5.5 Geology and Soils

5.5.1 INTRODUCTION

This section addresses potential environmental effects of the proposed Project related to geology, soils, seismicity, and paleontological resources. The impacts examined include risks related to geologic hazards such as earthquakes, landslides, liquefaction, expansive soils; impacts on the environment related to soil erosion and sedimentation; and impacts related to paleontological resources. The analysis in this section is based, in part, on the following documents and resources:

- *City of Redlands General Plan 2035,* December 5, 2017;
- *City of Redlands General Plan Update and Climate Action Plan Environmental Impact Report* (General Plan EIR), Dyett & Bhatia, July 2017;
- *City of Redlands Municipal Code;*
- *Redlands Transit Villages Specific Plan Project Cultural and Paleontological Assessments*, Material Culture Consulting, February 2022 (Appendix C)

5.5.2 REGULATORY SETTING

5.5.2.1 Federal Regulations

Society of Vertebrate Paleontology

The Society of Vertebrate Paleontology's Handbook for Society of Vertebrate Paleontology and Official Society Policy and Guidelines outlines practices and guidelines for practicing paleontologists. Additionally, the Society provides standard procedures for the assessment and mitigation of adverse impacts to paleontological resources.

5.5.2.2 State Regulations

Public Resources Code (PRC) Section 5097.5

Requirements for paleontological resource management are included in the PRC Division 5, Chapter 1.7, Section 5097.5, and Division 20, Chapter 3, Section 30244, which states: No person shall knowingly and willfully excavate upon, or remove, destroy, injure or deface any historic or prehistoric ruins, burial grounds, archaeological or vertebrate paleontological site, including fossilized footprints, inscriptions made by human agency, or any other archaeological, paleontological or historical feature, situated on public lands, except with the express permission of the public agency having jurisdiction over such lands. Violation of this section is a misdemeanor. These statutes prohibit the removal, without permission, of any paleontological site or feature from lands under the jurisdiction of the state or any city, county, district, authority, or public corporation, or any agency thereof. As a result, local agencies are required to comply with PRC 5097.5 for their own activities, including construction and maintenance, as well as for permit actions (e.g., encroachment permits) undertaken by others. PRC Section 5097.5 also establishes the removal of paleontological resources as a misdemeanor, and requires reasonable mitigation of adverse impacts to paleontological resources from developments on public (state, county, city, and district) lands.

5.5.2.3 Local Regulations

City of Redlands General Plan 2035

The following policies contained in the City of Redlands General Plan 2035 are relevant to implementing projects within the proposed TVSP related to paleontological resources:

Principle 2-P.16 Work with local paleontologists to identify significant non-renewable paleontological resources.

Action 2-A.75 Require, as a standard condition of approval, that project applicants provide an assessment as to whether grading for the Proposed Project would impact underlying soil units or geologic formations that have a moderate to high potential to yield fossiliferous materials, prior to issuance of a grading permit. If the potential for fossil discovery is moderate to high, require applicants to provide a paleontological monitor during rough grading of the project.

Action 2-A.76 Establish a procedure for the management of paleontological materials found onsite during a development, including the following provisions:

- If materials are found on-site during grading, require that work be halted until a qualified professional evaluates the find to determine if it represents a significant paleontological resource.
- If the resource is determined to be significant, the paleontologist shall supervise removal of the material and determine the most appropriate archival storage of the material.
- Appropriate materials shall be prepared, catalogued, and archived at the applicant's expense and shall be retained within San Bernardino County if feasible.

5.5.3 ENVIRONMENTAL SETTING

Paleontological Resources

Paleontological resources include any fossilized remains, traces, or imprints of organisms, preserved in or on the earth's crust, that are of paleontological interest and that provide information about the history of life on earth, except that the term does not include any materials associated with an archaeological resource or any cultural item defined as Native American human remains. Significant paleontological resources are defined as fossils or assemblages of fossils that are unique, unusual, rare, uncommon, or important to define a particular time frame or geologic strata, or that add to an existing body of knowledge in specific areas, in local formations, or regionally.

The Specific Plan Area is situated at the foot of the San Bernardino Mountains, a part of the Transverse Ranges Geomorphic Province. The mountains within the province, including the San Gabriel and San Bernardino mountains to the north and northeast, were uplifted by tectonic activity, and provide a major sedimentary source for the alluvium basins of the adjacent areas.

