
16	6.3	24036.1	0.0	0.0	0.	0.	0.0	0.0	0.0
17	5.9	19295.6	0.0	0.0	0.	0.	0.0	0.0	0.0
18	0.2	646.7	0.0	0.0	0.	0.	0.0	0.0	0.0
19	6.0	15874.2	0.0	0.0	0.	0.	0.0	0.0	0.0
20	5.9	11843.3	0.0	0.0	0.	0.	0.0	0.0	0.0
21	5.8	7861.6	0.0	0.0	0.	0.	0.0	0.0	0.0
22	5.7	3941.0	0.0	0.0	0.	0.	0.0	0.0	0.0
23	2.9	523.5	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	27.00	13.00
2	34.05	16.78
3	40.99	20.75
4	47.83	24.91
5	54.54	29.26
6	61.14	33.79
7	67.61	38.50
8	73.94	43.38

9	80.15	48.43
10	86.21	53.65
11	92.12	59.04
12	97.89	64.58
13	103.50	70.28
14	107.78	74.88

Circle Center At X = -107.40 ; Y = 272.14 ; and Radius = 291.92
 Factor of Safety
 *** 1.560 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	27.00	13.00
2	34.02	16.83
3	40.96	20.82
4	47.80	24.97
5	54.54	29.27
6	61.19	33.72
7	67.73	38.33
8	74.17	43.08
9	80.50	47.97
10	86.71	53.01
11	92.81	58.18
12	98.79	63.50
13	104.65	68.95
14	110.38	74.53
15	110.75	74.90

Circle Center At X = -138.33 ; Y = 324.33 ; and Radius = 352.50
 Factor of Safety
 *** 1.583 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	27.00	13.00
2	34.25	16.38
3	41.37	20.04
4	48.34	23.97
5	55.15	28.16
6	61.80	32.61
7	68.27	37.31
8	74.55	42.26
9	80.64	47.45
10	86.53	52.87
11	92.20	58.51
12	97.66	64.36
13	102.88	70.42
14	106.43	74.87

Circle Center At X = -57.02 ; Y = 202.79 ; and Radius = 207.55
 Factor of Safety
 *** 1.584 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	27.00	13.00
2	34.14	16.60
3	41.18	20.41
4	48.10	24.42
5	54.90	28.64
6	61.57	33.05
7	68.11	37.66
8	74.51	42.46
9	80.77	47.45
10	86.87	52.62
11	92.83	57.96
12	98.62	63.48
13	104.25	69.16
14	109.59	74.89

Circle Center At X = -91.75 ; Y = 257.53 ; and Radius = 271.84
 Factor of Safety
 *** 1.593 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	27.00	13.00
2	33.90	17.04
3	40.75	21.18
4	47.54	25.40
5	54.28	29.73
6	60.95	34.14
7	67.56	38.65
8	74.11	43.24
9	80.59	47.93
10	87.01	52.70
11	93.36	57.56
12	99.65	62.51
13	105.87	67.55
14	112.01	72.67
15	114.67	74.94

Circle Center At X = -263.41 ; Y = 517.17 ; and Radius = 581.83

Factor of Safety
 *** 1.604 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	27.00	13.00
2	34.39	16.07
3	41.62	19.48
4	48.69	23.23
5	55.58	27.30
6	62.27	31.68
7	68.75	36.37
8	75.01	41.36
9	81.02	46.64
10	86.78	52.18
11	92.28	58.00
12	97.50	64.06
13	102.44	70.35
14	105.64	74.86

Circle Center At X = -35.03 ; Y = 172.78 ; and Radius = 171.39

Factor of Safety
 *** 1.608 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	27.00	13.00
2	34.25	16.38
3	41.38	20.00
4	48.38	23.87
5	55.25	27.98
6	61.97	32.33
7	68.53	36.90
8	74.93	41.70
9	81.17	46.71
10	87.22	51.94
11	93.09	57.37
12	98.77	63.00
13	104.26	68.83
14	109.54	74.84
15	109.58	74.89

Circle Center At X = -67.18 ; Y = 224.69 ; and Radius = 231.69

Factor of Safety
 *** 1.614 ***

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	27.00	13.00
2	33.78	17.25
3	40.53	21.55
4	47.25	25.88
5	53.95	30.25

6	60.63	34.66
7	67.28	39.11
8	73.90	43.59
9	80.50	48.11
10	87.07	52.68
11	93.62	57.28
12	100.14	61.91
13	106.63	66.59
14	113.09	71.30
15	118.07	74.97

Circle Center At X = -707.13 ; Y = 1189.82 ; and Radius = 1387.02

Factor of Safety

*** 1.620 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	27.00	13.00
2	33.80	17.21
3	40.57	21.47
4	47.32	25.78
5	54.03	30.13
6	60.71	34.53
7	67.36	38.97
8	73.98	43.47
9	80.57	48.00
10	87.13	52.59
11	93.65	57.22
12	100.14	61.89
13	106.60	66.61
14	113.03	71.38
15	117.80	74.97

Circle Center At X = -573.55 ; Y = 990.59 ; and Radius = 1147.32

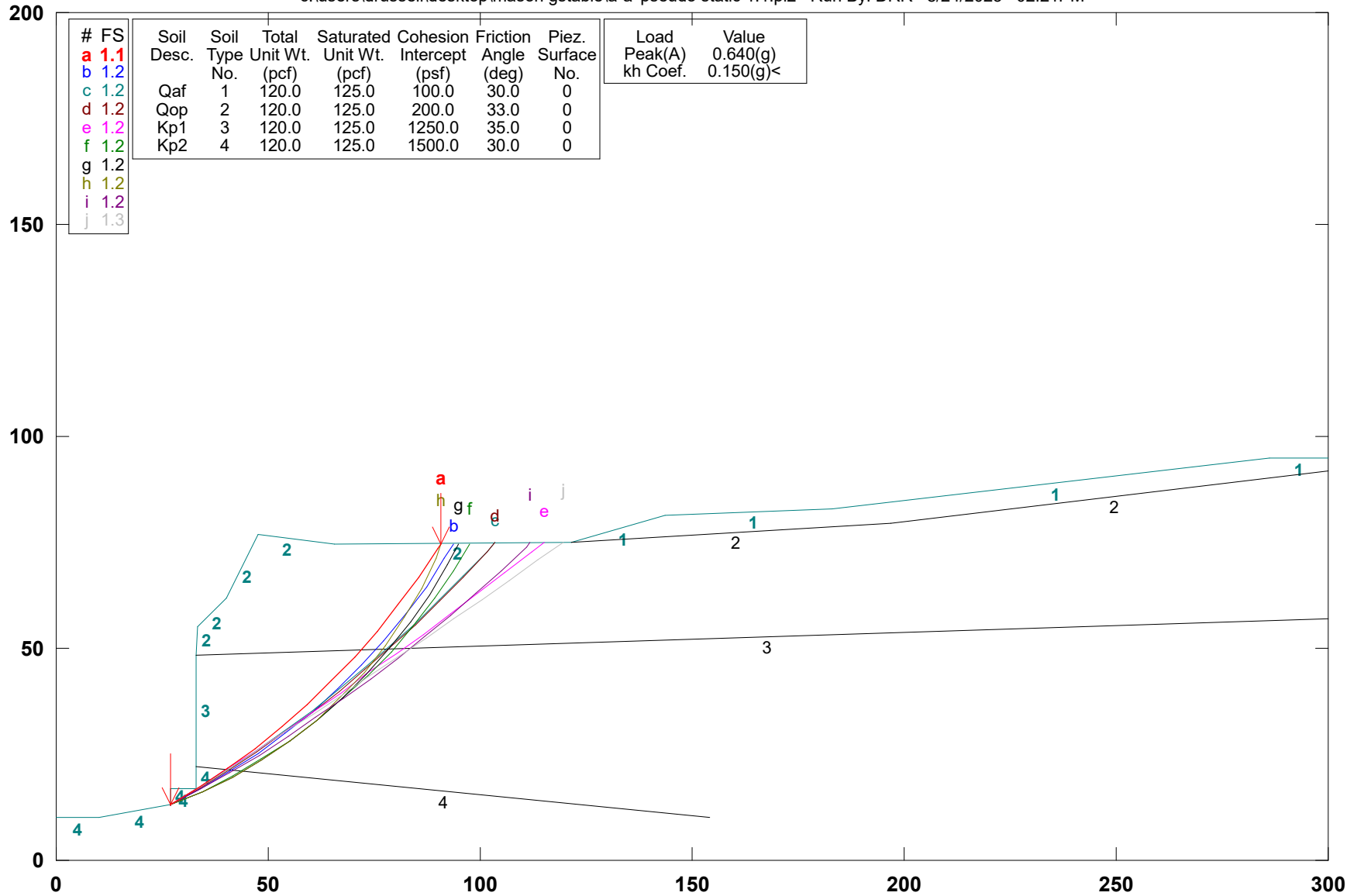
Factor of Safety

*** 1.621 ***

**** END OF GSTABL7 OUTPUT ****

Mason Residence CWE 2230146.01 A-A' Pseudo Static 1.1

c:\users\drussell\desktop\mason gstable\A-A' pseudo static 1.1.pl2 Run By: DRR 8/24/2023 02:21PM



GSTABL7 v.2 FSmin=1.1
 Safety Factors Are Calculated By The Modified Bishop Method

*** GSTABL7 ***

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.003, June 2002 **

(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.

Analysis Run Date: 8/24/2023

Time of Run: 02:21PM

Run By: DRR

Input Data Filename: C:\Users\drussell\Desktop\Mason GStable\a-a' pseudo static 1.1.in

Output Filename: C:\Users\drussell\Desktop\Mason GStable\a-a' pseudo static 1.1.OUT

Unit System: English

Plotted Output Filename: C:\Users\drussell\Desktop\Mason ble\a-a' pseudo static 1.1.PLT

PROBLEM DESCRIPTION: Mason Residence CWE 2230146.01

A-A' Pseudo Static 1.1

BOUNDARY COORDINATES

15 Top Boundaries

19 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	10.00	10.00	10.00	4
2	10.00	10.00	27.00	13.00	4
3	27.00	13.00	27.10	17.00	4
4	27.10	17.00	33.00	17.00	4
5	33.00	17.00	33.05	22.00	4
6	33.05	22.00	33.10	48.50	3
7	33.10	48.50	33.20	55.00	2
8	33.20	55.00	40.00	62.00	2
9	40.00	62.00	47.50	77.00	2
10	47.50	77.00	65.50	74.50	2
11	65.50	74.50	121.50	75.00	2
12	121.50	75.00	143.50	81.50	1
13	143.50	81.50	183.00	83.00	1
14	183.00	83.00	286.00	95.00	1
15	286.00	95.00	300.00	95.00	1
16	197.00	79.50	300.00	92.00	2
17	121.50	75.00	197.00	79.50	2
18	33.10	48.50	300.00	57.00	3
19	33.05	22.00	154.00	10.00	4

Default Y-Origin = 0.00(ft)

Default X-Plus Value = 0.00(ft)

User Specified Y-Plus Value = 10.00(ft)

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param. (psf)	Pressure Constant (psf)	Piez. Surface No.
1	120.0	125.0	100.0	30.0	0.00	0.0	0
2	120.0	125.0	200.0	33.0	0.00	0.0	0
3	120.0	125.0	1250.0	35.0	0.00	0.0	0
4	120.0	125.0	1500.0	30.0	0.00	0.0	0

Specified Peak Ground Acceleration Coefficient (A) = 0.640(g)

Specified Horizontal Earthquake Coefficient (kh) = 0.150(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.

