APPENDIX F

GEOLOGIC AND SOILS HAZARDS EVALUATION REPORT

SCAG REAP Project 2-B

Geologic and Soils Hazards Evaluation Report

prepared for

Kimley-Horn
660 South Figueroa Street, Suite 2050
Los Angeles, California 90017

prepared by

Rincon Consultants, Inc.
250 East 1st Street, Suite 1400
Los Angeles, California 90012

August 18, 2023

RINCON CONSULTANTS, INC.
Environmental Scientists | Planners | Engineers
rinconconsultants.com

Rincon Consultants, Inc.

1530 Monterey Street, Suite D
San Luis Obispo, California 93401

805 547 0900

info@rinconconsultants.com
www.rinconconsultants.com

August 18, 2023
Project No. 21-12086

Jessie Fan, ENV SP
Project Manager
Kimley-Horn
660 South Figueroa Street, Suite 2050
Los Angeles, California 90017
Via email: Jessie.Fan@kimley-horn.com

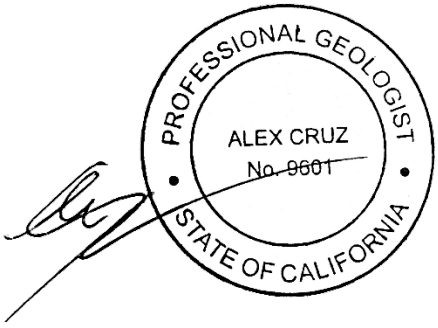
Subject: Geologic and Soils Hazards Evaluation Report
SCAG REAP Project 2-B – Palmdale Housing Project
Palmdale, California

Dear Ms. Fan:

This report presents the findings of a Geologic and Soils Hazards Evaluation completed by Rincon Consultants, Inc. (Rincon) for the Southern California Association of Governments (SCAG) Regional Early Action Planning (REAP) Project 2-B – Palmdale Housing Project, located within the City of Palmdale, County of Los Angeles, California.

Thank you for selecting Rincon for this project. If you have any questions, or if we can be of any future assistance, please contact us.

Sincerely,
Rincon Consultants, Inc.



This document has been digitally signed and sealed by Alex Cruz, PG, on 8/18/2023.

Alex Cruz, PG
Senior Environmental Geologist

This document has been digitally signed and sealed by Torin Snyder, PG, CHG on 8/18/2023.

Torin Snyder, PG, CHG
Principal

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1 Introduction and Background

Rincon Consultants Inc. (Rincon) has prepared this Geologic and Soils Hazards Evaluation Report (Report) for the Southern California Association of Governments (SCAG) Regional Early Action Planning (REAP) Project 2-B – Palmdale Housing Project located within the City of Palmdale, County of Los Angeles, California (Project Site, Figure 1).

The purpose of this Report is to present the results of a Geologic and Soil Hazards Evaluation, which identifies potential environmental impacts related to geologic and soil hazards that may result from, or be posed to, the development of the Project. The geologic hazards considered in this Report include:

- Seismic hazards, including ground surface fault ruptures, ground shaking, and liquefaction
- Soil hazards, such as expansive soils, subsidence and collapse, erosion, and slope stability

These hazards were evaluated specifically with respect to Appendix G of the current California Environmental Quality Act (CEQA) Guidelines. This Report is intended to support the Environmental Impact Report (EIR) that is being prepared for the Project in accordance with CEQA Guidelines.

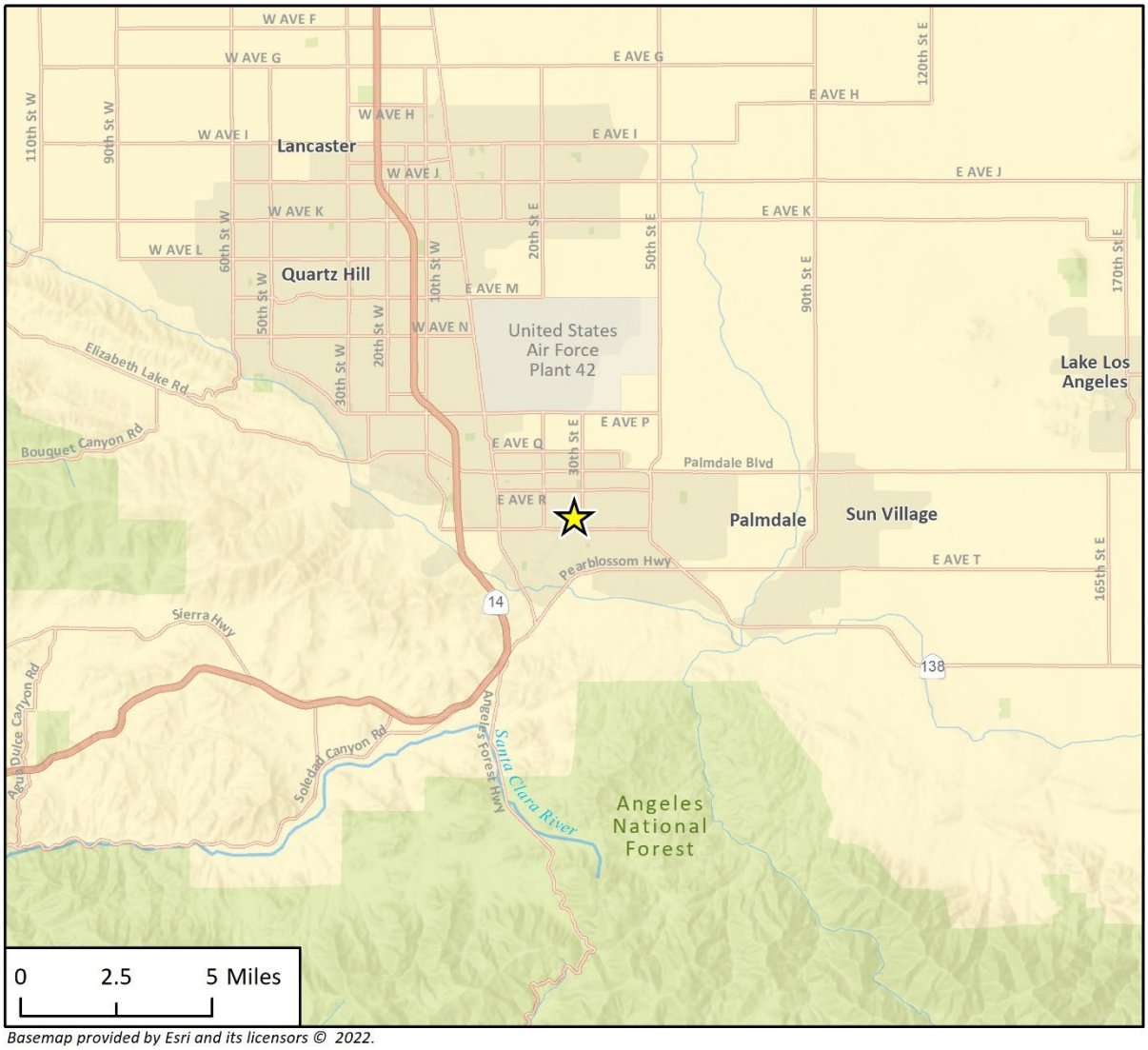
1.1 Methodology

To identify and assess geologic hazards, Rincon's geologists reviewed publicly available information, including maps, online databases, articles, reports, and published research papers. Information sources used in this Report include, but are not limited to, the following:

- U.S. Geological Survey (USGS) topographic maps
- USGS and California Geological Survey (CGS) geologic maps
- Seismic hazard zone maps
- Landslide inventory maps
- USGS and CGS active fault maps and ground shaking maps
- Alquist-Priolo Special Studies Zones Earthquake Fault maps
- Natural Resources Conservation Services soils maps
- Safety Elements of the General Plan for the City of Palmdale

All sources are documented in Section 8, with internet links included where available. The sources were interpreted and reviewed by a Professional Geologist; professional stamps and signatures are included in Section 7.

