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08-AFC-13
DATE NOV 19 2009
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Tessera Solar
power from stirling energy systems

November 19, 2009

Mr. Christopher Meyer
CEC Project Manager
Attn: Docket No. 08-AFC-13
California Energy Commission
1516 Ninth Street
Sacramento, CA 95814-5512

Mr. Jim Stobaugh
BLM Project Manager
Attn: Docket No. 08-AFC-13
Bureau of Land Management
P.O. Box 12000
Reno, NV 89520

RE: SES Solar One Project
Applicant's Responses to CEC and BLM Data Request Set 1, Part 2
Cultural Resources Data Responses and 25 Percent Submittal
Data Requests 92-108

Dear Mr. Meyer and Mr. Stobaugh,

Tessera Solar hereby submits the Applicant's responses to CEC and BLM Data Request Set 1, Part 2, Data Requests 92-108. I certify under penalty of perjury that the foregoing is true, correct, and complete to the best of my knowledge.

Sincerely,

Felicia L. Bellows

Felicia L. Bellows
Vice President of Development

Tessera Solar
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Dear Mr. Meyer and Mr. Stobaugh,

Tessera Solar hereby submits the Applicant's responses to CEC and BLM Data Request Set 1, Part 2, Data Requests 92-108, Confidential Volume 2. This confidential filing is to be made under the Application for Confidentiality filed December 1st, 2009. The information submitted is substantially similar to the previously submitted information and all the facts and circumstances remain unchanged. I certify under penalty of perjury that the foregoing is true, correct, and complete to the best of my knowledge.

Sincerely,

Felicia L Bellows

Felicia L. Bellows
Vice President of Development

SES SOLAR ONE

In Response to CEC & BLM Data Requests
Data Requests 92-108
VOLUME 1: Data Responses

Application for Certification (08-AFC-13)

November 2009

Submitted to:
Bureau of Land Management
2601 Barstow Road
Barstow, CA 92311

Submitted to:
California Energy Commission
1516 9th Street, MS 15
Sacramento, CA 95814-5504

Submitted by:
SES Solar Three, LLC
SES Solar Six, LLC

SES

Stirling Energy Systems
4800 N. Scottsdale Road, Suite 5500
Scottsdale, AZ 85251

TECHNICAL AREA: CULTURAL RESOURCES

Data Request 92. Please provide a discussion of the historical geomorphology of the project area to better evidence a consideration of the potential there for buried archaeological deposits. The discussion should describe the development of the landforms on which the project area is proposed, with a focus on the character of the depositional regime of each landform since the Late Pleistocene era. The bases for the discussion should be data on geomorphology, sedimentology, pedology, hydrology, and stratigraphy of the project area or the near vicinity. The source of these data should be available Quaternary science or geoarchaeological literature. The presentation of the discussion should also include maps that overlay the above data on the project area.

Response: Please see the Sensitivity Analysis of the Solar One Project Area, provided as attachment CUL-1, provided behind this response.

Geoarchaeological Sensitivity Analysis

of the Solar One Project Area

Jay Rehor, M.A., RPA

Data Response 92/93

Background and Setting

The following discussion is largely focused on identifying those portions of the project area that have the potential for harboring archaeological deposits *with no surface manifestation*. It has been shown that some alluvial landforms, with desert pavements that have evolved through accretion of eolian silts and sands and the gradual bearing of larger clasts to the surface, have the potential for containing buried archaeology (Ahlstrom and Roberts 2001). However, a representative portion (if not the vast majority) of this archaeological deposit will be incorporated into the surface pavement through the same accretionary process. Thus, these older surfaces are not likely to contain archaeology that is not at least partially evident on the surface (see Data Response 94 for additional discussion of the relationship between archaeological material and desert pavements).

Geomorphic processes have played a major role in the differential preservation of archaeological sites in the Mojave Desert. For example, early cultural sites related to the San Dieguito and Lake Mojave cultural complexes are almost exclusively known from surface contexts on terminal Pleistocene and early Holocene geomorphic surfaces (Sutton 1996:229). This represents the differential preservation of older sites on relict landforms, with other sites likely buried by subsequent depositional processes, or destroyed by erosional processes. These same processes have also affected the distribution of resources (i.e., lithic raw material, water, biotic communities, etc.) across the landscape and, thus, the placement of archaeological sites in relationship to those resources. The primary factors effecting geomorphic processes in the Mojave region are the underlying structural geology and climate change.

Regional climatic trends through the Late Pleistocene and Holocene are important to the current study because of effects on the production of material for alluvial deposition and the concomitant susceptibility of the landscape to erosion. Regional correlations between periods of alluvial fan deposition during the Latest Pleistocene and Holocene indicate that climatic changes superseded other factors as the primary force driving alluvial deposition (McDonald, McFadden, and Wells. 2003:203). Within the Mojave Desert, several major intervals of alluvial deposition have been identified and appear roughly correlative across the region, largely transcending geomorphic variation (Anderson and Wells 2003; Harvey and

Wells 2003; McDonald, McFadden and Wells 2003). Figure 1 shows a summary of the timing of these major depositional events across numerous mountain fronts in the Mojave.

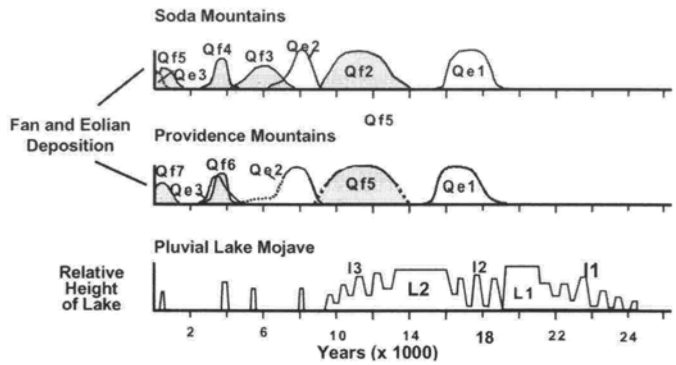


Figure 1. Correlation of Mojave Desert Geomorphic Events
(Qf designates period of alluvial fan deposition, Qe eolian dune formation, and L pluvial lake highstands; from McDonald, McFadden and Wells 2003:198)

In general, the Pleistocene-Holocene transition ca. 13,000 to 9,000 years before present (BP) represents a major period of fan deposition, followed by subsequent periods during the Holocene at approximately 8,000 to 5,000 BP, 4,000 to 3,000 BP (both corresponding with brief resurgences of Lake Mojave), and after approximately 1,500 BP. It was initially conjectured that these periods, especially around the Pleistocene-Holocene transition, correlated with general environmental desiccation, a decrease in soil moisture and vegetation, and an increase in sediment supply and erosion (e.g., Bull 1991; Wells et al. 1987). However, recent field studies have demonstrated that changes in vegetation cover alone do not explain increased sediment mobility. Instead, the most plausible hypothesis points towards a northward shift in the dominant late summer/early fall jet-stream, allowing tropical Pacific cyclones from southern Mexico into the region and causing unusually large amounts of precipitation over short periods (McDonald, McFadden and Wells 2003:202).

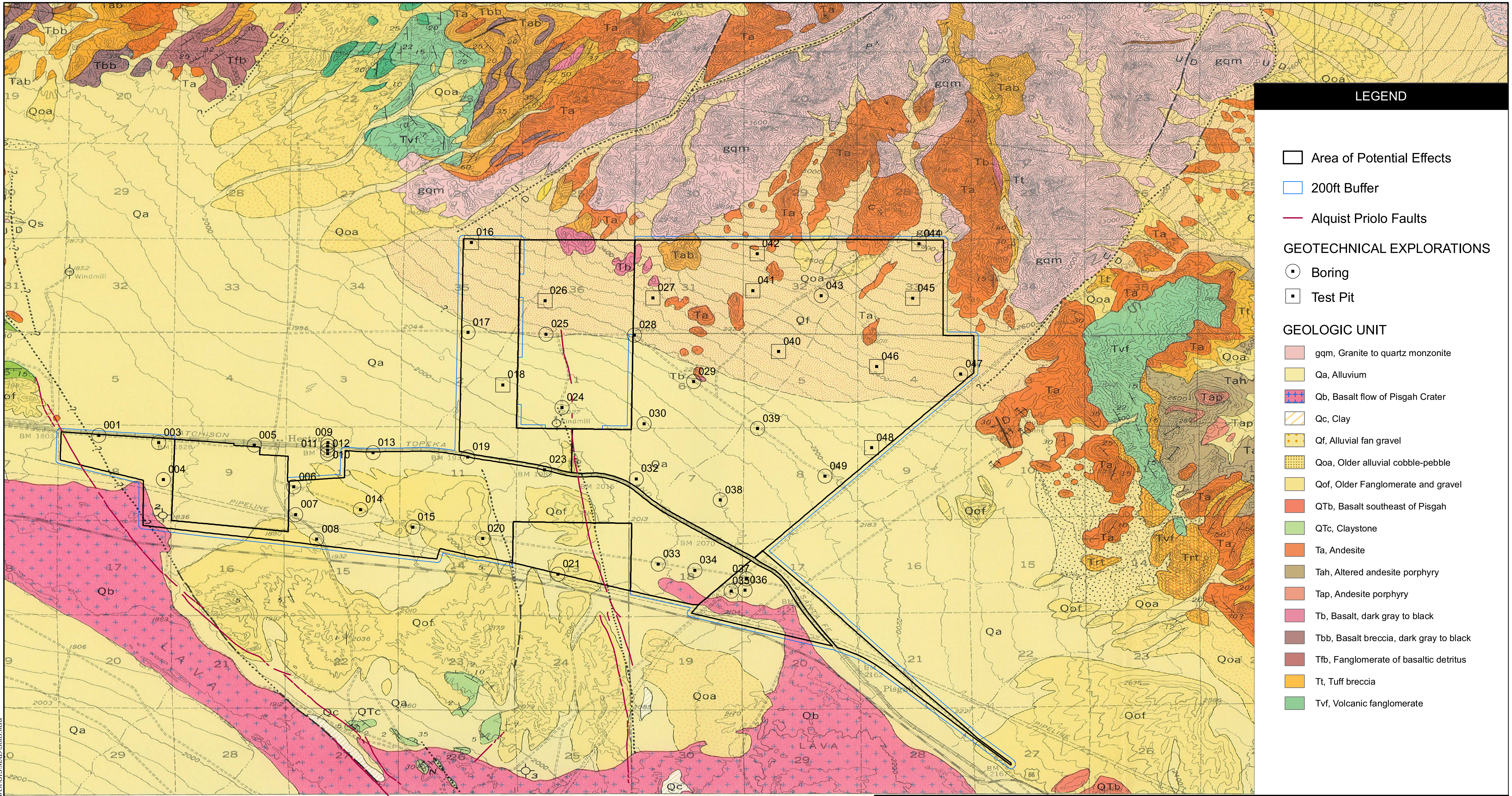
Pollen and lake level records suggest general trends in late Pleistocene and Holocene climate change, but these records do not make clear what meteorological changes are responsible for the trends. Pleistocene climate was wetter and cooler than today, with extensive lakes (including Troy Lake, several miles west of the Solar One project area), and pinion-juniper woodlands extending into much lower elevations (Spaulding 1990). The vegetation transition from the Pleistocene through early Holocene appears to have been relatively gradual, with woodlands retreating and giving way to desert scrub. During the middle Holocene (ca. 8,000 to 4,000 BP) climate appears to have been generally warmer and drier than today, but with some indications of significant oscillations in climatic patterns (Spaulding 1990), possibly akin to those suggested by McDonald, McFadden, and Wells (2003) and responsible for the middle Holocene Qf3 fan deposition in the Soda Mountains (see Figure 1, above). The late Holocene climate was generally similar to modern conditions. However, given the higher resolution record for this more recent period, it appears that several periods of extended drought (including the Medieval Climatic Anomaly, ca. 1150 to 600 BP) as well as at least one cooler wetter period (the Little Ice Age, ca. 600 to 150 BP; Grove 1988) marked the late Holocene.

Periodic increases in effective moisture likely resulted in higher seasonal wash flow, improving the exploitable habitat for human residents, and accelerating the geomorphic processes that led to the burial or erosion of archaeological sites. These climatic changes also increased the sediment supply available for wind-blown (eolian) transport on dry lake beds and former stream channels during intervals of decreased effective moisture. Eolian processes deflated sediment source areas and deposited that material elsewhere. Taken together, these processes created, destroyed, and buried landforms that humans may have occupied across the Mojave Desert.

In additional to climate, tectonics play a less active but equally important role, through the uplift of remnant landforms and the exposure of raw materials (lithics) for human use. At least two strands of the Alquist-Priolo Fault Zone run through the southern portion of the project area (Figure 2), and have caused noticeable uplift and preservation of relict landforms. In addition, volcanic activity, which is inherently linked to tectonics, has had a dramatic effect on the geomorphic development of the project area.

Identification of Major Landforms within the Project Area

The Solar One study area is bounded to the north and east by the granitic/quartz monzonite/basaltic pluton that forms the Cady Mountains, and to the south by the Pisgah Lava flows (Figure 2). The rock outcrops of the Cady Mountains are heavily eroded and mantled by Quaternary fan piedmonts, with more recent fan aprons issuing from the leading edge of these piedmonts. Alternatively, the Pisgah Lava flows have largely created a barrier to the introduction of more recent alluvial material from the mountains and fans to the south, and have served to preserve older deposits at the surface. All of these Quaternary landforms are actually comprised of numerous remnants and more recent deposits of varying ages. By examining the relationship between the landform components we can develop relative age estimates, conclusions as to the depositional history of that landform, and the potential of each landform to harbor buried paleosols of appropriate age.



by U.S. Geological Survey, 1955

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PREVIOUS GEOLOGIC MAPPING WITHIN THE SOLAR ONE VICINITY

SOURCE:
Diblee, T.W., Jr. (2008) *Geologic Map of the Newberry and Cady Mountains 15' Quadrangles*

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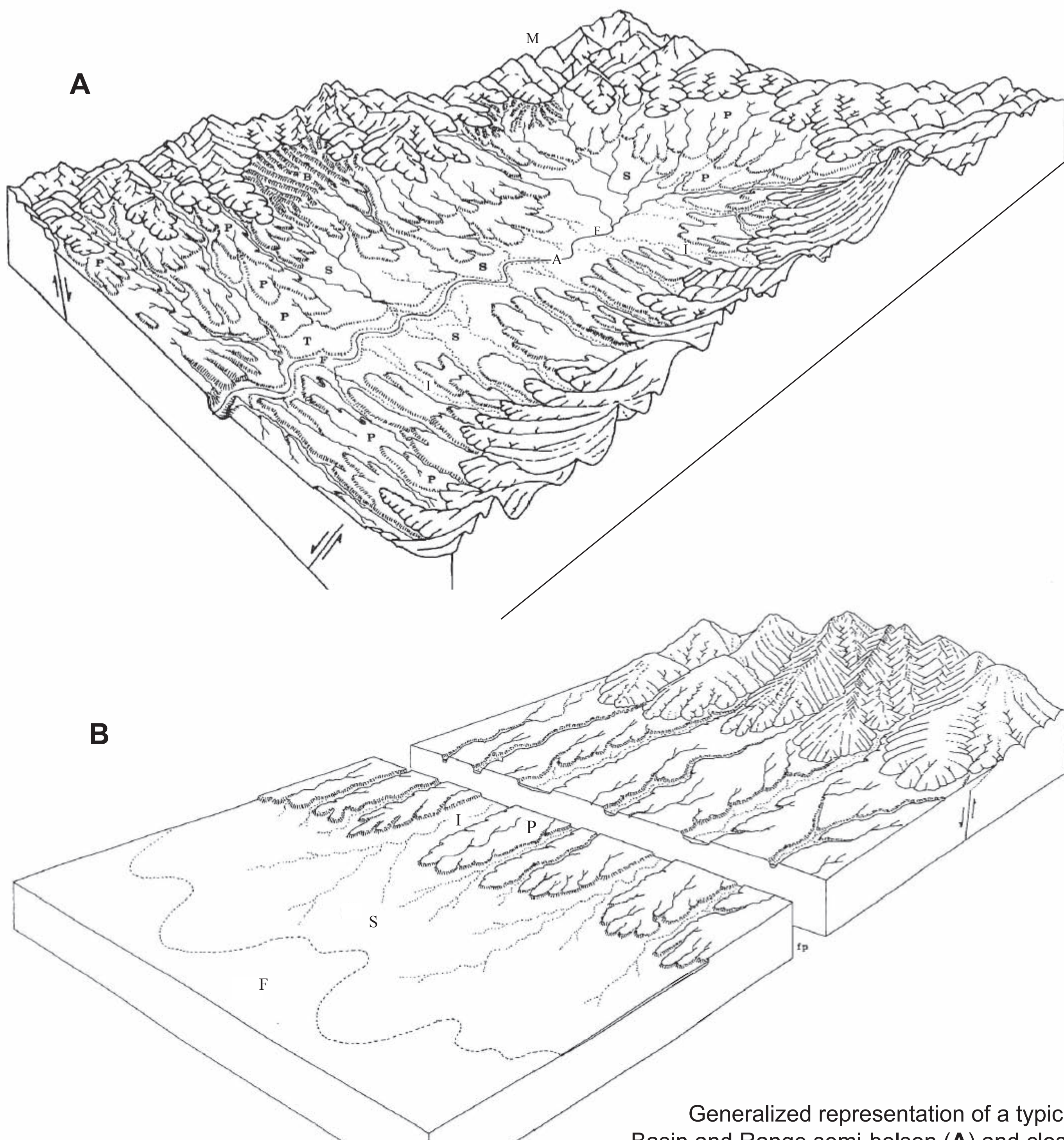
SOURCE: Dibblee (2008)



Generalized representation of a typical Basin and Range semi-bolson (**A**) and close-up of fan components (**B**). Landforms include: *bounding mountains (M), alluvial fans (A), fan piedmont (P), fan skirt* or *aprons (S), inset fans* (*I*), *alluvial flat (F), axial channel (A)*, and *alluvial terraces (*T*)*. In the Solar One study area, the fan skirt area is actually comprised of a series of interfingered aprons

SOURCE: Peterson 1981:29,35

MAJOR BASIN AND RANGE LANDFORMS
GEOARCHAEOLOGICAL ANALYSIS, SOLAR ONE PROJECT

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Before beginning such a discussion, however, a common set of descriptive landscape terms and definitions is necessary. Many different terms are used to describe desert geomorphology, with vastly different implications of scale, accuracy, and implied formation processes. “Alluvial fan” and “bajada” are two common terms that are often misleading because they are used to refer to different types of depositional and erosional landscapes and subsume numerous smaller landform components. The terminology adopted in this study follows after Peterson (1981) because the classification system emphasizes the temporal and spatial relationship between landform components, and was devised in relation to the study and classification of Basin and Range soils– making it highly relevant to the current geoarchaeological study. Diagrams showing the basic major landforms are provided in Figure 3. A discussion of these various landforms is provided in the following sections, with direct reference to the Solar One study area.

