July 26, 2016

Ridge Development Company
2211 Michaelson Drive, Suite 650
Irvine, California 92612

Attention: Ms. Kathleen Bonesz
Senior Vice President
Predevelopment Services & Construction Management

Project No.: **16G180-1**

Subject: **Geotechnical Hazards Review**
Proposed Vista Ridge Logistics Park
Cajon Boulevard at Institution Road
San Bernardino, California

Ms. Bonesz:

In accordance with your request, this report presents the geotechnical hazards review for the proposed development. In order to prepare this report, we have conducted geotechnical and geologic research of available sources. This report does not include any field or laboratory testing. A comprehensive geotechnical study will be required prior to developing this site.

Site Location and Proposed Development

The subject site is located on the southwest side of Cajon Boulevard at the intersection of Cajon Boulevard and Institution Road in San Bernardino, California. The site is bounded to the northeast by Cajon Boulevard, to the southeast by a vacant lot, to the southwest by UPSP Railroad easement, and a vacant lot to the northwest. The general location of the site is illustrated on the Site Location Map, enclosed as Plate 1 in Appendix A of this report.

The site consists of two parcels which total 38.4± acres in size. The northwestern parcel is an irregular shaped parcel, 18.16± acres in size. The southeast parcel is also an irregular shaped parcel, 20.24± acres in size. Based on aerial photographs obtained from Google Earth, the two parcels are vacant and undeveloped. The ground surface appears to consist of exposed soil with moderate to heavy native grass and weed growth. The northwestern parcel and the southeastern parcel are separated by the Palm Avenue overpass. The southern fork of the Palm Avenue connects Cajon Boulevard to Palm Avenue and the northern fork of the overpass crosses over Cajon Boulevard and the railroad easement.

Based on the conceptual site plan prepared by Herdman Rierson Architecture, the site will be developed with two commercial/industrial buildings. Building B-1 will be located in the northwestern parcel and will be 325,920± ft² in size and Building B-2 will be located in the southeastern parcel and will be 385,831± ft² in size. Building B-1 will be constructed with loading docks along the southeast side of the building and Building B-2 will be constructed in a cross-dock configuration with loading docks along the southeast and northwest sides of the

building. It is expected that the buildings will be surrounded by asphaltic concrete pavements in the drive lanes and parking stalls and Portland cement concrete in the loading dock areas.

Detailed structural information is not currently available. It is assumed that the new buildings will be of concrete tilt-up construction, typically supported on conventional shallow foundation systems, with slab-on-grade floors. Based on the assumed construction, maximum column and wall loads are expected to be on the order of 80 kips and 3 to 5 kips per linear foot, respectively.

Regional Geology

The subject site is located within the Peninsular Ranges province. The Peninsular Ranges province consists of several northwesterly-trending ranges in the southwestern California. The province is truncated to the north by the east-west trending Transverse Ranges. Prior to the mid-Mesozoic, the region was covered by seas and thick marine sedimentary and volcanic sequences were deposited. The bedrock geology that dominates the elevated areas of the Peninsular Ranges consists of high-grade metamorphic rocks intruded by Mesozoic plutons. During the Cretaceous, extensive mountain building occurred during the emplacement of the southern California batholith. The Peninsular Ranges have been significantly disrupted by Tertiary and Quaternary strike-slip faulting along the Elsinore and San Jacinto faults. This tectonic activity has resulted in the present terrain.

Geologic Conditions

The geologic conditions of the subject site were determined by research of the Geologic Map of for the San Bernardino North 7.5′ Quadrangle, San Bernardino County, California, published by the California Geological Survey (CGS) formerly known as the California Division of Mines and Geology. A portion of this map is presented as Plate 2 of this report. As shown on Plate 2, the subject site is primarily underlain by very young wash deposits on the southeastern parcel and portions of the northwestern parcel and young alluvial-valley deposits on the majority of the northwestern parcel and portions of the southeastern parcel. The very young wash deposits are described as unconsolidated to locally cemented sand, gravel, and boulder deposits in active washes of streams and on active surfaces of alluvial fans. This unit typically shows fresh flood scours and channel-and-bar morphology with small areas of older surficial deposits. The young alluvial-valley deposits are described as slightly dissected, slightly consolidated to cemented deposits of angular to sub-angular silt, sand, and pebbles.

Fault Rupture Hazard

Research of the Alquist-Priolo Earthquake Fault Zone Map for the San Bernardino North Quadrangle, published by the CGS indicates that the San Jacinto Fault Zone (SJFZ) study area is located 3,400± feet southwest of the subject site and the San Andreas Fault Zone (SAFZ) is located 8,400± feet northeast of the subject site. A portion of the map depicting this condition is presented as Plate 3 of this report. In addition, the Geologic Hazards Overlays, San Bernardino North 7.5′ Quadrangle, FH 22C, published by San Bernardino County, depicts the SJFZ and the SAFZ in the same locations as the Alquist Priolo Earthquake Fault Zone Map. A portion of this map is presented as Plate 4 of this report.