3000 Trial Surfaces Have Been Generated.

300 Surface(s) Initiate(s) From Each Of 10 Points Equally Spaced

Along The Ground Surface Between X = 27.00(ft)

and X = 33.00(ft)
 Each Surface Terminates Between X = 90.00(ft)
 and X = 160.00(ft)
 Unless Further Limitations Were Imposed, The Minimum Elevation
 At Which A Surface Extends Is Y = 0.00(ft)

8.00(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 Evaluated = 3000

Statistical Data On All Valid FS Values:

FS Max = 3.760 FS Min = 1.130 FS Ave = 2.910

Standard Deviation = 0.544 Coefficient of Variation = 18.68 %

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	27.00	13.00
2	33.83	17.16
3	40.48	21.62
4	46.92	26.36
5	53.15	31.38
6	59.15	36.67
7	64.92	42.21
8	70.44	48.00
9	75.70	54.03
10	80.70	60.28
11	85.41	66.74
12	89.84	73.40
13	90.64	74.72

Circle Center At X = -64.87 ; Y = 171.48 ; and Radius = 183.18

Factor of Safety

*** 1.130 ***

Individual data on the 22 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force		Tie Force		Earthquake Force		
			Top (lbs)	Bot (lbs)	Norm (lbs)	Tan (lbs)	Hor (lbs)	Ver (lbs)	Surcharge Load (lbs)
1	0.1	23.6	0.0	0.0	0.	0.	3.5	0.0	0.0
2	5.9	1516.4	0.0	0.0	0.	0.	227.5	0.0	0.0
3	0.0	17.0	0.0	0.0	0.	0.	2.5	0.0	0.0
4	0.0	111.3	0.0	0.0	0.	0.	16.7	0.0	0.0
5	0.1	420.0	0.0	0.0	0.	0.	63.0	0.0	0.0
6	0.6	2908.3	0.0	0.0	0.	0.	436.3	0.0	0.0
7	6.2	29306.4	0.0	0.0	0.	0.	4396.0	0.0	0.0
8	0.0	65.9	0.0	0.0	0.	0.	9.9	0.0	0.0
9	0.5	2274.6	0.0	0.0	0.	0.	341.2	0.0	0.0
10	6.4	35102.6	0.0	0.0	0.	0.	5265.4	0.0	0.0
11	0.6	3478.1	0.0	0.0	0.	0.	521.7	0.0	0.0
12	5.6	32193.7	0.0	0.0	0.	0.	4829.1	0.0	0.0
13	6.0	30099.8	0.0	0.0	0.	0.	4515.0	0.0	0.0
14	5.8	24600.2	0.0	0.0	0.	0.	3690.0	0.0	0.0
15	0.6	2228.7	0.0	0.0	0.	0.	334.3	0.0	0.0
16	4.9	17258.9	0.0	0.0	0.	0.	2588.8	0.0	0.0
17	1.5	4673.2	0.0	0.0	0.	0.	701.0	0.0	0.0
18	3.7	10200.3	0.0	0.0	0.	0.	1530.0	0.0	0.0
19	5.0	10464.8	0.0	0.0	0.	0.	1569.7	0.0	0.0
20	4.7	6310.4	0.0	0.0	0.	0.	946.6	0.0	0.0
21	4.4	2460.5	0.0	0.0	0.	0.	369.1	0.0	0.0
22	0.8	63.2	0.0	0.0	0.	0.	9.5	0.0	0.0

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	27.00	13.00
2	34.07	16.75
3	40.95	20.83
4	47.62	25.25
5	54.06	29.99
6	60.26	35.04
7	66.21	40.39

8	71.90	46.02
9	77.29	51.93
10	82.40	58.09
11	87.19	64.49
12	91.67	71.12
13	93.87	74.75

Circle Center At X = -45.92 ; Y = 159.17 ; and Radius = 163.35
 Factor of Safety
 *** 1.173 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	27.00	13.00
2	33.85	17.13
3	40.60	21.43
4	47.24	25.88
5	53.78	30.50
6	60.19	35.28
7	66.50	40.21
8	72.68	45.29
9	78.73	50.51
10	84.66	55.89
11	90.45	61.41
12	96.11	67.06
13	101.63	72.85
14	103.43	74.84

Circle Center At X = -139.24 ; Y = 296.62 ; and Radius = 328.75
 Factor of Safety
 *** 1.183 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	27.00	13.00
2	33.91	17.03
3	40.71	21.25
4	47.39	25.64
5	53.96	30.22
6	60.40	34.97
7	66.70	39.88
8	72.88	44.97
9	78.92	50.22
10	84.81	55.63
11	90.56	61.19
12	96.15	66.91
13	101.59	72.78
14	103.41	74.84

Circle Center At X = -119.56 ; Y = 272.21 ; and Radius = 297.77
 Factor of Safety
 *** 1.190 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	27.00	13.00
2	33.76	17.28
3	40.48	21.62
4	47.17	26.01
5	53.83	30.44
6	60.45	34.94
7	67.03	39.48
8	73.58	44.07
9	80.09	48.72
10	86.57	53.42
11	93.01	58.17
12	99.41	62.96
13	105.77	67.81
14	112.10	72.71
15	114.94	74.94

Circle Center At X = -516.74 ; Y = 878.46 ; and Radius = 1022.09
 Factor of Safety
 *** 1.229 ***

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	27.00	13.00
2	34.33	16.21
3	41.46	19.83
4	48.39	23.84
5	55.07	28.23
6	61.51	32.98
7	67.66	38.09
8	73.52	43.54
9	79.07	49.30
10	84.29	55.36
11	89.16	61.71
12	93.67	68.32
13	97.57	74.79

Circle Center At X = -26.78 ; Y = 145.65 ; and Radius = 143.14

Factor of Safety
 *** 1.236 ***

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	27.00	13.00
2	34.37	16.10
3	41.54	19.67
4	48.46	23.68
5	55.11	28.12
6	61.47	32.98
7	67.51	38.23
8	73.20	43.85
9	78.52	49.82
10	83.45	56.12
11	87.98	62.72
12	92.07	69.59
13	94.73	74.76

Circle Center At X = -18.14 ; Y = 130.62 ; and Radius = 125.98

Factor of Safety
 *** 1.238 ***

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	27.00	13.00
2	34.43	15.96
3	41.63	19.46
4	48.54	23.49
5	55.13	28.01
6	61.37	33.02
7	67.23	38.48
8	72.65	44.35
9	77.63	50.61
10	82.13	57.23
11	86.13	64.16
12	89.60	71.37
13	90.92	74.73

Circle Center At X = -9.04 ; Y = 114.40 ; and Radius = 107.61

Factor of Safety
 *** 1.243 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	27.00	13.00
2	34.02	16.83
3	40.96	20.81
4	47.82	24.94
5	54.58	29.21
6	61.25	33.63
7	67.82	38.19
8	74.30	42.89
9	80.67	47.73
10	86.93	52.70

11	93.09	57.81
12	99.14	63.05
13	105.07	68.41
14	110.88	73.91
15	111.91	74.91

Circle Center At X = -147.70 ; Y = 341.83 ; and Radius = 372.35

Factor of Safety

*** 1.246 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	27.00	13.00
2	33.77	17.26
3	40.53	21.54
4	47.26	25.86
5	53.98	30.21
6	60.67	34.59
7	67.35	39.00
8	74.00	43.44
9	80.64	47.91
10	87.25	52.41
11	93.85	56.94
12	100.42	61.49
13	106.97	66.08
14	113.51	70.70
15	119.51	74.98

Circle Center At X = -910.69 ; Y = 1512.52 ; and Radius = 1768.56

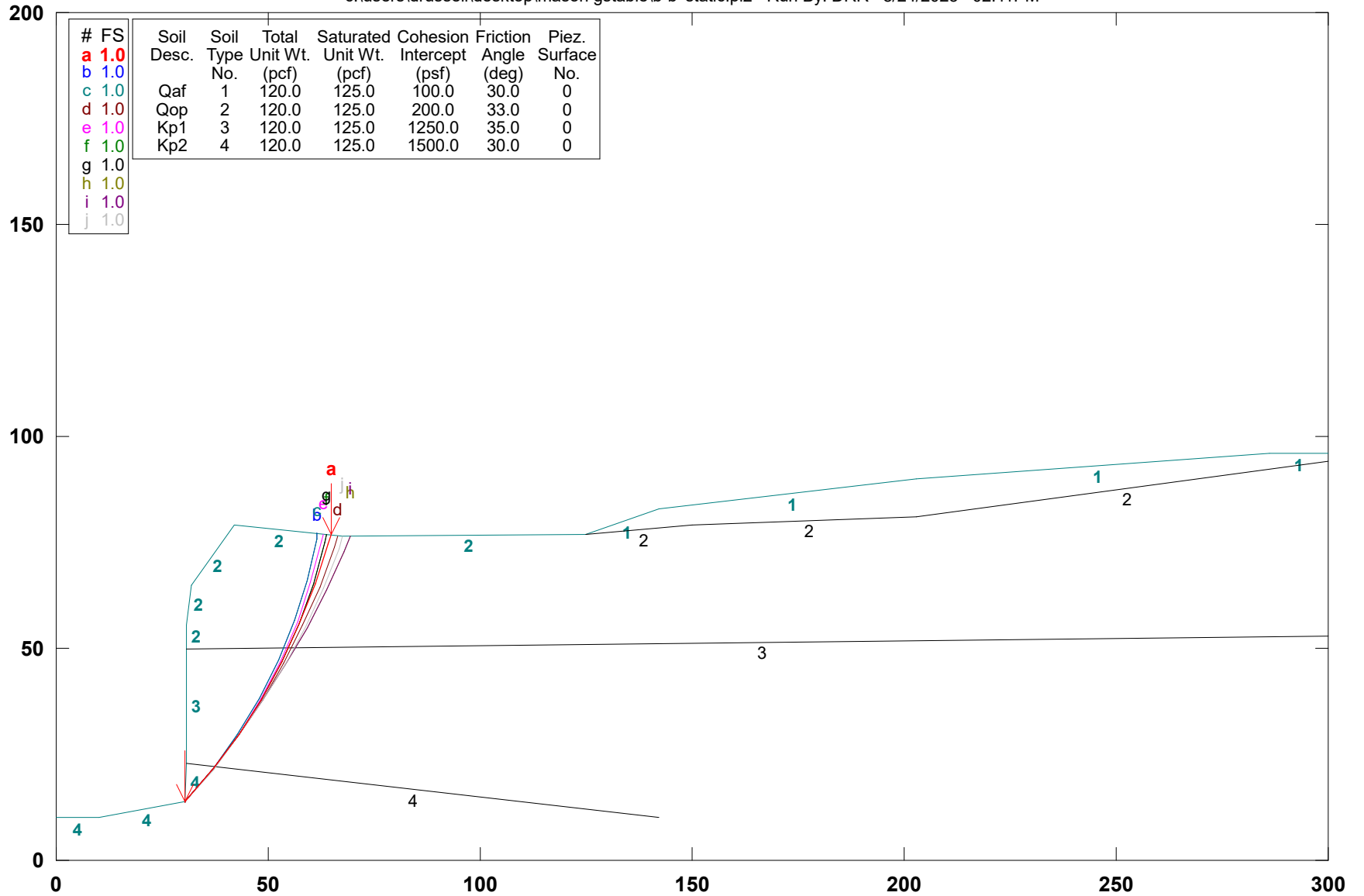
Factor of Safety

*** 1.255 ***

**** END OF GSTABL7 OUTPUT ****

Mason Residence CWE 2230146.01 B-B' Static

c:\users\drussell\desktop\mason gstable\b-b' static.pl2 Run By: DRR 8/24/2023 02:11PM



GSTABL7 v.2 FSmin=1.0
 Safety Factors Are Calculated By The Modified Bishop Method

*** GSTABL7 ***

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.003, June 2002 **
 (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.

Analysis Run Date: 8/24/2023
 Time of Run: 02:11PM
 Run By: DRR
 Input Data Filename: C:\Users\drussell\Desktop\Mason GStable\b-b' static.
 Output Filename: C:\Users\drussell\Desktop\Mason GStable\b-b' static.OUT
 Unit System: English
 Plotted Output Filename: C:\Users\drussell\Desktop\Mason ble\b-b' static.PLT

PROBLEM DESCRIPTION: Mason Residence CWE 2230146.01
 B-B' Static

BOUNDARY COORDINATES
 13 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	10.00	10.00	10.00	4
2	10.00	10.00	30.50	14.00	4
3	30.50	14.00	30.60	23.00	4
4	30.60	23.00	30.70	50.00	3
5	30.70	50.00	30.80	55.50	2
6	30.80	55.50	32.00	65.00	2
7	32.00	65.00	42.00	79.00	2
8	42.00	79.00	67.50	76.50	2
9	67.50	76.50	125.00	77.00	2
10	125.00	77.00	142.00	83.00	1
11	142.00	83.00	203.00	90.00	1
12	203.00	90.00	286.00	96.00	1
13	286.00	96.00	300.00	96.00	1
14	203.00	81.00	300.00	94.00	2
15	150.00	79.00	203.00	81.00	2
16	125.00	77.00	150.00	79.00	2
17	30.70	50.00	300.00	53.00	3
18	30.60	23.00	142.00	10.00	4

Default Y-Origin = 0.00(ft)
 Default X-Plus Value = 0.00(ft)
 User Specified Y-Plus Value = 10.00(ft)

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param. (psf)	Pressure Constant (psf)	Piez. Surface No.
1	120.0	125.0	100.0	30.0	0.00	0.0	0
2	120.0	125.0	200.0	33.0	0.00	0.0	0
3	120.0	125.0	1250.0	35.0	0.00	0.0	0
4	120.0	125.0	1500.0	30.0	0.00	0.0	0

A Critical Failure Surface Searching Method, Using A Random
 Technique For Generating Circular Surfaces, Has Been Specified.
 3000 Trial Surfaces Have Been Generated.
 3000 Surface(s) Initiate(s) From Each Of 1 Points Equally Spaced
 Along The Ground Surface Between X = 30.50(ft)
 and X = 30.50(ft)
 Each Surface Terminates Between X = 50.00(ft)
 and X = 100.00(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.
 Restrictions Have Been Imposed Upon The Angle Of Initiation.
 The Angle Has Been Restricted Between The Angles Of 10.0
 And 50.0 deg.