At the broadest scale, the Solar One study area– including the surrounding piedmonts to the north, east, and south– can be classified as a “semi-bolson” (Figure 3). Common in desert regions of the Basin and Range, semi-bolsons differ from true bolsons in that they lack a playa or floodplain, which alluvial fans normally terminate on, and instead are cut through by an axial drainage that marks the termination of the various piedmont landforms. The Solar One project area is similar to the upper (right-hand) portions of the semi-bolson depicted in Figure 3, in that it lacks many of the distinct depositional features of the larger down-stream axial channel (e.g., terrace, floodplain). The typical axial channel eventually opens out into a true bolson and associated playa. In the case of the Solar One study area, this is represented by Troy Lake, several miles west of the project area near the western extent of the Cady Mountains.

The Solar One project area semi-bolson can be further divided into two dominant structural sections. The larger of these consists of the Cady Mountains and associated coalescing alluvial fan piedmont gradually sloping down to the southwest– that dominates the northern approximately 2/3 of the project area. The second structural section is formed by several different component landforms that are generally lower but more topographically diverse, including the Pisgah Lava flows (functionally related to the Lava Bed Mountains, further to the south), several old remnant fans, inset fans, and associated alluvial flats. These northern and southern sections are divided by the axial channel, which runs roughly east–west, and which has likely been significantly altered by the Burlington Northern Santa Fe rail line that generally follows the same course.

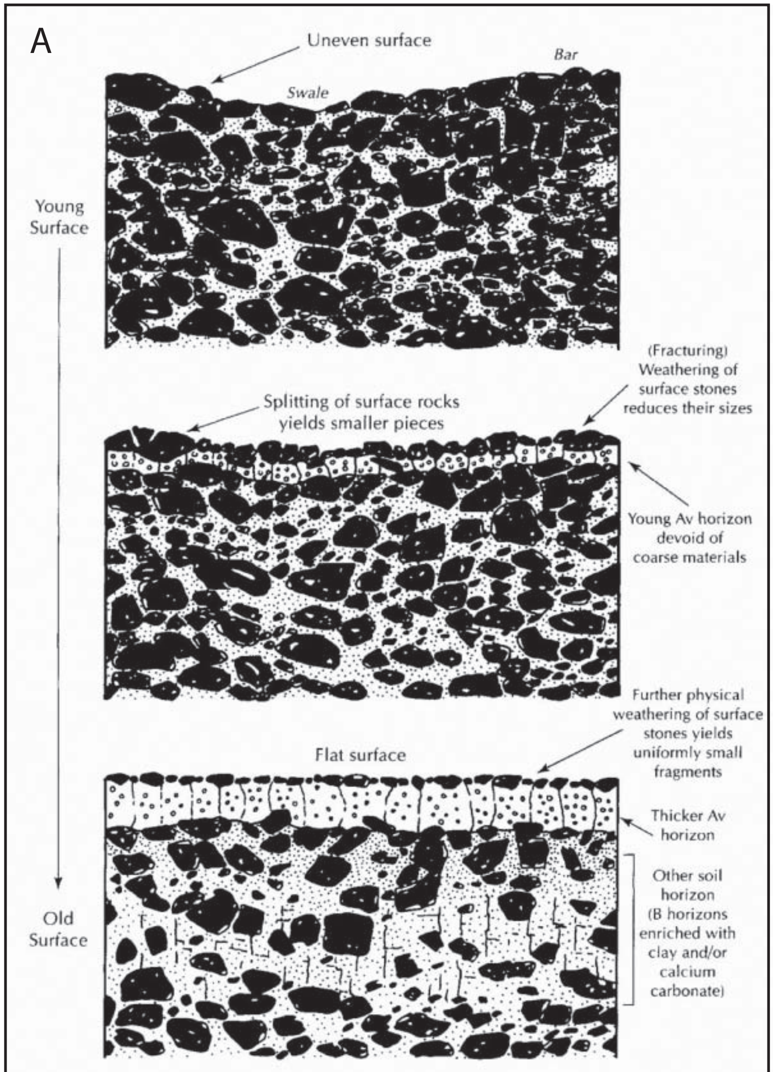
Dating Alluvial Desert Deposits

The age of the various geomorphic surfaces within the project area is of central concern because it is one of the most important factors in constraining the possibility of buried archaeological deposits. Older land surfaces– those that were deposited prior to human occupation in the Americas (ca. 13,000 years ago) and which are still exposed on the surface– have very little possibility of containing buried archaeological deposits. On the other hand, younger land surfaces, if deposited in the right location, with low enough energy, may bury and preserve archaeological material previously deposited on an older surface. However, if these younger deposits unconformably overlie heavily eroded older formations, any archaeology that may have originally been deposited on the older surface would be effectively destroyed. Determining the nature of any subsurface contacts is thus integral in understanding the potential for buried archaeology within the younger landforms.

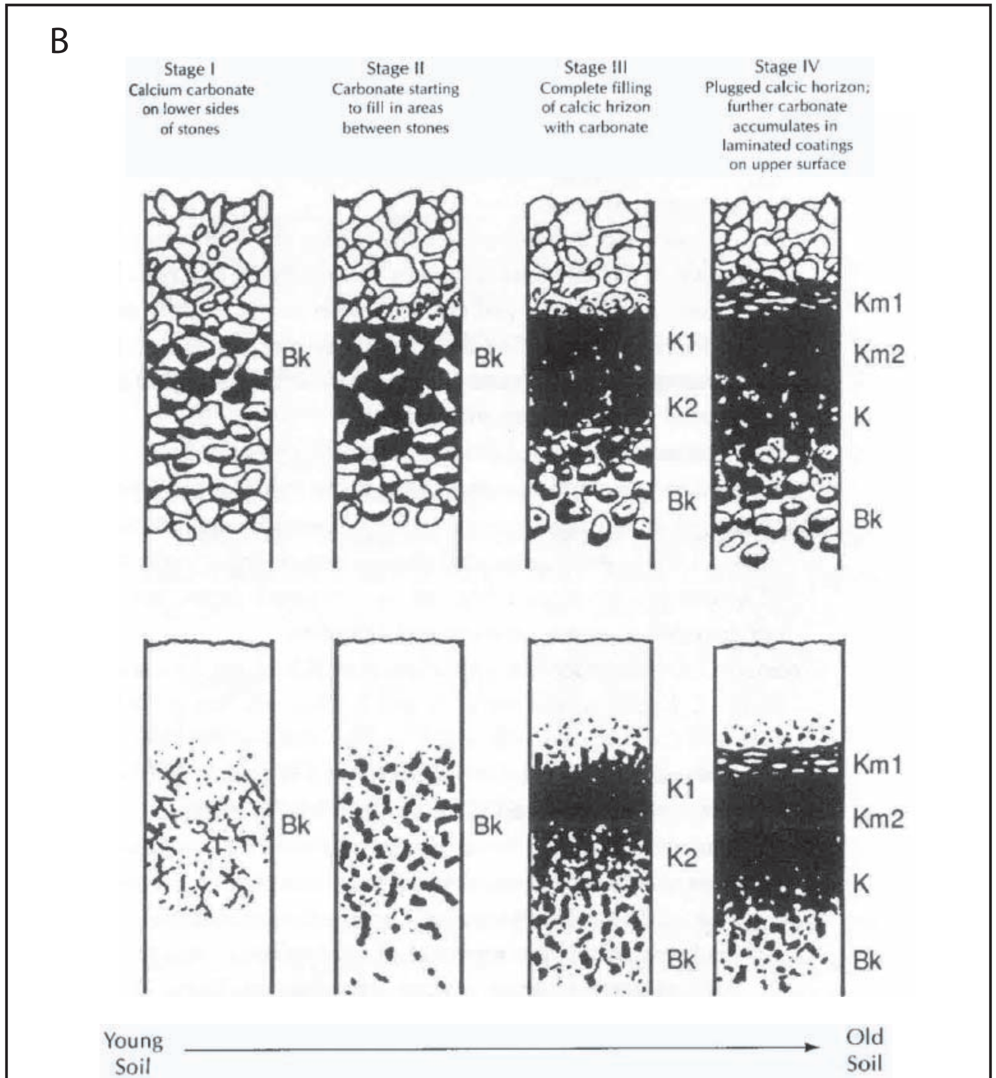
Unfortunately, dating of desert geomorphic surfaces is difficult and there is significant variation in the precision of various methods used in determining relative and numerical ages (McDonald, McFadden, and Wells 2003:190). Two primary, non-chronometric methods (e.g., not carbon-14, thermo-luminescence), are used for determining the age of desert landforms: soil development and desert pavement development. Figure 4 provides a graphic representation of pavement and subsoil horizon development through time in desert environments. Both of these methods are heavily dependent on environmental factors such as temperature, precipitation, and parent material. As such, they are most effective within a confined homogeneous area.

Early investigations into the development of desert pavements hypothesized that they were formed through fluvial and eolian erosion of fine grain sediments, leaving a deflated lag deposit of coarser material at the surface (Cooke 1970). More recent work– particularly on volcanic lava surfaces where fine-grain alluvial sediments are largely absent– indicates that desert pavements are instead formed through a process of fine-grain eolian sand and silt accretion (Wells et al. 1995). As dust blows onto a surface, it accumulates between larger surface clasts and over time infiltrates below the clasts and causes them to “float” on a fine-grain layer that thickens over time. This process may partially explain the upper vesicular A-horizon (see below) noted in most older desert soils. However, erosion may still play a role in the formation of pavements in some contexts, such as eolian dune complexes (McAuliffe and McDonald 1995:61-62).

While desert pavement formation is dependent on factors of time and climate, parent material also plays a major role. In general, alluvium derived from plutonic (e.g., granitic) sources form much weaker



Formation of desert pavement.



Schematic showing (**A**) development of desert pavement and (**B**) stages of calcic horizons for gravelly and non-gravelly parent material.

SOURCES:
Phillips and Wentworth 2000
Birkeland, Machette, and Haller 1991

DEVELOPMENT OF DESERT SOIL FEATURES
GEOARCHAEOLOGICAL ANALYSIS, SOLAR ONE PROJECT

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pavement– with fewer interlocking stones and less evident varnish– than volcanic and limestone sources (McDonald, McFadden, and Wells 2003:193). Along a nearby Mojave Desert mountain front, it was determined that "minimal, if any, pavement formation occurs on alluvial fan surfaces in the granite-derived piedmont, regardless of age" (Eppes, McDonald, and McFadden 2003:109).

Given these factors, perhaps a more reliable estimate of landform age within the project area is soil horizon development. Due to the time-transgressive nature of soil development in arid environments, the stage of calcium-carbonate ($CaCO_3$ or "k") illuviation and development and the degree of B horizon development are identifiable markers of age. In this study of the Solar One project area, the degree of desert pavement formation and calcic horizon formation were used in conjunction as indicators of landform age during field studies. In addition, more typical soil classifications were made on exposed profiles in order to assess pedogenic processes at play in the project area.

In general, soils on older Pleistocene alluvium are characterized by a strongly cemented (Stage III), well-developed calcium-carbonate B or K horizon (Figure 4). Conversely, Holocene alluvial fan deposits typically exhibit a bar and swale surface morphology lacking prominent desert pavement development. Early Holocene alluvial fan deposits typically exhibit moderate B-horizon development and Stage II calcium carbonate morphology. Middle to Late Holocene alluvial fan deposits tend to have very weakly developed B horizons and Stage I calcium carbonate morphology. Latest Holocene surfaces, which are generally active washes, exhibit no soil development (Dohrenwend et al. 1991:328; McDonald, McFadden, and Wells 2003:193).

For this study of the Solar One project area, master soil horizons were defined using standard United States Department of Agriculture soil taxonomy (Soil Survey Staff 2006) and techniques specific to desert soils (Birkeland, Machette, and Haller 1991). This organizational system uses upper-case letters (A, B, C) to describe in-place weathering characteristics. Most horizons and layers are given a single capital letter symbol where: "A" is the organic-rich upper horizon developed at or near the original ground surface; "B" is the horizon formed in the middle of a profile, with concentrations of illuviated clays, iron, etc., and general changes in soil structure; and "C" is the relatively unweathered parent material which the other soil horizons formed upon.

These master horizons are preceded by Arabic numerals (2, 3, etc.) when the horizon is associated with a different stratum; where number 1 is understood but not shown, and lower numbers indicate superposition over larger numbers. Lower-case letters are used to designate subordinate soil horizons (Table 1).

Combinations of these numbers and letters indicate the important characteristics of each major stratum and soil horizon, from which inferences can be drawn.

Table 1. Subordinate Distinctions Within Master Soil Horizons

Subordinate Horizon	Description
c	Cementation or induration of the soil matrix
k	Accumulation of pedogenic carbonates, commonly calcium carbonate.
m	Strong cementation
ox	Oxidized iron and other minerals in parent material (C-horizon)
t	Accumulation of subsurface silicate clay (illuviation)
v	Vesicular soil development
w	Development of color or structure with little apparent illuvial accumulation

Methods and Results

Major landforms within the project area were initially identified using both color and black-and-white aerial photography (DigitalGlobe 2009), in combination with existing geologic maps of the area (Dibblee 2008; URS 2008). Given these designations, certain broad assumptions could be made about the age and depositional history of each portion of the project area. This mapping and assumptions were verified and modified during an initial field reconnaissance, through on the ground examination of the landscape and key indicators such as relative slope, desert pavement development, and subsoil formation.

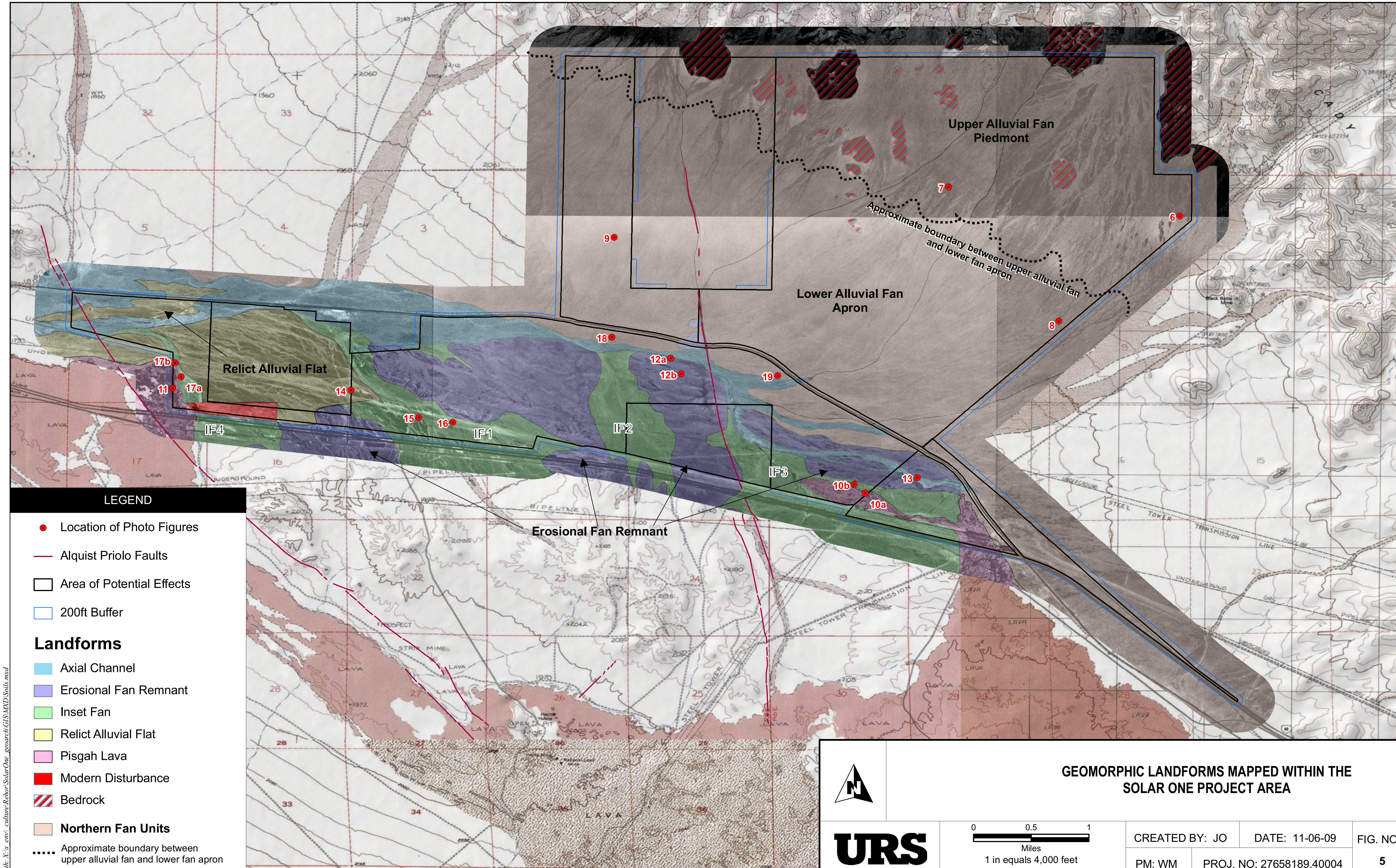
Subsurface examination within the Solar One project area was undertaken in three ways. During the initial field reconnaissance, numerous cuts were identified where on-fan drainages and larger channels had incised alluvial deposits and exposed subsurface profiles. Although there are innumerable drainage features, the majority, particularly in the northern portions of the project area, are relatively small with only minor incision. To augment this data, the URS geoarchaeologist was present during geotechnical investigations involving Modified California Sampler borings and backhoe excavated test pits. Borings were advanced between 25 and 50 feet below surface while test pits extended 15 feet. However, soils and contacts relevant to this study (i.e., late Pleistocene age or younger) occurred within the upper approximately 6.5 feet (2 meters) throughout the study area– and typically much shallower. All excavated deposits were actively sorted through for archaeological materials and the excavations monitored for depositional changes that may suggest greater potential for buried archaeology. Additionally, a sample of any depositional contacts considered to have archaeological potential was screened through ¼–inch hardware mesh. No archaeological material was observed during any of the subsurface investigations.

The combined results of this study are shown in Figure 5 and summarized in Table 2. The following is a discussion of these results.

Table 2. Summary of Geoarchaeological Sensitivity of Landforms within the Solar 2 Study Area

Area	Landform	Age	Depositional Regime*	Sensitivity
Northern Section	Rock Outcrops	Tertiary or older	Erosional	None
	Upper Alluvial Fan Piedmont	Pleistocene to Mid-Holocene	Erosional	Very Low
	Lower Alluvial Fan Apron	Pleistocene to Holocene	Variable	Low
Southern Section	Pisgah Lava	Late Pleistocene	Stable	None to very low
	Erosional Fan Remnant (fanglomerate)	Pleistocene	Erosional	Very Low
	Inset Fans	Pleistocene to Holocene	Variable	Very Low to Low
	Relict Alluvial Flat	Pleistocene (?)	Erosional (variable)	Very Low
	Axial Channel (and associated minor landforms)	Late Holocene	Variable	Very Low to Moderate

*Represents the dominant regime since the terminal Pleistocene



LEGEND

- Location of Photo Figures
- Alquist Priolo Faults
- Area of Potential Effects
- 200ft Buffer

Landforms

- Axial Channel
- Erosional Fan Remnant
- Inset Fan
- Relict Alluvial Flat
- Pisgah Lava
- Modern Disturbance
- Bedrock

Northern Fan Units

- Approximate boundary between upper alluvial fan and lower fan apron

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GEOMORPHIC LANDFORMS MAPPED WITHIN THE SOLAR ONE PROJECT AREA

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SOURCE: GlobeXplorer

Northern Section

The northern portion of the study area is the simpler of the two. This area consists of a fan piedmont that is comprised of numerous coalescing alluvial fans issuing from the mouths of small mountain valleys within the Cady Mountains. The piedmont is composed of the upper alluvial fans themselves, as well as more recent fan aprons at lower elevations. The surfaces of these landforms typically consist of numerous active and abandoned channels and intervening surfaces that range from Early Pleistocene to Holocene in age (Dohrenwend et al. 1991:327). Given the punctuated deposition and erosion of these landforms during the Holocene, however, the archaeological record represented on these landforms may be incomplete.

