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Item 20

November 15, 2023
P-9279, L-33224

David Aranda
Kensington Police Protection & Community Services District
217 Arlington Avenue
Kensington, CA 94707

RE: Initial Geotechnical/Geological Studies
Police Department Building Site
Kensington, California

Dear Mr. Aranda:

At your request, we have performed initial geotechnical/geologic studies for a possible new Kensington Police Protection & Community Services District (KPPCSD) facility. No conceptual plans for the site have been developed, but the facility will likely include a main building (with perhaps 3,000 square feet of floor space over one or two stories), parking for 15 vehicles, and an access driveway from Arlington Avenue. Given the sloping terrain on the site, some grading will be necessary.

GENERAL SITE DESCRIPTION

The property under consideration for this project is a large, vacant parcel along the east side of Arlington Avenue, immediately south of the Kensington Library. The property slopes downhill to the west, toward Arlington Avenue. This location is illustrated on Figure 1, Site Plan. It should be noted the boundaries shown on this figure are approximate, and based on general parcel outlines we obtained; the actual site boundaries should be established by a professional land surveyor.

PURPOSE AND SCOPE OF WORK

The purpose of our services in this initial study was to assess the viability of the site for the proposed development from a geotechnical/geologic hazards standpoint.

Our scope of work would included:

- Reviewing key relevant published geologic maps and reports.
- Reviewing available consultant reports for the immediate area.
- Performing a reconnaissance of the site and vicinity to observe current site conditions and possible evidence of obvious geologic concerns.

- Compiling and reviewing the collected data.
- Preparation of an initial geotechnical/geologic study report presenting our analyses and including our conclusions regarding the viability of the site for the proposed development from a geotechnical/geologic hazards standpoint.

PUBLISHED DATA

1. **Topography and Geology**

The topographic map for this area (the Richmond Quadrangle) prepared by the United States Geological Survey (USGS) indicates the site is located in an area of moderately sloping terrain near the crest of the northern Berkeley Hills. The northern corner of the site is the highest point on the parcel and has an elevation of approximately 660 feet (mean sea level datum), while the southern corner is the lowest point and has an elevation of about 600 feet.

The site is located in the northern portion of the Coast Ranges geomorphic province of California. The oldest widespread rocks in the region are highly deformed sedimentary and volcanic rocks of the Mesozoic Age (the period from 225 million to 65 million years before present) Franciscan Assemblage. These rocks are in fault contact with similar-age sedimentary rocks of the Mesozoic Age Great Valley Sequence, and sometimes are overlain by Mesozoic age volcanic rocks which belong to the Coast Range Ophiolite. The Mesozoic rocks are, in turn, overlain by a diverse sequence of Tertiary Age (the period from 65 million to 1.8 million years before present) sedimentary and volcanic rocks. Since their formation, the Mesozoic and Tertiary rocks have been extensively deformed by repeated episodes of folding and faulting (Dibblee, 2005; Graymer and others, 1996; and Radbruch and Case, 1967).

A geologic map of the area (Graymer, 2000) indicates that the site is locally within a complex geologic environment of many of the bedrock units described above. A copy of the portion of the Graymer map that includes the site is presented as Figure 2, Geologic Map. This figure illustrates that the Graymer maps the site as underlain by serpentinite (sp), a unit within the Franciscan Assemblage. Nearby, volcanic keratophyre bedrock (Jsv, belonging to the Coast Range Ophiolite), as well as sedimentary bedrock of the Knoxville Formation (KJk, part of the Great Valley Sequence) and mélange units associated with the Franciscan Assemblage are all present.

2. **Landslides**

As a result of the shearing from episodes of folding and faulting, a number of landslides are present in the Kensington area. One landslide map series often cited for Bay Area sites are the preliminary photo-interpretive landslide maps by Tor Nilsen of the USGS; in the subject area the relevant map is for the Richmond Quadrangle (Nilsen, 1975). A copy of the portion of the Nilsen map of the study area is presented as Figure 3, Landslide Map 1. This map indicates the site is within a graded area in the upper reaches of a queried massive landslide complex that underlies most of Kensington and a large part of El Cerrito. Although we have seen that many other Bay Area landslide maps by Nilsen illustrating smaller landslide deposits are fairly reliable, we believe that the photographic interpretation technique without field verification is not reliable for these massive landslide areas (and that perhaps why Nilsen has designated them as “queried” or uncertain). In contrast, the landslide mapping by the California Division of Mines and Geology (now the California Geological Survey) in their 1973 study of El Cerrito, Richmond, and San Pablo (which also included Kensington) is more reliable regarding the locations of landslides in the

Kensington area. A copy of the portion of the CDMG map of this area from their 1973 publication is presented as Figure 4, Landslide Map 2. This map indicates the large Blakemont landslide is immediately adjacent to the northwest corner of the site (but does not encroach into it), and a very small landslide deposit is present about 1,000 feet east of the site.