Figure 1 Regional Location



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Project Location

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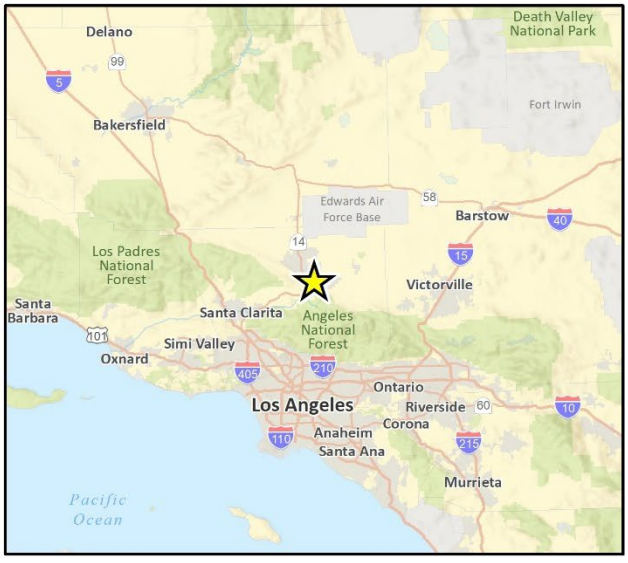


1.2 Project Description

The following sections describe the Project's site, development plans, and zoning.

Project Site

The proposed Project site is in the city of Palmdale, approximately 35 miles north of downtown Los Angeles, in the high desert area of northeast Los Angeles County (County; Figure 1).

The approximately 14.32 acre proposed Project site consists of five parcels, numbered Parcels 1 through 5, that will be consolidated from 45 smaller parcels located between 25th Street East, East Avenue R 8, 29th Street East, and East Avenue R12 in south Palmdale (Figure 2).

Regional access to the proposed Project site is provided via State Route 14 (SR 14), which runs north-south approximately 2.8 miles west of the proposed Project site. Local access to the proposed Project site is provided via SR 138, East Avenue S, and 25th Street East. The proposed Project site encompasses portions of Section 6 of Township 5N, Range 11W, Section 1 of Township 5N, Range 12W, and Sections 31 and 32 of Township 6N, Range 11W on the Palmdale, California USGS 7.5-minute topographic quadrangle.

The proposed Project site is vacant and undeveloped. Single-family residential uses are adjacent to the Project site along the east and can be found across East Avenue R12 to the south. To the north and west of the Project site lie areas of undeveloped land.

Development Plans

The Project proposes to develop a community of mixed housing types serving a range of income levels. The proposed Project includes 330 dwelling units composed of 152 affordable walkup apartments, 84 market rate apartments, 60 townhomes, and 34 cottages.

The proposed Project would include 4.5 acres of landscaped and open space areas, representing approximately 31 percent of the overall Project area. An additional 0.7 acre of landscaped areas would be developed within the public right-of-way in the form of planting strips and other landscaping. Parcel 5 would be developed as a two-acre public park. Parcels 1 through 3 would feature pocket parks and Parcel 2 would include play areas, connecting the street to the interior of each parcel development.

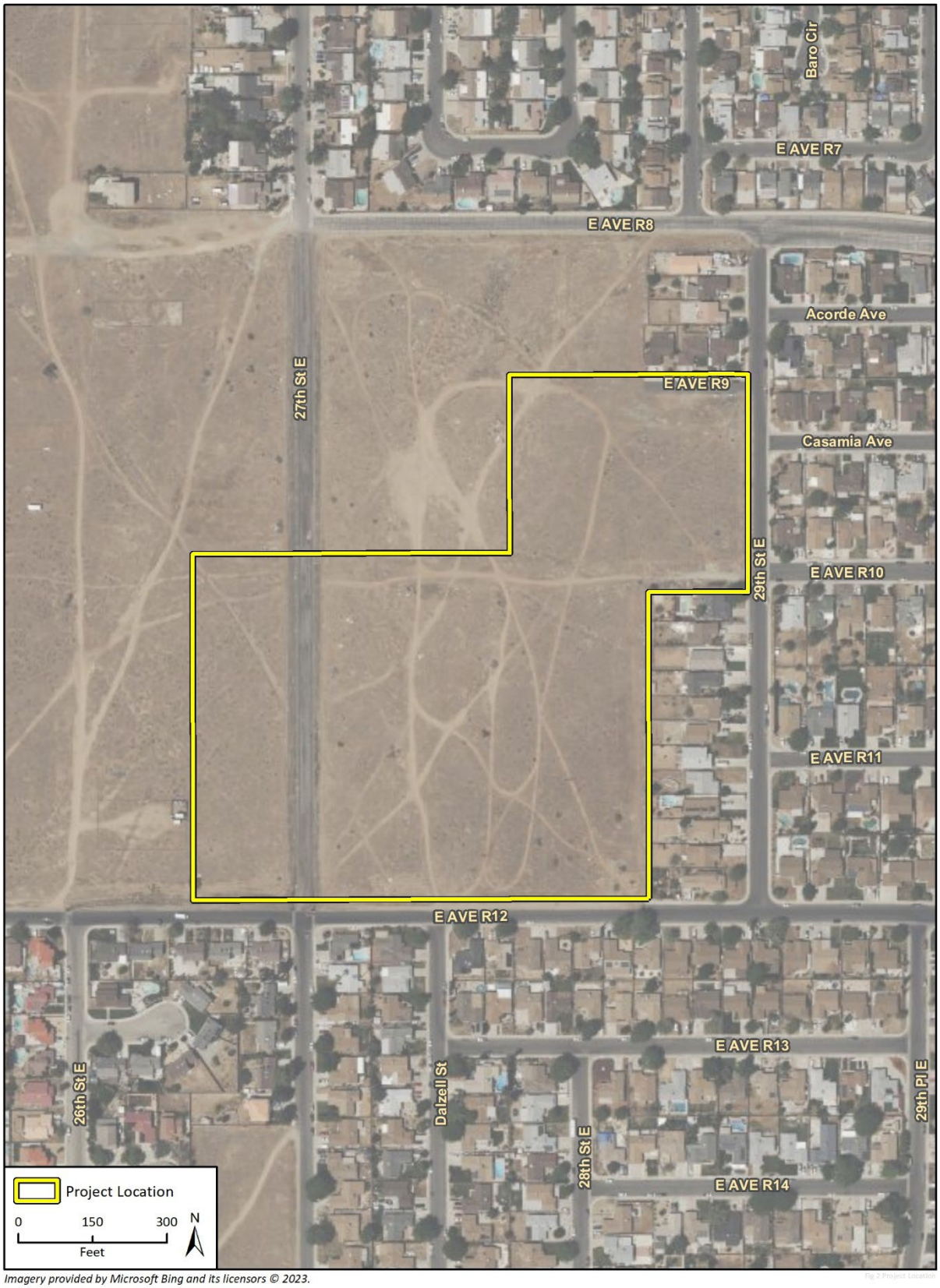
Project construction is anticipated to occur in multiple phases based on the parcel. As there is no known Project Proponent at this time, the phasing and construction schedule is speculative. Based on projects of similar size and phasing, assumptions were made to present a feasible construction schedule based on the parcels. Construction of Parcel 1 would last approximately 12 months, beginning as early as October 2025 and ending as early as September 2026. Construction of Parcel 2 would last approximately 14 months, beginning as early as August 2026 and ending as early as September 2027. Construction of Parcel 3 would last approximately 13 months, beginning as early as January 2024 and ending as early as January 2025. Construction of Parcel 4 would last approximately 11 months, beginning as early as December 2024 and ending as early as October 2025. Construction of Parcel 5 would last approximately 11 months, beginning as early as September 2027 and ending as early as July 2028. For purposes of this environmental analysis, the opening year is assumed to be 2028.

Zoning

The proposed Project site and surrounding areas to the west, north, and east are designated Residential Neighborhood (RN2), in the City of Palmdale General Plan.[1] Areas directly to the south are designated Single Family Residential 3 (SFR3). The RN2 land use designation is intended for a range of housing types, including small-lot single-family residential, townhouses, condominiums, and apartments with on-site recreation and open space.

[1] City of Palmdale, Palmdale 2045, Land Use Element, September 2022.