The most distinct, well-developed desert pavement observed on the alluvial fan piedmont is located in the northeast portion of the piedmont, which has the largest proportion of andesite bedrock (Figure 2; Dibblee 2008). This andesite is generally more resistant than the coarse grain granite and monzonite, and appears to form a more distinct varnish (Figure 6b). Given the predominance of granitic parent material, we can expect that desert pavements within the northern portion of the project area will generally be much weaker than in other areas of the Mojave Desert, where more resistant parent material may be present (including the southern portion of the project area). Additionally, comparison of pavement surfaces within the project area may be tenuous, especially between the northern and southern portions, which consist of very different parent materials and geomorphic histories. While a well-developed pavement is invariably indicative of an old landsurface, a poorly developed pavement is not inherently young. None the less, an initial field reconnaissance, and a general understanding of the development of alluvial fans within the Basin and Range, suggested that the majority of surfaces within the northern fan piedmont are late Pleistocene to Holocene in age. Given these constraints, an examination of subsurface conditions was considered necessary to evaluate landform ages and to determine the potential for buried archaeological deposits.

Rock Outcrops (Sensitivity: None)

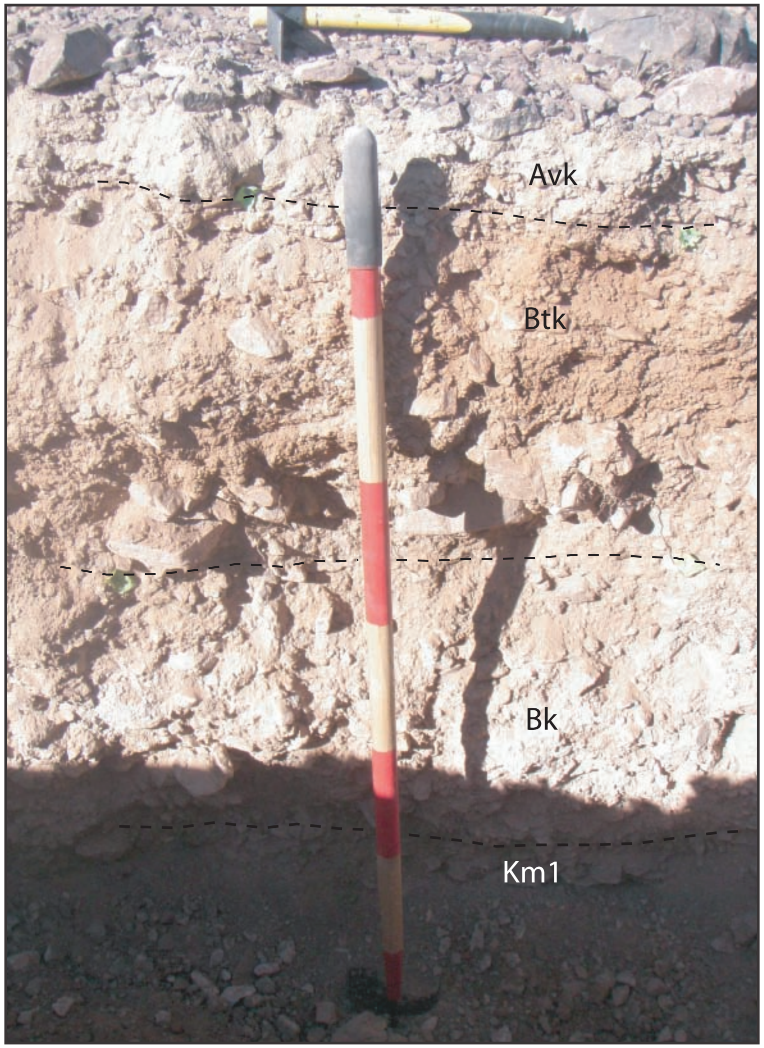
At the higher reaches of the piedmont (the northern extent of the project area), rock outcrops are present (Figures 2 and 5). These are limited exposures of highly dissected Tertiary andesite and basalt bedrock which form steep, highly-eroded hills (inselbergs) sticking up out of the alluvial fans (Dibblee 2008). While these limited andesite and basalt outcrops provide some of the parent material that make up the alluvial fans, the vast majority appears to be granite and quartz monzonites, which also form the majority of the southern Cady Mountains and into which extend the mountain valleys that transport the material that forms the alluvial fans (Dibblee 2008). Of course, these rock outcrops have little or no potential for harboring buried archaeological deposits.

Upper Alluvial Fan Piedmont (Sensitivity: Very Low)

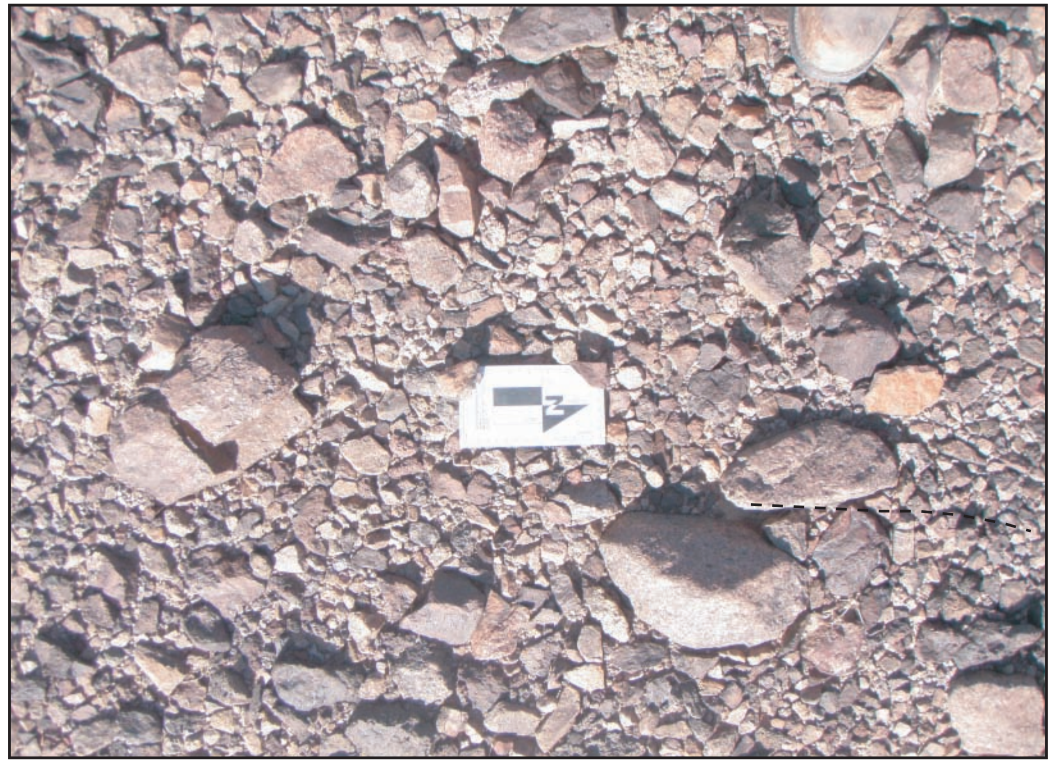
In general, there appears to be a trend of decreasing sediment size as one moves downslope along the piedmont gradient. This is typical of alluvial fans, with bouldery material near the fan head and fine sands at the distal toe (Peterson 1981:22). Test pits and borings within the northern portion of the Solar One project area (e.g., TP 016, 026, 027, and 040 through 047; Figure 2) consistently revealed profiles dominated by angular to sub-angular cobbles and gravels, with a clast supported matrix of sandy loam (Figures 6 and 7). Different weathering profiles laterally (east–west) across the piedmont indicate that the various fans that make up the piedmont are of different ages– as is expected given the results from other mountain fronts in the Mojave Desert (e.g., Bull 1991; Eppes, McDonald, and McFadden 2003; McFadden and Wells 2003). However, no buried soils were identified and the very coarse clast size indicates a very high-energy colluvial/debris flow depositional environment that precludes the preservation of paleo-surfaces and associated archaeological remains.

The oldest major alluvial fan structure on the piedmont appears to be located along the eastern boundary. Very well-developed varnish and rubification on the desert pavement in the upper portion of the fan, and well-developed subsurface weathering profiles throughout the fan suggest a late Pleistocene age or older. Figure 6 shows a portion of the surface pavement and the subsurface profile at TP 047. The subsurface profile exhibits very strong pedogenic development, with an upper vesicular horizon, a Btk-horizon with strong reddening (5YR 5/4), and multiple calcic horizons, the strongest exhibiting Stage IV cementation (multiple additional K- and Bk-horizons, lower in the profile, are not shown in Figure 6a). Figure 7 shows the subsurface profile within a younger fan (Qf3) along the upper fan piedmont. Coarse high-energy angular and sub-angular colluvial/debris flow material is apparent throughout the profile, and is consistent with other profiles observed across the upper fan piedmont.

The lithology of the northern coalescing fan piedmont is important for two reasons: the parent material of the alluvial fans directly affects the ability of distinct desert pavements to form and, thus, determination of surface age (as discussed above); and it dictates the availability of usable lithic raw materials for prehistoric populations. Coarse grained granites and monzonites have very little utility as a raw lithic material, as they are not appropriate for flaked stone tool industries, and are similarly difficult to use as



(**A**) Very strong upper pedogenic profile in TP 047, with very coarse angular and sub-angular clast-supported carbonate-cemented matrix (trench profile continues through additional K and Bk-horizons consistenta Pleistocene age for this stable surface; scale sections = 20 cm each).



(**B**) Well-developed pavement at TP 047.

UPPER ALLUVIAL FAN PIEDMONT PHOTOS 1
GEOARCHAEOLOGICAL ANALYSIS, SOLAR ONE

URS

Not to Scale

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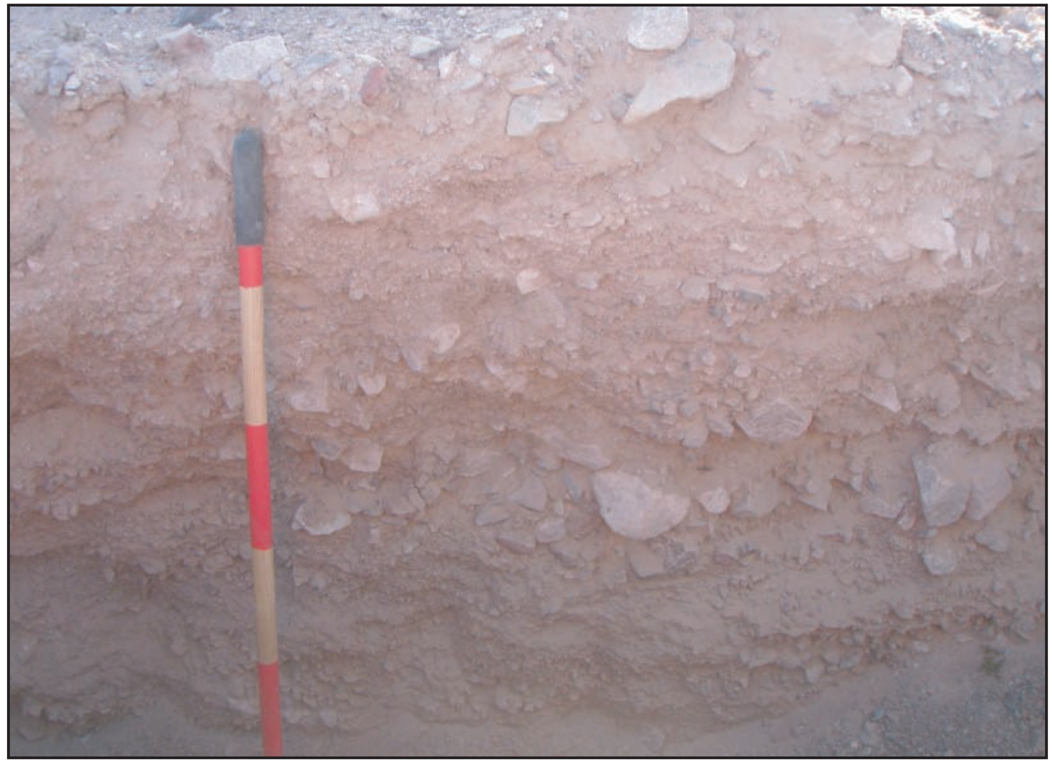
(**A**) Coarse high-energy debris flow fan deposits to depth (15 feet) in TP 040 (consistent with profiles observed throughout the upper fan piedmont).



(**B**) Close-up of TP 040 profile (west wall; scale divisions = 20cm each).

FAN PIEDMONT 3
GEOARCHAEOLOGICAL ANALYSIS, SOLAR ONE

URS

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groundstone due to their coarse grain and friable nature. The predominance of this parent material may largely explain the dearth of prehistoric archaeological sites on older alluvial fan segments within the northern portion of the project area. This same reasoning would further reduce the potential for buried archaeological resources with the fan piedmont (including the lower fan aprons, see below). In conjunction with the lack of identified paleosols and the consistently high-energy subsurface deposits, the sensitivity for buried archaeological deposits within the upper alluvial fan piedmont is considered very low.

Lower Alluvial Fan Apron (Sensitivity: Low)

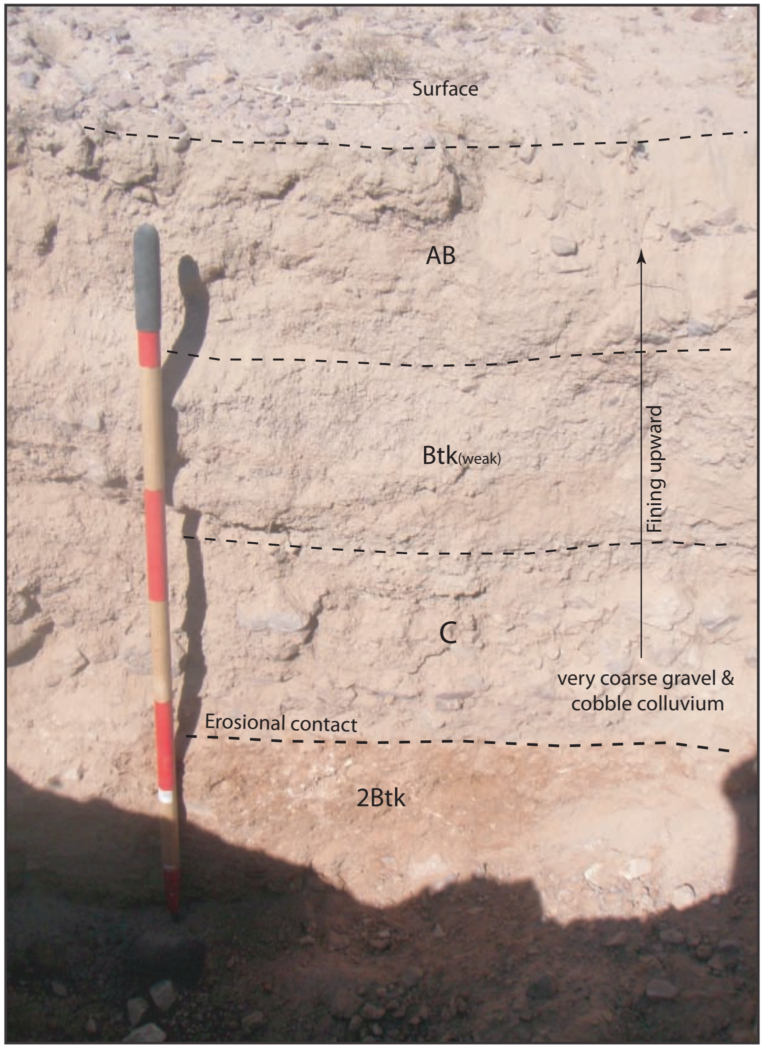
The finer grain material that dominates the lower portions of the fan piedmont, the near absence of well-developed pavement surfaces, as well as the geomorphic structure– with countless small anastomatizing channels and distinct bar and swale surface morphology– are all typical of fan aprons. However, the topographical continuity between the upper and lower portions of the piedmont is atypical of alluvial fans and their associated younger aprons (Peterson 1981:22-24; see e.g., Figure 3b) and raises questions about the functional relationship and timing of deposition between the upper alluvial fan and the lower aprons. Is the surface morphology and grain size differentiation between the two portions of the fan piedmont a result of timing (i.e., the upper surfaces are older and had time to develop pavement surfaces), or a result of natural clast sorting (i.e., coarse grain material naturally settles-out up-slope, with progressively finer material as one moves down gradient)? The apparent young age of the lower apron surfaces is an initial indicator of their potential to harbor buried archaeological deposits. However, further investigations indicate that there is a low geoarchaeological potential due to the nature of their geomorphic evolution.

Powell states that younger alluvial fan aprons often "bury or feather out onto older fans distally" (2002:16). Thus, this middle and lower portion of the northern fan piedmont has undergone deposition (and erosion?) since the earliest documented human occupation of this area. Therefore archaeological sites in this portion of the project area have been removed by erosion or may remain buried under these younger fan deposits. Along the eastern alluvial fan piedmont at Clark Mountain, in the northeastern Mojave, it was demonstrated that major progradation of the fan aprons occurred between 8,000 and 4,000 BP, followed by a switch to an erosional regime during the late Holocene. It was conjectured that this transition was due to a reduction in available sediment for deposition (CH2MHill 2008). After an initial erosion of the uplands, fluctuating precipitation and sediment-starved runoff eroded recently deposited material on the lower hillslopes. The middle and lower portion of the Solar One alluvial fan piedmont, dominated by fan aprons, is not a stabilized surface. Recent landforms such as bar and swale topography, countless small anastomatizing gullies, and larger channels extend across most of this area and indicate ongoing dissection and active erosion.

Buried pedogenic horizons were identified in numerous test pits and borings within the apron portion of the northern fan piedmont. The nature of these contacts are indicative of the initial formation of the lower piedmont and suggests that deposition is typically preceded by significant erosion. Figures 8 and 9 are representative of the profiles observed across the fan aprons. Figure 8 (TP 048) shows a single weak AB-Btk-C weathering profile, overlying a well developed 2Btk-horizon. The upper unit consists of a single fining upward sequence dominated by coarse sub-angular gravels and cobbles at its base, and sandy loam with few gravels near the surface. This suggests that this portion of the fan apron was formed as a single depositional package, likely during the middle or late Holocene. However, the coarse material at its base, and the very distinct lower erosional contact, indicate that initial deposition of the apron was relatively high-energy and preceded by significant erosion. The lower buried pedogenic unit has a Btk-Bkm-Bk-Ck-C profile, consistent with a Pleistocene age and a truncated upper profile.