The nearest fault zone indicated on the referenced geologic map is the SJFZ located 2,400± feet southwest of the subject site. The SJFZ is a right-lateral strike-slip fault with minor right-reverse. The SJFZ has a total length of 210 km with a slip rate ranging between 7 and 17 mm/yr. The interval between surface ruptures ranges between 100 and 300 years with a probable magnitude of M_w 6.5 to 7.5 (SCEC). The SAFZ is also depicted on the geologic map and the SAFZ is located 8,000± feet northeast of the subject site. The SAFZ is a right-lateral strike-slip fault that is approximately 1,200 km in length with a slip rate ranging between 20 to 35 mm/yr. The interval between surface ruptures average approximately 140 years with a probable magnitude of M_w 6.8 to 8.0.

It should be noted that the subject site is located in an area which is subject to strong ground motions due to earthquakes. As indicated that there are several faults capable of producing significant ground motions that are located near the subject site. Due to economic considerations, it is not generally considered reasonable to design a structure that is not susceptible to earthquake damage. Therefore, significant damage to structures may be unavoidable during large earthquakes. The proposed structures should, however, be designed to resist structural collapse and thereby provide reasonable protection from serious injury, catastrophic property damage and loss of life.

Research of the Alquist-Priolo Earthquake Fault Zone Map, the Geologic Hazards Overlays, and the referenced geologic map, the subject site is not located within a fault zone. Therefore, the possibility of significant fault rupture on the site is considered to be low.

Liquefaction

Liquefaction is the loss of strength in generally cohesionless, saturated soils when the pore-water pressure induced in the soil by a seismic event becomes equal to or exceeds the overburden pressure. The primary factors which influence the potential for liquefaction include groundwater table elevation, soil type and grain size characteristics, relative density of the soil, initial confining pressure, and intensity and duration of ground shaking. The depth within which the occurrence of liquefaction may impact surface improvements is generally identified as the upper 50 feet below the existing ground surface. Liquefaction potential is greater in saturated, loose, poorly graded fine sands with a mean (d_{50}) grain size in the range of 0.075 to 0.2 mm (Seed and Idriss, 1971). Clayey (cohesive) soils or soils which possess clay particles ($d<0.005$mm) in excess of 20 percent (Seed and Idriss, 1982) are generally not considered to be susceptible to liquefaction, nor are those soils which are above the historic static groundwater table.

The site is located within a designated medium susceptibility liquefaction hazard zone, as mapped by the county of San Bernardino. A copy of the Geologic Hazards Overlays, San Bernardino North 7.5' Quadrangle, FH 22C, depicting this condition, in enclosed as Plate 4 of this report. As shown on Plate 4, the majority of the northwestern parcel is located within a designated liquefaction hazard zone. As such, detailed liquefaction evaluations would be required as part of the design level geotechnical investigation. If liquefiable soils are identified on the subject site, geotechnical or structural mitigation would be required. These mitigation methods could range from additional rigidity within the foundations and floor slabs to full scale ground improvements such as compaction grouting.

Based on our experience with projects in this area, the groundwater is typically greater than 50± feet. As part of our research, we reviewed available groundwater data in order to determine the historic high groundwater level for the site. The primary reference used to determine the historic groundwater depths in this area was the California Department of Water Resources website, http://www.water.ca.gov/waterdatalibrary/. The nearest monitoring well is located approximately 1.7± miles northwest of the site. Water level readings within this monitoring well indicate historically high groundwater levels of 115± feet (November 2011) below the ground surface. Therefore, liquefaction may not be a design consideration for this project.

Other Secondary Seismic Hazards

Secondary seismic hazards include lateral spreading, seismic settlement of dry soils and landsliding. Based on the proximity of the SJFZ and the SAFZ, the presence of potentially liquefiable soils, and moderate sloping topography, there is a potential for lateral spreading and seismic settlements of dry sands. All of these conditions should be evaluated during the geotechnical investigation.

Seismic Design Parameters

The 2013 CBC was adopted by all municipalities within Southern California on January 1, 2014. The CBC provides procedures for earthquake resistant structural design that include considerations for on-site soil conditions, occupancy, and the configuration of the structure including the structural system and height. The seismic design parameters presented below are based on the soil profile and the proximity of known faults with respect to the subject site.

The 2013 CBC Seismic Design Parameters have been generated using U.S. Seismic Design Maps, a web-based software application developed by the United States Geological Survey. This software application, available at the USGS web site calculates seismic design parameters in accordance with the 2013 CBC, utilizing a database of deterministic site accelerations at 0.01 degree intervals. The table below is a compilation of the data provided by the USGS application.

2013 CBC SEISMIC DESIGN PARAMETERS

Parameter		Value
Mapped Spectral Acceleration at 0.2 sec Period	S_S	2.406
Mapped Spectral Acceleration at 1.0 sec Period	S_1	1.118
Site Class	---	D
Site Modified Spectral Acceleration at 0.2 sec Period	S_{MS}	2.406
Site Modified Spectral Acceleration at 1.0 sec Period	S_{M1}	1.677
Design Spectral Acceleration at 0.2 sec Period	S_{DS}	1.604
Design Spectral Acceleration at 1.0 sec Period	S_{D1}	1.118

The values presented in the table above are significantly elevated above typical sites in Southern California. As a result, it is expected that the structural design will need to incorporate

additional rigidity and/or reinforcement within the foundations and above ground portions of any structures proposed for the subject site.

