Notice is hereby given to all prospective bidders that plans and specifications on the subject project are modified as hereinafter set forth. This Addendum shall be attached to and form a part of the plans and specifications. All bidders must acknowledge receipt of this addendum on the Bid Form. In case of difference with previous addenda or communications, this addendum takes precedence.

It is the responsibility of all bidders to notify all subcontractors from whom they request bids and from whom they accept bids of all changes contained in this addendum.

Item 1. Reference: Specification Section 00 11 16 Invitation to Bid
Specification Section 00 22 13 Instruction to Bidders
Question: Will there be an extension to the bid schedule? Please advise.
Response: Change Bid Date on above referenced documents: November 10, 2020. Refer to attachment for Item #1

Item 2. Reference: Specification Section 01 10 00 Summary
Question: Article 1.3 references “Work Covered by Other Contracts” and Article 1.4 references “Work Under Separate Contracts.” Please advise on extent of work covered by others.
Response: Replace Article 1.3.A with:

“The Work of this Project is defined by the Contract Documents and consists of the following:

1. Project consists of site work and infrastructure required for the Fire District Mountain Station 6. Project includes relocation of existing generator, installation of new dual pane windows, new retractable power and compressed air wheel, provide new power and water outlets, new patio covering, new concrete pad and utility hook-ups for Fuel Trailer, new site improvements, new finish walls and flooring, new water filtration system, utility hook-ups and cabinet work.”

And remove Article 1.4 from Specification Section 01 10 00 Summary. There will be no other work associated with this contract. Refer to attachment for Item #2.
Item 3.  Reference: Bid RFI:
Question: Please provide Soils Report as referenced in Bid Documents
Response: See attachment for Item #3

Item 4.  Reference: Pre-Bid Conference Question:
Question: Please provide Pre-Bid Conference Sign-in Sheet
Response: See attachment for Item #4

Item 5.  Reference: Pre-Bid Conference Question:
Question: Can the project team please provide a Hazardous Material Survey for existing materials?
Response: Hazardous Materials Survey to be issued with upcoming Addendum

END OF ADDENDUM ITEMS

ATTACHMENTS:

ITEM #1: Updated specification section 00 11 00 Invitation to Bid and specification section 00 22 13 Instruction to Bidders

ITEM #2: Updated specification section 01 10 00 Summary

ITEM #3: Soils Report Dated 5/22/2020

ITEM #4: Sign-in sheet dated 2020 October 21

ITEM #5: No attachment
1.1 PROJECT INFORMATION

A. Notice to Bidders: Qualified bidders are invited to submit bids for Project as described in this Document according to the Instructions to Bidders.

Project Identification: Sonoma County Fire District Mountain Station #6.

1. Project Location: 5198 Sharp Road, Calistoga, CA 94515

B. Owner: Sonoma County Fire District Mountain Station #6, 5198 Sharp Road, Calistoga, CA 94515

1. Owner’s Representative: Fire Chief: Mark Heine, (707) 838-1170 mheine@sonomacountyfd.org

C. Architect: Kitchell, 2450 Venture Oaks Way, Suite 500, Sacramento, CA 95833

Project Manager, Jeff Peterson, (916) 654-9753 jpeterson@kitchell.com

D. Construction Manager: Kitchell, 2450 Venture Oaks Way, Suite 500, Sacramento, CA 95833

1. Project Manager: Jennifer Frahm, (916) 713-6955 jfrahm@Kitchell.com

E. Project Description: The Sonoma County Fire District Mountain Station #6 project, located at 5198 Sharp Road in Calistoga, California, consists of site work and infrastructure required for the Fire District Mountain Station 6. Project includes relocation of existing generator, installation of new dual pane windows, new retractable power and compressed air wheel, provide new power and water outlets, new patio covering, new concrete pad and utility hook-ups for Fuel Trailer, new site improvements, new finish walls and flooring, new water filtration system, utility hook-ups and cabinet work.

F. Construction Contract: Bids will be received for the following Work:

1. General Contract (all trades).

1.2 BID SUBMITTAL AND OPENING

A. Owner will receive sealed bids until the bid time and date at the location indicated below. Owner will consider bids prepared in compliance with the Instructions to Bidders issued by Owner, and delivered as follows:

1. Bid Date: November 3, 2020
2. Bid Time: 2:00 p.m., local time.
3. Location: Sonoma County Fire District Headquarters, 8200 Old Redwood Hwy, Windsor, CA 95492, (707) 838-1170.

B. Bids will be thereafter publicly opened and read aloud.

1.3 BID SECURITY

A. A certified check or bid bond for not less than ten percent (10%) of the proposal shall be submitted with each bid as a guarantee that the bidder, if awarded the Contract, will fulfill the terms of the bid. No bids may be withdrawn for a period of 90 days after opening of bids. Owner reserves the right to reject any and all bids and to waive informalities and irregularities. Substitution of Securities: The Owner will permit the substitution of securities in accordance with the provisions of PCC Section 22300.

1.4 PREBID CONFERENCE

A. A non-mandatory pre-bid conference will be held at 10:00am on Wednesday, October 21st, 2020 Sonoma County Fire District Mountain Station #6, 5198 Sharp Road, Calistoga, CA 94515, Sonoma County Fire District INVITATION TO BID 00 11 16 - 5/2 Mountain Station #6
Bidders seeking any such additional examination or other inquiries or information concerning the Project will do so at the bidder’s sole expense.

B. Bidders seeking to conduct any additional examination or other inquiry at the Project site must request site access from the Construction Manager at least two (2) working days in advance. The location of any excavation, boring or other invasive testing will be subject to approval on behalf of the Construction Manager and any other agencies with jurisdiction over such testing. Bidders may not conduct tests at the Project site prior to obtaining Construction Manager approval. The Construction Manager may require bidders to execute an access agreement prior to approving testing at the Project site. Once approved testing is complete, Bidders must fill all trenches or holes, restore all pavement to match existing structural section, and otherwise clean up and restore the test site to its pre-test condition.

1.5 BIDDING PROCEDURE

A. Bids must be delivered to the Sonoma County Fire District Headquarters, 8200 Old Redwood Hwy, Windsor, CA 95492 no later than 2:00PM on Tuesday, November 3rd, 2020. Bids will be opened and read publicly at that time. Bids that are submitted late according to the official time kept by the District Clerk or a designee, including any extension granted due to a material change, will be returned unopened. Telephones for use by bidders will not be available.

B. In accordance with California Public Contract Code Section 20170, bids must be presented under sealed cover. A completed bid label form furnished with the bid forms must be affixed to and visible on the outside of the sealed bid cover at the time the bid is submitted. Bids must be submitted using the bid forms furnished with the bid package. Bids must bear the bidder's legal name and be signed by a representative authorized to bind the bidder. Bids must be typed or written in ink. Corrections may be made if initialed by the individual signing the bid. No oral or telegraphic modifications of bids, including facsimile modifications, will be considered. Bids that are incomplete or that are not presented on the bid forms furnished with the bid package may be deemed non-responsive.

C. Each bid must give the full business address of the bidder. Bids of partnerships must furnish the full name of all partners and must be signed in the partnership name by one of the members of the partnership, or by an authorized representative, followed by the printed name and title of the person signing. Bids of corporations must be signed with the legal name of the corporation, followed by the name of the state of incorporation and by the signature and designation of the president, secretary or other person authorized to bind the corporation. The name of each person signing shall also be typed or printed below the signature. Upon request of the Construction Manager, bidders will furnish satisfactory evidence of the authority of the person signing the bid. Bids of joint ventures must include a certified copy of the legal agreement constituting the joint venture.

D. No person, firm, corporation, partnership or legal joint venture may submit more than one bid for the Project. However, a person, firm, corporation, partnership or legal joint venture that has submitted a subcontract proposal to a bidder, or that has quoted prices on materials to a bidder may submit a subcontract proposal, quote prices to other bidders and submit its own bid.

E. In accordance with California Public Contract Code Section 20170, all bids must include one of the forms of bidder’s security specified in the Notice to Bidders in an amount of at least ten (10%) percent of the total of the bid prices for the base bid and those additive or deductive items specifically identified in the Notice to Bidders for the purpose of determining the lowest price bid. Bidders that elect to provide bidder’s security in the form of a bid bond must execute a bid bond using the form provided in the bid forms. The bidder’s security is tendered as a guarantee that the successful bidder, if awarded the Project contract, will execute and submit to the Owner all required bonds, certificates of insurance, completed contract forms and other
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Project information.
   2. Work covered by Contract Documents.
   3. Work under separate contracts.
   4. Access to site.
   5. Work restrictions.

B. Related Requirements:
   1. Section 01 50 00 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner’s facilities.
   2. Section 13 34 23 "Fabricated Structures"

1.2 PROJECT INFORMATION

A. Project Identification: Sonoma County Fire District Mountain Station #6.
   1. Project Location: 5198 Sharp Road, Calistoga, CA 94515.

B. Owner: Sonoma County Fire District Mountain Station #6, 5198 Sharp Road, Calistoga, CA 94515.
   1. Owner's Representative: Fire Chief: Mark Heine.
      mheine@sonomacountyfd.org
   2. Architect: Kitchell CEM, 2750 Gateway Oaks Dr., Suite 300, Sacramento, CA 95833
      Project Manager, Jennifer Frahm (916) 713-6955, jfrahm@kitchell.com

C. Construction Manager: Kitchell, 2750 Gateway Oaks Dr., Suite 300, Sacramento, CA 95833
   1. Project Manager: Jennifer Frahm, (916) 713-6955

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. Project consists of site work and infrastructure required for the Fire District Mountain Station 6. Project includes relocation of existing generator, installation of new dual pane windows, new retractable power and compressed air wheel, provide new power and water outlets, new patio covering, new concrete pad and utility connection for fuel trailer, new site improvements, new finish walls and flooring, new water filtration system, utility connections and cabinet work.

B. Type of Contract.
   1. Project will be constructed under a single prime contract.
1.4 WORK UNDER SEPARATE CONTRACTS

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.

B. Concurrent Work: Owner has awarded separate contract(s) for the following construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.
   1. Delivery and setup of Modular Building: To Pacific Mobile for Delivery and setup of a 24'x60' modular building and access ramp.

1.5 ACCESS TO SITE

A. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor’s use of Project site is limited only by Owner’s right to perform work or to retain other contractors on portions of Project.

1.6 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.
   1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

B. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet of entrances, operable windows, or outdoor-air intakes.

C. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.

1.7 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
   1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
   2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
   1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
   2. Abbreviations: Materials and products are identified by abbreviations and scheduled on Drawings.
   3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.
Geologic Hazards and Geotechnical Engineering Report

MOUNTAIN STATION #6
5198 Sharpe Road
Calistoga, California
MPE No. 05021-01

May 22, 2020
# Geologic Hazards and Geotechnical Engineering Report

**MOUNTAIN STATION #6**

5198 Sharp Road  
Calistoga, California  
MPE No. 05021-01

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Geologic Hazards and Geotechnical Engineering Report

MOUNTAIN STATION #6
5198 Sharpe Road
Calistoga, California
MPE No. 05021-01
May 22, 2020

INTRODUCTION

We have completed a Geologic Hazards and Geotechnical Engineering Investigation for the proposed Mountain Station #6 renovation project located at 5198 Sharpe Road in Calistoga, California. The purposes of our study have been to investigate the site, soil, groundwater, geologic and seismic conditions at the site, and to prepare Geologic and Geotechnical Engineering conclusions and recommendations for use by the other members of the design team in preparing project plans and specifications for the proposed project. This report presents the results of our work.

SCOPE OF SERVICES

Our scope of work included the following:

1. Site reconnaissance;
3. Review of available historic aerial photographs, topographic maps and groundwater information of the area;
4. Review of geologic maps and fault maps;
5. Review of historic seismicity within 100 kilometers (km) of the site;
6. Subsurface exploration, including the drilling, logging, and sampling five exploratory soil borings to approximate maximum depths of 9 to 19½ feet below existing ground surface (bgs) in the areas proposed for the improvements. One test boring was excavated utilizing hand-auger equipment in the area not accessible to the drilling equipment;
7. Collection of bulk and in-situ soil samples at various depths within the borings;
8. Laboratory testing of selected soil samples;
9. Engineering analyses; and,
10. Preparation of this report.

FIGURES AND ATTACHMENTS

<table>
<thead>
<tr>
<th>Figure</th>
<th>Title</th>
<th>Figure</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Vicinity Map</td>
<td>11</td>
<td>Geologic Cross-Section A₁-A⁴</td>
</tr>
<tr>
<td>2</td>
<td>Regional Geologic Map</td>
<td>12</td>
<td>Geologic Cross-Section A²-A³</td>
</tr>
<tr>
<td>3</td>
<td>Boring Location Map</td>
<td>13</td>
<td>Regional Fault Map</td>
</tr>
<tr>
<td>4 - 9</td>
<td>Logs of Soil Borings</td>
<td>14</td>
<td>Regional Seismicity Map</td>
</tr>
<tr>
<td>10</td>
<td>Unified Soil Classification System</td>
<td>15</td>
<td>FEMA Flood Map</td>
</tr>
</tbody>
</table>

Appended to this report are:
- Appendix A - General information regarding project concepts; exploratory methods used during our field investigation; and, laboratory test results not included on the boring logs.
- Appendix B - *Guide Earthwork Specifications* that may be used in the preparation of contract documents.
- Appendix C - Output files from the EQFAULT/EQSEARCH programs.
- Appendix D - A list of references cited.

PROPOSED DEVELOPMENT

Based on our review of the aforementioned plans, it is our understanding the project will include construction of an approximately 200-square foot addition to the existing building, an approximately 200-square foot covered patio, an approximately 410-square foot concrete utility pad for water tank and fuel trailer, a generator pad, a condensing unit pad, an approximately 30-foot diameter fire sprinkler tank, an approximately 220-square foot fire sprinkler pump pad, and a new driveway. It is our understanding that the proposed addition will be wood-framed structure supported on a conventional foundation system with concrete slab-on-grade floors. The sprinkler water tank will be supported on concrete ring foundation with independent concrete bottom slab. Associated development is anticipated to include asphalt concrete (AC) driveway and underground utilities.
Based on the review of the plans, earthwork cuts and fills of up to three feet are anticipated in the area of the proposed fire sprinkler tank and fire sprinkler pump pad. Earthwork cuts and fills of up to one foot are anticipated in the areas of the remainder of the proposed structures.