The geologic units underlying the Specific Plan Area are mapped as younger and older Quaternary surficial deposits, more specifically very young wash deposits, active (Qvyw), young axial-valley deposits, Unit 3 (Qya3), old alluvial-fan deposits, Unit 3 (Qof3), and very old axial-valley deposits, Unit 3 (Qvoa3). Very young surficial deposits are the result of recently transported and deposited sediment into channels and washes on surfaces of alluvial fans, alluvial plains, and on hill slopes. Older surficial deposits contain sedimentary units that are moderately consolidated and slightly to moderately dissected. Alluvial-fan deposits (Qof series) are gravelly sand and silt sediments. Very old surficial deposits are sedimentary units that are moderately to well consolidated to lithified, and moderately to well dissected. Valley-filling deposits

(Qvoa series) are dominated by sand with minor gravel alluvial deposits and includes residuum or pedogenic-soil profile developed on the San Timoteo Formation beds. The Plio-Pleistocene San Timoteo Formation is located south of the Specific Plan Area in more elevated terrain and may underlie younger and older Quaternary deposits in the Specific Plan Area (MCC 2022).

5.5.4 THRESHOLDS OF SIGNIFICANCE

Appendix G of State CEQA Guidelines indicates that a project could have a significant effect if it were to:

GEO-1 Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving:

- GEO-1i Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault. (Refer to Division of Mines and Geology Special Publication 4),
- GEO-1ii Strong seismic ground shaking,
- GEO-1iii Seismic-related ground failure, including liquefaction;
- GEO-1iv Landslides;

GEO-2 Result in substantial soil erosion or the loss of topsoil;

GEO-3 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;

GEO-4 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;

GEO-5 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

GEO-6 Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature.

The Initial Study established that the proposed Project would not result in impacts related to Thresholds GEO-1i, GEO-1iv, and GEO-5 and less than significant impacts related to Thresholds GEO-1ii, GEO-1iii, GEO-2, GEO-3, and GEO-4. No further assessment of these impacts is required in this Draft EIR.

5.5.5 METHODOLOGY

In determining whether a paleontological related impact would result from the proposed Project, the analysis includes consideration of the types of soils that exist within the Specific Plan Area, the paleontological sensitivity of those soils, the past disturbance on the site, and the proposed excavation. The analysis combines these factors to identify the potential of construction from implementing projects within the Specific Plan Area to impact any unknown paleontological resources.

5.5.6 ENVIRONMENTAL IMPACTS

IMPACT GEO-6: THE PROJECT WOULD NOT DIRECTLY OR INDIRECTLY DESTROY A UNIQUE PALEONTOLOGICAL RESOURCE OR SITE OR UNIQUE GEOLOGIC FEATURE.

Less than Significant Impact with Mitigation Incorporated.

Unique Geologic Feature

Notable geological features in the Valley Region of San Bernardino County include the San Andreas Fault at the southwest foot of the San Bernardino Mountains, the San Jacinto Fault at the southwest edge of the San Bernardino Basin, and the Cucamonga Fault at the southern foot of the San Gabriel Mountains. However, there are no unique geological features in the vicinity of the Specific Plan Area (PlaceWorks, 2019). As such, construction of implementing projects pursuant to the TVSP would not result in impacts to unique geologic features.

Paleontological Resources

The paleontological record search did not yield any fossil localities within the Specific Plan Area and no fossil localities within one mile of the Specific Plan Area. However, nine fossil localities from similar sedimentary deposits have been recorded within a 70-mile radius of the Specific Plan Area. The closest fossil locality from the LACM Records Search is LACM IP 437, located approximately 20-miles east of the Specific Plan Area. The locality came from an unknown Pleistocene formation and consisted of invertebrates at an unknown depth. Additional literature was consulted, including the University of California Museum of Paleontology (UCMP)'s Miocene Mammal Mapping Project (MioMap), resulting in eight fossil localities from the San Timoteo Formation located approximately five miles south-southeast of the Specific Plan. These eight localities are the closest fossils to the Specific Plan Area. Additionally, 11 localities from the San Timoteo Formation and 13 localities from the Mount Eden Formation are located approximately 13 to 18 miles southeast of the Specific Plan Area, near the city of Beaumont (MCC 2022).