Figure 2 Project Location



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2 Regulatory Setting

The Project is subject to federal, State, and local regulatory requirements that are intended to characterize and reduce the risks posed by geologic and other natural hazards. Mandatory compliance with current State and local construction, engineering, and geotechnical building standards, which are based on the best available science and technology, provide protection against such hazards. Regulatory requirements and industry standards address these risks primarily via design and construction techniques that are confirmed and approved by regulatory entities at various stages of the Project's planning and implementation phases.

Generally, these regulatory requirements and industry standards are delineated in several documents; sources that may contain guidelines and/or requirements that are applicable to the Project include, but are not limited to, the following: the Palmdale Municipal Code (PMC); the Palmdale 2045 General Plan; the International Code Council, Inc. (ICC) International Building Code (IBC; most recent update) as adopted by the California Building Code (CBC; Title 24 of the California Code of Regulations); the Greenbook Committee of Standard Specifications for Public Works Projects (Greenbook Specifications; most recent update); and the State Water Resources Control Board's Construction Stormwater Program.

A brief description of each source is included below:

- **Palmdale Municipal Code.** The PMC largely adopts the CBC with specific edits. Chapter 8.04 - Adoption of Health, Safety And Technical Construction Codes of the PMC includes building and construction requirements to reduce hazard potential that are applicable to all new constructions, including the Project (CoP 2022b). These requirements include, but are not limited to:
  - **Grading and Excavation – Chapter 8.04.204 – 8.04.209.** Adopts Chapters 16 and 17 of the 2022 CBC with amended provisions. These sections contain various seismic requirements.
  - **Grading and Excavation – Chapter 8.04.200.** Adopts Appendix J of the 2022 CBC with amended provisions. Section 113 includes construction limitations in the vicinity of geologic faults.
  - **Grading and Excavation – Chapter 8.04.240.** Adopts Appendix J of the 2022 CBC with amended provisions. Requires a geotechnical report as prepared by a registered design professional, and may also require an engineering geologic report. For sites with mapped maximum spectral response accelerations at short periods greater than 50% of the acceleration (g-units; 0.5g), a liquefaction study is required.
- **Palmdale 2045 General Plan.** California Senate Bill 271 Assembly Bill 2038 required that counties and cities adopt General Plan policies regarding natural hazards. Palmdale 2045 General Plan is the City of Palmdale's General Plan, and it provides direction and resources intended to mitigate death, injuries, and environmental and economic damage (CoP 2022a). Palmdale 2045 General Plan contains several policies that are applicable to the Project, including, but not limited to:
  - **Chapter 13, Safety Element – Seismic Safety Goals SE 1-1 through SE 1-5**. Require new developments to complete soils reports and ensure structural designs address seismic, liquefaction, and other geologic hazards.

- **Chapter 13, Safety Element – Wildfire and Fire Goal SE 2-6 and Flooding Goals SE 4-1 through 4-3.** Require new developments to incorporate design elements that address hazards associated with erosion.

- **California Building Code and International Building Code.** The CBC contains engineering and design requirements for buildings in California, and incorporates elements of the IBC, ASTM, and International and the American Society of Civil Engineers (ASCE) standards. The following CBC sections contain requirements that may be applicable to the Project:
  - General provisions – Chapter 1
  - Structural design (including soil and seismic loading) – Chapters 16/16a
  - Structural tests and special inspections (including seismic resistance) – Chapters 17/17A
  - Soils and foundations – Chapters 18/18A
  - Grading, including excavation, fill, drainage, and erosion control – Appendix J
- **Greenbook Specifications.** The Standard Specifications for Public Works Construction, or "Greenbook," is produced by a committee of experts from the American Public Works Association, Engineering Contractors Association, Southern California Contractors Association, and others. The Greenbook provides standards for construction materials and methods, engineering, construction activities, and protocols for assessing and mitigating geologic and soil hazards. The Greenbook is widely adopted by regulatory agencies.
- **State Water Resources Control Board's Construction Stormwater Program.** Construction General Permit Order 2009-0009-DWQ requires that dischargers whose projects disturb one or more acres of soil obtain a Construction General Permit, in order to comply with the National Pollutant Discharge Elimination System (NPDES) program. The Construction General Permit requires the development of a Storm Water Pollution and Prevention Plan (SWPPP) to protect against the discharge of pollutants during construction.

3 Physical Setting

3.1 Topography

The Project Site lies at an elevation of approximately 2,640 feet above mean sea level (ft amsl; USGS 2021) and is generally flat with a gradual northerly and northeasterly slope away from the San Gabriel Mountains, located approximately 3 miles south of the Project Site.

3.2 Regional Geology

Palmdale is in the southern part of the Mojave geomorphic province. The Mojave is a broad interior region of isolated mountain ranges separated by stretches of desert plains. There are two important fault trends that control topography in the Mojave: a prominent northwest-southeast trend and a secondary east-west trend (apparent alignment with Transverse Ranges is significant). The Mojave province is wedged in a sharp angle between the Garlock Fault (southern boundary Sierra Nevada) and the San Andreas Fault, where it bends east from its northwest trend. The northern boundary of the Mojave is separated from the prominent Basin and Range geomorphic province by the eastern extension of the Garlock Fault (CGS 2002).

3.3 Local Geology

The Project Site is underlain by Quaternary-age alluvium, composed of fluvial gravel, sand, and silt (Olson et. al. 2013). Currently, no known faults have been mapped through the Project Site. The closest known active fault (defined as having observed or inferred movement within the past 10,000 years) is the Cemetery Fault, within the San Andreas Fault Zone, mapped approximately 0.5 mile to the southwest (USGS 2017). The primary trace of the San Andreas Fault, with known deformation within the past 150 years, is located approximately 1.5 miles to the southwest. Additionally, an unnamed fault of the Quaternary age (evidence of displacement less than 2.58 million years) is mapped approximately 9 miles to the southeast of the Project Site (USGS 2017). No other known faults have been mapped within 10 miles of the Project Site.

The Project Site has been mapped in an area containing soils predominantly classified as Rosamond loam, in the fluvent sub-order, and with small areas of Adelanto coarse sandy loam and Hesperia fine sandy loam series soils (USDA 1970[2)]. The Rosamond soil series consists of deep, well-drained soils that formed in material weathered mainly from granitic alluvium (UCD 2022).

3.4 Hydrogeology

The Project Site is within the Antelope Valley Groundwater Basin (Basin 6-044) as defined by the DWR Bulletin 118, and within the Lancaster sub-basin as defined by the Antelope Valley Integrated Regional Water Management Plan (AVIRWMP; RWMG 2013). The Lancaster sub-basin is the largest

[2] Soil Survey Area CA675; accessed from the University of California at Davis SoilWeb online viewer https://casoilresource.lawr.ucdavis.edu/gmap/ and from https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx

and most economically significant in the region, and due to the various groundwater uses, groundwater levels vary locally.

The region has two primary aquifers: an upper unconfined aquifer that historically has had artisan flows due to perched saturated zones, and a lower aquifer that is isolated by clayey zones (RWMG 2013). Due the arid climate, groundwater is the primary source of the region's water supply. Groundwater levels have historically fluctuated, but overall trends correlate directly to changes in land use. Groundwater extraction has generally exceeded recharge in the region, and this over-drafted condition has caused some water levels to decrease by more than 200 feet in some areas, although others in the rural western extent of the region have seen increased water levels (RWMG 2013).

Rincon understands that the depth to groundwater at the Project Site has not been specifically evaluated; however, a USGS monitoring well[3], located approximately 2,600 feet to the north, which has periodic groundwater depth data, reported a groundwater depth of 227.47 below ground surface on March 14, 2022 (DWR 2022b); screened interval information for this well was not available.

[3] USGS Location Name: 006N011W31A001S; Well ID 343419118044401

4 Evaluation Results

The results of the Geologic and Soils Hazards Evaluation for the Project Site are included below.