**FINDINGS**

**SITE DESCRIPTION**

The project site is an approximately 0.25-acre property located at 5198 Sharpe Road in Calistoga, California. The approximate location of the project is north latitude 38.5583° and west longitude 122.6236°.

The site is generally bounded to the north by Sharpe Road, beyond which are grape wines; and, to the north, east, and west by rural single-family residences. On the dates of our investigation, the project site was utilized as a fire station. Areas proposed for the proposed fire sprinkler tank and fire sprinkler pump pad are within north facing gentle slope. Areas proposed for the reminder of the improvements were gravel covered flat areas. Two storage sheds were located in the area of the proposed addition. An existing water tank was located in the area proposed for the utility pad for the new water tank. Numerous underground utilities were noted throughout areas proposed for the improvements. Wooden fences were present along the southern and western property borders.

Review of the United States Geological Survey (USGS) 7.5-minute series *Calistoga Quadrangle, California – Sonoma County* (1998 edition), indicates the site ground surface elevation is approximately +1000 feet relative to mean sea level (msl). Portion of the USGS topographic map containing the site and vicinity, is included with this report as Figure 1.

**SITE HISTORY**


The site was an undeveloped, tree covered area land at least until 1983. The existing fire station was constructed sometime between 1983 and 1993. Sometime between 2013 and
2015 a shed, in the area of the proposed addition, was constructed. An existing water tank was present on site since at least 2012.

GEOLOGIC SETTING

REGIONAL GEOLOGY AND STRUCTURE

The project site lies in the northern-eastern portion of the Coast Ranges geomorphic province of California. The Ranges and valleys trend northwest, subparallel to the Sand Andreas Fault System. Strata dip beneath sediments of the Great Valley geomorphic Province. To the west is the Pacific Ocean. The eastern border of the northern Coast Ranges consist of strike-ridges and valleys in Upper Mesozoic strata and partially overlain by volcanic rocks of the Quin Sabe, Sonoma and Clear Lake volcanic fields.

SITE GEOLOGY

The CGS Preliminary Geologic Map of the Calistoga, 7.5-minute Quadrangle, Napa and Sonoma Counties, California: A Digital Database, indicates the project site is underlain by Pliocene age Tuff of Petrified Forest of Sonoma Volcanics (Map Symbol: Tstp) described as thick section of silicic tuff, tuff breccia, and agglomerate. The subsurface conditions encountered in our borings were generally consistent with those typically mapped.

The United States Department of Agriculture, Natural Resources Conservation Service website (http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx), indicates the site is underlain by Felta very gravelly loam (5 to 15 percent slopes) consisting of well drained soils developed on alluvium derived from igneous, metamorphic and sedimentary rock. Soils formed on foot slopes. The typical soil profile consist of very gravelly loam to a depth of 5 inches, over very gravelly clay loam to a depth of 24 inches, over very gravelly sandy clay loam to a depth of 60 inches. Soils tend to have moderate corrosion potential towards concrete and steel. Soils have somewhat limited use for local road and street and dwelling without basements construction. Soils are somewhat limited to shallow excavations. Soils have a very limited use for small commercial buildings. The mapped soils are generally consistent with the soils encountered during our site investigation.
SUBSURFACE SOIL CONDITIONS

Fill soils consisting of fine, angular, poorly graded gravel were encountered in borings D1 through D4 and extended to depths of 2 to 3 inches bgs. Native soils/rock encountered in our test borings consisted of stiff to very stiff fat clays to depths of 1 to 4 feet bgs underlain by completely weathered tuff (volcanic rock) to depths of 2 to 9 feet bgs. These strata were underlain by highly weathered tuff to the maximum depth explored of 19½ feet bgs. Fat clays were not encountered in test borings D2 and D4 where completely weathered rock was encountered essentially from the surface.

For soil conditions at a specific location, please refer to the Logs of Soil Borings (Figures 4 through 9). An explanation of the symbols and classification system used on the Logs is presented on Figure 10. Graphic illustrations of the subsurface conditions encountered in the borings are presented on the geologic cross-sections (Figures 11 and 12).

GROUNDWATER

Perched groundwater was encountered in one boring (D2) advanced on April 7, 2020, at a depth of approximately 6½ feet bgs.

Groundwater levels may fluctuate beneath the site depending on the time of year and rainfall amounts. Therefore, groundwater conditions presented in this report may not be representative of those which may be encountered during or subsequent to construction.

REGIONAL SEISMICITY

FAULTING

The project site is not located across the mapped trace of any known fault, nor was there any indication of surface rupture or fault-related surface disturbance at the site during our review of aerial photographs, site reconnaissance, or geotechnical investigation.

The site is not located within an Alquist-Priolo Earthquake Fault Zone as currently designated by the State of California (DMG Special Publication No. 42, revised 1997). The nearest Earthquake Fault Zone is the Maacama Fault, located approximately 4 miles (6.4 kilometers) northwest of the project site. A Regional Fault Map (Figure 13) is included with this report.
According to the United States Geological Survey (USGS), 2008 National Seismic Hazard Maps – Source Parameters website, (http://geohazards.usgs.gov/cfusion/hazfaults_2008_search/query_main.cfm), the closest Type A or Type B fault to the site is the Maacama-Gerberville Fault, located approximately 4 miles (6.4 kilometers) northwest of the project site.

Using the USGS Earthquake Hazards Program, 2008 National Seismic Hazard Maps-Source Parameters, we have prepared Table 1 containing Class A and B faults and fault rupture segments within 62 miles (100 kilometers) of the site that are considered capable of producing earthquakes with maximum moment magnitudes (MW) 6.5 or greater. The $M_{\text{max}}$ value represents the maximum earthquake believed possible for each fault.

Table 1 - Faults and Fault Rupture Segments Influential to Mountain Station #6

<table>
<thead>
<tr>
<th>Fault Name</th>
<th>Maximum Magnitude (MW)</th>
<th>Distance To Site Miles (Kilometers)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maacama-Garberville</td>
<td>7.40</td>
<td>4.0 (6.43)</td>
</tr>
<tr>
<td>Hayward-Rodgers Creek;RC+HN+HS</td>
<td>7.33</td>
<td>7.25 (11.66)</td>
</tr>
<tr>
<td>Hayward-Rodgers Creek;RC+HN</td>
<td>7.19</td>
<td>7.25 (11.66)</td>
</tr>
<tr>
<td>Hayward-Rodgers Creek;RC</td>
<td>7.07</td>
<td>7.25 (11.66)</td>
</tr>
<tr>
<td>Collayomi</td>
<td>6.70</td>
<td>15.54 (25.02)</td>
</tr>
<tr>
<td>West Napa</td>
<td>6.70</td>
<td>17.09 (27.51)</td>
</tr>
<tr>
<td>Hunting Creek-Berryessa</td>
<td>7.10</td>
<td>17.36 (27.93)</td>
</tr>
<tr>
<td>Bartlett Springs</td>
<td>7.30</td>
<td>26.65 (42.89)</td>
</tr>
<tr>
<td>Green Valley Connected</td>
<td>6.80</td>
<td>26.94 (43.36)</td>
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<tr>
<td>N. San Andreas;SAO+SAN</td>
<td>7.75</td>
<td>27.70 (44.59)</td>
</tr>
<tr>
<td>N. San Andreas;SAO+SAN+SAP</td>
<td>7.86</td>
<td>27.70 (44.59)</td>
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<tr>
<td>N. San Andreas;SAO+SAN+SAP+SAS</td>
<td>7.94</td>
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<tr>
<td>N. San Andreas;SAN</td>
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<td>27.70 (44.59)</td>
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<tr>
<td>N. San Andreas;SAN+SAP</td>
<td>7.70</td>
<td>27.70 (44.59)</td>
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<tr>
<td>N. San Andreas;SAN+SAP+SAS</td>
<td>7.80</td>
<td>27.70 (44.59)</td>
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<td>Great Valley 4a, Trout Creek</td>
<td>6.60</td>
<td>30.06 (48.38)</td>
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<tr>
<td>Great Valley 4b, Gordon Valley</td>
<td>6.80</td>
<td>31.23 (50.26)</td>
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<tr>
<td>Great Valley 3, Mysterious Ridge</td>
<td>7.10</td>
<td>32.16 (51.76)</td>
</tr>
<tr>
<td>Fault Name</td>
<td>Maximum Magnitude (MW)</td>
<td>Distance To Site Miles (Kilometers)</td>
</tr>
<tr>
<td>------------------------------------------------</td>
<td>------------------------</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td>Hayward-Rodgers Creek;HN+HS</td>
<td>7.00</td>
<td>34.05 (54.80)</td>
</tr>
<tr>
<td>Hayward-Rodgers Creek;HN</td>
<td>6.60</td>
<td>34.05 (54.80)</td>
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<td>Great Valley 5, Pittsburg Kirby Hills</td>
<td>6.70</td>
<td>39.88 (64.18)</td>
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<td>Great Valley 2</td>
<td>6.50</td>
<td>40.72 (65.53)</td>
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<td>Point Reyes</td>
<td>6.90</td>
<td>42.35 (68.15)</td>
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<td>N. San Andreas;SAP</td>
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<td>53.36 (85.87)</td>
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<td>N. San Andreas;SAP+SAS</td>
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<td>Great Valley 1</td>
<td>6.80</td>
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<td>San Gregorio Connected</td>
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<td>54.49 (87.70)</td>
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<td>Hayward-Rodgers Creek; HS</td>
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<td>55.14 (88.73)</td>
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<td>Mount Diablo Thrust</td>
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<td>56.72 (91.28)</td>
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<td>Calaveras;CN</td>
<td>6.87</td>
<td>61.04 (98.24)</td>
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<tr>
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<td>7.03</td>
<td>61.04 (98.24)</td>
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<tr>
<td>Calaveras;CN+CC</td>
<td>7.00</td>
<td>61.04 (98.24)</td>
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</tbody>
</table>

Review of the CGS California Fault Activity Map of California (2010) database indicates that the nearest faults to the site are the Quaternary Unnamed Fault located approximately ½ mile (0.9 kilometer) north from the site and the Quaternary Unnamed Thrust Fault located approximately 1.2 miles (1.9 kilometers) south from the site.

Results of the hazard deaggregation conducted utilizing USGS Unified Hazard Tool indicates that the mode magnitude earthquake for the site is 7.4.

**Historic Seismicity**

Seismological data regarding significant historical earthquakes affecting the site was obtained using the commercially available software program EQSEARCH (Blake, 2000; database updated 2018). The EQSEARCH database was developed by extracting records of events greater than magnitude 5.0 from the DMG Comprehensive Computerized Earthquake Catalog, and supplemented by records from the USGS; University of California, Berkeley; the California Institute of Technology; and, the University of Nevada at Reno. A search radius of 62 miles (100 kilometers) was specified for this analysis. A historic earthquake epicenter
map showing earthquakes (magnitude 5 or greater) within the project region is presented as Figure 13.

A review of the historical earthquake data indicates that the most significant earthquake shaking (acceleration) experienced at the project site occurred during the 1969 Santa Rosa earthquake sequence. The source of these events is attributed to the Rodgers Creek Fault System. The estimated magnitudes of these events were 5.6 and 5.7 and they produced an estimated site peak ground acceleration of 0.119g. The closest epicenter is located approximately 1.1 miles (11.4 kilometers) south-west of the site. An examination of the tabulated EQSEARCH data suggests that the project site has experienced maximum ground shaking equivalent to Modified Mercalli Intensity VIII\(^1\) as the result of these earthquakes.

Among the most recent earthquakes, the Mw=5.0 2000 Yountville, the Mw=6.0 2014 South Napa, and the Mw=5.0 2016 Geysers events produced estimated site peak ground accelerations of 0.047g, 0.053g, and 0.039g respectively.

The number of earthquakes greater than Mw 5.0 within a 62 mile (100 kilometer) radius of the site is presented in the following table.

<table>
<thead>
<tr>
<th>Earthquake Magnitude</th>
<th>Number of Times Exceeded</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.0</td>
<td>40</td>
</tr>
<tr>
<td>5.5</td>
<td>15</td>
</tr>
<tr>
<td>6.0</td>
<td>8</td>
</tr>
<tr>
<td>6.5</td>
<td>2</td>
</tr>
<tr>
<td>7.0</td>
<td>1</td>
</tr>
<tr>
<td>7.5</td>
<td>1</td>
</tr>
<tr>
<td>6.0</td>
<td>1</td>
</tr>
</tbody>
</table>

Output files from the EQFAULT/EQSEARCH programs are included in Appendix C.

---

\(^1\) VIII – Severe: Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
COSEISMIC GROUND DEFORMATION

The California State Legislature passed the Seismic Hazards Mapping Act (SHMA) in 1990 (Public Resources Code Division 2, Chapter 7.8) as a result of earthquake damage caused by the 1987 Whittier Narrows and 1989 Loma Prieta earthquakes. The purpose of the SHMA is to protect public safety from the effects of strong ground shaking, liquefaction, landslides, or other ground failure, and other hazards caused by earthquakes (California Geological Survey [CGS] Special Publication [SP] 117).

There are currently 25 State designated Seismic Hazard Zone maps for Sonoma County.

SEISMIC CODE PARAMETERS

Section 1613A of the 2019 edition of the CBC references ASCE Standard 7-16 for seismic design. The following seismic parameters were determined based on the site latitude and longitude using the web interface developed by the Structural Engineers Association of California (SEAOC) and California Office of Statewide Health Planning and Development (OSHPD) (https://seismicmaps.org/) to retrieve seismic design data from the public domain computer program developed by the USGS. The seismic design parameters summarized in the table below may be used for seismic design of the proposed improvements.

