# COMBINED PALEONTOLOGICAL IDENTIFICATION AND EVALUATION REPORT WITHOUT SURVEY FOR THE HIGH DESERT CORRIDOR FREEWAY, LOS ANGELES AND SAN BERNARDINO COUNTIES, CALIFORNIA

07-LA and 08-SBD (PM: SR-14 to SR-18/I-15)
EA 116720; Project ID No. 0712000035

Approved by: Karl Price date 8/27/14
KARL PRICE ~~Kelly Ewing-Toledo~~, Branch Chief, Caltrans District 7
Division of Environmental Planning
100 S. Main Street, Los Angeles, CA 90012

Reviewed By: Date: 8/27/2014
Alex Kirkish, Principal Investigator PQS, Caltrans, District 7
Division of Environmental Planning,
100 South Main Street, Suite 100, Los Angeles, CA 90012

Submitted by: date August 20, 2014
Sherri M. Gust, M.S.: Qualified Principal Paleontologist
Kim Scott and Courtney Richards
Cogstone Resource Management Inc., 1518 W. Taft Avenue, Orange, CA 92865

**August 2014**

*For individuals with sensory disabilities this document is available in alternative formats. Please call or write to Alex Kirkish, California Department of Transportation District 7, 100 S. Main St, MS 16A, Los Angeles, CA 90012, 213-897-2795.*

**Key Words:** approximately 63 linear miles and 7789.6 acres; Lancaster West, Lancaster East, Ritter Ridge, Palmdale, Littlerock, Lovejoy Buttes, El Mirage, Shadow Mountains SE, Adelanto, Victorville, Turtle Valley, Apple Valley North, Apple Valley South, and Fifteenmile Valley 7.5-minute USGS Topographic Maps; Four fossil localities within the Project Study Area and another 63 are within a 1 mile radius of the study area; Keywords: Holocene, Pleistocene, Quaternary, Pliocene, Mesozoic, Paleozoic, Holocene, alluvium, alluvial fan, granitics, limestone; Anaverde Formation

# TABLE OF CONTENTS

**GEOLOGIC TERMS** ..... **III**
**EXECUTIVE SUMMARY** ..... **V**
**INTRODUCTION** ..... **1**
**PROJECT LOCATION AND DESCRIPTION** ..... **1**
PROJECT DESCRIPTION ..... 1
PURPOSE AND NEED ..... 1
PROJECT ALTERNATIVES ..... 2
*No Build Alternative* ..... *2*
*Freeway/Expressway Alternative (Avenue P-8, I-15, and SR-18)* ..... *2*
*Freeway/Tollway Alternative (Avenue P-8, I-15, and SR-18)* ..... *3*
*Freeway/Expressway Alternative with High-Speed Rail (HSR) Feeder/Connector Service* ..... *3*
*Freeway/Tollway Alternative with High-Speed Rail Feeder/Connector Service* ..... *3*
PREVIOUS VERSIONS OF APE ALTERNATIVES ..... 3
PROJECT STUDY AREA ..... 4
PROJECT PERSONNEL ..... 6
**REGULATORY ENVIRONMENT AND PERMITTING** ..... **7**
FEDERAL LAWS AND REGULATIONS ..... 7
*Paleontological Resources Protection Act* ..... *7*
*Federal-Aid Highway Act* ..... *9*
*National Environmental Policy Act* ..... *9*
*Antiquities Act* ..... *10*
STATE LAWS AND REGULATIONS ..... 10
*California Environmental Quality Act (CEQA)* ..... *10*
*Public Resources Code (PRC)* ..... *11*
SAN BERNARDINO COUNTY LAWS AND REGULATIONS ..... 11
PERMITTING REQUIREMENTS ..... 12
**RESOURCE CONTEXT** ..... **13**
REGIONAL GEOLOGY ..... 13
STRATIGRAPHY ..... 13
*Quaternary deposits* ..... *13*
*Quaternary older deposits* ..... *31*
*Pliocene Anaverde Formation* ..... *31*
*Mesozoic granitics* ..... *31*
*Paleozoic metasedimentary rocks* ..... *32*
**RECORD SEARCH** ..... **32**
**FIELD RECONNAISSANCE** ..... **34**
**PALEONTOLOGICAL SENSITIVITY** ..... **34**
**ADVERSE IMPACTS ANALYSIS** ..... **53**
BASELINE CONSIDERATIONS ..... 53
DEFINITION OF SIGNIFICANCE FOR PALEONTOLOGICAL RESOURCES ..... 53
SIGNIFICANCE EVALUATION ..... 54
**RECOMMENDATIONS** ..... **55**
**MITIGATION MEASURES** ..... **55**
**REFERENCES CITED** ..... **56**
**APPENDIX A. QUALIFICATIONS** ..... **58**
**APPENDIX B. PALEONTOLOGY RECORDS SEARCHES** ..... **63**
SAN BERNARDINO COUNTY MUSEUM RECORDS SEARCH ..... 64
UNIVERSITY OF CALIFORNIA MUSEUM OF PALEONTOLOGY AT BERKELEY RECORDS SEARCH ..... 71
NATURAL HISTORY MUSEUM OF LOS ANGELES COUNTY RECORDS SEARCH ..... 72

**APPENDIX C. SENSITIVITY RANKING CRITERIA ..... 74**

# LIST OF FIGURES

FIGURE 1. PROJECT VICINITY MAP ..... 1
FIGURE 2. PROJECT LOCATION MAP ..... 5
FIGURE 3. PROJECT GEOLOGY INDEX ..... 14
FIGURE 3A. PROJECT GEOLOGY, 1 OF 16 ..... 15
FIGURE 3B. PROJECT GEOLOGY, 2 OF 16 ..... 16
FIGURE 3C. PROJECT GEOLOGY, 3 OF 16 ..... 17
FIGURE 3D. PROJECT GEOLOGY, 4 OF 16 ..... 18
FIGURE 3E. PROJECT GEOLOGY, 5 OF 16 ..... 19
FIGURE 3F. PROJECT GEOLOGY, 6 OF 16 ..... 20
FIGURE 3G. PROJECT GEOLOGY, 7 OF 16 ..... 21
FIGURE 3H. PROJECT GEOLOGY, 8 OF 16 ..... 22
FIGURE 3I. PROJECT GEOLOGY, 9 OF 16 ..... 23
FIGURE 3J. PROJECT GEOLOGY, 10 OF 16 ..... 24
FIGURE 3K. PROJECT GEOLOGY, 11 OF 16 ..... 25
FIGURE 3L. PROJECT GEOLOGY, 12 OF 16 ..... 26
FIGURE 3M. PROJECT GEOLOGY, 13 OF 16 ..... 27
FIGURE 3N. PROJECT GEOLOGY, 14 OF 16 ..... 28
FIGURE 3O. PROJECT GEOLOGY, 15 OF 16 ..... 29
FIGURE 3P. PROJECT GEOLOGY, 16 OF 16 ..... 30
FIGURE 4. PROJECT PALEONTOLOGIC SENSITIVITY INDEX ..... 36
FIGURE 4A. PROJECT PALEONTOLOGIC SENSITIVITY, 1 OF 16 ..... 37
FIGURE 4B. PROJECT PALEONTOLOGIC SENSITIVITY, 2 OF 16 ..... 38
FIGURE 4C. PROJECT PALEONTOLOGIC SENSITIVITY, 3 OF 16 ..... 39
FIGURE 4D. PROJECT PALEONTOLOGIC SENSITIVITY, 4 OF 16 ..... 40
FIGURE 4E. PROJECT PALEONTOLOGIC SENSITIVITY, 5 OF 16 ..... 41
FIGURE 4F. PROJECT PALEONTOLOGIC SENSITIVITY, 6 OF 16 ..... 42
FIGURE 4G. PROJECT PALEONTOLOGIC SENSITIVITY, 7 OF 16 ..... 43
FIGURE 4H. PROJECT PALEONTOLOGIC SENSITIVITY, 8 OF 16 ..... 44
FIGURE 4I. PROJECT PALEONTOLOGIC SENSITIVITY, 9 OF 16 ..... 45
FIGURE 4J. PROJECT PALEONTOLOGIC SENSITIVITY, 10 OF 16 ..... 46
FIGURE 4K. PROJECT PALEONTOLOGIC SENSITIVITY, 11 OF 16 ..... 47
FIGURE 4L. PROJECT PALEONTOLOGIC SENSITIVITY, 12 OF 16 ..... 48
FIGURE 4M. PROJECT PALEONTOLOGIC SENSITIVITY, 13 OF 16 ..... 49
FIGURE 4N. PROJECT PALEONTOLOGIC SENSITIVITY, 14 OF 16 ..... 50
FIGURE 4O. PROJECT PALEONTOLOGIC SENSITIVITY, 15 OF 16 ..... 51
FIGURE 4P. PROJECT PALEONTOLOGIC SENSITIVITY, 16 OF 16 ..... 52

# LIST OF TABLES

TABLE 1. USGS 7.5' MAPS, TOWNSHIP RANGES, AND SECTIONS ..... 6
TABLE 2. FOSSILS KNOWN FROM THE QUATERNARY ALLUVIAL DEPOSITS ..... 33
TABLE 3. FOSSILS KNOWN FROM THE ANAVERDE FORMATION ..... 34
TABLE 4. PALEONTOLOGICAL SENSITIVITY RANKINGS ..... 35

# LIST OF ACRONYMS AND ABBREVIATIONS

**BLM** – Bureau of Land Management
**B.A.** – Bachelors of Art
**B.S.** – Bachelors of Science
**Caltrans** - California Department of Transportation
**CEQA** – California Environmental Quality Act
**CFR** - Code of Federal Regulations
**FHWA** – Federal Highway Administration
**HDC** - High Desert Corridor
**HSR** - High Speed Rail
**I-15** – Interstate 15
**LACM** – Natural History Museum of Los Angeles County
**Metro** - Los Angeles County Metropolitan Transportation Authority
**mph** - miles per hour
**M.S.** – Masters of Science
**NEPA** – National Environmental Policy Act
**NHPA** - National Historic Preservation Act
**PER –** Paleontological Evaluations Report
**PFYC** – Potential Fossil Yield Classification
**PIR -** Paleontological Identification Report
**PL –** Public Law
**PM** – Post Mile
**PMP -** Paleontological Mitigation Plan
**PRC –** Public Resources Code
**PSA –** High Desert Corridor Project Study Area
**SBCM –** San Bernardino County Museum
**SR** - State Route
**UCMP –** University of California Museum of Paleontology
**US-395** - United States Highway 395
**USC** – Unites States Code
**USGS –** United States Geological Survey

# GEOLOGIC TERMS

**Qa** – Quaternary (Holocene) alluvium
**Qc** - Quaternary (Holocene) playa deposits
**Qg** - Quaternary (Holocene) Mojave River deposits
**Qs** - Quaternary (Holocene) dune sand
**Qoa** - Pleistocene older alluvium
**Qos** – Pleistocene older schist cobble conglomerates
**Tac** - Pliocene Anaverde Formation, sandstone
**Tas** - Pliocene Anaverde Formation, grey shale
**gqm** - Mesozoic granite and quartz monzonite
**hdg** - Mesozoic hornblende diorite and gabbro
**qd** - Mesozoic quartz diorite
**qm** - Mesozoic quartz monzonite
**ml** - Paleozoic limestone

# EXECUTIVE SUMMARY

The purpose of this document is to assess the potential for impacting fossil resources to identify and evaluate paleontological resources within the proposed High Desert Corridor (HDC) Project Study Area (PSA) in Los Angeles and San Bernardino counties. The High Desert Corridor (HDC) project is being undertaken by the California Department of Transportation (Caltrans) in coordination with the Los Angeles County Metropolitan Transportation Authority (Metro) and other partner agencies. The High Desert Corridor project involves the construction of a new, approximately 63-mile long, east-west freeway/expressway, and possible toll or rail facility, between State Route (SR) 14 in Los Angeles County and SR 18 in San Bernardino County

Geologic mapping indicates that virtually the entire project is mapped as Quaternary alluvium derived from the San Gabriel and San Bernardino mountains to the south. Additional Quaternary units include dune sands, playa and river deposits. Quaternary older alluvium and Quaternary older schist gravels, the Pliocene Anaverde Formation, Mesozoic plutonic rocks, and Paleozoic metasedimentary rocks are also to be impacted. The PSA and a one-mile radius were searched for resources. Four localities were present within the PSA and an additional sixty three localities occur within one mile of the project.

Paleontological sensitivity analysis ranked the Mesozoic plutonic rocks as Caltrans no sensitivity and Paleontological Fossil Yield Classification (PFYC) 1. The Holocene deposits, Quaternary older schist cobble conglomerate, and the Paleozoic metasedimentary rocks were ranked low on both the Caltrans and PFYC (level 2) scales. As a limestone the Paleozoic deposits may include fossils and were ranked Caltrans low and PFYC 3b indicating moderate potential but undemonstrated yield. Three geologic units were ranked as Caltrans high and PFYC 3a indicating moderate potential but unpredictable location of occurrence. These are the Quaternary older alluvium, and both units of the Anaverde Formation. No project rock units were ranked higher.

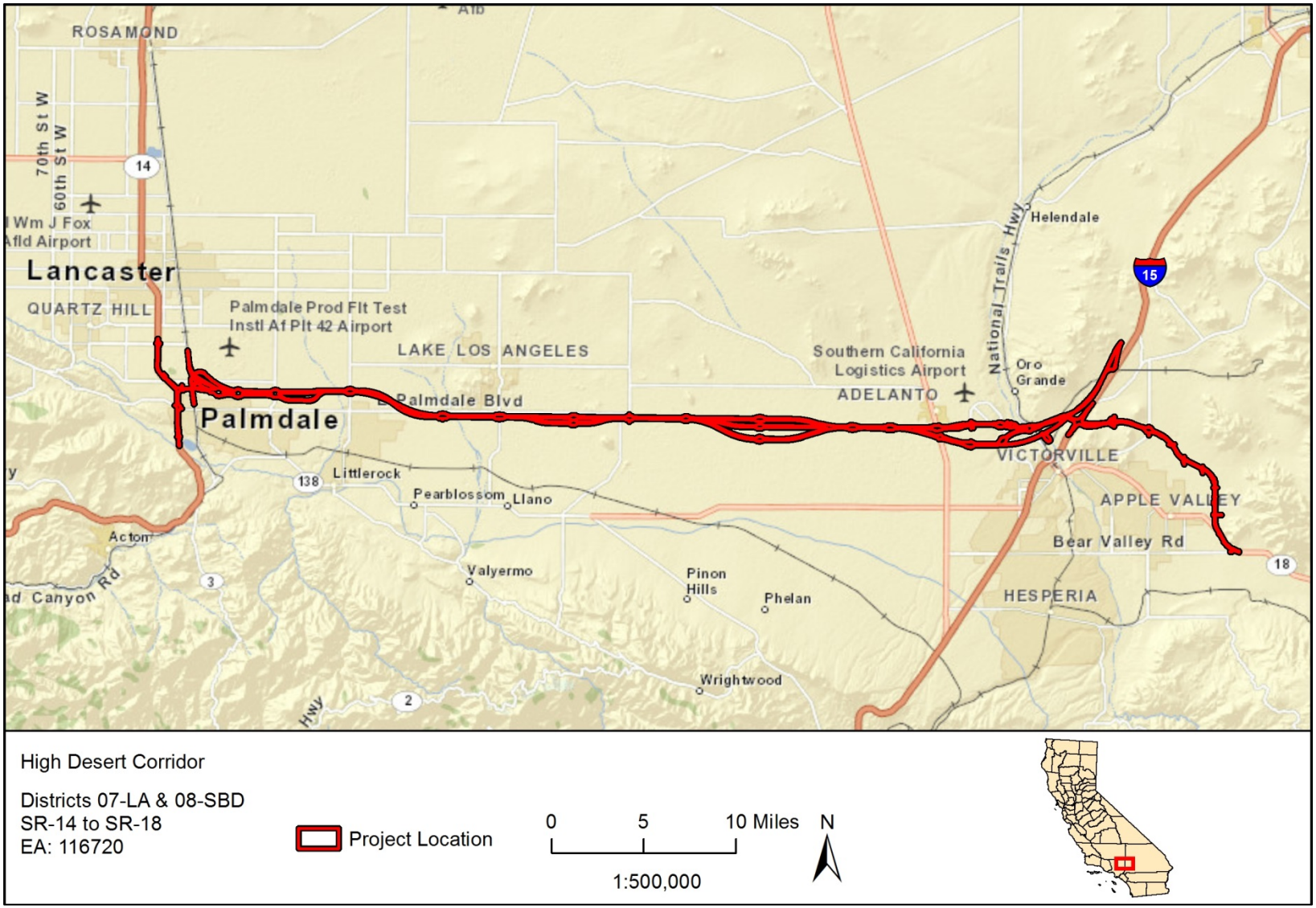
Grading, excavation and other surface and subsurface excavation in defined areas of the proposed project have the potential to impact significant nonrenewable fossil resources of Pleistocene and Pliocene age. All excavations in areas mapped as Quaternary older alluvium (Qoa) and Anaverde Formation (Tac, Tas) have the potential to encounter significant paleontological resources and should be monitored full time. Excavations more than 10 feet in depth into Quaternary alluvial deposits (Qa, Qg, Qc, Qs) should be spot checked periodically for the presence of older, paleontologically sensitive sediments. Should sediments conducive to fossil preservation be encountered, monitoring should be implemented in those areas. Areas mapped as Paleozoic rocks (ml) and Quaternary older schist cobble conglomerate (Qos) should be reviewed for the fossil potential. Areas mapped as Mesozoic rocks (qm, hdg, qd, gqm) do not require monitoring. Drilling activities are also exempt from monitoring as recovered fossil fragments would not meet significance criteria. A Paleontological Mitigation Plan (PMP) shall be prepared by a qualified paleontologist prior to the start of construction.

# INTRODUCTION

The High Desert Corridor (HDC) project is being undertaken by the California Department of Transportation (Caltrans) in coordination with the Los Angeles County Metropolitan Transportation Authority (Metro) and other partner agencies. The High Desert Corridor project involves the construction of a new, approximately 63-mile long, east-west freeway/expressway, and possible toll or rail facility, between State Route (SR) 14 in Los Angeles County and SR 18 in San Bernardino County (Figure 1).

Originally conceived of in the 1970s, environmental studies were begun on two small components of the High Desert Corridor in 2007 and 2009. In 2007, the City of Victorville, with oversight from Caltrans District 7, began work on High Desert Corridor-Phase I, a project between SR 395 and SR 18 on the eastern end of the corridor. On the western end, Caltrans District 7 began working in 2009 on the new State Route 138 project between SR 14 and 100$^{th}$ Street East. A Phase I Cultural Resources Survey of that portion of the High Desert Corridor was completed and approved by Caltrans in 2011 (Wood & Robinson 2011). Through consultation with regulatory and resource agencies for the proposed projects, it was determined that they should be combined into one large project, the High Desert Corridor, which incorporates the two “end pieces” and fills in the gap between them.

The proposed project is located in the western Mojave Desert region stretching from SR 14 in Los Angeles County to SR 18 in San Bernardino County. The proposed project would run through the City of Palmdale in an east-west direction parallel to the existing Avenue P-8 corridor from SR 14 to 100$^{th}$ Street East for a distance of approximately 10 miles. At 110$^{th}$ St East the proposed project curves south and heads west parallel to East Palmdale Blvd. In San Bernardino County, the proposed project parallels Air Expressway or Rancho Rd, depending on the alternative. It crosses the Mojave River and I-15 and leads into Apple Valley. In Apple Valley, near Corwin Rd, the proposed project turns south and terminates at SR 18. SR 14 would also be widened and several ramps altered or replaced over a length of five miles along the existing SR 14 alignment. Similarly, I-15 will be improved over a two mile length, with two new intersections.




High Desert Corridor

Districts 07-LA & 08-SBD
SR-14 to SR-18
EA: 116720

Project Location

0 5 10 Miles

1:500,000

N

**Figure 1. Project Vicinity Map**

# PROJECT LOCATION AND DESCRIPTION

## PROJECT DESCRIPTION

The California Department of Transportation (Caltrans), in cooperation with the Los Angeles County Metropolitan Transportation Authority (Metro), proposes construction of the High Desert Corridor (HDC) as a new transportation facility in the High Desert region of Los Angeles and San Bernardino counties. The proposed 63-mile-long west-east facility would provide route continuity and relieve traffic congestion between State Route (SR) 18 and United States Highway 395 (US 395) in San Bernardino County with SR-14 in Los Angeles County. The project would comprise of one or more of the following major components, including highway, tollway, rail transit, bikeway, and recommendation for green energy facilities.

## PURPOSE AND NEED

The purpose of the proposed action is to improve west-east mobility through the High Desert region of southern California by addressing present and future travel demand and mobility needs within the Antelope and Victor valleys. The proposed action is intended to achieve the following objectives:

- Increase capacity of west-east transportation facilities to accommodate existing and future transportation demand
- Improve travel safety and reliability within the High Desert region
- Improve the regional goods movement network
- Provide improved access and connectivity to regional transportation facilities, including airports and existing and future passenger rail systems, which include the proposed California HSR system and the proposed XpressWest HSR system
- Contribute to state greenhouse gas (GHG) reduction goals through the use of green energy features

The specific needs to be addressed by the proposed action include:

- Recent and future planned population growth within the High Desert region
- Limited and unreliable west-east connectivity within the High Desert region
- Regional demands for goods movement to support the growth of the regional economy
- Future demands for the use of green energy, including sustainability and green energy provisions in state law and policy

## PROJECT ALTERNATIVES

Several project alternatives and design variations have been considered and evaluated. A No Build Alternative and four build alternatives were selected for detailed evaluation in the Draft Environmental Impact Report/Environmental Impact Statement.

### NO BUILD ALTERNATIVE

Under the No Build alternative, no new transportation infrastructure would be built within the project area to connect Los Angeles and San Bernardino Counties aside from existing SR-138 safety corridor improvements in Los Angeles County and SR-18 corridor improvements in San Bernardino County. Traffic circulation and congestion currently experienced on Palmdale Boulevard, Air Expressway, and Happy Trails Highway (existing SR-18) would remain. The no action alternative functions as a baseline to compare against all of the proposed build alternatives.

### FREEWAY/EXPRESSWAY ALTERNATIVE (AVENUE P-8, I-15, AND SR-18)

This alternative would consist of a combination of a controlled-access freeway and an expressway. It generally would follow Avenue P-8 in Los Angeles County and just south of El Mirage Road in San Bernardino County. This alternative then extends east to Air Expressway Road near I-15 and curves south, terminating at Bear Valley Road. The incorporation of green energy technologies and a bike path along segments of the alternative would also be considered.

Four physical alignment variations are being considered, including:

- Variation A: Near Palmdale, the freeway/expressway would dip slightly south of the main alignment, approximately between 15$^{th}$ Street East and Little Rock Wash.
- Variation B: East of the county line, the freeway/expressway would flare out slightly south of the main alignment between Oasis Road and Coughlin Road. Variation B1 would be at the same location, but it would flare out a little less and pass through the Krey airfield.
- Variation D: Near the community of Lake Los Angeles, the freeway/expressway would dip slightly south of the main alignment, just south of Avenue R approximately between 180$^{th}$ Street East and 230$^{th}$ Street East.
- Variation E: Near Adelanto and Victorville, the freeway/expressway would dip south of the federal prison.

### FREEWAY/TOLLWAY ALTERNATIVE (AVENUE P-8, I-15, AND SR-18)

This alternative would follow the same physical alignment as the Freeway/Expressway Alternative (including Variations A, B, D, and E), but it would have a section between 100th Street East and US 395 operate as a tollway. Details of this operating feature are being evaluated as part of an ongoing P3 analysis. The incorporation of green energy technologies and a bike path would also be considered.

### FREEWAY/EXPRESSWAY ALTERNATIVE WITH HIGH-SPEED RAIL (HSR) FEEDER/CONNECTOR SERVICE

This alternative would be the same as the Freeway/Expressway Alternative except that it would also include an HSR Feeder/Connector Service between the cities of Palmdale and Victorville. The HSR Feeder/Connector Service would utilize proven steel wheel-on-steel track technology and have a design speed of 180 miles per hour (mph) with an operating speed of 160 mph. Additional details of this operating feature, including the type of train technology (i.e., electric versus diesel-electric), its location in relation to the HDC (median-running alignment), and its connections to existing and proposed rail stations, are being evaluated as part of an ongoing Rail Alternatives Analysis. The incorporation of green energy technologies and a bike path would also be considered.

### FREEWAY/TOLLWAY ALTERNATIVE WITH HIGH-SPEED RAIL FEEDER/CONNECTOR SERVICE

This alternative would be the same as the Freeway/Tollway Alternative except that it would also include an HSR Feeder/Connector Service between the cities of Palmdale and Victorville. The incorporation of green energy technologies and a bike path would also be considered.

## PREVIOUS VERSIONS OF APE ALTERNATIVES

During the current phase of cultural resources survey from 2011 through 2013, design and engineering changes to the proposed project resulted in Alternative footprints for portions of the project. These Alternatives are no longer being considered in the same exact configuration. Several Alternative variations were proposed to find a Right-of-Way (ROW) across the Mojave River while avoiding both sensitive cultural resources and planned housing developments approved by the City of Victorville. These variations were surveyed in the field, and then were further refined by Caltrans to limit disturbance to sites and avoid extensive testing and data recovery excavations. Other variations were developed for the roadway footprint, and then discarded after further consideration. High speed train alternatives were proposed beginning in 2012, and further refined or discarded due to engineering issues.

## PROJECT STUDY AREA

The PSA is mapped on the Lancaster West, Lancaster East, Ritter Ridge, Palmdale, Littlerock, Lovejoy Buttes, El Mirage, Shadow Mountains SE, Adelanto, Victorville, Turtle Valley, Apple Valley North, Apple Valley South, and Fifteenmile Valley 7.5' United States Geological Survey topographic maps, within the San Bernardino Base Meridian (Table 1, Figure 2). The project includes approximately 63-linear miles of potential new construction between SR-14 in Los Angeles County and I-15 and SR-18 in San Bernardino County, incorporating much of the current SR-18 in the improvements (Figure 1, 2).

Designs for the project are not completed as of yet, however the vertical impact is expected to be approximately 30 feet in some of the bridge construction.