4.1 Significance Thresholds

In accordance with Appendix G of the CEQA Guidelines, each geologic or soil hazard is assigned one of four significance thresholds based on the findings of this Report. The significance thresholds are:

1. **Potentially Significant Impact.** Would generally result in the loss or degradation of public health and safety or conflict with local, State, or Federal agency regulations.
2. **Less Than Significant with Mitigation Incorporated.** Would generally not result in the loss or degradation of public health and safety provided that the prescribed mitigation measures are implemented.
3. **Less Than Significant Impact.** Would generally not result in the loss or degradation of public health and safety, even without the implementation of mitigation measures.
4. **No Impact.** The impact simply does not apply to projects like the one involved (e.g., the project falls outside a fault rupture zone).

An impact related to geology and soils would be considered some degree of significant if the proposed project would:

a. Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving:
    i. Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zone Map issues by the State Geologist for the area or based on other substantial evidence of a known fault (refer to Division of Mile sand Geology Special Publication 42);
    ii. Strong seismic ground shaking;
    iii. Seismic-related ground failure, including liquefaction;
    iv. Landslides;
b. Result in substantial soil erosion or the loss of topsoil;
c. Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse;
d. Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial direct or indirect risks to life or property;
e. Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater; or
f. Directly or indirectly destroy a unique paleontological site or unique geologic feature?

Because the proposed Project does not propose the use of septic tank or any alternative wastewater disposal systems, an analysis of potential impacts related to septic tanks or alternative

wastewater disposal systems (CEQA Guidelines Geology and Soils checklist question “e”) is not included in this Report.

Additionally, a separate paleontological technical study is being prepared; therefore, this Report does not assess impacts to unique paleontological sites (CEQA Guidelines Geology and Soils checklist question “f”).

The evaluation of geology and soils impacts assumes that the construction and development of the Project would adhere to all applicable local, State, and Federal regulations, and conform to the current required State and local construction, engineering, and geotechnical building standards, as appropriate.

4.2 Potential Project Impacts

a.i)	Would the project directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving rupture of a known earthquake fault?

4.2.1 Ground Surface Fault Rupture

Surface rupture refers to the displacement of the ground surface along a pre-existing fault. Fault rupture can endanger life and property if structures are constructed on, or cross over, a fault, due to the differential movement of the ground surface. Alquist-Priolo Earthquake Fault Zoning Act (Alquist-Priolo Act) directed the State Geologist to delineate regulatory “zones of required investigation” to reduce the threat to public health posed by geologic faults and earthquakes. Zones of required investigation indicate areas with active faults that have the potential for surface rupture.

The Project Site does not overlie the trace of any known fault, (Figure 3) and is not located within an earthquake zone of required investigation as designated by the Alquist-Priolo Act (CGS 2022b). It should be noted that given the alluvium composing the valley floor, there are believed to be many unmapped faults in the region (CoP 2021). The closest zone of required investigation is the Cemetery Fault section of San Andreas Fault Zone, located approximately 0.5 miles southwest of the Project Site (Figure 4). Therefore, the risk of ground surface fault ruptures at the Project Site is minimal, and there is no impact.

Figure 3 Regional Quaternary Faults

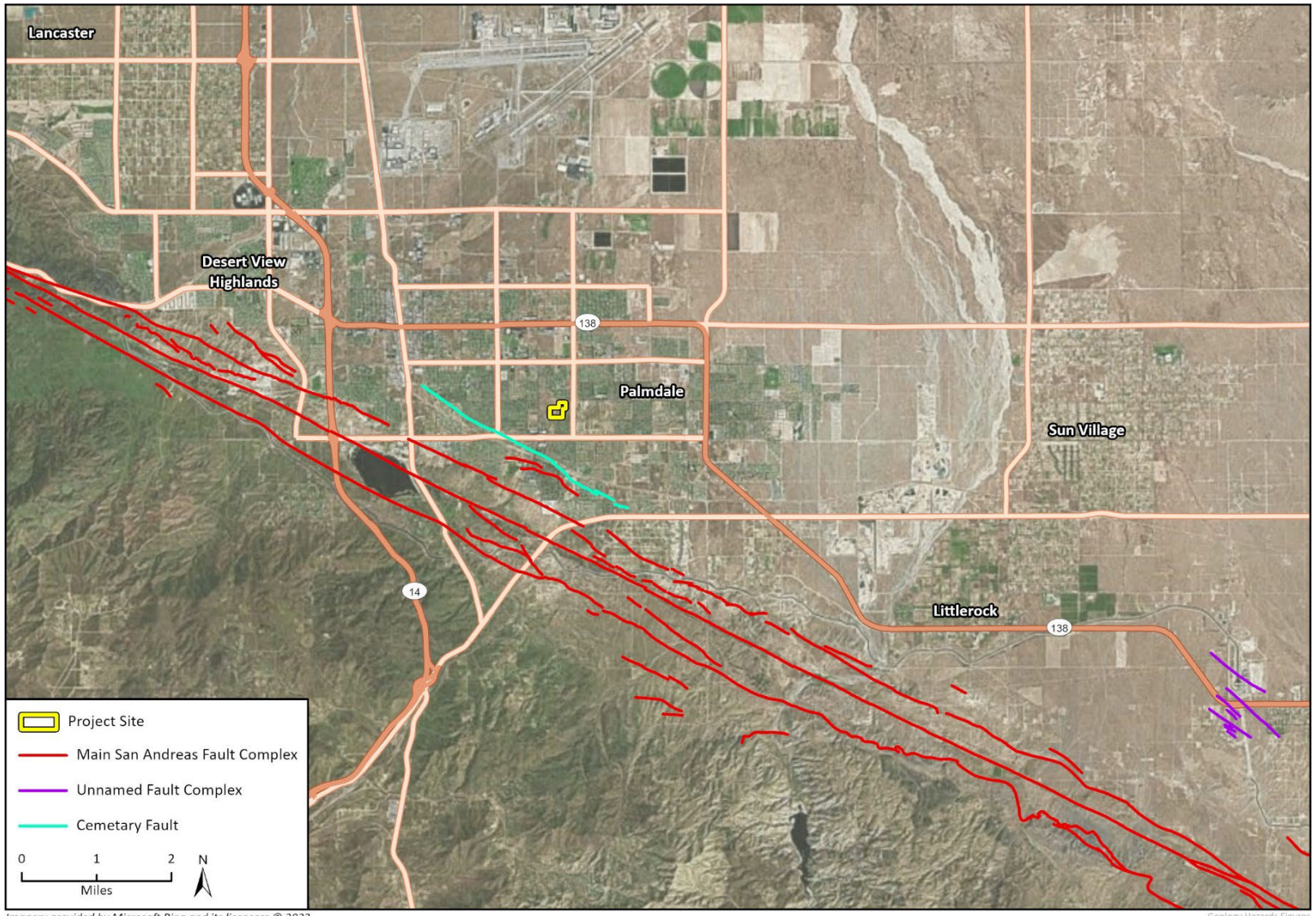
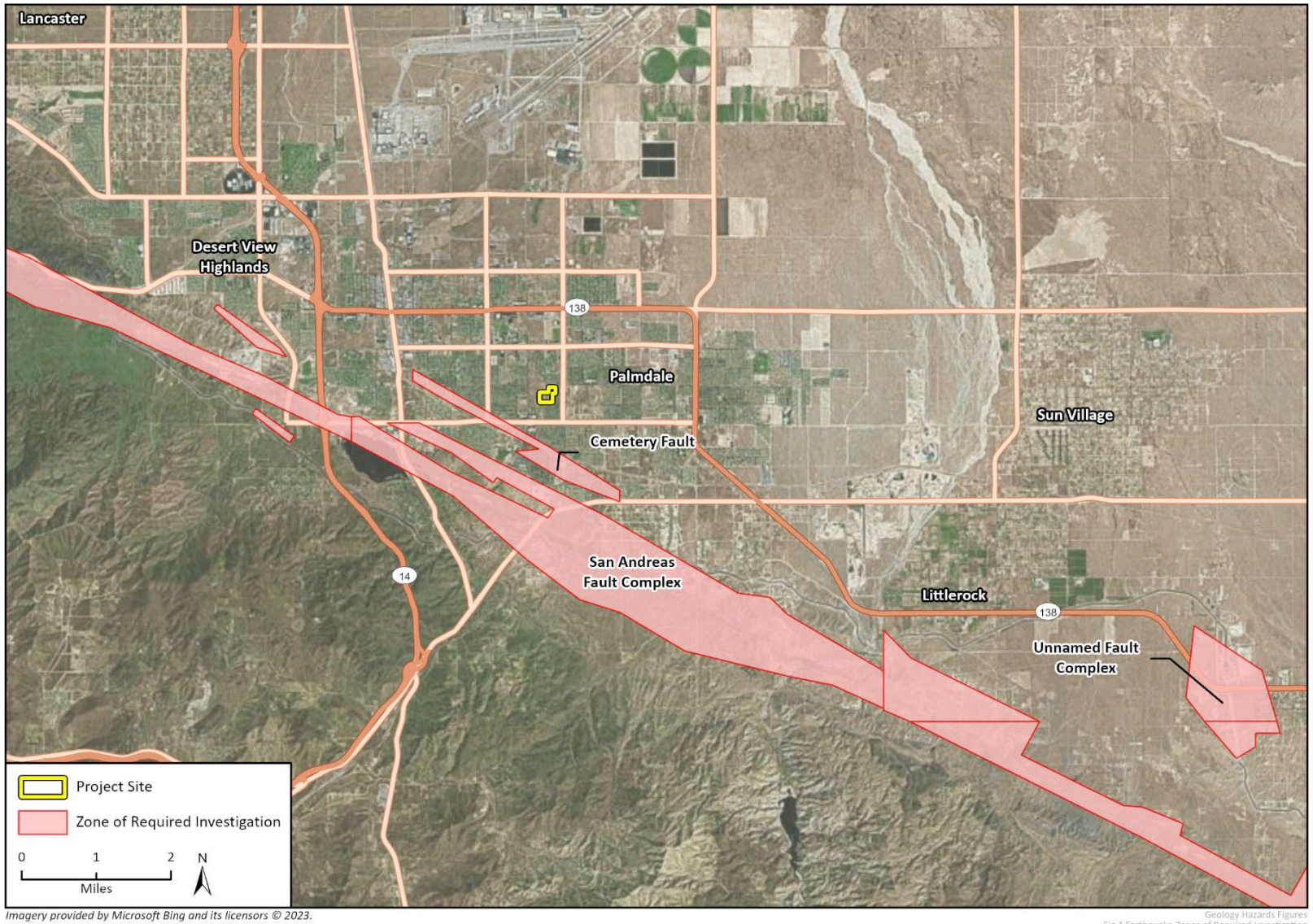