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 Evaluated = 3000

Statistical Data On All Valid FS Values:

FS Max = 1.841 FS Min = 0.966 FS Ave = 1.480
 Standard Deviation = 0.263 Coefficient of Variation = 17.75 %

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.50	14.00
2	36.98	21.61
3	42.95	29.64
4	48.38	38.03
5	53.25	46.77
6	57.53	55.81
7	61.21	65.11
8	64.27	74.63
9	64.81	76.76

Circle Center At X = -82.09 ; Y = 116.43 ; and Radius = 152.21

Factor of Safety
 *** 0.966 ***

Individual data on the 15 slices

Slice No.	Width (ft)	Weight (lbs)	Water		Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force		Surcharge Load (lbs)
			Top (lbs)	Bot (lbs)			Hor (lbs)	Ver (lbs)	
1	0.1	53.3	0.0	0.0	0.	0.	0.0	0.0	0.0
2	0.1	267.9	0.0	0.0	0.	0.	0.0	0.0	0.0
3	0.1	461.5	0.0	0.0	0.	0.	0.0	0.0	0.0
4	1.2	6507.8	0.0	0.0	0.	0.	0.0	0.0	0.0
5	5.0	29779.0	0.0	0.0	0.	0.	0.0	0.0	0.0
6	0.4	2653.9	0.0	0.0	0.	0.	0.0	0.0	0.0
7	4.6	27750.5	0.0	0.0	0.	0.	0.0	0.0	0.0
8	1.0	5708.1	0.0	0.0	0.	0.	0.0	0.0	0.0
9	5.4	29191.7	0.0	0.0	0.	0.	0.0	0.0	0.0
10	4.9	20866.6	0.0	0.0	0.	0.	0.0	0.0	0.0
11	1.7	5828.8	0.0	0.0	0.	0.	0.0	0.0	0.0
12	2.6	7736.2	0.0	0.0	0.	0.	0.0	0.0	0.0
13	3.7	7435.8	0.0	0.0	0.	0.	0.0	0.0	0.0
14	3.1	2608.3	0.0	0.0	0.	0.	0.0	0.0	0.0
15	0.5	70.4	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.50	14.00
2	36.98	21.62
3	42.83	29.73
4	48.01	38.28
5	52.49	47.22
6	56.24	56.49
7	59.23	66.03
8	61.45	75.78
9	61.64	77.07

Circle Center At X = -61.17 ; Y = 98.57 ; and Radius = 124.72

Factor of Safety
 *** 0.969 ***

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.50	14.00
2	36.98	21.62
3	42.83	29.73
4	48.01	38.28
5	52.49	47.22

6 56.24 56.49
 7 59.23 66.03
 8 61.45 75.78
 9 61.64 77.07
 Circle Center At X = -61.17 ; Y = 98.57 ; and Radius = 124.72

Factor of Safety
 *** 0.969 ***

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.50	14.00
2	37.02	21.58
3	43.06	29.55
4	48.61	37.87
5	53.64	46.51
6	58.13	55.45
7	62.07	64.64
8	65.44	74.05
9	66.19	76.63

Circle Center At X = -90.44 ; Y = 124.56 ; and Radius = 163.86

Factor of Safety
 *** 0.969 ***

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.50	14.00
2	37.02	21.59
3	42.95	29.64
4	48.25	38.11
5	52.91	46.96
6	56.89	56.14
7	60.17	65.58
8	62.73	75.25
9	63.05	76.94

Circle Center At X = -67.19 ; Y = 104.52 ; and Radius = 133.18

Factor of Safety
 *** 0.969 ***

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.50	14.00
2	37.04	21.56
3	43.02	29.58
4	48.41	38.00
5	53.17	46.80
6	57.29	55.91
7	60.74	65.30
8	63.50	74.91
9	63.91	76.85

Circle Center At X = -70.93 ; Y = 108.35 ; and Radius = 138.52

Factor of Safety
 *** 0.970 ***

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.50	14.00
2	37.04	21.56
3	43.02	29.58
4	48.41	38.00
5	53.17	46.80
6	57.29	55.91
7	60.74	65.30
8	63.50	74.91
9	63.91	76.85

Circle Center At X = -70.93 ; Y = 108.35 ; and Radius = 138.52

Factor of Safety
 *** 0.970 ***

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
-----------	-------------	-------------

1	30.50	14.00
2	36.95	21.64
3	43.05	29.56
4	48.79	37.75
5	54.16	46.19
6	59.14	54.86
7	63.72	63.75
8	67.90	72.83
9	69.40	76.52

Circle Center At X = -136.04 ; Y = 161.18 ; and Radius = 222.26
 Factor of Safety
 *** 0.970 ***

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.50	14.00
2	36.95	21.64
3	43.05	29.56
4	48.79	37.75
5	54.16	46.19
6	59.14	54.86
7	63.72	63.75
8	67.90	72.83
9	69.40	76.52

Circle Center At X = -136.04 ; Y = 161.18 ; and Radius = 222.26
 Factor of Safety
 *** 0.970 ***

Failure Surface Specified By 9 Coordinate Points

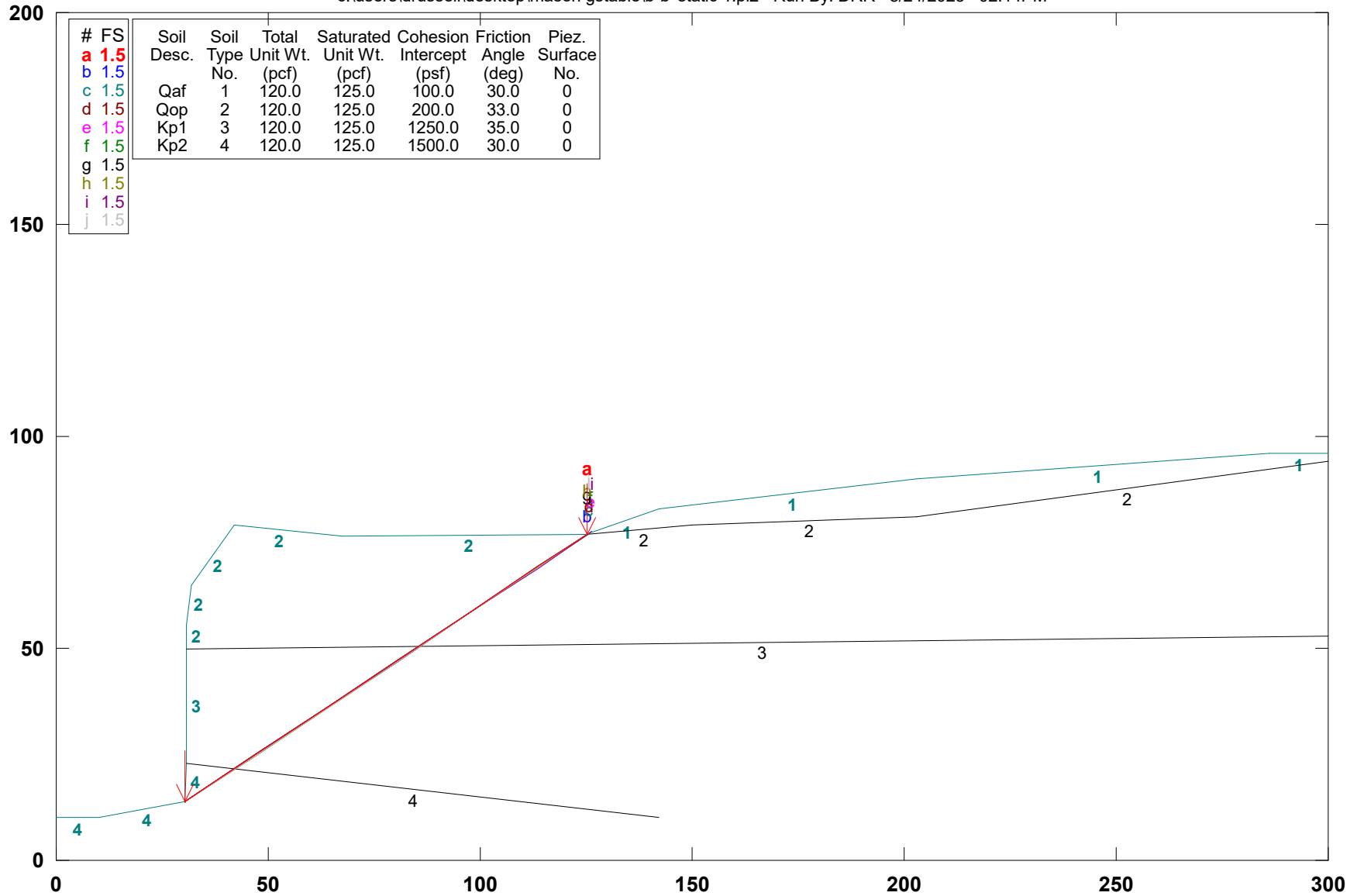
Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.50	14.00
2	37.05	21.55
3	43.17	29.46
4	48.83	37.71
5	54.02	46.25
6	58.72	55.08
7	62.91	64.16
8	66.58	73.46
9	67.59	76.50

Circle Center At X = -99.90 ; Y = 133.80 ; and Radius = 177.08
 Factor of Safety
 *** 0.972 ***

**** END OF GSTABL7 OUTPUT ****

Mason Residence CWE 2230146.01 B-B' Static TO 1.5

c:\users\drussell\desktop\mason gstable\b-b' static 1.pl2 Run By: DRR 8/24/2023 02:14PM



GSTABL7 v.2 FSmin=1.5

Safety Factors Are Calculated By The Modified Bishop Method

*** GSTABL7 ***

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.003, June 2002 **

(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.

Analysis Run Date: 8/24/2023

Time of Run: 02:14PM

Run By: DRR

Input Data Filename: C:\Users\drussell\Desktop\Mason GStable\b-b' static 1.5

Output Filename: C:\Users\drussell\Desktop\Mason GStable\b-b' static 1.OUT

Unit System: English

Plotted Output Filename: C:\Users\drussell\Desktop\Mason ble\b-b' static 1.PLT

PROBLEM DESCRIPTION: Mason Residence CWE 2230146.01

B-B' Static TO 1.5

BOUNDARY COORDINATES

13 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	10.00	10.00	10.00	4
2	10.00	10.00	30.50	14.00	4
3	30.50	14.00	30.60	23.00	4
4	30.60	23.00	30.70	50.00	3
5	30.70	50.00	30.80	55.50	2
6	30.80	55.50	32.00	65.00	2
7	32.00	65.00	42.00	79.00	2
8	42.00	79.00	67.50	76.50	2
9	67.50	76.50	125.00	77.00	2
10	125.00	77.00	142.00	83.00	1
11	142.00	83.00	203.00	90.00	1
12	203.00	90.00	286.00	96.00	1
13	286.00	96.00	300.00	96.00	1
14	203.00	81.00	300.00	94.00	2
15	150.00	79.00	203.00	81.00	2
16	125.00	77.00	150.00	79.00	2
17	30.70	50.00	300.00	53.00	3
18	30.60	23.00	142.00	10.00	4

Default Y-Origin = 0.00(ft)

Default X-Plus Value = 0.00(ft)

User Specified Y-Plus Value = 10.00(ft)

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion (psf)	Friction Angle (deg)	Pore Pressure Param. (psf)	Pressure Constant (psf)	Piez. Surface No.
1	120.0	125.0	100.0	30.0	0.00	0.0	0
2	120.0	125.0	200.0	33.0	0.00	0.0	0
3	120.0	125.0	1250.0	35.0	0.00	0.0	0
4	120.0	125.0	1500.0	30.0	0.00	0.0	0

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified. 3000 Trial Surfaces Have Been Generated.

3000 Surface(s) Initiate(s) From Each Of 1 Points Equally Spaced

Along The Ground Surface Between X = 30.50(ft)

and X = 30.50(ft)

Each Surface Terminates Between X = 125.00(ft)

and X = 180.00(ft)

Unless Further Limitations Were Imposed, The Minimum Elevation

At Which A Surface Extends Is Y = 0.00(ft)

20.00(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 Evaluated = 3000
 Statistical Data On All Valid FS Values:
 FS Max = 5.768 FS Min = 1.497 FS Ave = 3.608
 Standard Deviation = 1.292 Coefficient of Variation = 35.81 %
 Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.50	14.00
2	47.18	25.03
3	63.85	36.09
4	80.50	47.17
5	97.13	58.27
6	113.75	69.40
7	125.14	77.05

Circle Center At X = -7608.50 ; Y = 11583.64 ; and Radius = 13864.01
 Factor of Safety
 *** 1.497 ***

Slice No.	Width (ft)	Weight (lbs)	Water		Tie		Earthquake		Surcharge Load (lbs)
			Force Top (lbs)	Force Bot (lbs)	Force Norm (lbs)	Force Tan (lbs)	Force Hor (lbs)	Force Ver (lbs)	
1	0.1	53.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.1	268.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.1	463.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	1.2	6574.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	10.0	64441.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.1	572.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	5.1	33895.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	16.7	94228.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	3.7	17253.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	13.0	52588.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	5.2	17179.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	11.5	30658.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	16.6	25912.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	11.2	5093.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	0.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Failure Surface Specified By 7 Coordinate Points
 Point No. X-Surf (ft) Y-Surf (ft)
 1 30.50 14.00
 2 47.18 25.03
 3 63.85 36.09
 4 80.50 47.17
 5 97.13 58.27
 6 113.75 69.40
 7 125.14 77.05

Circle Center At X = -7608.25 ; Y = 11583.27 ; and Radius = 13863.57
 Factor of Safety
 *** 1.497 ***

Failure Surface Specified By 7 Coordinate Points
 Point No. X-Surf (ft) Y-Surf (ft)
 1 30.50 14.00
 2 47.20 25.01
 3 63.88 36.04
 4 80.55 47.10
 5 97.20 58.18
 6 113.83 69.29
 7 125.72 77.25

Circle Center At X = -7224.75 ; Y = 11039.78 ; and Radius = 13198.73
 Factor of Safety
 *** 1.500 ***

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.50	14.00
2	47.20	25.01
3	63.88	36.04
4	80.55	47.10
5	97.20	58.18
6	113.83	69.29
7	125.72	77.26

Circle Center At X = -7222.25 ; Y = 11036.06 ; and Radius = 13194.25
 Factor of Safety
 *** 1.500 ***