Geotechnical Design Considerations

Site specific geotechnical design considerations will depend upon the results of the design-level geotechnical investigation. However, based on the location of the subject site, the presence of near surface soils with a moderate potential for collapse or consolidation will likely be the most significant design consideration for this project. Typically, remedial grading, extending to depths of 3 to 5± feet is required in order to mitigate the collapse/consolidation potential of near surface alluvium. These depths can be refined as part of the design-level geotechnical investigation. Other geotechnical issues that may impact the subject site could include previous placement of undocumented fill soils, soils which are subject to erosion, and potential excavation difficulties if cemented soils are encountered.

Closure

We sincerely appreciate the opportunity to be of service on this project. We look forward to providing additional consulting services during the course of the project. If we may be of further assistance in any manner, please contact our office.

Respectfully Submitted,

SOUTHERN CALIFORNIA GEOTECHNICAL, INC.

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Project Geologist

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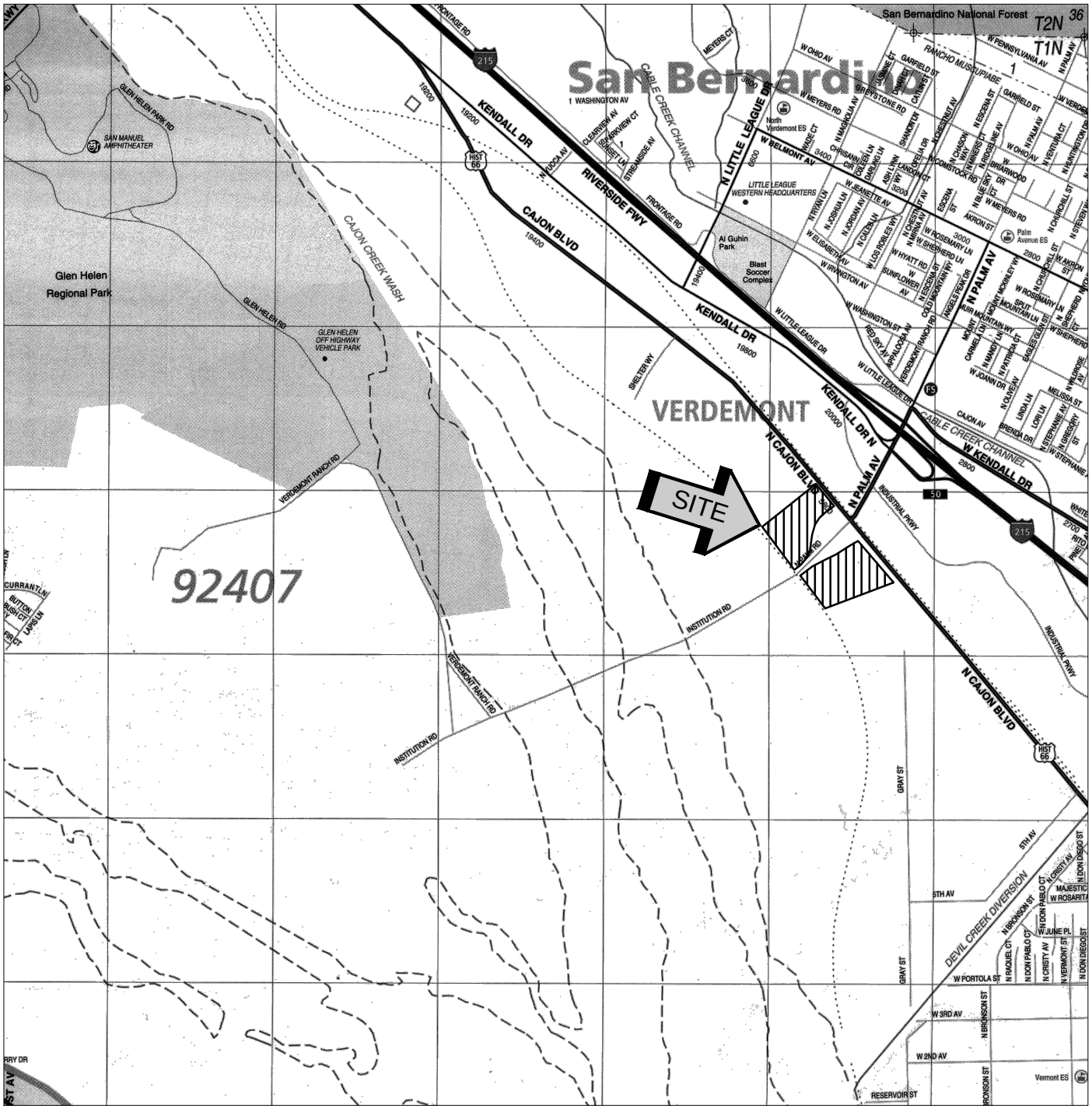
Enclosure: Plate 1: Site Location Map
Plate 2: Site Geologic Map
Plate 3: Alquist-Priolo Earthquake Fault Zone Map
Plate 4: Seismic Hazards Map
Plate 5: Seismic Design Parameters