Figure 4 Zones of Required Investigation



a.ii)	Would the project directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving strong seismic ground shaking?

4.2.2 Seismically Induced Ground Shaking

As with virtually all of California, the Project is located in an area with the potential for ground shaking that may cause structural or property damage in the event of an earthquake. The intensity of ground motion depends upon the magnitude of an earthquake, the distance from the epicenter, and the geology between the epicenter and the site. Ground motion caused by earthquakes can be amplified in softer, unconsolidated soil, in which seismic wave velocity decreases but wave amplitude increases, as opposed to in harder material, such as bedrock. As amplitude increases, so does ground acceleration, and the ground shaking intensity.

A list of historical earthquakes, occurring between 1900 and 2022, within 50 miles of the Project Site and having a magnitude of 4.5 or greater, are summarized on Table 1; a map illustrating the locations and magnitudes of these earthquakes is presented on Figure 5.

Table 1 Regional Earthquakes

Date	Magnitude	General Location
9/19/2020	4.5	3 km (kilometer) WSW of South El Monte, California
3/29/2014	5.1	2 km NW of Brea, California
5/18/2009	4.7	2 km E of Lennox, California
7/29/2008	5.4	5 km S of Chino Hills, California
8/9/2007	4.7	5 km NNW of Chatsworth, California
9/3/2002	4.8	4 km NE of Yorba Linda, California
4/27/1997	4.9	11 km SW of Valencia, California
4/26/1997	5.1	12 km ESE of Piru, California
6/26/1995	5	11 km SW of Valencia, California
12/6/1994	4.5	3 km NW of Lake View Terrace, California
3/20/1994	5.2	3 km WNW of Panorama City, California
1/29/1994	5.1	6 km NNE of Chatsworth, California
1/27/1994	4.6	4 km ENE of Chatsworth, California
1/24/1994	4.6	9 km SSW of Santa Clarita, California
1/22/1994	4.6	6 km WSW of Santa Clarita, California
1/21/1994	4.5	3 km NW of Pacoima, California
1/19/1994	5.1	10 km SSW of Valencia, California
1/19/1994	5.1	8 km ESE of Piru, California
1/19/1994	4.5	3 km NE of Reseda, California
1/18/1994	4.8	6 km SW of Santa Clarita, California
1/18/1994	5.2	10 km ESE of Piru, California
1/17/1994	5.6	7 km NNE of Simi Valley, California
1/17/1994	4.9	6 km NE of Chatsworth, California
1/17/1994	4.6	4 km WSW of Northridge, California

Date	Magnitude	General Location
1/17/1994	4.9	10 km SSW of Valencia, California
1/17/1994	4.7	4 km NNW of Pacoima, California
1/17/1994	4.6	2 km NW of Northridge, California
1/17/1994	5.2	9 km N of Chatsworth, California
1/17/1994	4.8	5 km N of Granada Hills, California
1/17/1994	4.9	3 km N of Northridge, California
1/17/1994	5.9	1 km ENE of Granada Hills, California
1/17/1994	6.7	1 km NNW of Reseda, California
7/11/1992	5.7	12 km NW of California City, California
6/28/1991	5.8	13 km NNE of Sierra Madre, California
4/17/1990	4.5	1 km N of Claremont, California
3/1/1990	4.7	6 km N of Claremont, California
2/28/1990	5.5	6 km NNE of Claremont, California
6/12/1989	4.8	1 km WSW of East Los Angeles, California
12/3/1988	5.0	1 km SSE of Pasadena, California
6/26/1988	4.7	4 km NNE of Claremont, California
6/10/1988	5.4	16 km NE of Lebec, California
2/11/1988	4.7	2 km WNW of El Monte, California
10/4/1987	5.3	2 km WSW of Rosemead, California
10/1/1987	4.6	3 km ESE of Monterey Park, California
10/1/1987	4.8	2 km E of Monterey Park, California
10/1/1987	4.7	3 km SE of Monterey Park, California
10/1/1987	5.9	2 km SSW of Rosemead, California
2/9/1971	4.6	9 km NNE of Lake View Terrace, California
2/9/1971	4.8	4 km NE of Pacoima, California
2/9/1971	5.3	10 km SSW of Agua Dulce, California
2/9/1971	4.6	4 km SW of Lake View Terrace, California
2/9/1971	4.6	10 km SSW of Agua Dulce, California
2/9/1971	4.5	10 km SSW of Agua Dulce, California
2/9/1971	4.5	10 km SSW of Agua Dulce, California
2/9/1971	5.8	10 km SSW of Agua Dulce, California
2/9/1971	4.7	10 km SSW of Agua Dulce, California
2/9/1971	4.5	10 km SSW of Agua Dulce, California
2/9/1971	5.8	10 km SSW of Agua Dulce, California
2/9/1971	6.6	10 km SSW of Agua Dulce, California
9/12/1970	5.2	3 km W of Lytle Creek, California
4/15/1965	4.6	5 km NNE of Fontana, California
1/27/1954	5.0	12 km W of Tehachapi, California
4/29/1953	4.7	20 km ENE of Grapevine, California
9/2/1952	4.6	19 km SE of Arvin, California

Date	Magnitude	General Location
8/23/1952	4.8	5 km NNE of Acton, California
8/13/1952	4.7	19 km SE of Arvin, California
7/21/1952	4.7	2 km NW of Lebec, California
7/21/1952	5.2	5 km SW of Tehachapi, California
3/1/1948	4.6	2 km ENE of Lytle Creek, California
7/13/1935	4.6	0 km S of Citrus, California
1/9/1934	4.5	2 km NNE of Montclair, California
3/11/1933	4.9	0 km SW of Gardena, California
8/31/1930	5.3	1 km SW of Las Flores, California
7/8/1929	4.7	2 km WSW of La Mirada, California
8/4/1927	5.3	2 km SSW of Santa Monica, California
6/22/1920	4.9	2 km SSW of Santa Monica, California

As discussed in Section 3.3, the Project Site overlies Quaternary-aged alluvium composed of alluvial gravel, sand, and silt; these materials have an increased risk of damage due to ground shaking because they are generally unconsolidated. Additionally, the Project Site is in an area mapped as having generally high to very high earthquake hazard (CGS 2016)[4].