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.50	14.00
2	47.20	25.00
3	63.89	36.02
4	80.57	47.07
5	97.22	58.14
6	113.86	69.24
7	125.98	77.35

Circle Center At X = -7417.69 ; Y = 11345.02 ; and Radius = 13559.78
 Factor of Safety
 *** 1.501 ***

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.50	14.00
2	47.20	25.00
3	63.89	36.02
4	80.57	47.07
5	97.22	58.14
6	113.86	69.24
7	125.98	77.35

Circle Center At X = -7417.96 ; Y = 11345.42 ; and Radius = 13560.26
 Factor of Safety
 *** 1.501 ***

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.50	14.00
2	47.25	24.93
3	63.95	35.93
4	80.61	47.00
5	97.23	58.13
6	113.79	69.33
7	125.08	77.03

Circle Center At X = -2638.98 ; Y = 4122.91 ; and Radius = 4899.93
 Factor of Safety
 *** 1.501 ***

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.50	14.00
2	47.25	24.93
3	63.95	35.93
4	80.61	47.00
5	97.23	58.13
6	113.79	69.33
7	125.08	77.03

Circle Center At X = -2638.55 ; Y = 4122.25 ; and Radius = 4899.14
 Factor of Safety
 *** 1.501 ***

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.50	14.00
2	47.21	24.99
3	63.90	36.00

4	80.58	47.04
5	97.25	58.10
6	113.89	69.18
7	126.27	77.45

Circle Center At X = -7733.76 ; Y = 11838.14 ; and Radius = 14145.46

Factor of Safety
*** 1.502 ***

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.50	14.00
2	47.25	24.92
3	63.97	35.91
4	80.64	46.96
5	97.27	58.07
6	113.85	69.25
7	125.55	77.20

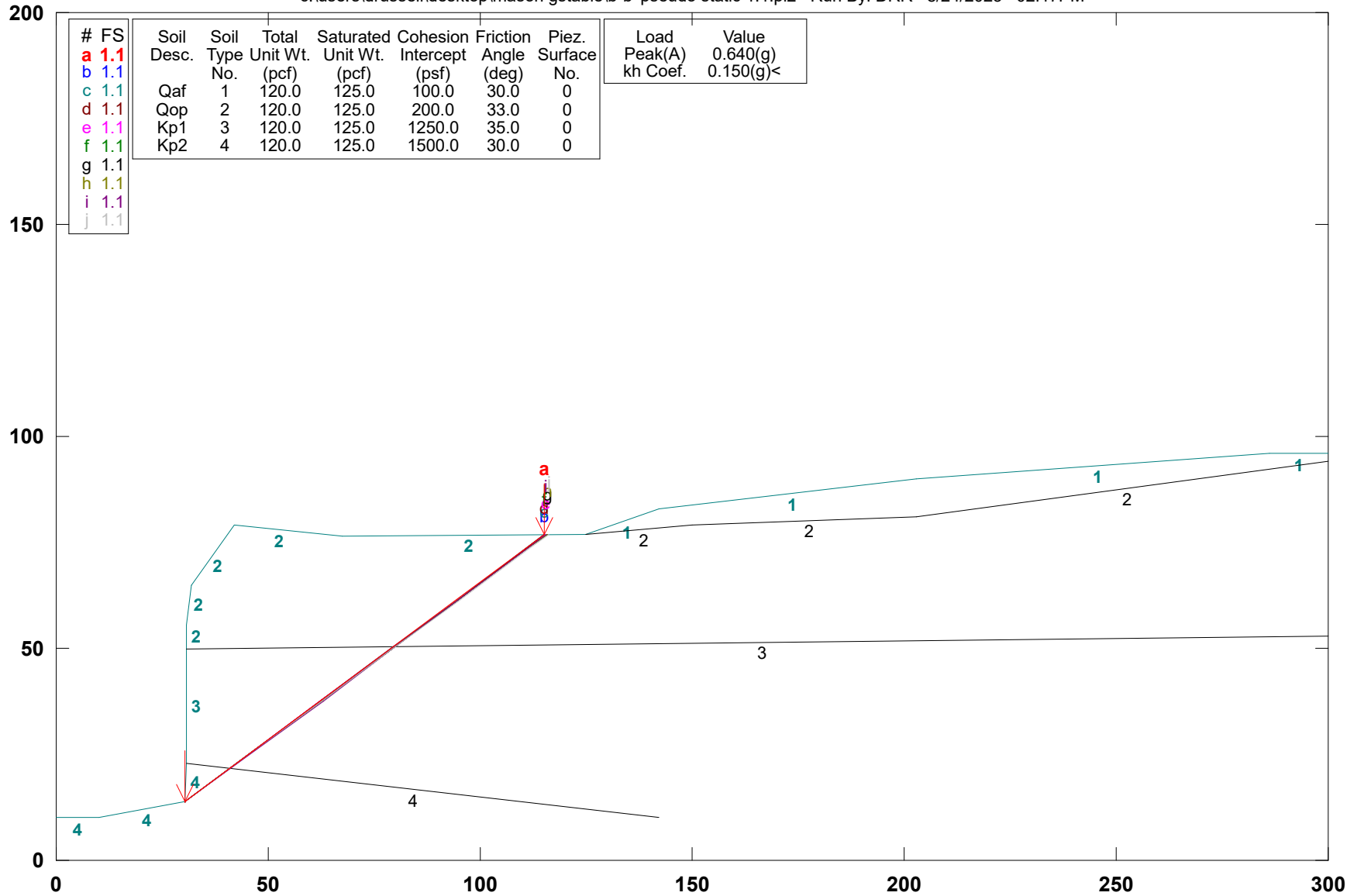
Circle Center At X = -2822.70 ; Y = 4409.28 ; and Radius = 5240.15

Factor of Safety
*** 1.503 ***

**** END OF GSTABL7 OUTPUT ****

Mason Residence CWE 2230146.01 B-B' Pseudo Static TO 1.1

c:\users\drussell\desktop\mason gstable\b-b' pseudo static 1.1.pl2 Run By: DRR 8/24/2023 02:17PM



GSTABL7 v.2 FSmin=1.1

Safety Factors Are Calculated By The Modified Bishop Method

*** GSTABL7 ***

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.003, June 2002 **

(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.

Analysis Run Date: 8/24/2023

Time of Run: 02:17PM

Run By: DRR

Input Data Filename: C:\Users\drussell\Desktop\Mason GStable\b-b' pseudo static 1.1.in

Output Filename: C:\Users\drussell\Desktop\Mason GStable\b-b' pseudo static 1.1.OUT

Unit System: English

Plotted Output Filename: C:\Users\drussell\Desktop\Mason ble\b-b' pseudo static 1.1.PLT

PROBLEM DESCRIPTION: Mason Residence CWE 2230146.01

B-B' Pseudo Static TO 1.1

BOUNDARY COORDINATES

13 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	10.00	10.00	10.00	4
2	10.00	10.00	30.50	14.00	4
3	30.50	14.00	30.60	23.00	4
4	30.60	23.00	30.70	50.00	3
5	30.70	50.00	30.80	55.50	2
6	30.80	55.50	32.00	65.00	2
7	32.00	65.00	42.00	79.00	2
8	42.00	79.00	67.50	76.50	2
9	67.50	76.50	125.00	77.00	2
10	125.00	77.00	142.00	83.00	1
11	142.00	83.00	203.00	90.00	1
12	203.00	90.00	286.00	96.00	1
13	286.00	96.00	300.00	96.00	1
14	203.00	81.00	300.00	94.00	2
15	150.00	79.00	203.00	81.00	2
16	125.00	77.00	150.00	79.00	2
17	30.70	50.00	300.00	53.00	3
18	30.60	23.00	142.00	10.00	4

Default Y-Origin = 0.00(ft)

Default X-Plus Value = 0.00(ft)

User Specified Y-Plus Value = 10.00(ft)

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	120.0	125.0	100.0	30.0	0.00	0.0	0
2	120.0	125.0	200.0	33.0	0.00	0.0	0
3	120.0	125.0	1250.0	35.0	0.00	0.0	0
4	120.0	125.0	1500.0	30.0	0.00	0.0	0

Specified Peak Ground Acceleration Coefficient (A) = 0.640(g)

Specified Horizontal Earthquake Coefficient (kh) = 0.150(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.

3000 Trial Surfaces Have Been Generated.

3000 Surface(s) Initiate(s) From Each Of 1 Points Equally Spaced

Along The Ground Surface Between X = 30.50(ft)

and X = 30.50(ft)

Each Surface Terminates Between X = 115.00(ft)
 and X = 180.00(ft)
 Unless Further Limitations Were Imposed, The Minimum Elevation
 At Which A Surface Extends Is Y = 0.00(ft)
 20.00(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 Evaluated = 3000
 Statistical Data On All Valid FS Values:
 FS Max = 4.031 FS Min = 1.060 FS Ave = 2.466
 Standard Deviation = 0.829 Coefficient of Variation = 33.62 %
 Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.50	14.00
2	46.57	25.90
3	62.63	37.82
4	78.68	49.76
5	94.72	61.71
6	110.74	73.68
7	115.06	76.91

Circle Center At X = ***** ; Y = 15335.99 ; and Radius = 19058.47
 Factor of Safety
 *** 1.060 ***

Slice No.	Width (ft)	Weight (lbs)	Water Force		Tie Force		Earthquake Force		Surcharge Load (lbs)
			Top (lbs)	Bot (lbs)	Norm (lbs)	Tan (lbs)	Hor (lbs)	Ver (lbs)	
1	0.1	53.6	0.0	0.0	0.	0.	8.0	0.0	0.0
2	0.1	268.7	0.0	0.0	0.	0.	40.3	0.0	0.0
3	0.1	462.8	0.0	0.0	0.	0.	69.4	0.0	0.0
4	1.2	6564.0	0.0	0.0	0.	0.	984.6	0.0	0.0
5	9.0	57168.8	0.0	0.0	0.	0.	8575.3	0.0	0.0
6	1.0	6655.0	0.0	0.0	0.	0.	998.3	0.0	0.0
7	4.6	29941.8	0.0	0.0	0.	0.	4491.3	0.0	0.0
8	16.1	88463.9	0.0	0.0	0.	0.	13269.6	0.0	0.0
9	4.9	21672.4	0.0	0.0	0.	0.	3250.9	0.0	0.0
10	11.2	41522.7	0.0	0.0	0.	0.	6228.4	0.0	0.0
11	1.1	3356.5	0.0	0.0	0.	0.	503.5	0.0	0.0
12	15.0	36922.1	0.0	0.0	0.	0.	5538.3	0.0	0.0
13	16.0	17516.6	0.0	0.0	0.	0.	2627.5	0.0	0.0
14	4.3	827.8	0.0	0.0	0.	0.	124.2	0.0	0.0

Failure Surface Specified By 7 Coordinate Points
 Point No. X-Surf (ft) Y-Surf (ft)
 1 30.50 14.00
 2 46.58 25.89
 3 62.65 37.80
 4 78.71 49.72
 5 94.75 61.66
 6 110.79 73.62
 7 115.20 76.91
 Circle Center At X = ***** ; Y = 16039.25 ; and Radius = 19922.99
 Factor of Safety
 *** 1.061 ***

Failure Surface Specified By 7 Coordinate Points
 Point No. X-Surf (ft) Y-Surf (ft)
 1 30.50 14.00
 2 46.60 25.87
 3 62.68 37.76
 4 78.73 49.69
 5 94.76 61.65
 6 110.77 73.64
 7 115.12 76.91
 Circle Center At X = -6000.17 ; Y = 8214.03 ; and Radius = 10178.87
 Factor of Safety

*** 1.062 ***
 Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.50	14.00
2	46.63	25.82
3	62.73	37.69
4	78.80	49.60
5	94.83	61.55
6	110.83	73.55
7	115.29	76.92

 Circle Center At X = -4250.50 ; Y = 5872.94 ; and Radius = 7256.32
 Factor of Safety
 *** 1.064 ***

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.50	14.00
2	46.63	25.83
3	62.73	37.69
4	78.81	49.58
5	94.88	61.49
6	110.92	73.44
7	115.58	76.92

 Circle Center At X = -6742.38 ; Y = 9262.30 ; and Radius = 11463.12
 Factor of Safety
 *** 1.065 ***

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.50	14.00
2	46.68	25.76
3	62.79	37.61
4	78.84	49.53
5	94.84	61.54
6	110.77	73.64
7	115.04	76.91

 Circle Center At X = -2252.82 ; Y = 3171.07 ; and Radius = 3896.23
 Factor of Safety
 *** 1.066 ***

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.50	14.00
2	46.63	25.82
3	62.74	37.67
4	78.84	49.55
5	94.91	61.45
6	110.97	73.37
7	115.72	76.92

 Circle Center At X = -7229.26 ; Y = 9936.98 ; and Radius = 12295.10
 Factor of Safety
 *** 1.066 ***

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.50	14.00
2	46.65	25.79
3	62.78	37.63
4	78.88	49.49
5	94.95	61.39
6	111.00	73.33
7	115.79	76.92

 Circle Center At X = -5238.28 ; Y = 7246.21 ; and Radius = 8947.90
 Factor of Safety
 *** 1.068 ***

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.50	14.00

2	46.69	25.75
3	62.83	37.56
4	78.91	49.45
5	94.94	61.40
6	110.93	73.42
7	115.53	76.92

Circle Center At X = -2670.01 ; Y = 3753.12 ; and Radius = 4612.35

Factor of Safety

*** 1.069 ***

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.50	14.00
2	46.65	25.80
3	62.79	37.61
4	78.91	49.45
5	95.01	61.31
6	111.10	73.18
7	116.16	76.92