The profile shown in Figure 9 (TP 018) is similar in many was to that in Figure 8, with some notable exceptions. The upper unit consists of an Av-Bwk-Ck-C profile that is better developed, with a maximum of Stage I+ to II carbonate development, and consistent with a middle Holocene (?) age. Note that the surface pavement is only slightly more distinct than the preceding example, despite the apparent pedogenic age difference (indeed, the Figure 8b surface is more accurately described as stony, with no varnish and only very minor rubification on the ventral surfaces of surface clasts). Again, this unit has coarse angular debris flow-type gravels at its base, and a distinct erosional contact with the underlying paleosol. However, rather than being a single depositional unit, the upper apron mantle appears to be composed of at least three lithologic units, each represented by a fining upward sequence. The continuous weathering profile across these lithologic contacts indicates that they were deposited in relatively rapid succession, with no periods of stability which would have formed individual pedogenic profiles. The lower buried pedogenic unit has a Km-Bkm-Bk-Ck-C profile, again, consistent with a Pleistocene age and an even more heavily truncated upper profile.

Although distinct very old paleosols, buried below recent alluvium, were consistently identified within the lower portions of the alluvial fan piedmont, they are marked by heavily erosional upper contacts. It appears that significant erosion occurred prior to deposition of the fan apron mantles. This erosion would have destroyed any archaeology deposited on these older (now buried) surfaces, and effectively nullifies the potential for buried archaeology within the middle and lower portions of the northern fan piedmont.



(**A**) Upper weak subsurace profile in TP 048, with very coarse C-horizon overlying erosional contact and truncated paleosol (trench profile continues through another fining sequence, not shown, including cemented K-horizons with coarse clasts; scale sections = 20 cm each).

(**B**) Surface of fan piedmont/apron at TP 048 (view to NE).

LOWER FAN APRON PHOTOS 1
GEOARCHAEOLOGICAL ANALYSIS, SOLAR ONE

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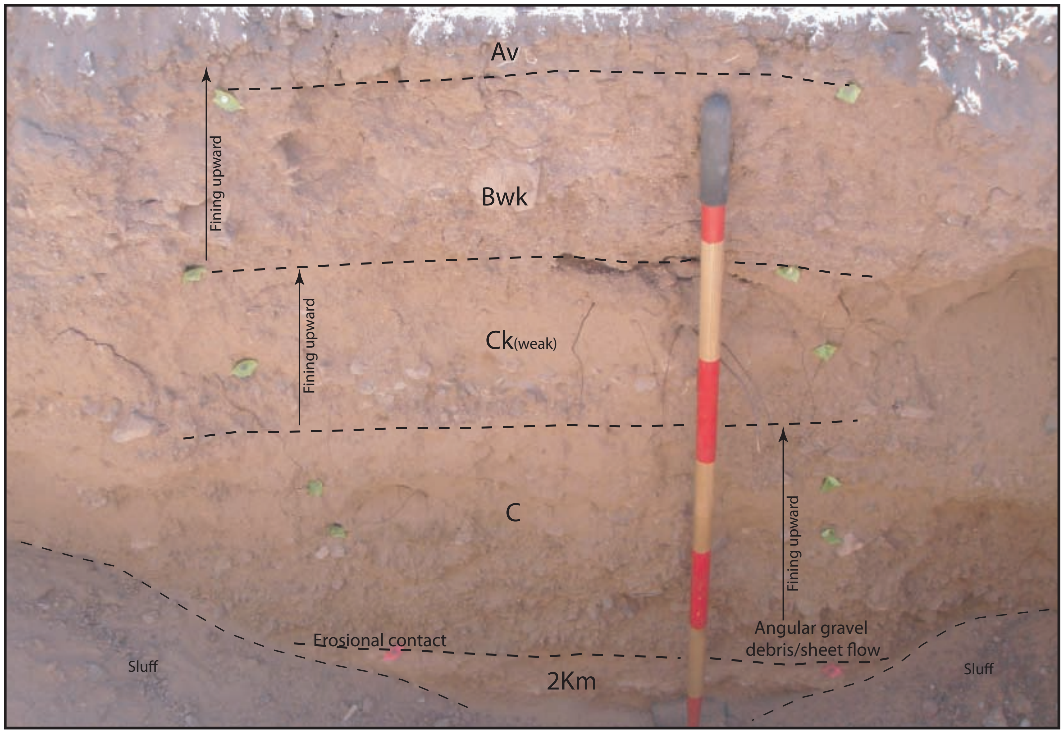

(**A**) Upper weakly developed pedogenic profile in Test Pit (TP) 018 (east wall), overlying a lower calcrete (Km) horizon of a very old heavily truncated paleosol. Multiple lithologic contacts can be seen in the upper soil, but continuous pedogenesis indicates they were likely laid down over a short time span.

(**B**) Gravelly surface at TP 018 with no pavement development (view to N).

LOWER FAN APRON PHOTOS 2
GEOARCHAEOLOGICAL ANALYSIS, SOLAR ONE PROJECT

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CREATED BY: JR	DATE: 11-01-09	FIG. NO: 9
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The presence of more recent lithologic contacts, as exemplified in Figure 9a, indicates that the fan aprons were sometimes formed through multiple depositional events, but the lack of identifiable paleosols at these contacts suggests that they were laid down more-or-less contemporaneously and, therefore, have a low archaeological potential.

Southern Section

The southern portion of the study area is comprised of generally older and more variable landscape elements compared to the northern portion. While also considered a piedmont, the southern area appears to be generally much older, comprised of numerous relict landforms, with differing source material and component landforms.

An initial clue to the age of the landforms of the southern area is provided by the Pisgah Lava flow (Figure 2). This flow is generally considered to have erupted in a series of closely related events ca. 20,000 BP[1]. The Pisgah lavas overlie numerous deposits just south of the study area, including the older alluvial sediments (Qoa), fanglomerate (Qof), and various clay units (Qc and QTc) mapped by Dibblee (2008) and observed during the field visit for this current study. As such, all of these mapped deposits are at least older than ca. 20,000 BP (i.e., were laid-down well before human occupation in the region). Additionally, the emplacement of the Pisgah lavas effectively blocked deposition of new alluvial material from the Rodman Mountains to the south. This explains both the lack of large late Pleistocene and Holocene alluvial fan deposits– that are present in the northern portion of the Solar One project area and throughout the Basin and Range– as well as the presence of so many relict landforms at the surface. Whereas the alluvial fan material in the northern section has its source in the mountain valleys of the Cady Mountains, any more recent depositional landforms within the southern section are comprised of material reworked from the older relict alluvial landforms.

Pisgah Lava (Sensitivity: None to Very Low)

As stated above, the Pisgah Lava flows have been dated to approximately 20,000 BP. As such, they have no potential for harboring buried archaeological deposits. The exception to this statement is the eolian

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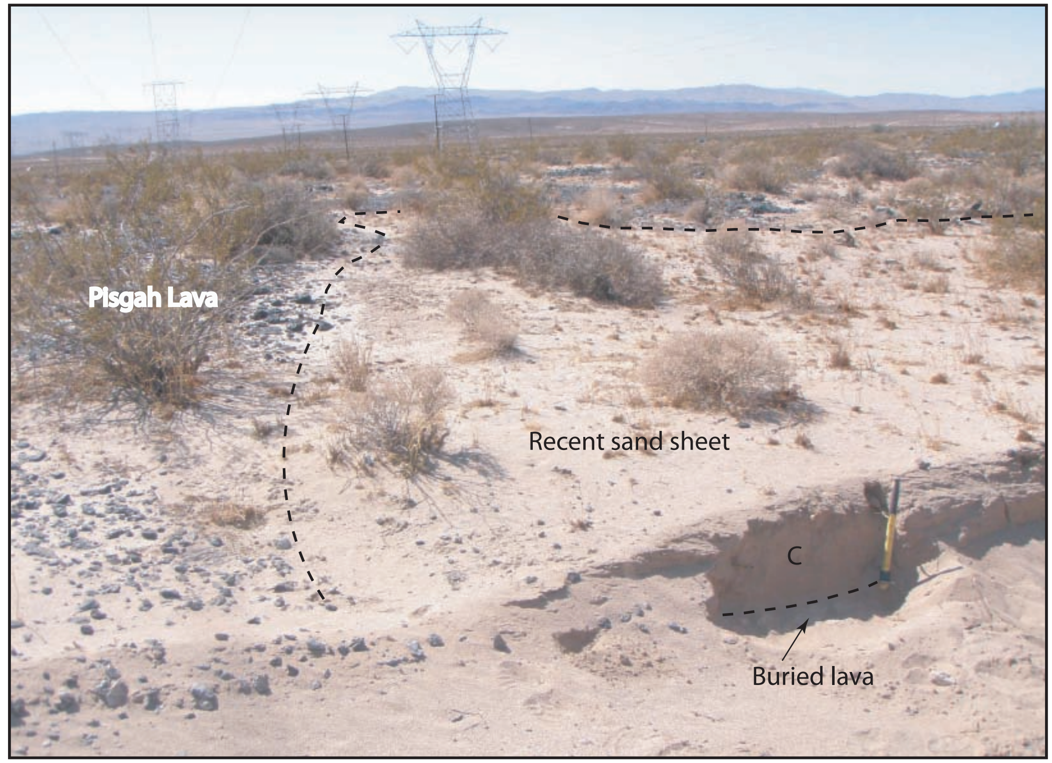
[1] Sylvester et al. (2002) place the timing of the eruptions at 18,000 ±5,000 BP based on argon-argon dating, whereas Phillips (2003) obtained a date of 22,500 ±1,300 BP based on cosmogenic ^{36}Cl analysis. These dates are within the expected range, of a few thousand years, for the multiple flows issuing from the Pisgah crater.

(**A**) Stage II carbonate development in roadcut through inset fan IF3 (planview) near photo B.



(**B**) Thin aerially limited eolian sand sheet overlying Pisgah Lava in eastern portion of project area (view to S; handtool = approx. 40cm).

PISGAH PHOTOS 1
GEOARCHAEOLOGICAL ANALYSIS, SOLAR ONE

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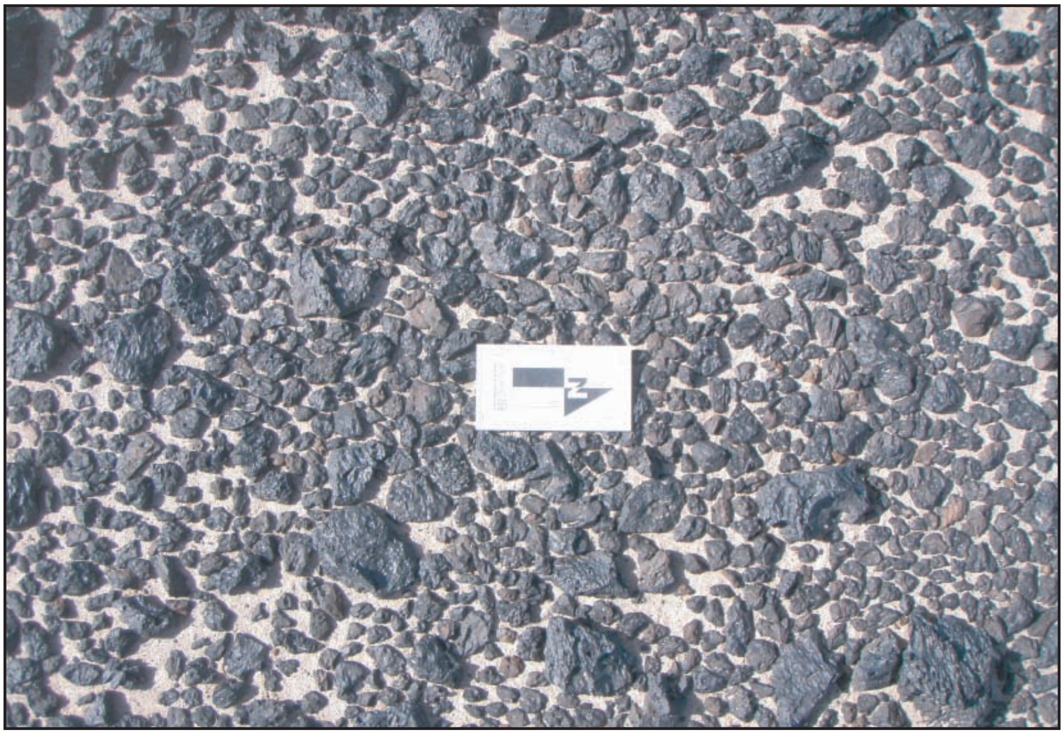
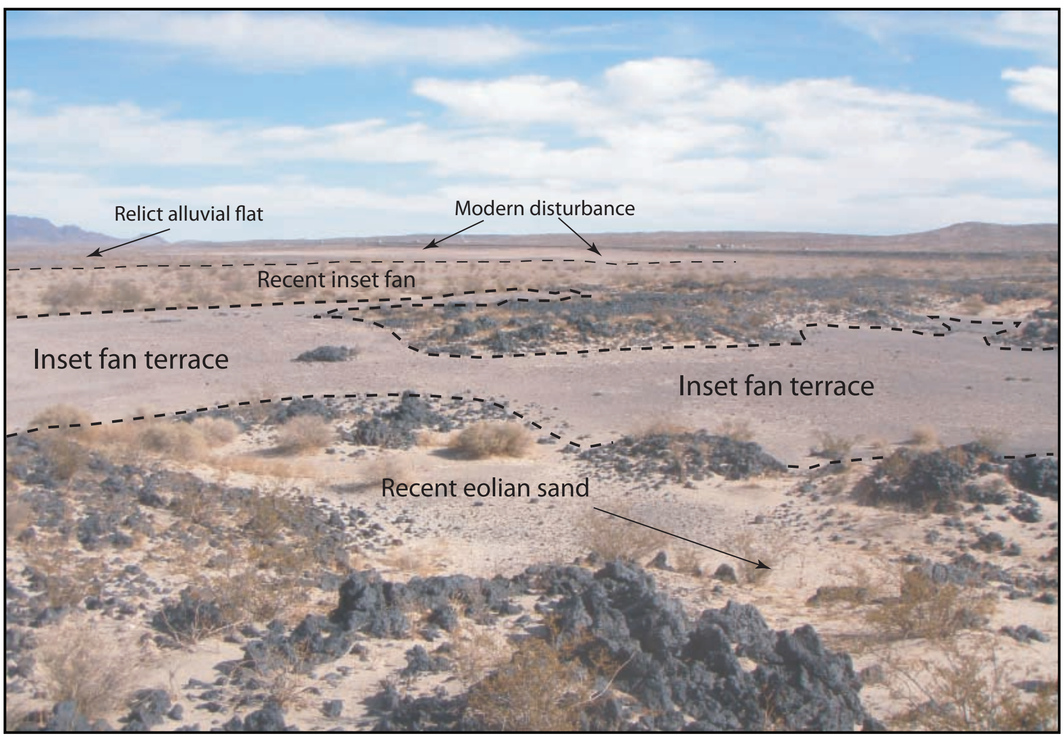


(**A**) Well-developed desert pavement on ca. 20,000 BP Pisgah Lava flow.



(**B**) Inset fan (terrace) along Pisgah lava flow, appears to be an older terrace of the adjacent active channel with a significant addition of eolian silts and sands, inset into low-lying embayment of the Pisgah Lava flows (location of KRM-135; looking SE).

PISGAH LAVA PHOTOS 2
GEOARCHAEOLOGICAL ANALYSIS, SOLAR ONE

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sand deposits that have mantled certain limited areas along the base of the lavas. Figure 10b shows an example of a relatively limited sand sheet that has built up along the edge of a portion of the flow near the Pisgah Substation, in the eastern portion of the study area. Limited subsurface exploration indicated that the sheet was only approximately 30 cm thick and directly overlaid the lava flow. Lack of soil development within the sand sheet suggests that it is a very recent, unstabilized deposit. No subsurface archaeological materials were observed.

Figure 11 shows a desert pavement that has developed on a portion of the Pisgah flow– elevated on a mantle of accretionary eolian sand and silt– and gives an indication of the degree of pavement development that can be expected on a 20,000 year old lavic surface.

A portion of at least one large archaeological site identified during inventory efforts (KRM-135; URS 2009) is located in close association with the Pisgah Lava flows. The higher elevation western portion of this site is located on fine grain sediments, with a pebbly surface, which appear to be mantled into small embayments of the lava flow (Figure 11b). The sediments within these areas appear to be a mixture of fine grain alluvium from a nearby drainage which have been deposited as an older terrace set and preserved within these embayments, along with more recent eolian sands and silts accreted onto the existing surface. As such, these limited portions of KRM-135 appear to have the potential for at least a minor subsurface component, and may represent the only limited potential for buried archaeological deposits associated with the Pisgah Lava flows.

Erosional Fan Remnant (Sensitivity: Very Low)

A large proportion of the southern section of the project area is dominated by very old alluvial landforms referred to here as “erosional fan remnants.” The erosional fan remnants are generally coincident with the areas of Quaternary fanglomerate (Qof) as mapped by Dibblee (2008). The fanglomerate is an early Pleistocene or older alluvial/fluvial deposit up to 300 feet thick, comprised of poorly sorted coarse gravels and cobbles of mixed Mesozoic porphyry complex, metavolcanics, and Tertiary volcanic rocks (as well as chalcedony/jasper). The clast-supported matrix appears to be comprised of loamy sand with a high $CaCO_3$ content. This very old Quaternary geologic unit has been uplifted along the multiple faults that run north–south through the southern portion of the project area (Figures 2 and 5). These faults may have a normal and rotational component, with the highest portions of the uplifted erosional fan remnants located along the fault scarp, which have eroded steeply toward the east (along the scarp) and more gradually to the west.

(**A**) Stage III to IV calcic development in sideslope of a fanglomerate erosional fan remnant.

(**B**) Near summit of fanglomerate erosional fan remnant, showing well-developed pavement and minor bar and swale morphology.

FANGLOMERATE FAN REMNANT PHOTOS 1
GEOARCHAEOLOGICAL ANALYSIS, SOLAR ONE

URS

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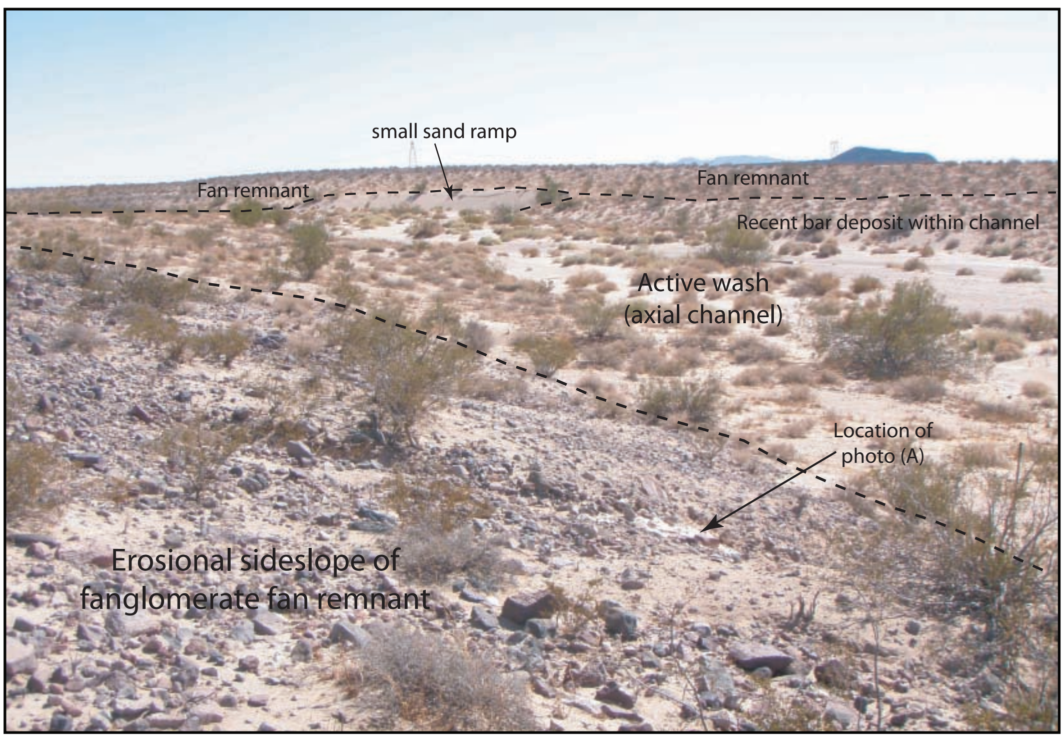
(**A**) Stage IV calcic development in sideslope of eastern fanglomerate (?) fan remnant (handtool = approx. 40cm).