The site is underlain by volcanic rock, therefore, it is our opinion that Seismic Site Class C is most applicable to the soils/rock conditions on site.

The values provided below may be utilized for design of the proposed improvements.

<table>
<thead>
<tr>
<th>Table 2 - 2019 CBC/ASCE 7-16 Seismic Design Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latitude: 38.5583° N</td>
</tr>
<tr>
<td>Longitude: -122.6236° W</td>
</tr>
<tr>
<td>ASCE 7-16 Table/Figure</td>
</tr>
<tr>
<td>2019 CBC Table/Figure</td>
</tr>
<tr>
<td>Factor/Coefficient</td>
</tr>
<tr>
<td>Value</td>
</tr>
<tr>
<td>Short-Period MCE at 0.2</td>
</tr>
<tr>
<td>Figure 22-1</td>
</tr>
<tr>
<td>Figure 1613A.3.1(1)</td>
</tr>
<tr>
<td>Ss</td>
</tr>
<tr>
<td>2.062 g</td>
</tr>
<tr>
<td>1.0 Period MCE</td>
</tr>
<tr>
<td>Figure 22-2</td>
</tr>
<tr>
<td>Figure 1613A.3.1(2)</td>
</tr>
<tr>
<td>Si</td>
</tr>
<tr>
<td>0.778 g</td>
</tr>
<tr>
<td>Soil Class</td>
</tr>
<tr>
<td>Table 20.3-1</td>
</tr>
<tr>
<td>Section 1613A.3.2</td>
</tr>
<tr>
<td>Site Class</td>
</tr>
<tr>
<td>C</td>
</tr>
<tr>
<td>Site Coefficient</td>
</tr>
<tr>
<td>Table 11.4-1</td>
</tr>
<tr>
<td>Table 1613A.3.3(1)</td>
</tr>
<tr>
<td>Fa</td>
</tr>
<tr>
<td>1.2</td>
</tr>
<tr>
<td>Site Coefficient</td>
</tr>
<tr>
<td>Table 11.4-2</td>
</tr>
<tr>
<td>Table 1613A.3.3(2)</td>
</tr>
<tr>
<td>Fv</td>
</tr>
<tr>
<td>1.4</td>
</tr>
<tr>
<td>Equation 11.4-1</td>
</tr>
<tr>
<td>Equation 16A-37</td>
</tr>
<tr>
<td>Sms</td>
</tr>
<tr>
<td>2.475 g</td>
</tr>
</tbody>
</table>
The site modified peak ground acceleration $\text{PGA}_M$ (Equation 11.8-1, ASCE 7-16) is 1.049 g.

**PRIMARY SEISMIC HAZARDS**

**Seismic Hazards**

No active or potentially active faults are known to cross the project site as indicated by the published geologic maps or aerial photographs reviewed for this project. The project site is not located within an Earthquake Fault Zone, or designated seismic hazard zone; therefore, a site specific ground motion analysis is not warranted. The project site is located within an area of moderate seismic activity; however, design of the structure in conformance with the 2019 edition of the California Building Code (Title 24 of the California Code of Regulations, Chapter 16A), should be sufficient to prevent significant damage from ground shaking during seismic events resulting from movement on any of the faults or fault systems discussed in this report.

**Seismic Sources**

Several faults exhibiting activity in the Quaternary time are mapped within 62 miles (100 kilometers) of the project site. These faults and fault systems, their Maximum Magnitude Earthquakes ($M_{\text{wmax}}$) and distances to the project site are listed within the Faulting section of this report. Hazard deaggregation indicates that the causing
faults contributing to the estimated site PGA are Maacama Fault and Rodgers Creek Fault.

The Maacama Fault is a major dextral component of the San Andresa Fault system that extends from near Laytonville in Mendocino County nearly to Mark West Creek in Sonoma County. A total fault length is approximately 100 miles (160 kilometers). The fault connects via a 6 km right step with the Rodgers Creek fault to the south. Extension to the north of Laytonville is not well documented, but suggested by seismicity or it may connect structurally with late Quaternary Brush Mountain shear zone to the northwest. The fault offsets Pliocene-Pleistocene sediment of the Glen Ellen Formation and all older units. Locally offsets late Quaternary alluvium near Maacama Creek, Ukiah, and Willits. It is estimated about 20 km of dextral slip has occurred during the Quaternary based on inferred offset of the Pliocene Sonoma Volcanics. Based on Holocene surface traces, the California Division of Mines and Geology established it as a regulatory Earthquake Fault Zone under the Alquist-Priolo Act. Fault creep measured near Ukiah and Willits shows about 5.6 mm/year, and 7.6 mm/year, respectively, of dextral slip. The fault is fairly well defined by seismicity. A paleoseismic study indicates that the most recent event is prehistoric and occurred between 1520 A.D. and 1650 A.D. whereas other trench investigations indicate Holocene rupture in several places near Ukiah and Willits. It is estimated a preliminary maximum dextral slip rate of 11-14 mm/year, based on a dextrally offset terrace riser of middle to early Holocene age.

The Rodgers Creek Fault is a Holocene dextral fault which offsets upper Cenozoic volcanic and sedimentary rock units along the southwestern flanks of Sonoma Mountains and unnamed hills to the north. Dextral offset is estimated to be 28±3 kilometers in the past 6 million years. Important branch of the larger San Andreas Fault system. The southern end of the fault connects with the Hayward fault via a 6-km-wide right stepover under San Pablo Bay. The northern end connects with the Maacama fault via a complex right stepover of about 6 km. Based on surface traces, the fault was zoned under the Alquist-Priolo Earthquake Fault Zoning Act from Windsor Creek on the north almost to San Pablo Bay. Paleoseismic investigations may have identified the last three earthquakes and determined a slip rate of 6.4–10.4 mm/year for the south part of the fault. Historical dextral slip is indicated by first-motion studies for the 1969 Santa Rosa earthquakes which also documented a
complex but continuous zone of seismicity for the northern half of the Rodgers Creek fault and its stepover to the Maacama fault.

**Surface Fault Rupture**

No known faults are mapped crossing the immediate vicinity of the site. The site does not lie within an Earthquake Fault Zone as currently designated by the State of California and no evidence of surface faulting was observed during our historical aerial photography review, site reconnaissance, or geotechnical investigation. It is our opinion that the potential of fault-related surface rupture at the site is low.

**Seismic Risk**

Hazard deaggregation indicates that the causing faults contributing to the estimated site PGA are Maakama Fault (M=7.34 event) and Rodgers Creek Fault (M=7.02 event).

**Secondary Hazards**

**Liquefaction**

Liquefaction is a soil strength and stiffness loss phenomenon that typically occurs in loose, saturated cohesionless soils as a result of strong ground shaking during earthquakes. The potential for liquefaction at a site is usually determined based on the results of a subsurface geotechnical investigation and the groundwater conditions beneath the site. Hazards to buildings associated with liquefaction include bearing capacity failure, lateral spreading, and differential settlement of soils below foundations, which can contribute to structural damage or collapse. The site is not located within a State Designated Seismic Hazard Zone for liquefaction. According to the Sonoma County General Plan 2020, Public Safety Element the project site is not located in liquefaction hazard area.

Considering the site is underlain by volcanic rock, the potential for soil liquefaction beneath the site is very low.
Cyclic Softening of Clay and Clay-like Soils

Cyclic softening of clay soils commonly understood as the reduction in soil stiffness and strength due to repeated cyclic loading. This phenomenon is typically observed in soft, saturated soils with PI above 7. The site is underlain by stiff to very stiff clays and volcanic rock. Therefore, it is our opinion the potential for cyclic softening occurring beneath the site is very low.

Lateral Spreading

Liquefaction-induced lateral spreading is defined as the finite, lateral displacement of gently sloping ground as a result of pore pressure build up or liquefaction in a shallow underlying deposit during an earthquake. Lateral spreading usually occurs on gently sloping ground exposed to a slope or free face. Based on the very low potential for liquefaction on site, it is our opinion that the potential for lateral spreading at the site is very low.

Seismically Induced Settlement

The site is not located in a Seismic Hazard Zone for liquefaction as designated by the state of California, which delineates areas of historical occurrence of liquefaction or local geological, geotechnical and groundwater conditions indicating a potential for permanent ground displacement. The site is underlain by stiff to very stiff clays and volcanic rock, therefore, it is our opinion the potential for site seismically induced ground subsidence is low.

Subsidence & Hydrocollapse

Regional subsidence occurs when large areas of land sink in response to withdrawal of groundwater, petroleum, or natural gas. According to a review of the Areas of Land Subsidence in California Map (California Water Science Center), the site is not currently located within an area of land subsidence from groundwater pumping, peat loss, or oil extracting. In our opinion, the site is not located in an area subject to high subsidence, due to the absence of factors and conditions needed to cause subsidence (excessive withdrawal of groundwater, petroleum, or natural gas) and geological conditions (shallow depth to volcanic rock).
The site is underlain by stiff to very stiff fat clays and volcanic rock, therefore, the potential for hydrocollapse of on-site soils is very low.

_Landslides and Slope Stability_

The site is not located in a Landslide Hazard Zone as designated by the State of California. According to the *Sonoma County General Plan 2020, Public Safety Element* the project site is not located in deep-seated landslide hazard area. According to the CGS Map _Landslides and Relative Slope Stability – Northern Sonoma County_, the site is within zone Bf, Locally level areas within hilly terrain; may be underlain or bounded by unstable or potentially unstable rock materials. Considering the very gentle slopping site topography the potential for development of the landslides or slope instability is low.

_Tsunami_

The project site is well inland and there are no significant bodies of standing water near the site; therefore, the potential for tsunamis influencing the site is negligible.

_Seiche_

There are no significant bodies of standing water near the site; therefore, the potential for seiches influencing the site is very negligible.

_Flood/Dam Inundation_

The site is not located within a Special Flood Hazard Area (SFHA) as designated by the Federal Emergency Management Agency (FEMA). According to the Flood Insurance Rate Maps (FIRM) Panel 0625E, Map Number 06097C0625E, published by FEMA, with an effective date of December 2, 2008, the proposed site is within Zone D, Area of Undetermined Flood Hazard (Figure 15).

Review of the Dam Breach Inundation Map Web Publisher, maintained by Department of Water Resources, indicates that the site is not located in the area prone to inundation due to the dam failure.
According to the Sonoma County General Plan 2020, Public Safety Element the project site is not located in dam failure inundation hazard area.

Volcanic Hazard

Review of the USGS Map of Potential Hazards from Future Volcanic Eruptions in California (Miller, 1989), shows the project site is approximately 25 miles (40 kilometers) south of Clear Lake Volcanic Area. Based on the above information, it is our opinion that a potential for volcanic hazard affect the site is low.

Naturally Occurring Asbestos (NOA)

Asbestos is the generic term for the naturally occurring fibrous (asbestiform) varieties of six silicate minerals. Asbestos also refers to an industrial product obtained by mining and processing deposits of asbestiform minerals. According to California Geological Survey Open-File Report 2000-19, A General Location Guide for Ultramafic rocks in California-Areas More Likely to Contain Naturally Occurring Asbestos (2000), and the USGS Open-File Report 2011-1188, Reported Historic Asbestos Mines, Historic Asbestos Prospects, and Other Natural Occurrences of Asbestos in California (2011), the project site does not lie within an area mapped as containing Naturally Occurring Asbestos (NOA) or ultramafic rock in outcrop.

Radon Gas

Sections 307 and 309 of the Indoor Radon Abatement Act of 1988 (IRAA) directed EPA to list and identify areas of the U.S. with the potential for elevated indoor radon levels. EPA's Map of Radon Zones assigns each of the 3,141 counties in the U.S. to one of three zones based on radon potential. Sonoma County and the project site are located in Zone 3 for radon potential. Zone 3 counties have a predicted average indoor radon screening level less than two pCi/L and are indicated to have a Low Potential for radon.
CONCLUSIONS

FOUNDATION AND STRUCTURAL SUPPORT

Areas proposed for the improvements contain existing utilities and fills; therefore, proper clearing and removal of existing utilities and fills, and proper backfilling of excavations is very important to provide adequate and uniform structural support. Site clearing operations will disturb the surface and near-surface soils creating loose and variable soil conditions; therefore, we will recommend all disturbed and/or loose soils within areas proposed for the new improvements be over-excavated and replaced with properly moisture conditioned and compacted engineered fill to promote more uniform support for the planned improvements.

Specific recommendations for processing and re-compaction are presented in the SITE PREPARATION AND OVER-EXCAVATION section of this report.

Our work indicates that undisturbed and re-compacted native soils/rock and engineered fill, properly placed and compacted in accordance with the recommendations of this report, will be capable of supporting the proposed improvements.

Provided the over-excavation, processing, and re-compaction of on-site disturbed soils is performed as recommended, we estimate total settlements (static and seismic) of foundations to be one inch with differential settlements to be approximately ½-inch in 40 linear feet. In our opinion, the majority of any initial static settlements will occur during construction. We do not anticipate long-term secondary static settlements to occur, based on the soil conditions and the recommended re-compaction.

EXPANSIVE SOILS

The results of our subsurface exploration indicate the on-site fat clays and weathered volcanic rock are possess a medium expansion potential when tested in accordance with the ASTM D4829 test method (see Figures A1 and A2). In our opinion, these soils are capable of exerting significant expansion pressures on foundations, interior floor slabs and exterior flatwork, if exposed at or near final subgrades.
In floor slab and exterior flatwork areas, on past projects, replacement with imported non-expansive soils or aggregates, has produced significant reductions in expansive soil movements, but some floor slab (both interior and exterior) movement can still occur. Proposed interior and exterior slabs-on-grade should be underlain by a minimum of 18 inches of granular, imported, non-expansive engineered fill.

Specific recommendations to mitigate the effects of potentially expansive soils are provided in later sections of this report.

**SUITABILITY OF ON-SITE SOILS/ROCK FOR USE AS FILL**

The on-site soils are considered suitable for use as engineered fill materials, provided these materials are free from concentrations of organic debris (roots and root balls), over-size rock, rubble, debris, rubbish, or other deleterious materials and are at the proper moisture content for compaction. If encountered, removal of rubble, debris, and organic debris from on-site soils may require laborers handpicking the fill materials, and/or screening prior to allowing the soils to be re-used as fill.