Circle Center At X = -9391.77 ; Y = 12930.91 ; and Radius = 15988.30

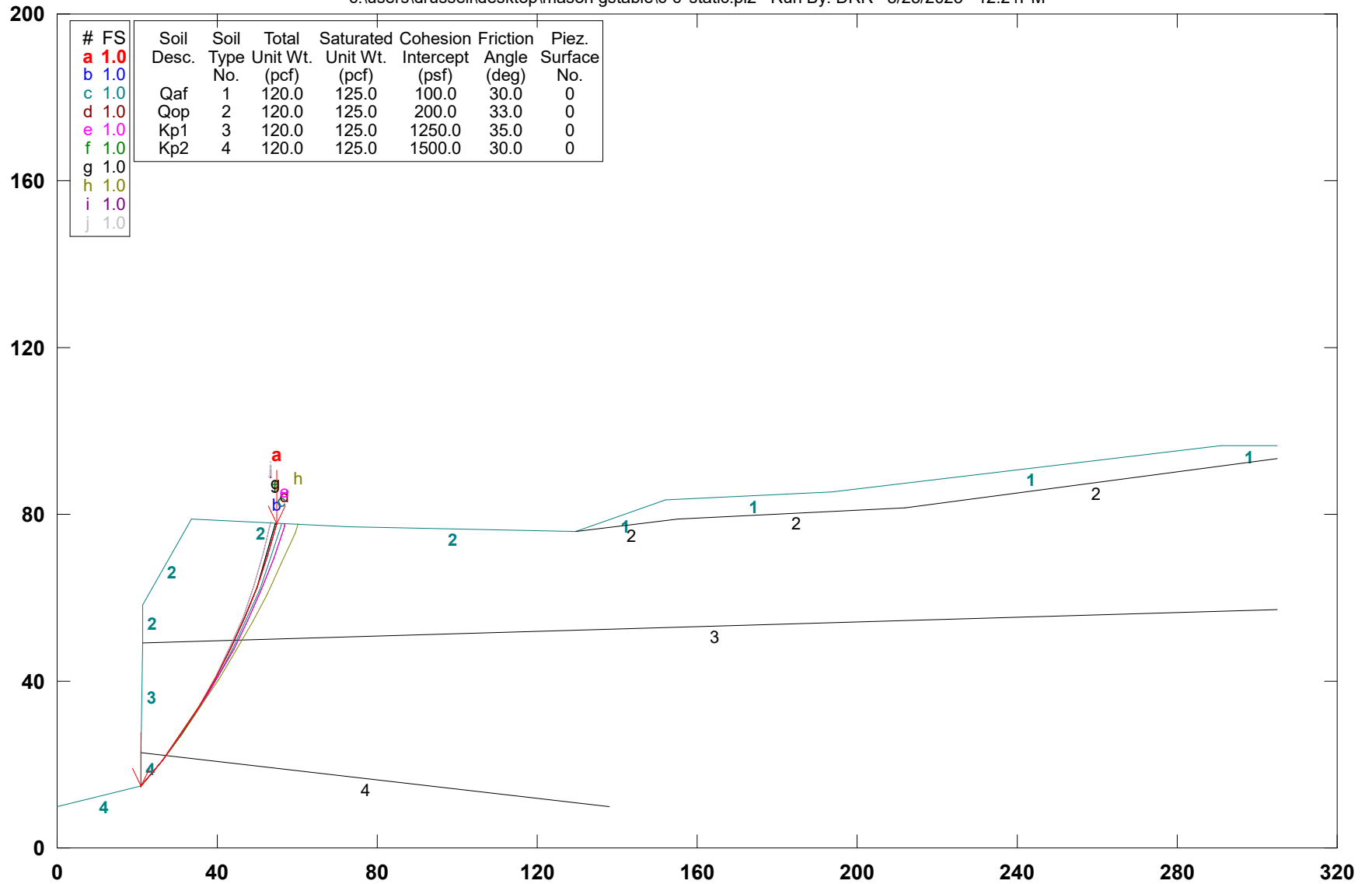
Factor of Safety

*** 1.069 ***

**** END OF GSTABL7 OUTPUT ****

Mason Residence CWE 2230146.01 C-C' Static

c:\users\drussell\desktop\mason gstable\c-c' static.pl2 Run By: DRR 8/25/2023 12:21PM



GSTABL7 v.2 FSmin=1.0

Safety Factors Are Calculated By The Modified Bishop Method

*** GSTABL7 ***

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.003, June 2002 **
 (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.

Analysis Run Date: 8/25/2023
 Time of Run: 12:21PM
 Run By: DRR
 Input Data Filename: C:\Users\drussell\Desktop\Mason GStable\c-c' static.
 Output Filename: C:\Users\drussell\Desktop\Mason GStable\c-c' static.OUT
 Unit System: English
 Plotted Output Filename: C:\Users\drussell\Desktop\Mason ble\c-c' static.PLT

PROBLEM DESCRIPTION: Mason Residence CWE 2230146.01
 C-C' Static

BOUNDARY COORDINATES
 11 Top Boundaries
 16 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	10.00	21.00	15.00	4
2	21.00	15.00	21.10	23.00	4
3	21.10	23.00	21.20	49.00	3
4	21.20	49.00	21.30	58.50	2
5	21.30	58.50	33.50	79.00	2
6	33.50	79.00	73.00	77.00	2
7	73.00	77.00	129.50	76.00	2
8	129.50	76.00	152.00	83.50	1
9	152.00	83.50	193.50	85.50	1
10	193.50	85.50	291.00	96.50	1
11	291.00	96.50	305.00	96.50	1
12	212.00	81.50	305.00	93.30	2
13	155.00	79.00	212.00	81.50	2
14	129.50	76.00	155.00	79.00	2
15	21.20	49.00	305.00	57.00	3
16	21.10	23.00	138.00	10.00	4

Default Y-Origin = 0.00(ft)
 Default X-Plus Value = 0.00(ft)
 User Specified Y-Plus Value = 10.00(ft)

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param. (psf)	Pressure Constant (psf)	Piez. Surface No.
1	120.0	125.0	100.0	30.0	0.00	0.0	0
2	120.0	125.0	200.0	33.0	0.00	0.0	0
3	120.0	125.0	1250.0	35.0	0.00	0.0	0
4	120.0	125.0	1500.0	30.0	0.00	0.0	0

A Critical Failure Surface Searching Method, Using A Random
 Technique For Generating Circular Surfaces, Has Been Specified.
 3000 Trial Surfaces Have Been Generated.
 3000 Surface(s) Initiate(s) From Each Of 1 Points Equally Spaced
 Along The Ground Surface Between X = 21.00(ft)
 and X = 21.00(ft)
 Each Surface Terminates Between X = 45.00(ft)
 and X = 100.00(ft)
 Unless Further Limitations Were Imposed, The Minimum Elevation
 At Which A Surface Extends Is Y = 0.00(ft)
 8.00(ft) Line Segments Define Each Trial Failure Surface.
 Restrictions Have Been Imposed Upon The Angle Of Initiation.

The Angle Has Been Restricted Between The Angles Of 20.0
And 50.0 deg.

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 Evaluated = 3000
Statistical Data On All Valid FS Values:
FS Max = 1.625 FS Min = 0.973 FS Ave = 1.337
Standard Deviation = 0.179 Coefficient of Variation = 13.39 %
Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	21.00	15.00
2	26.17	21.10
3	31.02	27.46
4	35.54	34.07
5	39.70	40.90
6	43.50	47.94
7	46.93	55.17
8	49.98	62.56
9	52.65	70.11
10	54.91	77.78
11	54.95	77.91

Circle Center At X = -93.73 ; Y = 117.53 ; and Radius = 153.87

Factor of Safety
*** 0.973 ***

Slice No.	Width (ft)	Weight (lbs)	Water Force		Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force		Surcharge Load (lbs)
			Top (lbs)	Bot (lbs)			Hor (lbs)	Ver (lbs)	
1	0.1	47.3	0.0	0.0	0.	0.	0.0	0.0	0.0
2	0.1	249.9	0.0	0.0	0.	0.	0.0	0.0	0.0
3	0.1	461.5	0.0	0.0	0.	0.	0.0	0.0	0.0
4	4.9	25948.8	0.0	0.0	0.	0.	0.0	0.0	0.0
5	0.9	5147.6	0.0	0.0	0.	0.	0.0	0.0	0.0
6	3.9	21903.2	0.0	0.0	0.	0.	0.0	0.0	0.0
7	2.5	14157.7	0.0	0.0	0.	0.	0.0	0.0	0.0
8	2.0	11329.7	0.0	0.0	0.	0.	0.0	0.0	0.0
9	4.2	20635.2	0.0	0.0	0.	0.	0.0	0.0	0.0
10	3.8	15591.0	0.0	0.0	0.	0.	0.0	0.0	0.0
11	0.8	2894.3	0.0	0.0	0.	0.	0.0	0.0	0.0
12	2.6	8163.2	0.0	0.0	0.	0.	0.0	0.0	0.0
13	3.1	7095.2	0.0	0.0	0.	0.	0.0	0.0	0.0
14	2.7	3758.9	0.0	0.0	0.	0.	0.0	0.0	0.0
15	2.3	1096.7	0.0	0.0	0.	0.	0.0	0.0	0.0
16	0.0	0.3	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	21.00	15.00
2	26.17	21.10
3	31.02	27.46
4	35.54	34.07
5	39.70	40.90
6	43.50	47.94
7	46.93	55.17
8	49.98	62.56
9	52.65	70.11
10	54.91	77.78
11	54.95	77.91

Circle Center At X = -93.73 ; Y = 117.53 ; and Radius = 153.87

Factor of Safety
*** 0.973 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	21.00	15.00
2	26.20	21.08

3	31.09	27.41
4	35.67	33.97
5	39.92	40.75
6	43.84	47.72
7	47.42	54.88
8	50.64	62.20
9	53.51	69.67
10	56.00	77.27
11	56.16	77.85

Circle Center At X = -101.33 ; Y = 124.74 ; and Radius = 164.34
 Factor of Safety
 *** 0.973 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	21.00	15.00
2	26.21	21.07
3	31.13	27.38
4	35.75	33.91
5	40.06	40.65
6	44.05	47.58
7	47.72	54.69
8	51.04	61.97
9	54.02	69.39
10	56.65	76.95
11	56.91	77.81

Circle Center At X = -106.08 ; Y = 129.36 ; and Radius = 170.96
 Factor of Safety
 *** 0.974 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	21.00	15.00
2	26.21	21.07
3	31.13	27.38
4	35.75	33.91
5	40.06	40.65
6	44.05	47.58
7	47.72	54.69
8	51.04	61.97
9	54.02	69.39
10	56.65	76.95
11	56.91	77.81

Circle Center At X = -106.08 ; Y = 129.36 ; and Radius = 170.96
 Factor of Safety
 *** 0.974 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	21.00	15.00
2	26.22	21.07
3	31.09	27.41
4	35.60	34.01
5	39.75	40.86
6	43.51	47.92
7	46.88	55.17
8	49.84	62.61
9	52.39	70.19
10	54.51	77.90
11	54.52	77.94

Circle Center At X = -86.34 ; Y = 112.56 ; and Radius = 145.05
 Factor of Safety
 *** 0.976 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	21.00	15.00
2	26.22	21.07
3	31.09	27.41
4	35.60	34.01

5	39.75	40.86
6	43.51	47.92
7	46.88	55.17
8	49.84	62.61
9	52.39	70.19
10	54.51	77.90
11	54.52	77.94

Circle Center At X = -86.34 ; Y = 112.56 ; and Radius = 145.05
 Factor of Safety
 *** 0.976 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	21.00	15.00
2	26.18	21.10
3	31.14	27.37
4	35.89	33.81
5	40.41	40.41
6	44.71	47.16
7	48.77	54.05
8	52.59	61.08
9	56.17	68.23
10	59.50	75.51
11	60.39	77.64

Circle Center At X = -154.38 ; Y = 169.11 ; and Radius = 233.47
 Factor of Safety
 *** 0.976 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	21.00	15.00
2	26.19	21.08
3	31.02	27.46
4	35.47	34.11
5	39.52	41.01
6	43.15	48.14
7	46.36	55.47
8	49.14	62.97
9	51.47	70.62
10	53.26	78.00

Circle Center At X = -79.94 ; Y = 106.44 ; and Radius = 136.20
 Factor of Safety
 *** 0.976 ***