SOURCE: SAN BERNARDINO COUNTY
THOMAS GUIDE, 2013

SITE LOCATION MAP
VISTA RIDGE LOGISTICS PARK
SAN BERNARDINO, CALIFORNIA
SCALE: 1" = 2400'
DRAWN: DRK CHKD: JAS
SCG PROJECT 16G180-1
PLATE 1

SOUTHERN CALIFORNIA GEOTECHNICAL

DESCRIPTION OF MAP UNITS

VERY YOUNG SURFICIAL DEPOSITS—Sediment recently transported and deposited in channels and washes, on surfaces of alluvial fans and alluvial plains, and on hillslopes. Soil-profile development is non-existant to minimal. Includes:

- Qw — **Very young wash deposits (late Holocene)**—Unconsolidated to locally cemented sand, gravel, and boulder deposits in active washes of streams and on active surfaces of alluvial fans. Typically shows fresh flood scours and channel-and-bar morphology. Locally includes small areas of older surficial deposits. Most deposits are centimeters to a few meters thick. Includes:
- Qw_2 — **Very young wash deposits, Unit 2 (late Holocene)**—Chiefly sand and gravel. Distinguished as lower level terraces in Qw terrace sequence; pebble to boulder clasts are sparse to abundant
- Qw_1 — **Very young wash deposits, Unit 1 (late Holocene)**—Chiefly sand and gravel. Distinguished as upper level terraces in Qw terrace sequence; pebble to boulder clasts are sparse to abundant
- Qf — **Very young alluvial-fan deposits (late Holocene)**—Unconsolidated to locally cemented, undissected deposits of gravel and sand that for active parts of alluvial fans. Essentially no pedogenic soil development
- Qf_1 — **Very young alluvial-fan deposits, Unit 1 (late Holocene)**—Undissected, unconsolidated to loosely compacted deposits of gravel and sand. Distinguished as high-level terrace in Qf terrace sequence
- Qc — **Very young colluvial deposits (late Holocene)**—Unconsolidated to slightly consolidated sandy and pebbly deposits of hillslopes and base of slopes. No pedogenic soil development
- Qt — **Very young talus deposits (late Holocene)**—Unconsolidated deposits of angular and sub-angular pebble-, cobble-, and boulder-sized clasts that form scree and rubble on hillslopes and at bases of slopes
- Qls — **Very young landslide deposits (late Holocene)**—Slope-failure deposits that consist of displaced bedrock blocks and (or) chaotically mixed rubble. Most deposits are probably active or recently active
- Qs — **Very young surficial deposits, undifferentiated (late Holocene)**—Sand and pebble to small cobble gravel deposits not assigned to any specific surficial materials unit. Unconsolidated to slightly consolidated. Includes wash, alluvial fan, colluvial, and valley-filling deposits

YOUNGER SURFICIAL DEPOSITS—Sedimentary units that are slightly consolidated to cemented and slightly to moderately dissected. Alluvial fan deposits (Qyf series) typically have high Coarse:fine clast ratios. Younger surficial units have upper surfaces that are capped by slight to moderately developed pedogenic-soil profiles (A/C to $A/AC/B_{cambric}C_{ox}$ profiles). Includes:

- Qyf — **Young alluvial-fan deposits (Holocene and late Pleistocene)**—Slightly consolidated to cemented, undissected to slightly dissected deposits of unsorted boulders, cobbles, gravel, and sand that form inactive parts of alluvial fans. Many have unsorted clast and matrix supported debris-flow fabrics. Subunits of Qyf generally form a nested series of thin fills that include from younger to older:
- Qyf_5 — **Young alluvial-fan deposits, Unit 5 (late Holocene)**—Sand and pebble-boulder gravel. Unconsolidated to slightly consolidated; sand is fine to coarse grained. Occupies topographically highest position relative to other Qyf units
- Qyf_4 — **Young alluvial-fan deposits, Unit 4 (late Holocene)**—Sand and pebble-boulder gravel. Unconsolidated to slightly consolidated; sand is fine to coarse grained. Differs from Qyf_5 and from Qyf_3 by relative position in terrace sequence, consolidation, and surface dissection
- Qyf_3 — **Young alluvial-fan deposits, Unit 3 (late and middle Holocene)**—Sand and pebble-boulder gravel. Unconsolidated to slightly consolidated, sand is fine to coarse grained. Differs from Qyf_4 and from Qyf_2 by relative position in terrace sequence, consolidation, and surface dissection
- Qyf_2 — **Young alluvial-fan deposits, Unit 2 (early Holocene)**—Sand, silty sand, and granule-pebble gravel. Slightly to moderately consolidated; sand is fine to coarse grained. Differs from Qyf_3 by relative position in terrace sequence, consolidation, surface dissection, and average grainsize and from Qyf_1 by relative topographic position and slight differences in average grain size
- Qyf_1 — **Young alluvial-fan deposits, Unit 1 (early Holocene and late Pleistocene)**—Sand and pebble-boulder gravel. Slightly to moderately consolidated; sand is fine to coarse grained. Differs from Qyf_2 by relative position in terrace sequence, consolidation, surface dissection, and slight difference in average grainsize