(**B**) Overview of fan remnant with active wash (axial channel) bisecting the landform.

FANGLOMERATE FAN REMNANT 2
GEOARCHAEOLOGICAL ANALYSIS, SOLAR ONE

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CREATED BY: JR	DATE: 10-01-09	FIG. NO: 13
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As the name implies, these uplifted relict landforms are largely erosional, particularly along the steeper sideslopes of the fan remnants. The flatter summits of the fan remnants (or “ballenas” if the ridges have been completely separated from other portions of the original alluvial unit) are more stabilized and may exhibit more well-developed desert pavements than the sideslopes. This pavement likely formed through a combination of accretionary processes (McFadden, Wells, and Jercinovich 1987) as well as erosional process, where the finer alluvial matrix is eroded away leaving a disproportionate amount of larger clasts at the surface (McAuliffe and McDonald 1995). Subsurface profiles along the sideslopes (Figure 12) exhibit Stage III to IV $CaCO_3$ morphology, consistent with a Pleistocene or older age.

An additional small area of erosional fan remnant, not mapped as Qof by Dibblee (2008), was identified near the Pisgah Substation, in the western portion of the project area (Figures 5 and 13). The subsurface profile, exposed in a channel that cuts through the deposit indicates that it is similar to the Qof– with similar lithology and $CaCO_3$ development– and may be functionally related. The uplifted exposed summit of the fan remnant is limited to a small area east of the Pisgah Substation, while an older depositional fan apron that appears to be related to the fan remnant extends out to the west (they are mapped together on Figure 5 due to their functional relationship, and a presumed age for both).

In general, the areas mapped as erosional fan remnant (and Qof by Dibblee 2008) have a very low potential for harboring buried archaeological deposits. These landforms are far too old to bury archaeologically sensitive paleosols. The large number of prehistoric archaeological sites present on the surface of these landforms speaks to both their antiquity, and the presence of valuable lithic materials (volcanics and silica rich precipitates) within the fanglomerate deposits.

An exception to this, as on other landforms discussed in this study, is the presence of small confined areas of fine-grain recent eolian deposition. Within the erosional fan remnants, these areas are generally limited to small coppice dunes (small piles of sand built up around and temporarily stabilized by vegetation). The coppice dunes observed in the project area are generally very small, averaging less than 0.5 meter tall by 1 meter wide. Due to their limited area, it is very unlikely that they would obscure an entire site, or bury artifacts significantly different than those observed on the site as a whole.

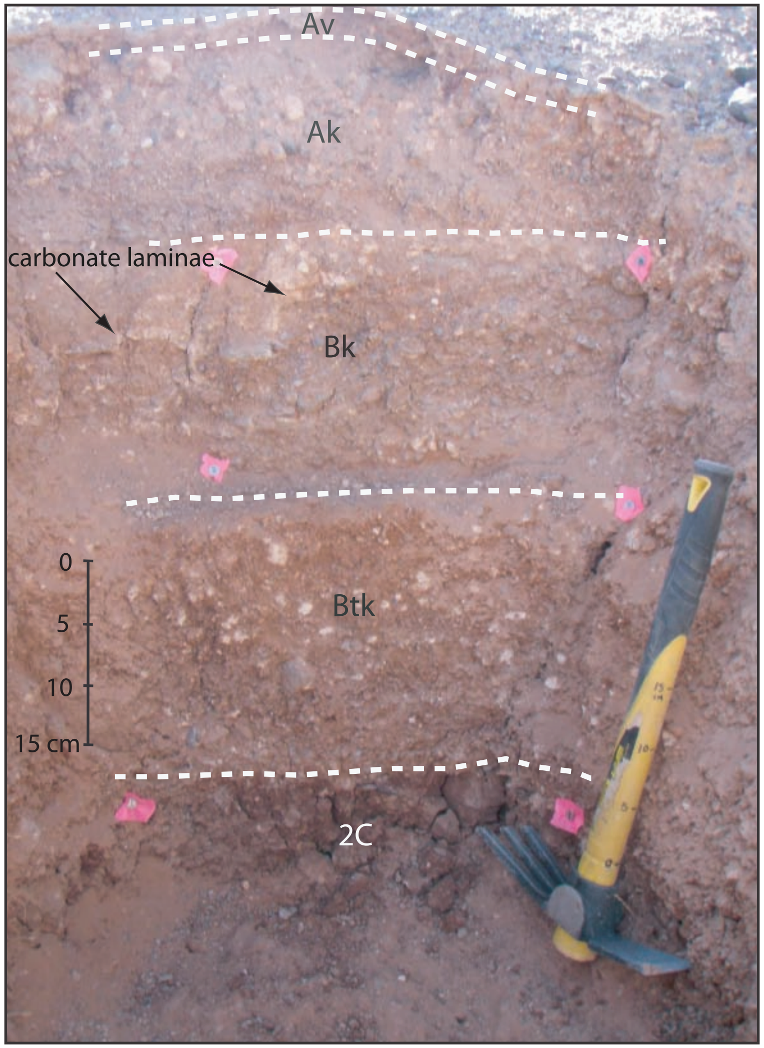
Inset Fans (Sensitivity: Very Low to Low)

Numerous distinct inset fans were mapped within the southern portion of the Solar One project area. These are very gross landform designations and, in reality, the areas mapped as inset fan may be comprised of numerous component landforms. However, the dominant landforms in these areas consist of depositional alluvium (fans) inset between older relict landforms. The inset fans have been labeled separately to allow ease of discussion (Figure 5).

Perhaps the most geomorphically complicated and interesting of these inset fan units is IF1, located in the central-western area of the southern section of the Solar One project area. This area has a gravel and cobble surface lag deposit that forms a well-developed desert pavement, and appears somewhat similar to the clasts from the surrounding Qof fan remnants. The source material for these clasts is likely largely from the eroded fan remnants. However, an examination of the subsurface matrix indicates a much different geomorphic origin for this area. IF1 is underlain by a reddish brown lean clay, which exhibits a course angular blocky structure. Ped faces, when freshly excavated and exposed, exhibit a distinct glossy clay film that may be slickensides, related to periodic wetting and drying cycles. Geotechnical borings B006, B007, and B008 indicate that this clay is over 50 feet thick.

In lower lying areas (including the relict alluvial flat; see below), the clay is overlain by a shallow, well-developed soil profile with a well-developed desert pavement (Figure 14) that represents a secondary inset fan (Figure 16). These soils exhibit Stage II to III $CaCO_3$ formation, with diffuse carbonate throughout the profile and distinct thick and indurated laminae within the Bk- and/or K-horizons. Where observed, subsurface profiles contain a well-developed Av-Bwk-Bk-Btk-BCk pedogenic sequence. These pedogenic features suggest that the soil within the IF1 area (and relict alluvial flat), as well as the clay they overlie, are very old, and are consistent with Pleistocene and early Holocene soils observed at other locales within the Mojave Desert (see e.g., McDonald, McFadden, and Wells 2003:Table 1). The contact between the surface soil unit and the clay appears to be an erosional unconformity.

In higher relief portions of IF1, it appears that these soils have either been stripped away or never formed, leaving distinct inset fan remnants and ballenas composed entirely of the clay with a coarse gravel and cobble deflated lag deposit at the surface (Figures 15 and 16). Indeed, the IF1 structure is old enough that it too has been dissected and contains both erosional and depositional landforms. An additional indication of the age of the clay unit is the presence of distinct, approximately 5cm thick veins and inclusions of gypsum precipitate within the clay (Figure 16). Given its age and physical characteristics, the underlying thick clay unit at IF1 may be functionally related to the late Miocene or early Pleistocene claystones (QTc) mapped by Dibblee (2008) south of the Solar One project area. These are described as light reddish-brown lacustrine deposits that are soft to moderately hard (Dibblee 2008) and which are likely the result of a large paleo-lake that once occupied the area.



(**A**) Profile in relict alluvial flat near associated inset fan (IF1), showing Stage II to III calcic development, unconformably overlying very old clay unit (2C).
(handtool = approx. 40 cm).

(**B**) Surface above profile, showing well-developed pavement with heavy disturbance from vehicles (tire tracks).

ALLUVIAL FLAT PHOTOS
GEOARCHAEOLOGICAL ANALYSIS, SOLAR ONE

URS

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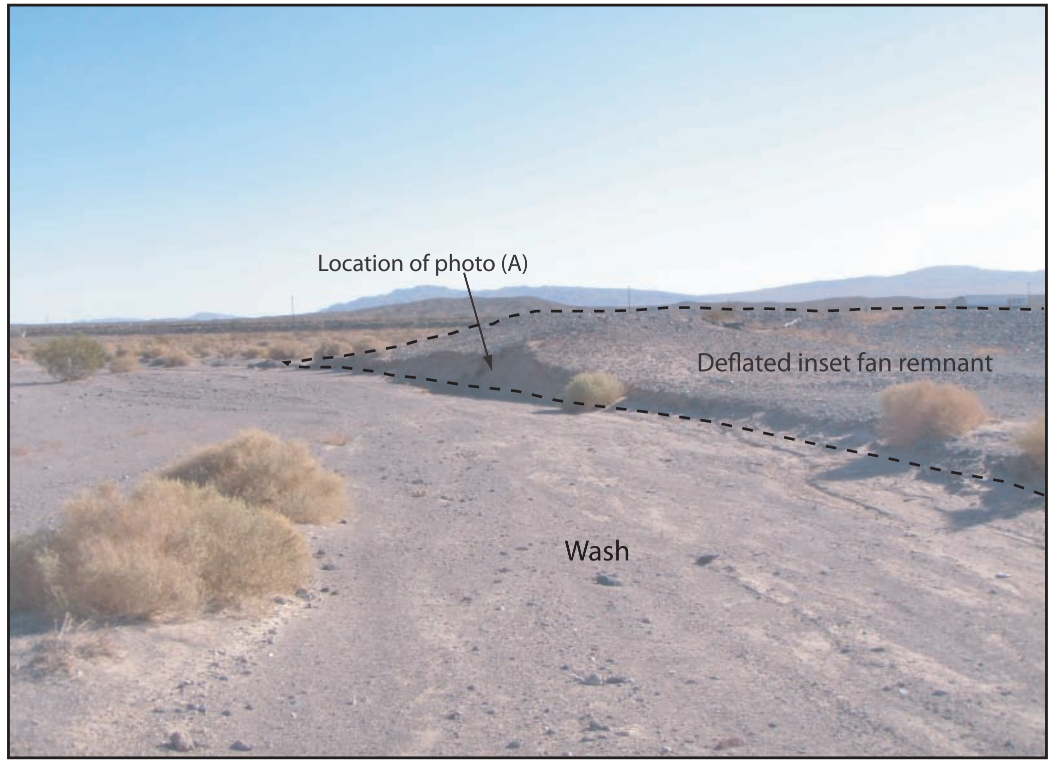
(**A**) Very old red clay unit with carbonate (mostly near surface) and gypsum inclusions; deflated lag deposit at surface.



(**B**) Deflated/erosional inset fan remnant cut by active wash, showing location of photo (A); Highway 40 in background.

INSET FAN PHOTOS 1
GEOARCHAEOLOGICAL ANALYSIS, SOLAR ONE

URS

Not to Scale

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(**A**) Gypsum vein within very old clay unit, exposed at surface of deflated/erosional landform within IF1.

(**B**) Overview of deflated/erosional inset fan remnant, showing coarse gravel and cobble lagdeposit at surface and secondary inset fan along its margins.

INSET FAN PHOTOS 2
GEOARCHAEOLOGICAL ANALYSIS, SOLAR ONE

URS

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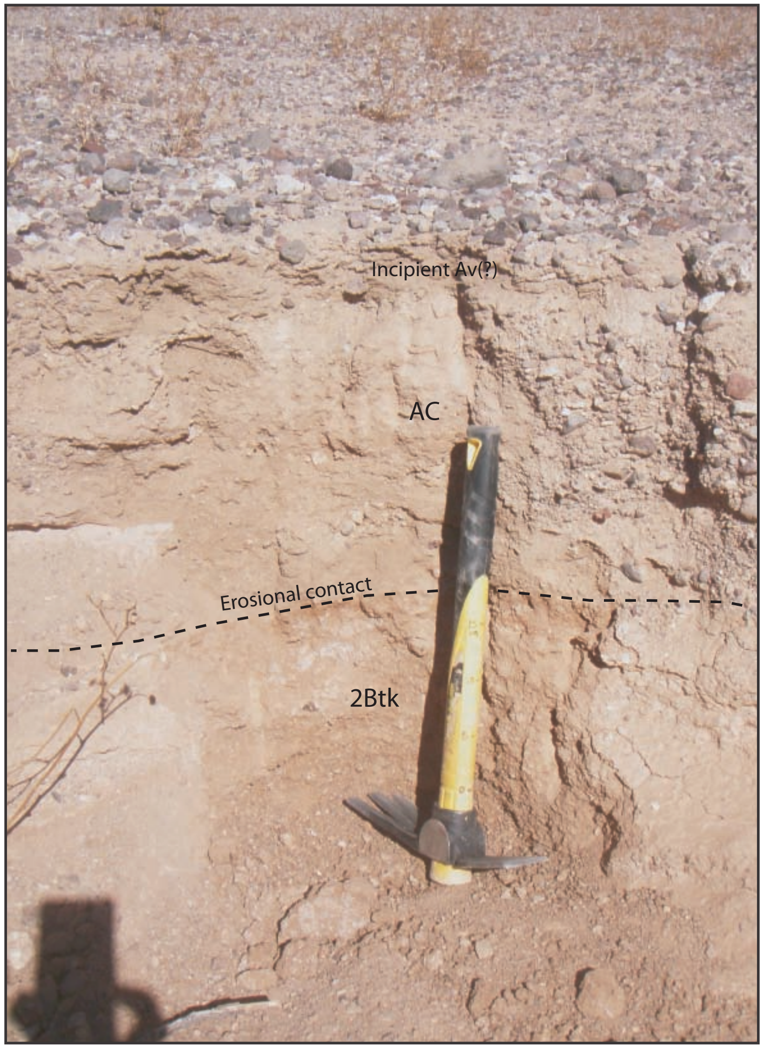
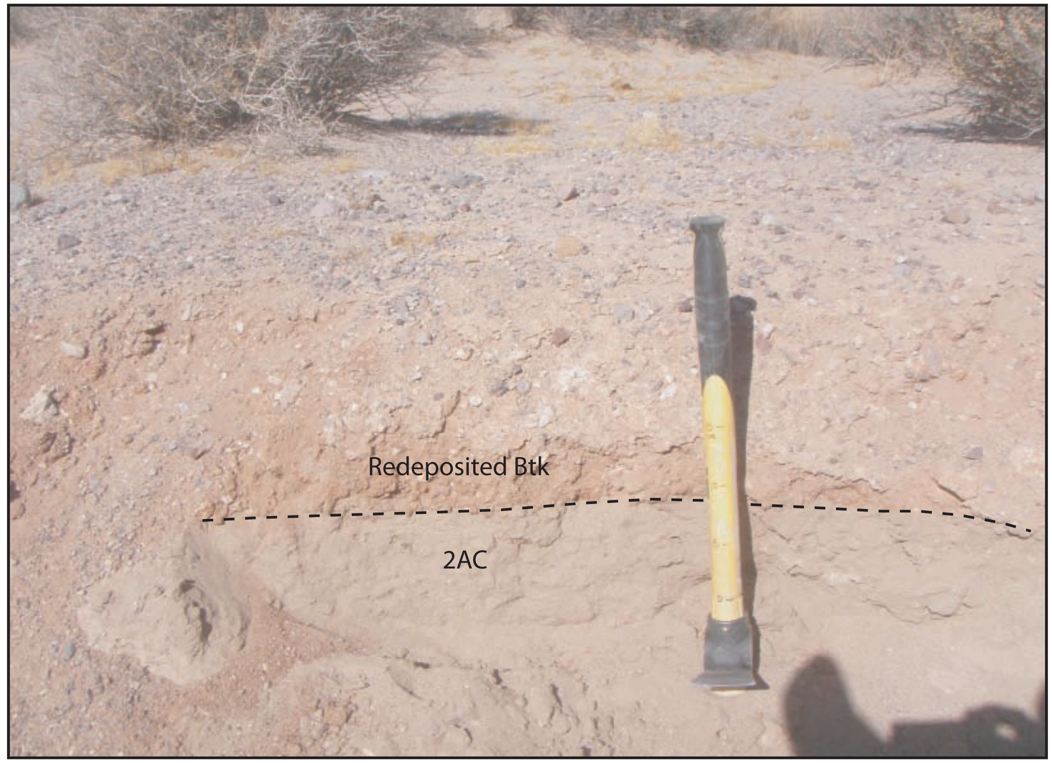


(**A**) Cut along wash in inset fan IF4, showing young alluvial loam with gravel unconformably overlying much older B-horizon with Stage II+ carbonate development (similar to lower Btk-horizon in Figure 8a, and presumed to underlie much of the relict alluvial flat; handtool = approx. 40 cm).



(**B**) Redeposited older clay-rich Btk overlying young alluvium (AC-horizon) downstream from photo (A); note similar pebbly/gravelly surface in both locations (potential for reworked and redepositd artifacts within young deposits, with at least a representative sample at surface; handtool = approx. 40 cm).

INSET FAN PHOTOS 3
GEOARCHAEOLOGICAL ANALYSIS, SOLAR ONE

URS

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CREATED BY: JR | DATE: 11-01-09 | FIG. NO: 17
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Given the age of the soils, the lack of identified paleosols, the very old unconformable lower clay unit, and the largely erosional nature of the relict IF1 inset fan, the potential for buried archaeological deposits is considered extremely low.