3. Faulting and Seismic Shaking

Seismic activity within the northern Coast Ranges is generally associated with active faults belonging to the San Andreas system of faults, including major active structures both east and west of the site. The principal active faults in the region are the Hayward-Rodgers Creek fault, mapped approximately 300 feet southwest of the site; the San Andreas fault, 18.5 miles to the west; and the Calaveras fault, 13 miles to the southeast. Other major active faults in the region include the San Gregorio fault, approximately 21.5 miles to the west; the Greenville fault, 18.5 miles east; the Concord-Green Valley fault, 14 miles northeast; and the West Napa fault, 18.5 miles northeast (Jennings and Bryant, 2010). Table 1 summarizes the fault parameters of selected known active faults closest to the site and Figure 5, Regional Active Fault Map provides locations of the key faults:

Table 1. Fault Parameters

Fault	Distance and Direction from Site[1]	Maximum Moment Magnitude
Hayward-Rodgers Creek	300 feet southwest	7.6
Calaveras (north of Calaveras Reservoir)	13 miles southeast	6.8
Concord-Green Valley	14 miles northeast	6.9
San Andreas (1906 rupture)	18.5 miles west	7.9
San Gregorio	21.5 miles west	7.3
Greenville	18.5 miles east	6.9
West Napa	18.5 miles northeast	6.5

1 Measured from Lienkaemper (1992), Wagner et al. (1990) and Jennings and Bryant (2010).

The nearest active trace of the Hayward-Rodgers Creek fault is mapped approximately 300 feet southwest of the site (California Geological Survey, 1982; and Lienkaemper, 1992). The site is located within the Alquist-Priolo Earthquake Fault Zone (APEFZ) established by the State of California around the Hayward-Rodgers Creek fault. The mapped fault location and the limits of the APEFZ in the area are presented on Figure 6, Alquist-Priolo Earthquake Fault Zone Map.

The term "active fault," as used herein, refers to a fault that has experienced movement during Holocene time (about the last 11,000 years). The Hayward-Rodgers Creek fault is a northwest-trending zone about 70 miles long, which extends from southeastern San Jose, through multiple east bay communities, into San Pablo Bay. Beneath San Pablo Bay, the fault steps right (east), continuing north to Napa. To the south, near San Jose, the Hayward-Rodgers Creek fault merges with the Calaveras fault (Jennings and Bryant, 2010).

The Hayward-Rodgers Creek fault last ruptured along the southern segment near Castro Valley in a major earthquake in 1868, and with an average recurrence interval of 161 (± 65) years, it is considered to present a high rupture hazard in the near future (Lienkaemper and others, 2012).

During historical times, well-documented surface creep has occurred along the Hayward-Rodgers Creek fault at average rates ranging from about 0.2 to 0.4 inches per year (Lienkaemper and others, 1991). More recently, there has been recognition of variability in creep rates, both spatially along the fault trace and temporally. Lienkaemper and others (2012) describe several discrete fault segments that have experienced increased or decreased creep rates since the 1989 Loma Prieta earthquake, including one apparent locked segment that may indicate it to be the next segment to rupture.

Studies by the United States Geological Survey's Working Group on California Earthquake Probabilities (Aagaard and others, 2016) have estimated a 72-percent probability that at least one magnitude-6.7-or-greater earthquake will occur in the San Francisco Bay Region before the year 2043. They estimated that the highest probability for a magnitude-6.7-or-greater earthquake would be on the Hayward-Rodgers Creek fault, at 33 percent. The nearest active trace of the Hayward-Rodgers Creek fault is approximately 1,000 feet to the southwest. Additionally, there is a 22-percent probability for a magnitude-6.7-or-greater earthquake to occur on the Northern San Andreas fault, located approximately 18.5 miles to the west, and 16-percent probability for a magnitude-6.7-or-greater earthquake to occur on the Concord fault, located approximately 14 miles to the northeast, during that same period.

LOCAL CONSULTANT STUDIES

Two studies were performed by Durham, Durham, & Mannion (DDM) for an addition to the Youth Hut in Kensington Park in the 1980's. It should be noted that the Youth Hut is now the Kensington Community Center building located about 300 feet north of the parcel under consideration in this report. The DDM reports were:

- "Geologic Investigation of the Vicinity of the Kensington Youth Hut", dated August 14, 1986 (?).
- "Fault Assessment of the Kensington Youth Hut Area, Kensington, Contra Costa County, California", dated April 6, 1988.

The 1986 report was focused on geologic contacts between various geologic units that extended through the Youth Hut area being caused by faulting, as well as through the entire park area, including the parcel under consideration in this report. Based on their mapping, and limited test pits in the Youth Hut area, they concluded the contacts may have been old faults, but the contacts did not show any evidence of being recent or active.