**On-site fat clays and weathered volcanic rock should not be used within 18 inches of final interior and exterior slab-on-grade subgrade.**

**EXCAVATION CONDITIONS**

Based on our field investigation, the on-site native soils/rock should be readily excavatable with conventional earthmoving and trenching equipment typically used in the area. The weathered volcanic rock will require more effort to excavate; however, special trenching and excavation equipment should not be necessary.

In general, we anticipate soil sidewalls for most site excavations will remain stable at near-vertical inclinations for short periods of time without significant caving, unless perched water and/or seepage is encountered, or saturated and/or low cohesion sandy soils are encountered or the exposed soils are allowed to dry. Excavations encountering perched water and seepage will be susceptible to sloughing or caving upon excavation or if left open for an extended period of time requiring sloped excavations and other stabilization methods.
Excavations deeper than five feet that will be entered by workers should be sloped and/or braced in accordance with current OSHA regulations. The contractor must provide an adequately constructed and braced shoring system in accordance with federal, state and local safety regulations for individuals working in an excavation that may expose them to the danger of moving ground. If material is stored or heavy equipment is operated near an excavation, stronger shoring would be needed to resist the extra pressure due to the superimposed loads.

**SOIL CORROSION POTENTIAL**

Representative soil samples were submitted to Sunland Analytical Lab, Inc. for testing to determine pH, resistivity, and sulfate and chloride concentrations to help evaluate the potential for corrosive attack upon reinforced concrete. Results of the corrosion testing performed by Sunland Analytical Lab are summarized in the Table 3.

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Test Method</th>
<th>Sample Identification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil pH</td>
<td>CA DOT 643 Modified*</td>
<td>4.14  4.92  5.31</td>
</tr>
<tr>
<td>Minimum Resistivity</td>
<td>CA DOT 643 Modified*</td>
<td>1,050 Ω-cm  1,130 Ω-cm  1,130 Ω-cm</td>
</tr>
<tr>
<td>Chloride</td>
<td>CA DOT 417</td>
<td>4.5 ppm  12.1 ppm  19.1 ppm</td>
</tr>
<tr>
<td>Sulfate</td>
<td>CA DOT 422</td>
<td>26.9 ppm  12.6 ppm  13.3 ppm</td>
</tr>
</tbody>
</table>

* = Small cell method
Ω-cm = Ohm-centimeters
ppm = Parts per million

The California Department of Transportation Corrosion Technology Section, Office of Materials and Foundations, Corrosion Guidelines Version 3.0, March 2018, considers a site to be corrosive to foundation elements if one or more of the following conditions exists for the representative soil and/or water samples taken: has a chloride concentration greater than or equal to 500 ppm, sulfate concentration greater than or equal to 1,500 ppm, or the pH is 5.5 or less. **Based on this criterion, the on-site soils/rock may be corrosive to foundation elements due to the low pH.**

Table 19.3.1.1 – Exposure Categories and Classes, American Concrete Institute (ACI) 318-19, Section 19.3, as referenced in Section 1904.1 of the 2019 CBC, indicates the severity of sulfate exposure for the samples tested is not a concern. Ordinary Type I-II Portland cement is
considered suitable for use on this project, assuming a minimum concrete cover is maintained over the reinforcement.

Mid Pacific Engineering, Inc. are not corrosion engineers. Therefore, to further define the soil corrosion potential at the site, or to determine the need or design parameters for cathodic protection or grounding systems, a corrosion engineers should be consulted. Import fills, if used for construction, should be sampled and tested to verify the materials have corrosion characteristics within acceptable limits and generally should be similar to the tested on-site soils.

**PERMANENT GROUNDWATER**

Due to the anticipated depth to groundwater, permanent groundwater should not be a significant factor in the design and construction of the proposed improvements at this site.

**SEASONAL WATER**

The near-surface soils also may be in a near-saturated condition during and for a significant time following the rainy season due to rain water being unable to penetrate through the low permeability soils below existing site grade. Earthwork operations attempted following the onset of the rainy season and prior to prolonged drying will be hampered by high soil moisture contents. Heavy, prolonged rainfall events will promote high soil moisture contents and increase the potential for trapped water over impermeable soil layers that could further affect grading operations. If grading operations are to proceed shortly after the rainy season, and before prolonged periods of warm dry weather, the near-surface soils and soils to be used as engineered fill including trench backfill may be at moisture contents where significant and prolonged aeration or lime-treatment may be required to dry the soils to a moisture content where the specified degree of compaction can be achieved. The contractor should anticipate the additional time and effort necessary to achieve a compactable moisture content.

Perched groundwater was encountered in one boring (D2) advanced on April 7, 2020, at a depth of approximately 6½ feet bgs. For the budgeting purposes, perched groundwater should be anticipated in utility excavations in the area of the proposed addition at a depth of 5 feet bgs. Perched or seepage water may be present within excavations, depending upon
the time of year when construction takes place. The need for dewatering of excavations can best be determined during site work when subsurface conditions are fully exposed.

Seasonal moisture and landscape irrigation will result in high soil moisture contents below interior floor slabs throughout their lifetime. Moisture vapor penetration resistance should be a significant consideration in design and construction of interior floor slabs.

**RECOMMENDATIONS**

The project is in a preliminary stage of development; therefore, we consider it essential that our office review site, final grading, and structural foundation plans to verify the applicability of the following recommendations, perform additional investigations, and provide supplemental recommendations, as conditions dictate. Our recommendations are contingent upon our office performing the recommended plan reviews and providing a letter indicating that the recommendations of this report are applicable to the proposed construction.

Considering the former improvements existed on-site, we recommend construction bid documents contain a unit price (price per cubic yard) to compensate for the variations in the depths of over-excavation and engineered fill construction.

The recommendations presented below are appropriate for typical construction in the late spring through fall months. The on-site soils likely will be saturated by rainfall in the winter and spring months, and will not be compactable without drying by aeration or the addition of lime (or a similar product) to dry the soils. Should the construction schedule require work to continue during the wet months, additional recommendations should be provided by the Geotechnical Engineer retained to provide services during project construction.

**SITE CLEARING**

Initially, all structural areas of the site should be cleared of trees, vegetation, debris, and other deleterious materials to expose firm and stable soil conditions as identified by our on-site representative. Our review of available literature and historical photographs provide a limited site history. Former structures and trees were present on-site. Therefore, unknown buried structures (foundations, underground utilities, etc.) may be present on-site and may
be encountered during construction. If encountered, these structures should be removed and the resulting cavities or holes should be backfilled with properly moisture conditioned and compacted engineered fill as described in this report.

Where practical, the clearing should extend a minimum of five feet beyond the limits of the proposed improvement and structural areas of the site; however, clearing operations shall not encroach existing improvements (pavements, foundations, etc.). Existing underground utilities located within proposed improvements pads should be completely removed and/or rerouted as necessary. Utilities located outside the structural area should be properly abandoned (i.e., fully grouted provided the abandoned utility is situated at least 2½ feet below the final subgrade level to reduce the potential for localized “hard spots”).

Trees and large brush designated for removal should include the entire root ball and all surface roots larger than ½-inch in diameter. Adequate removal of debris, rubble, and tree roots may require laborers and handpicking to clear the subgrade soils to the satisfaction of our on-site representative. Depressions resulting from clearing operations and any other loose, disturbed, soft or otherwise unstable materials should be removed to expose a firm, undisturbed soils prior to backfilling with properly placed and compacted engineered fill to restore the areas back to the required grades.

Remaining areas should be stripped of surface vegetation and organically contaminated topsoil; strippings may be stockpiled for later use in landscape areas or disposed of off-site. Strippings should not be used in general fill construction, but may be used in landscaped areas, provided they are kept at least five feet from the building pads, exterior flatwork and pavements, and moisture conditioned and compacted. Strippings should not be used in landscaped berms that will support sound walls, retaining walls, concrete flatwork, or other at-grade structure.

It is essential that our representative be present during clearing operations to verify adequate removal of existing and former structures, as well as trees and roots, and determine the need for over-excavation of disturbed soil areas. It is essential that excavations resulting from clearing operations be left as shallow dish-shaped depressions for proper location and to allow proper access with compaction equipment during grading operations. If clearing and removal of structures takes place without direct observation by the Geotechnical Engineer, deeper cross-ripping and/or over-excavation of the disturbed areas, building pads or structural areas affected will be required.
SITE PREPARATION

Provided MPE is present during clearing operations and the excavations for removal of subsurface elements are left as dish shaped depressions so that our representative can verify adequate and complete removal, pad preparation can proceed as recommended below. If this is not the case and MPE is not present during site clearing operations or if excavations are backfilled without our observation and testing, all building and structural pads (building/structural area plus five feet beyond) will require deeper processing or over-excavation and re-compaction.

The areas to receive interior slab-on-grade, exterior slab-on-grade, pavements, and fills should be ripped and cross-ripped to a minimum depth of 12 inches, moisture conditioned to at least the optimum moisture content, and compacted to at least 90 percent of the ASTM D1557 maximum dry density. Where practical, the areas of scarification and compaction should extend a minimum of three feet horizontally beyond the proposed structural improvements lines. The compacted subgrades must be in a stable and unyielding condition for proper structural support. Any exposed remnants from former construction should be removed and debris cleared from the site.

MPE should review the final plans to verify the applicability of these recommendations and determine the need for revised recommendations.

Compaction operations should be undertaken with a heavy, self-propelled, sheepsfoot compactor (Caterpillar CS56B, or equivalent-size compactor) and should be performed in the presence of our representative who will evaluate the performance of the subgrade under compactive load and identify loose or unstable soils that could require additional excavation and/or compaction. Loose, soft, or unstable soils, as identified by our representative in the field, should be cleaned out to firm, undisturbed and stable soils, as determined by our representative, and should be restored to grade with engineered fill compacted in accordance with the recommendations of this report. Difficulty in achieving subgrade compaction or unusual soil instability may be indications of loose fill associated with past subsurface items. Should these conditions exist, the materials should be excavated to check for subsurface structures and the excavations backfilled with engineered fill. We recommend construction bid documents contain a unit price (price per cubic yard) for all excess excavation due to loose, soft, or unsuitable materials and replacement with engineered fill.
Engineered fill should be placed in horizontal lifts not exceeding six inches in compacted thickness. Engineered fill should be brought to at least the optimum moisture content and compacted to at least 90 percent of the maximum dry density as determined by ASTM D1557. Compaction operations should be undertaken with a heavy, self-propelled, sheepsfoot compactor capable of providing proper compaction to the full depth of each lift of fill. Additional passes with the compactor shall be added, as required by the Geotechnical Engineer, to achieve a firm, stable and unyielding subgrade condition. Compactive effort should be applied uniformly across the full width of fill construction. Care must be taken when compacting at the edges of the over-excavations, to ensure that the fills are uniformly tied into the adjacent sloping ground by benching into undisturbed native soil. Each lift of engineered fill should be properly benched into adjacent side slopes, if present, to remove loose soils and promote uniformity.

Sprinkler Tank and pump station structures should not be supported upon differential fill depths greater than five feet.

Engineered fill should be properly benched into the existing slopes steeper than three horizontal (3H) to one vertical (1V) to remove loose surficial soils. Each bench should consist of a level terrace excavated at least 12 inches into the slope. For every three feet of vertical height of fill, a larger bench should be constructed, extending at least five feet into the existing slope. Taller slopes will require a wider bench placed at mid-slope height. Our representative should observe the benching of the slopes to evaluate the need for additional or larger benches into the basin slope, based on exposed conditions.

The on-site soils will be suitable for use as engineered fill if the materials are at a workable moisture content and free of rubbish, rubble, debris and concentrations of organics, and have a maximum particle size of three inches or less. Hand picking of exposed roots, rubbish, debris, and over-sized rock should be performed by the Contractor to adequately clear the grades and properly prepare and clear the soils proposed as fill, prior to use.

The upper 18 inches of final structure pad and exterior flatwork subgrades must consist of approved imported granular, non-expansive soils.
Imported fill material, should consist of well-graded granular soils or well-graded aggregates with a Plasticity Index of 15 or less, an Expansion Index of 20 or less and should have no particles greater than three inches in maximum dimension. Clean, open graded gravels (such as crushed rock or pea gravel) and other such materials are not acceptable for fill construction. The contractor also should supply appropriate documentation for imported fill materials indicating the materials are free of known contamination and have corrosion characteristics within acceptable limits. The imported materials should be sampled, tested, and approved before being transported to the project site. Samples should be submitted to the Geotechnical Engineer at least two weeks prior to planned importation to the site.

The upper six inches of pavement subgrades and exterior slab subgrades supporting vehicle loadings should be uniformly compacted to at least 95 percent of the ASTM D1557 maximum dry density, and must be stable under construction traffic prior to placement of aggregate base. Final subgrade processing and compaction should be performed just prior to placement of aggregate base, after construction of underground utilities is complete.

Site preparation should be accomplished in accordance with the recommendations of this section and the Guide Earthwork Specifications provided in Appendix B. It is essential that a representative from our office be present on a nearly full-time basis during site preparation and all grading operations to verify complete removal of former improvements and/or unstable soil deposits, to observe the earthwork construction, perform compaction testing and verify compliance with our recommendations and the job specifications.

**Utility Trench Backfill**

Utility trench backfill should be mechanically compacted in maximum six-inch lifts. Trench backfill should be brought to uniform moisture content above the optimum moisture and each lift mechanically compacted to at least 90 percent of the maximum dry density. The upper six inches of trenches in pavement areas should be compacted to at least 95 percent of the maximum dry density. Jetting of trench backfill as a means of compaction is not acceptable. We recommend that native soil be used as trench backfill within the perimeter of the building foundations to help minimize soil moisture variations beneath the structure. The native soil backfill should extend at least three feet horizontally beyond perimeter foundation lines. The upper 12 inches of backfill material for trenches within building pads and slab-on-grade subgrades should be non-expansive granular soils or aggregate base.
We recommend that underground utility trenches that are aligned nearly parallel with foundations be at least three feet laterally from the outer edge of foundations, wherever possible. As a general rule, trenches should not encroach into the zone extending outward at a 1:1 (horizontal to vertical) inclination below the bottom of the foundations. In addition, trenches parallel to foundations should not remain open longer than 72 hours. The intent of these recommendations is to prevent loss of both lateral and vertical support of foundations, resulting in possible settlement.