Additionally, Older Quaternary alluvium, similar to the old alluvial-fan and very old axial-valley deposits mapped within the Specific Plan Area, have produced significant Pleistocene fossils throughout Southern California. While the younger deposits typically do not contain significant fossils within the uppermost layers, it is likely they are underlain by older Quaternary deposits and, potentially, Plio-Pleistocene San Timoteo Formation. Therefore, excavations have the potential to impact paleontologically sensitive sediments throughout the Specific Plan Area (both at the surface and in the subsurface) and potentially destroy the fossil resources contained within. Therefore, Mitigation Measure GEO-1 is included to require preparation of paleontological resources management program (PRMP) for future projects that propose subsurface disturbance greater than five feet deep within areas mapped as low sensitivity or any subsurface disturbance within an area mapped as a high sensitivity geologic unit. With implementation of Mitigation Measure GEO-1, impacts related to paleontological resources would be less than significant.

5.5.7 CUMULATIVE IMPACTS

Impacts to paleontological resources are also site-specific rather than cumulative. Soils within the Valley Region of San Bernardino County, including the Specific Plan Area, are sensitive for paleontological resources. However, with incorporation of Mitigation Measure GEO-1, which protects paleontological resources from loss or destruction and requires that new development within the Specific Plan Area include appropriate measures to preserve the quality and integrity of these resources, avoid them when possible, and salvage and preserve them if avoidance is not possible, cumulative impacts would be less than significant.

5.5.8 EXISTING REGULATIONS, STANDARD CONDITIONS, AND PLANS, PROGRAMS, OR POLICIES

Existing Regulations

None.

Standard Conditions

None.

Plans, Programs, or Policies

None.

5.5.9 LEVEL OF SIGNIFICANCE BEFORE MITIGATION

Without mitigation, Impact GEO-6 would be **potentially significant.**

5.5.10 MITIGATION MEASURES

Mitigation Measure GEO-1: Paleontological Resources Management Program (PRMP). If a project proposes subsurface disturbance within an area mapped as a high sensitivity geologic unit (i.e., older alluvial deposits), or subsurface disturbance greater than 5 feet deep within an area mapped at the surface as a low sensitivity geologic unit (i.e., younger alluvial deposits), a paleontological resource management program (PRMP) is required unless a qualified paleontologist retained by a Project Proponent provides a letter to the City verifying that a PRMP is not warranted based on the results of a project-specific assessment. The PRMP will be reviewed and approved by the City prior to the issuance of a grading permit. The PRMP will be designed and implemented prior to any ground disturbance activities to monitor, salvage, and curate any recovered fossils associated with the project area, should these be unearthed. It is recommended that, if necessary, a project's PRMP implement the following standard procedures:

1. The applicant shall retain a qualified paleontologist (Project Paleontologist) approved by the City to create and implement a project-specific plan for monitoring site grading/earthmoving activities. As per Society of Vertebrate Paleontology (SVP) guidelines, a qualified paleontological monitor is an individual who has demonstrated sufficient paleontological training and field experience to have acceptable knowledge and experience of fossil identification, salvage and collection methods, paleontological techniques, and stratigraphy. An undergraduate degree in geology or paleontology is preferable but is less important than documented experience performing paleontological monitoring. The paleontological monitor must work under the direction of the Project Paleontologist.
2. The project paleontologist retained shall review the approved development plan and grading plan and conduct any pre-construction work necessary to render appropriate monitoring requirements as appropriate. These requirements shall be documented by the project paleontologist in a paleontological resource management program (PRMP). This PRMP shall be submitted to the City for approval prior to issuance of a grading permit. Information to be contained in the PRMP, at a minimum and in addition to other industry standards and Society of Vertebrate Paleontology standards, are as follows:
    a. The Project Paleontologist shall participate in a pre-construction project meeting with development staff and construction operations to ensure an understanding of any monitoring measures required during construction, as applicable.