Young alluvial-valley deposits (Holocene and late Pleistocene)—Slightly to moderately dissected, consolidated to cemented deposits of angular to subangular silt, sand and pebbles. Generally finer grained than Qyf units Includes:

- Qya_5 — **Young alluvial-valley deposits, Unit 5 (Holocene and late Pleistocene)**—Slightly dissected, slightly consolidated to cemented deposits of angular to subangular silt, sand and pebbles. Differs from Qya_4 by relative position in terrace sequence, consolidation, and surface dissection
- Qya_4 — **Young alluvial-valley deposits, Unit 4 (Holocene and late Pleistocene)**—Slightly to moderately dissected, consolidated to cemented deposits of angular to subangular silt, sand and pebbles. Differs from Qya_5 and Qya_3 by relative position in terrace sequence, consolidation, and surface dissection
- Qya_3 — **Young alluvial-valley deposits, Unit 3 (Holocene and late Pleistocene)**—Slightly to moderately dissected, moderately well consolidated to cemented deposits of angular to subangular silt, sand and pebbles. Differs from Qya_4 by relative position in terrace sequence, consolidation, and surface dissection
- Qyls — **Young landslide deposits (Holocene and late Pleistocene)**—Landslide-failure deposits that consist of displaced bedrock blocks and (or) chaotically mixed rubble. Deposits are probably inactive under current climatic conditions and moderate to strong ground-shaking conditions
- Tgr — **Hypabyssal granitic dikes (Miocene)**—Hornblende-biotite granodiorite in Shandin Hill area and leucocratic biotite-quartz-plagioclase porphyry in Perris Hill area. Granodiorite is medium and fine grained, porphyry is fine grained. Presumed to be early Miocene to late Oligocene because of similarity to dated rocks intruding Pelona Schist in other areas
- Mzps — **Pelona Schist (Mesozoic)**—Muscovite-chlorite-albite-quartz schist; contains numerous, but volumetrically minor, layers of fine-grained quartzite and greenstone. Typically fine-grained, green, gray, and brown. Layering ranges from fine laminations to massive zones several meters thick. Layering is probably all transposed bedding, but locally some could be primary bedding; no primary sedimentary structures identified. Unit is highly susceptible to landsliding. Age is very poorly constrained; based primarily upon plutonic intrusions into Pelona (Mukasa and others, 1984; Silver and Nourse, 1986) which have ambiguous contact relations

Contact—Solid where located within ±15 meters; dashed where located within ±30 meters

Contact—Separates terraced alluvial units, hachers point towards topographically lower surface. Located within ±15 meters

70 **Fault**—High angle. Solid where located within ±15 meters; dashed where located within ±30 meters; dotted where concealed. Hachures indicate scarp; hachures on down-dropped block. Opposed arrows indicate relative movement. Arrow and number indicate direction and amount of dip. MLS, Mill Creek strand; MCS, Mission Creek strand; SBS, San Bernardino strand of San Andreas Fault zone