The subsequent 1988 report was much more detailed and included hand augering eight borings in the general Youth Hut area. Based on their work, they developed a geologic map of the entire Kensington Park site. DDM concluded the area was underlain by a complex bedrock setting including Franciscan Assemblage units, as well as younger sedimentary units and rhyolite (keratophyre). They mapped the property now proposed for the new Police Department development as underlain by serpentinite, greenstone, and silica-carbonate rocks belonging to the Franciscan Assemblage. DDM concluded no active faults passed though the subject site, and the nearest active fault traces were related to the Hayward fault which passed 300 to 400 feet to the southwest. It should be noted that this report was subsequently reviewed and approved by the Contra Costa County geologist for compliance with the Alquist-Priolo Act active fault criteria.

SITE RECONNAISSANCE

We recently visited the site and observed the surficial characteristics of the property. The site is irregular in shape and the terrain on the property is quite variable. There has clearly been past grading over much of the site, probably related to Kensington Park and past site uses. Level areas for recreational courts, lawns, playgrounds, and picnic areas are present along the northeastern boundary of the site. A broad, undeveloped, graded level bench area is present on the site just downhill of the level picnic and pavement area. We noted a pipe present near the center of the site which discharges water from the upper-level areas; this leads to a surface flow channel which crosses the site to carry surface water westerly down to an inlet by the Arlington Avenue sidewalk. A broad area of high moisture (with green vegetation amidst the brown dry native grasses) is present immediately south of the flow channel. A second area of high moisture was observed in the eastern corner of the site.

Cut slopes are present along the southwestern boundary of the subject site just uphill of the Arlington Avenue sidewalk. Bedrock outcrops are present throughout these cut slopes, and some raveling of the bedrock materials was noted but no significant instabilities. Although there were some uneven portions of the site, it appears these features are primarily related to past grading activities, and not to landsliding.

Locations of some of the key surface features we observed at the site are presented on the Site Plan (Figure 1).

EVALUATION AND CONCLUSIONS

1. Introduction

The primary focus of our initial geotechnical/geologic studies was to assess whether there were serious geologic hazards present on the property that might render the site unsuitable for development from a geotechnical/geologic perspective. The most key hazards we evaluated in this regard was related to landsliding or fault rupture. Secondary concerns such as strong earthquake shaking, expansive soils, and site grading have also been considered. These elements are discussed below.

2. Landsliding

Based on our review of published literature and our site observations, it is our opinion there is a low likelihood of significant landslides being present at the site. The natural setting is one of relatively strong bedrock units that are not highly susceptible to landsliding. The most reliable landslide map of the area (CDMG, 1973) does not indicate any landslides are present on the property. No dramatic landforms were noted during our site reconnaissance that seemed to be indicative of ground instability. The raveling of the bedrock we observed in cut slopes along Arlington Avenue is largely an erosional process and not a sign of landslide-type instability. However, it should be noted that past grading may have resulted in the placement of potentially unstable fill materials on the property, particularly where the undeveloped, graded bench is present.

3. Fault Rupture

The site is located within the Alquist-Priolo Earthquake Fault Zone (APEFZ) established by the State of California around the Hayward-Rodgers Creek fault. However, all of the data we reviewed indicates the active trace(s) of the Hayward-Rodgers Creek fault pass about 300 feet southwest of the project site.

Therefore, we conclude the site has a low likelihood for fault rupture during future earthquakes. Nonetheless, if the project proceeds, a detailed fault study of the site will need to be performed because the site is located within an APEFZ, and because police department usage makes the development a critical facility.

4. Strong Earthquake Shaking

It is very likely all facilities that might be built on the site will be subject to very high levels of shaking during a future earthquake. Of course, this is true of all projects constructed in the Bay Area, and excellent design practices have been developed to provide reasonable performance during such events. Although the site is located fairly close to the Hayward-Rodgers Creek fault, reasonable design details are readily available for the levels of shaking that would occur during an earthquake event on that fault.

5. Expansive Soils

The surficial soils at the site are likely to be highly expansive, and such soils can cause damage to improvements during shrink/swell behavior that typically occurs. However, such soils are common throughout the Bay Area, and design practices are in widespread use to minimize impacts from expansive soils.

6. Site Grading

The site currently has mild to moderate slopes present, and grading will be necessary to develop the proposed facilities. Because the site generally contains shallow soils over strong bedrock, normal grading practices can be used and should perform well. Some remedial grading of existing fill from old grading activities may be necessary to stabilize such areas where concerns exist regarding future stability.

7. Conclusions

Based on our work to date, it is our opinion there are no significant geotechnical/geologic hazards at the site that will render the site unsuitable for the development of the proposed police facilities.