b. Paleontological monitoring of earthmoving activities will be conducted on an as-needed basis by the project paleontologist during all earthmoving activities that may expose sensitive strata. Earthmoving activities in areas of the project area where previously undisturbed strata will be buried but not otherwise disturbed will not be monitored. The project paleontologist or his/her assign will have the authority to reduce monitoring once he/she determines the probability of encountering fossils has dropped below an acceptable level.
c. If the Project Paleontologist finds fossil remains, earthmoving activities will be diverted temporarily around the fossil site until the remains have been evaluated, documented, and recovered. Earthmoving will be allowed to proceed through the site when the Project Paleontologist determines the fossils have been recovered and/or the site mitigated to the extent necessary.
d. If fossil remains are encountered by earthmoving activities when the Project Paleontologist is not onsite, these activities will be diverted around the fossil site and the Project Paleontologist called to the site immediately to evaluate, document, and recover the remains.
e. If fossil remains are encountered, fossiliferous rock and soil will be recovered from the fossil site and processed to allow for the recovery of smaller fossil remains. Test samples may be recovered from other sampling sites in the geologic unit if appropriate.
f. Any recovered fossil remains will be prepared to the point of identification and identified to the lowest taxonomic level possible by knowledgeable paleontologists. The remains then will be curated (assigned and labeled with museum* repository fossil specimen numbers and corresponding fossil site numbers, as appropriate; placed in specimen trays and, if necessary, vials with completed specimen data cards) and catalogued, an associated specimen data and corresponding geologic and geographic site data will be archived (specimen and site numbers and corresponding data entered into appropriate museum repository catalogs and computerized data bases) at the museum repository by a laboratory technician. The remains will then be accessioned into the museum* repository fossil collection, where they will be permanently stored, maintained, and, along with associated specimen and site data, made available for future study by qualified scientific investigators.
g. A qualified paleontologist shall prepare a report of findings made during all site grading activity with an appended itemized list of fossil specimens recovered during grading (if any). This report shall be submitted to the Development Services Department for review and approval prior to building final inspection as described elsewhere in these conditions.

A. Pregrading Conference

The Project Paleontologist and/or designee shall participate in a pre-grading conference with development staff and construction operations, to ensure an understanding of the monitoring requirements and implementation procedures to be utilized during construction. This meeting shall take place before the initiation of major ground-disturbing activities. Training at this meeting shall inform all construction personnel of the procedures to be followed upon the discovery of paleontological resources, general paleontological items, including the paleontology and geology of the area, as well as pictures of typical fossils that can be found during construction. This training should stress applicable state, federal, and local laws, and include

information on what to do in case an unanticipated discovery is made by a worker. All construction personnel should be instructed to stop work within a 50-foot radius of the find and immediately inform their field supervisor upon any discovery in the project area. The Project Paleontologist shall be called to assess the find to determine if monitors should be mobilized to the project area to examine and evaluate the fossils.

B. Paleontological Monitoring

Paleontological monitoring of earthmoving activities within older Quaternary alluvial deposits will be initially conducted on a full-time basis, and earthmoving activities below five feet within younger Quaternary alluvial deposits will be conducted on a part-time (spot-checking) basis by the paleontological monitor. The Project Paleontologist may re-evaluate the necessity for paleontological monitoring after initial examination of the affected sediments during excavation, which may result in part-time or spot-checking the remainder of excavations, or cessation of monitoring. Paleontological monitoring of construction excavations involves field inspection of trenches, spoils piles, scraped or graded surfaces. Monitors shall maintain close communication with the on-site construction personnel to maintain a safe working environment and to be fully appraised of the upcoming Project activity areas and any schedule changes. All monitors shall complete daily documentation of all construction activities requiring monitoring, including the location of monitoring activities throughout the day, observations of sediment type and distribution, observations regarding paleontological resources, collection of resources and other information. This documentation will be prepared by each monitor on each shift, in a Daily Field Monitoring Summary and Daily Paleontological Locality Collection log, as relevant to the discoveries each day. The monitor shall photograph ground disturbing activities, sediment, and resources for documentation purposes and will fill out a Photograph Log each day. The Daily Field Monitoring Summary, Daily Paleontological Locality Collection Log and/or Photograph Log shall comprise the field notes. These notes shall be filed weekly with the Project Paleontologist and be made available to the Proponent and City upon request.