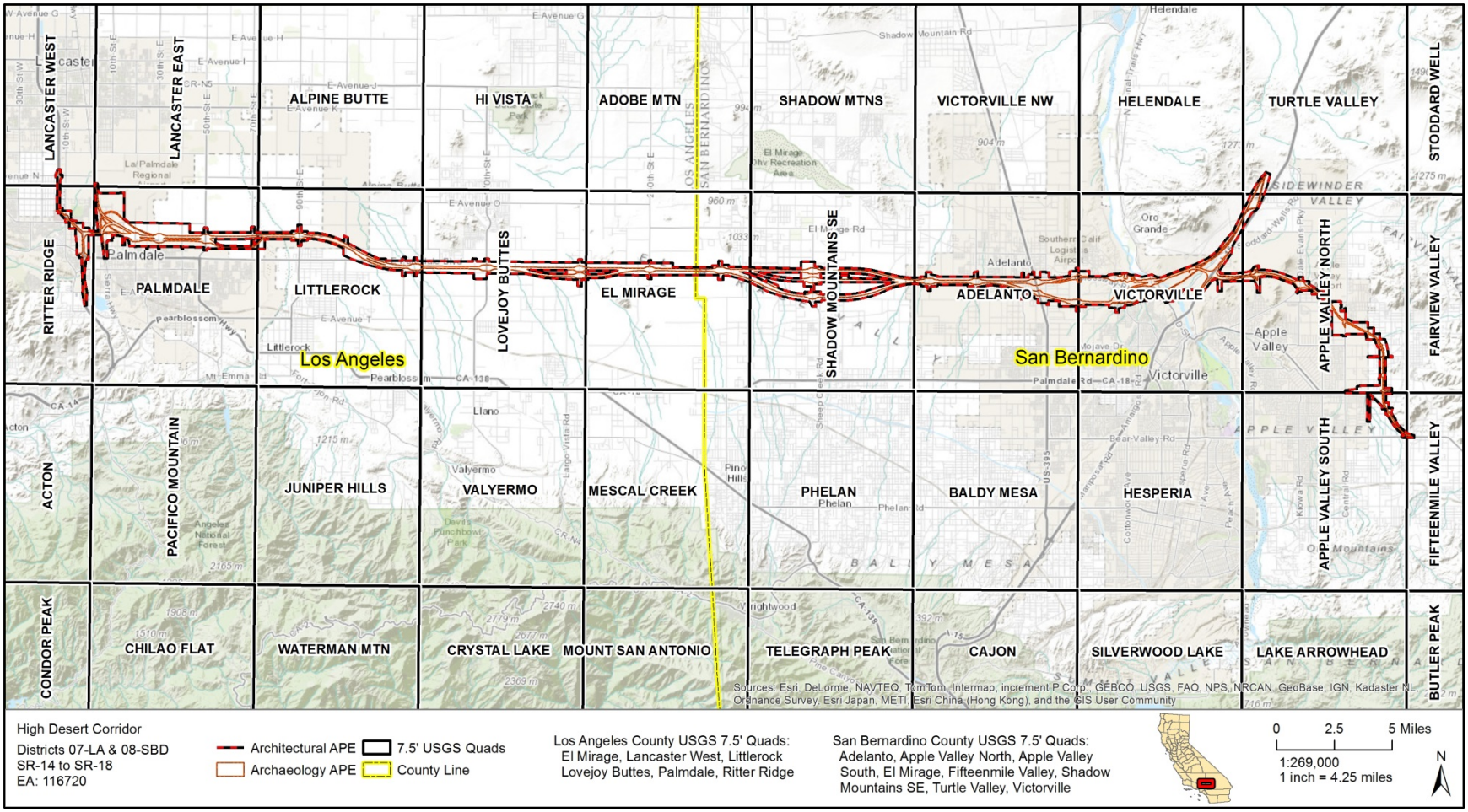



**Figure 2. Project Location Map**

**Table 1. USGS 7.5' Maps, Township Ranges, and Sections**

| Los Angeles County | | | |
|---|---|---|---|
| **USGS 7.5' Quad** | **Township** | **Range** | **Sections** |
| El Mirage | 6N | 8W | 25-29, 32, 33 |
| Lancaster East | 6N | 12W | 11 |
| Lancaster West | 6N | 12W | 4, 9 |
| Little Rock | 6N | 9W | 30 |
| | | 10W | 19-22, 25-27 |
| | | 11W | 24 |
| Lovejoy Buttes | 6N | 8W | 29-32 |
| | | 9W | 25-28, 29, 30, 36 |
| Palmdale | 6N | 11W | 19-23, 24 |
| | | 12W | 11, 13, 14, 23, 24, 26 |
| Ritter Ridge | 6N | 12W | 9, 15, 16, 21-23, 27, 34 |
| | 6N | 12W | 4 |
| **San Bernardino County** | | | |
| **USGS 7.5' Quad** | **Township** | **Range** | **Sections** |
| El Mirage | 6N | 7W | 28-30, 33 |
| Shadow Mountains SE | 5N | 7W | 2 |
| | 6N | 6W | 28-34 |
| | | 7W | 2, 25-27, 34-36 |
| Adelanto | 5N | 5W | 2, 3 |
| | 6N | 5W | 26, 27, 31-34, 35 |
| | | 6W | 34, 35, 36 |
| Victorville | 5N | 4W | 6 |
| | | 5W | 1, 2 |
| | 6N | 4W | 13, 23-25, 26, 27-36 |
| | | 5W | 25, 26, 35, 36 |
| Turtle Valley | 6N | 3W | 6, 7 |
| | | 4W | 12 |
| Apple Valley North | 5N | 3W | 2, 3, 10, 11, 12, 13, 24 |
| | 6N | 3W | 7, 29-34 |
| | | 4W | 12, 13, 25 |
| Apple Valley South | 4N | 2W | 6 |
| | 5N | 3W | 25, 36 |
| | | 2W | 31 |
| Fifteenmile Valley | 5N | 2W | 6, 31, 32 |

## PROJECT PERSONNEL

Cogstone Resource Management Inc. conducted the research and prepared the report. Sherri Gust served as Principal Investigator for the project, supervised all work, and edited this report. Gust is a Qualified Principal Paleontologist with a M.S. in Anatomy (Evolutionary Morphology) from the

University of Southern California, a B.S. in Anthropology from the University of California at Davis, and over 35 years of experience in California.

Kim Scott prepared portions of the report. Scott has a M.S. in Biology with an emphasis in paleontology from California State University, San Bernardino and over 18 years of experience in California paleontology and geology. Courtney Richards also prepared portions of the report. Richards has a M.S. in Biological Sciences with an emphasis in Paleontology from Marshall University, a B.S. in Earth and Space Sciences from the University of Washington and more than two years of experience in California. André Simmons prepared the GIS report maps. Simmons has a B.A. in Anthropology from California State University, Fullerton, cross-training in paleontology, and three years of GIS experience. Qualifications of project personnel are provided (Appendix A).

# REGULATORY ENVIRONMENT AND PERMITTING

This project is subject to federal, state and local legislation and guidelines regarding paleontological resources.

## FEDERAL LAWS AND REGULATIONS

A variety of Federal statutes specifically address paleontological resources. They generally become applicable to specific projects if that delivery crosses Federal lands or involves a Federal agency license, permit, approval, or funding.

### PALEONTOLOGICAL RESOURCES PROTECTION ACT

The Paleontological Resources Preservation Act (Public Law (PL) 111-011, Title VI, Subtitle D on Paleontological Resources Preservation) requires the Secretaries of the Interior and Agriculture to manage and protect paleontological resources on Federal land using scientific principles and expertise. The law affirms the authority for many of the policies the Federal land managing agencies already have in place for the management of paleontological resources such as issuing permits for collecting paleontological resources, curation of paleontological resources, and confidentiality of locality data. It only applies to Federal lands. It provides authority for the protection of significant paleontological resources on Federal lands including criminal and civil penalties for fossil theft and vandalism. The act states (in part):

a) The term ‘‘paleontological resource’’ means 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.

b) The Secretary shall manage and protect paleontological resources on Federal land using scientific principles and expertise.

c) The Secretary shall develop appropriate plans for inventory, monitoring, and the scientific and educational use of paleontological resources, in accordance with applicable agency laws, regulations, and policies. These plans shall emphasize interagency coordination and collaborative efforts where possible with non-Federal partners, the scientific community, and the general public.

d) A paleontological resource may not be collected from Federal land without a permit issued under this subtitle by the Secretary.

e) The Secretary may issue a permit for the collection of a paleontological resource pursuant to an application if the Secretary determines that:

1) the applicant is qualified to carry out the permitted activity;

2) the permitted activity is undertaken for the purpose of furthering paleontological knowledge or for public education;

3) the permitted activity is consistent with any management plan applicable to the Federal land concerned; and

4) the proposed methods of collecting will not threaten significant natural or cultural resources.

f) A permit for the collection of a paleontological resource issued under this section shall contain such terms and conditions as the Secretary deems necessary to carry out the purposes of this subtitle. Every permit shall include requirements that:

1) the paleontological resource that is collected from Federal land under the permit will remain the property of the United States;

2) the paleontological resource and copies of associated records will be preserved for the public in an approved repository, to be made available for scientific research and public education; and

3) specific locality data will not be released by the permittee or repository without the written permission of the Secretary.

g) Any paleontological resource, and any data and records associated with the resource, collected under a permit, shall be deposited in an approved repository. The Secretary may enter into agreements with non-Federal repositories regarding the curation of these resources, data, and records.

h) Information concerning the nature and specific location of a paleontological resource shall be exempt from disclosure under section 552 of title 5, United States Code, and any other law unless the Secretary determines that disclosure would further the purposes of

> this subtitle, not create risk of harm to or theft or destruction of the resource or the site containing the resource and be in accordance with other applicable laws.

### FEDERAL-AID HIGHWAY ACT

Section 305 of the Federal Aid Highway Act of 1956 (20 United States Code (USC) 78, 78a) gives the Federal Highway Administration (FHWA) authority to use Federal funds to salvage archaeological and paleontological sites affected by highway projects. The Archaeological and Paleontological Statute (23 USC 305) amends the Antiquities Act of 1906. Specifically, it states:

> Funds authorized to be appropriated to carry out this title to the extent approved as necessary, by the highway department of any State, may be used for archaeological and paleontological salvage in that state in compliance with the Act entitled "An Act for the preservation of American Antiquities," approved June 8, 1906 (PL 59-209; 16 USC 431-433), and State laws where applicable.

This statute allows funding for mitigation of paleontological resources recovered pursuant to Federal aid highway projects, provided that "excavated objects and information are to be used for public purposes without private gain to any individual or organization" (Federal Register [FR] 46(19): 9570).

### NATIONAL ENVIRONMENTAL POLICY ACT

The National Environmental Policy Act (NEPA; 42 USC 4321-4347) mandates the protection of cultural resources within its general policy for environmental protection. It requires the preservation of important historic, cultural, and natural aspects of our national heritage, and the maintenance, wherever possible, of an environment that supports diversity and a variety of individual choice. Regulations promulgated by the Advisory Council on Historic Preservation provide for the coordination of NEPA and National Historic Preservation Act (NHPA) compliance, under 36 CFR Part 800.14(a). Regulations for implementing the procedural provisions of NEPA are available at 40 Code of Federal Regulations (CFR) Part 1500-1508.

If the presence of a significant environmental resource is identified during the scoping process, Federal agencies and their agents must take the resource into consideration when evaluating project effects. Consideration of paleontological resources may be required under NEPA when a project is proposed for development on Federal land, or land under Federal jurisdiction. The level of consideration depends upon the Federal agency involved.

### ANTIQUITIES ACT

The Antiquities Act of 1906 (16 USC 431-433) states, in part:

> That any person who shall appropriate, excavate, injure or destroy any historic or prehistoric ruin or monument, or any object of antiquity, situated on lands owned or controlled by the Government of the United States, without the permission of the Secretary of the Department of the Government having jurisdiction over the lands on which said antiquities are situated, shall upon conviction, be fined in a sum of not more than five hundred dollars or be imprisoned for a period of not more than ninety days, or shall suffer both fine and imprisonment, in the discretion of the court.

Although there is no specific mention of natural or paleontological resources in the Act itself, or in the Act's uniform rules and regulations (Title 43 Part 3, 43 CFR 3), "objects of antiquity" has been interpreted to include fossils by the National Park Service, the Bureau of Land Management (BLM), the Forest Service, and other Federal agencies. Permits to collect fossils on lands administered by Federal agencies are authorized under this Act (see “Permit Requirements” section, below). Therefore, projects involving Federal lands will require permits for both paleontological resource evaluation and mitigation efforts.

## STATE LAWS AND REGULATIONS

Paleontological resources are protected by state law. This protection covers all vertebrate fossils (animals with backbones) and any unique paleontological locality.

### CALIFORNIA ENVIRONMENTAL QUALITY ACT (CEQA)

The CEQA of 1970 as amended states that: It is the policy of the state that public agencies should not approve projects as proposed if there are feasible alternatives or feasible mitigation measures available which would substantially lessen the significant environmental effects of such projects, and that the procedures required are intended to assist public agencies in systematically identifying both the significant effects of proposed projects and the feasible alternatives or feasible mitigation measures which will avoid or substantially lessen such significant effects (Chapter 1, Section 21002).

CEQA Guidelines (Article 1, Section 15002(a)(3)) state that CEQA is intended to:
Prevent significant, avoidable damage to the environment by requiring changes in projects through the use of alternatives or mitigation measures when the governmental agency finds the changes to be feasible.

If paleontological resources are identified during the paleontological assessment as being within the proposed project area, the sponsoring agency must take those resources into consideration

when evaluating project effects. The level of consideration may vary with the importance of the resource.

### PUBLIC RESOURCES CODE (PRC)

Section 5097.5 states that no person shall knowingly and willfully excavate upon, or remove, destroy, injure or deface any … vertebrate paleontological site, including fossilized footprints, …, 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.

## SAN BERNARDINO COUNTY LAWS AND REGULATIONS

Paleontological resources are protected by county ordinances. This protection covers all of the County of San Bernardino (Development Code §82.20.040) defines a qualified paleontologist as meeting the following criteria:

> Education: An advanced degree (Masters or higher) in geology, paleontology, biology or related disciplines (exclusive of archaeology).
>
> Professional experience: At least five years professional experience with paleontologic (not including cultural) resources, including the collection, identification and curation of the resources.

The County of San Bernardino (Development Code §82.20.030) requires that paleontologic mitigation programs include, but not be limited to:

> (a) All paleontological work will be supervised by a qualified paleontologist.
>
> (b) Field survey before grading. In areas of potential but unknown sensitivity, field surveys before grading shall be required to establish the need for paleontologic monitoring.
>
> (c) Monitoring during grading. A project that requires grading plans and is located in an area of known fossil occurrence, or that has been demonstrated to have fossils present in a field survey, shall have all grading monitored by trained paleontologic crews working under the direction of a qualified paleontologist, so that fossils exposed during grading can be recovered and preserved. Paleontologic monitors shall be equipped to salvage fossils as they are unearthed, to avoid construction delays, and to remove samples of sediments that are likely to contain the remains of small fossil invertebrates and vertebrates. Monitors shall be empowered to temporarily halt or divert equipment to allow removal of abundant or large specimens. Monitoring is not necessary if the potentially-fossiliferous units described for the property in question

are not present, or if present are determined upon exposure and examination by qualified paleontologic personnel to have low potential to contain fossil resources.

(d) Recovered specimens. Qualified paleontologic personnel shall prepare recovered specimens to a point of identification and permanent preservation, including washing of sediments to recover small invertebrates and vertebrates. Preparation and stabilization of all recovered fossils is essential in order to fully mitigate adverse impacts to the resources.

(e) Identification and curation of specimens. Qualified paleontologic personnel shall identify and curate specimens into the collections of the San Bernardino County Museum (SBCM) Division of Geological Sciences, an established, accredited museum repository with permanent retrievable paleontologic storage. These procedures are also essential steps in effective paleontologic mitigation and CEQA compliance. The paleontologist must have a written repository agreement in hand prior to the initiation of mitigation activities. Mitigation of adverse impacts to significant paleontologic resources is not considered complete until curation into an established museum repository has been fully completed and documented.

(f) Report of findings. Qualified paleontologic personnel shall prepare a report of findings with an appended itemized of specimens. A preliminary report shall be submitted and approved before granting of building permits, and a final report shall be submitted and approved before granting of occupancy permits. The report and inventory, when submitted to the appropriate Lead Agency along with confirmation of the curation of recovered specimens into the collections of the SBCM, will signify completion of the program to mitigate impacts to paleontologic resources.

## PERMITTING REQUIREMENTS

The proposed project includes lands of the Bureau of Land Management (BLM). No permits were required for the preparation of this report.

# RESOURCE CONTEXT

## REGIONAL GEOLOGY

The PSA lies within the Mojave Desert Geomorphic Province which consists of fault bounded isolated mountain ranges and large expanses of desert. Most of the Project lies north of the San Andreas Fault Zone and east of the Garlock Fault Zone, both of which impact the alignment of the nearby mountain ranges. The Mojave Desert (also locally called the "High Desert") has a closed drainage system which results in thick alluvial fans and numerous playas (Wagner 2002).

## STRATIGRAPHY

Dibblee (2008a, 2008b, 2008c, 2008d; Figure 3) maps the majority of the PSA as Quaternary alluvium derived from the San Gabriel and San Bernardino mountains to the south. Additional Quaternary units include dune sands, playa and river deposits. Quaternary older alluvium and Quaternary older schist gravels, the Pliocene Anaverde Formation, Mesozoic plutonic rocks, and Paleozoic metasedimentary rocks are also to be impacted.

### QUATERNARY DEPOSITS

The majority of the Project is mapped as Holocene (less than 11,000 years old) alluvium (Qa; Figure 3 all maps; Dibblee 2008a, 2008b, 2008c, 2008d). Sediments include unconsolidated sands silts and gravels that increase in coarseness in relation to the location of the source. Much of the western and central portions of this project from Palmdale to Adelanto and the eastern portion of this project in Apple Valley consist of coarse to fine grained alluvial fan deposits off the San Gabriel- San Bernardino mountains and the local hills.

Deposits of Holocene (less than 11,000 years old) dune sand, playa deposits, and river deposits are also present. Quaternary (Holocene) dune sand (Qs; Figure 3g, 3o; Dibblee 2008b, 20008c) consists of windblown deposits of unconsolidated sand. Quaternary (Holocene) playa deposits (Qc; Figure 3f, 3n, 3o; Dibblee 2008a, 2008c, 2008d) are unconsolidated clays and silts deposited in a lake. Quaternary (Holocene) Mojave River deposits (Qg; Figure 3k; Dibblee 2008b; Bortugno and Spittler 1986) are unconsolidated silts to boulder sized stream deposits of the current Mojave River.