FUTURE WORK

When plans for the proposed police facilities are created, a detailed geotechnical/geologic investigation of the site should be performed. This will include geotechnical engineering and geologic components. A fault rupture analysis will be needed to satisfy the requirements of the Alquist-Priolo Earthquake Fault Zone provisions. This will include fault trenching that extends at least 50 feet beyond any proposed buildings. Also, subsurface borings and laboratory testing of recovered samples will be needed to guide the development of geotechnical recommendations for site grading, building foundations, site drainage, and other details.

LIMITATIONS

This firm’s services would be performed in accordance with generally accepted geological and geotechnical engineering principles and practices. This warranty is in lieu of all other warranties, either expressed or implied.

Thank you for the election of our firm to perform this work. If you have any questions, please call us.

Very truly yours,

Alan Kropp, G.E.
Principal Engineer

AK/jc

Copies: Addressee (PDF) – daranda@kppcsd.org

Attachments: Figure 1 - Site Plan
Figure 2 - Geologic Map
Figure 3 - Landslide Map 1
Figure 4 - Landslide Map 2
Figure 5 - Regional Active Fault Map
Figure 6 - Alquist-Priolo Earthquake Fault Zone Map

P-9279 Kensington Police - Vacant Lot Initial Study

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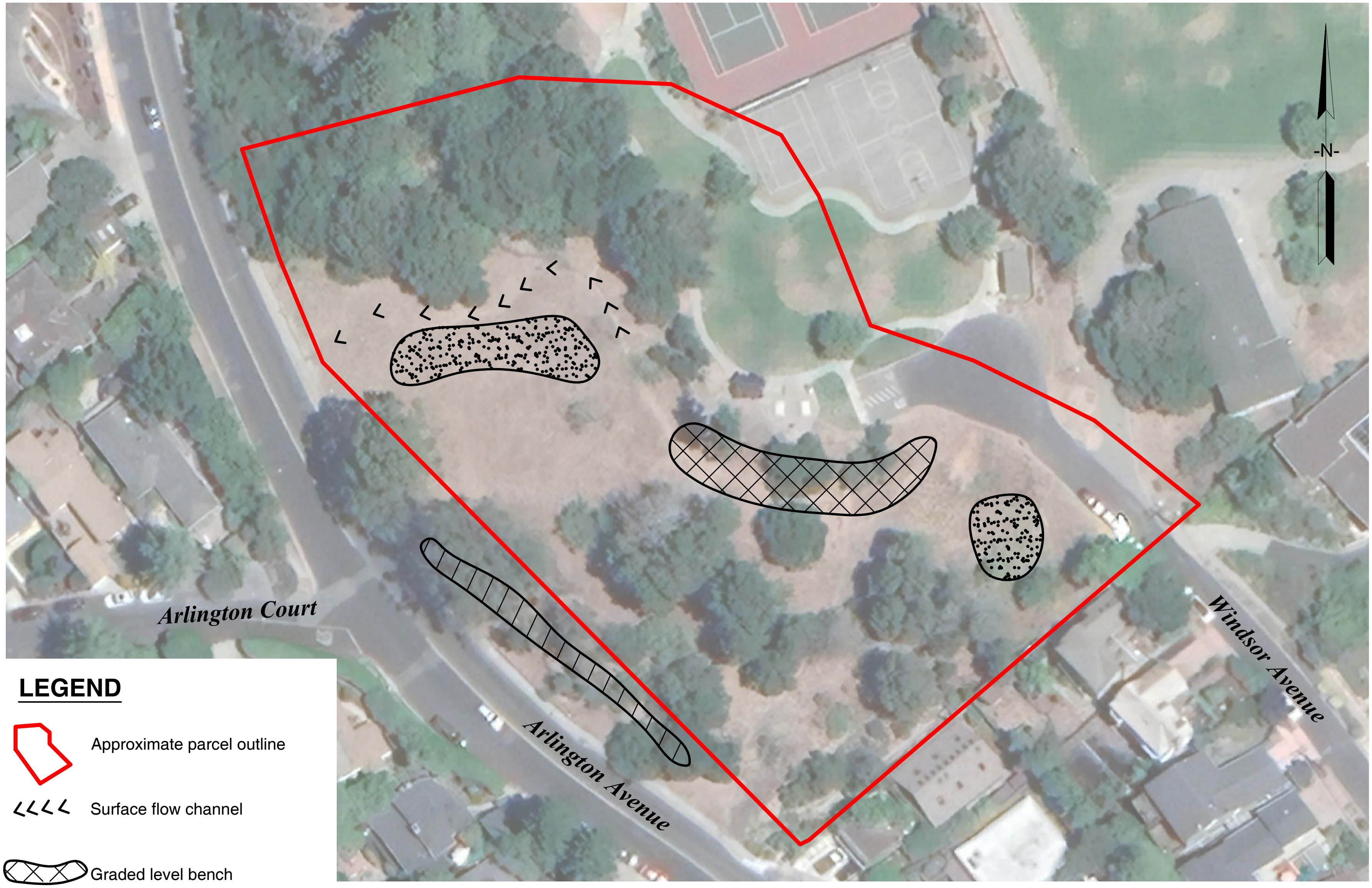

LEGEND

- Approximate parcel outline
- Surface flow channel
- Graded level bench
- Moisture area
- Bedrock exposed in cut slope

Base: Google Earth, 7/10/2022.