The other inset fan units (IF2 and IF3), mapped to the east of IF1 are more typical of inset fans in desert piedmont contexts, in that they do not appear to be underlain by, or composed of, the very old resistant clay unit. These inset fans are, instead, largely composed of reworked and redeposited alluvium from the sideslopes of the fan remnants into which they are inset. Subsurface pedogenic indicators observed during the field reconnaissance and in geotechnical borings indicate that these other inset fans are relatively old (middle Holocene?). Subsurface profiles observed within inset fans IF2 and IF3 generally correspond to an Av-ABw-Btk-Bk Cox-C sequence with Stage I+ to II $CaCO_3$ morphology (Figure 10a). While these soils are likely younger than those observed in other areas across the southern section of the study area, no paleosols were discovered.

In general, these inset fans are considered unlikely to contain buried archaeology because they were largely laid down unconformably on the erosional Pleistocene fanglomerate deposits. The preservation of archaeological material is wholly dependent on the erosional history prior to deposition of the inset pediment. Given the highly erosive nature of the fanglomerate piedmont in general, this type of localized subsurface preservation seems unlikely.

The final smaller inset fan (IF4) mapped at the western extent of the Solar One project area, inset between the relict alluvial flat and the Pisgah Lava (Figure 5) appears much younger and more active than the other inset fans. The meandering channel that created the inset fan has been heavily affected by modern disturbance adjacent to it, and the construction of a culvert under Highway 40 which focuses numerous small upstream gullies into a single drainage. Profiles within a stabilized bank of the incising channel show that it has actively eroded the underlying paleosol (probably related to the relict alluvial flat) and redeposited it unconformably further downstream (Figure 17). The nature of the relatively high-energy unsorted gravelly alluvium upstream (Figure 17a) suggests that any artifacts on this surface may be the result of erosion and redeposition. As such, the IF4 inset fan is also considered to have very low potential for buried archaeological deposits (with no surface manifestation); though additional reworked artifacts, where they are evident on the surface, may be partially buried in a highly disturbed context within recent depositional units.

Relict Alluvial Flat (Sensitivity: Very Low)

The large area mapped as "relict alluvial flat", in the western portion of the project area, appears to be functionally related to the IF1 inset fan. As such, this area could also be considered an apron of the IF1 inset fan. However, alluvial flat is preferred here because it describes the properties of the geomorphic surface– a nearly level alluvial surface between the piedmont and axial stream of a semi-bolson– without assuming genesis from a single parent landform, and without inherent morphological assumptions[2]. As with other landforms, the term "relict" implies that the surface has been stable for a considerable time and, as such, has also been highly dissected.

This landform can be distinguished from other relict landforms in the southern area by a nearly flat, low lying surface that is cut by numerous braided and anastomatizing channels/gullies. These channels are dominantly oriented in the same direction as the major axial channel (i.e. east–west) that crosses the project area. Between these small channels/gullies tend to be bars of intact desert pavement. Although no borings or test pits were advanced within the western portion of the relict alluvial flat, the geoarchaeological reconnaissance and an earlier geologic reconnaissance of the project area (URS 2008) – which mapped a surface clay unit at the western extent of the project area– suggest that the landform is underlain by the thick Pleistocene/Miocene clay. Soils in this area have well-developed subsurface horizons (Figure 14) that are similar to those observed within the IF1 inset fan (see previous discussion).

The geomorphic evolution and interpretation of geoarchaeological sensitivity for the relict alluvial flat is considered similar to that of the IF1 inset fan. Given the well-formed pavement, upper pedogenic unit, and dissected nature of the relict flat, it appears that this area was dominated by a stable and subsequent erosional geomorphic regime for much of the Holocene. The potential for buried archaeological deposits within this area is considered very low.

Axial Channel (Sensitivity: Very Low to Moderate)

The area mapped as "axial channel" (Figure 5) represents the area occupied by the main drainage that bisects the Solar One semi-bolson, as well as component landforms related to the active channel. While the active channel is primarily an erosional structure, small depositional features such as alluvial flats, limited terraces, and fine overbank deposits are the result of deposition by the axial channel. In the

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[2] For example, a fan apron is generally assumed to consist of a thin mantle of relatively young alluvium that typically buries an older pedogenic soil (Peterson 1981:51).

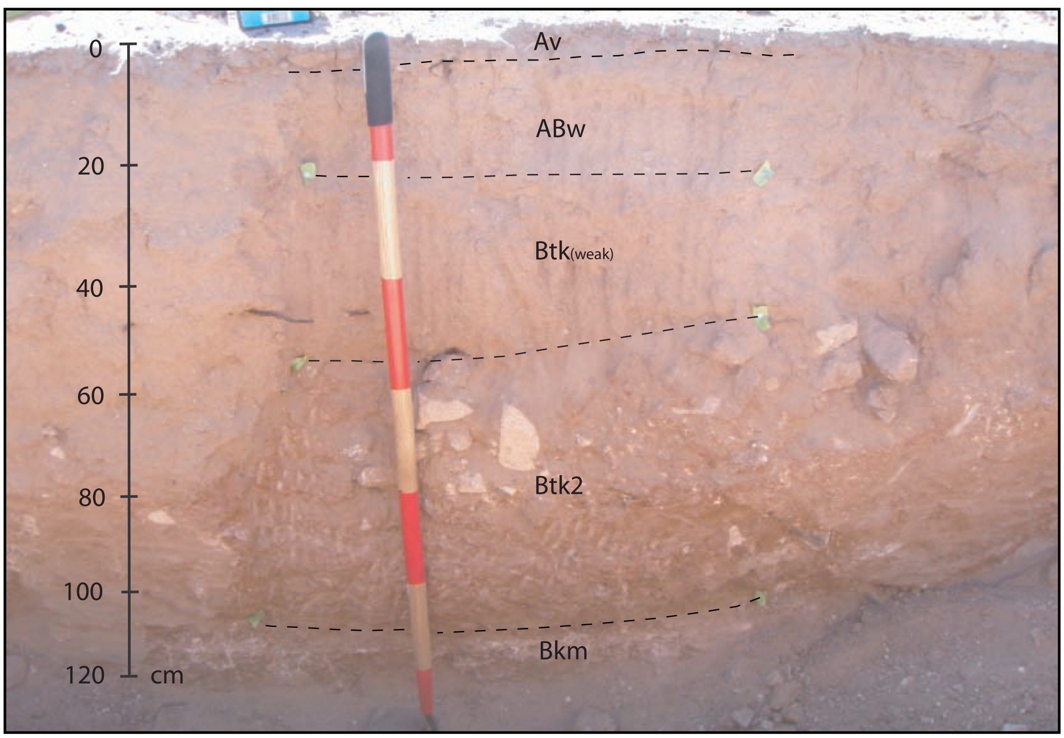
absence of identified springs or fresh water sinks/lakes, the axial channel represents the largest and most reliable source of seasonal water within the Solar One project area. As such, this would have represented a very important resource to prehistoric populations in the project area. The only limited evidence for food processing (milling equipment) found during the cultural resources survey of Solar One is found in close proximity to this water course.

Figure 18 shows the excavations at TP050, near the interface of the lower fan piedmont apron and the axial channel zone. It is difficult to determine if the fine-grain alluvium at the surface of this location originates from the on-fan drainages or the axial channel, but appears that it may be related to an overbank deposit of the channel. The subsurface profile within TP050 is well-developed but unusual. The lack of pavement development at the surface is not consistent with the subsurface profile. An Av horizon has developed in the upper 3 to 5 cm, with a slightly consolidated loamy sand with gravel subsoil (ABw). This is followed by a zone of weak clay and carbonate accumulation (Btk) with observable rubification (ox). This overlies a second Btk-horizon with much stronger structure, distinct clay films on grains within peds, and carbonate accumulation completely surrounding larger gravels and cobbles (Stage II). This is underlain by an indurated carbonate layer (Bkm; Stage III+), as well as a Bk and Cox horizon not shown in Figure 18b.

The existence of multiple B-horizons and gradual increase of carbonates to an indurated lamina is common in very old soils. However, the low carbonate accumulation and weak structure in the upper horizons (with such a well-developed lower profile) is unusual. A distinct lithologic contact is observable between the two Btk horizons (Figure 18b) with the upper dominated by fine-grain loamy sand and the lower dominated by coarse gravels and cobbles. While this may simply represent a facies shift during a single depositional event, the above observations suggest that the contact may also be pedogenic, with the lower Btk representing a truncated portion of a buried soil. In either case, the potential for intact buried archaeological deposits is low (i.e., either a buried surface is absent, or any archaeological deposits on that surface have likely been removed through subsequent erosion).

Figure 19 shows the profile within Test Pit 051, in a similar geomorphic setting near the interface of the toe of a fan apron and the axial channel zone. The upper pedogenic unit is less well-developed than the preceding example, with an AB-Bw-Bwk-C profile, corresponding to a late Holocene age. This unit overlies a very old buried pedogenic unit with a Btk-Bkm-Km1-Km2-Bk-Ck-C profile. Again, a truncated erosional contact seems to be indicated.

(**A**) Surface at Test Pit (TP) 050, with sandy alluvium and few gravels (hill in background = fanglomerate fan remnant; view to south).



(**B**) Upper subsurace profile in TP 050, showing strong soil development and distinct lithologic contact (south wall of test pit).

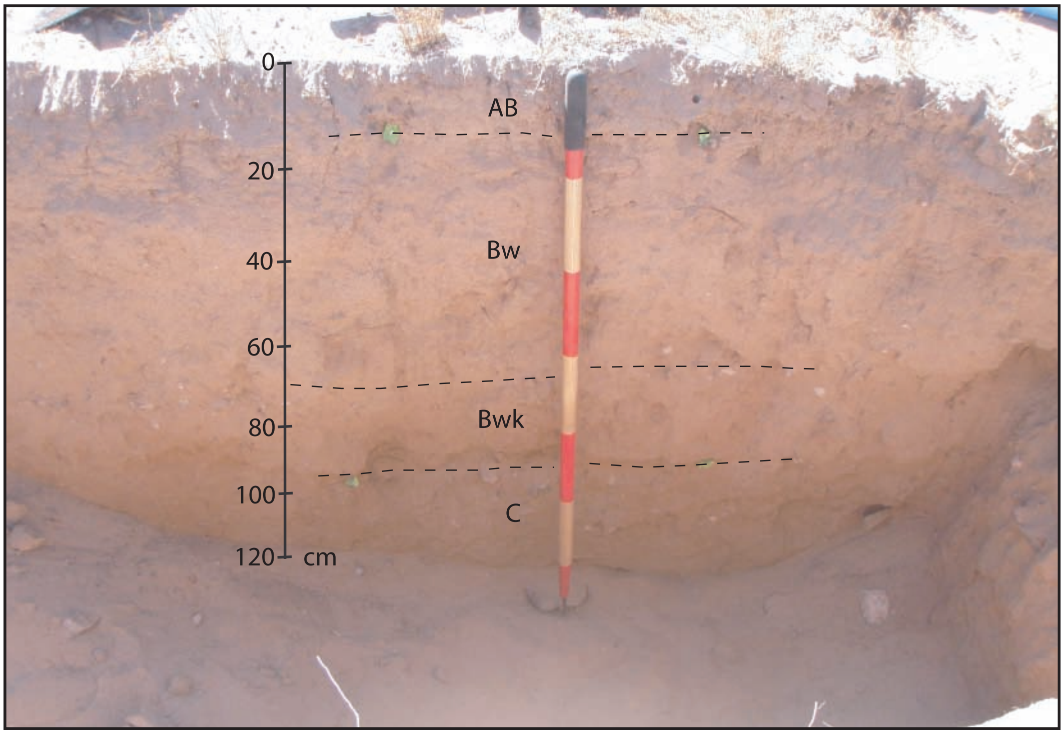
AXIAL CHANNEL PHOTOS 1
GEOARCHAEOLOGICAL ANALYSIS, SOLAR ONE

URS

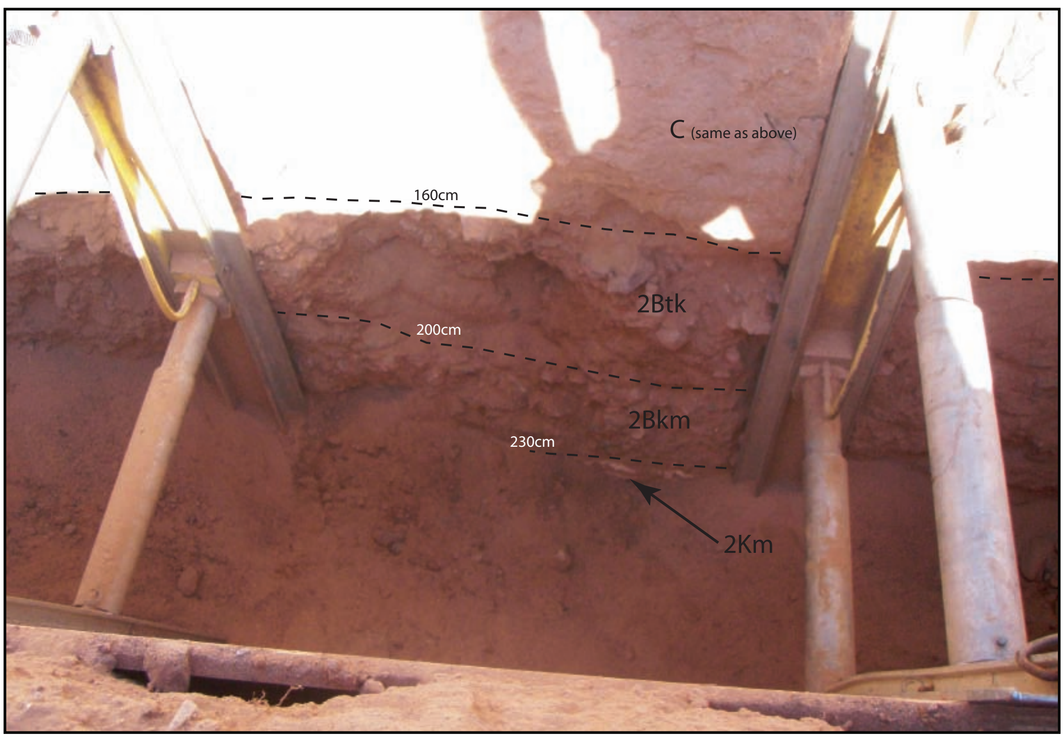
Not to Scale

CREATED BY: JR	DATE: 11-01-09	FIG. NO: 18
PM: WM	PROJ. NO: 27658189.40004	

Path: X:\x_env_culture\Rehor\SolarOne_geoarch\Deliverables\Final\Figures



(**A**) Upper weakly developed pedogenic units in Test Pit (TP) 051 (south wall).



(**B**) Lower pedogenic units in TP 051 (north wall), showing very old buried soil and distinct lithologic contact; indurated calcrete horizon (Km) barely visible at bottom.

AXIAL CHANNEL PHOTOS 2
GEOARCHAEOLOGICAL ANALYSIS, SOLAR ONE

URS

Not to Scale

CREATED BY: JR	DATE: 11-01-09	FIG. NO: 19
PM: WM	PROJ. NO: 27658189.40004	

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No well preserved upper horizons of paleosols were observed in the subsurface explorations within the vicinity of the axial channel. However, multiple truncated paleosols were noted below relatively young fine-grain alluvial deposits. This suggests that there is the potential for low-energy burial of older landsurfaces under significant amounts of recent alluvium (up to 2 meters) within the reach of the axial channel. The preservation of archeological deposits on these surfaces is entirely dependent on the erosional history prior to burial (in both of the test pits discussed here, it appears that significant erosion may have occurred prior to burial). Given these considerations, the geoarchaeological sensitivity of the axial channel is considered low within the current active channel/wash, but moderate on the small terraces and minor component landforms adjacent to the channel where, given the right geomorphic history, significant fine-grain low-energy alluvium *may* bury intact relict surfaces. The archaeological sensitivity of these limited areas is bolstered by the proximity to the only major seasonal watercourse identified within the study area.

Conclusions

The findings from this geoarchaeological study of the Solar One project area are consistent with previous findings from the Mojave Desert. In a recent summary of the region, Sutton (1996) concludes that, contrary to the popular belief that all archaeological sites in the Mojave Desert exist in surface contexts, "there are… many depositional environments [within the Mojave], and there is a great potential for buried sites in many areas… e.g., along the Mojave River, along lakeshores, and in cave sites" (1996:225). Given results from other areas (e.g., Roberts, Warren, and Eskenazi 2007), dune complexes, springs, and other areas with widespread episodic and stabilized eolian deposition, should also be added to the list. All of these landform types are largely absent from the Solar One study area, consistent with an overall low sensitivity for buried archaeological sites within the landforms of the project area.

The axial channel (and associated deposits), which cuts across the central portion of the study area and interfaces with fine-grain sediments from the toe of the alluvial fan piedmont, may represent the only geomorphic feature in the Solar One project area where buried archaeological deposits (with no surface manifestation) may reasonably be expected. While much smaller than the Mojave River drainage discussed by Sutton (1996), the same geomorphic processes that have buried sites along the Mojave River may be at play here, though on a much smaller scale. The fine-grain alluvial deposition along the margins of the axial channel– in the form of limited terrace deposits and alluvial flats– is functionally similar to that along the Mojave River, though large stratified alluvial terraces like those associated with the larger river, are clearly absent. As such, buried archaeological deposits, if present in this portion of the project area, will likely be aerially confined sites with a sparse deposit similar to surface sites in the Solar One study area, buried under up to two meters of very recent fine-grain alluvium. Given the likelihood that the course of the axial channel has meandered over its history, and scoured any existing landsurfaces, the preservation of buried archaeological sites in this area will likely be greatly limited.

The vast majority of the northern alluvial fan piedmont is represented by a subsurface depositional environment that is too high-energy and coarse, with no observed paleosols, to preserve buried archaeological deposits. This lack of depositional sensitivity is coupled with an absence of economically viable lithic resources, which may largely explain the absence of surface sites on the fan piedmont. The high-energy erosional contacts between buried paleo-surfaces and overlying mantle deposits within the fan aprons, coupled with the lack of viable economic resources, largely precludes the presence of buried archaeological deposits within in this portion of the project area as well. Both the very old age and largely erosional nature of the major landforms in the southern section of the project area indicate that buried archaeological sites (with no surface manifestation) are very unlikely. It appears that the greatest potential for site burial in the southern portion of the Solar One project area, is in those places where unconsolidated and active eolian sands have obscured alluvial landforms. However, these eolian features appear to be so limited that they are unlikely to obscure any significant portion of an archaeological site.

A secondary conclusion of this geoarchaeological study is that prehistoric site location within the Solar One study area seems to be largely dictated by the availability of raw lithic materials. The series of coalescing fans that make up the alluvial fan piedmont north of the railroad tracks have their source in the Cady Mountains. An examination of Dibblee's (2008) geologic map of the Cady Mountains, indicates that the dominant material present above these fans is granite to quartz monzonite (gqm), with more limited (and presumable more resistant) outcrops of basalt and andesite (Tb and Ta). This is confirmed by subsurface geoarchaeological investigations of the alluvial fans, which show that the majority of material present is coarse-grained granitic sands, gravels, and cobbles, with little utility for prehistoric tool making. On the other hand, the fanglomerate remnant alluvial fans– and inset alluvial fans, which generally are comprised of reworked fanglomerate– that make up the majority of the landforms south of the railroad tracks, have a much more variable parent material– including volcanics, metavolcanics, and silicates (jasper, etc.) – more conducive to prehistoric tool production.