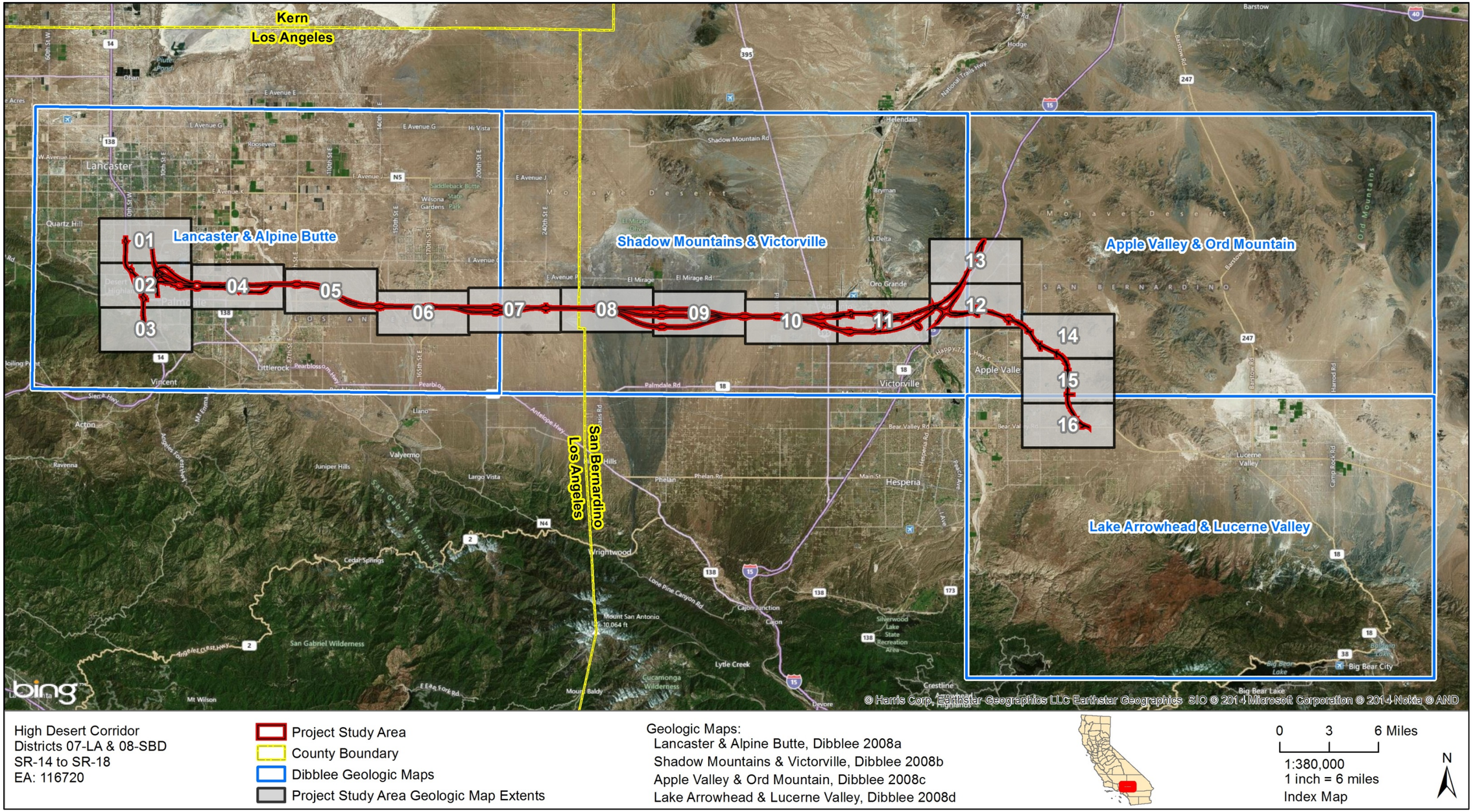



**Figure 3. Project Geology index**

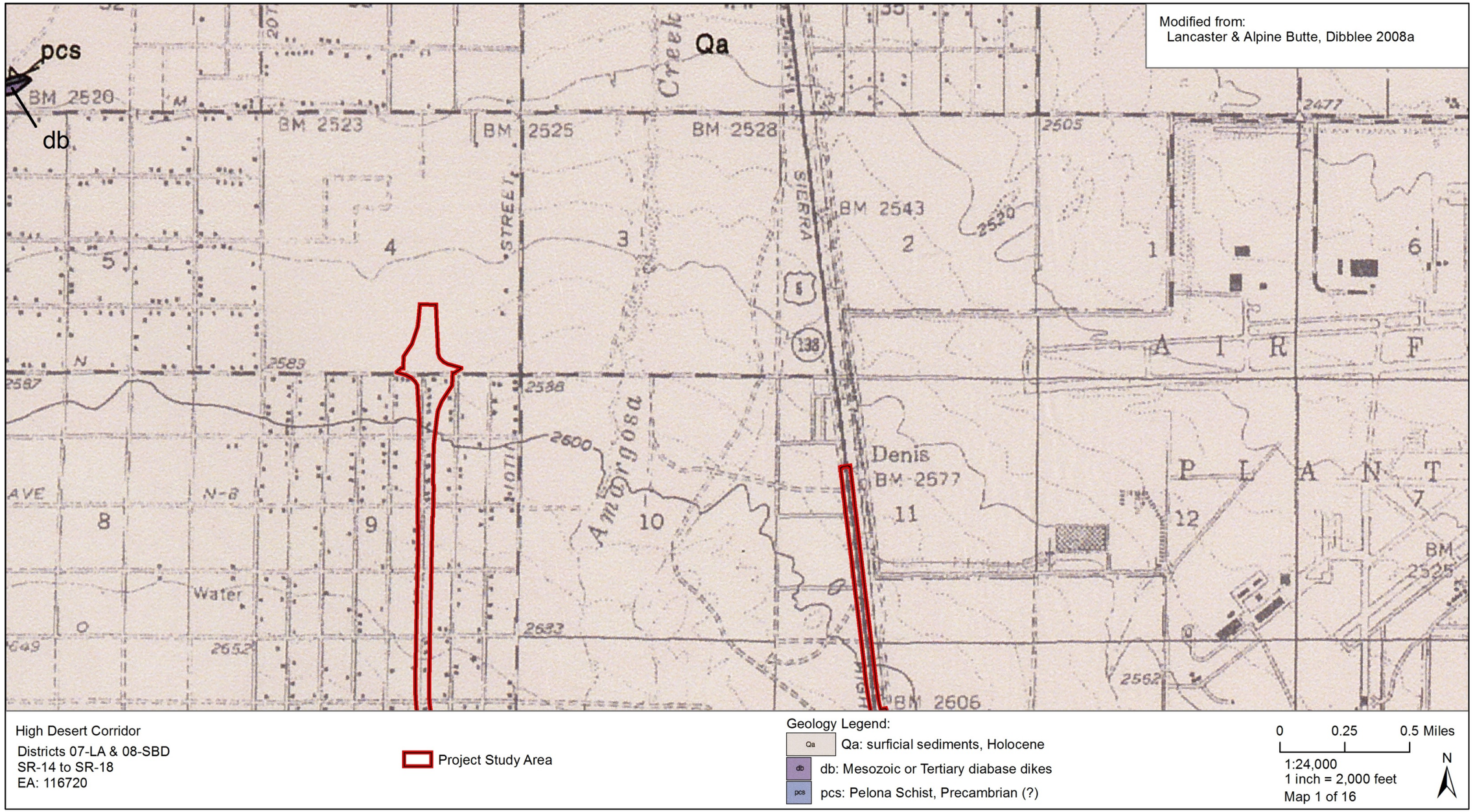



**Figure 4a. Project Geology, 1 of 16**

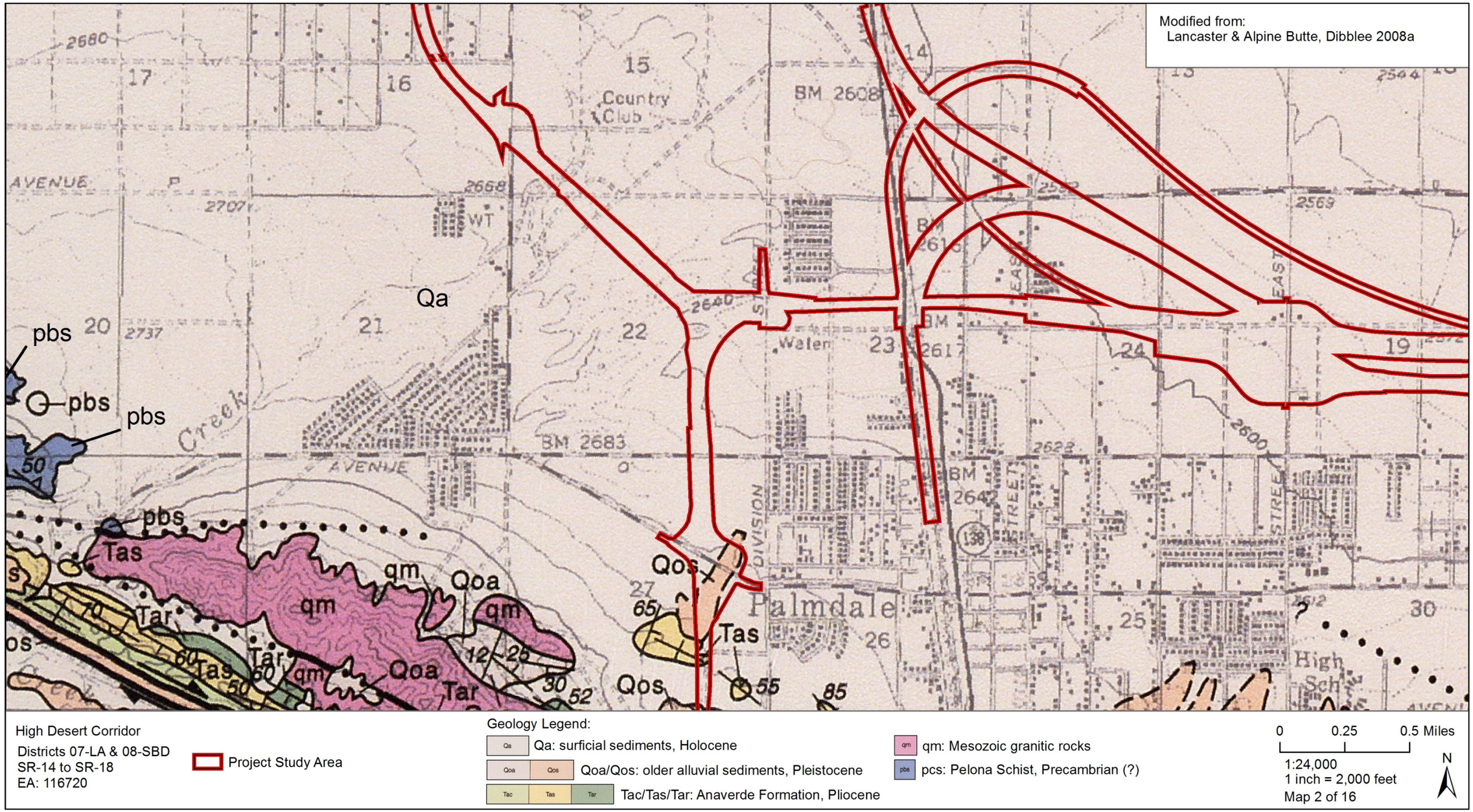



**Figure 5b. Project Geology, 2 of 16**

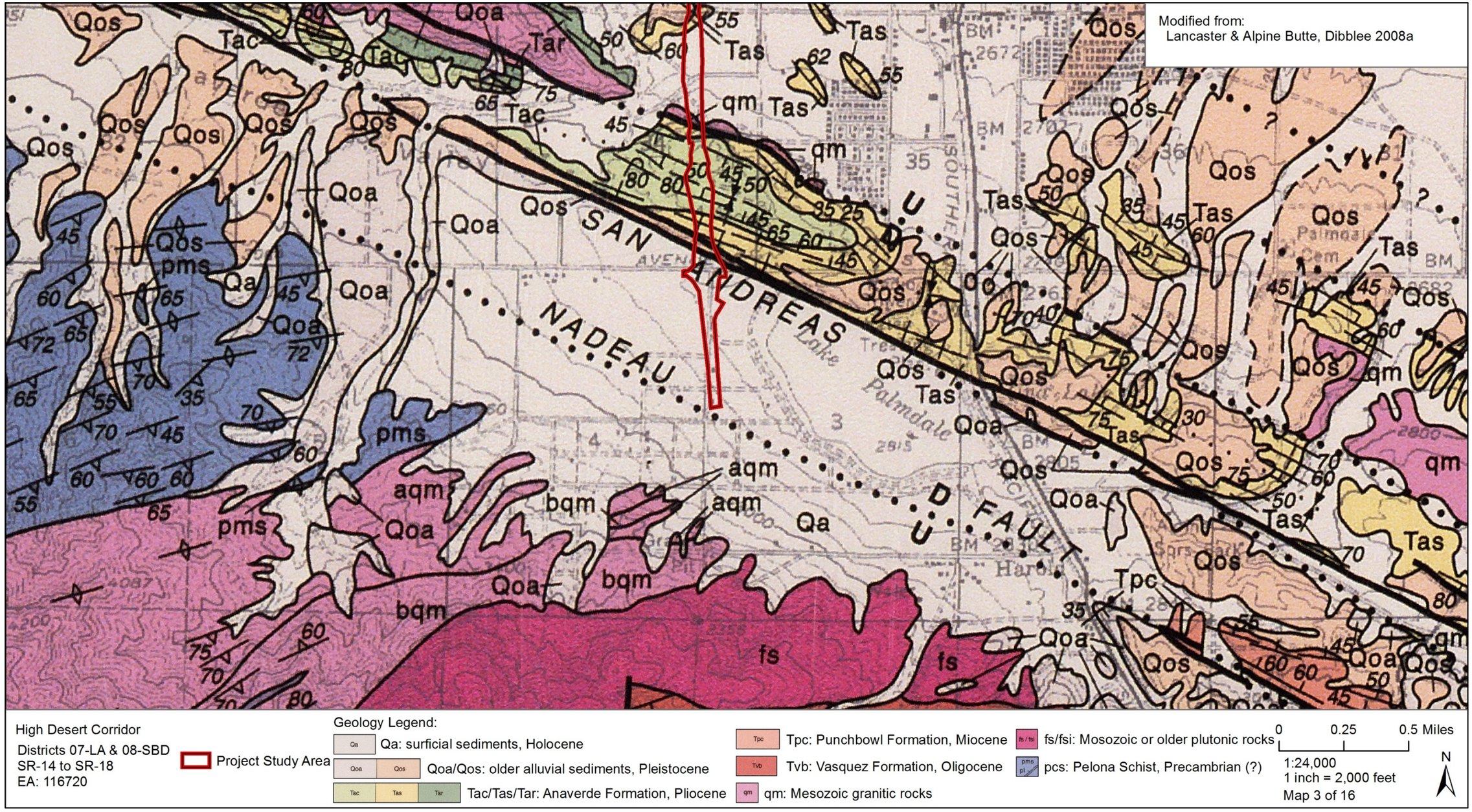
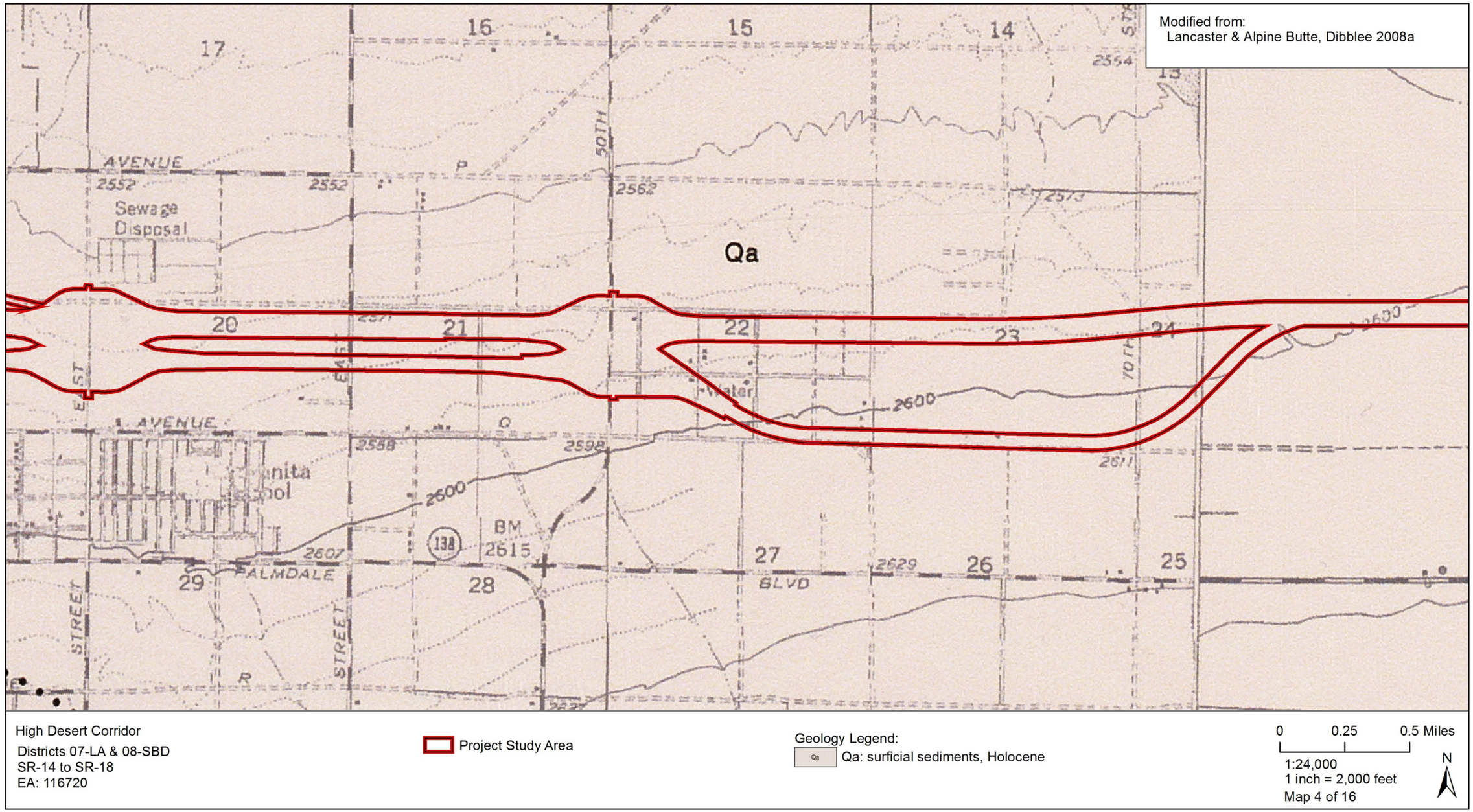



**Figure 6c. Project Geology, 3 of 16**




High Desert Corridor
Districts 07-LA & 08-SBD
SR-14 to SR-18
EA: 116720

**Figure 7d. Project Geology, 4 of 16**

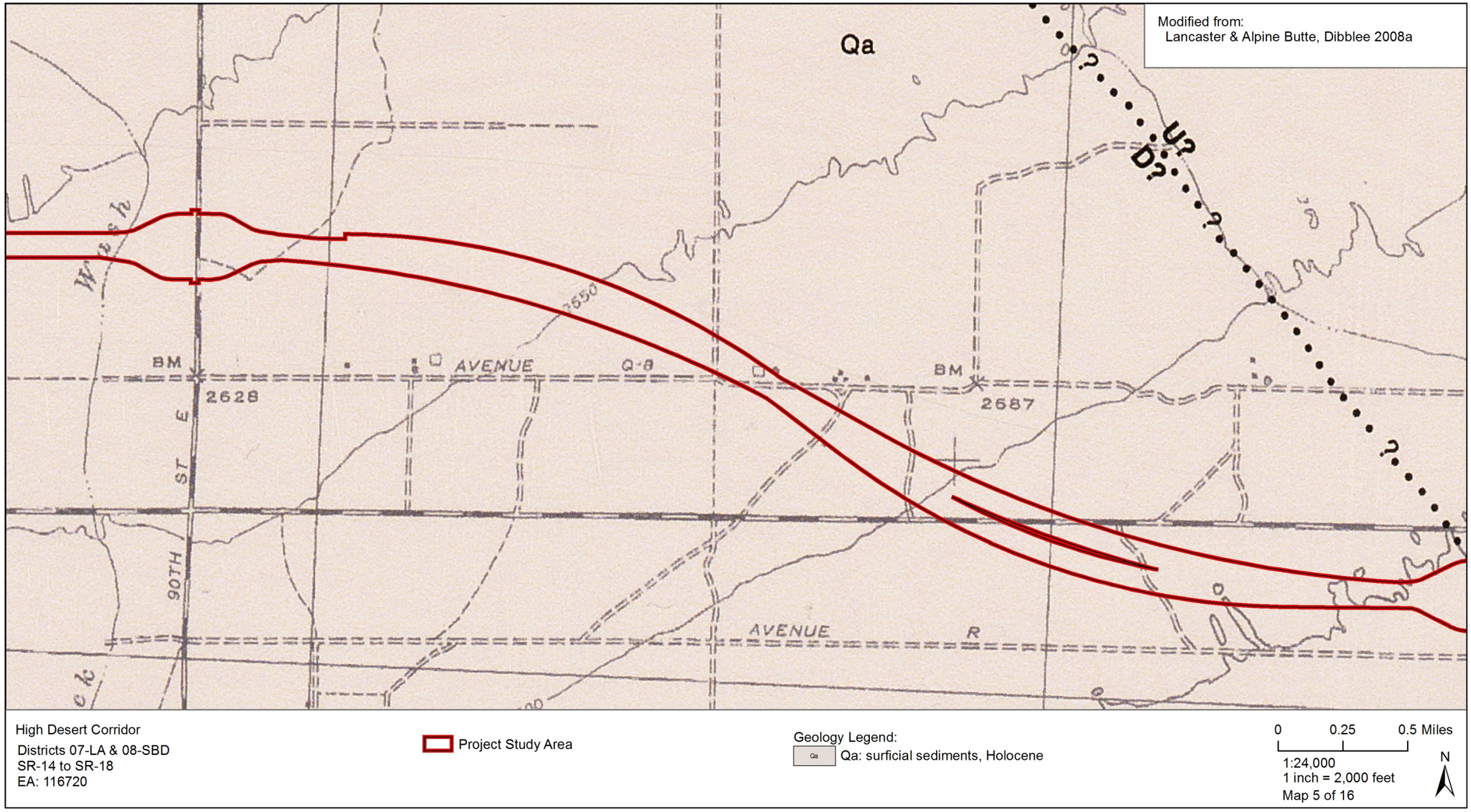



**Figure 8e. Project Geology, 5 of 16**

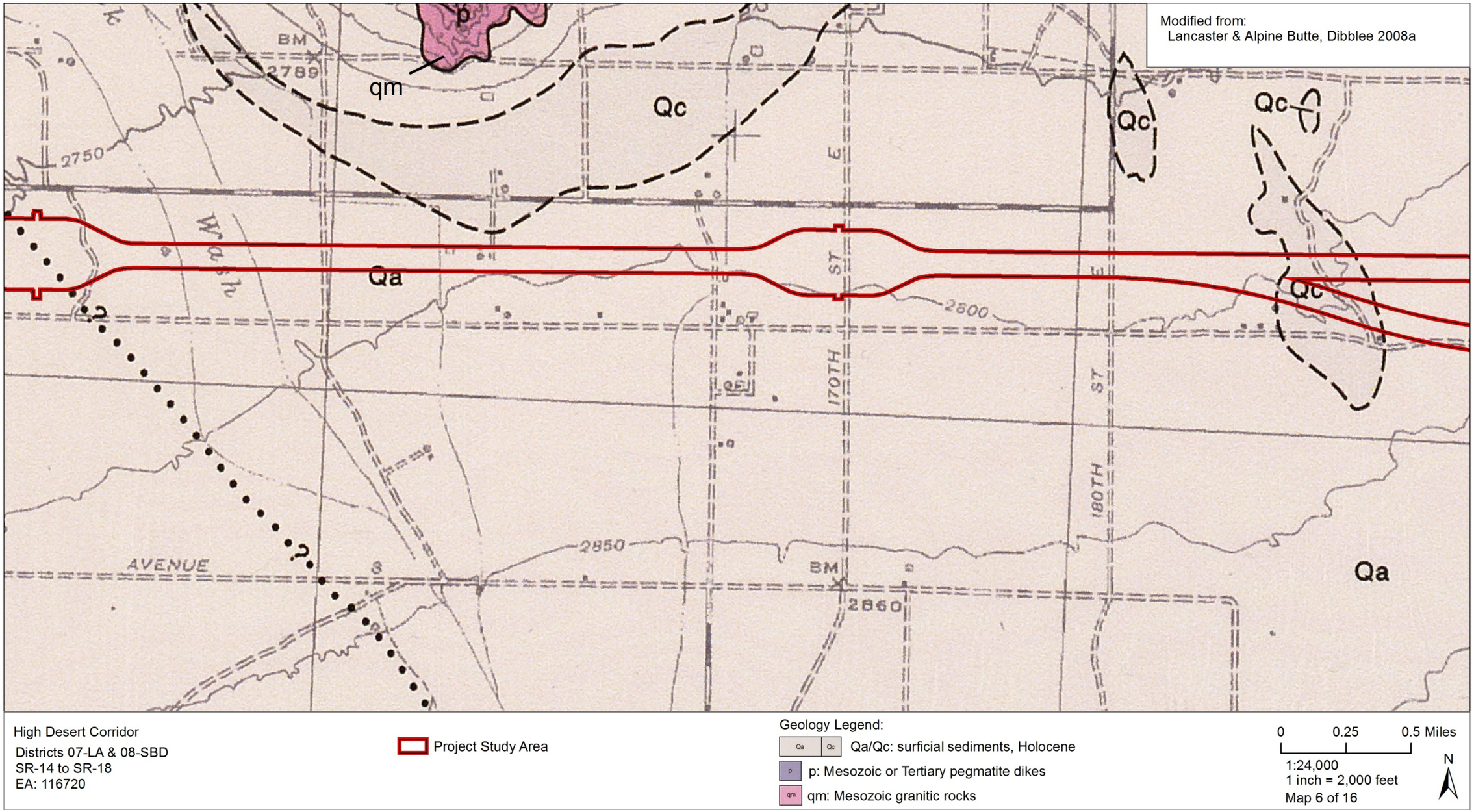



**Figure 9f. Project Geology, 6 of 16**

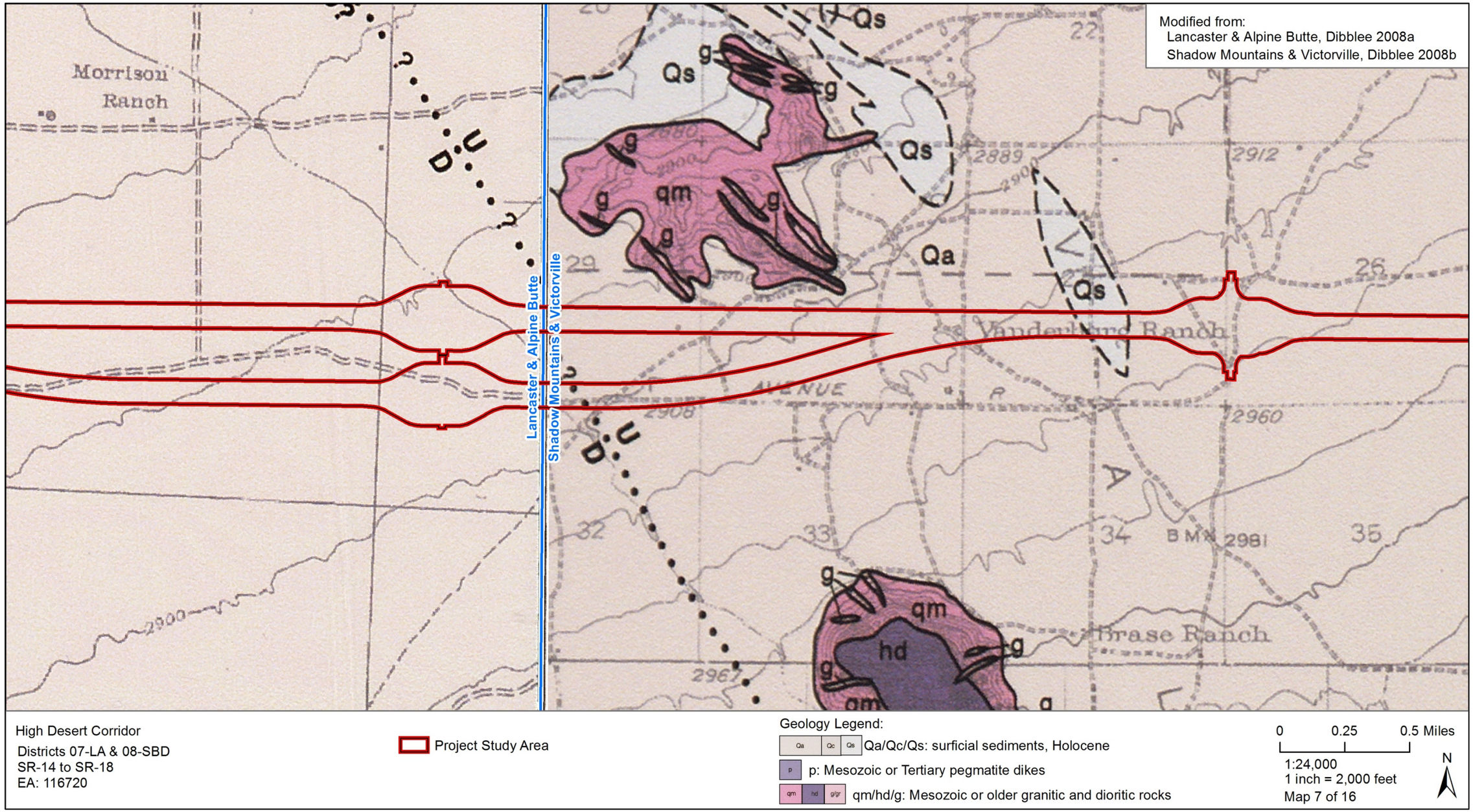
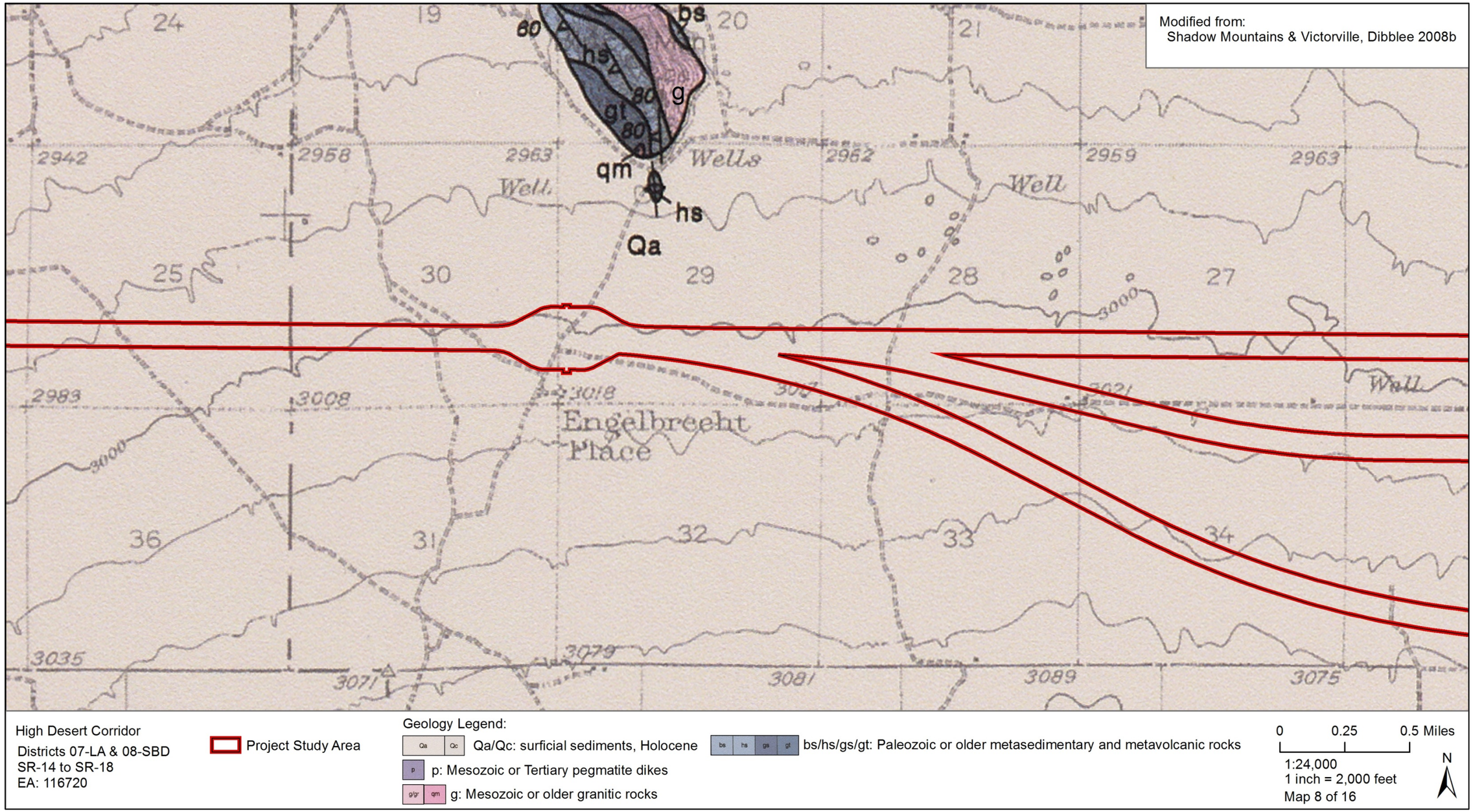



**Figure 10g. Project Geology, 7 of 16**




High Desert Corridor
Districts 07-LA & 08-SBD
SR-14 to SR-18
EA: 116720

Project Study Area

Geology Legend:

Qa/Qc: surficial sediments, Holocene

bs/hs/gs/gt: Paleozoic or older metasedimentary and metavolcanic rocks

p: Mesozoic or Tertiary pegmatite dikes

g: Mesozoic or older granitic rocks

0 0.25 0.5 Miles

1:24,000
1 inch = 2,000 feet
Map 8 of 16

N

**Figure 11h. Project Geology, 8 of 16**

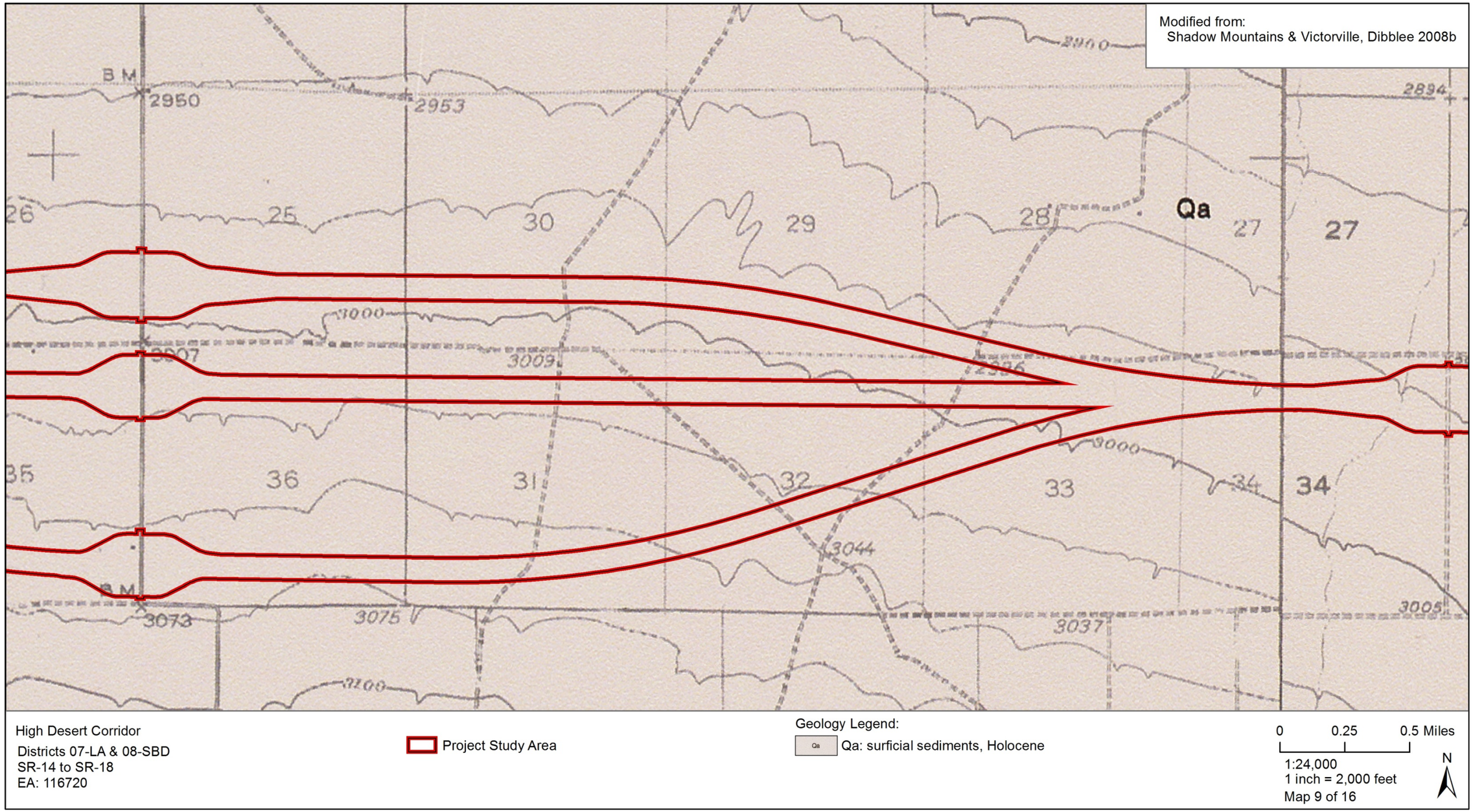



**Figure 12i. Project Geology, 9 of 16**

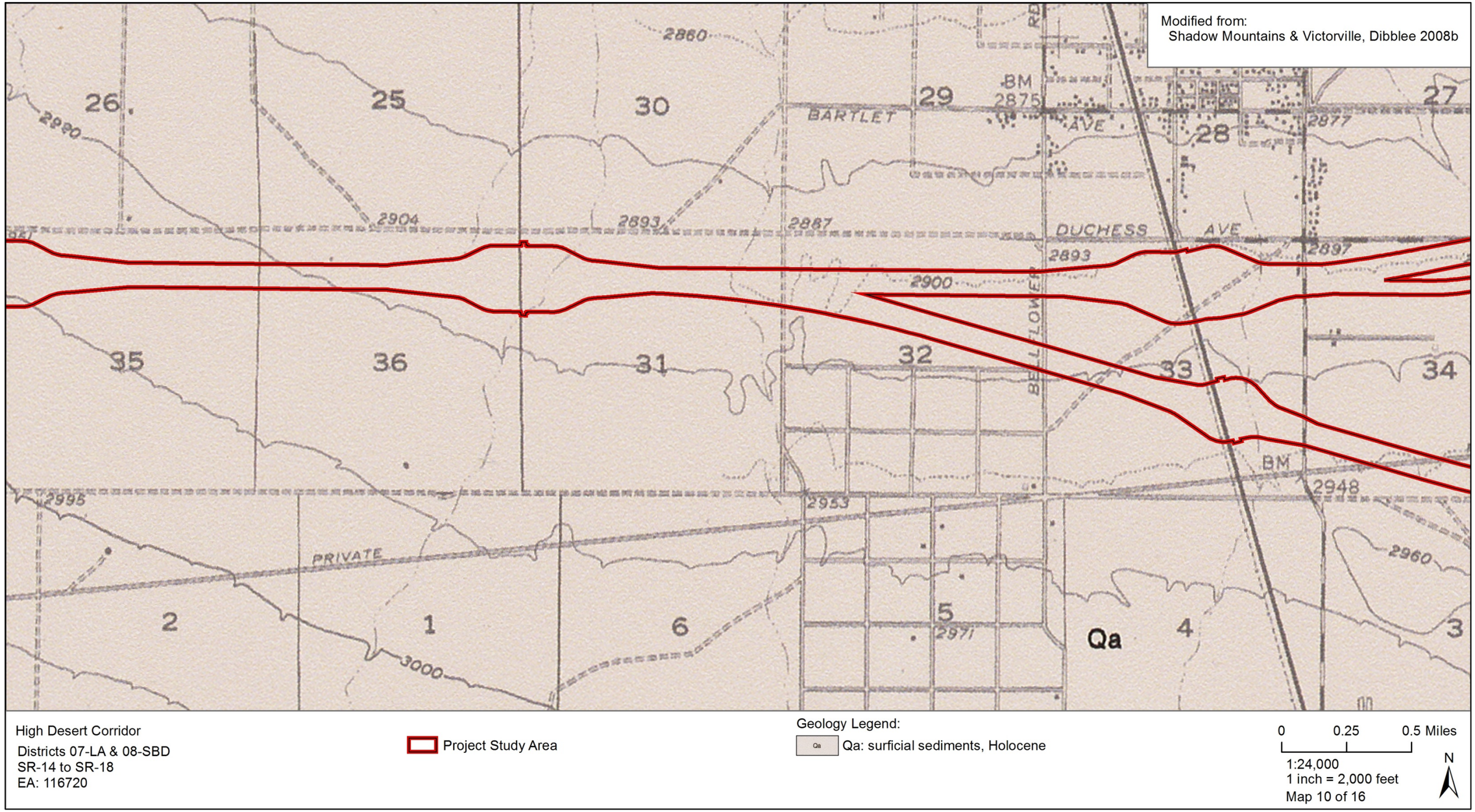



**Figure 13j. Project Geology, 10 of 16**

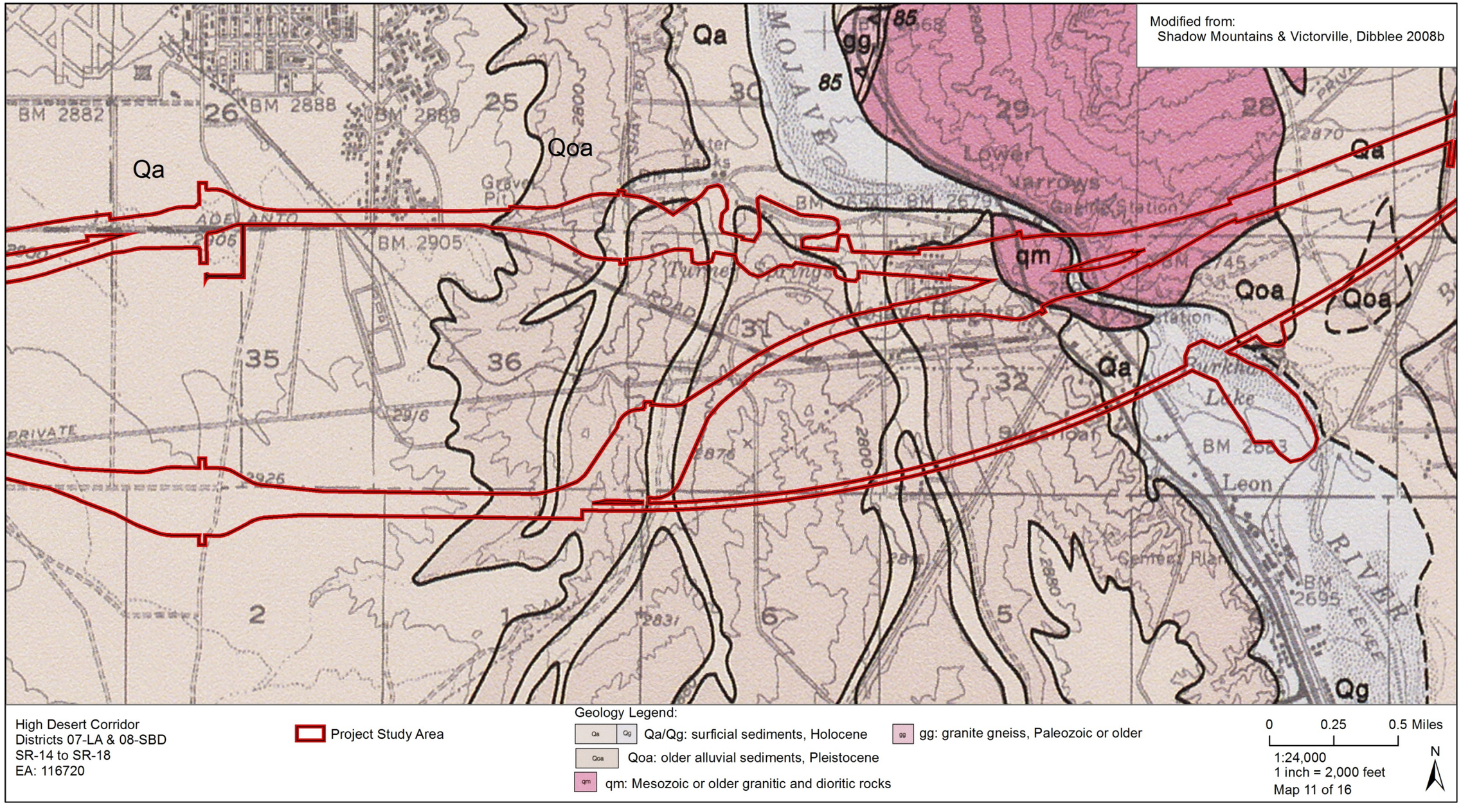



**Figure 14k. Project Geology, 11 of 16**

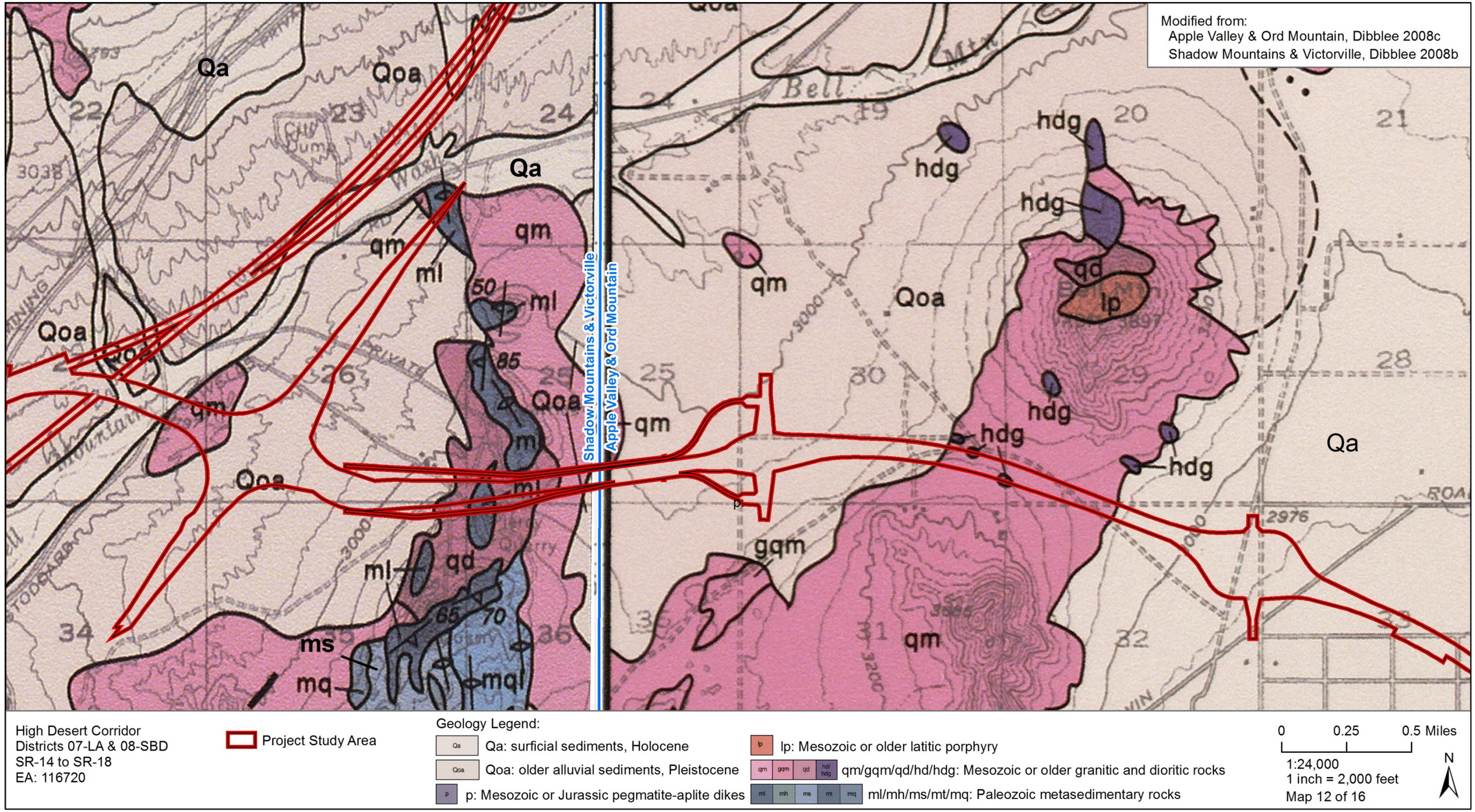



**Figure 15l. Project Geology, 12 of 16**

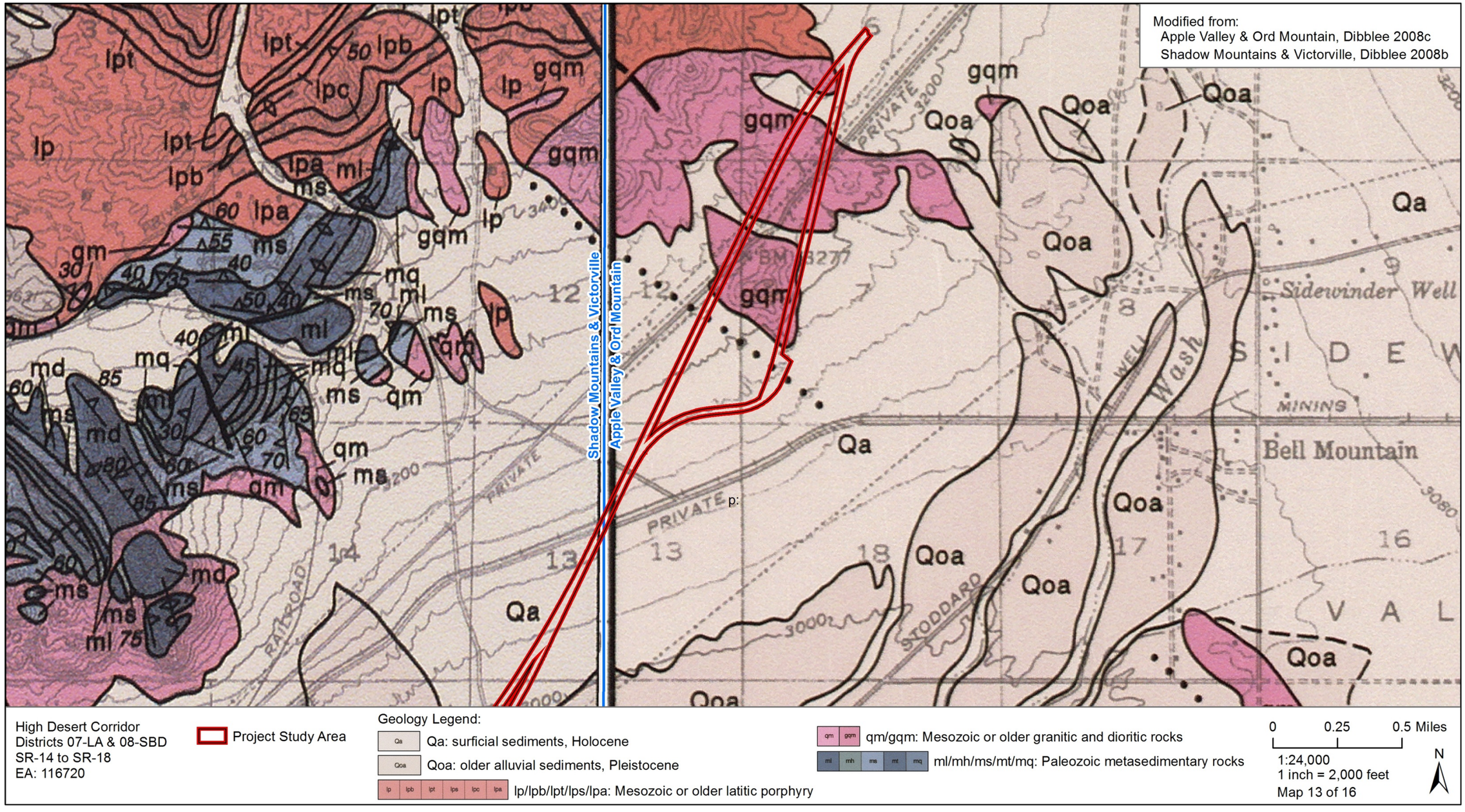



**Figure 16m. Project Geology, 13 of 16**

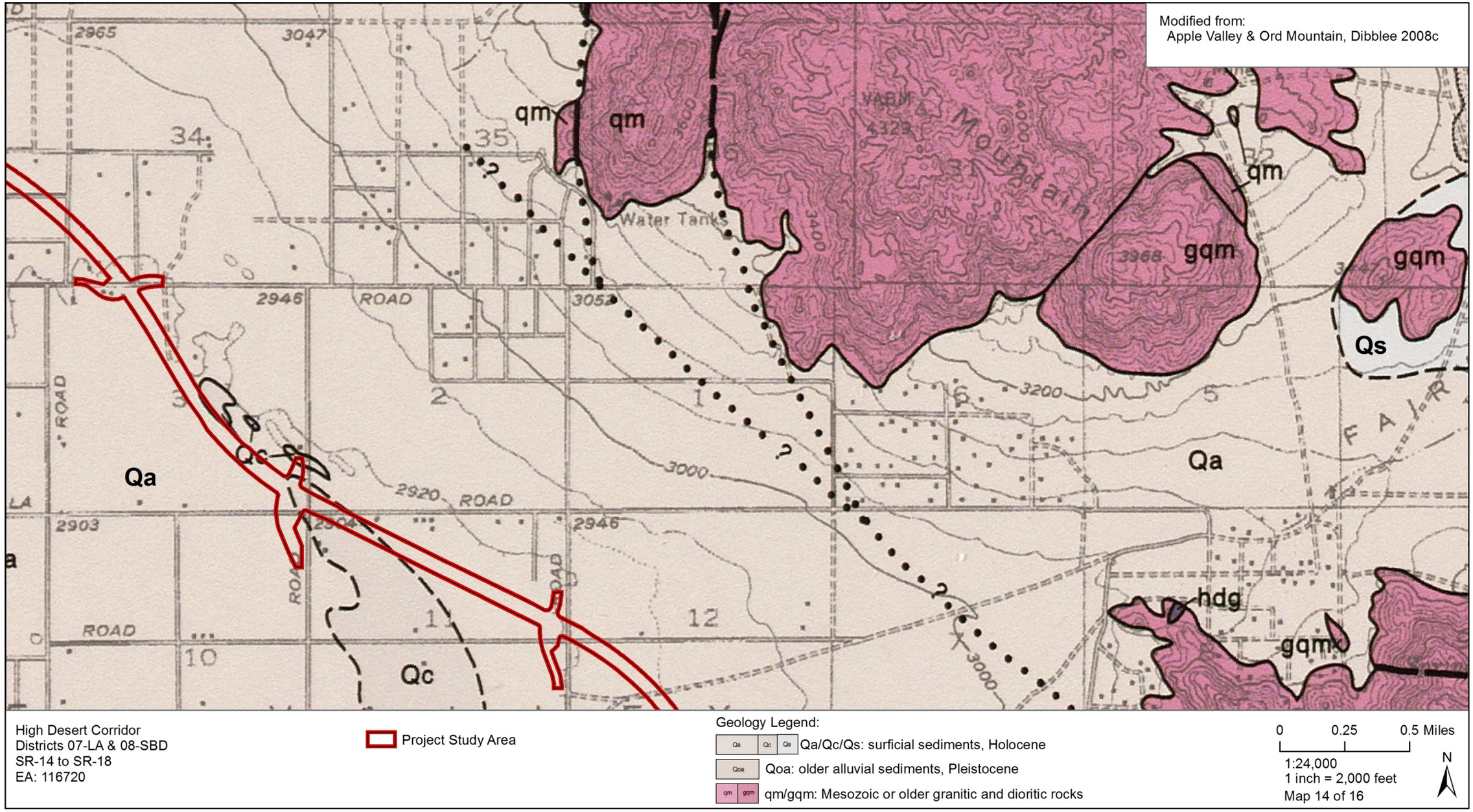



**Figure 17n. Project Geology, 14 of 16**

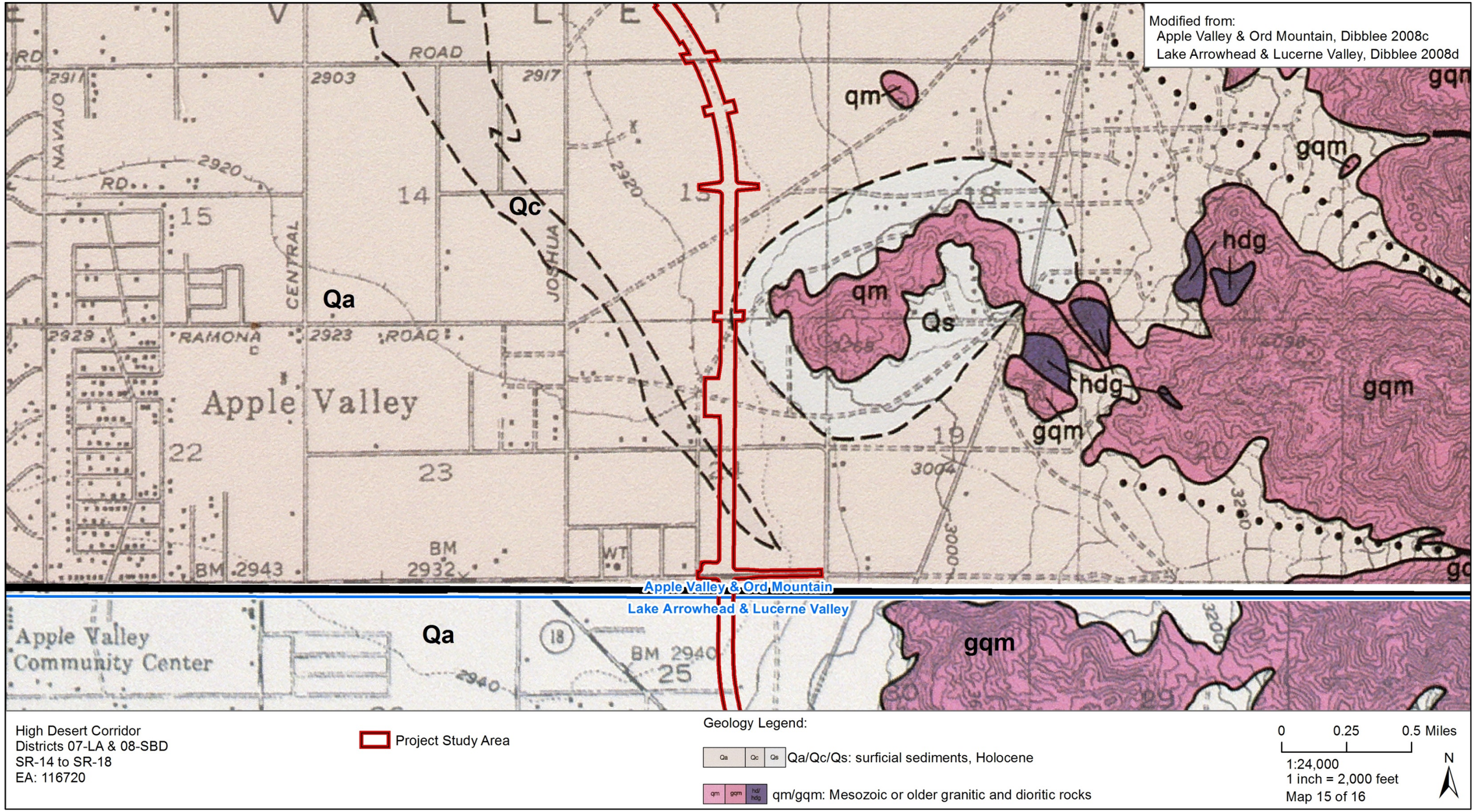



**Figure 18o. Project Geology, 15 of 16**

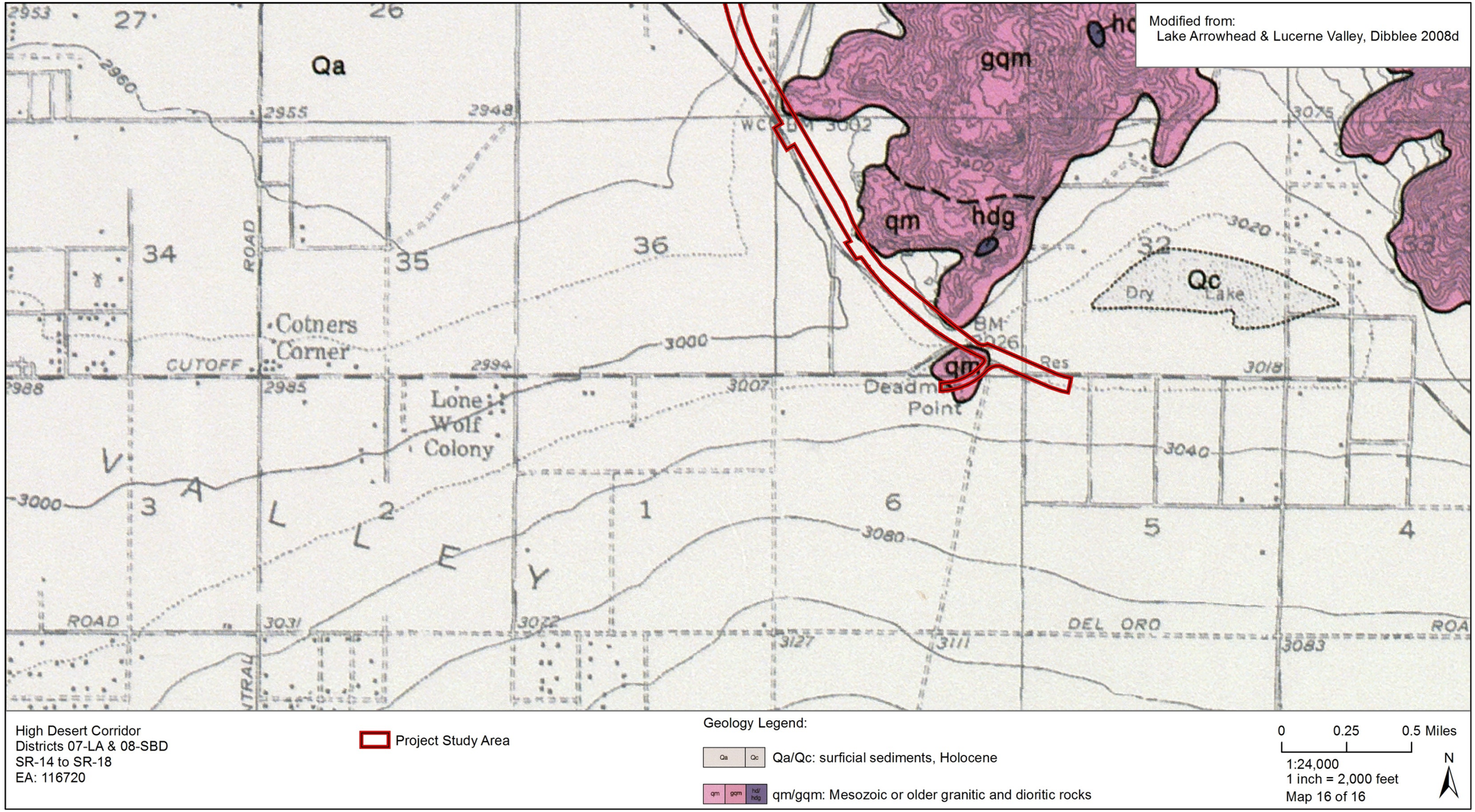



**Figure 19p. Project Geology, 16 of 16**

### QUATERNARY OLDER DEPOSITS

Outcrops of Pleistocene (11,000 years to 2.6 million years old) older alluvium (Qoa; Figure 3k, 3l; Dibblee 2008b, 2008c; Bortugno and Spittler 1986; Cox and Hillhouse 2000) of the ancient Mojave River (Figure 3k, 3l), dating to the Irvingtonian North American Land Mammal Age (780 to 350 thousand years) near to the Southern California Logistics Airport (Cox and Hillhouse 2000) are present in the Victorville area. These poorly to moderately consolidated, light grey to buff, silt to boulder sized stream deposits of the ancient Mojave River, boarder the modern river channel as terraces (Cox and Hillhouse 2000; Dibblee 2008b, 2008c).

Pleistocene older schist cobble conglomerates (Qos; Figure 3b, 3c; Dibblee 2008a) are derived from the Pelona Schist near the San Andreas Fault Zone. These grey to brown, schist-rich gravels area supported in a matrix of biotite-rich sands (Dibblee 2008a).

### PLIOCENE ANAVERDE FORMATION

Outcrops of Pliocene (2.6 to 5.3 million years old) Anaverde Formation (Tas, Tac; Figure 3b, 3c; Dibblee 2008a) are present in the southwestern portion of the PSA. The sandstone (Tas) is a grey-white to yellowish buff, fine to coarse grained commonly conglomeratic, arkosic sand. Deposited by large streams off of local granitic rock there are also occasional sections of thin bedded shale (Dibblee 2008a). A grey shale unit (Tac) is also present within the PSA. Primarily consisting of thin bedded, clayey to silty shale the unit also includes interbeds of fine grained arkosic sands (Dibblee 2008a).

### MESOZOIC GRANITICS

A Mesozoic (252 to 66 million year old) questionably Jurassic (201 to 145 million year old) quartz monzonite (qm; Figure 3c, 3k, 3l, 3p; Dibblee 2008a, 2008b, 2008c, 2008d), occurs throughout the PSA in small outcrops. This grey-white, medium grained, massive to rarely gneissoid rock forms the major batholith of the western Mojave Desert. Along the San Andreas Fault Zone the quartz monzonite is intensely sheared.

Found in the eastern portion of the PSA as outcrops within the quartz monzonite, a black, medium to coarse grained, massive, Mesozoic hornblende diorite and gabbro (hdg; Figure 3l; Dibblee 2008c) occurs to the north of Apple Valley.

A dark grey, medium grained, massive Mesozoic quartz diorite (qd; Figure 3l; Dibblee 2008b) is found east of the Mojave River near Apple Valley.

Light grey to tan, fine to medium grained, massive, Mesozoic granite and quartz monzonite (gqm; Figure 3m; Dibblee 2008c) is found to the northeast of Victorville.

### PALEOZOIC METASEDIMENTARY ROCKS

A white to dark blue-grey, fine to coarsely crystalline, massive to bedded, Paleozoic (541 to 252 million year old) questionably Pennsylvanian (323 to 299 million year old) limestone (ml; Figure 3l; Dibblee 2008b) is found east of the Mojave River near Apple Valley.

## RECORD SEARCH

A paleontological records search for the Project was conducted by the San Bernardino County Museum (SBCM; Scott 2014; Appendix B). Prior records searches (Allen 2014) were also conducted at the University of California Museum of Paleontology in Berkeley (UCMP; Holroyd 2010; Appendix B) and at the Natural History Museum of Los Angeles County (LACM; McLeod 2010; Appendix B).

Neither the UCMP or the LACM had any records of fossils occurring within the PSA but the SBCM had four (Scott 2014; Table 2). An additional sixty three localities occur within one mile of the PSA (McLeod 2010, Scott 2014; Table 2).

In the Palmdale area are records of Quaternary reptiles and small mammals (McLeod 2010, Scott 2014) from thirty four localities (McLeod 2010, Scott 2014; Table 2). As these taxa occur both in the Holocene and Pleistocene, they are not temporally diagnostic of either time period and may or may not be fossils. An additional locality from the Pliocene Anaverde Formation near the south western portion of the PSA has produced the remains of a mastodon (Scott 2014; Table 3).

No localities are known from the central portion of the PSA in the alluvial fan deposits from the San Gabriel and San Bernardino mountains. In the Adelanto-Victorville-Apple Valley area, Quaternary sediments of the ancestral Mojave River have produced another thirty two localities, four of which occur within the PSA (Scott 2014, Jefferson 1981b; Table 2). Along with numerous small mammals and reptiles, the remains of extinct animals including mammoth (*Mammuthus meridionalis*), giant ground sloth (*Paramylodon harlani*), horse (*Equus* sp. cf. *E. scotti*), and camels (*Hemiauchenia*, *Camelops hesternus*) have been recovered (Scott 2014).

None of the Mesozoic or Paleozoic units have records of fossils.