Failure Surface Specified By 10 Coordinate Points

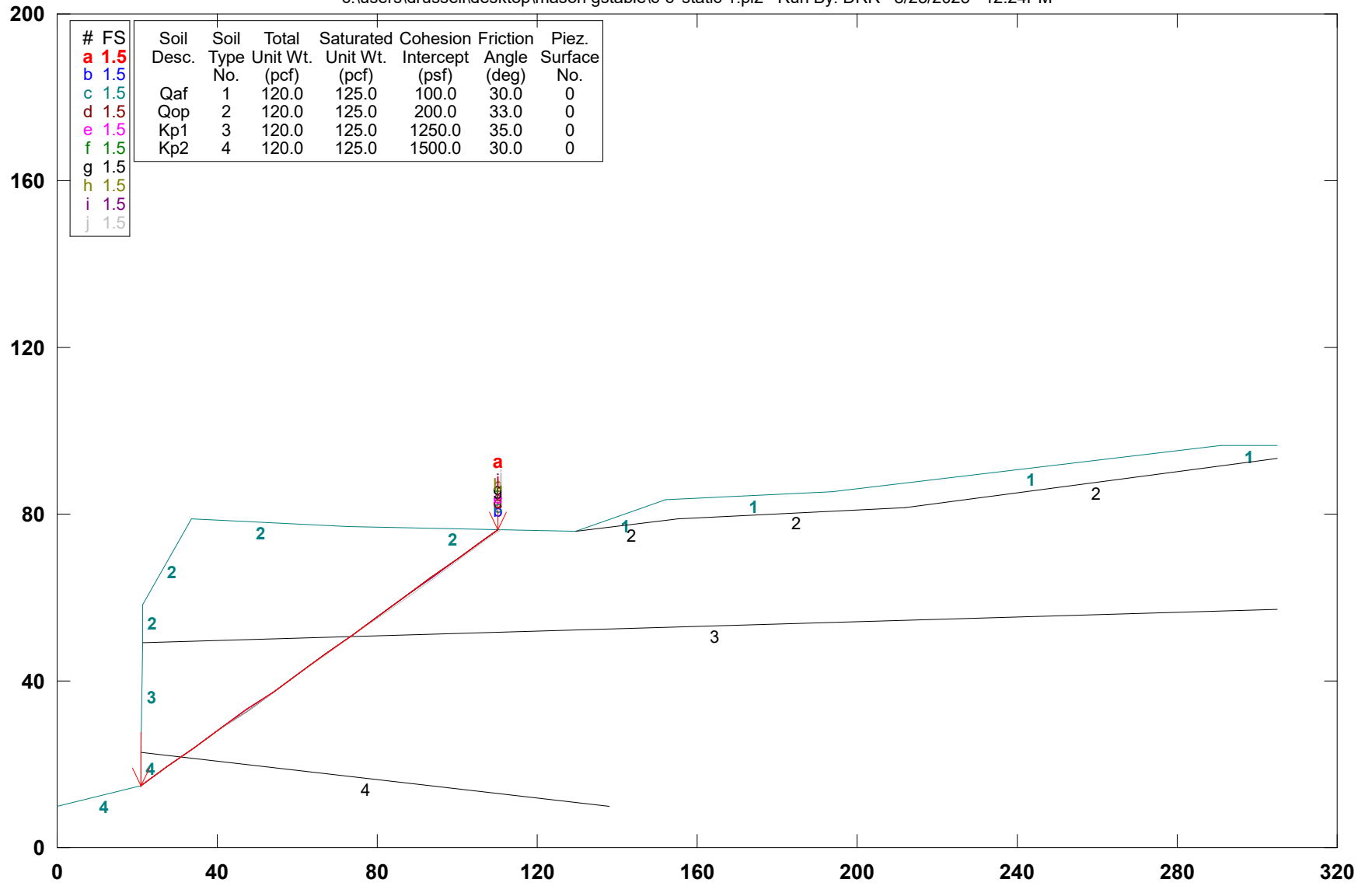
Point No.	X-Surf (ft)	Y-Surf (ft)
1	21.00	15.00
2	26.19	21.08
3	31.02	27.46
4	35.47	34.11
5	39.52	41.01
6	43.15	48.14
7	46.36	55.47
8	49.14	62.97
9	51.47	70.62
10	53.26	78.00

Circle Center At X = -79.94 ; Y = 106.44 ; and Radius = 136.20
 Factor of Safety
 *** 0.976 ***

**** END OF GSTABL7 OUTPUT ****

Mason Residence CWE 2230146.01 C-C' Static to 1.5 FOS

c:\users\drussell\desktop\mason gstable\c-c' static 1.pl2 Run By: DRR 8/25/2023 12:24PM



GSTABL7 v.2 FSmin=1.5

Safety Factors Are Calculated By The Modified Bishop Method

*** GSTABL7 ***

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.003, June 2002 **
 (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.

Analysis Run Date: 8/25/2023
 Time of Run: 12:24PM
 Run By: DRR
 Input Data Filename: C:\Users\drussell\Desktop\Mason GStable\c-c' static 1.5

Output Filename: C:\Users\drussell\Desktop\Mason GStable\c-c' static 1.OUT

Unit System: English
 Plotted Output Filename: C:\Users\drussell\Desktop\Mason ble\c-c' static 1.PLT

PROBLEM DESCRIPTION: Mason Residence CWE 2230146.01
 C-C' Static to 1.5 FOS

BOUNDARY COORDINATES
 11 Top Boundaries
 16 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	10.00	21.00	15.00	4
2	21.00	15.00	21.10	23.00	4
3	21.10	23.00	21.20	49.00	3
4	21.20	49.00	21.30	58.50	2
5	21.30	58.50	33.50	79.00	2
6	33.50	79.00	73.00	77.00	2
7	73.00	77.00	129.50	76.00	2
8	129.50	76.00	152.00	83.50	1
9	152.00	83.50	193.50	85.50	1
10	193.50	85.50	291.00	96.50	1
11	291.00	96.50	305.00	96.50	1
12	212.00	81.50	305.00	93.30	2
13	155.00	79.00	212.00	81.50	2
14	129.50	76.00	155.00	79.00	2
15	21.20	49.00	305.00	57.00	3
16	21.10	23.00	138.00	10.00	4

Default Y-Origin = 0.00(ft)
 Default X-Plus Value = 0.00(ft)
 User Specified Y-Plus Value = 10.00(ft)

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param. (psf)	Pressure Constant (psf)	Piez. Surface No.
1	120.0	125.0	100.0	30.0	0.00	0.0	0
2	120.0	125.0	200.0	33.0	0.00	0.0	0
3	120.0	125.0	1250.0	35.0	0.00	0.0	0
4	120.0	125.0	1500.0	30.0	0.00	0.0	0

A Critical Failure Surface Searching Method, Using A Random
 Technique For Generating Circular Surfaces, Has Been Specified.
 3000 Trial Surfaces Have Been Generated.
 3000 Surface(s) Initiate(s) From Each Of 1 Points Equally Spaced
 Along The Ground Surface Between X = 21.00(ft)
 and X = 21.00(ft)
 Each Surface Terminates Between X = 110.00(ft)
 and X = 220.00(ft)

Unless Further Limitations Were Imposed, The Minimum Elevation
 At Which A Surface Extends Is Y = 0.00(ft)
 8.00(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 Evaluated = 3000

Statistical Data On All Valid FS Values:

FS Max = 6.523 FS Min = 1.466 FS Ave = 3.554
Standard Deviation = 1.366 Coefficient of Variation = 38.45 %

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	21.00	15.00
2	27.62	19.50
3	34.23	24.00
4	40.84	28.51
5	47.44	33.03
6	54.04	37.55
7	60.63	42.08
8	67.22	46.62
9	73.80	51.17
10	80.38	55.72
11	86.96	60.27
12	93.53	64.84
13	100.09	69.41
14	106.65	73.99
15	110.02	76.34

Circle Center At X = -4389.31 ; Y = 6510.68 ; and Radius = 7851.41

Factor of Safety
*** 1.466 ***

Slice No.	Width (ft)	Weight (lbs)	Individual data on the		21 slices		Earthquake		
			Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Force Hor (lbs)	Force Ver (lbs)	Surcharge Load (lbs)
1	0.1	47.6	0.0	0.0	0.	0.	0.0	0.0	0.0
2	0.1	250.8	0.0	0.0	0.	0.	0.0	0.0	0.0
3	0.1	463.0	0.0	0.0	0.	0.	0.0	0.0	0.0
4	6.3	35211.9	0.0	0.0	0.	0.	0.0	0.0	0.0
5	3.5	21611.7	0.0	0.0	0.	0.	0.0	0.0	0.0
6	2.4	15494.7	0.0	0.0	0.	0.	0.0	0.0	0.0
7	0.7	4825.1	0.0	0.0	0.	0.	0.0	0.0	0.0
8	6.6	41656.3	0.0	0.0	0.	0.	0.0	0.0	0.0
9	6.6	37785.9	0.0	0.0	0.	0.	0.0	0.0	0.0
10	6.6	33915.7	0.0	0.0	0.	0.	0.0	0.0	0.0
11	6.6	30045.6	0.0	0.0	0.	0.	0.0	0.0	0.0
12	6.6	26175.8	0.0	0.0	0.	0.	0.0	0.0	0.0
13	5.6	19066.2	0.0	0.0	0.	0.	0.0	0.0	0.0
14	0.2	729.8	0.0	0.0	0.	0.	0.0	0.0	0.0
15	0.8	2511.5	0.0	0.0	0.	0.	0.0	0.0	0.0
16	6.6	18543.3	0.0	0.0	0.	0.	0.0	0.0	0.0
17	6.6	14845.2	0.0	0.0	0.	0.	0.0	0.0	0.0
18	6.6	11147.0	0.0	0.0	0.	0.	0.0	0.0	0.0
19	6.6	7448.9	0.0	0.0	0.	0.	0.0	0.0	0.0
20	6.6	3750.7	0.0	0.0	0.	0.	0.0	0.0	0.0
21	3.4	488.9	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	21.00	15.00
2	27.62	19.49
3	34.24	23.99
4	40.85	28.49
5	47.45	33.01
6	54.06	37.52
7	60.65	42.05
8	67.25	46.58
9	73.83	51.12
10	80.42	55.66
11	87.00	60.21
12	93.57	64.77
13	100.14	69.33

14 106.71 73.91
 15 110.20 76.34
 Circle Center At X = -4467.03 ; Y = 6637.03 ; and Radius = 7999.60
 Factor of Safety
 *** 1.468 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	21.00	15.00
2	27.62	19.49
3	34.24	23.99
4	40.85	28.49
5	47.45	33.01
6	54.06	37.52
7	60.65	42.05
8	67.25	46.58
9	73.83	51.12
10	80.42	55.66
11	87.00	60.21
12	93.57	64.77
13	100.14	69.33
14	106.71	73.91
15	110.20	76.34

Circle Center At X = -4467.03 ; Y = 6637.03 ; and Radius = 7999.60
 Factor of Safety
 *** 1.468 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	21.00	15.00
2	27.62	19.49
3	34.24	23.99
4	40.85	28.49
5	47.45	33.01
6	54.06	37.52
7	60.65	42.05
8	67.25	46.58
9	73.83	51.12
10	80.42	55.66
11	87.00	60.21
12	93.57	64.77
13	100.14	69.33
14	106.71	73.91
15	110.20	76.34

Circle Center At X = -4467.03 ; Y = 6637.03 ; and Radius = 7999.60
 Factor of Safety
 *** 1.468 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	21.00	15.00
2	27.62	19.49
3	34.24	23.99
4	40.85	28.49
5	47.45	33.01
6	54.06	37.52
7	60.65	42.05
8	67.25	46.58
9	73.83	51.12
10	80.42	55.66
11	87.00	60.21
12	93.57	64.77
13	100.14	69.33
14	106.71	73.91
15	110.20	76.34

Circle Center At X = -4467.03 ; Y = 6637.03 ; and Radius = 7999.60
 Factor of Safety
 *** 1.468 ***

Failure Surface Specified By 15 Coordinate Points

Point	X-Surf	Y-Surf
-------	--------	--------

No.	(ft)	(ft)
1	21.00	15.00
2	27.63	19.48
3	34.25	23.96
4	40.87	28.46
5	47.48	32.96
6	54.09	37.48
7	60.69	42.00
8	67.28	46.53
9	73.87	51.07
10	80.45	55.62
11	87.03	60.17
12	93.60	64.74
13	100.16	69.31
14	106.72	73.89
15	110.21	76.34

Circle Center At X = -3387.61 ; Y = 5068.06 ; and Radius = 6095.24

Factor of Safety
 *** 1.470 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	21.00	15.00
2	27.63	19.48
3	34.25	23.96
4	40.87	28.46
5	47.48	32.96
6	54.09	37.48
7	60.69	42.00
8	67.28	46.53
9	73.87	51.07
10	80.45	55.62
11	87.03	60.17
12	93.60	64.74
13	100.16	69.31
14	106.72	73.89
15	110.21	76.34

Circle Center At X = -3387.61 ; Y = 5068.06 ; and Radius = 6095.24

Factor of Safety
 *** 1.470 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	21.00	15.00
2	27.63	19.48
3	34.25	23.96
4	40.87	28.46
5	47.48	32.96
6	54.09	37.48
7	60.69	42.00
8	67.28	46.53
9	73.87	51.07
10	80.45	55.62
11	87.03	60.17
12	93.60	64.74
13	100.16	69.31
14	106.72	73.89
15	110.21	76.34

Circle Center At X = -3387.61 ; Y = 5068.06 ; and Radius = 6095.24

Factor of Safety
 *** 1.470 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	21.00	15.00
2	27.63	19.48
3	34.25	23.97
4	40.86	28.47
5	47.47	32.98
6	54.08	37.49

7	60.68	42.01
8	67.28	46.53
9	73.87	51.07
10	80.46	55.61
11	87.04	60.15
12	93.62	64.71
13	100.19	69.27
14	106.75	73.84
15	110.34	76.34

Circle Center At X = -4131.82 ; Y = 6159.42 ; and Radius = 7416.19

Factor of Safety
 *** 1.470 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	21.00	15.00
2	27.64	19.47
3	34.27	23.94
4	40.90	28.42
5	47.52	32.90
6	54.14	37.40
7	60.76	41.90
8	67.37	46.40
9	73.97	50.91
10	80.57	55.43
11	87.17	59.96
12	93.76	64.49
13	100.35	69.03
14	106.93	73.58
15	110.91	76.33