Strike and dip of beds

70 **Inclined**

70 **Overturned**

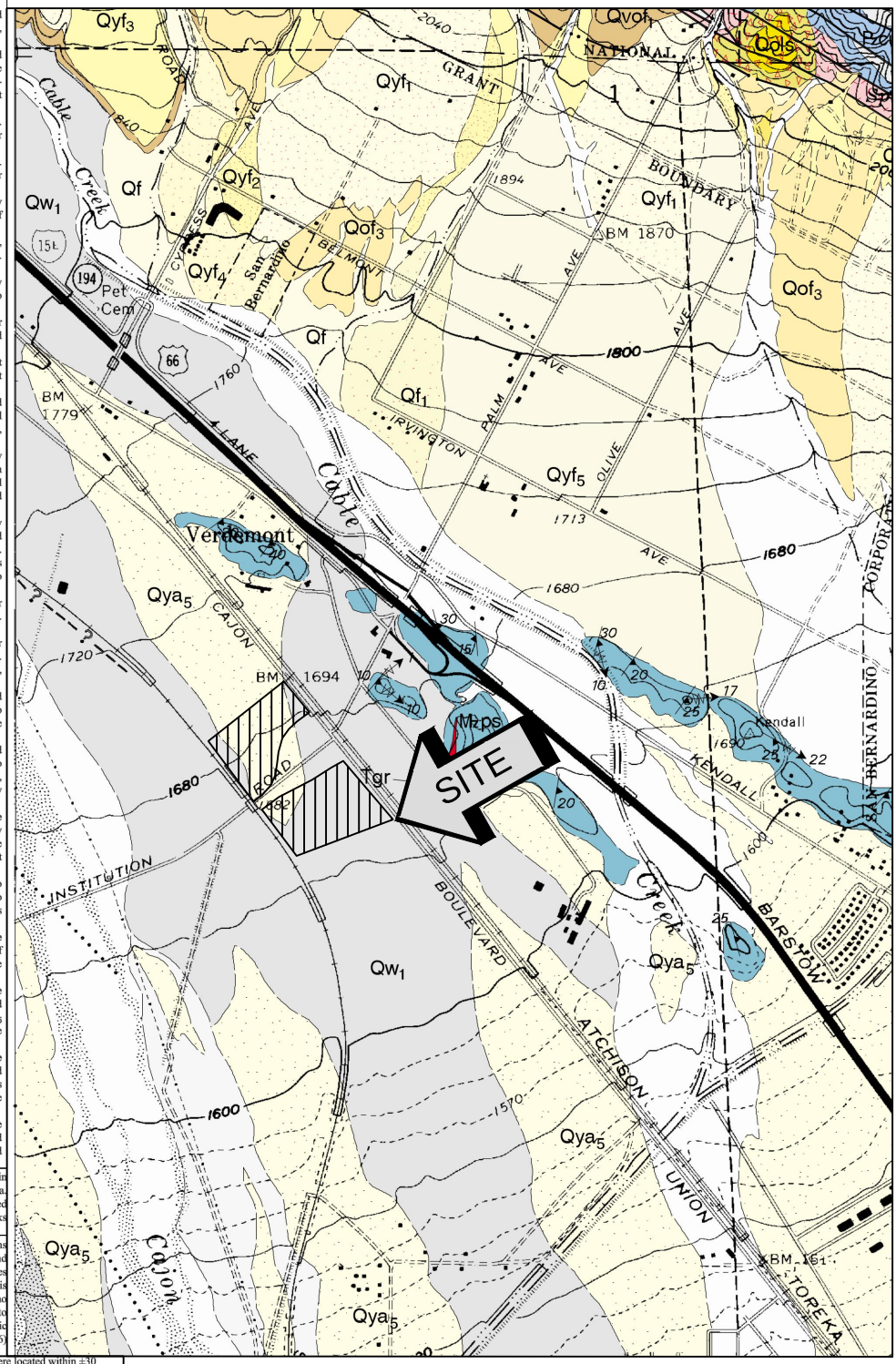
Strike and dip of metamorphic foliation

70 **Inclined**

Bearing and plunge of linear features

70 **Minor fold axes**

70 **Aligned metamorphic minerals**



SOURCE: "GEOLOGIC MAP OF THE SAN BERNARDINO NORTH 7.5' QUADRANGLE, SAN BERNARDINO COUNTY, CALIFORNIA" MILLER, MATTI, AND CARSON, 2001