C. *Monitor's Authority to Temporarily Halt Project Activities*

Paleontological monitors have authority to initiate a temporary work stoppage of construction activities to assess and/or recover paleontological discoveries. It is important that all earthmoving contractor personnel recognize the authority of the paleontological monitor(s) to redirect project construction activities. The monitor(s) will attempt to minimize schedule impacts, however, in cases of large discoveries, this process can be quite lengthy, and recent discoveries in the region have shown the area to be highly sensitive for paleontological materials. The monitor(s) will stay with the discovery and notify the construction foreman and the Project Paleontologist. The monitor will demarcate a 50-foot buffer zone around the specimen using flagging or other high-visibility methods until the find is assessed and potential impacts to paleontological resources are avoided, minimized, or mitigated.

D. Data Recovery Plan for Paleontological Resources

If fossils are discovered, the qualified paleontological monitor shall recover them. In the instance of an extended salvage period, the Project Paleontologist shall work with the construction manager to temporarily direct, divert, or halt earthwork to allow recovery of fossil remains in a timely manner. If the find is too large to be managed by one monitor, additional assistance will be called upon to expedite the process. Because of the potential for the recovery of small fossil remains, it may be necessary to collect bulk samples (up to 6,000 pounds) of sedimentary rock matrix. Screen-washing will only occur in the event of a significant discovery. The Project Paleontologist will consult with the Project Applicant/Proponent prior to collecting any bulk samples. Scientifically significant fossils of microscopic size consisting of vertebrates, invertebrates,

plants, or trace fossils, may be in sediments that produce significant finds. The locations of any significant discoveries should be sampled and later screen-washed and picked in the paleontological laboratory to fully document the microfaunal or microfloral diversity of the locality.

Construction activities shall continue outside of a 50-foot buffer to the discovery site based on the size of the fossil and in consultation with the foreperson and other construction leads. All scientifically important fossils shall be salvaged and fully documented within a detailed stratigraphic framework as construction conditions and safety considerations permit. Fossils will only be retrieved from within the project boundaries. Once the fossils have been partially prepared in the laboratory, non-significant resources such as bone fragments lacking identifiable features (processes or definable skeletal structures) shall be discarded or used only for educational or public outreach purposes.

F. Monitoring Compliance Report

The Project Paleontologist shall prepare a final paleontological report prior to issuance of final building inspection, or other City milestone, to verify compliance with project conditions and mitigation measures. The report shall follow industry standard guidelines and City of Redlands requirements and shall include at a minimum: a discussion of monitoring methods and techniques uses, the results of the monitoring program including any fossils recovered, an inventory of any resources recovered, locality forms, if any, final disposition of the resources, and any additional recommendations.

G. Curation of Paleontological Resources

Fossil remains collected during monitoring and salvage shall be cleaned, repaired, sorted, and catalogued as part of the monitoring program. When potentially scientifically significant fossil discoveries are made by paleontological monitors, they should be quickly and professionally explored, assessed, and evaluated to minimize construction delays; the City Development Services Department and Project Paleontologist will be notified immediately. Additional paleontologists will be brought in to assist with the salvage as needed. Salvages may consist of the relatively rapid removal of small isolated fossils from an active cut, to hand-quarrying of larger fossils over several hours, to excavations of large fossils or large numbers of smaller fossils from a bone bed over several days or weeks.

At each paleontological locality, the Project Paleontologist or paleontological monitor will record the field number, date of discovery and date of collection, geographic coordinates, elevation, formation, stratigraphic provenance, lithologic description of sediment that produced the fossil(s), type(s) of fossils and type(s) of element(s), taphonomic and paleoenvironmental interpretations, associations with other fossils, photograph(s), and collector(s). All fossils and matrix samples must be properly labeled prior to removal from the locality where they were discovered and taken to a secure laboratory for preparation to the point of identification and curation.

5.5.11 LEVEL OF SIGNIFICANCE AFTER MITIGATION

Implementation of Mitigation Measure GEO-1 would reduce potential impacts associated unique paleontological resource impacts to a level that is less than significant. Therefore, no significant unavoidable adverse impacts related to geology and soils and paleontological resources would occur.

REFERENCES

City of Redlands General Plan 2035. Accessed: https://www.cityofredlands.org/post/planning-division-general-plan

City of Redlands Municipal Code. Accessed: https://codelibrary.amlegal.com/codes/redlandsca/latest/redlands_ca/0-0-0-1

Material Cultural Consulting. Redlands Transit Villages Specific Plan Project Cultural and Paleontological Assessments (MCC 2022). January 2022. Appendix C.

This page intentionally left blank.