Pipe bedding, shading and trench backfill and compaction within municipal streets should conform to jurisdictional requirements.

**FOUNDATION DESIGN**

We are providing design soil values for the analysis of proposed foundations, and suggested minimums for dimensions, but only from a Geotechnical Engineering perspective. The project Structural Engineer should determine final foundation design width and depth dimensions and reinforcing requirements, based on their specific structural design which should include an appropriate factor of safety applied to the overall design.

Total and differential settlements (static and seismic) of 1-inch and ½-inch in 40 linear feet, respectively, should be anticipated for the design of the proposed foundations.

The proposed building addition may be supported upon continuous and/or isolated spread foundations extending at least 18 inches into the prepared building pad, or at least 18 inches below lowest adjacent soil grade, whichever is deeper. Continuous foundations should be at least 12 inches wide; isolated foundations should be at least 12 inches wide. Foundations must be continuous around the perimeter of the building addition to help minimize moisture migration beneath the structure. However, depth of the existing fire station foundation was not known at the time this report was prepared. Foundations for the proposed building addition should be constructed at the same elevation as the existing foundations at the distance of five feet from the existing foundations to minimize the potential of the settlement of the existing foundations. The Structural Engineer should determine the need for and design of dowelling of new and existing foundations and slabs.

Foundations so established may be sized for a maximum allowable soil pressure of 2,250 pounds per square foot (psf) for the dead load plus live load condition with a 1/3 increase in allowable soil pressure for consideration of seismic or wind forces may be used in sizing.
foundations. The weight of foundation concrete extending below soil grade may be disregarded in sizing computations.

The proposed Sprinkler Water Tank may be supported upon circle continuous and/or isolated spread foundations extending at least 24 inches into the prepared structure pad, or at least 18 inches below lowest adjacent soil grade, whichever is deeper. Continuous circle foundations should be at least 15 inches wide; isolated foundations should be at least 18 inches wide. Foundations should bear entirely on undisturbed, slightly weathered rock. In the area of the proposed Sprinkler Water Tank rock was encountered at depths of 1 to 2½ feet below ground surface.

Foundations so established may be sized for a maximum allowable soil pressure of 3,000 pounds per square foot (psf) for the dead load plus live load condition with a 1/3 increase in allowable soil pressure for consideration of seismic or wind forces may be used in sizing foundations. The weight of foundation concrete extending below soil grade may be disregarded in sizing computations.

We recommend that all foundations be adequately reinforced to provide structural continuity, mitigate cracking and permit spanning of local soil irregularities. As a minimum, continuous foundations should contain at least four No. 4 steel reinforcing bars placed two each, near the top and bottom of the foundations. The project designer should determine the need for additional reinforcement based on structural requirements, including the use of slab ties to provide structural continuity and integrity of the slab and foundation system. Foundations must be continuous around the perimeter to provide a cut-off barrier to reduce water infiltration beneath the structure.

Resistance to lateral displacement of shallow foundations may be computed using an allowable friction factor of 0.3 multiplied by the effective vertical load on each foundation. Additional lateral resistance may be achieved using an allowable passive earth pressure against the vertical projection of the foundation equal to an equivalent fluid pressure of 300 psf per foot of depth. These two modes of resistance should not be added unless the frictional component is reduced by 50 percent since mobilization of the passive resistance requires some horizontal movement, effectively reducing the frictional resistance.
Passive resistance should be computed below a depth at which at least five feet of engineered fill or native soil is present in front of the foundation, as measured horizontally from the exterior edge of the foundation.

It is an essential requirement that foundation excavations be observed by a representative of MPE to verify competent and uniform bearing conditions and evaluate the need for any modifications to these recommendations as may be required by specific circumstances. The observations should take place prior to placement of reinforcing steel but following cleaning of the excavations. To account for any re-compaction of foundation bottoms or deepening of foundations that might be required, we suggest bid documents include a unit price for additional compaction or foundation excavation and concrete that may be required.

**INTERIOR FLOOR SLAB SUPPORT**

Interior concrete slab-on-grade floors should be supported upon subgrades consisting of at least 18 inches of uniformly moisture conditioned and properly compacted non-expansive maintained at or near optimum conditions.

**Sprinkler Water Tank and Pump Station Slabs**

As a guide minimum, we recommend interior slab-on-grade floors be at least six inches thick and, as a minimum, contain chaired No. 4 reinforcing bars on 18-inch center-on-center spacing, located at mid-slab depth. Final slab thickness, compressive strength, reinforcement, and joint spacing and details should be determined by the structural engineer based on anticipated loadings, uses and desired performance. Temporary loads exerted during construction from vehicle traffic, cranes, forklifts, and storage of palletized construction materials should be considered in the design of the slab.

Interior warehouse floor slabs should be underlain by at least six inches of Class 2 aggregate base compacted to at least 95 percent of the maximum dry density as determined by ASTM D1557. If higher performance of the slab is desired, the aggregate base section and concrete section can be increased by the owner and design team.
Modulus of Subgrade Reaction

A maximum modulus of subgrade reaction \( (k_s) \) of 150 pounds per cubic inch (pci) is considered appropriate for design on interior floor slabs, based on the upper 18 inches of imported, non-expansive soils or lime-treated clay soils being uniformly compacted in accordance with the recommendations presented in the report.

Slab-on-grade floors that will be used for vehicle support (including forklift traffic) should be constructed in accordance with the recommendations presented under the PAVEMENT DESIGN section of this report.

Building Addition Slab

Interior slab-on-grade floors should be at least four inches thick and, as a minimum, contain chaired No. 3 reinforcing bars on 18-inch center-on-center spacing, located at mid-slab depth. This slab reinforcement is suggested as a guide "minimum" only; final reinforcement and joint spacing should be determined by the structural engineer.

Slabs that will receive moisture sensitive floor covering should be underlain by a layer of free-draining gravel serving as a deterrent to migration of capillary moisture. The gravel layer should be at least four inches thick and should be graded such that 100 percent passes a one-inch sieve and none passes a No. 4 sieve. If heavier floor loads are anticipated, the crushed rock section (if used) beneath interior slab-on-grade floor could be increased or replaced with Class 2 aggregate base compacted to at least 95 percent of the maximum dry density as determined by ASTM D1557.

Additional moisture protection for interior slabs may be provided by placing a plastic water vapor retarder (at least 10-mils thick) directly over the crushed rock. The plastic water vapor retarder should meet or exceed the minimum specifications as outlined in ASTM E1745. Consideration should be given to using a thicker, higher quality membrane for additional moisture protection such as a 15-mil thick Stego vapor barrier or other product. The membrane should be installed so that there are no holes or uncovered areas. All seams should overlap and be sealed with manufacturer-approved tape, continuous at the laps to create vapor tight conditions. All perimeter edges of the membrane, such as pipe penetrations, interior and exterior footings, joints, etc., should be sealed or caulked per
manufacturer’s recommendations. An optional, thin layer of clean sand above the membrane is acceptable, as an aid to curing of the slab concrete.

It is emphasized that thicker slabs with greater reinforcing will be needed in areas supporting higher loads or where increased performance is desired, especially within the warehouse area which may be subjected to heavy concentrated loads from vehicles, for lifts, equipment and storage of products. The architect or structural engineer should determine the final thickness, strength, reinforcement, and joint spacing of exterior slab-on-grade concrete based on anticipated slab loadings, uses and desired performance. Temporary loads exerted during construction from vehicle traffic, cranes, forklifts, and storage of palletized construction materials should be considered in the design of the slab-on-grade floors.

Floor slab construction practice over the past 25 years or more has included placement of a thin layer of sand over the vapor retarder membrane. The intent of the sand is to aid in the proper curing of the slab concrete. However, recent debate over excessive moisture vapor emissions from floor slabs includes concern of water trapped within the sand. As a consequence, we consider use of the sand layer as optional. The concrete curing benefits should be weighed against efforts to reduce slab moisture vapor transmission.

The recommendations presented above should mitigate significant soils-related cracking of the slab-on-grade floors. Also important to the performance and appearance of a Portland cement concrete slab is the quality of the concrete, the workmanship of the concrete contractor, the curing techniques utilized and spacing of control joints.

**FLOOR SLAB MOISTURE PENETRATION RESISTANCE**

It is considered likely that floor slab subgrade soils will become wet to near-saturated at some time during the life of the structures. This is a certainty when slabs are constructed during the wet seasons or when constantly wet ground or poor drainage conditions exist adjacent to structures. For this reason, it should be assumed that all slabs in occupied areas, as well as those intended for moisture-sensitive floor coverings or materials, require protection against moisture or moisture vapor penetration. Standard practice includes the gravel and water vapor retarder as suggested above. However, the gravel and plastic membrane offer only a limited, first-line of defense against soil-related moisture. Recommendations contained in this report concerning foundation and floor slab design are presented as minimum requirements, only from the geotechnical engineering standpoint.
It is emphasized that the use of sub-slab crushed rock and water vapor retarder will not "moisture proof" the slab, nor does it assure that slab moisture transmission levels will be low enough to prevent damage to floor coverings or other building components. If increased protection against moisture vapor penetration of slabs is desired, a concrete moisture protection specialist should be consulted. The architect and design team should consider all available measures for slab moisture protection. It is commonly accepted that maintaining the lowest practical water-cement ratio in the slab concrete is an effective way to help reduce future moisture vapor penetration of the completed slabs.

EXTERIOR FLATWORK (NON-PAVEMENT AREAS)

Exterior flatwork should be supported on a minimum of 18 inches of imported, granular, non-expansive soils. If the expansive soils/rock are not removed and replaced, or treated, we offer the following alternate recommendations to help minimize the impact of the clays on the performance of the slabs. However, the project owner should expect some vertical and differential movement to occur in the flatwork. The subgrade soils should be uniformly compacted at a moisture content above the optimum and maintained in an over optimum moisture condition prior to concrete placement. Proper moisture conditioning of the subgrade soils is considered essential to the performance of exterior flatwork.

The architect or structural engineer should determine the final thickness, strength, reinforcement, and joint spacing of exterior slab-on-grade concrete; however, we offer the following suggested minimum guidelines. Exterior flatwork should be at least four inches thick and be constructed independent of perimeter building foundations and isolated column foundations by the placement of a layer of felt material between the flatwork and the foundation. Expansion joints should be provided to allow for minor vertical movement of the flatwork. Practices recommended by the Portland Cement Association (PCA) and the American Concrete Institute (ACI) for proper placement and curing of concrete should be followed during exterior concrete flatwork construction. Reinforcement should consist of at least heavy duty welded wire fabric (flat sheets), or equivalent steel reinforcing bars, placed mid-depth of the slab. Edges thickened to at least twice the slab thickness may be constructed along the perimeter of exterior slabs where intermittent light loading is expected over the slabs. Slabs receiving wheeled traffic should be designed as pavements and be appropriately thickened and reinforced. For increased support and performance, the exterior slabs may be underlain by a minimum four inches of Class 2 aggregate compacted to 95 percent relative compaction.
Areas adjacent to new foundations and slabs-on-grade should be fully landscaped to prevent near-surface drying and maintain more uniform soil moisture conditions adjacent to and under the foundations and slabs. From a Geotechnical perspective, drip irrigated landscaping often does not apply sufficient water to prevent drying of the near-surface soils. Alternatively, the adjacent areas can be covered with impervious materials, such as concrete, to help maintain uniform soil moisture. We recommend that final landscaping plans not allow fallow ground adjacent to exterior concrete flatwork or foundations.

**RETAINING WALLS & LOADING DOCKS**

Retaining walls that are essentially fixed at the top (unable to rotate about their bases) should be capable of resisting "active" lateral soil pressures equal to an equivalent fluid pressure of 55 psf per foot of retained soil. Rigid or restrained retaining walls that are not allowed to yield at the top should be capable of resisting "at-rest" lateral soil pressures equal to an equivalent fluid pressure of 70 psf per foot of retained soil. These soil pressures assume a horizontal grade behind the walls and that the walls will be fully drained so that hydrostatic pressures will not develop behind the wall.

Retaining wall foundations may be designed in accordance with the criteria contained in the FOUNDATION DESIGN section of this report for the Sprinkler Water Tank. Resistance to lateral foundation displacement for retaining wall systems may be computed using the values provided in the FOUNDATION DESIGN section of this report, only if the bottom of the foundation is at least five feet horizontally from the face of any fill slope.

Retaining walls should be fully drained to prevent the build-up of hydrostatic forces behind the wall. Drainage may be accomplished by the use of weep holes or perforated PVC pipe placed near the base of the wall and sloped to a discharge point at a gradient of at least one percent. The perforated pipe should be completely surrounded by a drainage blanket composed of State of California Class 2 permeable material (*Caltrans Standard Specifications*, Section 68-1.025). The drainage blanket should be at least one foot in width and should extend to within one foot of the top of the wall. The upper foot of wall backfill should be composed of compacted native soils. Alternatively, ¾- to ¾-inch open-graded crushed rock may be used in place of the Class 2 permeable drain rock, provided that the rock and the perforated pipe are completely enveloped in a nonwoven geotextile fabric that is approved by our office.
Structural backfill materials for retaining walls (other than the drainage layer) should be granular soils that are free of significant quantities of rubbish, rubble and organics; clay soils should not be used for wall backfill. Structural backfill should be placed in lifts not exceeding 12 inches in compacted thickness, and should be mechanically compacted to not less than 90 percent relative compaction, based on ASTM D1557.

For walls higher than 6 feet, seismic loads should be applied at 2/3 of the wall height.

**PAVEMENT DESIGN**

The near-surface soils primarily consisting of fat clays and weathered volcanic rock, it is our opinion that an R-value of 15 should be used for pavement design (See Figures A3 and A4).