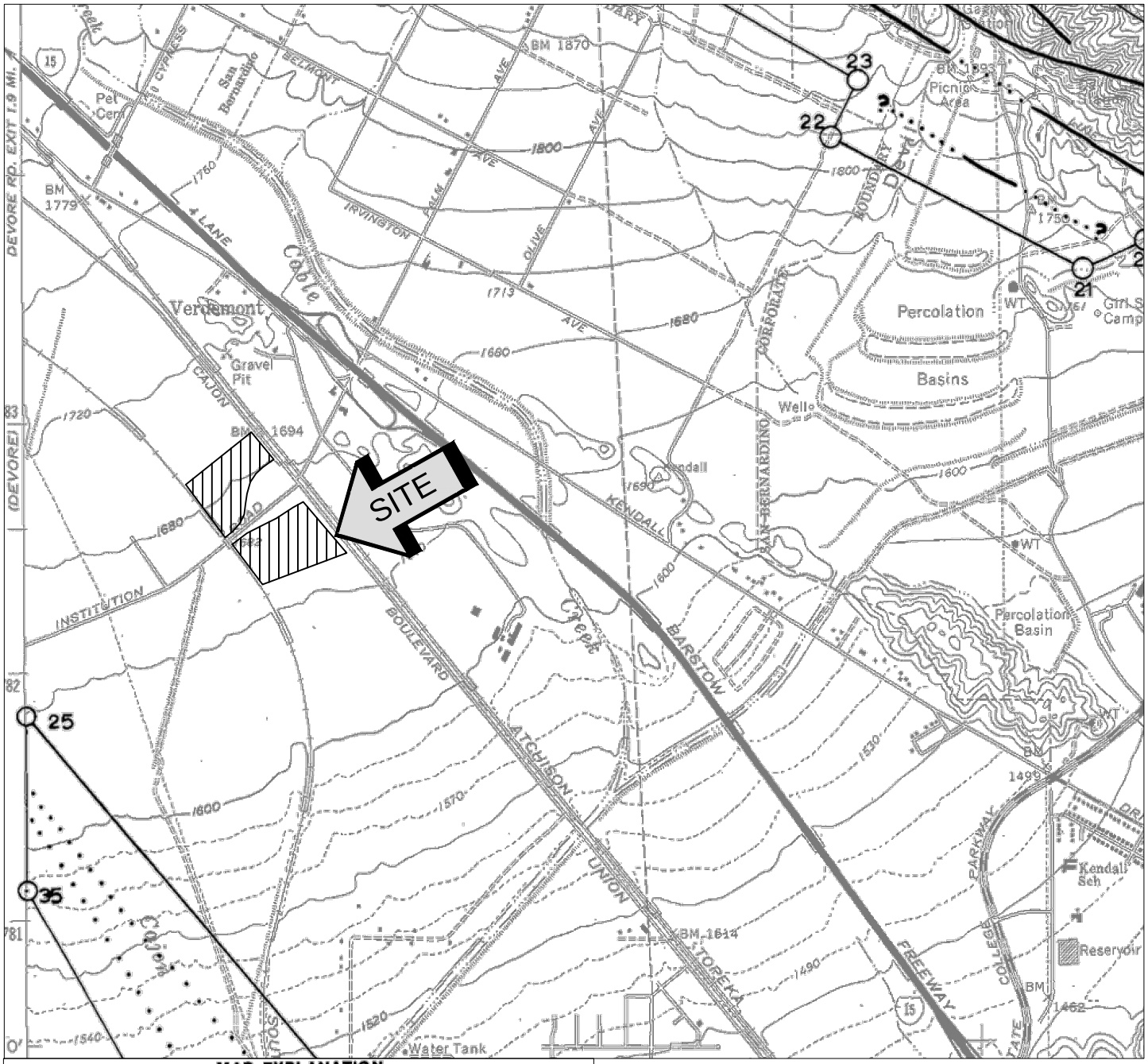
GEOLOGIC MAP

VISTA RIDGE LOGISTICS PARK

SAN BERNARDINO, CALIFORNIA

SCALE: 1" = 2000'	
DRAWN: DRK CHKD: JAS	
SCG PROJECT 16G180-1	
PLATE 2	

SOUTHERN CALIFORNIA GEOTECHNICAL



MAP EXPLANATION

Potentially Active Faults

Faults considered to have been active during Quaternary time, solid line where accurately located, long dash where approximately located, short dash where inferred, dotted where concealed, query (?) indicates additional uncertainty Evidence of historic offset indicated by year of earthquake-associated event or C for displacement caused by creep or possible creep

Aerial photo lineaments (not field checked), based on youthful geomorphic and other features believed to be the results of Quaternary faulting

Special Studies Zone Boundaries

These are delineated as straight-line segments that connect consecutively numbered turning points so as to define one or more special studies zone segments

Seaward projection of zone boundary

SOURCE: STATE OF CALIFORNIA SPECIAL STUDIES ZONES, SAN BERNARDINO NORTH QUADRANGLE, 1974

ALQUIST-PRIOLO ZONE MAP

VISTA RIDGE LOGISTICS PARK

SAN BERNARDINO, CALIFORNIA

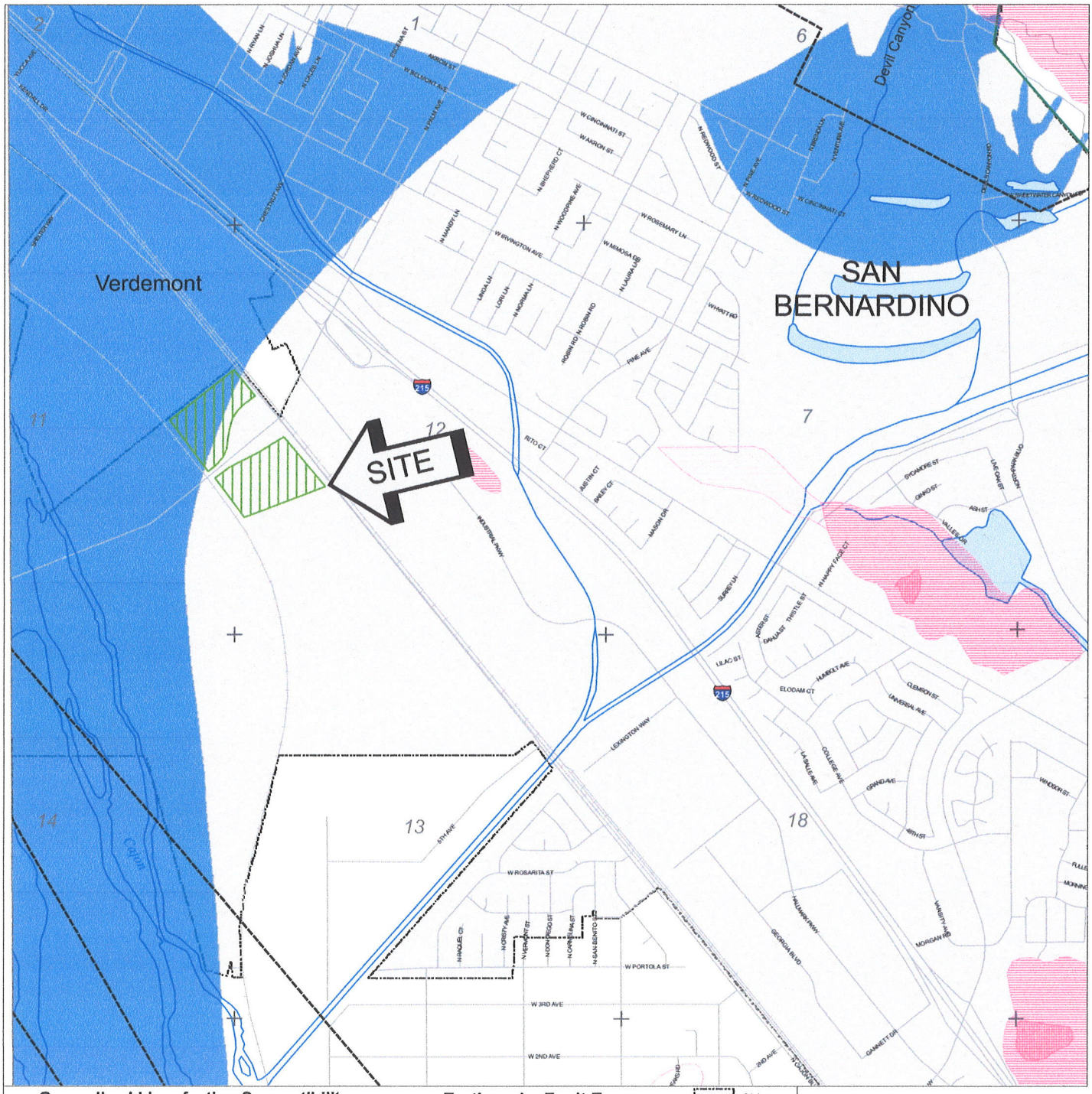
SCALE: 1" = 2000'