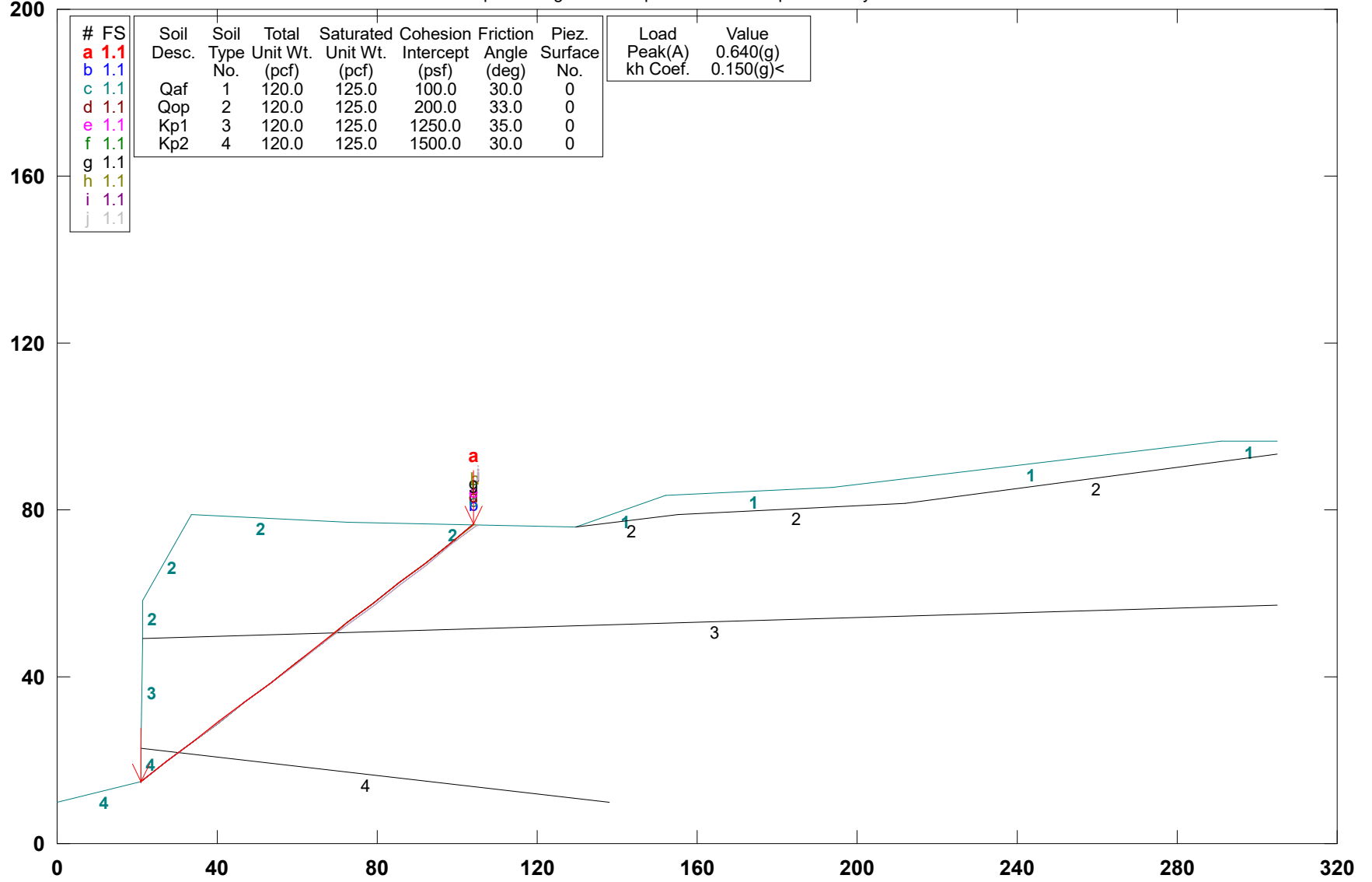
Circle Center At X = -4382.69 ; Y = 6567.40 ; and Radius = 7894.71

Factor of Safety
 *** 1.479 ***

**** END OF GSTABL7 OUTPUT ****

Mason Residence CWE 2230146.01 C-C' Pseudo Static to 1.1 FOS

c:\users\drussell\desktop\mason gstable\c-c' pseudo static 1.1.pl2 Run By: DRR 8/25/2023 12:27PM



Load Peak(A)	Value
kh Coef.	0.150(g)<

GSTABL7 v.2 FSmin=1.1

Safety Factors Are Calculated By The Modified Bishop Method

*** GSTABL7 ***

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.003, June 2002 **

(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.

Analysis Run Date: 8/25/2023

Time of Run: 12:27PM

Run By: DRR

Input Data Filename: C:\Users\drussell\Desktop\Mason GStable\c-c' pseudo static 1.1.in

Output Filename: C:\Users\drussell\Desktop\Mason GStable\c-c' pseudo static 1.1.OUT

Unit System: English

Plotted Output Filename: C:\Users\drussell\Desktop\Mason ble\c-c' pseudo static 1.1.PLT

PROBLEM DESCRIPTION: Mason Residence CWE 2230146.01

C-C' Pseudo Static to 1.1 FOS

BOUNDARY COORDINATES

11 Top Boundaries

16 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	10.00	21.00	15.00	4
2	21.00	15.00	21.10	23.00	4
3	21.10	23.00	21.20	49.00	3
4	21.20	49.00	21.30	58.50	2
5	21.30	58.50	33.50	79.00	2
6	33.50	79.00	73.00	77.00	2
7	73.00	77.00	129.50	76.00	2
8	129.50	76.00	152.00	83.50	1
9	152.00	83.50	193.50	85.50	1
10	193.50	85.50	291.00	96.50	1
11	291.00	96.50	305.00	96.50	1
12	212.00	81.50	305.00	93.30	2
13	155.00	79.00	212.00	81.50	2
14	129.50	76.00	155.00	79.00	2
15	21.20	49.00	305.00	57.00	3
16	21.10	23.00	138.00	10.00	4

Default Y-Origin = 0.00(ft)

Default X-Plus Value = 0.00(ft)

User Specified Y-Plus Value = 10.00(ft)

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param. (psf)	Pressure Constant (psf)	Piez. Surface No.
1	120.0	125.0	100.0	30.0	0.00	0.0	0
2	120.0	125.0	200.0	33.0	0.00	0.0	0
3	120.0	125.0	1250.0	35.0	0.00	0.0	0
4	120.0	125.0	1500.0	30.0	0.00	0.0	0

Specified Peak Ground Acceleration Coefficient (A) = 0.640(g)

Specified Horizontal Earthquake Coefficient (kh) = 0.150(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.

3000 Trial Surfaces Have Been Generated.

3000 Surface(s) Initiate(s) From Each Of 1 Points Equally Spaced Along The Ground Surface Between X = 21.00(ft)

and X = 21.00(ft)

Each Surface Terminates Between X = 104.00(ft)

and X = 220.00(ft)

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 0.00(ft)

8.00(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 Evaluated = 3000

Statistical Data On All Valid FS Values:

FS Max = 4.286 FS Min = 1.071 FS Ave = 2.341

Standard Deviation = 0.847 Coefficient of Variation = 36.21 %

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	21.00	15.00
2	27.46	19.72
3	33.92	24.44
4	40.37	29.17
5	46.82	33.90
6	53.26	38.65
7	59.70	43.40
8	66.13	48.15
9	72.56	52.91
10	78.99	57.68
11	85.40	62.46
12	91.82	67.24
13	98.23	72.02
14	104.14	76.45

Circle Center At X = -4658.71 ; Y = 6433.52 ; and Radius = 7943.37

Factor of Safety

*** 1.071 ***

Individual data on the 20 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force		Tie Force		Earthquake Force		Surcharge Load (lbs)
			Top (lbs)	Bot (lbs)	Norm (lbs)	Tan (lbs)	Hor (lbs)	Ver (lbs)	
1	0.1	47.6	0.0	0.0	0.	0.	7.1	0.0	0.0
2	0.1	250.7	0.0	0.0	0.	0.	37.6	0.0	0.0
3	0.1	462.8	0.0	0.0	0.	0.	69.4	0.0	0.0
4	6.2	34168.5	0.0	0.0	0.	0.	5125.3	0.0	0.0
5	3.1	18559.8	0.0	0.0	0.	0.	2784.0	0.0	0.0
6	3.0	19119.7	0.0	0.0	0.	0.	2868.0	0.0	0.0
7	0.4	2750.8	0.0	0.0	0.	0.	412.6	0.0	0.0
8	6.5	40271.9	0.0	0.0	0.	0.	6040.8	0.0	0.0
9	6.4	36327.8	0.0	0.0	0.	0.	5449.2	0.0	0.0
10	6.4	32384.6	0.0	0.0	0.	0.	4857.7	0.0	0.0
11	6.4	28442.4	0.0	0.0	0.	0.	4266.4	0.0	0.0
12	6.4	24501.2	0.0	0.0	0.	0.	3675.2	0.0	0.0
13	3.0	9985.3	0.0	0.0	0.	0.	1497.8	0.0	0.0
14	3.5	10575.6	0.0	0.0	0.	0.	1586.3	0.0	0.0
15	0.4	1258.6	0.0	0.0	0.	0.	188.8	0.0	0.0
16	6.0	15433.9	0.0	0.0	0.	0.	2315.1	0.0	0.0
17	6.4	12916.8	0.0	0.0	0.	0.	1937.5	0.0	0.0
18	6.4	9142.2	0.0	0.0	0.	0.	1371.3	0.0	0.0
19	6.4	5368.3	0.0	0.0	0.	0.	805.2	0.0	0.0
20	5.9	1606.4	0.0	0.0	0.	0.	241.0	0.0	0.0

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	21.00	15.00
2	27.47	19.71
3	33.93	24.42
4	40.39	29.14
5	46.84	33.87
6	53.29	38.61
7	59.73	43.35
8	66.17	48.10
9	72.60	52.86
10	79.02	57.63
11	85.45	62.40

12 91.86 67.18
 13 98.27 71.97
 14 104.25 76.45
 Circle Center At X = -4165.34 ; Y = 5774.23 ; and Radius = 7119.98

Factor of Safety
 *** 1.072 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	21.00	15.00
2	27.47	19.71
3	33.93	24.42
4	40.39	29.14
5	46.84	33.87
6	53.29	38.61
7	59.73	43.35
8	66.17	48.10
9	72.60	52.86
10	79.02	57.63
11	85.45	62.40
12	91.86	67.18
13	98.27	71.97
14	104.25	76.45

Circle Center At X = -4165.34 ; Y = 5774.23 ; and Radius = 7119.98

Factor of Safety
 *** 1.072 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	21.00	15.00
2	27.47	19.71
3	33.93	24.42
4	40.39	29.14
5	46.84	33.87
6	53.29	38.61
7	59.73	43.35
8	66.17	48.10
9	72.60	52.86
10	79.02	57.63
11	85.45	62.40
12	91.86	67.18
13	98.27	71.97
14	104.25	76.45

Circle Center At X = -4165.34 ; Y = 5774.23 ; and Radius = 7119.98

Factor of Safety
 *** 1.072 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	21.00	15.00
2	27.47	19.71
3	33.93	24.42
4	40.39	29.14
5	46.84	33.87
6	53.29	38.61
7	59.73	43.35
8	66.17	48.10
9	72.60	52.86
10	79.02	57.63
11	85.45	62.40
12	91.86	67.18
13	98.27	71.97
14	104.25	76.45

Circle Center At X = -4165.34 ; Y = 5774.23 ; and Radius = 7119.98

Factor of Safety
 *** 1.072 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	21.00	15.00

2	27.47	19.71
3	33.93	24.42
4	40.39	29.14
5	46.84	33.87
6	53.29	38.61
7	59.73	43.35
8	66.17	48.10
9	72.60	52.86
10	79.02	57.63
11	85.45	62.40
12	91.86	67.18
13	98.27	71.97
14	104.25	76.45

Circle Center At X = -4165.34 ; Y = 5774.23 ; and Radius = 7119.98

Factor of Safety
 *** 1.072 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	21.00	15.00
2	27.47	19.71
3	33.93	24.42
4	40.39	29.14
5	46.84	33.87
6	53.29	38.61
7	59.73	43.35
8	66.17	48.10
9	72.60	52.86
10	79.02	57.63
11	85.45	62.40
12	91.86	67.18
13	98.27	71.97
14	104.25	76.45

Circle Center At X = -4165.34 ; Y = 5774.23 ; and Radius = 7119.98

Factor of Safety
 *** 1.072 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	21.00	15.00
2	27.47	19.71
3	33.93	24.42
4	40.39	29.14
5	46.85	33.87
6	53.30	38.60
7	59.74	43.34
8	66.18	48.09
9	72.62	52.84
10	79.05	57.60
11	85.47	62.36
12	91.89	67.13
13	98.31	71.91
14	104.39	76.44

Circle Center At X = -4673.42 ; Y = 6473.09 ; and Radius = 7984.02

Factor of Safety
 *** 1.073 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	21.00	15.00
2	27.49	19.68
3	33.97	24.37
4	40.45	29.06
5	46.92	33.76
6	53.39	38.47
7	59.86	43.18
8	66.31	47.90
9	72.77	52.63
10	79.22	57.36
11	85.66	62.10

12	92.10	66.85
13	98.54	71.60
14	104.97	76.36
15	105.07	76.43

Circle Center At X = -4573.63 ; Y = 6390.67 ; and Radius = 7858.74

Factor of Safety
*** 1.079 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	21.00	15.00
2	27.49	19.68
3	33.97	24.37
4	40.45	29.06
5	46.92	33.76
6	53.39	38.47
7	59.86	43.18
8	66.31	47.90
9	72.77	52.63
10	79.22	57.36
11	85.66	62.10
12	92.10	66.85
13	98.54	71.60
14	104.97	76.36
15	105.07	76.43

Circle Center At X = -4573.63 ; Y = 6390.67 ; and Radius = 7858.74

Factor of Safety
*** 1.079 ***

**** END OF GSTABL7 OUTPUT ****

Appendix D

References

REFERENCES

American Society of Civil Engineers; ASCE 7 Hazard Tool; <https://asce7hazardtool.online>

California Department of Boating and Waterways and San Diego Association of Governments, 1991, Shoreline Erosion Assessment and Atlas of the San Diego Region.