The pavement sections have been calculated for a range of traffic indices using the design procedures contained in Chapters 600 to 670 of the 6th Edition of the *California Highway Design Manual*.

<table>
<thead>
<tr>
<th>Traffic Index (TI)</th>
<th>Pavement Subgrade R-value = 15</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Type B Asphalt Concrete</td>
</tr>
<tr>
<td></td>
<td>(inches)</td>
</tr>
<tr>
<td>4.0</td>
<td>2½</td>
</tr>
<tr>
<td>5.0</td>
<td>2½</td>
</tr>
<tr>
<td></td>
<td>3*</td>
</tr>
<tr>
<td>6.0</td>
<td>2½</td>
</tr>
<tr>
<td></td>
<td>3½*</td>
</tr>
</tbody>
</table>

* = Asphalt concrete thickness includes the Caltrans Safety Factor.

We emphasize that the performance of a pavement is critically dependent upon uniform compaction of the subgrade soils, as well as all engineered fill and utility trench backfill.
within the limits of the pavements. Materials used for pavement construction should conform to the appropriate sections of the most recent editions of the Sacramento County Standards and the Caltrans *Standard Specifications*.

*Portland Cement Concrete Pavements (Exterior Slabs-on-Grade Which are Subject for Vehicular Traffic)*

Traffic frequencies and loadings are not yet known. When more information is available we should review the preliminary section thicknesses to determine their applicability. For preliminary purposes, we recommend the following minimum Portland Cement concrete thicknesses for subgrades for a Traffic Index of 6.0.

<table>
<thead>
<tr>
<th>Traffic Index (TI)</th>
<th>Subgrade Condition</th>
<th>Class 2 Aggregate Base (inches)</th>
<th>Portland Cement Concrete (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.0</td>
<td>R-Value=15</td>
<td>6</td>
<td>6</td>
</tr>
</tbody>
</table>

We recommend PCC slabs be constructed with thickened edges. The thickened edge should be constructed and tapered over a minimum distance of 48 inches in accordance with American Concrete Institute (ACI) 330R design details. Reinforcing for crack control, if desired, should consist of at least No. 4 reinforcing bars placed on maximum 18-inch centers each way throughout the slab. Reinforcement must be located at mid-slab depth to be effective. Joint spacing and details should be determined by the project engineer and should conform with the current PCA or ACI guidelines. Portland cement concrete should achieve a minimum compressive strength of at least 3500 pounds per square inch at 28 days.

**SITE DRAINAGE**

Control of surface water on this site is essential to proper performance of the planned improvements. Final site grading should be accomplished to provide positive drainage of surface water away from building, pavements, and structures and prevent ponding of water adjacent to foundations, slabs or pavements. Proper control of surface water drainage is essential to the performance of foundations, slabs-on-grade, and pavements. The ground adjacent to the planned building and structures should be sloped away from the structures.
at a gradient no less than two percent for a distance of at least 10 feet. We recommend using full-roof gutters, with downspouts from roof drains connected to rigid non-perforated piping directed to an appropriate drainage point away from the structures, or discharging onto paved surfaces leading away from the structures and foundations. Concentrated storm water discharge collected from roof downspouts or surface drains should not be allowed to drain on unprotected slopes adjacent to structure. The ground should be graded to drain positively away from all flatwork and building structure. Ponding of surface water should be avoided near pavements, foundations, and flatwork. Landscape berms, if planned, should be constructed in such a manner as to promote drainage away from the buildings.

All excavations and fill slopes (if any) should be protected from concentrated storm water run-off to minimize potential erosion. Control of water over the slopes may be accomplished by constructing V-ditches near the top of slopes, or by grading the area behind the top of slope to drain away from the slope. Ponding of surface water or allowing sheet flow of water over any open excavation must be avoided.

Earthwork Testing and Observation

Site preparation should be accomplished in accordance with the recommendations of this report and the appended Guide Earthwork Specifications. Representatives of Mid Pacific Engineering, Inc. must be present during site preparation and all grading operations to observe and test the fills to verify compliance with our recommendations and the job specifications. In the event that MPE is not retained to provide geotechnical engineering observation and testing services during construction, the Geotechnical Engineer retained to provide this service should indicate in writing that they agree with the recommendations of this report, and prepare supplemental recommendations as necessary.

A final report by the "Geotechnical Engineer" should be prepared upon completion of the project indicating compliance with or deviations from this report and the project plans and specifications. Please be aware that the title Geotechnical Engineer is restricted in the State of California to a Civil Engineer authorized by the State of California to use the title "Geotechnical Engineer."
FUTURE SERVICES

We recommend that our firm be given the opportunity to review the final plans and specifications to verify that the intent of our recommendations has been implemented in those documents. Testing and approval of proposed import sources is an essential requirement to qualify the proposed soils for use as engineered fill for this project. This sampling and testing should be completed well in advance of the proposed start of construction.
LIMITATIONS

Our recommendations are based upon the information provided regarding the proposed construction, combined with our analysis of site conditions revealed by the field exploration and laboratory testing programs. We have used our best engineering judgment based upon the information provided and the data generated from our investigation. This report has been prepared in accordance with generally accepted standards of practice existing in northern California at the time of the report. No warranty, either express or implied, is provided.

If the proposed construction is modified or re-sited; or, if it is found during construction that subsurface conditions differ from those we encountered at the test boring locations, we should be afforded the opportunity to review the new information or changed conditions to determine if our conclusions and recommendations must be modified. Mid Pacific Engineering, Inc., should be retained to review the final plans and specifications to verify that the intent of our recommendations has been implemented in those documents.

We emphasize that this report is applicable only to the proposed construction and the investigated site and should not be utilized for construction on any other site. The conclusions and recommendations of this report are considered valid for a period of two years. If design is not completed and construction has not started within two years of the date of this report, the report must be reviewed and updated, as necessary.

Mid Pacific Engineering, Inc.

Vasiliy V. Parfenov
Senior Engineering Geologist
CEG No. 2355

Todd G. Kamisky
Principal Engineer
GE No. 2567
FIGURES
NOTES: Adapted from USGS National Topographic Map, Calistoga Quadrangle, California – Calistoga California, 7.5-minute series, 2018.

REGIONAL GEOLOGIC MAP
MOUNTAIN STATION #6
5198 Sharp Road
Calistoga, California

FIGURE 2
Date: 5/21
MPE No. 05021-01
EXPLANATION

- **D1**: Approximate Boring Location, MPE, 2020
- **Geologic Cross Section**

NOTES: Adapted from the Civil Site Plan, prepared by Kitchell.

SITE PLAN

MOUNTAIN STATION #6

5198 Sharp Road

Calistoga, California

FIGURE 2

Date: 5/20

MPE No. 05021-01
FIGURE 4

Mid Pacific Engineering, Inc.
**Project:** Mountain Station #6  
**Project Location:** 5198 Sharp Road, Calistoga, California

---

**LOG OF SOIL BORING D2**

**MPE Number:** 05021-01

**Logged By:** VVP  
**Checked By:** VVP

**Date(s) Drilled:** 4/7/2020  
**Drilling Method:** Solid Flight Helical Auger  
**Drilling Contractor:** Hillside Geotechnical Drilling  
**Total Depth of Drill Hole:** 19½ Feet

**Drill Rig Type:** Mobile B-24 Track  
**Diameter(s) of Hole, inches:** 4½ Inches  
**Approx. Surface Elevation, ft MSL:**

**Groundwater Depth (Elevation), feet:** 6½ feet  
**Sampling Method(s):** 140 Lb Hammer/30" Drop  
**Drill Hole Backfill:** Neat cement

---

**ELEVATION, feet**  
**DEPTH, feet**  
**GRAPHIC LOG**

**ENGINEERING CLASSIFICATION AND DESCRIPTION**

<table>
<thead>
<tr>
<th>SAMPLE</th>
<th>SAMPLE NUMBER</th>
<th>BLOWS PER FOOT</th>
<th>MOISTURE CONTENT, %</th>
<th>DRY UNIT WEIGHT, pcf</th>
<th>ADDITIONAL TESTS</th>
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<tbody>
<tr>
<td>D2-1</td>
<td>&gt;100</td>
<td>36.9</td>
<td>64</td>
<td>&lt;200 = 16.0%</td>
<td>PI=54% LL=93%</td>
</tr>
<tr>
<td>D2-2</td>
<td>&gt;100</td>
<td>73.4</td>
<td>54</td>
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<td></td>
</tr>
<tr>
<td>D2-3</td>
<td>&gt;100</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D2-4</td>
<td>&gt;100</td>
<td>67.0</td>
<td>52</td>
<td>&lt;200 = 23.0%</td>
<td></td>
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</table>

**Remarks:**

- 3 inches of Gray, poorly graded fine gravel (GP-FILL)
- Brown, completely weathered, tuff rock (RX)
- highly weathered
- Auger Refusal at 19½ feet
<table>
<thead>
<tr>
<th>Date(s) Drilled</th>
<th>Logged By</th>
<th>Drilling Method</th>
<th>Drilling Contractor</th>
<th>Total Depth of Drill Hole</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/7/2020</td>
<td>DR</td>
<td>AMS Hand Auger</td>
<td>N/A</td>
<td>2½ Feet</td>
<td></td>
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</tbody>
</table>

**Drilling Contractor:** N/A

**Total Depth of Drill Hole:** 2½ Feet

**Groundwater Depth:** Not Encountered

**Diameter(s) of Hole:** 3½ Inches

**Sampling Method(s):** N/A

**Drill Rig Type:** N/A

**Approx. Surface Elevation, ft MSL:**

**Surface Elevation, ft MSL:**

**Drill Hole Backfill:** Soil Cuttings

**Auger Refusal at 2½ feet**

**ENGINEERING CLASSIFICATION AND DESCRIPTION**

<table>
<thead>
<tr>
<th>ELEVATION, feet</th>
<th>GRAPHIC LOG</th>
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</thead>
<tbody>
<tr>
<td>0</td>
<td>2 inches of Gray, poorly graded fine gravel (GP-FILL)</td>
</tr>
<tr>
<td>5</td>
<td>Dark brown, most, fat clay (CH)</td>
</tr>
<tr>
<td>10</td>
<td>light brown</td>
</tr>
<tr>
<td>15</td>
<td>Auger Refusal at 2½ feet</td>
</tr>
<tr>
<td>20</td>
<td></td>
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<tr>
<td>25</td>
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</table>
**LOG OF SOIL BORING D4**

**Project Location:** 5198 Sharp Road, Calistoga, California

**MPE Number:** 05021-01

**Date Drilled:** 4/7/2020

**Logged By:** VVP

**Checked By:** VVP

**Drilling Method:** Solid Flight Helical Auger

**Drilling Contractor:** Hillside Geotechnical Drilling

**Total Depth of Drill Hole:** 9 Feet

**Drill Rig Type:** Mobile B-24 Track

**Diameter(s) of Hole, inches:** 4½

**Approx. Surface Elevation, ft MSL:**

**Groundwater Depth (Elevation), feet:** Not Encountered

**Sampling Method(s):** 140 Lb Hammer/30” Drop

**Remarks:**

**Remarks:**

**Log of Soil Boring D4**

**Project:** Mountain Station #6

**Elevation, feet:**

<table>
<thead>
<tr>
<th>Elevation, feet</th>
<th>Depth, feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>3 inches of Gray, poorly graded fine gravel (GP-FILL)</td>
</tr>
<tr>
<td>3</td>
<td>Brown, completely weathered tuff rock (RX)</td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td></td>
</tr>
</tbody>
</table>

**Engineering Classification and Description**

<table>
<thead>
<tr>
<th>Sample</th>
<th>Sample Number</th>
<th>Blows per Foot</th>
<th>Moisture Content, %</th>
<th>Dry Unit Weight, pcf</th>
<th>UCC tfs</th>
</tr>
</thead>
<tbody>
<tr>
<td>D4-1</td>
<td>60</td>
<td>34.1</td>
<td>82</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D4-2</td>
<td>&gt;100</td>
<td>35.6</td>
<td>73</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D4-3</td>
<td>&gt;100</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Additional Tests:** UCC 0.2 tfs

**Mid Pacific Engineering, Inc.**
Project: Mountain Station #6
Project Location: 5198 Sharp Road, Calistoga, California

LOG OF SOIL BORING D5

ELEVATION, feet  DEPTH, feet

GRAPHIC LOG

ENGINEERING CLASSIFICATION AND DESCRIPTION

SAMPLE DATA

TEST DATA

SAMPLE  NUMBER  BLOWS PER FOOT  MOISTURE CONTENT, %  DRY UNIT WEIGHT, pcf  ADDITIONAL TESTS  UCC  tsf

D5-1 27 40.6 43.1 72 70

D5-2 100 51.0 46

D5-3 100

D5-4 100

D5-5 100

Remarks

Dark brown, moist, very stiff, fat clay (CH)

Brown, completely weathered tuff rock (RX)

olive brown to yellow brown, highly weathered

gray
**LOG OF SOIL BORING D6**

**Project:** Mountain Station #6  
**Project Location:** 5198 Sharp Road, Calistoga, California

**MPE Number:** 05021-01

---

**Date(s) Drilled:** 4/7/2020  
**Logged By:** VVP  
**Checked By:** VVP

**Drilling Method:** Solid Flight Helical Auger  
**Drilling Contractor:** Hillside Geotechnical Drilling

**Total Depth of Drill Hole:** 19½ Feet

**Drill Rig Type:** Mobile B-24 Track

**Groundwater Depth (Elevation), feet:** Not Encountered  
**Sampling Method(s):** 140 Lb Hammer/30” Drop

**Remarks**

---

### GRAPHIC LOG

#### ENGINEERING CLASSIFICATION AND DESCRIPTION

<table>
<thead>
<tr>
<th>Sample</th>
<th>Elevation, feet</th>
<th>Depth, feet</th>
<th>Sample Data</th>
<th>Test Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>D6-1</td>
<td>19</td>
<td>67.0</td>
<td>19</td>
<td>67.0</td>
</tr>
<tr>
<td>D6-2</td>
<td>&gt;100</td>
<td>39.4</td>
<td>&gt;100</td>
<td>39.4</td>
</tr>
<tr>
<td>D6-3</td>
<td>&gt;100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D6-4</td>
<td>&gt;100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D6-5</td>
<td>&gt;100</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Sample:** D6-1
- **Elevation, feet:** 19
- **Depth, feet:** 67.0
- **Sample Data:** 19
- **Test Data:** 67.0, 55
- **Additional Tests:** UCC 0.9 tsf