Data Response 94

Staff's assertion that "the degree of desert pavement [development] is *not* in fact indicative of the presence of buried archaeological deposits" is an accurate statement (CEC 2009: 4; *emphasis* added). However, clarification is needed within both Staff's statement, and the initial theoretical model that was being reacted to (URS 2009:4-2). A well-formed desert pavement does not preclude the existence of a *buried component* to a site located on that pavement, but it does significantly decrease the likelihood that a buried archaeological deposit *not already evident on the surface* is buried below it. See Data Response 93 for a discussion of buried archaeological sites with no surface manifestation.

The vast majority of prehistoric archaeological sites recorded within the Solar One Project Area are situated on well-developed desert pavements located in the southern portion of the Project Area. The age of an archaeological deposit, in relationship to a given pavement, has relevance in terms of the potential for buried site components. Given the currently accepted accretionary model of desert pavement formation (see Data Response 93), if (relatively younger) artifacts are deposited on an already well-developed and stabilized pavement, few, if any, of the artifacts will work their way down in the stratigraphic column. Alternatively, if (relatively older) artifacts are deposited on an actively accreting and, as yet, unformed or stabilized surface, over time a portion of these artifacts will become incorporated as part of the desert pavement, while a portion will remain throughout the depositional column. For example, it has been shown that Paleo-Indian sites, located on desert pavement in arid to semi-arid environments, can possess artifacts from the surface of the pavement up to 70 cm deep (Apple and York 1993; Davis 1970). Although it is unlikely that accreted sediments accumulated this thick, additional subsurface pedoturbation (e.g., argillic shrink/swell, displacement by plant roots) may explain the significant depth of these very old artifacts below the surface.

The lack of time-sensitive diagnostic artifacts across the Solar 1 project area makes it difficult to assess what sites are older, and thus more likely to contain buried artifacts, versus those that are younger and less likely to contain buried components. One corollary, which may prove useful, is the degree of weathering of surface artifacts. The longer that artifacts have been part of the desert pavement, the more patination and visible weathering from eolian abrasion on the surface of the artifact. As such, this theory would contend that sites with a large number of heavily weathered surface artifacts will have a higher number of subsurface artifacts than a site with relatively "fresh" looking artifacts. Testing of this concept may prove beneficial during any Phase II investigations at Solar One. Additionally, while the accretionary model of pavement formation likely explains the majority of pavements observed across the Solar One project area, some pavements/stony surfaces likely formed through erosion and are unlikely to contain buried site components (see e.g., the Data Response 93 discussion of relict fan remnants within IF1).

While it is true that artifacts *may* be present below a surface archaeological site on desert pavement, it has been consistently demonstrated that in such contexts artifact density decreases significantly and rapidly with depth (typically confined to the upper few centimeters), and that buried artifacts are similar in type to those on the surface with no discernable temporal stratification (e.g., Basgall 2000, 2003; Davis 1979; Hunt 1960; Wallace 1962). As such, it is unlikely that any functional interpretation will be altered by the recovery of the limited artifacts incorporated in the subsurface matrix of a site on desert pavement. The discussion of artifacts buried beneath desert pavement surfaces may be moot, at least for the majority of the sparse lithic sites at Solar One, which lack any diagnostic artifacts (i.e., no new functional or temporal information is likely to be gained from any limited subsurface recovery).

The peer-reviewed sources that Staff references in Data Request 94 (Harvey and Wells 2003; McDonald, McFadden, and Wells 2003; Wells, McFadden, and Dohrenwend 1987) do not deal specifically with the relationship between desert pavement development and the burial and preservation of the archaeological record. Instead, these studies deal with the timing of major depositional events and, peripherally, with accretionary desert pavement formation processes on these landforms (see the proceeding response for a discussion of this literature and topics). In fact, these studies, in the limited nature in which they address desert pavements, do actually *support* the contention that more well-developed pavements are less likely to contain buried archaeology (not already evident on the surface). Within these studies, moderate to strongly developed desert pavements are consistently shown to be associated with early Pleistocene to early Holocene landforms (see e.g., McDonald, McFadden, and Wells 2003: Table 1; Harvey and Wells 2003: Table 2). As such, well-developed desert pavements are generally too old to bury archaeological deposits, and *are* indicative of the absence of archaeological deposits not at least partially evident on the surface. However, an even better measure of landform age– and associated buried archaeological potential– includes a combined analysis of soil development, parent material, and pavement development, as discussed in the previous Data Response 93.

Perhaps more directly relevant to Staff's concerns, regarding the potential for buried components of surface archaeological sites in desert pavement contexts, is a recent publication by Ahlstrom and Roberts (2001) which reports on findings from the Sonoran Desert in southern Arizona. Based on excavations at eight archaeological sites with significant amounts of stabilized desert pavement, the authors report finding a total of 23 buried thermal features, four "occupation surfaces", one pit structure, and one refuse deposit. The authors claim that their results "call into question the idea that low-density, low-diversity artifact scatters associated with desert-pavement surfaces can simply be dismissed as surface manifestations with no potential for subsurface cultural remains" (Ahlstrom and Roberts 2001:2).

Despite Ahlstrom and Robert's (2001) claims, a close reading of their study suggests that the subsurface features identified in their investigations seem to be confined to very specific contexts: fine-grain alluvial and/or eolian depositional environments, within or directly adjacent to cleared circle features in the desert pavement, and sites with a relatively diverse artifact assemblage. Indeed, all of the sites discussed in the paper contain a high artifact diversity (at least compared to the sites recorded at Solar One), including lithics, ceramics, ground-stone/milling tools, rock rings, and cleared circles. Although numerous hearth features were found buried below a pebble surface, the authors contention that they were buried below desert pavement is not borne out by the evidence. In fact, hearth features that were buried below "desert pavement" were directly adjacent to the edge of a cleared circle. As such, the pebbles and stones covering the surface above the hearth features were not part of an intact desert pavement, formed over thousands of years, but smaller clasts which had begun to creep into and "heal" the surface disturbance of the cleared circle feature.

Unfortunately– and by the authors' own admission (Ahlstrom and Roberts 2001:2) – data on the quality and quantity of desert varnish or rubification was not collected prior to destruction of the ground surface. However, there was presumably an observable difference in the true desert pavement surrounding the cleared circles, and the stones which had begun to infill from the outer edge toward the center and covered the buried features (e.g., further distance between surface clasts; lower degree of varnish and rubification than surrounding clasts from undisturbed pavement; rubification on the dorsal surface of stones which had originally developed in-place and then were redeposited "upside-down"; etc.). None the less, Ahlstrom and Roberts' results are instructive to archaeologists working in arid environments with desert pavement. If testing features cleared in the desert pavement ("cleared circles"), archaeologists should be aware of differences in the quality of the stone surface at the edge of the clearings, and place units accordingly at the edge of the true cleared area.

Based on years of experience and accumulated data, Carrico and Quillen (1982:184), concluded that "excavations of rock circles and cleared circles have consistently proven unproductive in southern California and western Arizona desert regions." Indeed, Ahlstrom and Robert acknowledge that their "research contradicts the experience of archaeologists who have excavated rock rings and cleared circles, or who have dug units through desert pavement without result" (2001:19). As such, their findings must be taken in the larger context and by no means guarantee that subsurface features will be present in association with cleared circles. Rather, their results suggests that limited testing of such features should continue, in certain contexts, and that cleared circles on desert pavements shouldn't be written-off completely– despite a preponderance of evidence to the contrary.

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TECHNICAL AREA: CULTURAL RESOURCES

Data Request 93. In the absence of extant Quaternary science or geoarchaeological literature sufficient to enable the reconstruction of the historical geomorphology of the project area, staff requests that the applicant please conduct a primary geoarchaeological field study of the project area to facilitate the assessment of the likelihood that archaeological deposits are buried beneath the project area surface, where the construction and operation of the proposed project will involve disturbance at depth.

Response: Please see the Sensitivity Analysis of the Solar One Project Area, provided as attachment CUL-1.

TECHNICAL AREA: CULTURAL RESOURCES

Data Request 94.

Staff requests that a further aspect of the above research into the geoarchaeology of the project area be a discussion of desert pavement development on landforms in the project area.

The extant discussion of desert pavements in the *Archaeological Field Survey Methodology* subsection of the Technical Report (pp. 4-1 – 4-3, subsection 4.3.1) correlates the degree of desert pavement development with the likely presence of buried archaeological deposits. Older, more developed desert pavements are said to the less likely to cap such buried deposits. The applicant appears to use this concept later in the Technical Report to evaluate the potential for archaeological sites on the surface of the project area to have subsurface components (see, as examples, site descriptions for DRK-023 and RAN-025 in the December 2008 version of the Technical Report (pp. 6-35 and 6-37), and compare to revised descriptions for CA-SBR-12993 and CA-SBR-13054 in the Technical Report (pp. 5-27 and 5-29)).

More recent research indicates that this largely anecdotal concept is inaccurate; that the degree of desert pavement is not in fact indicative of the presence of buried archaeological deposits. (See e.g., Harvey and Wells 2003; McDonald, McFadden, and Wells 2003; Wells, McFadden, and Dohrenwend 1987). A more critical discussion of desert pavement development, therefore, may have significant implications for the preliminary interpretation of archaeological sites across the surface of the project area.

Please include in the above research into the geoarchaeology of the project area a thorough discussion of the principles of desert pavement development in arid and semiarid environments and a discussion of the differential development and distribution of such pavements across the project area. The discussion needs to reference the recent literature on the topic, preferably the peer-reviewed literature, and to avoid any substantive conclusions based on anecdote or opinion.

Response: Please see Jay Rehor's Geoarchaeological Sensitivity Analysis of the Solar One Project Area, provided as attachment CUL-1.

TECHNICAL AREA: CULTURAL RESOURCES

Data Request 95. Staff requests that the applicant use the results of the above research into the geoarchaeology of the project area to more clearly reflect the physical contexts of project area cultural resources. Specifically, staff requests that the applicant please provide revisions to the inconsistent conventions in the Technical Report that are meant to describe the geomorphic settings of the cultural resources that the applicant found in the project area of the analysis. The revisions need to reflect more standard geomorphic conventions for landforms and subordinate landform features. The present descriptive conventions for landforms and subordinate landform features. The present descriptive conventions in the Technical Report, such as “open desert pavement plateau wash,” “eroding desert terrace,” and, “open desert plateau,” do not help place the individual cultural resources in the context of the major landforms in the project area. The revisions to the present conventions need to facilitate the correlation of found cultural resources with the results of the above geoarchaeological research, and describe the particular, perhaps multiple subordinate geomorphic features that bound and encase the individual archaeological sites on the major landforms in the project area. Such revisions would enable meaningful interpretations of the distribution of found cultural resources across the project area landscape.

Response: Please see Jay Rehor’s Geoarchaeological Sensitivity Analysis of the Solar One Project Area, provided as attachment CUL-1.

TECHNICAL AREA: CULTURAL RESOURCES

Data Request 96. As further clarification of the physical contexts of project area cultural resources, please explain whether the desert pavements depicted on the Sketch Maps of DPR 523 Series forms represent sub-meter GPS polygons, or whether the depicted pavements are simply general symbols.

Response: The desert pavements depicted on the Sketch Maps of DPR 523 Series forms represent sub-meter GPS polygons.

TECHNICAL AREA: CULTURAL RESOURCES

Data Request 97. To enable staff to reliably identify, analyze, and develop preliminary evaluations for each of the newly found archaeological sites in the proposed project area, please provide revisions to the descriptions of the approximately 143 archaeological sites in the Technical Report to present, in a consistent format, objective and informed archaeological site and artifact assemblage descriptions using explicit descriptive conventions, and develop a reasoned interpretation for each site.

To facilitate the revision process, please use the Template for Class III, Phase I Archaeological Site Descriptions (Attachment 1) to draft the revisions. Please note that it is critical to the interpretation and preliminary evaluation of the historic significance of site components to discuss potential cultural contexts for each site component. Such contexts make explicit the prehistoric or historic themes to which each component has the potential to relate.

Response: Please find the revised site descriptions and overview location maps for the 25 percent sample re-survey of the Solar One Project area, as described in Data Request 97, in the Applicant's Response to the CEC and BLM Data Request, filed under confidential cover. A total of 40 previously recorded sites are included in the 25 percent sample re-survey; some of these sites have been subsequently combined to result in larger archaeological sites. These combined sites were assigned new Primary and Trinomial numbers by the San Bernardino Archaeological Information Center in November 2009.

TECHNICAL AREA: CULTURAL RESOURCES

Data Request 98. Please revise the cultural resources taxonomy to more objectively reflect the character of the archaeological deposits in the project area of analysis, and further divide each type, where feasible, into preliminary chronological groups. Please provide the revisions in the text of the *Research Design* section and in tables 6.2-1 and 6.2-2 of the April 2009 Technical Report. Staff recommends dropping subjective resource types such as "permanent or semi-permanent settlement sites," "temporary camps or food processing sites," and "ephemeral stone acquisition and use of surface quarry sites," and "ephemeral stone acquisition and use of surface quarry sites" in favor of multiple individual types that more precisely articulate the archaeology of the resources. As examples, surface deposits of chipped stone and groundstone artifacts would simply type out as a "chipped stone and groundstone artifact scatter". A deposit that includes one or more fire-affected rock features and one or more rock piles among a scatter with fire-affected rock features and rock piles." The interpretation of the individual archaeological site types as semi-permanent settlements, food processing sites, surface quarry sites, and so forth would typically occur in the *Discussions/Interpretations* section of the Technical Report. Such interpretation is a necessary element of the evaluation of the historical significance of each resource and a necessary precursor to the thoughtful disposition of the cultural resources inventory.

The preliminary chronological grouping of the prehistoric and historical archaeological deposits needs to draw on the available sources of chronological data. For prehistoric archaeological sites, the preliminary chronological groups ought to reflect the cultural chronology of the *Environmental and Cultural Setting* section of the April 2009 Technical Report and be made, where feasible, relative to sources of relative chronological groups similarly ought to be made relative to the most recent ceramic, bottle and bottle glass, and tin can typologies, and, where applicable the typologies for less frequent artifact classes such as nails, ammunition, and buttons, and reflect, at a minimum, the broad historic periods set out in the *Environmental and Cultural Setting* section, if not narrower time ranges within those periods.

Response: The various resource types have been re-defined from the March 2009 version of the Cultural Resources Technical Report, as outlined below, to provide more objective descriptions of the resources located on the Solar One Project site. Some previous definitions, such as the use of the terms "permanent or semi-permanent settlement sites," "temporary camps or food processing sites," and "ephemeral stone acquisition and use or surface quarry sites," have been replaced in favor of more objective terms that characterize the deposits and do not postulate uses of the cultural remains that were identified. Additional terms have been added and are included in the list below.

In consideration of an objective cultural resources taxonomy as suggested by Data

Request 98, all cultural resources recorded in the Project area have been assigned to one or more of the following site type categories:

Isolated Find: Per the guidelines applied to field survey and recordation of cultural resources within the Project area provided by Bureau of Land Management (BLM) archaeologist Jim Shearer, an isolated find is defined as a group of five or fewer prehistoric artifacts (without a tool) within 30 meters of each other. Individual and groups of less than five historic period artifacts were not recorded.

Lithic Reduction Scatter: This site type includes all sites containing flaked and/or battered stone artifacts indicative of lithic reduction activities, including lithic debitage, cores (including early-stage bifacial cores), tested (or assayed) cobbles, and hammerstones; no other artifact types are present.

Complex Lithic Scatter: This site type may contain the same artifact types defined above for Lithic Reduction Scatters, but will also contain formed flaked stone tools indicative of a wider range of activities beyond lithic reduction, such as projectile points or other late-stage bifacial tools, patterned or unpatterned flake tools, and edge-modified flakes.

Ground Stone Scatter: This site type includes milling-related artifacts, including "top" and "bottom" stones such as manos and/or expedient hand stones and metates, respectively.

Ceramic Scatter: Ceramic scatters are sites that contain objects made of clay which were fired and hardened to form utilitarian vessels or objects for use by prehistoric cultures. These objects are usually found as fragments at archaeological sites.

Fire-Affected Rocks and/or Hearths: These are typically loose scatters or discrete concentrations of rocks that have been affected by intense heat and display cracking or pot lid fractures, charring, and/or fire/smoke blackening.

Cleared Circles: These features are typically found on desert pavement surfaces. They consist of roughly circular areas ranging from approximately 1-3 meters in diameter where the larger rocks on the ground surface have been removed or relocated to the outer edge of the area, leaving only the smaller, surficial pebbles remaining within the circumference of the features.

Trails: Trails are 30 to 50 centimeters wide footpaths that appear tamped or pushed (constructed) into the surrounding soils. These features are most apparent on desert pavement surfaces or other stable landforms. Often, particularly on desert pavement surfaces, the larger rocks have been cleared from the path of the trail. This site type may or may not be associated with other archeological remains.

Rock Cluster Features: These are features that may occur as isolated finds or can be associated with prehistoric or historical archaeological sites. These features consist of constructed rock concentrations that stand out from the surrounding ground surface. Such features can consist of a single course of rocks, or rocks stacked higher than one course high. These features may represent prehistoric activity, or they may be associated with mining claims and homesteading land claims. These types of rock clusters are also commonly used by off-highway vehicle (OHV) users to demarcate OHV tracks, trails, and racecourses.

Historical Refuse: A deposit and/or sparse distribution of domestic, commercial, construction, or industrial debris (e.g., cans, bottles, ceramic tableware, milled lumber, machinery, and appliances) that dates before 1960.

Historical Structure: Any structure constructed before 1960 including, but not limited to, residential buildings, commercial buildings, ancillary structures, and electrical sub-stations.

Historical Survey/Mapping Features: These are built/constructed features erected prior to 1960 (not including Rock Cluster Features) that may be isolated and/or associated with other site types listed. An example of such features includes United States Government Land Office (GLO) benchmarks, aerial photograph markers, and concrete foundations.

Historical Linear Site: These linear sites include the following subtypes constructed prior to 1960, and may or may not be associated with other historical resources.

- Roads
- Railroads
- Transmission Lines

Historical Mining Site: These sites may include, but are not limited to, borrow pits, shafts, adits/prospects or other surface mining features, access roads, mining-related equipment and other mining-related artifacts, and mining-related structural ruins dating prior to 1960.

Multiple Activity Area: These are sites that contain diffuse scatters and/or discrete concentrations consisting of a combination of artifact types or features that conform to any of the site types defined above (excluding isolated finds) and will be defined by the combination of constituents within the site (e.g., mining site with historical structure, lithic reduction scatter with hearth, etc.).

The second part of this data request asks for the identified site types to be divided into preliminary chronological groups. Tables 6.2-1 and 6.2-2 of the April 2009 *Cultural Resources Technical Report* have been modified for the sites in the 25 percent sample of sites that were resurveyed. The modified table is included below as Table CUL-1. The site descriptions have been filed under confidential cover.

Placement of cultural resource sites into chronological groups on the basis of general artifact assemblages is difficult unless diagnostic artifacts are located and identified at a particular cultural resource locale, as stated in Data Request 98 above. Diagnostic artifacts are items that can provide a broad range of dates for an archaeological or historical deposit based on previously known information, primarily the known cultural chronology for the region as pieced together by previous researchers.