Earthquakes are considered the most likely serious hazard facing the City of Palmdale (CoP 2021). The San Andreas Fault Zone is located approximately 1.5 miles southwest of the Project Site (Figure 3). The San Andreas Fault is a complex fault system more than 800 miles long with well-defined segments and strike-slip displacement (USGS 2016a). Geomorphic expressions include linear topographic scarps, narrow ridges and valleys, and deflected stream channels (USGS 1990). The estimated slip-rate of the Mojave section is approximately 35 millimeters per year (USGS 2016b), and the most recent deformation age is within the last 150 years (USGS 2017). The San Andreas Fault is capable of producing an earthquake over magnitude 8 on the Richter scale, and is likely to rupture within the next 50 to 100 years (CoP 2021).

The USGS Unified Hazard Tool[5] (UHT) calculates estimated peak ground accelerations (PGA) based on a given time horizon and on site-specific parameters and published earthquake hazard and probability maps. The PGA for the Project Site were calculated using Dynamic Conterminous U.S. 2014 (v4.2.0) hazard model edition assuming a Site Class of D/E Boundary. The PGA for the Project Site were compared to the Modified Mercalli scale (Kramer, Upsall 2006) to provide a qualitative assessment of ground shaking. According to the UHT, the Project Site has a 2% chance in 50 years of experiencing a PGA of approximately 1.31g. This PGA corresponds to a “extreme perceived shaking” based on the Modified Mercalli scale (Kramer, Upsall 2006)[6], and “very heavy” potential damage. According to a different source, the Project Site is mapped in an area corresponding to ground accelerations of 0.7 – 0.8g (CoP 2021).

Based on this information, the Project Site is susceptible to seismic activity, and would be subject to significant ground shaking during a reasonably likely earthquake. However, provided that

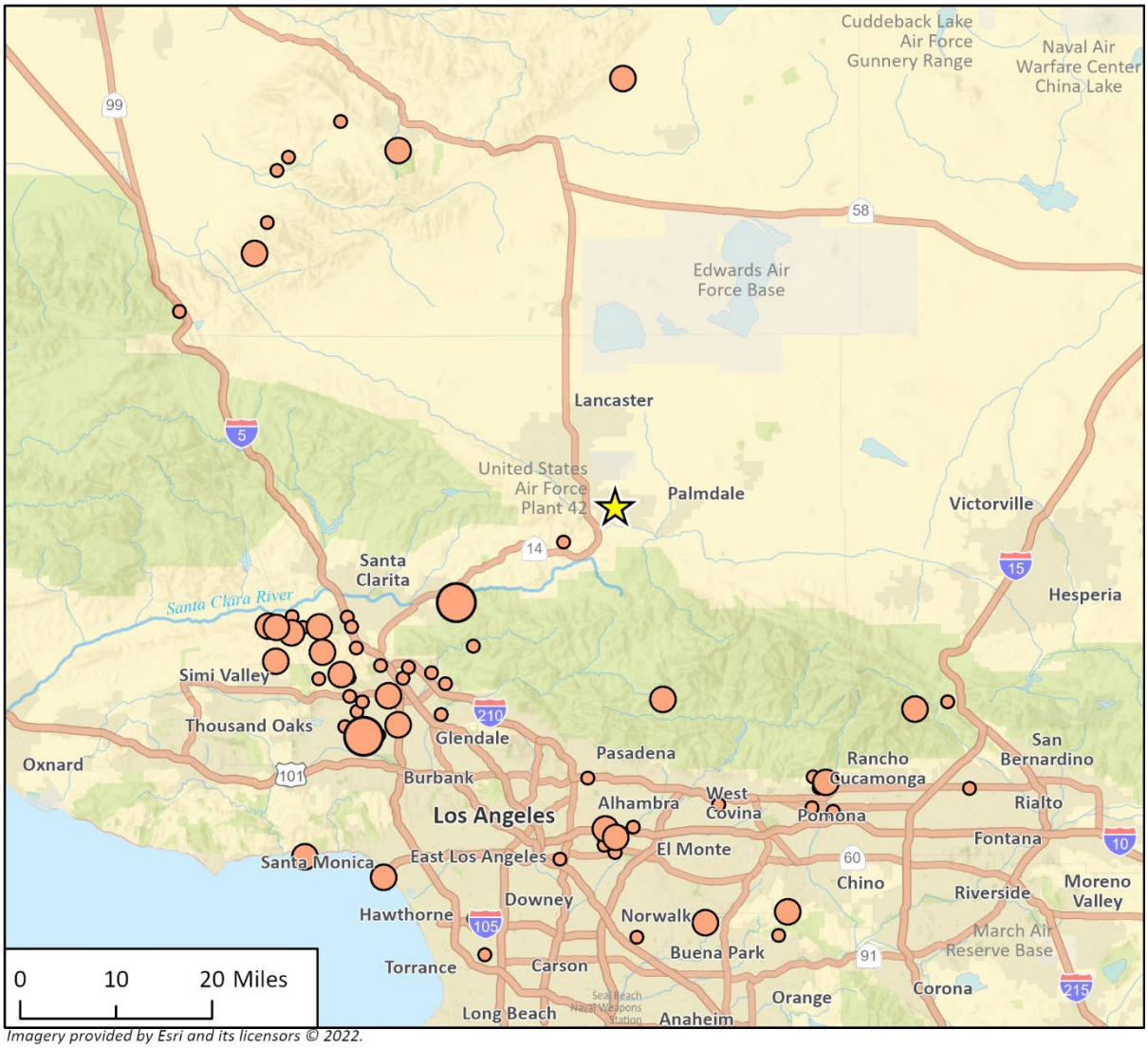
[4] Based on a 1-second spectral period with 2% exceedance probability in 50 years.

[5] https://earthquake.usgs.gov/hazards/interactive/

[6] The PGA derived for this Report is intended to offer a qualitative assessment of potential ground shaking and is not intended to provide information for use in engineering calculations or designs for the Project.

construction adheres to proper building and engineering standards, impacts would be less than significant. The Project would be required to minimize this risk through incorporation of applicable CBC standards as adopted by the City (PMC Chapters 8.04.04 – 8.04.209), and adhere to the goals and policies for the seismic safety elements as outlined in the Palmdale General Plan. During the plan check process, the City would review detailed structural engineering drawings of the proposed seismic anchoring, which would be approved by a licensed structural engineer to ensure that in the event of a design earthquake, the property loss and injury would be minimized. With adherence to existing regulatory requirements, the Project would not directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death, associated with seismic-related ground shaking, ground failure, or landslides.

Figure 5 Historical Regional Earthquakes



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a.iii)	Would the project directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving seismic-related ground failure, including liquefaction?
a.iv)	Would the project directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving landslides?
c.	Would the project be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?

4.2.3 Liquefaction and Lateral Spreading

Liquefaction is a process in which saturated soil temporarily becomes fluid during intense and prolonged ground shaking, or because of a sudden shock or strain. Liquefaction typically occurs in areas with loose sand or silt where groundwater is shallow (less than 40 ft bgs [SMGB 2014]). Settlement is the vertical compression of the soil structure in response to a load, such as a building or compressive ground shaking in an earthquake. Settlement can be rapidly induced by liquefaction as sediments densify in response to the dissipation of pore water pressures (dewatering). Lateral spreading occurs when, during liquefaction, soil is not constrained laterally and flows horizontally.