**Table 2. Fossils known from the Quaternary alluvial deposits**
† = indicates that the animal is extinct; * indicates that the locality is within the PSA.
From McLeod (2010) and Scott (2014).

| **PALMDALE AREA** | | | |
|---|---|---|---|
| **Group** | **Common name** | **Taxon** | **Reference; Location** |
| **small mammals** | cottontail rabbit | *Sylvilagus* sp. | McLeod 2010; Palmdale, LACM 5942 – 5953, pipeline along Ave S from just before 90th Street East to almost the San Bernardino County Line |
| | pocket mouse | *Chaetodipus* sp. | |
| | kangaroo rat | *Dipodomys* sp. | |
| | pocket gopher | *Thomomys* sp. | |
| **reptiles** | gopher snake | *Pitupohis* sp. | |
| | king snake | *Lampropeltis* sp. | |
| | leopard lizard | *Gambelia wislizenii* | |
| **misc** | plants, rodents, small vertebrates | misc | Scott 2014; Palmdale, SBCM 9.2.3-9.2.7, 9.2.15-9.2.31 |
| **VICTORVILLE AREA** | | | |
| **Group** | **Common name** | **Taxon** | **Reference; Location(s)** |
| **large mammals** | southern mammoth | † *Mammuthus meridionalis* | Scott 2014; Victorville; SBCM 1.114.36, 1.114.37, or 1.114.274 |
| | mammoth | † *Mammuthus* sp. | Jefferson 1991, Scott 2014; Victorville: SBCM 1.114.6-1.114.24*, 1.114.27*-1.114.28 |
| | horse, possibly Scott's horse | † *Equus* sp. cf. *E. scotti* | Scott 2014; Victorville; SBCM 1.114.36, 1.114.37, or 1.114.274 |
| | horse | † *Equus* sp. | Jefferson 1991, Scott 2014; Victorville: SBCM 1.114.3; 1.114.6-1.114.24*; 1.114.27*-1.114.28 |
| | yesterday's camel | † *Camelops hesternus* | Scott 2014; Victorville; SBCM 1.114.36, 1.114.37, or 1.114.274 |
| | camel | † *Camelops* sp. | Jefferson 1991, Scott 2014; Victorville; SBCM 1.114.6-1.114.24* |
| | llama | † *Hemiauchenia* sp. | Scott 2014; Victorville; SBCM 1.114.36, 1.114.37, or 1.114.274 |
| | camel | † Camelidae | Jefferson 1991; Victorville: SBCM 1.114.27*-1.114.28 |
| | giant ground sloth | † *Paramylodon harlani* | Scott 2014; Victorville; SBCM 1.114.36, 1.114.37, or 1.114.274 |
| | large mammal | Mammalia | Scott 2014; Victorville SBCM 1.114.30* |
| | large mammal (?) | ?Mammalia | Scott 2014; Adelanto SBCM 1.115.1-1.115.2, 1.115.10; Victorville SBCM 1.114.27* |
| | mammal | Mammalia | Scott 2014; Victorville: SBCM 1.114.33b* |
| **small mammals** | jack rabbit | *Lepus* sp. | Scott 2014; Jefferson 1991; Victorville: SBCM 1.114.31, 1.114.33b* |
| | pocket gopher | *Thomomys* sp. | Scott 2014; Victorville: SBCM 1.114.33b* |
| | pocket mouse | *Perognathus* cf. *longimembris* | Scott 2014; Victorville: SBCM 1.114.33b* |
| | kangaroo rat | *Dipodomys sp.* | Scott 2014; Jefferson 1991; Victorville: SBCM 1.114.6-1.114.24* |

| Group | Common name | Taxon | Reference; Location(s) |
|---|---|---|---|
| **small mammals** | wood rat, possibly white throated wood rat | *Neotoma* cf. *albiugula* | Scott 2014; Victorville: SBCM 1.114.33b* |
| | rodent | Rodentia | Scott 2014; Victorville: SBCM 1.114.33b*; Apple Valley: SBCM 1.107.2 |
| **reptiles** | western banded gecko | *Coleonyx varigatus* | Scott 2014; Victorville: SBCM 1.114.33b* |
| **plants** | root casts | Plantae root casts | Scott 2014; Victorville: SBCM 1.114.33b* |

**Table 3. Fossils known from the Anaverde Formation**
† = indicates that the animal is extinct
From Scott (2014).

| Group | Common name | Taxon | Reference; Location |
|---|---|---|---|
| **large mammals** | mastodon | † *Mammut* sp. | Scott 2014; southern Palmdale, SBCM 9.2.2 |

# FIELD RECONNAISSANCE

A field reconnaissance was conducted by Allen (2014). No field reconnaissance was requested for this project due to the time constraints in producing this report.

# PALEONTOLOGICAL SENSITIVITY

Caltrans utilizes a tripartite scale to characterize paleontological sensitivity consisting of no potential, low potential and high potential (Caltrans 2012, Appendix C). A multilevel ranking system was developed by professional resource managers as a more practical tool, the Potential Fossil Yield Classification (PFYC) system (BLM 2009, Appendix C) which has a multi-level scale based on demonstrated yield of fossils. The PFYC system provides additional guidance regarding assessment and management for different fossil yield rankings and is therefore used here to complement the Caltrans scale.

Occurrences of fossil resources are closely tied to the geologic units (e.g., formations or members) that contain them. The probability for finding significant fossils in a project area can be broadly predicted from previous records of fossils recovered from the geologic units present in and/or adjacent to the study area.

Using the PFYC system, geologic units are classified based on the relative abundance of vertebrate fossils or scientifically significant invertebrate or plant fossils and their sensitivity to adverse impacts. This ranking is not designed to be applied to specific paleontological localities or small areas within units. Although significant localities may occasionally occur in a geologic unit, a few widely scattered important fossils or localities do not necessarily indicate a higher PFYC value; instead, the relative abundance of localities is intended to be the major determinant for the value assignment. Geological setting and fossil localities were considered in determining paleontological sensitivity according to PFYC criteria.

Mesozoic plutonic rocks were assigned as Caltrans no sensitivity and PFYC 1. The Holocene deposits, Quaternary older schist cobble conglomerate, and the Paleozoic metasedimentary rocks were ranked low on both the Caltrans and PFYC (level 2) scales. As a limestone the Paleozoic deposits may include fossils and were ranked Caltrans low and PFYC 3b indicating moderate potential but undemonstrated yield (Table 4; Figure 4).

Three geologic units were ranked as Caltrans high and PFYC 3a indicating moderate potential but unpredictable location of occurrence. These are the Quaternary older alluvium, and both units of the Anaverde Formation. No project rock units were ranked higher (Table 4; Figure 4).

**Table 4. Paleontological Sensitivity Rankings**

| **Caltrans ranking** | | **high** | | | **low** | | **no** |
|---|---|---|---|---|---|---|---|
| **PFYC ranking** | | **5 very high** | **4 high** | **3a moderate; patchy** | **3b moderate; undemonstrated** | **2 low** | **1 very low** |
| **Rock Units** | **Map symbol (Figure 3)** | | | | | | |
| Quaternary alluvium | Qa, Qg, Qc, Qs | | | | | X | |
| Quaternary older alluvium | Qoa | | | X | | | |
| Quaternary older schist cobble conglomerate | Qos | | | | | X | |
| Anaverde Formation | Tas | | | X | | | |
| Anaverde Formation | Tac | | | X | | | |
| Mesozoic plutonic rocks | qm, hdg, qd, gqm | | | | | | X |
| Paleozoic metasedimentary rocks | ml | | | | X | | |