30 0 60 120
APPROXIMATE SCALE FEET

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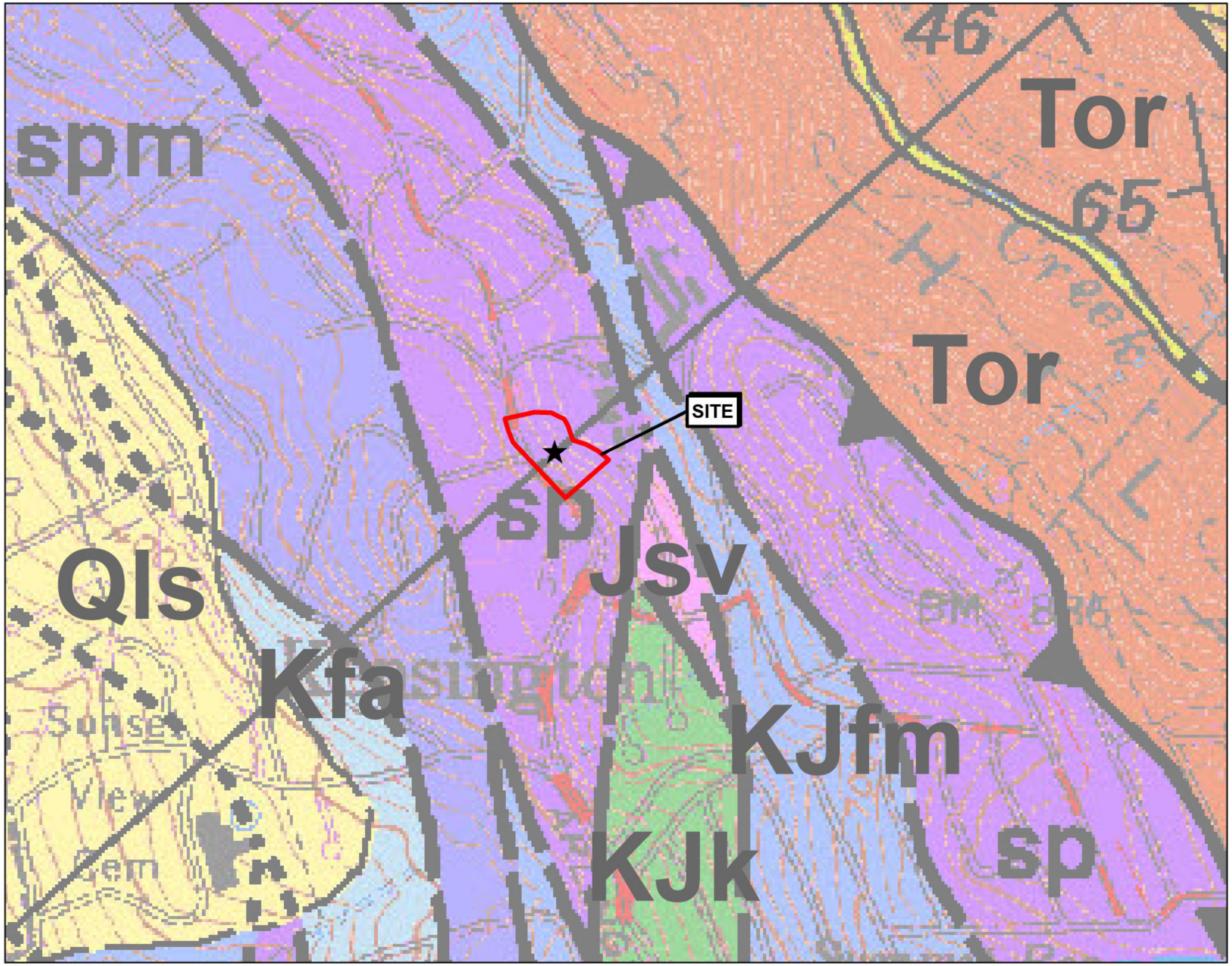
SITE PLAN		
POLICE DEPARTMENT BUILDING SITE Kensington, California		
PROJECT NO.	DATE	FIGURE **1**
P-9279	**November 2023**	



Base: Graymer, 2000.