---

**Remarks**

- Dark brown, moist, stiff, fat clay (CH)
- Brown, completely weathered tuff rock (RX)
- Highly weathered
- Gray
<table>
<thead>
<tr>
<th>MAJOR DIVISIONS</th>
<th>SYMBOL</th>
<th>CODE</th>
<th>TYPICAL NAMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>COARSE GRAINED SOILS (More than 50% of soil &gt; no. 200 sieve size)</td>
<td>GW</td>
<td>Well graded gravels or gravel - sand mixtures, little or no fines</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GP</td>
<td>Poorly graded gravels or gravel - sand mixtures, little or no fines</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GM</td>
<td>Silty gravels, gravel - sand - silt mixtures</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GC</td>
<td>Clayey gravels, gravel - sand - silt mixtures</td>
<td></td>
</tr>
<tr>
<td>SANDS (50% or more of coarse fraction &lt; no. 4 sieve size)</td>
<td>SW</td>
<td>Well graded sands or gravelly sands, little or no fines</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SP</td>
<td>Poorly graded sands or gravelly sands, little or no fines</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SM</td>
<td>Silty sands, sand - silt mixtures</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SC</td>
<td>Clayey sands, sand clay mixtures</td>
<td></td>
</tr>
<tr>
<td>FINE GRAINED SOILS (More than 50% of soil &lt; no. 200 sieve size)</td>
<td>ML</td>
<td>Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CL</td>
<td>Inorganic clays of low to medium plasticity, gravely clays, sandy clays, silty clays, lean clays</td>
<td></td>
</tr>
<tr>
<td></td>
<td>OL</td>
<td>Organic silts and organic silty clays of low plasticity</td>
<td></td>
</tr>
<tr>
<td>SILTS &amp; CLAYS LL&lt; 50</td>
<td>MH</td>
<td>Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CH</td>
<td>Inorganic clays of high plasticity, fat clays</td>
<td></td>
</tr>
<tr>
<td></td>
<td>OH</td>
<td>Organic clays of medium to high plasticity, organic silty clays, organic silts</td>
<td></td>
</tr>
<tr>
<td>HIGHLY ORGANIC SOILS</td>
<td>Pt</td>
<td>Peat and other highly organic soils</td>
<td></td>
</tr>
<tr>
<td>ROCK</td>
<td>RX</td>
<td>Rocks, weathered to fresh</td>
<td></td>
</tr>
<tr>
<td>FILL</td>
<td>FILL</td>
<td>Artificially placed fill material</td>
<td></td>
</tr>
</tbody>
</table>

OTHER SYMBOLS

- = Drive Sample: 2-1/2" O.D. Modified California sampler
- = Hand Driven Sample
- = SPT Sampler
- = Initial Water Level
- = Final Water Level
- = Estimated or gradational material change line
- = Observed material change line

Laboratory Tests
- PI = Plasticity Index
- EI = Expansive Index
- UCC = Unconfined Compression Test
- TR = Triaxial Compression Test
- GR = Gradation Analysis (Sieve)
- K = Permeability Test

GRAIN SIZE CLASSIFICATION

<table>
<thead>
<tr>
<th>CLASSIFICATION</th>
<th>RANGE OF GRAIN SIZES</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOULDERS</td>
<td>Above 12&quot;</td>
</tr>
<tr>
<td>COBBLES</td>
<td>12&quot; to 3&quot;</td>
</tr>
<tr>
<td>GRAVEL coarse (c)</td>
<td>3&quot; to No. 4</td>
</tr>
<tr>
<td>fine (f)</td>
<td>3&quot; to 3/4&quot;</td>
</tr>
<tr>
<td>3/4&quot; to No. 4</td>
<td>4.76 to 0.74</td>
</tr>
<tr>
<td>SAND coarse (c)</td>
<td>No. 4 to No. 200</td>
</tr>
<tr>
<td>Medium (m) fine (f)</td>
<td>No. 4 to No. 10</td>
</tr>
<tr>
<td>No. 10 to No. 40</td>
<td>2.00 to 0.420</td>
</tr>
<tr>
<td>No. 200</td>
<td>0.420 to 0.074</td>
</tr>
<tr>
<td>SILT &amp; CLAY</td>
<td>Below No. 200</td>
</tr>
</tbody>
</table>

FIGURE 10
Date: 05/20
MPE No. 05021-01

UNIFIED SOIL CLASSIFICATION SYSTEM
Mountin Station # 6
5198 Sharpe Road
Calistoga, California

Mid Pacific Engineering, Inc.
FIGURE 11
Date: 5/20
MPE No. 05021-01

GEOLOGIC CROSS SECTION A¹ – A⁴
MOUNTAIN STATION Nº 6
5198 Sharp Road
Calistoga, California

T.D. = 19 feet

Scale: Hor. 1" = 20 Feet
Ver. 1" = 4 Feet
NOTES: Adapted from Federal Emergency Management Agency (FEMA), Flood Insurance Rate Map (FIRM), Map Number 06097C0625E, Effective Date December 2, 2008.
APPENDICES
A. GENERAL INFORMATION

The performance of a Geologic Hazards and Geotechnical Engineering Investigation Report for the proposed Mountain Station #6 renovation project located at 5198 Sharpe Road in Calistoga, California, was authorized by Jeff Peterson with Kitchell on March 19, 2020. Authorization was for an investigation as described in our proposal letter of March 13, 2020, sent to our client, Kitchell, whose mailing address is 2450 Venture Oaks Way, Suite 500, Sacramento, California 95833; telephone (916) 648-9700; e-mail jpeterson@kitchell.com.

B. FIELD EXPLORATION

On April 7, 2019, five soil borings were drilled at the approximate locations indicated on Figure 3, utilizing a B-24 Mobile, track-mounted drill rig equipped with 4½-inch diameter, solid flight augers. The borings were drilled to maximum depths of approximately 9 to 19½ feet below existing site grades. In the area not accessible to the drill rig, one boring was excavated utilizing 3-inch diameter hand auger to a depth of approximately 2½ feet below existing site grades.

At various intervals, relatively undisturbed soil/rock samples were recovered with a 2½-inch O.D., 2-inch I.D. Modified California sampler (ASTM D3550), driven by a 140-pound hammer freely falling 30 inches. The number of blows of the hammer required to drive the 18-inch long sampler each 6-inch interval was recorded with the sum of the blows required to drive the sampler the lower 12-inch interval, or portion thereof, being designated the penetration resistance or "blow count" for that particular drive.

The samples obtained were retained in 2-inch diameter by 6-inch long, thin-walled brass tubes contained within the sampler. Immediately after recovery, the field engineer visually classified the soil/rock in the tubes. The ends of the tubes were sealed to preserve the natural moisture contents. Disturbed bulk samples of the surface materials also were obtained at various locations and depths. Soil/rock samples were taken to our laboratory for additional classification (ASTM D2488) and selection of samples for testing.

The Logs of Soil Borings, Figures 4 through 9, contain descriptions of the soils encountered in each boring. A Boring Legend explaining the Unified Soil Classification System and the symbols used on the logs is contained on Figure 10.
C. LABORATORY TESTING

Selected undisturbed samples of the soils were tested to determine dry unit weight (ASTM D2937) and natural moisture content (ASTM D2216), percent passing the 200 sieve (ASTM D1140), Atterberg limits (ASTM D4318) tests, and unconfined compression strength (ASTM D2166). The results of these tests are included on the boring logs at the depth each sample was obtained.

Two bulk samples of the near-surface soils were subjected to an Expansion Index testing (ASTM D4829). The results of these tests are presented on Figures A1 and A2.

Two bulk samples of the anticipated pavement subgrade soils was subjected to Resistance ("R-") value testing. The results of the tests were used in the pavement design and presented on Figures A3 and A4.

Three samples of near-surface soils were submitted to Sunland Analytical in Rancho Cordova, California, for corrosivity testing in accordance with No. 643 (Modified Small Cell), CT 532, CT 422, and CT 417. The analytical results are presented in the text of the report.
## EXPANSION INDEX TEST RESULTS

(ASTM D4829-03)
(UBC 18-2)

Material Description: Brown, Completely Weathered Rock (RX)
Location: D2 (½ to 3 feet)

<table>
<thead>
<tr>
<th>Sample Number</th>
<th>Pre-Test Moisture (%)</th>
<th>Post-Test Moisture (%)</th>
<th>Dry Density (pcf)</th>
<th>Expansion Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>D2</td>
<td>36.8</td>
<td>66.0</td>
<td>60</td>
<td>58</td>
</tr>
</tbody>
</table>

### CLASSIFICATION OF EXPANSIVE SOIL

<table>
<thead>
<tr>
<th>EXPANSION INDEX</th>
<th>POTENTIAL EXPANSION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 20</td>
<td>Very Low</td>
</tr>
<tr>
<td>21 - 50</td>
<td>Low</td>
</tr>
<tr>
<td>51 - 90</td>
<td>Medium</td>
</tr>
<tr>
<td>91 - 130</td>
<td>High</td>
</tr>
<tr>
<td>Above 130</td>
<td>Very High</td>
</tr>
</tbody>
</table>
## EXPANSION INDEX TEST RESULTS

(ASTM D4829-03)
(UBC 18-2)

Material Description: Dark Brown, Sandy Silt (ML)
Location: D5 (0 to 2 feet)

<table>
<thead>
<tr>
<th>Sample Number</th>
<th>Pre-Test Moisture (%)</th>
<th>Post-Test Moisture (%)</th>
<th>Dry Density (pcf)</th>
<th>Expansion Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>D5</td>
<td>19.9</td>
<td>45.3</td>
<td>77</td>
<td>90</td>
</tr>
</tbody>
</table>

### CLASSIFICATION OF EXPANSIVE SOIL

<table>
<thead>
<tr>
<th>EXPANSION INDEX</th>
<th>POTENTIAL EXPANSION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 20</td>
<td>Very Low</td>
</tr>
<tr>
<td>21 - 50</td>
<td>Low</td>
</tr>
<tr>
<td>51 - 90</td>
<td>Medium</td>
</tr>
<tr>
<td>91 - 130</td>
<td>High</td>
</tr>
<tr>
<td>Above 130</td>
<td>Very High</td>
</tr>
</tbody>
</table>
RESISTANCE VALUE TEST RESULTS  
(California Test 301)

Material Description: Brown, Completely Weathered Rock (RX)  
Location: D2 (½ – 3 Feet)

<table>
<thead>
<tr>
<th>Specimen No.</th>
<th>Dry Unit Weight (pcf)</th>
<th>Moisture at Compaction (%)</th>
<th>Exudation Pressure (psi)</th>
<th>Expansion Pressure (psi)</th>
<th>R-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>70.7</td>
<td>51.7</td>
<td>788</td>
<td>238</td>
<td>80</td>
</tr>
<tr>
<td>2</td>
<td>76.7</td>
<td>40.3</td>
<td>619</td>
<td>65</td>
<td>55</td>
</tr>
<tr>
<td>3</td>
<td>70.7</td>
<td>47.4</td>
<td>386</td>
<td>30</td>
<td>27</td>
</tr>
<tr>
<td>4</td>
<td>68.9</td>
<td>50.6</td>
<td>272</td>
<td>0</td>
<td>21</td>
</tr>
</tbody>
</table>

Resistance-value @ 300 psi = 22
# RESISTANCE VALUE TEST RESULTS
(California Test 301)

Material Description: Dark brown, Sandy Silt (ML)
Location: D5 (0 – 2 Feet)

<table>
<thead>
<tr>
<th>Specimen No.</th>
<th>Dry Unit Weight (pcf)</th>
<th>Moisture at Compaction (%)</th>
<th>Exudation Pressure (psi)</th>
<th>Expansion Pressure (psi)</th>
<th>R-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>85.9</td>
<td>30.9</td>
<td>768</td>
<td>143</td>
<td>45</td>
</tr>
<tr>
<td>2</td>
<td>84.2</td>
<td>33.5</td>
<td>665</td>
<td>0</td>
<td>26</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>34.0</td>
<td>384</td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>4</td>
<td>81.7</td>
<td>36.8</td>
<td>278</td>
<td>9</td>
<td>19</td>
</tr>
</tbody>
</table>

Resistance-value @ 300 psi = 20
APPENDIX B
APPENDIX B

GUIDE EARTHWORK SPECIFICATIONS

MOUNTAIN STATION #6
5198 Sharpe Road
Calistoga, California
MPE No. 05021-01

PART 1: GENERAL

1.1 SCOPE

A. General Description

This item shall include clearing of all surface and subsurface structures including undocumented fills, stockpiles, underground piping, septic systems, pavements, concrete slabs, foundations, fences, surface debris including all asphalt concrete rubble, concrete rubble, trees, shrubbery and associated items; preparation of surfaces to be filled, filling, spreading, compaction, observation and testing of the fill; and, all subsidiary work necessary to complete the grading of the building area to conform with the lines, grades and slopes as shown on the accepted Drawings.