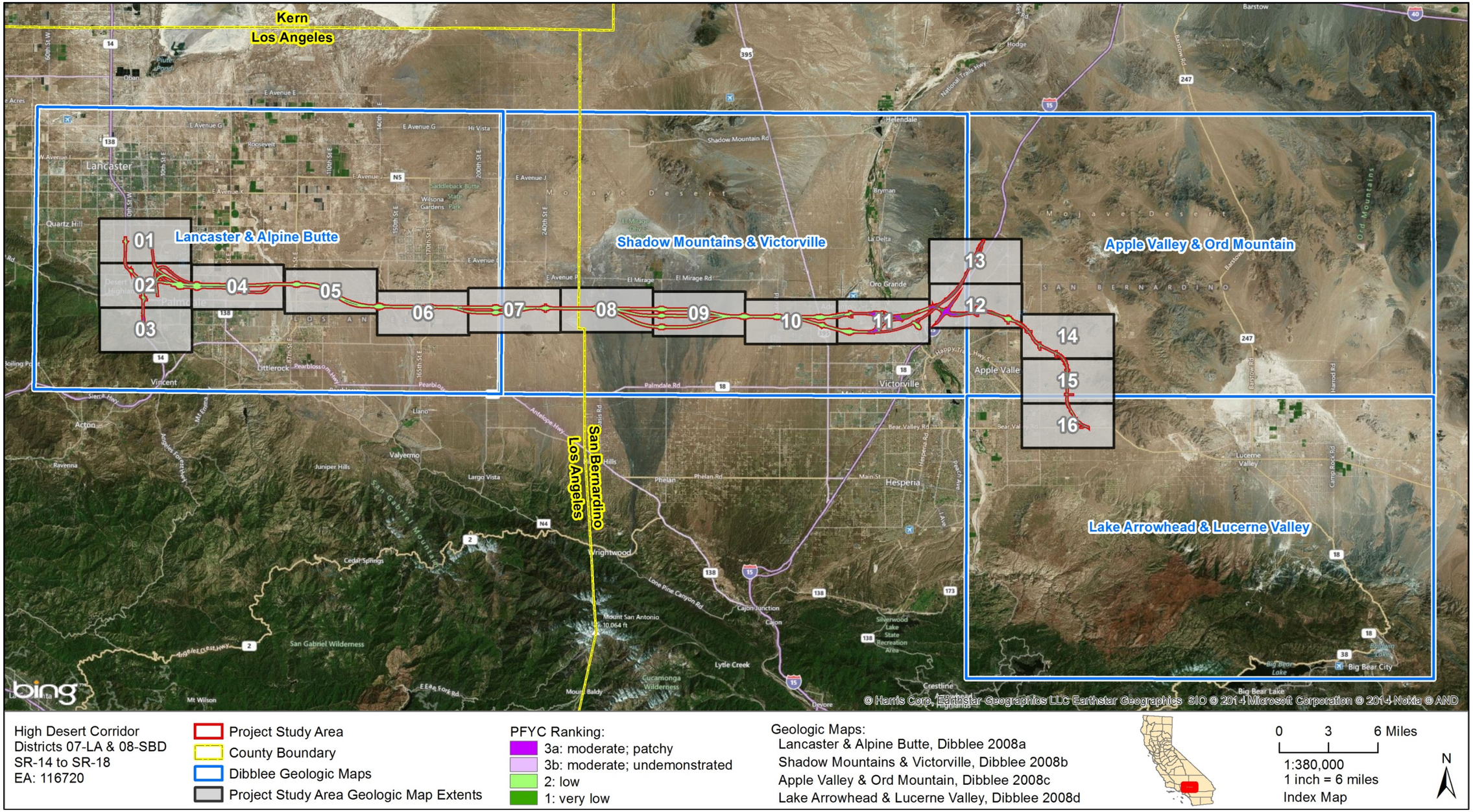



**Figure 4. Project Paleontologic Sensitivity Index**

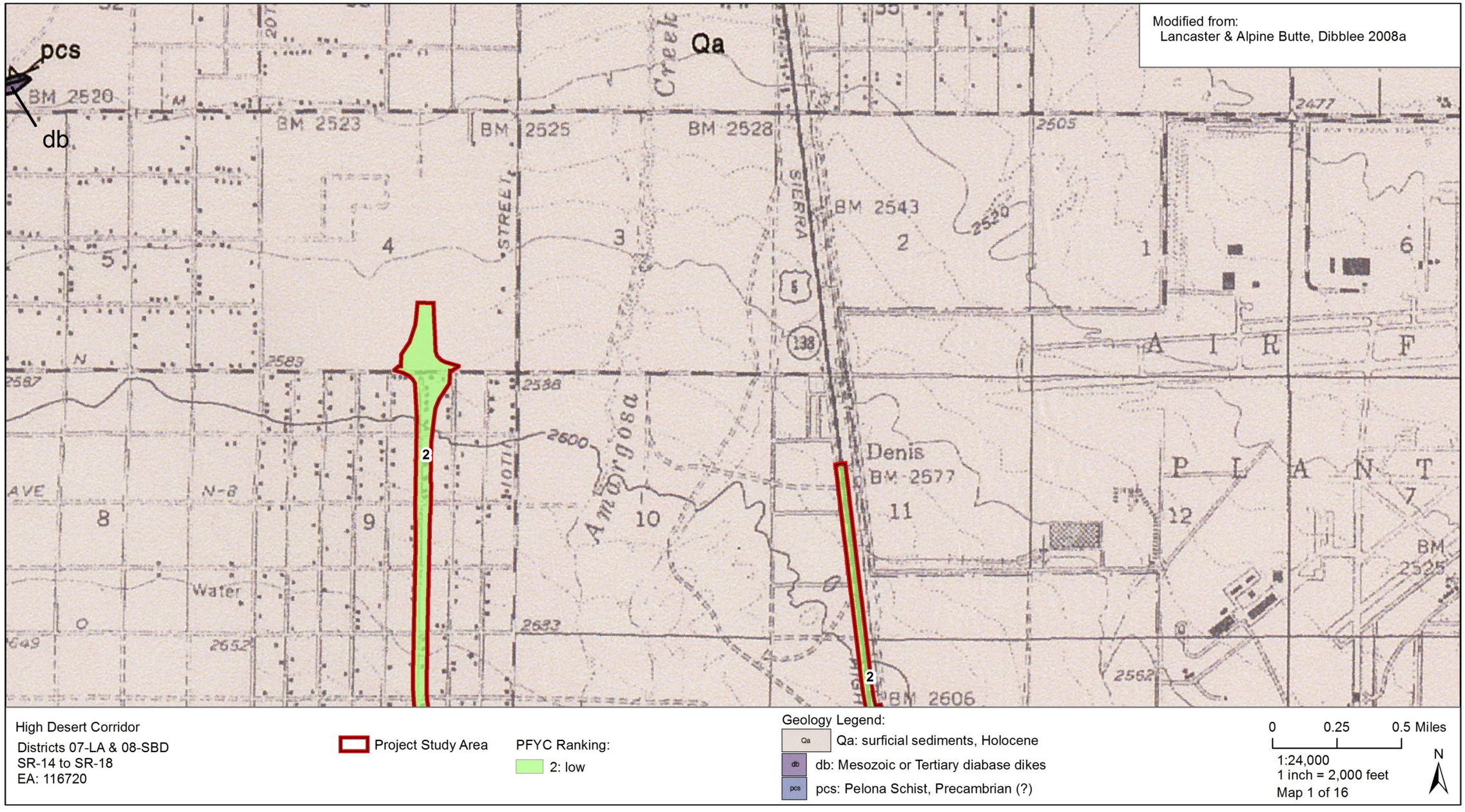



**Figure 4a. Project Paleontologic Sensitivity, 1 of 16**

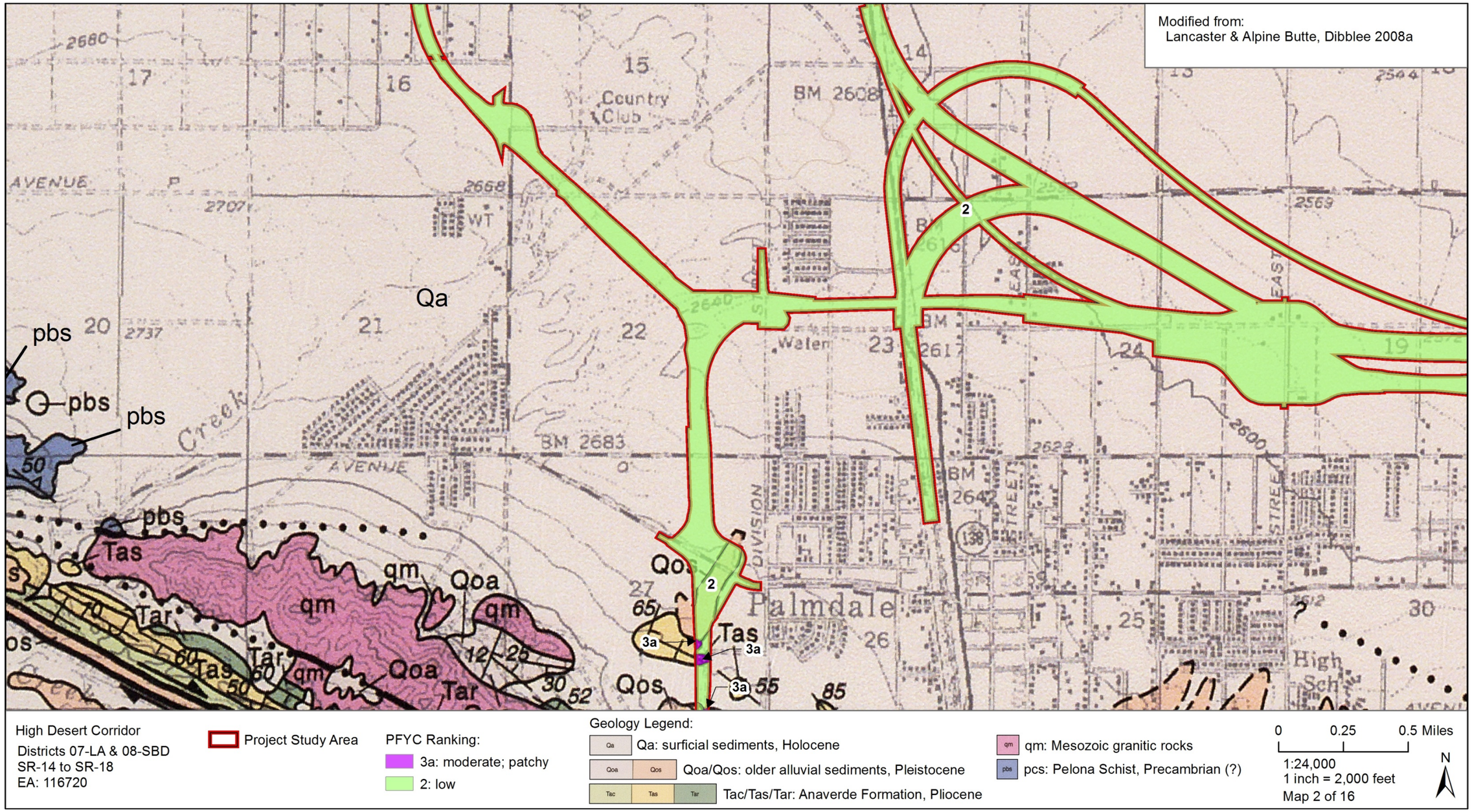



**Figure 4b. Project Paleontologic Sensitivity, 2 of 16**

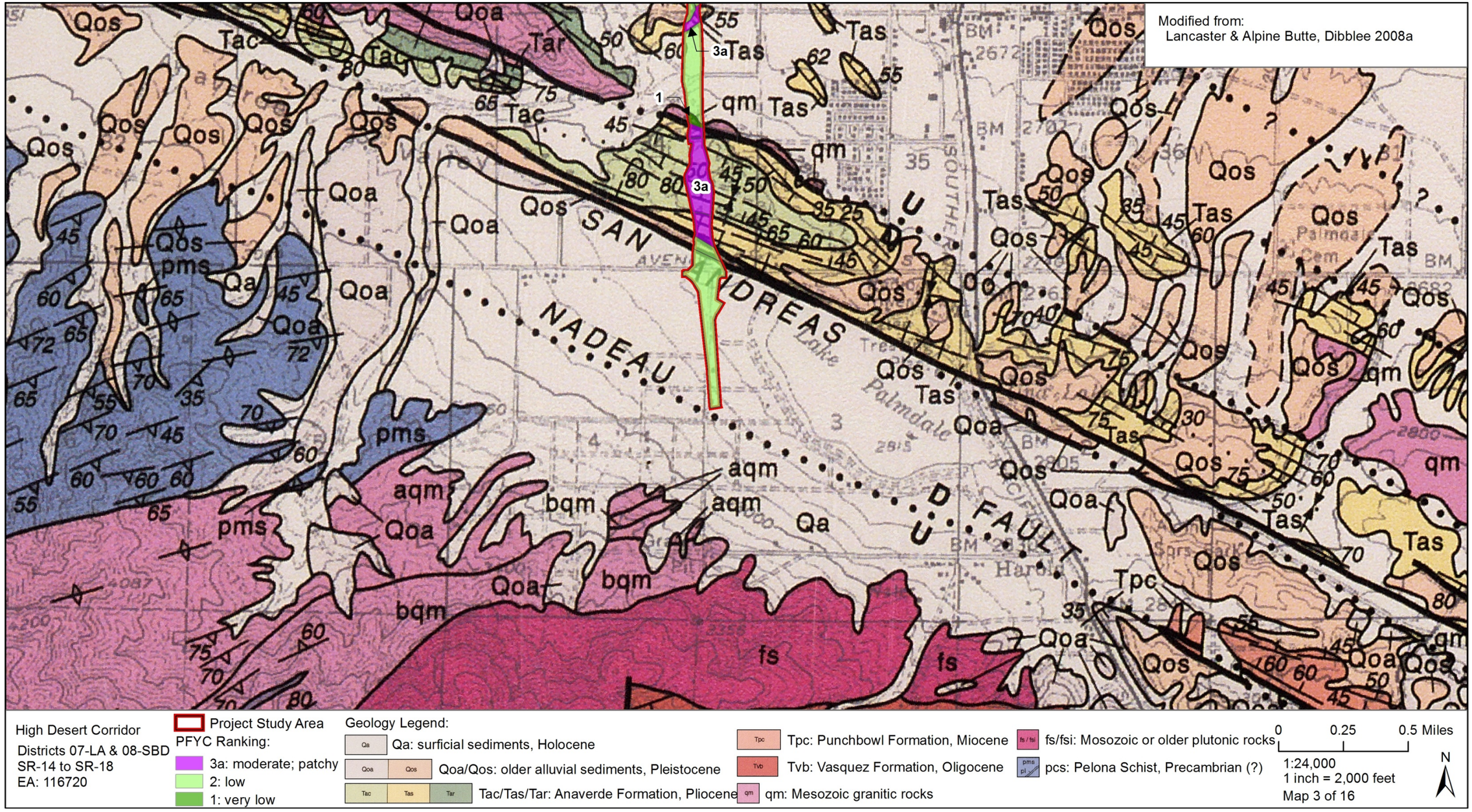



**Figure 4c. Project Paleontologic Sensitivity, 3 of 16**

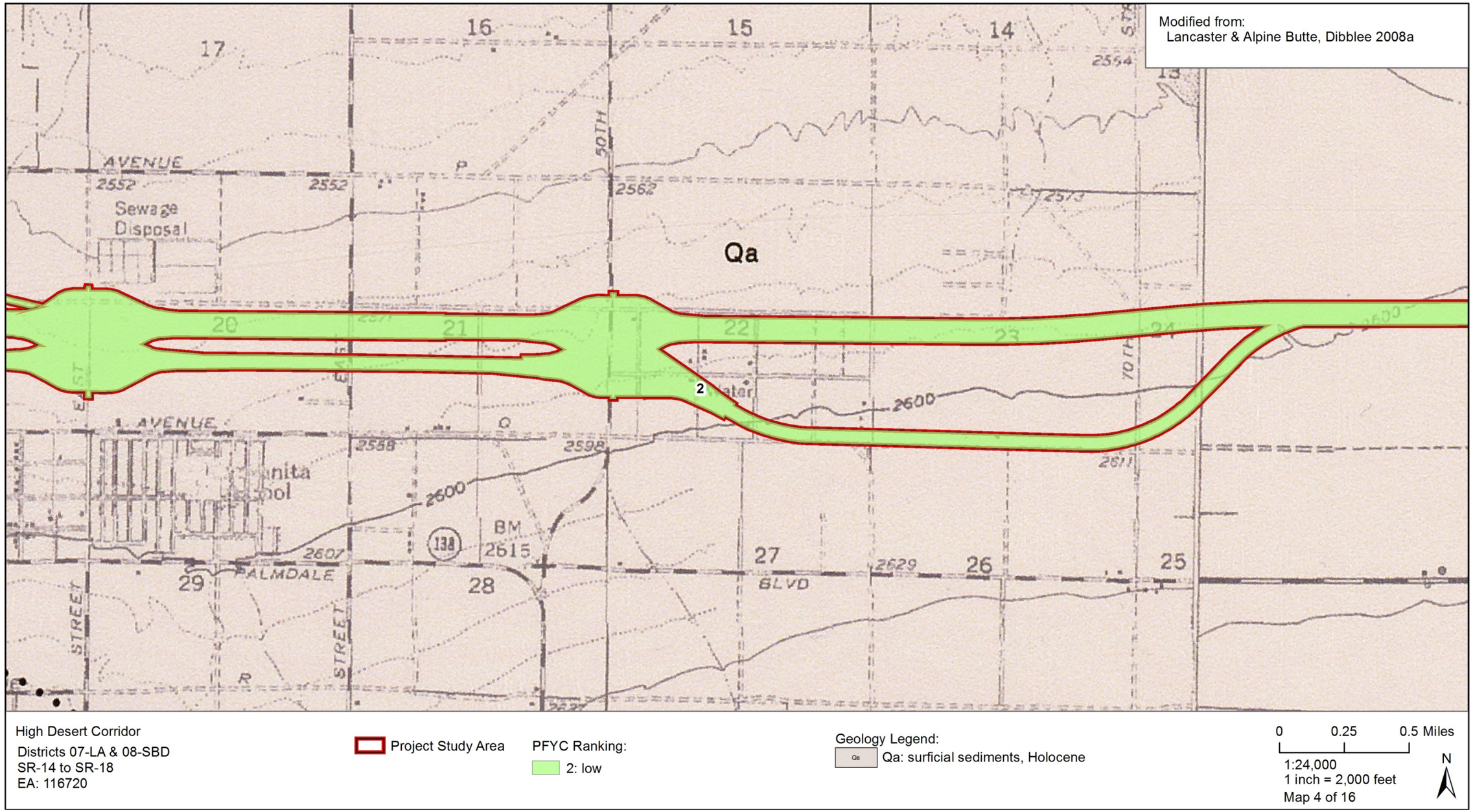



**Figure 4d. Project Paleontologic Sensitivity, 4 of 16**

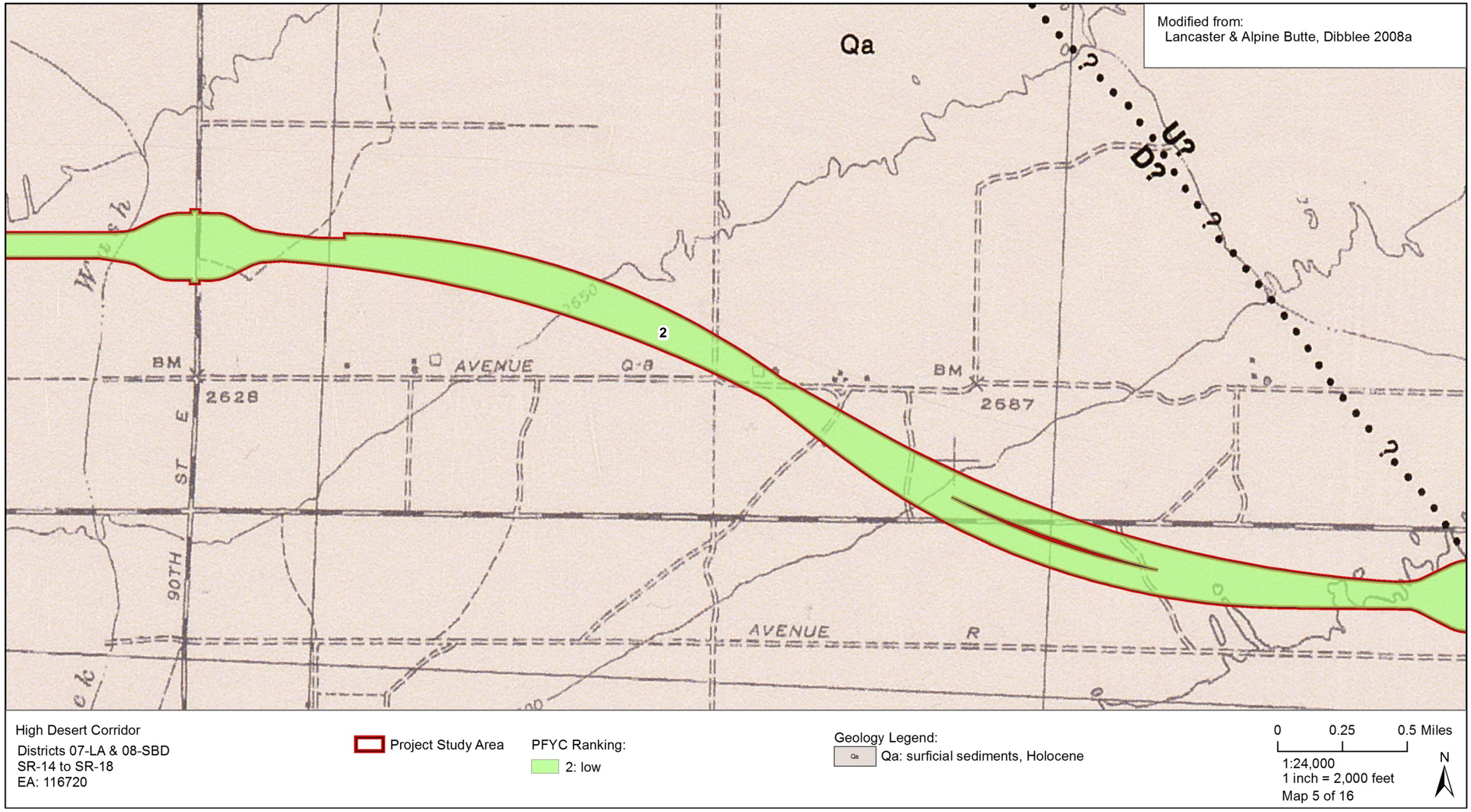



**Figure 4e. Project Paleontologic Sensitivity, 5 of 16**

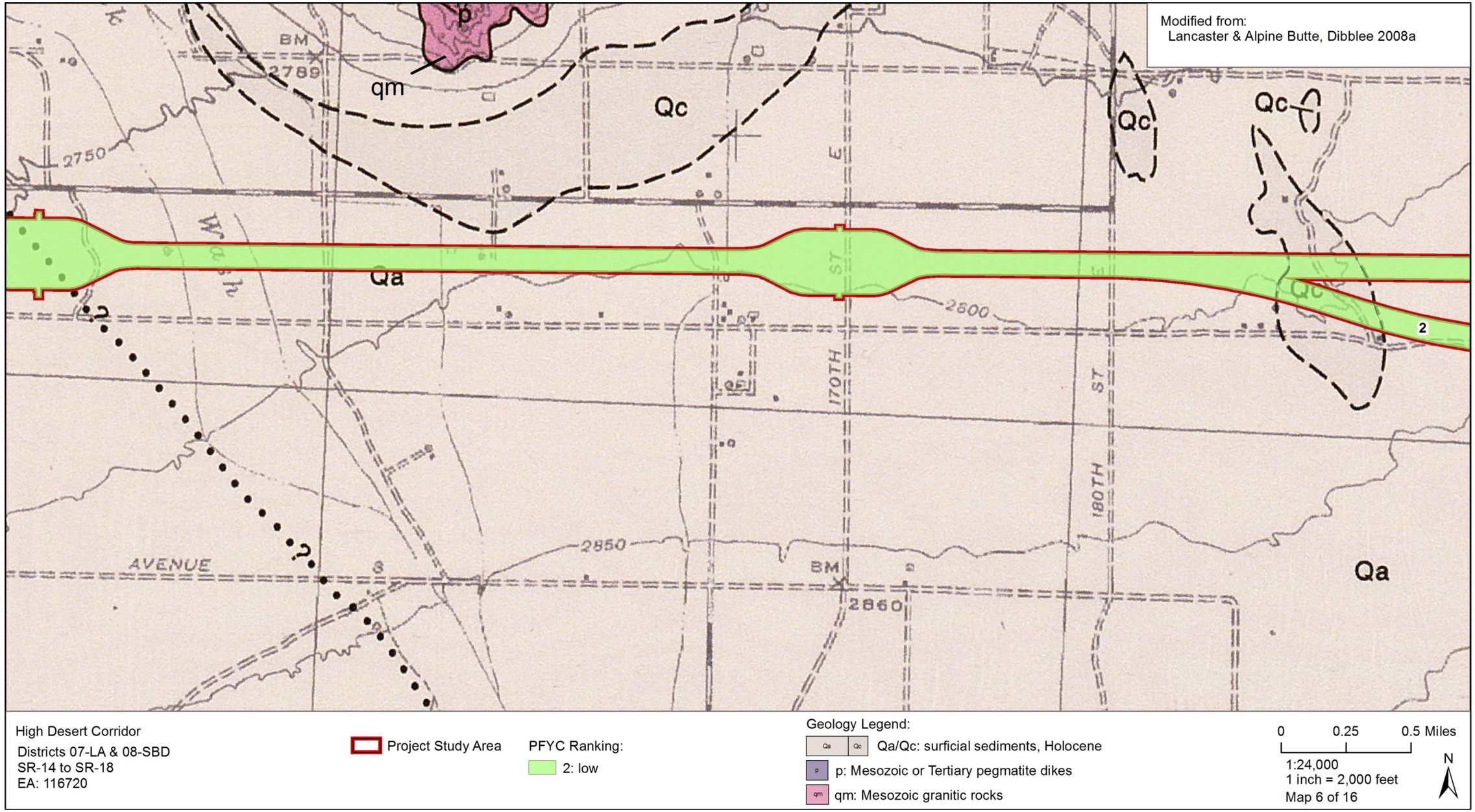



**Figure 4f. Project Paleontologic Sensitivity, 6 of 16**

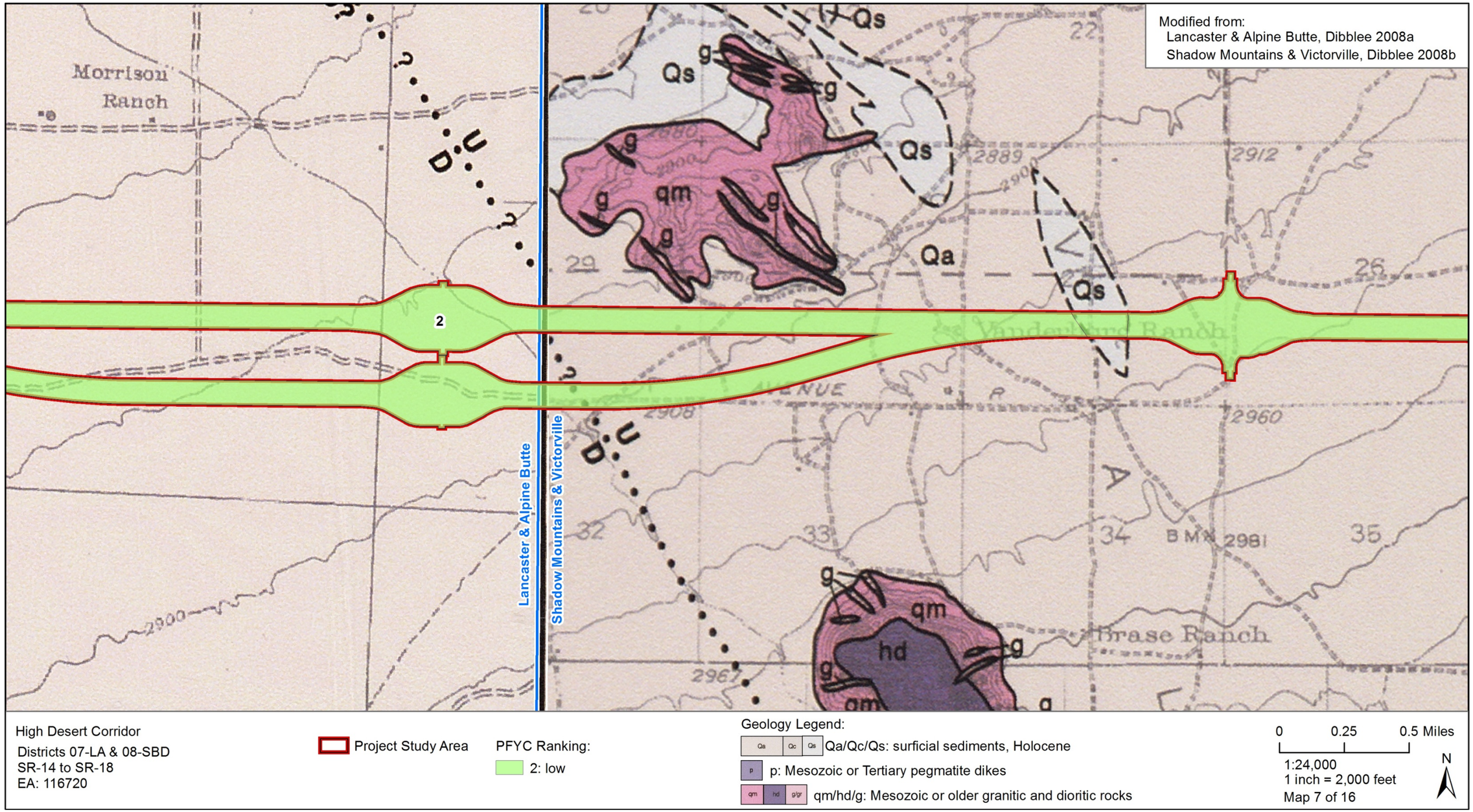



**Figure 4g. Project Paleontologic Sensitivity, 7 of 16**

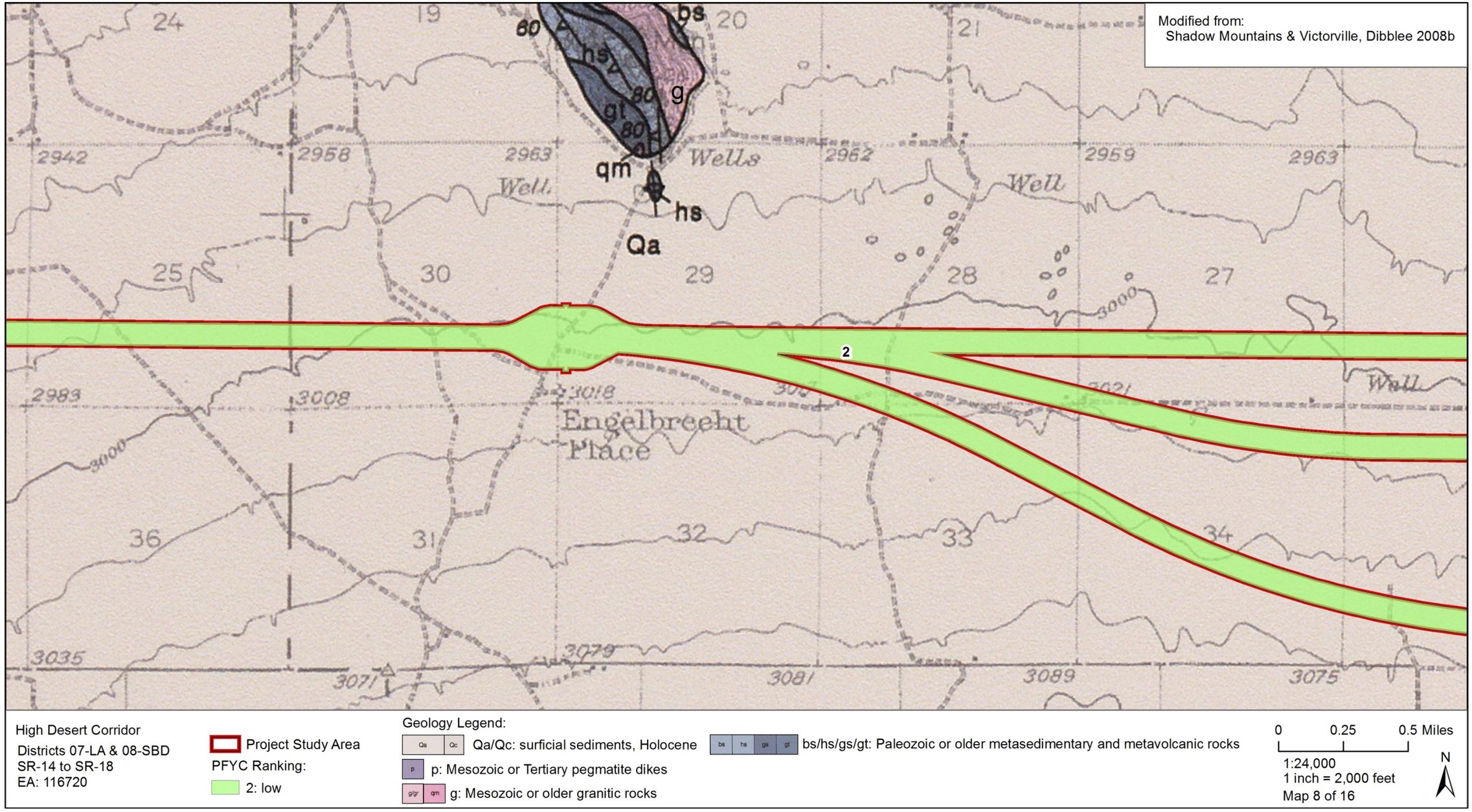



**Figure 4h. Project Paleontologic Sensitivity, 8 of 16**

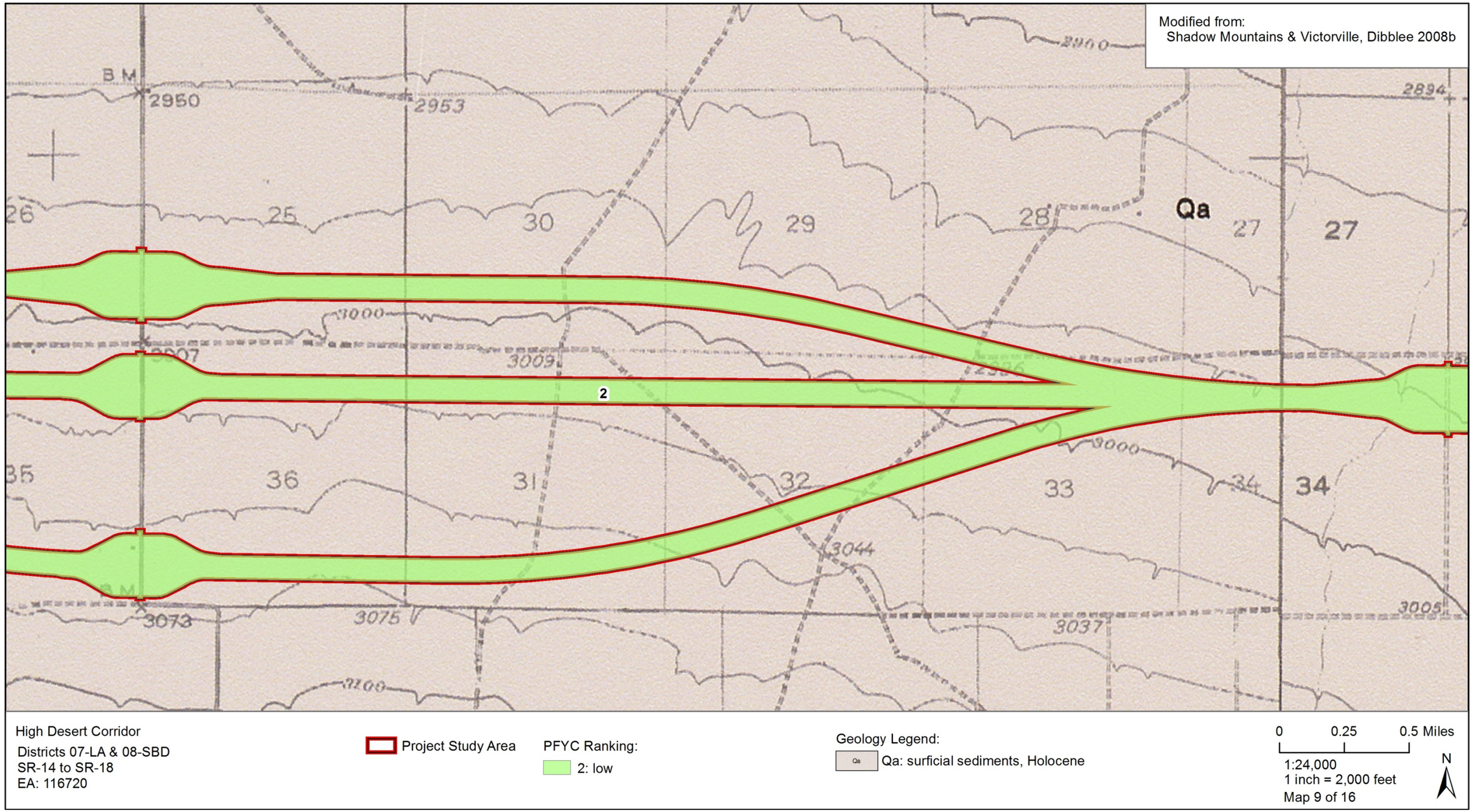



**Figure 4i. Project Paleontologic Sensitivity, 9 of 16**

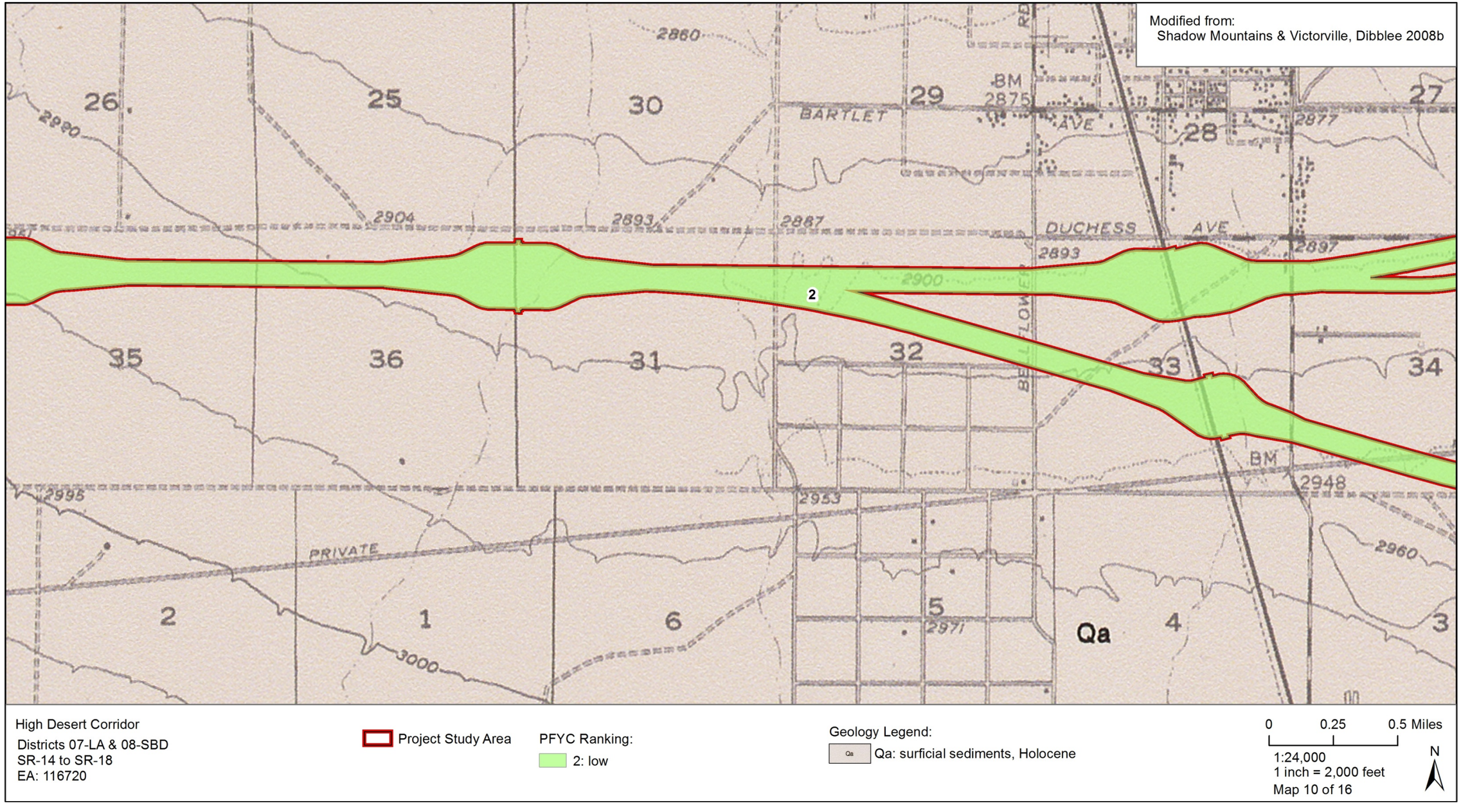



**Figure 4j. Project Paleontologic Sensitivity, 10 of 16**

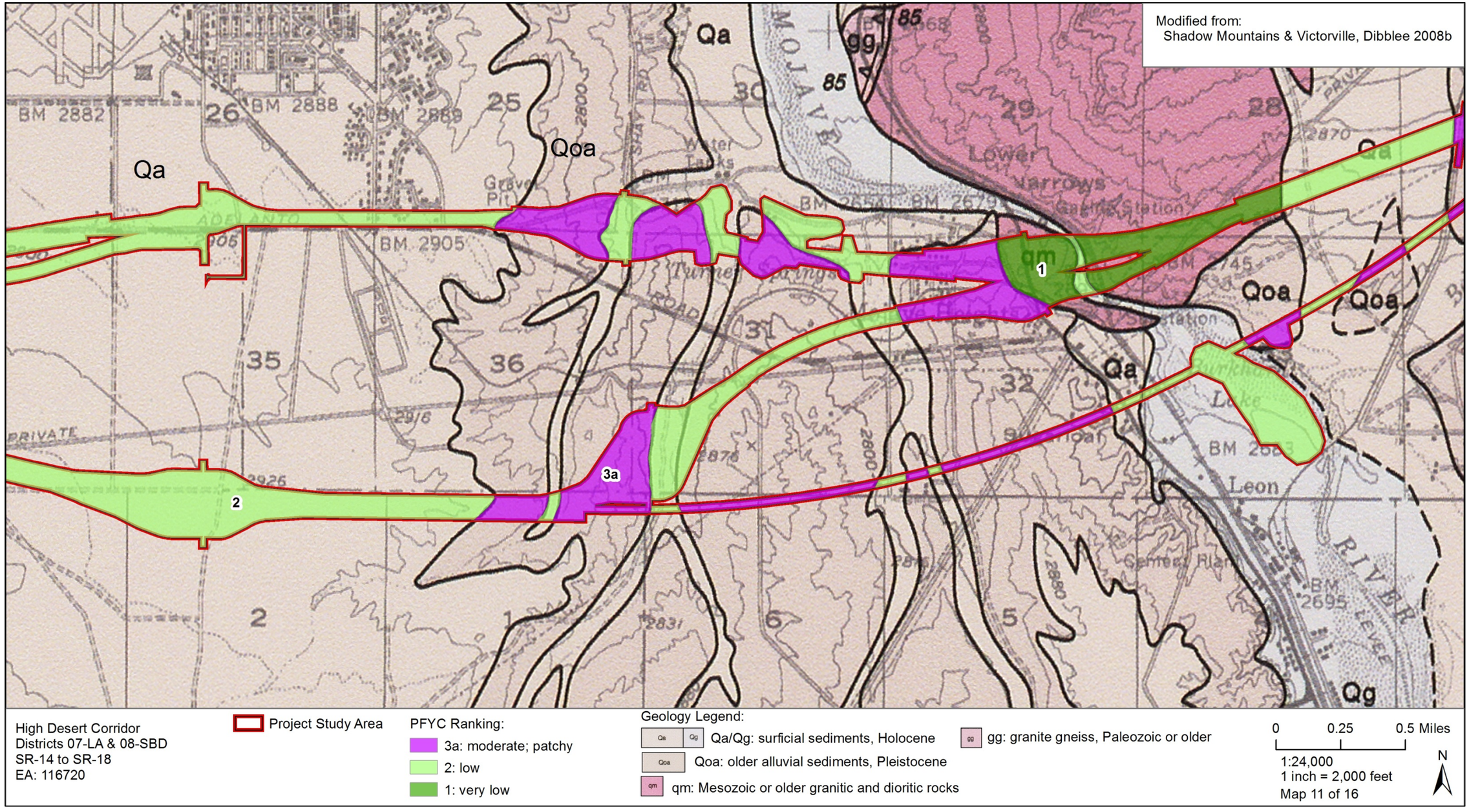



**Figure 4k. Project Paleontologic Sensitivity, 11 of 16**

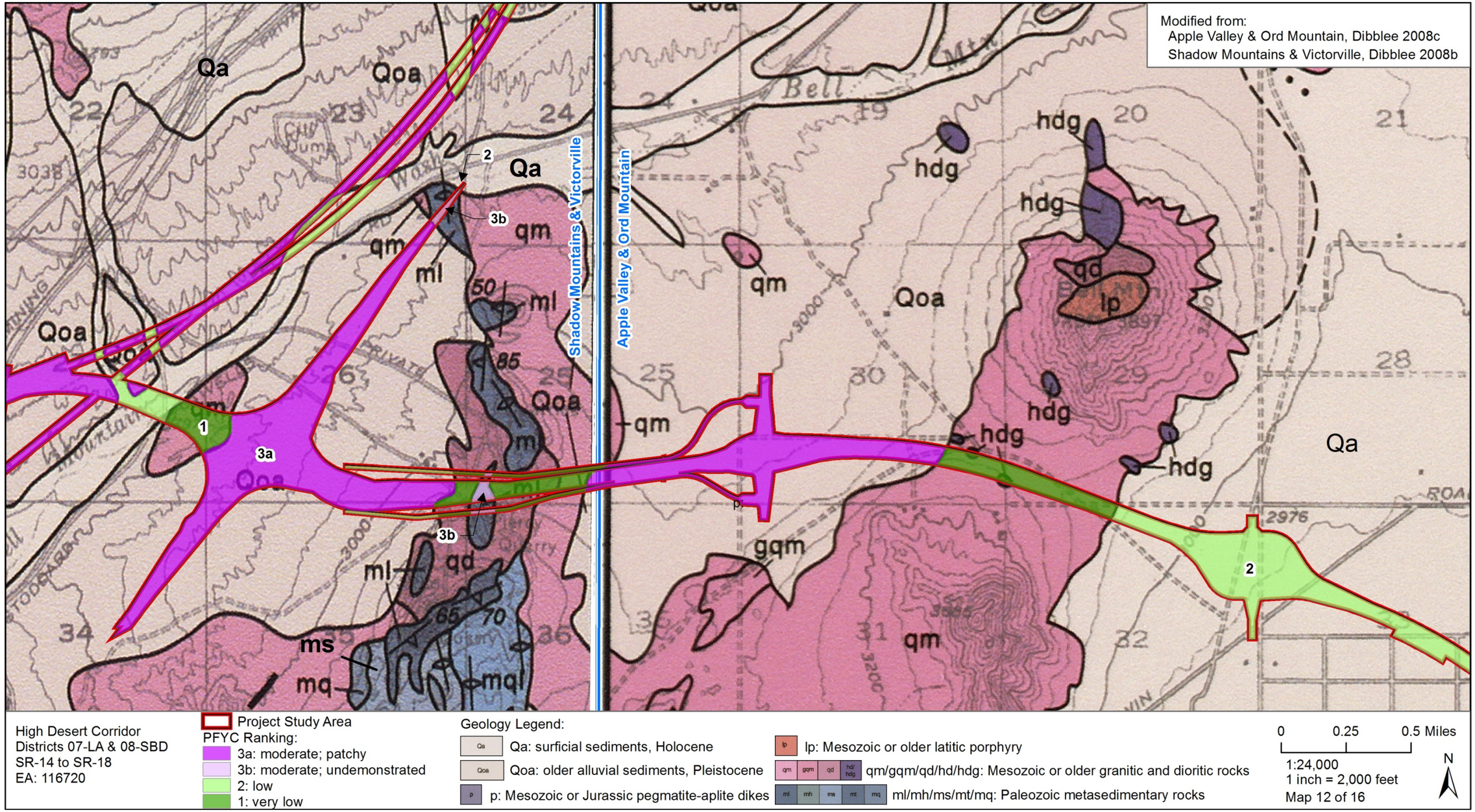



**Figure 4l. Project Paleontologic Sensitivity, 12 of 16**

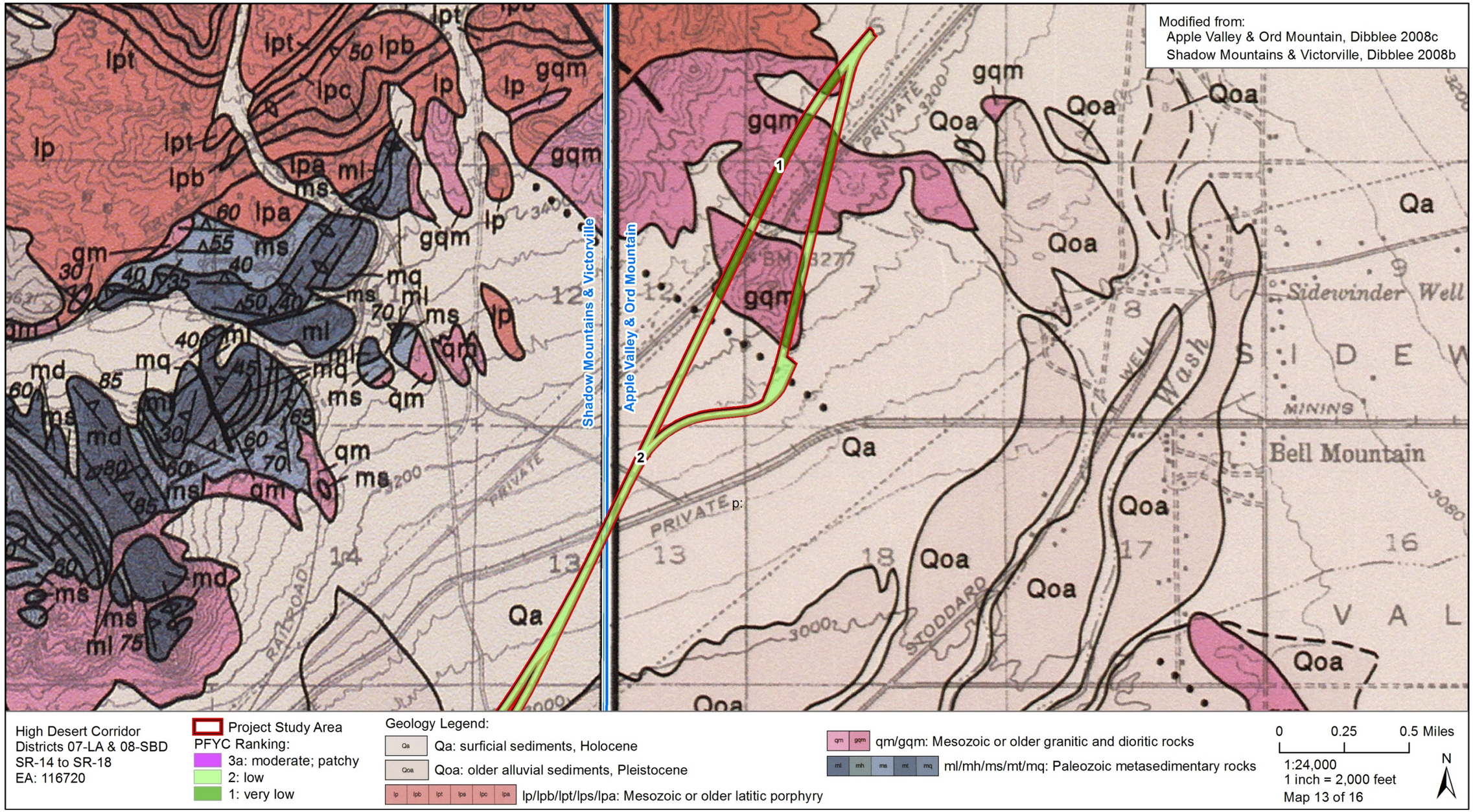



**Figure 4m. Project Paleontologic Sensitivity, 13 of 16**

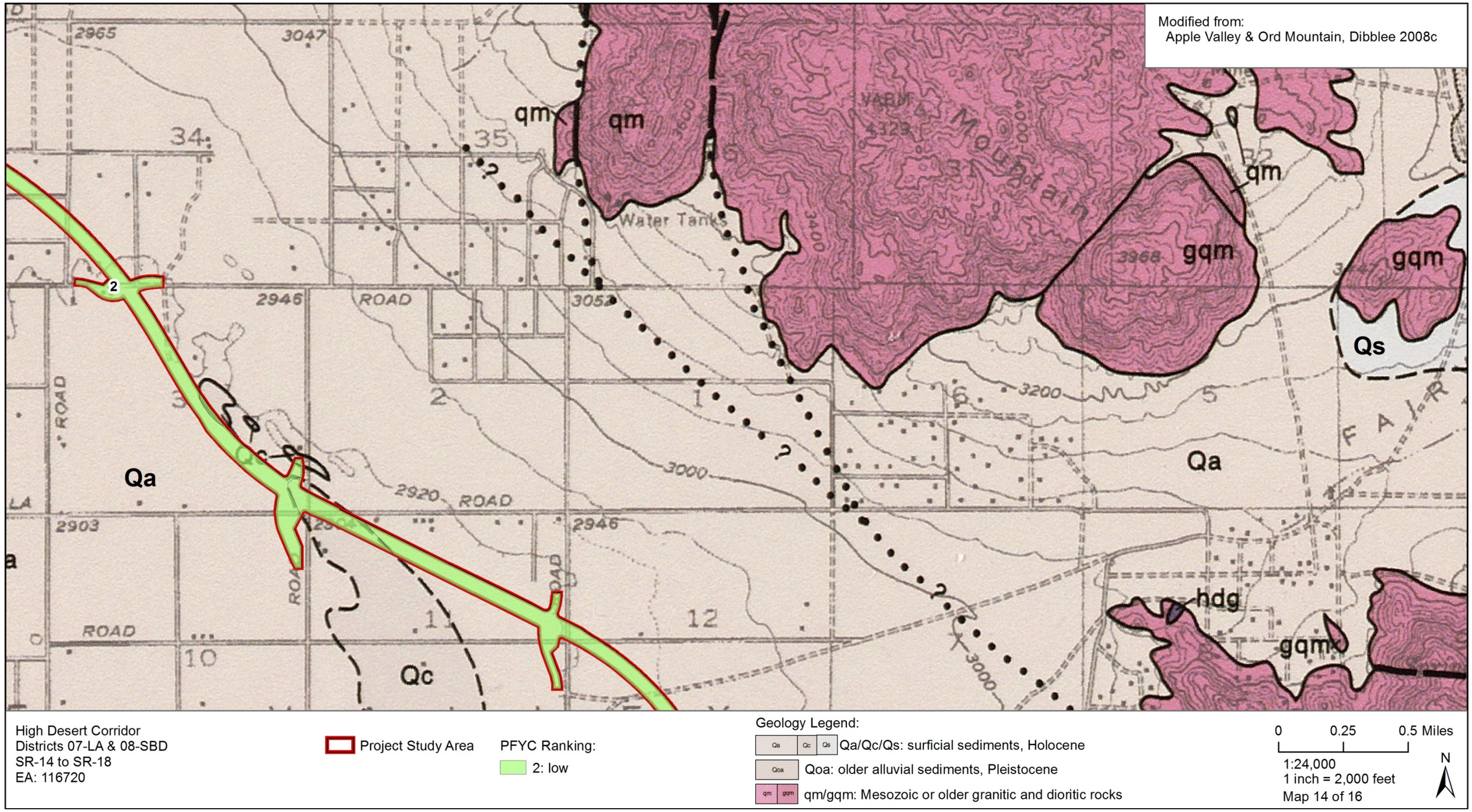



**Figure 4n. Project Paleontologic Sensitivity, 14 of 16**

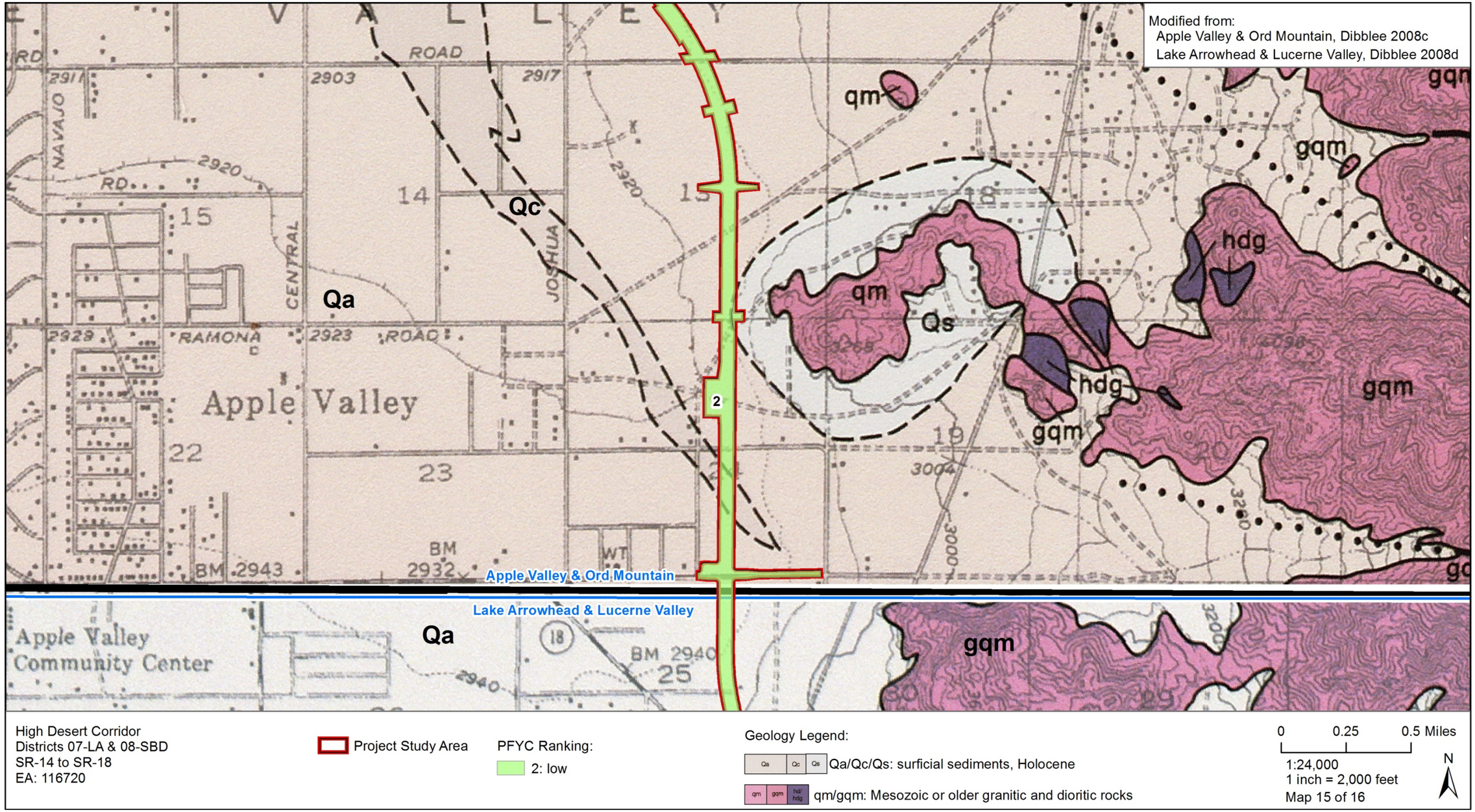



**Figure 4o. Project Paleontologic Sensitivity, 15 of 16**

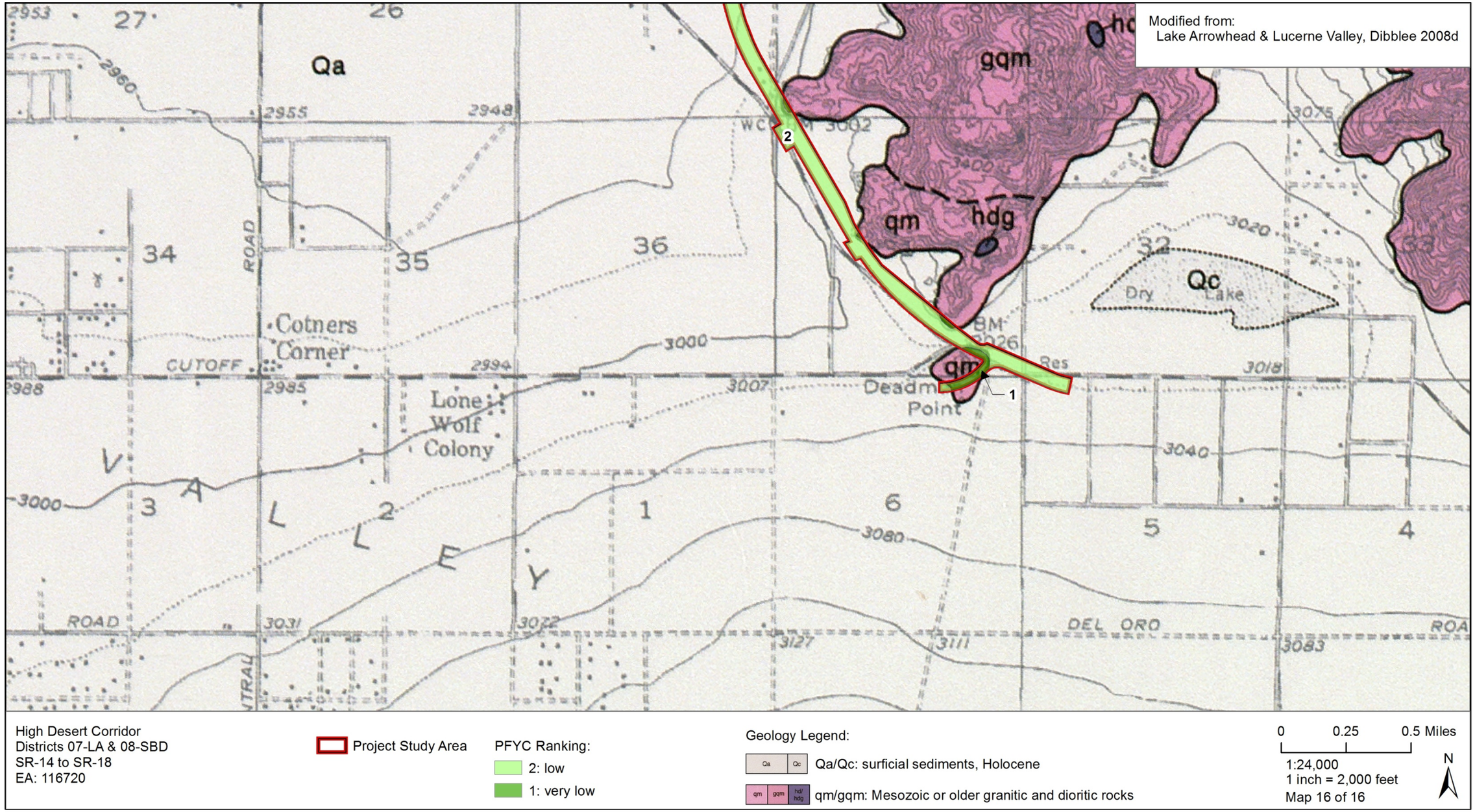



**Figure 4p. Project Paleontologic Sensitivity, 16 of 16**

# ADVERSE IMPACTS ANALYSIS

## BASELINE CONSIDERATIONS

The Quaternary older alluvium and Anaverde Formation have been demonstrated to be the only paleontologically sensitive sediments within the PSA that may be affected by project activities. Caltrans guidance for evaluating fossil deposits and sensitivity of resources states:

> Regardless of the format used by a paleontologist to rank formations, the importance of any rock unit must be explicitly stated in terms of specific fossils known or suspected to be present (and if the latter, why such fossils are suspected), and why these fossils are of paleontological importance. Some land-managing agencies may require the use of specific guidelines to assess significance whereas others may defer to the expertise of local paleontologists and provide little guidance. Because each situation may differ, it is important that there is a clear understanding between project staff (Caltrans or local), consultants, and personnel from other agencies as to exactly what criteria will be used to assess the significance of rock units affected by a particular project.
>
> As a practical matter, no consideration is generally afforded paleontological sites for which scientific importance cannot be demonstrated. If a paleontological resource assessment results in a determination that the site is insignificant or of low sensitivity, this conclusion should be documented in a Paleontological Evaluation Report (PER) and in the project's environmental document in order to demonstrate compliance with applicable statutory requirements.
>
> If a paleontological resource is determined to be significant, of high sensitivity, or of scientific importance, and the project impacts it, a mitigation program must be developed and implemented. Mitigation can be initiated prior to, and/or during, construction. The latter is more common for Caltrans projects. It should be pointed out; however, that mitigating during construction poses a greater risk of construction delays. Mitigation is an eligible federal project cost, in accordance with 23 U.S.C. 305, only if acceptable significance documentation is submitted. Thus, coordination between Caltrans, FHWA, and all jurisdictional agencies is critical to formally establishing the significance of a resource. [PER Instructions, Chapter 8, Vol. 1, SER, http://www.dot.ca.gov/ser/vol1/sec3/physical/Ch08Paleo/chap08paleo.htm]

## DEFINITION OF SIGNIFICANCE FOR PALEONTOLOGICAL RESOURCES

Only qualified, trained paleontologists with specific expertise in the type of fossils being evaluated can determine the scientific significance of paleontological resources. Fossils are considered to be significant if one or more of the following criteria apply:

1. The fossils provide information on the evolutionary relationships and developmental trends among organisms, living or extinct;

2. The fossils provide data useful in determining the age(s) of the rock unit or sedimentary stratum, including data important in determining the depositional history of the region and the timing of geologic events therein;

3. The fossils provide data regarding the development of biological communities or interaction between paleobotanical and paleozoological biotas;

4. The fossils demonstrate unusual or spectacular circumstances in the history of life;

5. The fossils are in short supply and/or in danger of being depleted or destroyed by the elements, vandalism, or commercial exploitation, and are not found in other geographic locations (Scott and Springer 2003).

As so defined, significant paleontological resources are determined to be fossils or assemblages of fossils that are unique, unusual, rare, uncommon, or diagnostically important. Significant fossils can include remains of large to very small aquatic and terrestrial vertebrates or remains of plants and animals previously not represented in certain portions of the stratigraphy. Assemblages of fossils that might aid stratigraphic correlation, particularly those offering data for the interpretation of tectonic events, geomorphologic evolution, and paleoclimatology are also critically important (Scott and Springer 2003; Scott et al. 2004).

## SIGNIFICANCE EVALUATION

The potential to affect any fossils varies with depth of impacts, previous disturbance and presence of non-fossiliferous sediments. Logistics of excavation also affect the possibility of recovering scientifically significant fossils since, as outlined above, information on exact location, vertical elevation, rock unit of origin, and other aspects of context are critical.

The no action alternative would create no surface or subsurface impacts and thus would not create adverse impacts to potential paleontological resources. Vertical impacts of construction are at present unknown as the designs have yet to be completed, however are expected to be as much as 30 feet deep in bridge construction areas. Due to the depth these excavations have the potential to impact fossils in any of the Quaternary deposits (Figure 4). Even shallow excavations in areas mapped as Quaternary older alluvium, particularly near the Mojave River, and the Anaverde Formation (Figure 4) have the potential to encounter significant paleontological resources and should be monitored full-time.

## RECOMMENDATIONS

Grading, excavation and other surface and subsurface excavation in defined areas of the proposed project have the potential to impact significant nonrenewable fossil resources of Pleistocene and Pliocene age. All excavations in areas mapped as Quaternary older alluvium (Qoa) and Anaverde Formation (Tac, Tas) have the potential to encounter significant paleontological resources and should be monitored full time. Excavations more than 10 feet in depth into Quaternary alluvial deposits (Qa, Qg, Qc, Qs) should be spot checked periodically for the presence of older, paleontologically sensitive sediments. Should sediments conducive to fossil preservation be encountered, monitoring should be implemented in those areas. Areas mapped as Paleozoic rock (ml) and Quaternary older schist cobble conglomerate (Qos) should be spot checked during construction and further evaluated for fossil potential as excavation proceeds. Areas mapped as Mesozoic rocks (qm, hdg, qd, gqm) do not require monitoring.

## MITIGATION MEASURES

PAL-1: A Paleontological Mitigation Plan (PMP) shall be prepared by a qualified paleontologist, with a current BLM statewide paleontology permit, when design is at or near completion and shall include elements specified as components of a PMP in SER Chapter 8, which could also include curation repository agreements from the Natural History Museum of Los Angeles County and the San Bernardino County Museum for any fossils from their respective counties. The PMP shall acknowledge the portions of the project on BLM lands and shall include all requirements of the Principal Paleontologist's BLM permit and all BLM monitoring guidance.

PAL-2: Paleontological monitoring, sampling, and fossil recovery shall be conducted as specified in the PMP by qualified paleontologists.

PAL-3: All recovered fossils shall be prepared to permit identification by experts and cataloged.

PAL-4: Fossils meeting significance criteria shall be submitted to the appropriate repository along with copies of all records, photos and maps to obtain permanent accession numbers

PAL-5: The Paleontological Mitigation Report shall include all elements specified in SER Chapter 8 as components of a PMR and shall include all results including specimens recovered with permanent accession numbers.

# REFERENCES CITED

Allen, J.
2014 Draft Paleontological Identification Report/Paleontological Evaluation Report High Desert Corridor/SR-138 Widening Project from SR-14 to SR-18. Cities of Lancaster, Palmdale and Victorville, Los Angeles County, California, District 07-LA SR-14 to SR-18 EA 116720. On File with Caltrans District 7.

BLM
2009 Paleontological Resources Preservation Act. Online at: http://www.blm.gov/pgdata/etc/medialib/blm/wo/Planning_and_Renewable_Resources/coop_agencies/paleontology_library/paleon_legis.Par.45651.File.dat/PL-111-011-prpa.pdf