DRAWN: DRK
CHKD: JAS

SCG PROJECT
16G180-1

PLATE 3

SOUTHERN CALIFORNIA GEOTECHNICAL



Generalized Liquefaction Susceptibility

- Low
- Medium
- High

Earthquake Fault Zones

- Earthquake Fault Zone Boundary
- County Designated Fault Zones

Cities

SOURCE: "GEOLOGIC HAZARDS OVERLAYS, SAN BERNARDINO NORTH 7.5' QUADRANGLE, SAN BERNARDINO COUNTY, CALIFORNIA, FH 22C"

GEOLOGIC HAZARDS MAP
VISTA RIDGE LOGISTICS PARK
SAN BERNARDINO, CALIFORNIA
SCALE: 1" = 2000'
DRAWN: DRK CHKD: JAS
SCG PROJECT 16G180-1
PLATE 4

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL

USGS Design Maps Summary Report

User–Specified Input

Report Title Vista Ridge Logistics Park
Tue July 26, 2016 18:08:11 UTC

Building Code Reference Document ASCE 7-10 Standard
(which utilizes USGS hazard data available in 2008)

Site Coordinates 34.1861°N, 117.36653°W

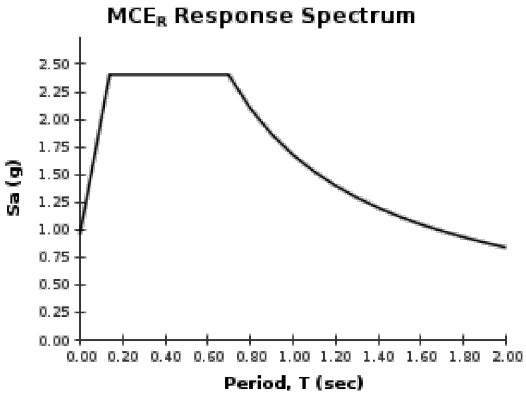
Site Soil Classification Site Class D – "Stiff Soil"

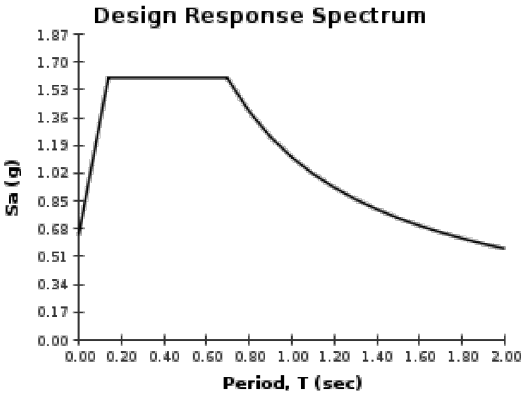
Risk Category I/II/III

USGS–Provided Output

S_S =	2.406 g	S_{MS} =	2.406 g	S_{DS} =	1.604 g
S_1 =	1.118 g	S_{M1} =	1.677 g	S_{D1} =	1.118 g

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.





SOURCE: U.S. GEOLOGICAL SURVEY (USGS)
<http://geohazards.usgs.gov/designmaps/us/application.php>

SEISMIC DESIGN PARAMETERS
VISTA RIDGE LOGISTICS PARK
SAN BERNARDINO, CALIFORNIA

DRAWN: DRK
CHKD: JAS

SCG PROJECT
16G180-1

PLATE 5

SOUTHERN CALIFORNIA GEOTECHNICAL