As discussed in Section 3.3, site-specific groundwater information is not available, and the Project Site overlies Quaternary-aged alluvium composed of gravel, sand, and silt; generally, course grained fractions are not susceptible to liquefaction. Most soil in the City is composed of very dense soil or soft rock, and there is a low likelihood of liquefaction (CoP 2021). Additionally, the Project Site is not located within a known liquefaction zone of required investigation (CGS 2022b); therefore, there is no impact. However, because the Project Site appears to be in an area with possible ground accelerations greater than 0.5g, a liquefaction study may be required by the PMC and city engineer.

4.2.4 Subsidence and Collapse

Subsidence is the differential (lateral or vertical) movement of the ground due to the collapse of soil pore space, which occurs without the application of an external load, such as a building. Subsidence can also occur during the compressive ground shaking of an earthquake. Common causes of subsidence in California are the over-pumping of groundwater, which reduces pore pressure, or the decay of organic matter, such as peat, which allows the soil substrate to compress and surface elevations to decrease. Subsidence is generally viewed as a regional change in surface elevation; however, localized differential displacements of the ground surface can damage foundations and structures as does settlement.

The Project Site is not located in an area that has experienced subsidence (DWR 2023), and subsidence is not a recognized hazard in the area (CoP 2021); therefore, there is no impact.

4.2.5 Slope Stability and Landslides

Landslides are a form of mass wasting, in which rocks or soil material travel downhill under the force of gravity in a slope failure. A site could be at risk of landslides occurring beneath its footprint that could undermine its foundational elements, or could also be affected by landslides that originate off-site and travel downslope for a distance. Significant damage to structures and/or infrastructure can occur depending on the extent and energy of the landslide.

Because the Project Site is virtually flat, there is no risk of onsite landslides. The closest mapped historical landslide is approximately 5.25 miles to the southwest (Figure 6; CGS 2023), and the San Gabriel Mountains are approximately 3 miles to the south. The closest landslide zones are located approximately 2 miles to the southwest (CGS 2022b); therefore, the risk of offsite landslides that could impact the Project Site is minimal, and there is no impact.

d. Would the project be located on expansive soil, creating substantial direct or indirect risks to life or property?

4.2.6 Expansive Soils

Soils with relatively high clay content that contain specific clay minerals (such as smectite clays) are considered expansive, which indicates that they shrink and swell in response to changing water content. This action is characterized by a soil's "shrink-swell potential," and can damage building and structural foundations via the differential movement of soil.

The shrink-swell potential of a soil can be quantified as its linear extensibility percent (LEP), which is based on the change in length of a sample as moisture content is decreased. LEPs and the corresponding LEP are summarized on below.

Table 2 Linear Extensibility Percent and Shrink-Swell Classes

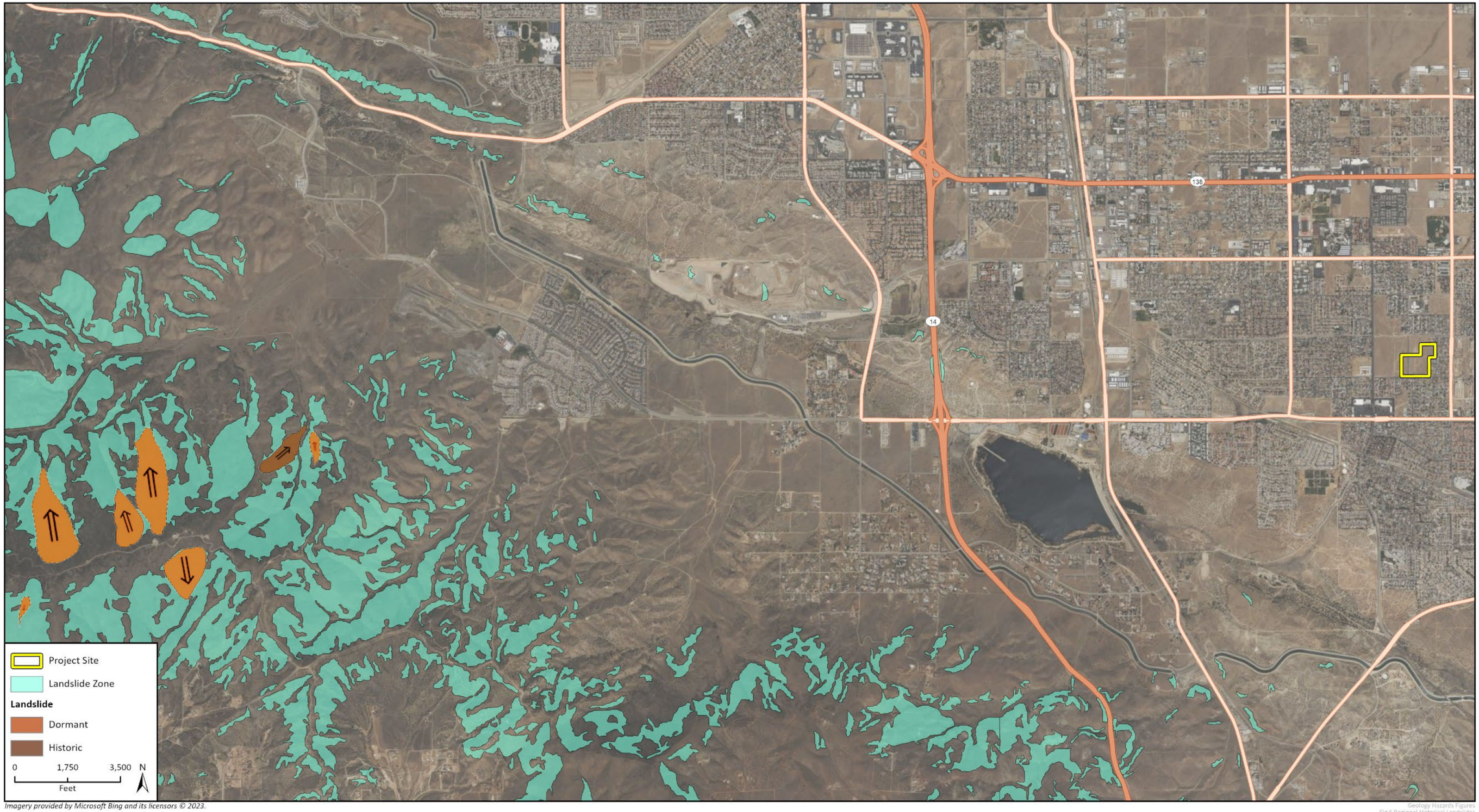
Shrink-Swell Class	LEP (percent)
Low	<3
Moderate	3 – 6
High	6 – 9
Very High	>9

Soils falling into the Moderate to Very High Shrink-Swell class have the potential to damage buildings, roads, and other structures if not mitigated.

As discussed in Section 3.3, the Project Site has been mapped in an area predominantly containing soil classified as Rosamond loam, with minor areas of Adelanto and Hesperia series soils in the southeast and northeast corners of the site respectively (Figure 7; USDA 1970). Rosamond loam has a reported LEP of 3.4%. The Adelanto and Hesperia series soils have LEPs of 1.1 and 1.5% respectively (UCD 2022). Therefore, there is a low to moderate risk of expansive soils.

However, a soils report for the Project Site will be required with submission of the grading permit application (CoP 2022b). The soils report will assess the shrink-swell potential of onsite soils in accordance with the City's Guidelines for Preparation of Geotechnical Reports. With implementation of required soil report, this impact would be less than significant.

Figure 6 Historical Landslides and Landslide Zones



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Landslide data provided by California Geological Survey, 2022.