California Geological Survey; 2010; Fault Activity Map of California; <https://maps.conservation.ca.gov/cgs/Dataviewer/>; accessed July 18, 2023.

California Geological Survey; 2018; Earthquake Fault Zones, A Guide for Government Agencies, Property Owners/Developers, and Geoscience Practitioners for Assessing Fault Rupture Hazards in California; Special Publication 42.

California Geological Survey; 2022; Earthquake Zones of Required Investigation; <https://maps.conservation.ca.gov/cgs/informationwarehouse/>, accessed July 18, 2023.

City of San Diego, 2008, Seismic Safety Study, Sheet 16.

City of San Diego, 2004, Coastal Beaches and Bluffs Guidelines, San Diego Municipal Code/Land Development Code.

Emery, K. O. and Kuhn, G. G., 1980, Erosion of rock shores at La Jolla, California: *Marine Geology*, v. 37, pp. 197-208.

Emery, K. O. and Kuhn, G. G., 1982, Sea cliffs: their processes, profiles, and classification: *Geological Society of America Bulletin*, v. 93, pp. 644-654

Federal Emergency Management Agency, San Diego County, California and Incorporated Areas Flood Insurance Rate Map, Map Number 06073C1857H, effective December 20, 2019.

Graehl, N.G.; and Wilson, R.I.; 2022; Tsunami Hazard Area Map, San Diego County; produced by the California Geological Survey and the California Governors Office of Emergency Services; dated 2022; displayed at multiple scales.

Jennings, C.W. and Bryant, W. A., 2010, Fault Activity Map, California Geological Survey, Geologic Data Map No. 6, <http://www.quake.ca.gov/gmaps/FAM/faultactivitymap.html>

Kennedy, Michael P. and Tan, Siang S., 2008, Geologic Map of the San Diego 30'x60' Quadrangle, California, California Geologic Survey, Map No. 3.

Southern California Earthquake Data Center; 2023; Earthquake Information, Fault Name Index; <https://scedc.caltech.edu/earthquake/faults.html>; accessed July 18, 2023.

Tan, S.S.; 1995; Landslide Hazards in the Southern Part of the San Diego Metropolitan Area, San Diego County, California; Relative Landslide Susceptibility and Landslide Distribution Map; Open File Report 95-03; Map No. 33; Plate D.

United States Geological Survey; 2017; Quaternary fault and fold database for the United States; <https://www.usgs.gov/natural-hazards/earthquake-hazards/faults>.; accessed July 18, 2023.

TOPOGRAPHIC MAPS

City of San Diego, 1953, Topographic Map Sheet 202-1689; Scale: 1 inch = 200 feet

PHOTOGRAPHS

Kenneth and Gabrielle Adelman, California Coastal Records Project, www.californiacoastline.org, Photos 7242017 (1972), 7956050 (1979), 9733 (2002), 200407952 (2004) 20104202 (2010), and 201312646 (2013).

San Diego County (US. Navy), 1928, Aerial Photographs, Packet 66, Photographs E1 and F1; Scale: 1 inch = 1000 feet (approximate).

Appendix F

Recommended Grading Specifications – General Provisions

RECOMMENDED GRADING SPECIFICATIONS - GENERAL PROVISIONS

PROPOSED MASON RESIDENCE

SUNSET CLIFFS BOULEVARD

SAN DIEGO, CALIFORNIA

GENERAL INTENT

The intent of these specifications is to establish procedures for clearing, compacting natural ground, preparing areas to be filled, and placing and compacting fill soils to the lines and grades shown on the accepted plans. The recommendations contained in the preliminary geotechnical investigation report and/or the attached Special Provisions are a part of the Recommended Grading Specifications and shall supersede the provisions contained hereinafter in the case of conflict. These specifications shall only be used in conjunction with the geotechnical report for which they are a part. No deviation from these specifications will be allowed, except where specified in the geotechnical report or in other written communication signed by the Geotechnical Engineer.

OBSERVATION AND TESTING

Christian Wheeler Engineering shall be retained as the Geotechnical Engineer to observe and test the earthwork in accordance with these specifications. It will be necessary that the Geotechnical Engineer or his representative provide adequate observation so that he may provide his opinion as to whether or not the work was accomplished as specified. It shall be the responsibility of the contractor to assist the Geotechnical Engineer and to keep him apprised of work schedules, changes and new information and data so that he may provide these opinions. In the event that any unusual conditions not covered by the special provisions or preliminary geotechnical report are encountered during the grading operations, the Geotechnical Engineer shall be contacted for further recommendations.

If, in the opinion of the Geotechnical Engineer, substandard conditions are encountered, such as questionable or unsuitable soil, unacceptable moisture content, inadequate compaction, adverse weather, etc., construction should be stopped until the conditions are remedied or corrected or he shall recommend rejection of this work.

Tests used to determine the degree of compaction should be performed in accordance with the following American Society for Testing and Materials test methods:

Maximum Density & Optimum Moisture Content - ASTM D1557

Density of Soil In-Place - ASTM D1556 or ASTM D2922

All densities shall be expressed in terms of Relative Compaction as determined by the foregoing ASTM testing procedures.

PREPARATION OF AREAS TO RECEIVE FILL

All vegetation, brush and debris derived from clearing operations shall be removed, and legally disposed of. All areas disturbed by site grading should be left in a neat and finished appearance, free from unsightly debris.

After clearing or benching the natural ground, the areas to be filled shall be scarified to a depth of 6 inches, brought to the proper moisture content, compacted and tested for the specified minimum degree of compaction. All loose soils in excess of 6 inches thick should be removed to firm natural ground which is defined as natural soil which possesses an in-situ density of at least 90 percent of its maximum dry density.

When the slope of the natural ground receiving fill exceeds 20 percent (5 horizontal units to 1 vertical unit), the original ground shall be stepped or benched. Benches shall be cut to a firm competent formational soil. The lower bench shall be at least 10 feet wide or 1-1/2 times the equipment width, whichever is greater, and shall be sloped back into the hillside at a gradient of not less than two (2) percent. All other benches should be at least 6 feet wide. The horizontal portion of each bench shall be compacted prior to receiving fill as specified herein for compacted natural ground. Ground slopes flatter than 20 percent shall be benched when considered necessary by the Geotechnical Engineer.

Any abandoned buried structures encountered during grading operations must be totally removed. All underground utilities to be abandoned beneath any proposed structure should be removed from within 10 feet of the structure and properly capped off. The resulting depressions from the above described procedure should be backfilled with acceptable soil that is compacted to the requirements of the Geotechnical Engineer. This includes, but is not limited to, septic tanks, fuel tanks, sewer lines or leach lines, storm drains and water lines. Any buried structures or utilities not to be abandoned should be brought to the attention of the Geotechnical Engineer so that he may determine if any special recommendation will be necessary.

All water wells which will be abandoned should be backfilled and capped in accordance to the requirements set forth by the Geotechnical Engineer. The top of the cap should be at least 4 feet below finish grade or 3 feet

below the bottom of footing whichever is greater. The type of cap will depend on the diameter of the well and should be determined by the Geotechnical Engineer and/or a qualified Structural Engineer.

FILL MATERIAL

Materials to be placed in the fill shall be approved by the Geotechnical Engineer and shall be free of vegetable matter and other deleterious substances. Granular soil shall contain sufficient fine material to fill the voids. The definition and disposition of oversized rocks and expansive or detrimental soils are covered in the geotechnical report or Special Provisions. Expansive soils, soils of poor gradation, or soils with low strength characteristics may be thoroughly mixed with other soils to provide satisfactory fill material, but only with the explicit consent of the Geotechnical Engineer. Any import material shall be approved by the Geotechnical Engineer before being brought to the site.

PLACING AND COMPACTION OF FILL

Approved fill material shall be placed in areas prepared to receive fill in layers not to exceed 6 inches in compacted thickness. Each layer shall have a uniform moisture content in the range that will allow the compaction effort to be efficiently applied to achieve the specified degree of compaction. Each layer shall be uniformly compacted to the specified minimum degree of compaction with equipment of adequate size to economically compact the layer. Compaction equipment should either be specifically designed for soil compaction or of proven reliability. The minimum degree of compaction to be achieved is specified in either the Special Provisions or the recommendations contained in the preliminary geotechnical investigation report. When the structural fill material includes rocks, no rocks will be allowed to nest and all voids must be carefully filled with soil such that the minimum degree of compaction recommended in the Special Provisions is achieved. The maximum size and spacing of rock permitted in structural fills and in non-structural fills is discussed in the geotechnical report, when applicable.

Field observation and compaction tests to estimate the degree of compaction of the fill will be taken by the Geotechnical Engineer or his representative. The location and frequency of the tests shall be at the Geotechnical Engineer's discretion. When the compaction test indicates that a particular layer is at less than the required degree of compaction, the layer shall be reworked to the satisfaction of the Geotechnical Engineer and until the desired relative compaction has been obtained.

Fill slopes shall be compacted by means of sheepfoot rollers or other suitable equipment. Compaction by sheepfoot roller shall be at vertical intervals of not greater than four feet. In addition, fill slopes at a ratio of

two horizontal to one vertical or flatter, should be trackrolled. Steeper fill slopes shall be over-built and cut-back to finish contours after the slope has been constructed. Slope compaction operations shall result in all fill material six or more inches inward from the finished face of the slope having a relative compaction of at least 90 percent of maximum dry density or the degree of compaction specified in the Special Provisions section of this specification. The compaction operation on the slopes shall be continued until the Geotechnical Engineer is of the opinion that the slopes will be surficially stable.

Density tests in the slopes will be made by the Geotechnical Engineer during construction of the slopes to determine if the required compaction is being achieved. Where failing tests occur or other field problems arise, the Contractor will be notified that day of such conditions by written communication from the Geotechnical Engineer or his representative in the form of a daily field report.

If the method of achieving the required slope compaction selected by the Contractor fails to produce the necessary results, the Contractor shall rework or rebuild such slopes until the required degree of compaction is obtained, at no cost to the Owner or Geotechnical Engineer.

CUT SLOPES

The Engineering Geologist shall inspect cut slopes excavated in rock or lithified formational material during the grading operations at intervals determined at his discretion. If any conditions not anticipated in the preliminary report such as perched water, seepage, lenticular or confined strata of a potentially adverse nature, unfavorably inclined bedding, joints or fault planes are encountered during grading, these conditions shall be analyzed by the Engineering Geologist and Geotechnical Engineer to determine if mitigating measures are necessary.

Unless otherwise specified in the geotechnical report, no cut slopes shall be excavated higher or steeper than that allowed by the ordinances of the controlling governmental agency.

ENGINEERING OBSERVATION

Field observation by the Geotechnical Engineer or his representative shall be made during the filling and compaction operations so that he can express his opinion regarding the conformance of the grading with acceptable standards of practice. Neither the presence of the Geotechnical Engineer or his representative or the observation and testing shall release the Grading Contractor from his duty to compact all fill material to the specified degree of compaction.

SEASON LIMITS

Fill shall not be placed during unfavorable weather conditions. When work is interrupted by heavy rain, filling operations shall not be resumed until the proper moisture content and density of the fill materials can be achieved. Damaged site conditions resulting from weather or acts of God shall be repaired before acceptance of work.

RECOMMENDED GRADING SPECIFICATIONS - SPECIAL PROVISIONS

RELATIVE COMPACTION: The minimum degree of compaction to be obtained in compacted natural ground, compacted fill, and compacted backfill shall be at least 90 percent. For street and parking lot subgrade, the upper twelve inches should be compacted to at least 95 percent relative compaction.

EXPANSIVE SOILS: Detrimentially expansive soil is defined as clayey soil which has an expansion index of 50 or greater when tested in accordance with the American Society of Testing Materials (ASTM) Laboratory Test D4829-95.

OVERSIZED MATERIAL: Oversized fill material is generally defined herein as rocks or lumps of soil over six inches in diameter. Oversized materials should not be placed in fill unless recommendations of placement of such material is provided by the Geotechnical Engineer. At least 40 percent of the fill soils shall pass through a No. 4 U.S. Standard Sieve.

TRANSITION LOTS: Where transitions between cut and fill occur within the proposed building pad, the cut portion should be undercut a minimum of one foot below the base of the proposed footings and recompacted as structural backfill. In certain cases that would be addressed in the geotechnical report, special footing reinforcement or a combination of special footing reinforcement and undercutting may be required.