N

LEGEND

Qls	Landslide deposits (Holocene and/or Pleistocene)
Tor	Orinda Formation (late Miocene)
KJk	Knoxville Formation (Early Cretaceous and Late Jurassic)
sp	Serpentinite
Jsv	Keratophyre and quartz keratophyre (Late Jurassic) (Late Cretaceous to Late Jurassic)
KJfm	Franciscan complex, mélange (Cretaceous Late Jurassic), includes mapped locally: Graywacke and meta-graywacke blocks
Kfa	Sandstone of the Alcatraz terrane of Blake and others (1984)(Cretaceous)
spm	Serpentinite matrix mélange

Original figure produced in color.

0 250 500 1,000 Feet

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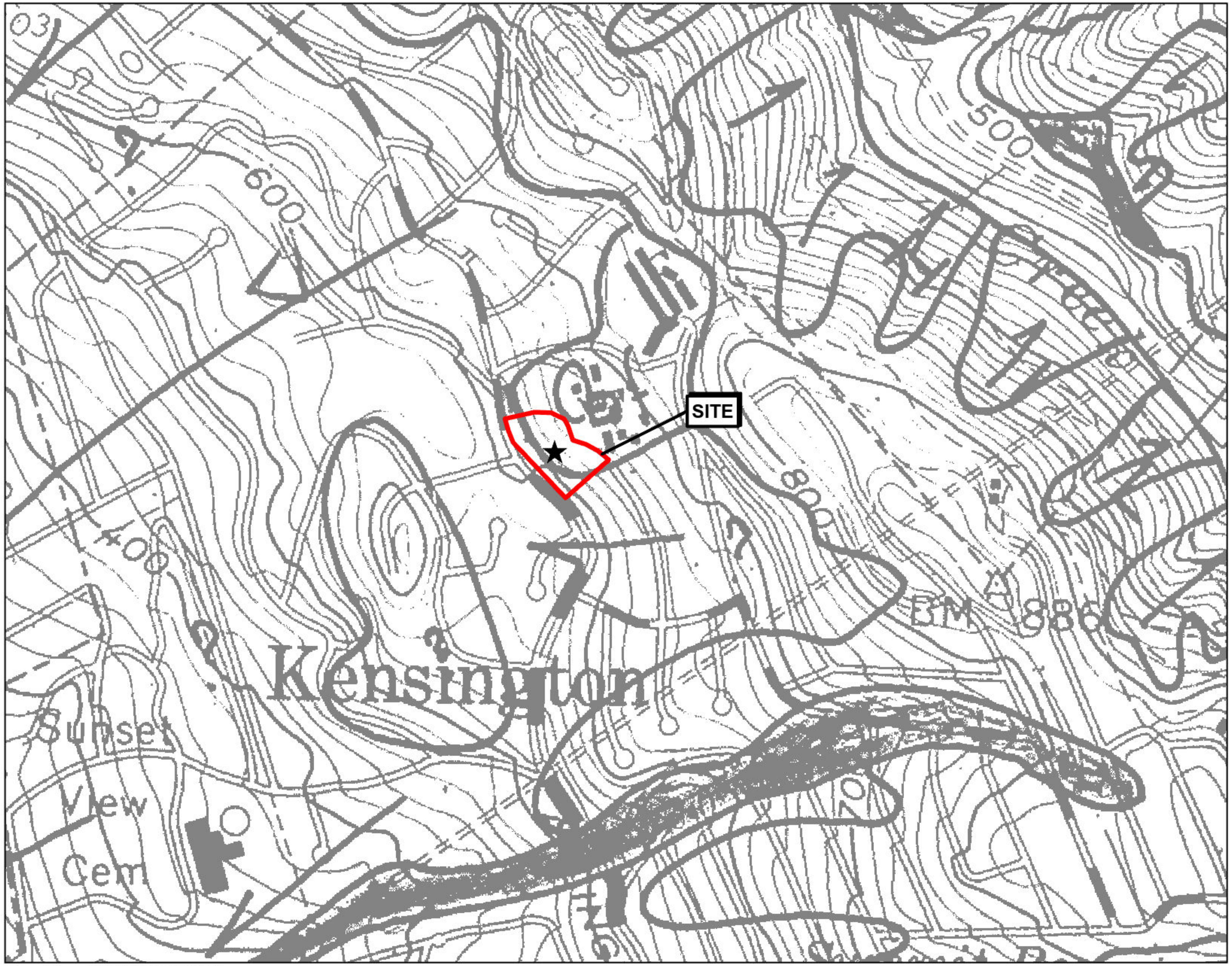
GEOLOGIC MAP

POLICE DEPARTMENT BUILDING SITE
Kensington, California

PROJECT NO.	DATE	FIGURE 2
P-9279	**November 2023**	



Base: Nilsen, USGS OFR 75-277-415

LEGEND

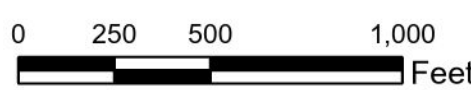
Landslide deposit

Arrows indicate general direction of movement. Queried where uncertain

Qaf

Artificial fill

Original figure produced in color.