Bortugno, E. J. and T. F. Spittler
1986 Geologic map of the San Bernardino quadrangle. California Division of Mines and Geology Regional Geologic Map Series Map 3a. Scale 1:250,000.

Caltrans
2012 Paleontology, Online Environmental Handbook, vol. 1, chapter 8. http://www.dot.ca.gov/ser/vol1/sec3/physical/Ch08Paleo/chap08paleo.htm

Cox, B. F. and J. W. Hillhouse
2000 Pliocene and Pleistocene evolution of the Mojave River, and associated tectonic development of the Transverse Ranges and Mojave Desert, based on borehole stratigraphy studies near Victorville, California. USGS Open File Report OF-00-147.

Dibblee, T, W. Jr.
2008a Geologic map of the Lancaster and Alpine Butte 15 minute quadrangles, Los Angeles County, California. Scale 1:62,500; Dibblee Foundation map DS-386.
2008b Geologic map of the Shadow Mountains and Victorville 15 minute quadrangles, San Bernardino and Los Angeles counties, California. Scale 1:62,500; Dibblee Foundation map DS-387.
2008c Geologic map of the Apple Valley and Ord Mountains 15 minute quadrangles, San Bernardino County, California. Scale 1:62,500; Dibblee Foundation map DS-377.
2008d Geologic map of the Lake Arrowhead and Lucerne Valley 15 minute quadrangles, San Bernardino County, California. Scale 1:62,500; Dibblee Foundation map DS-379.

Holroyd, P.
2010 UCMP Fossil local search. See Appendix B.

Jefferson, G. T.
1991 A Catalogue of late Quaternary Vertebrates from California: Part two, Mammals. *Natural History Museum of Los Angeles, Technical Report* #7.

McLeod, S. A.
2010 Paleontological resources for the proposed New SR-137 Freeway/Expressway Project in the City of Palmdale, Los Angeles County, project area. See Appendix B.

Scott, E.
2014 Paleontological literature and records review, High Desert Corridor Project, Western Mojave Desert, Los Angeles, and San Bernardino Counties, California. Appendix B.

Scott, E. and K. Springer
2003 CEQA and fossil preservation in southern California. The Environmental Monitor, Winter: 4-10, 17.

Scott, E., K. Springer, and J. C. Sagebiel
2004 Vertebrate paleontology in the Mojave Desert: The continuing importance of "Follow-Through" in preserving paleontological resources *in* M. W. Allen and Reed, J. editors The Human Journey and ancient life in California's deserts, proceedings from the 2001 Millennium Conference, 65-70.

Wagner, D.L.
2002 *California Geologic Survey Note 36*. http://www.conservation.ca.gov/cgs/information/publications/cgs_notes/note_36/Documents/note_36.pdf

# APPENDIX A. QUALIFICATIONS

## SHERRI GUST

Project Manager & Principal Investigator, Paleontology

### EDUCATION

1994 M. S., Anatomy (Evolutionary Morphology), University of Southern California, Los Angeles
1979 B. S., Anthropology (Physical), University of California, Davis

### SUMMARY QUALIFICATIONS

Gust has more than 30 years of experience in California, acknowledged credentials for meeting national standards, and is a certified/qualified principal paleontologist in all California cities and counties that maintain lists. She holds California and Nevada statewide BLM paleontology permits. Gust is an Associate of the Natural History Museum of Los Angeles County in the Vertebrate Paleontology and Rancho La Brea Sections. She is a Member of the Society of Vertebrate Paleontology and the Society of Economic Paleontologists and Mineralogists. She has special expertise in the identification and analysis of fossil bone.

### SELECTED PROJECTS

**Avenue 52 Grade Separation, Coachella, Riverside County.** Project Manager and Principal Paleontologist. Prepared Paleontological Identification/ Evaluation Report for grade separation along I-10. 2012

**Interstate 15 Joint Point of Entry, San Bernardino County.** Project Manager and Principal Paleontologist. Prepared a combined Paleontological Identification/Evaluation Report for a new combined agricultural inspection and commercial vehicle enforcement facility near the California-Nevada border. 2011.

**Interstate 15 Bridges, San Bernardino County.** Project Manager and Principal Paleontologist. Prepared a combined Paleontological Identification/Evaluation Report for the replacement of Cenda Ditch Bridge and Wheaton Wash Bridge east of Mountain Pass, CA. 2011

**State Route 91 HOV Project, Riverside.** Project Manager and Principal Paleontologist. Prepared a combined Paleontological Identification/Evaluation Report and Paleontological Mitigation Plan for the SR-91 High Occupancy Vehicle Lane Addition between Adams St. and the 60/91/215 Interchange in Riverside. 2011

**US 95 Vertical Curve Correction, south of Needles.** Project Manager and Principal Paleontologist. Prepared a combined Paleontological Identification/Evaluation Report and Paleontological Mitigation Plan for a vertical curve correction project south of Needles. 2011

**Palm Avenue Grade Separation, Caltrans District 8, San Bernardino County.** Project Manager and Principal Paleontologist. Prepared a combined Paleontological Identification/Evaluation Report for project involved adding a bridge of the Burlington Northern Santa Fe (BNSF) Railroad tracks at Palm Avenue and Route 66. 2010

**State Route 58 Realignment, Barstow.** Project Manager and Principal Paleontologist. Prepared a combined Paleontological Identification/Evaluation Report for a project to realign SR-58 in a ten mile stretch near Hinkley. 2010

**State Route 247 Widening, Yucca Valley.** Project Manager and Principal Paleontologist. Prepared a combined Paleontological Identification/Evaluation Report for a project to widen SR-247 between Yucca Valley and Flamingo Heights. 2009

**State Route 58 Realignment, San Bernardino County.** Project Manager and Principal Paleontologist. Prepared a combined Paleontological Identification/Evaluation Report for a project to realign SR-58 from the Kern County line to east of Kramer. 2009

**KIM SCOTT**
Field & Lab Director for Paleontology

## EDUCATION

2013 M.S., Biology with a paleontology emphasis, California State University, San Bernardino
2000 B.S., Geology with paleontology emphasis, University of California, Los Angeles

## SUMMARY QUALIFICATIONS

Scott has more than 18 years of experience in California paleontology. She is a qualified geologist and field paleontologist with extensive survey, monitoring and fossil salvage experience. In addition, she has special skills in fossil preparation (cleaning and stabilization) and preparation of stratigraphic sections and other documentation for fossil localities. Scott serves as company safety officer and is the author of the company safety and paleontology manuals.

## SELECTED PROJECTS

**I 10 HOV Widening.** Conducted paleontological survey and authored report for I 10 widening in Los Angeles San Bernardino counties, CA. Field and Lab Director. 2009-2014

**Merced Freeway Project, Caltrans District 10, Merced.** Alternated 2 week rotations performing direction of fossil recovery and field preparation of fossils for 5 mile segment of State Route 99 south of Merced. Some 128 localities and 1667 fossils recovered in five months of excavation for detention basins. Contributed to final report. Field / Lab Director and Report Contributor. 2012

**HECTF, Southern California Edison, Daggett.** Conducted paleontological survey and authored report for training facility in San Bernardino County, CA. Field and Lab Director. 2011-2012

**SR-41 Widening, Caltrans District 6, near Kettleman City.** Directed monitoring for widening and rehabilitating of an 8.5 mile segment of Highway 41 near Kettleman City. Supervised preparation of about 800 vertebrate, invertebrate and plant fossils recovered, prepared stratigraphic columns and contributed to preparation of Paleontological Monitoring Report. Field / Lab Director and Report Contributor. 2012

**Devers-Mirage 115 KV System Split Project, Southern California Edison, Riverside County.** Performed preconstruction paleontological survey, directed paleontological monitoring during construction activities and co-authored monitoring compliance report associated with electrical systems upgrade in of Cathedral City, Indian Wells, Palm Desert, Palm Springs, Rancho Mirage, Thousand Palms and unincorporated Riverside County. Field and Lab Director. 2011

**Geospatial Paleontology Database, Caltrans District 6, 9, and 10.** Conducted paleontological research for 15 counties in central and eastern California for paleontological screening tool. Paleontology Researcher. 2011-2012

**Tehachapi Renewable Transmission Project, Segments 1-3, Southern California Edison, Los Angeles and Kern counties**. Co-authored paleontological resources management plans and directed paleontological monitoring for construction of new electrical transmission facilities. Paleontology Field and Lab Director and Report Co-author. 2007-2009

**El Casco Substation Project, Southern California Edison, Riverside County**. Performed preconstruction mitigation measures and prepared portions of Paleontological Resources Treatment Plan. Field and Lab Director and Report co-author. 2009

## COURTNEY RICHARDS

Paleontologist and Assistant Field Director

### EDUCATION

2011 M.S., Biological Sciences, Marshall University
2006 B.S., Earth and Space Science, University of Washington

### SUMMARY QUALIFICATIONS

Richards is a qualified paleontologist with research, field, and laboratory experience. She earned her Bachelor's degree in Earth and Space Science at the University of Washington and her Master's degree in Biological Sciences with a paleontology focus at Marshall University. Richards has published papers on dinosaur and marine reptile paleontology research. Richards has personal expertise in fossil salvage, stratigraphy, fossil preparation, database analysis and identification. She has over two years of professional experience in California.