B. Related Work Specified Elsewhere

1. Trenching and backfilling for sanitary sewer system: Section ______.

2. Trenching and backfilling for storm drain system: Section ______.

3. Trenching and backfilling for underground water, natural gas, and electric supplies: Section ______.

C. Geotechnical Engineer

Where specific reference is made to "Geotechnical Engineer" this designation shall be understood to include either him or his representative.
1.2 PROTECTION
A. Adequate protection measures shall be provided to protect workers and passers-by at the site. Streets and adjacent property shall be fully protected throughout the operations.
B. In accordance with generally accepted construction practices, the Contractor shall be solely and completely responsible for working conditions at the job site, including safety of all persons and property during performance of the work. This requirement shall apply continuously and shall not be limited to normal working hours.
C. Any construction review of the Contractor's performance conducted by the Geotechnical Engineer is not intended to include review of the adequacy of the Contractor's safety measures, in, on or near the construction site.
D. Adjacent streets and sidewalks shall be kept free of mud, dirt or similar nuisances resulting from earthwork operations.
E. Surface drainage provisions shall be made during the period of construction in a manner to avoid creating a nuisance to adjacent areas.
F. The site and adjacent influenced areas shall be watered as required to suppress dust nuisance.

1.3 GEOTECHNICAL REPORT
A. A Geotechnical Engineering Report (MPE No. 05021-01; dated May 22, 2020) has been prepared for this site by Mid Pacific Engineering, Inc., Geotechnical Engineers. A copy is available for review at the office of Mid Pacific Engineering, Inc., 840 Embarcadero Drive, Suite 20, Sacramento, California 95605.
B. The information contained in the report was obtained for design purposes only. The Contractor is responsible for any conclusions he/she may draw from this report; should the Contractor prefer not to assume such risk, he/she should employ their own experts to analyze available information and/or to
make additional borings upon which to base their conclusions, all at no cost to the Owner.

1.4 EXISTING SITE CONDITIONS
The Contractor shall be acquainted with all site conditions. If un-shown active utilities are encountered during the work, the Architect shall be promptly notified for instructions. Failure to notify will make the Contractor liable for damage to these utilities arising from Contractor's operations subsequent to the discovery of such un-shown utilities.

1.5 SEASONAL LIMITS
Fill material shall not be placed, spread or rolled during unfavorable weather conditions. When the work is interrupted by heavy rains, fill operations shall not be resumed until field tests indicate that the moisture contents of the subgrade and fill materials are satisfactory.

PART 2: PRODUCTS

2.1 MATERIALS
A. All fill shall be of approved local materials from required excavations, supplemented by imported fill, if necessary. Approved local materials are defined as local soils/rock free from significant quantities of rubble, rubbish and vegetation, and having been tested and approved by the Geotechnical Engineer prior to use. The upper eighteen inches (18”) of all building pad or exterior flatwork subgrades shall consist of imported non-expansive, granular soils, or aggregate base. Expansive clays/weathered rock shall not be used as fill within the upper eighteen inches (18”) of the structure pads or exterior flatwork subgrades.

B. Imported fill materials shall be approved by the Geotechnical Engineer; they shall meet the above requirements. If select non-expansive soils are to be used for fill they shall have plasticity indices not exceeding fifteen (15), when tested in accordance with ASTM D4318; shall have a maximum expansion
index not exceeding twenty (20) when tested in accordance with ASTM D4829; and, shall be of three-inch (3") maximum particle size and similar corrosion characteristics previously tested for the site. Import fill shall be clean of contamination with appropriate documentation. All imported materials shall be approved by the Geotechnical Engineer prior to being transported to the site.

C. Asphalt concrete, aggregate base, aggregate sub-base, and other paving products shall comply with the appropriate provisions of the State of California (Caltrans) Standard Specifications, latest editions.

PART 3: EXECUTION

3.1 LAYOUT AND PREPARATION

Lay out all work, establish grades, locate existing underground utilities, set markers and stakes, set up and maintain barricades and protection of utilities—all prior to beginning actual earthwork operations.

3.2 CLEARING, GRUBBING AND PREPARING BUILDING PADS AND PAVEMENT AREAS

A. The site shall be cleared of existing structures including but not limited to underground utilities, brush, rubbish, rubble, and other deleterious materials. Deeper scarification and/or cross-ripping, to depths of twelve inches (12"), shall be performed as directed by the Geotechnical Engineer, based on the exposed conditions. Exposed remnants, rubble and debris shall be removed from the subgrades. Hand picking of exposed roots, rubble and debris shall be performed by the Contractor to adequately clear the grades and soils to be used as fill. Subsurface utilities to be relocated or abandoned shall be removed from within and to at least five feet beyond the perimeter of the proposed structural areas; remaining piping beyond the structure that is not removed shall be plugged. Excavations and depressions resulting from the removal of such items, as well as any existing excavations or loose soil deposits, as determined by the Geotechnical Engineer, shall be cleaned out to
firm, undisturbed soil and backfilled with suitable materials placed and compacted as engineered fills in accordance with these specifications.

B. In the areas of the proposed slabs, pavements, or areas to receive fill, the exposed subgrade shall be scarified and/or cross-ripping, to depths of twelve inches (12"), moisture-conditioned and compacted as required.

C. Where practical, subgrade preparation and compaction shall extend at least five feet (5') beyond the proposed structure lines, or as required by the Geotechnical Engineer based on the exposed soil and site conditions.

D. When the moisture content of the subgrade is below that required to achieve the specified density, and that minimum content recommended in the geotechnical report, water shall be added until the proper moisture content is achieved.

E. When the moisture content of the subgrade is too high to permit the specified compaction to be achieved, the subgrade shall be aerated by blading or other methods until the moisture content is satisfactory for compaction.

F. After the foundations for fill have been cleared, plowed or scarified, they shall be disked or bladed until uniform and free from large clods, brought to the proper moisture content and compacted to not less than ninety percent (90%) of the maximum dry density as determined by the ASTM D1557 Compaction Test. Soil compaction shall be performed using a heavy, self-propelled sheepfoot compactor.

G. Compaction operations shall be performed in the presence of the Geotechnical Engineer who will evaluate the performance of the materials under compactive load. Unstable soil deposits, as determined by the Geotechnical Engineer, shall be excavated to expose a firm base and grades restored with engineered fill in accordance with these specifications.
3.3 PLACING, SPREADING AND COMPACTING FILL MATERIAL

A. Engineered fills shall be placed in layers which when compacted shall not exceed six inches (6") in thickness. Each layer shall be spread evenly and shall be thoroughly mixed during the spreading to promote uniformity of material in each layer.

B. When the moisture content of the fill material is below that required to achieve the specified density, and that minimum content recommended in the geotechnical report, water shall be added until the proper moisture content is achieved.

C. When the moisture content of the fill material is too high to permit the specified degree of compaction to be achieved, the fill material shall be aerated by blading or other methods until the moisture content is satisfactory.

D. After each layer has been placed, mixed and spread evenly, engineered fill consisting of granular soils should be thoroughly moisture conditioned to at least the optimum moisture content and uniformly compacted to at least ninety percent (90%) of maximum dry density as determined by ASTM D1557. Native on-site clayey soils should be compacted at a moisture content of at least two percent (2%) above the optimum moisture content. Soils compaction shall be performed using a heavy, self-propelled sheepsfoot compactor, to the satisfaction of our on-site representative. Each layer shall be compacted over its entire area until the desired density has been obtained.

E. The filling operations shall be continued until the fills have been brought to the finished slopes and grades as shown on the accepted Drawings.

F. Engineered fill placed on slopes steeper than three horizontal (3H) to one vertical (1V) shall be properly benched into the existing slopes.
3.4 FINAL SUBGRADE PREPARATION

A. The upper eighteen inches (18") of structure pads and exterior flatwork subgrade shall consist of granular soils. Final structure pads and flatwork subgrades slabs shall be brought to a uniform moisture content of at least the optimum, and shall be uniformly compacted to at least ninety percent (90%) relative compaction for granular soils or at least two percent (2%) above the optimum moisture.

B. The upper twelve inches (12") of final subgrades supporting pavement sections shall be brought to a uniform moisture content of at least two percent (2%) above the optimum moisture and shall be uniformly compacted to at least ninety-five percent (95%) relative compaction, regardless of whether final subgrade elevations are attained by filling, excavation, or are left at existing grades. Pavement subgrades shall be proof-rolled in the presence of the Geotechnical Engineer prior to placement of aggregate base and shall be stable under construction equipment traffic.

3.5 TRENCH BACKFILL

Utility trench backfill shall be placed in lifts of no more than six inches (6") in compacted thickness. Utility trenches within the structure perimeter should be backfilled with compactable material matching the upper 12 inches of building subgrade material. Each lift shall be compacted to at least ninety percent (90%) compaction, as defined by ASTM D1557, except that the upper twelve inches of backfill within pavement areas shall be compacted in accordance with Section 3.5B.

3.6 TESTING AND OBSERVATION

A. Grading operations shall be observed by the Geotechnical Engineer, serving as the representative of the Owner.

B. Field density tests shall be made by the Geotechnical Engineer after compaction of each layer of fill. Additional layers of fill shall not be spread
until the field density tests indicate that the minimum specified density has been obtained.

C. Earthwork shall not be performed without the notification or approval of the Geotechnical Engineer. The Contractor shall notify the Geotechnical Engineer at least two (2) working days prior to commencement of any aspect of the site earthwork.

D. If the Contractor should fail to meet the technical or design requirements embodied in this document and on the applicable plans, the Contractor shall make the necessary readjustments until all work is deemed satisfactory, as determined by the Geotechnical Engineer and the Project Design Engineer. No deviation from the specifications shall be made except upon written approval of the Geotechnical Engineer or Project Design Engineer.
DETERMINISTIC ESTIMATION OF PEAK ACCELERATION FROM DIGITIZED FAULTS

JOB NUMBER: 05021-01
DATE: 04-22-2020

JOB NAME: Mountain Station #5

CALCULATION NAME: NEHRP C

FAULT-DATA-FILE NAME: C:\Program Files\EQFAULT1\CGSFLTE.DAT

SITE COORDINATES:
SITE LATITUDE: 38.5583
SITE LONGITUDE: 122.6236

SEARCH RADIUS: 62 mi

ATTENUATION RELATION: 2) Boore et al. (1997) Horiz. - NEHRP C (520)
UNCERTAINTY (M=Median, S=Sigma): M Number of Sigmas: 0.0
DISTANCE MEASURE: cd_2drp
SCOND: 1
Basement Depth: .50 km Campbell SSR: Campbell SHR:
COMPUTE PEAK HORIZONTAL ACCELERATION

FAULT-DATA FILE USED: C:\Program Files\EQFAULT1\CGSFLTE.DAT

MINIMUM DEPTH VALUE (km): 0.0
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42 faults found within the specified search radius.
The Maacama - Gerberville fault is closest to the site. It is about 3.9 miles (6.3 km) away. Largest maximum-earthquake site acceleration: 0.4437 g
ESTIMATION OF PEAK ACCELERATION FROM CALIFORNIA EARTHQUAKE CATALOGS

JOB NUMBER: 05021-01
DATE: 04-22-2020

JOB NAME: Mountain Station #5

EARTHQUAKE-CATALOG-FILE NAME: ALLQUAKE.DAT

MAGNITUDE RANGE:
MINIMUM MAGNITUDE: 5.00
MAXIMUM MAGNITUDE: 9.00

SITE COORDINATES:
SITE LATITUDE: 38.5583
SITE LONGITUDE: 122.6236

SEARCH DATES:
START DATE:   1800
END DATE:   2018

SEARCH RADIUS:
62.0 mi
99.8 km

ATTENUATION RELATION:  2) Boore et al. (1997) Horiz. - NEHRP C (520)

UNCERTAINTY (M=Median, S=Sigma): M Number of Sigmas: 0.0
ASSUMED SOURCE TYPE: SS [SS=Strike-slip, DS=Reverse-slip, BT=Blind-thrust]
SCOND: 1 Depth Source: A
Basement Depth: .50 km Campbell SSR: Campbell SHR:

COMPUTE PEAK HORIZONTAL ACCELERATION

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40 EARTHQUAKES FOUND WITHIN THE SPECIFIED SEARCH AREA.
TIME PERIOD OF SEARCH: 1800 TO 2018

LENGTH OF SEARCH TIME: 219 years

THE EARTHQUAKE CLOSEST TO THE SITE IS ABOUT 7.1 MILES (11.4 km) AWAY.

LARGEST EARTHQUAKE MAGNITUDE FOUND IN THE SEARCH RADIUS: 8.3

LARGEST EARTHQUAKE SITE ACCELERATION FROM THIS SEARCH: 0.119 g

COEFFICIENTS FOR GUTENBERG & RICHTER RECURRENCE RELATION:
    a-value= 0.861
    b-value= 0.365
    beta-value= 0.840

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TABLE OF MAGNITUDES AND EXCEEDANCES:
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REFERENCES

1. American Concrete Institute (ACI), 318-19, Building Code Requirements for Structural Concrete, 2014.
13. County of Sonoma, 2020, Sonoma County General Plan 2020, Public Safety Element.
14. FEMA, December 2, 2008, Flood Insurance Rate Map (FIRM), Panel 06097C, Map Number 06097C0625E, Sonom County and Incorporated Areas, California.
REFERENCES (cont’d)


DATE: October 21, 2020
PROJECT: Sonoma County Fire District, Mountain Statin #6
MEETING: Pre-Bid Conference and Job Walk
TIME: 10:00 AM
PLACE: Mountain Station 6

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<td></td>
<td>Kitchell</td>
<td>916-698-8122</td>
<td><a href="mailto:j-frahm@kitchell.com">j-frahm@kitchell.com</a></td>
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<tr>
<td>Richard Engelee</td>
<td></td>
<td>Engelee Const.</td>
<td>707-933-8289</td>
<td><a href="mailto:r@engeleeconst.com">r@engeleeconst.com</a></td>
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<td>Leo von Reusfeld</td>
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<td>Questfield Const.</td>
<td>707-762-2721</td>
<td><a href="mailto:leo@questfieldconst.com">leo@questfieldconst.com</a></td>
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<tr>
<td>Mike Graham Jr.</td>
<td></td>
<td>CWS Construction</td>
<td>415-599-6545</td>
<td><a href="mailto:charlie.jr.cws@gmail.com">charlie.jr.cws@gmail.com</a></td>
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<tr>
<td>Karyn Valdez</td>
<td></td>
<td>GCCI, Inc.</td>
<td>707-545-2134</td>
<td><a href="mailto:austin@gcciiinc.com">austin@gcciiinc.com</a></td>
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