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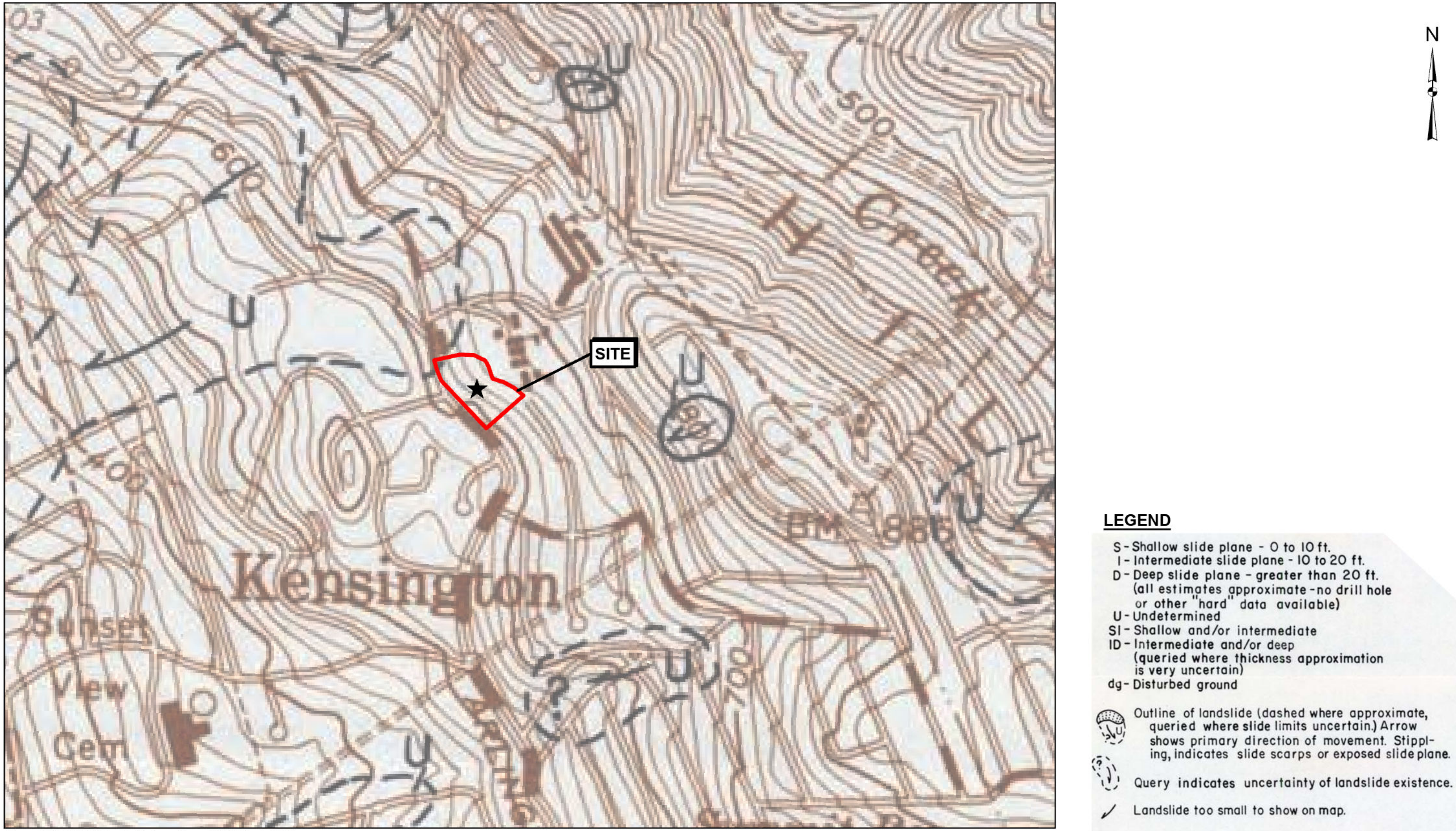
LANDSLIDE MAP 1		
POLICE DEPARTMENT BUILDING SITE Kensington, California		
PROJECT NO.	DATE	FIGURE 3
P-9279	**November 2023**	



Base: CDMG Tri Cities Preliminary Report 19, Plate 6, 1973.

Original figure produced in color.