### SELECTED PROJECTS

**Purple Line Extension (Westside Subway), Exploratory Shaft, Los Angeles County Metropolitan Transportation Authority, Los Angeles.** Assistant Field Director. Supervised and conducted paleontological monitoring and recorded stratigraphy during pre-construction drilling and excavation to a depth of 75' for a 36' by 18' exploratory shaft located in the La Brea Zone. 2012-present

**SR-91 HOV Project, Caltrans District 8, Riverside County.** Paleontology Technician. Performed paleontological monitoring of sensitive sediments during HOV lane construction along a 6-mile segment of SR-91 in Riverside County. 2012-present

**SANDAG San Diego River Bridge Double Track Project, San Diego County.** Paleontology Technician. Conducted a pedestrian survey and co-authored the subsequent paleontological technical report for the proposed construction of a new double track bridge across the San Diego River and the alignment of the track to each side of the bridge along a 1.1-mile long segment of the LOSSAN railroad corridor. 2013

**Pioneer High School Project, Los Angeles County.** Report Contributor. Prepared paleontology and geology sections of a combined archaeological and paleontological resources assessment report for a stadium improvement project at Pioneer High School in Whittier, CA. 2013

**East San Fernando Valley Transit Corridor, Los Angeles County Metropolitan Transportation Authority, Los Angeles County.** Paleontology Technician. Conducted a paleontological survey; co-authored paleontological assessment and existing condition reports for Metro's proposed project to construct a light railway and new bus lines from Sylmar to Sherman Oaks in the eastern portion of the San Fernando Valley. 2012-present

**Jackson Valley Rehabilitation Project, Caltrans District 10, Amador County.** Paleontology Technician. Performed paleontological monitoring of sensitive sediments during road widening along SR-88 near Ione, CA and co-authored the Paleontological Mitigation Plan and final monitoring report. 2012-2013

**Merced Freeway Project, Caltrans District 10.** Assistant Field and Lab Director. Alternated 2 week rotations performing direction of fossil recovery and field preparation of fossils for 5-mile segment of State Route 99 south of Merced. Some 128 localities and 1667 fossils recovered in five months of excavation for detention basins. Prepared fossils in lab and supervised matrix washing and microfossil sorting. Contributed to final report including preparation of stratigraphic columns. 2012.

**ANDRE-JUSTIN C. SIMMONS**
Archaeologist and Cross-trained Paleontologist

**EDUCATION**

2010 B.A., Anthropology and History, California State University, Fullerton, graduated *cum laude*

**SUMMARY QUALIFICATIONS**

Mr. Simmons is a qualified archaeologist and cross-trained paleontologist with field experience in survey, monitoring, faunal analysis, and excavation. Simmons also has expertise in laboratory preparation and analysis gathered from internships at CSUF and volunteer experience at the Page Museum at the La Brea Tar Pits. His key research interests include architecture and use of space among Paleoindians, the American Southwest, early historic and prehistoric California, and historical Mexico. Simmons is currently completing his Master's Degree in Anthropology at California State University, Fullerton. He has more than 24 hours of paleontology training and two years of experience as a paleontological monitor.

**SELECTED PROJECTS**

**WECC Path 42, Southern California Edison, Riverside County, CA.** Conducted a cultural resources records search and field survey for a 14.5 mile transmission line segment near Thousand Palms. Archaeological/ Paleontological Technician. 2011-2012

**Eldorado-Ivanpah Transmission Project, Southern California Edison, Eldorado, NV to Ivanpah, CA.** Performed paleontological monitoring for project that involves construction of 195 miles of new transmission lines and associated fiber optic lines across BLM and private lands. Paleontological Monitor. 2012-2013

**Devers-Mirage 115 KV System Split Project, Southern California Edison, Riverside County, CA.** Performed archaeological and paleontological monitoring during construction activities associated with maintaining and upgrading the electrical systems of Cathedral City, Indian Wells, Palm Desert, Palm Springs, Rancho Mirage, Thousand Palms and unincorporated Riverside County. Archaeological/Paleontological Monitor. 2011-2012

**Leatherneck Substation Project, Southern California Edison, San Bernardino County, CA.** Prepared GIS maps for a cultural resources survey and subsequent survey report for ten pulling stations near Twenty-Nine Palms. GIS Technician. 2012

**Equinox DSP – Rush Project, Southern California Edison, Riverside County, CA.** Performed archaeological and paleontological monitoring during ground disturbing activities associated with construction of a power pole line near Menifee. Archaeological/Paleontological Monitor. 2011

**Fogarty Substation, Southern California Edison, Riverside County, CA.** Performed archaeological and paleontological monitoring during ground disturbing activities in Lake Elsinore. A historic glass fragment and prehistoric shells were recovered. Archaeological/Paleontological Monitor. 2010-2011

**Daggett II, Southern California Edison, San Bernardino County, CA.** Conducted archaeological and paleontological monitoring of construction activities of transmission towers and associated access roads for the 225-acre Human External Cargo Helicopter Training Facilities Project in Daggett. Archaeological/Paleontological Monitor. 2011

**SR-99 Arboleda Drive Freeway Project, Caltrans District 10, Merced County, CA.** Conducted paleontological resources monitoring, fossil recovery, and fossil preparation for a 5-mile segment. Prepared GIS report maps. Some 128 localities and 1,667 fossils recovered in five months of excavation for detention basins. Paleontology & GIS Technician. 2012

# APPENDIX B. PALEONTOLOGY RECORDS SEARCHES

## SAN BERNARDINO COUNTY MUSEUM RECORDS SEARCH

**SAN BERNARDINO COUNTY MUSEUM**

2024 Orange Tree Lane • Redlands, California USA 92374-4560
(909) 307-2669 • Fax (909) 307-0539 • www.sbcountymuseum.org
TDD (909) 792-1462

COUNTY OF SAN BERNARDINO

Leonard Hernandez
Interim Director

14 August 2014

Cogstone Resource Management
attn: Courtney Richards
1518 W. Taft Avenue
Orange, CA 92865

re: **PALEONTOLOGY LITERATURE AND RECORDS REVIEW, HIGH DESERT CORRIDOR PROJECT, WESTERN MOJAVE DESERT, LOS ANGELES AND SAN BERNARDINO COUNTIES, CALIFORNIA**

Dear Ms. Richards,

The Division of Geological Sciences of the San Bernardino County Museum (SBCM) has completed a records search for the above-referenced project in western Mojave Desert region of Los Angeles and San Bernardino Counties, California. The proposed project corridor traverses portions of the following United States Geological Survey 7.5' topographic quadrangle maps: Adelanto, California (1956 edition, photorevised 1980); Apple Valley North, California (1970 edition, photoinspected 1978); Apple Valley South, California (1971 edition, photorevised 1980); El Mirage, California (1956 edition, photorevised 1968); Fifteenmile Valley, California (1971 edition); Lancaster East, California (1958 edition, photorevised 1974); Lancaster West, California (1958 edition, photorevised 1974); Littlerock, California (1957 edition); Lovejoy Buttes, California (1957 edition); Palmdale, California (1958 edition, photorevised 1974); Ritter Ridge, California (1958 edition, photorevised 1974); Shadow Mountains SE, California (1955 edition, photorevised 1968); Turtle Valley, California (1970 edition); and Victorville, California (1956 edition, photorevised 1981).

Previous mapping of the western Mojave Desert region (Jennings and Strand, 1969; Bortugno and Spittler 1986) indicates that the proposed High Desert Corridor project alignment will for the most part traverse surface sediments of Holocene or recent alluvium (= units **Qal**, **Q**). These sediments are too young geologically to have potential to contain significant nonrenewable paleontologic resources, and so are assigned low paleontologic sensitivity. However, these sediments may overlie older alluvium dating to the Pleistocene Epoch in the subsurface, at varying depths along the proposed project alignment. Where present in the subsurface, and depending upon the exhibited lithology and depositional context, such Pleistocene older alluvium may have high potential to contain scientifically significant fossil remains. Within the proposed study area and elsewhere throughout the western Mojave Desert, similar sediments of this age have previously yielded significant paleontologic resources (Jefferson, 1989, 1991; Reynolds, 1989; Scott and Cox, 2008).

GREGORY C. DEVEREAUX
Chief Executive Officer

Board of Supervisors
ROBERT A. LOVINGOOD ..... First District
JANICE RUTHERFORD, Chair ... Second District
JAMES RAMOS ..... Third District
GARY C. OVITT ..... Fourth District
JOSIE GONZALES ..... Fifth District

The proposed project corridor also traverses surface outcrops of well-dissected Pleistocene alluvial fans (= **Qod**), both near Lovejoy Buttes and in the vicinity of the Mojave River in and around Victorville. These sediments, too, have high potential to contain significant fossil resources, depending upon their lithology, and so are assigned high paleontologic sensitivity.

In the vicinity of Palmdale, the alignment crosses surface outcrops of early to middle Pliocene sediments (= **Pmlc**), known locally as the Anaverde Formation. This formation has produced remains of fossil plants; Dibblee (1967) noted that nineteen taxa of fossil plants were known from the Anaverde Formation. More recent work in the area has continued to produce fossil plants as well as large vertebrate mammals. Sediments of the Anaverde Formation are interpreted to have high potential to contain significant nonrenewable paleontologic resources subject to adverse impact during development-related excavation.

The proposed project alignment also traverses surface outcrops of Jurassic and Cretaceous quartz monzonite (= **KJqm**). These Mesozoic granitic rocks have no potential to contain fossil resources in a significant stratigraphic context, and so are assigned low paleontologic sensitivity.

For this review, I conducted a search of the Regional Paleontologic Locality Inventory (RPLI) at the SBCM. The results of this records search indicated that four (4) paleontological resource localities are recorded from along the proposed project alignment, all in the Victorville region. These localities (SBCM 1.114.24, 1.114.27, 1.114.30, and 1.114.33B) yielded fossil remains of Plantae (root casts), *Coleonyx variegatus* (western banded gecko), *Lepus* (jackrabbit), *Thomomys* (pocket gopher), *Perognathus* sp. cf. *P. longimembris* (pocket mouse), *Neotoma* sp. cf. *N. albigula* (wood rat), Rodentia (indeterminate rodent), and Mammalia (indeterminate mammal). *Confidential* locality data are appended. It is noted that none of the taxa from these localities are time-diagnostic, and so the Pleistocene age of the remains is not confirmed.

Additionally, numerous localities are located within roughly one mile of the proposed project corridor. In the Palmdale region, localities SBCM 9.2.3 - 9.2.7 and 9.2.15 - 9.2.31 are located within 1 mile of the western portions of the proposed study area. These localities yielded fossil root casts and remains of rodents and other small vertebrates from subsurface alluvium of presumed Pleistocene age (although, here too, none of the taxa represented are time diagnostic). Additionally, locality SBCM 9.2.2, located near the proposed alignment, yielded fossil remains of extinct mastodon from exposures of the Pliocene Anaverde Formation.

Near Adelanto, localities SBCM 1.115.1 - 1.115.2 and 1.115.10 yielded fragments of large mammal tooth enamel from surface and subsurface Pleistocene alluvium. Further east, in and around Victorville, localities SBCM 1.114.36 - 1.114.37 and 1.114.274 yielded fossil remains of *Mammuthus meridionalis* (extinct mammoth), *Paramylodon harlani* (giant ground sloth), *Equus* sp. cf. *E. scotti* (extinct horse), *Hemiauchenia* (extinct llama), *Camelops hesternus* (extinct large camel), and a variety of smaller forms. Finally, locality SBCM 1.107.2 in the Apple Valley region yielded indeterminate small mammal remains from Pleistocene older alluvium. The relative proximity of all these localities to portions of the proposed project alignment indicates that surface and subsurface

Pleistocene alluvium, if and where encountered, will have high potential to contain significant fossil resources. These localities therefore support an interpretation of high paleontologic sensitivity for these sediments.

**Recommendations**

The results of the literature review and the check of the RPLI at the SBCM demonstrate that excavation into surficial Pleistocene nonmarine alluvium within the boundaries of the proposed property in Palmdale has undetermined potential to adversely impact significant nonrenewable paleontologic resources. A field reconnaissance by a qualified vertebrate paleontologist with region experience is recommended to directly examine the area of potential effect and determine the paleontologic potential of the Pleistocene sediments on the property. Should the Pleistocene alluvium on the property exhibit a lithology conducive to the preservation of fossil resources, or should such resources be present at the surface on the property, the study area would be assigned high paleontologic sensitivity. In this event, a qualified vertebrate paleontologist would need to be retained to develop a program to mitigate adverse impacts to nonrenewable paleontologic resources. This mitigation program should be consistent with the provisions of the California Environmental Quality Act (Scott and Springer, 2003), as well as with regulations currently implemented by the Counties of Los Angeles and San Bernardino.

The County of San Bernardino (Development Code §82.20.040) defines a qualified vertebrate paleontologist as meeting the following criteria:

Education: An advanced degree (Masters or higher) in geology, paleontology, biology or related disciplines (exclusive of archaeology).

Professional experience: At least five years professional experience with paleontologic (not including cultural) resources, including the collection, identification and curation of the resources.

The County of San Bernardino (Development Code §82.20.030) requires that paleontologic mitigation programs include, but not be limited to:

(a) Field survey before grading. In areas of potential but unknown sensitivity, field surveys before grading shall be required to establish the need for paleontologic monitoring.

(b) Monitoring during grading. A project that requires grading plans and is located in an area of known fossil occurrence, or that has been demonstrated to have fossils present in a field survey, shall have all grading monitored by trained paleontologic crews working under the direction of a qualified professional, so that fossils exposed during grading can be recovered and preserved. Paleontologic monitors shall be equipped to salvage fossils as they are unearthed, to avoid construction delays, and to remove samples of sediments that are likely to contain the remains of small fossil invertebrates and vertebrates. Monitors shall be empowered to temporarily halt or divert equipment to allow removal of abundant or large specimens. Monitoring is not necessary if the potentially-fossiliferous

units described for the property in question are not present, or if present are determined upon exposure and examination by qualified paleontologic personnel to have low potential to contain fossil resources.

(c) Recovered specimens. Qualified paleontologic personnel shall prepare recovered specimens to a point of identification and permanent preservation, including washing of sediments to recover small invertebrates and vertebrates. Preparation and stabilization of all recovered fossils is essential in order to fully mitigate adverse impacts to the resources.

(d) Identification and curation of specimens. Qualified paleontologic personnel shall identify and curate specimens into the collections of the Division of Geological Sciences, San Bernardino County Museum, an established, accredited museum repository with permanent retrievable paleontologic storage. These procedures are also essential steps in effective paleontologic mitigation and CEQA compliance. The paleontologist must have a written repository agreement in hand prior to the initiation of mitigation activities. Mitigation of adverse impacts to significant paleontologic resources is not considered complete until curation into an established museum repository has been fully completed and documented.

(e) Report of findings. Qualified paleontologic personnel shall prepare a report of findings with an appended itemized of specimens. A preliminary report shall be submitted and approved before granting of building permits, and a final report shall be submitted and approved before granting of occupancy permits. The report and inventory, when submitted to the appropriate Lead Agency along with confirmation of the curation of recovered specimens into the collections of the San Bernardino County Museum, will signify completion of the program to mitigate impacts to paleontologic resources.

## References

Bortugno, E.J. and T. E. Spittler, 1986. Geologic map of California, San Bernardino sheet, scale 1:250,000. California Division of Mines and Geology Regional Geologic Map Series, Map 3A.

Dibblee, T.W., Jr., 1967. Areal geology of the western Mojave Desert. U.S. Geological Survey Professional Paper #552.

Jefferson, G.T., 1989. Late Pleistocene and earliest Holocene fossil localities and vertebrate taxa from the western Mojave Desert. *In* J. Reynolds (ed.), The west-central Mojave Desert: Quaternary studies between Kramer and Afton Canyon. Redlands: SBCM Association Special Publication, p. 27-40.

Jennings, C.W. and R.G. Strand, 1969. Geologic map of California, Los Angeles sheet, 1:250,000. Division of Mines and Geology.

Reynolds, S.F.B., 1989. Mid-Pleistocene faunas of the west-central Mojave Desert. *In* J. Reynolds (ed.), The west-central Mojave Desert: Quaternary studies between Kramer and Afton Canyon. Redlands: SBCM Association Special Publication, p. 44-50.

Scott, E. and S.M. Cox, 2008. Late Pleistocene distribution of *Bison* (Mammalia; Artiodactyla) in the Mojave Desert of southern California and Nevada. *In* X. Wang and L.G. Barnes (eds.), Geology and Vertebrate Paleontology of Western and Southern North America, Contributions in Honor of David P. Whistler. Natural History Museum of Los Angeles County Science Series No. 41, p. 359 - 382.

Scott, E. and K. Springer, 2003. CEQA and fossil preservation in southern California. The Environmental Monitor, Fall 2003, p. 4-10, 17.

Scott, E., K. Springer and J.C. Sagebiel, 2004. Vertebrate paleontology in the Mojave Desert: the continuing importance of "follow-through" in preserving paleontologic resources. In M.W. Allen and J. Reed (eds.) The human journey and ancient life in California's deserts: Proceedings from the 2001 Millennium Conference. Ridgecrest: Maturango Museum Publication No. 15, p. 65-70.

Please do not hesitate to contact us with any further questions you may have.

Sincerely,

Eric Scott, Curator of Paleontology
Division of Geological Sciences
San Bernardino County Museum

## SAN BERNARDINO COUNTY MUSEUM REGIONAL PALEONTOLOGIC LOCALITY INVENTORY

**SBCM:** 1.114.24 **PROJECT:**
**Name:** Thorn #14 **Area:** Victorville
**County:** San Bernardino County **State:** California **District:**
**USGS Map:**
**PM:** San Bernardino Meridian **T** 5N **R** 4W **Sections:** 28 S, NE, SE
**Field Number:**
**Other Number:**
**Repository:** **Collector:**
**Description:** fine-grained lacustrine and sediments with paleontolical specimens.
**Formation:** **Unit/Member:**
**Geologic Age:**
**Data Entry:** GB 10/13/2009
**Taxa/Object Found:**
**Notes:**

## SAN BERNARDINO COUNTY MUSEUM REGIONAL PALEONTOLOGIC LOCALITY INVENTORY

**SBCM:** 1.114.27 **PROJECT:**
**Name:** Village Drive #1 **Area:** Victorville
**County:** San Bernardino County **State:** California **District:**
**USGS Map:** Victorville, CA; 7.5' 1956 PR 1981
**Utm Zone:** 11 **Utm Datum:** NAD1927 **Meters East:** 469080 **Meters North:** 3825410
**Elevation Feet:** . **Elevation Meters:** .
**PM:** San Bernardino Meridian **T** 6N **R** 4W **Sections:** 30 SW, SE,
**Field Number:** 24/3E
**Other Number:**
**Repository:** SBCM **Collector:**
**Description:** Gray- green silty sand layer outcrops in bluffs of tan flubiatile sand on E side of Village Drive, Harold Formation ref Bowen 1954 Barstow quad, Woodburne & Golz 1972 Cajon Punchbowls, repenning 1980.
**Formation:** **Unit/Member:**
**Geologic Age:** Irvingtonian
**Data Entry:** GB 10/13/2009
**Taxa/Object Found:** ?Camelidae tooth enamel, ?Mammalia (large) long bone (very thin-walled)
**Notes:**

## SAN BERNARDINO COUNTY MUSEUM REGIONAL PALEONTOLOGIC LOCALITY INVENTORY

**SBCM:** 1.114.30 **PROJECT:**
**Name:** El Evado Edison Road #1 **Area:** Victorville
**County:** San Bernardino County **State:** California **District:** Barstow
**USGS Map:** Victorville, CA; 15'
**Utm Zone:** 11 **Utm Datum:** NAD1927 **Meters East:** 468310 **Meters North:** 3823870
**Elevation Feet:** . **Elevation Meters:** .
**PM:** San Bernardino Meridian **T** 6N **R** 4W **Sections:** 31 W, SW, SW,SW
**Field Number:** 24/1
**Other Number:**
**Repository:** SBCM **Collector:**
**Description:** A cut in bluffs exposes greenish silty sand, Harold Formation, ref Bowen 1954 BArstow quad, Woodburne & Golz 1972 Cajon Punchbowl, repenning 1980.
**Formation:** **Unit/Member:**
**Geologic Age:** Irvingtonian

**Data Entry:** GB 10/13/2009
**Taxa/Object Found:** Mammalia (large) limb fragment
**Notes:**

## SAN BERNARDINO COUNTY MUSEUM REGIONAL PALEONTOLOGIC LOCALITY INVENTORY

**SBCM:** 1.114.33B **PROJECT:**
**Name:** George#1 **Area:** Victorville
**County:** San Bernardino County **State:** California **District:**
**USGS Map:** Victorville, CA; 7.5' 1956 PR 1981
**Utm Zone:** 11 **Utm Datum:** NAD1927 **Meters East:** 468520 **Meters North:** 3825600
**Elevation Feet:** 2700. **Elevation Meters:** 822.96
**PM:** San Bernardino Meridian **T** 6N **R** 4W **Sections:** 30 E, SW, SW
**Field Number:**
**Other Number:** IPP T 4650
**Repository:** SBCM **Collector:**
**Description:** Irvingtonian or early Rancholabrean fine-grained lacustrine sediments and gravels
East of Victor Valley Country Club, west of Reservoir;
**Formation:** **Unit/Member:**
**Geologic Age:** Pleistocene

**Data Entry:** GB 10/13/2009
**Taxa/Object Found:** Plantae root casts, Coleonyx variegatus, Lepus, Thomomys, Perognathus cf. longimembris, Neotoma cf. albigula, Rodentia, Mammalia
**Notes:**

## UNIVERSITY OF CALIFORNIA MUSEUM OF PALEONTOLOGY AT BERKELEY RECORDS SEARCH

From: pholroyd@berkeley.edu

To: James Allen <jallenpaleo@gmail.com>

ccmark@berkeley.edu

date: Fri, Jul 30, 2010 at 10:24 AM

subject Re: Fossil locale search

mailed-by berkeley.edu

Dear Jim,

I conducted a search of the UCMP locality database for the project area and found no records of prior finds.

Cheers, Pat

Pat Holroyd, Ph.D.

Museum of Paleontology

University of California

Berkeley, CA 94720

pholroyd@berkeley.edu

## NATURAL HISTORY MUSEUM OF LOS ANGELES COUNTY RECORDS SEARCH

Natural History Museum of Los Angeles County
900 Exposition Boulevard • Los Angeles, CA 90007

Vertebrate Paleontology Section
Telephone: (213) 763-3325
FAX: (213) 746-7431
e-mail: smcleod@nhm.org or smcleod@usc.edu

16 August 2010

James R. Allen
6747 Tory Way
Dublin, CA 94568

Attn: James R. Allen, M.Sci. Geology, PG #8335

re: Paleontological resources for the proposed New SR-138 Freeway / Expressway Project, in the City of Palmdale, Los Angeles County, project area

Dear James:

I have thoroughly searched our paleontology collection records for the locality and specimen data for the proposed New SR-138 Freeway / Expressway Project, in the City of Palmdale, Los Angeles County, project area as outlined on the portions of the Ritter Ridge, Palmdale, and Littlerock USGS topographic quadrangle maps that you sent to me via e-mail on 12 August 2010. We do not have any vertebrate fossil localities that lie directly along the proposed project area, but we do have localities from the same type of sedimentary deposits that may occur within the proposed project area.

On the southwestern-most portion of the proposed project area, near the intersection of the Antelope Valley Freeway (Highway 14) and the Pearblossom Highway (Highway 138), there may be exposures of older Quaternary gravels. These deposits are unlikely to contain any significant vertebrate fossils and we have no localities anywhere nearby from such deposits. Surficial deposits in the remainder of the proposed project area, all in lower lying portions of the Antelope Valley, are composed of younger Quaternary Alluvium with older Quaternary deposits occurring at varying depths. These younger Quaternary deposits usually do not contain significant vertebrate fossils, at least in the uppermost layers. But due east of the southern portions of the proposed project route areas, along Avenue S from just before 90th Street East eastward almost to the San Bernardino County line, we have localities LACM 5942-5953 from pipeline excavations in the Quaternary Alluvium and older Quaternary sediments that produced a fauna of small vertebrates including gopher snake, *Pituophis*, kingsnake, *Lampropeltis*, leopard lizard, *Gambelia wislizenii*, cottontail rabbit, *Sylvilagus*, pocket mouse, *Chaetodipus*, kangaroo rat, *Dipodomys*, and pocket gopher, *Thomomys*.

Excavations in the older Quaternary gravels exposed in the very southwestern-most portion

of the proposed project area are quite unlikely to encounter significant vertebrate fossils. Surface grading or very shallow excavations in the younger Quaternary Alluvium exposed throughout most of the proposed project area, probably will not encounter any significant vertebrate fossils. Deeper excavations in the latter areas that extend down into older Quaternary deposits, however, may well uncover significant fossil vertebrate remains. Any substantial excavations in the sedimentary deposits in the proposed project area, therefore, should be monitored closely to quickly and professionally recover any fossil remains while not impeding development. These fossil vertebrate remains, however, may be quite small and would be missed in typical paleontological excavation monitoring. It is recommended, therefore, that sediment samples from substantial subsurface excavations be collected and processed to determine their small fossil potential. Any fossils recovered during mitigation should be deposited in an accredited and permanent scientific institution for the benefit of current and future generations.

This records search covers only the vertebrate paleontology records of the Natural History Museum of Los Angeles County. It is not intended to be a thorough paleontological survey of the proposed project area covering other institutional records, a literature survey, or any potential on-site survey.

Sincerely,

Samuel A. McLeod, Ph.D.
Vertebrate Paleontology

enclosure: draft invoice

# APPENDIX C. SENSITIVITY RANKING CRITERIA

| Caltrans Rank | Caltrans Description | PFYC Description | PFYC Rank |
|---|---|---|---|
| No Potential | Rock units of intrusive igneous origin, most extrusive igneous rocks, and moderately to highly metamorphosed rocks are classified as having no potential for containing significant paleontological resources | Very Low. The occurrence of significant fossils is non-existent or extremely rare. Includes igneous or metamorphic and Precambrian or older rocks. Assessment or mitigation of paleontological resources is usually unnecessary. | 1 |
| Low Potential | This category includes sedimentary rock units that: 1) are potentially fossiliferous, but have not yielded significant fossils in the past; 2) have not yet yielded fossils, but possess a potential for containing fossil remains; or 3) contain common and/or widespread invertebrate fossils if the taxonomy, phylogeny, and ecology of the species contained in the rock are well understood. | Low. Sedimentary geologic units that are not likely to contain vertebrate fossils or scientifically significant nonvertebrate fossils. Includes rock units too young to produce fossils, sediments with significant physical and chemical changes (e.g., diagenetic alteration) and having few to no fossils known. Assessment or mitigation of paleontological resources is not likely to be necessary. | 2 |
| | | Potentially Moderate but Undemonstrated Potential. Units exhibit geologic features and preservational conditions that suggest fossils could be present, but no vertebrate fossils or only common types of plant and invertebrate fossils are known. Surface-disturbing activities may require field assessment to determine appropriate course of action. | 3b |
| High Potential | Rock units which, based on previous studies, contain or are likely to contain significant vertebrate, significant invertebrate, or significant plant fossils | Moderate Potential. Units are known to contain vertebrate fossils or scientifically significant nonvertebrate fossils, but these occurrences are widely scattered and of low abundance. Common invertebrate or plant fossils may be found. Surface-disturbing activities may require field assessment to determine appropriate course of action. | 3a |
| | | High. Geologic units containing a high occurrence of significant fossils. Fossils must be abundant per locality. Vertebrate fossils or scientifically significant invertebrate or plant fossils are known to occur and have been documented, but may vary in occurrence and predictability. If impacts to significant fossils can be anticipated, on-the-ground surveys prior to authorizing the surface disturbing action will usually be necessary. On-site monitoring or spot-checking may be necessary during construction activities. | 4 |
| | | Very High. Highly fossiliferous geologic units that consistently and predictably produce vertebrate fossils or scientifically significant invertebrate or plant fossils. Vertebrate fossils or scientifically significant invertebrate fossils are known or can reasonably be expected to occur in the impacted area. On-the-ground surveys prior to authorizing any surface disturbing activities will usually be necessary. On-site monitoring may be necessary during construction activities. | 5 |