Geology Hazards Figures
Fig 6 Regional Historical Landslides

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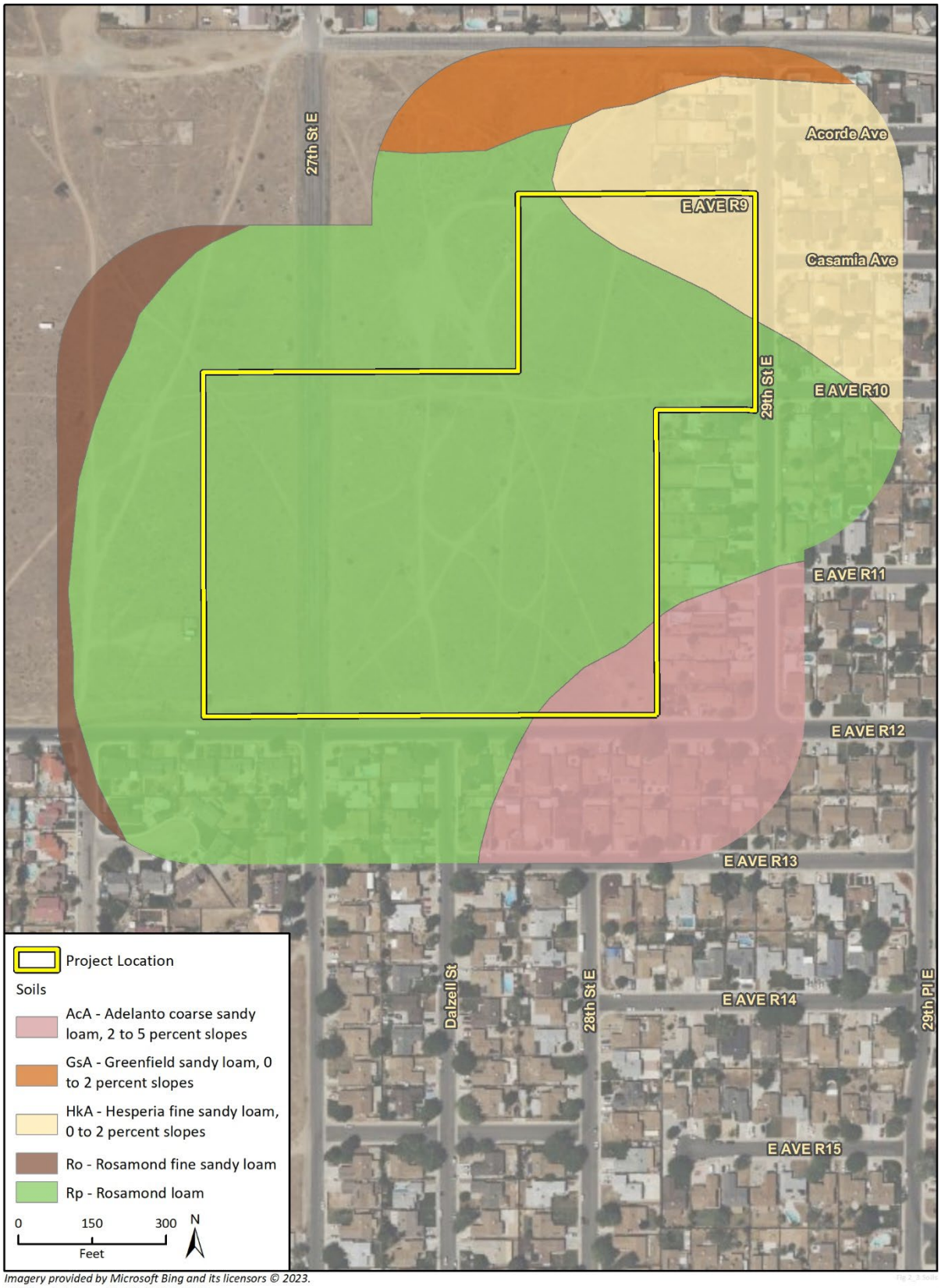
Figure 7 Soil Classifications



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Additional data provided by USDA, 2022.

b. Would the project result in substantial soil erosion or the loss of topsoil?

4.2.7 Erosion

Erosion is a natural process whereby soil and weathered rock materials are worn away and transported, most commonly by wind or water. This action presents hazards to structures because it removes soils, which can undermine foundational elements, and transports and deposits the eroded material at other locations, which could cover roads, fill in reservoirs, and cause other impairments to infrastructure.

The soil erodibility factor, or K-value, of the Universal Soil Loss Equation (USLE) and Revised Universal Soil Loss Equation (RUSLE), was used to assess the Project Site's vulnerability to erosion by surface water run-off (sheet and rill erosion). The K-value is a measure of the susceptibility of soil particles to detachment and transport by rainfall and runoff. K-values range from 0.02 to 0.69, and other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by surface water flows (Renard et. al. 1994). Soil erodibility and the associated K-factor ranges are presented on below:

Table 3 Soil Erodibility and K-Factor Ranges

K-Factor Range	Soil Erodibility
0.05 – 0.2	Low
0.2 – 0.4	Moderate
0.4 – 0.69	High

From: http://www.iwr.msu.edu/rusle/kfactor.htm

As discussed in Section 3.3, the Project Site has been mapped in an area predominantly containing soil classified as Rosamond loam, with minor areas of Adelanto and Hesperia series soils in the southeast and northeast corners of the site respectively (Figure 7); USDA 19870. Rosamond loam has a K-factor ranging from 0.32 to 0.49. The Adelanto and Hesperia series soils have K-factors ranging between 0.17 and 0.28, and 0.24 to 0.28 respectively (UCD 2022).

Based on these findings, there is a low to moderate soil erosion risk. The primary source of erosion would be during initial site ground disturbance and construction and from storm water runoff. However, prior to the initiation of construction, the Project would be required to obtain coverage under a Construction General Permit to comply with NPDES permitting program to control construction stormwater discharges. Compliance with the conditions of the Construction General Permit would require the developer to prepare and implement a Stormwater Pollution Prevention Plan (SWPPP) to reduce potential erosion and loss of topsoil during project construction activities. Typical Best Management Practices (BMPs) included in a SWPPP may include covering of inactive stockpiles, silt fences and gravel bag berms to trap sediments, and inlet protection, and slope stabilization to limit discharge of eroded soils from the construction site and sedimentation of surface waters offsite. Preparation of the required SWPPP would help ensure the project would not result in substantial temporary or long-term erosion or loss of topsoil. With implementation of required NPDES permitting program requirements, this impact would be less than significant.

5 Conclusions and Recommendations

Based on this Geologic and Soil Hazards Evaluation, there are no potentially significant impacts posed to or by the Project, and no mitigation measures are recommended provided that the applicant prepares a soils report per the Palmdale Municipal Code requirements and comply with the Construction General Permit and all other required reports and/or permits required by local, State, and Federal regulations are prepared for the Project.

6 Limitations

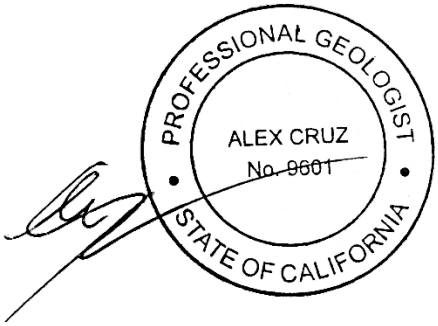
Rincon prepared this Report in a manner that is consistent with the level of care and skill ordinarily exercised by other members of the environmental profession. The conclusions, opinions, and recommendations presented herein are based on a limited number of observations and data; conditions could vary between or beyond the data evaluated. Rincon makes no other representation, guarantee or warranty, express or implied, regarding the services, communication (oral or written), Report, opinions, or instruments of service provided.

Rincon's Report is preliminary in nature and performed solely from a review of available public information. No interviews were conducted, regulatory agency personnel contacted or consulted, site reconnaissance performed, samples obtained, and no form of site or laboratory testing completed.

Although risk can never be eliminated, more detailed and extensive studies will yield more information, which may help understand and manage the level of risk involved. Since detailed study and analysis involves greater expense, clients participate in determining levels of service that provide adequate information for their purposes at acceptable levels of risk. More extensive studies could be performed to reduce these uncertainties and are recommended. The Limitations of this Report apply to any electronic data submitted to the client that is associated with this desktop review.

7 List of Preparers

This Report was prepared in accordance with generally accepted practices and procedures, under the direction of the following registered environmental professionals with Rincon Consultants, Inc.



This document has been digitally signed and sealed by Alex Cruz, PG, on 8/3/2023.

Alex Cruz, PG
Senior Environmental Geologist

This document has been digitally signed and sealed by Torin Snyder, PG, CHG on 8/3/2023.

Torin Snyder, PG, CHG
Principal

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