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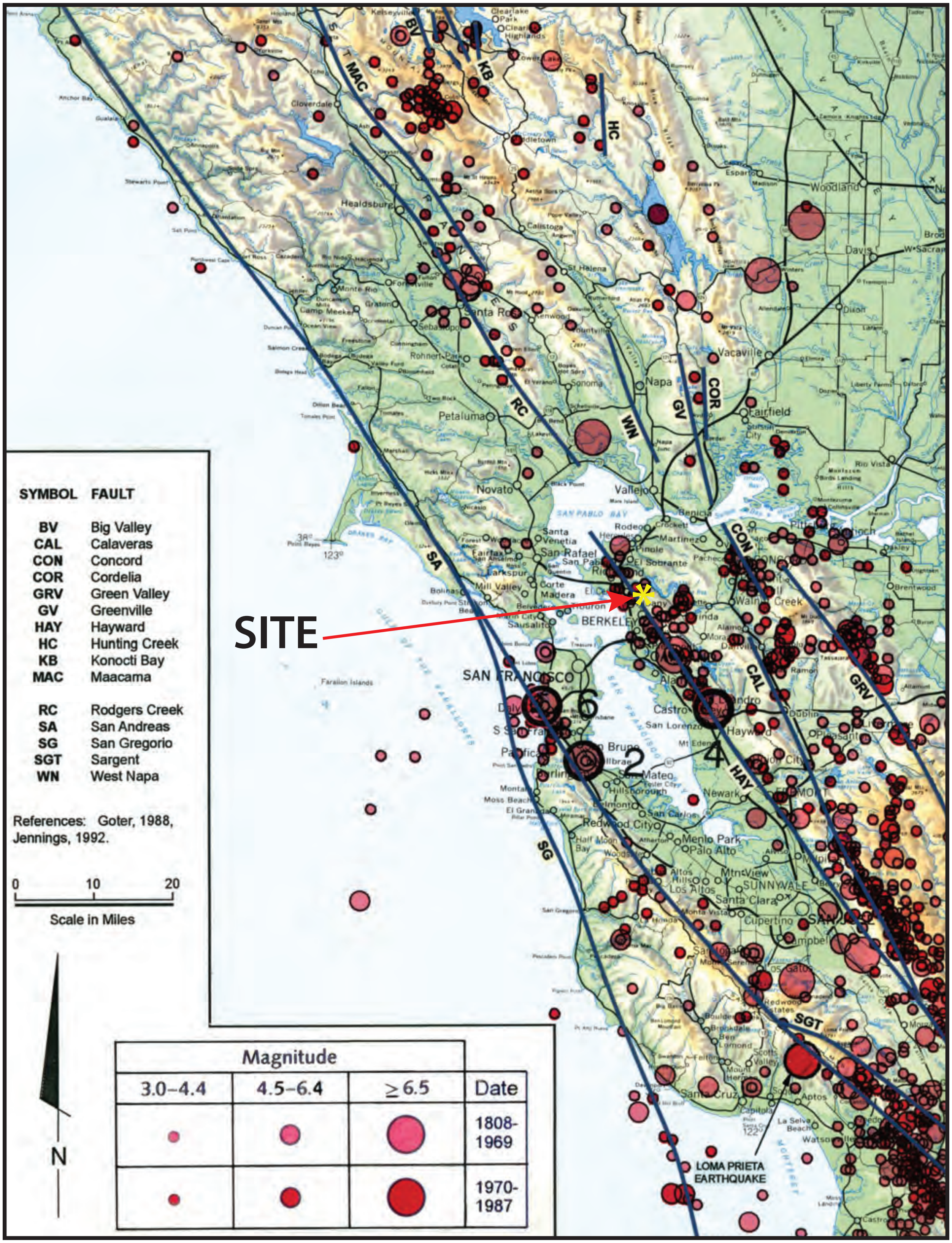
LANDSLIDE MAP 2		
POLICE DEPARTMENT BUILDING SITE Kensington, California		
PROJECT NO.	DATE	FIGURE **4**
P-9279	**November 2023**	



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REGIONAL ACTIVE FAULT MAP		
POLICE DEPARTMENT BUILDING SITE Kensington, California		
PROJECT NO.	DATE	FIGURE 5
P-9279	**November 2023**	

Base: *Alquist Priolo Earthquake Fault Zone Map, Richmond Quadrangle, California, 1982.*

N

LEGEND

MAP EXPLANATION

Potentially Active Faults

1906 C — Faults considered to have been active during Holocene time and to have a relatively high potential for surface rupture; 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.

Special Studies Zone Boundaries

These are delineated as straight-line segments that connect encircled turning points so as to define special studies zone segments.

Seaward projection of zone boundary.

Original figure produced in color.

0 750 1,500 3,000 Feet

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ALQUIST PRIOLO EARTHQUAKE FAULT ZONE MAP

POLICE DEPARTMENT BUILDING SITE
Kensington, California

PROJECT NO.	DATE	FIGURE 6
P-9279	**November 2023**	