The chronological sequence of the cultural complexes for the Mojave Desert initially proposed by Warren (1980, 1984) and Warren and Crabtree (1986), divides the prehistoric era into five temporal periods: Lake Mojave, Pinto, Gypsum, Saratoga Springs, and Shoshonean. The four earlier periods encompass what is called the Archaic Period of the Great Basin. The Saratoga Springs period includes formative influences from the Southwest (Lyneis 1982), while the Shoshonean period includes the ethnographic era. Claims have been made for archaeological assemblages dating to periods earlier than Lake Mojave, but as Warren and Crabtree (1986) note, all of these claims are controversial and, even if they are valid, they would have little or no relationship to later cultural developments in the region.

The Mojave Desert sequence has recently been expanded by Sutton *et al.,* (2007) to include elements more closely aligned to prehistoric cultural complexes in the Central Mojave Desert. Similar to Warren and Crabtree (1986), Sutton *et al.,* (2007) note little evidence of a “Pre-Clovis” occupation of the Mojave Desert during the Pleistocene, but they do not discount the possibility of such evidence existing in the region. In contrast to the earlier sequence, Pleistocene era occupation is identified and termed the hypothetical "Pre-Clovis" and "Paleo-Indian" Complexes. Other elements of the Sutton *et al.,* (2007) Mojave Desert chronology for the Holocene period include the Lake Mojave Complex, Pinto Complex, Dead Man Lake Complex, Gypsum Complex, Rose Spring Complex, and Late Prehistoric Complex. These cultural complexes and the artifact assemblages that characterize these complexes are summarized below. As used herein, "climactic periods (*e.g.,* Early Holocene) [refers] to specific spans of calendric time and cultural complexes (*e.g.,* Lake Mojave Complex) to denote specific archaeological manifestations that existed during (and across) those periods" (Sutton *et al.,* 2007:233).

Paleo-Indian Complex (10,000 to 8000 cal B.C.)

The Paleo-Indian Complex was an era of environmental transition between the late Pleistocene and early Holocene. The beginning of the Paleo-Indian Complex was characterized by increased rainfall and cooler temperatures, which formed deep lakes and marshes, even in the interior desert regions of California. As temperatures warmed at the start of the Holocene, glaciers slowly retreated, sea levels rose, and the interior lakes and marshes gradually evaporated over the millennia (Moratto 1984:78).

The earliest, clear evidence for human occupation of the Mojave Desert begins at about 12,000 years ago, while claims for earlier, pre-Holocene era occupations such as those made for the Calico Early Man site (Duvall and Venner 1979), Tule Springs (Harrington and Simpson 1961), Lake China (Davis 1978), and Lake Manix (Simpson 1958, 1960, 1961) remain unsubstantiated.

The Paleo-Indian Complex within the Mojave Desert is, thus far, represented exclusively by the Clovis Complex, though the relationship with the later Great Basin stemmed series points is also a consideration. The Late Pleistocene to Early Holocene geological period of transition, approximately 14,000 to 8,000 B.P., was a period of global climatic change and in the California interior, pluvial lakes formed from glacial melt (Roberts 1989). The Paleo-Indian Complex experienced profound environmental changes, as cool, moist conditions of the terminal Wisconsin glacial age gave way to a warmer, drier climate of the Holocene (Spaulding 1990).

One common theme among nearly all Paleo-Indian sites in North America is the tool assemblage, including fluted projectile points made from fine-grained lithic material and hafted to the end of a spear and launched using a throwing tool (atlatl). Fluted points, defined as a component of the Clovis culture in California, have been found nearly throughout the entire state from coastal estuary environments to ancient Pleistocene lakeshores, which are now in desert areas. In addition to fluted points, the Paleo-Indian tool assemblage was composed mainly of scrapers, burins, awls, and choppers, all used for the processing of animal remains and foodstuffs.

The China Lake site, located near an ancient Pleistocene lake, remains the only presumed occupation of the Paleo-Indian Complex in the Mojave Desert for the Late Pleistocene Period. Excavations at this site revealed a well-sealed stratigraphic context with prehistoric tools produced primarily from obsidian and fine-grained cryptocrystalline silicates (cherts and jaspers) intermixed with the fossilized remains of extinct mammals. The tool sequence from the site suggests that China Lake was inhabited from as early as 9,200 cal. B.C. (Sutton *et al.,* 2007: 234). The earliest calibrated dates for China Lake are from habitation debris at the Pleistocene lakeshore that continued through 10,000 B.C., where Proto-Clovis and Clovis cultures were identified.

Lake Mojave Complex (ca. 8000 to 6500 cal B.C.)

The temporal period 8000 to cal B.C. is referred to as the Altithermal Climatic Phase in which there was a dramatic shift towards a much warmer environment in the desert regions, and which appears to have witnessed a near hiatus in the occupation of the Mojave Desert. As the climate changed, so did the distribution of floral and faunal communities. As a result of these changes, people migrated towards the coastal regions to exploit littoral resources. A small frequency of ground stone implements is present during this time, inferring limited hard seed grinding activities (Sutton *et al.,* 2007:237). The high incidence of extra-local materials and marine shell is interpreted as wider spheres of interaction than witnessed previously. Sutton *et al.,* (2007: 237) interpret these and other data as indicators of “a forager-like strategy organized around relatively small social units.”

Cultural materials dating from this Complex encompass the Playa cultures (Rogers 1939), the San Dieguito Complex (Warren 1967), and the Lake Mojave Complex (Warren and Crabtree 1986). This phase is considered ancestral to the Early 6500 Archaic cultures of the Pinto Complex, representing a shift toward a more diversified and generalized economy (Sutton 1996:228). The Lake Mojave cultural pattern seems to represent relatively small nomadic social units centered on foraging strategies with undefined hunting and lacustrine resource exploitation patterns.

The Lake Mojave assemblages, first identified at Lake Mojave (Campbell *et al.,* 1937), include Lake Mojave series projectile points (leaf-shaped, long-stemmed points with narrow shoulders) and Silver Lake points (short-bladed, stemmed points with distinct shoulders). Other diagnostic items include flaked stone crescents; abundant bifaces; and a variety of large, well-made scrapers, gravers, perforators, and heavy core tools; ground stone implements generally occur in small numbers during this time. (Sutton *et al.,* 2007:234).

In the Mojave Desert and southern Great Basin, Lake Mojave Complex sites are typically (but not exclusively) found around the margins of ancient lakes, although the role of the lakes in the overall adaptation remains unclear. According to Sutton (1996:229), Lake Mojave Complex sites occur more commonly in the eastern and central Mojave Desert, while rare occurrences have been noted within the western Mojave in the China Lake, Coso, and Owens Lake areas

The Pinto Complex (ca. 6500 to 4000 cal B.C.)

The Pinto Complex represents a broad continuity in the use of flaked stone technology, including less reliance on obsidian and cryptocrystalline silicates, as well as a prevalence of ground stone implements in the material culture (Sutton *et al.,* 2007:238) which distinguish it from the Lake Mojave Complex. Increased aridity occurring between the Early and Middle Holocene periods about 7500 B.P. and 5000 B.P. appears to have been more pronounced across the Mojave Desert regions (S. Hall 1985; Spaulding 1991). It is during this time that woodland areas attained their approximate modern elevation range, and the modernization of desert scrub communities was completed with the migration of plant species such as creosote bush into the area (Byers and Broughton 2004). Warren (1984) sees this period as marking the beginning of cultural adaptation to the desert, as materials characteristic of the Pinto Complex gradually replace those of the preceding Lake Mojave Complex. Sites associated with this era are usually found in open settings, in relatively well-watered locales representing isolated oases of high productivity, such as near pluvial lakes, adjacent to fossil stream channels, near springs, and in upland regions. Many of these sites contain substantial midden deposition and cultural debris, which indicates larger groups and prolonged occupation for this time period (Sutton *et al.,* 2007:238).

From the period 5000 B.C. to 3500 B.C., there was increased occupation of the desert regions during the Medithermal Climatic Period. This period of moister and cooler temperatures allowed for the intensive re-occupation of the desert region. In the desert region, the occupation is referred to as the Pinto Basin Complex. However, Sutton *et al.,* (2007:238) cite recent work conducted on Fort Irwin and Twenty-Nine Palms that produced radiocarbon dates of 6870 cal B.C., pushing back the inception of the Pinto Complex to be coincidental with the Lake Mojave Complex.

The Pinto Complex is marked by the appearance of Pinto series projectile points, characterized as thick, shouldered, expanding stem points with concave bases, as well as bifacial and unifacial core tools, and an increase in millingstones. Pinto points were typically produced by percussion reduction with limited pressure retouch. Named for the Pinto Basin site (Campbell and Campbell 1935), the points were presumably used on atlatl darts. Large numbers of such artifacts were also recovered from the Stahl site near Little Lake (Harrington 1957; Schroth 1994).

Major technological shifts for this Complex include a significant increase in the use of millingstones (Warren and Crabtree 1986; Sutton *et al.,* 2007:238). Warren (1990) attributes the development to the exploitation of hard seeds, part of a process of subsistence diversification brought on by increased aridity and reduced ecosystem carrying capacity. Big game hunting probably continued as an important focus during this time, but the economic return of this activity likely decreased as artiodactyl populations declined in response to increased aridity (Warren and Crabtree 1986). During this transitional period there is faunal evidence that indicates exploitation of rabbit, rodent, reptile, and fresh water mussel resources.

A new complex has been proposed by Sutton *et al.,* (2007) that appears to be a variation of the Pinto Complex: the Dead Man Lake Complex (7000-3000 cal. B.C.), based on archaeological findings from the Twenty-Nine Palms area. The primary variation between the Pinto and the Dead Man Complex is the presence of small- to medium-sized contracting-stemmed or lozenge-shaped points, battered cobbles, bifaces, simple flaked tools, milling implements, and shell beads (Sutton *et al.,* 2007:239).

Based on the current archaeological data, there appears to have been an occupational hiatus within the inland desert regions between the Middle and Late Holocene period; few sites have been found that date between 3000 and 2000 cal B.C. It is believed that climatic changes during this period resulted in hotter and drier conditions. These changed conditions may have led to the abandonment of this region for approximately 1,000 years when people migrated to areas with more suitable climates (Sutton *et al.,* 2007:241).

Gypsum Complex (ca. 2000 cal B.C. to cal A.D. 200)

Gradual amelioration of the climate began by around 5000 B.P., culminating in the Neoglaciation at about 3600 B.P., with a period of increased moisture dating to the latter part of the Middle Holocene (Spaulding 1995). This increase in moisture would have presumably resulted in more favorable conditions in the desert, and it may have influenced changes in cultural adaptations, including increased populations, trade, and social complexity (Sutton 1996: 232; Sutton *et al.,* 2007:241).

Gypsum Complex sites are characterized by medium- to large-stemmed and corner-notched projectile points, including Elko series, Humboldt Concave Base, and Gypsum. Other Gypsum Complex attributes include rectangular-based knives, flake scrapers, occasional large scraper planes, choppers and hammerstones. Handstones and milling tools become relatively commonplace, and the mortar and pestle appear for the first time.

This Complex is marked by population increases and broadening economic activities as technological adaptation to the desert environment evolved. Hunting continued to be an important subsistence focus, but the processing of plant foods took on greater importance as evidenced by an increase in the frequency and diversity of ground stone artifacts. Later, the bow and arrow were introduced, increasing hunting efficiency. Perhaps due to these new adaptive mechanisms, the increase in aridity during the late Gypsum Complex (after ca. 2500 B.P.) seems to have had relatively little consequence on the distribution and increase in human populations (Warren 1984; Warren and Crabtree 1986). Base camps with extensive midden development are a prominent site type in well-watered valleys and near concentrated subsistence resources (Warren and Crabtree 1986). Additionally, evidence of ritualistic behavior during this time exists through the presence of rock art, quartz crystals, and paint (Sutton *et al.,* 2007:241).

A shift in subsistence orientation and mobility near the end of the Gypsum Complex is suggested, with increased emphasis on the hunting of smaller mammals (Basgall *et al.,* 1986; Sutton 1996:234). Rock art suggests that the hunting of mountain sheep was important during the Gypsum Complex (Grant *et al.,* 1968). Mountain sheep and deer, rabbits and hares, rodents, and reptiles remains are reported from Gypsum Complex sites in the central Mojave Desert (Hall and Basgall 1994). Evidence from the western Mojave Desert suggests that there was a major population increase ca. 3000 to 2300 B.P. (Gilbreath and Hildebrandt 1991; Sutton 1988).

Rose Spring Complex (ca. cal A.D. 200 to 1100)

The climate during the Rose Spring Complex remained relatively stable and consistent during the middle of the Late Holocene period. In the western Mojave Desert during this time, some regions show an increase in lake stands, such as at Koehn Lake (Sutton *et al.,* 2007:241). At the beginning of this period lakes were at high points. As the environment began to shift towards the end of this period, lakes began to desiccate and recede, marking the end of the Rose Spring Complex ca. Anno Domini (A.D.) 1100.

The Rose Spring Complex is characterized by small projectile points such as the Eastgate and Rose Spring series, which mark the introduction of bow and arrow technology. The Complex also includes stone knives, drills, pipes, bone awls, various milling implements, and marine shell ornaments. The use of obsidian is prevalent during this time (Sutton *et. al.,* 2007:241). Sutton (1996: 235; 2007:241) notes that Rose Spring Complex sites are common in the Mojave Desert and are often found near springs, washes, and lakeshores.

Subsistence practices during the Rose Spring Complex appear to have shifted to the exploitation of medium and small game, including rabbits/hares and rodents, with a decreased emphasis on large game. At the Rose Spring archaeological site, numerous bedrock milling features, including mortar cups and slicks, are associated with rich midden deposits, indicating that milling of plant foods had become an important activity. In addition, evidence of permanent living structures are found during this time (Sutton *et al.,* 2007:241). In the eastern Mojave Desert, agricultural people appear to have been present, as Anasazi populations from Arizona controlled or influenced a large portion of the northeastern Mojave Desert by cal A.D. 700 (Sutton *et al.,* 2007:242).

Late Prehistoric Complexes (cal A.D. 1100 to Contact)

Paleoenvironmental studies conducted within the western Mojave Desert point to increased effective moisture beginning just after 2000 B.P., as evidenced by a shoreline bench feature at Koehn Lake (Sutton 1996:238). The Koehn Lake site appears to have been abandoned by 1,000 years ago, as Koehn Lake desiccated during a major “medieval drought.” This drought may have influenced the movement of people from this area north and east across the Great Basin (Sutton 1996:239). Population began to decrease, due in part to a drier climate, and later as a result of European contact.

However, between 1,000 and 750 years ago, ethnic and linguistic patterns within the Mojave Desert increased in complexity. One of the most important regional developments during the Late Prehistoric Period was the apparent expansion of Numic-speakers (Shoshonean groups) throughout most of the Great Basin and the inland desert and mountainous regions of southern California. Many researchers accept the idea that sometime around A.D. 1,000, the Numa spread westward from a homeland in the southwestern Great Basin, possibly from Death Valley (Lamb 1958) or Owens Valley (Bettinger and Baumhoff 1982). While there is little dispute that the Numic spread occurred, there is much disagreement over its mechanics and timing (Madsen and Rhode 1995).

The Late Prehistoric Complexes reveal a significantly different suite of material culture than that seen in earlier assemblages. Characteristics of this Complex include Desert Side-notched and Cottonwood Triangular arrow points, an increase in the frequency of unshaped handstones and millingstones, incised stones, mortars, pestles, and shell beads (Warren and Crabtree 1986). Also during this time the first locally produced pottery (i.e., Brownware and Lower Colorado Buff Ware) is seen in the Mojave Desert Region, a technology likely coming from the Anasazi in the southwest. The faunal assemblages typically contain deer, rabbits/hares, reptile, and rodents. The use of obsidian dropped off during this time with the increased use of cryptocrystalline silicates. Large occupation sites, representing semi-permanent and permanent villages, emerge during this time as well.

Historic Period

There are three generally recognized divisions of the historic period: the Spanish Period (1540 to 1821); the Mexican Period (1821 to 1848); and the American Period (1848 to present). Characteristics of each period are summarized in more detail in Section 2.9 of the April 2009 revision of the Cultural Resources Technical Report (Report). A summary of the specific development of the Mojave Desert and the area within and surrounding the Project area is also included in this section of the Report. Temporally diagnostic artifacts used for the identification and chronological placement of historic era sites can include: glass bottles and jars, ceramic wares, metal cans, nails, and other miscellaneous items with datable manufacturing style attributes and maker’s marks.

It is important to note that placement of individual sites into chronological groups is difficult unless diagnostic artifacts are identified that can provide insights into the regional cultural chronology. Prehistoric artifacts that are chronological indicators that can provide a general time frame of site use include pottery or other ceramic artifact types and diagnostic projectile point types. If obsidian artifacts are present, the source of the obsidian can often be identified via X-ray Fluorescence (XRF) studies, and the artifacts can be relatively dated by obsidian hydration analyses to provide a range of dates for particular resources. Features that can be radiocarbon dated or correlated to a general period of time can also provide a range of dates for site use. However, as obsidian and radiocarbon studies are beyond the scope of the current study, the chronological placement of prehistoric sites must rely on the presence of temporally sensitive artifact types, such as those mentioned above, or specific feature types that can be correlated to a general time period. Historical sites may also contain diagnostic artifacts such as glassware, ceramics, metal cans, etc., for which date ranges can also be obtained. Information gleaned through archival research can often better refine the period of construction, use, and/or occupation of some types of historical resources.

In sum, certain artifacts found in the archaeological record are diagnostic, or characteristic of a time period. Ceramics, for example, can provide a range of dates for a site because it is known when ceramics were introduced into the southern California region. Ceramics occurred during the Late Prehistoric Period in this region and not during earlier periods, so it is safe to postulate that a site containing ceramics originates from the Late Prehistoric Period or later.

Additional diagnostic archaeological artifacts that can assist in the identification of site chronology include, but are not limited to, the occurrence of certain styles of projectile points, such as fluted (i.e., Clovis) points, Lake Mojave/Silver Lake points, Pinto points, Elko/Humbolt /Gypsum points, Rose Spring/Eastgate points, and Desert Side-notched/Cottonwood Triangular points. Fluted points are diagnostic of the Paleo-Indian Complex (10,000 to 8000 cal B.C.), while Lake Mojave/Silver Lake points are indicative of the Lake Mojave Complex (ca. 8000 – 6500 cal B.C.). Pinto points are diagnostic of the Pinto Complex (ca. 6500 – 4000 cal B.C.), and Elko/Humbolt/Gypsum points are indicators of the Gypsum Complex (ca. 2000 cal B.C. – cal A.D. 200). Rose Spring and Eastgate points are attributes of the Rose Spring Complex (ca. cal A.D. 200 – 1100), while Desert Side-notched and Cottonwood Triangular points are diagnostic of the Late Prehistoric Complex (cal A.D. 1100 - Contact).

If obsidian artifacts are present, the source of the obsidian can often be identified via X-ray Fluorescence (XRF) studies, and the artifacts can be relatively dated by obsidian hydration analyses to provide a range of dates for a particular resource. Ground stone implements such as manos and milling slabs/metates can be found in sites spanning from the Lake Mojave Complex through the Late Prehistoric Complex, but certain types of ground stone implements such as mortars and pestles generally occur in sites dating from ca. 2000 cal B.C. onwards. Certain features, such as hearths that contain charcoal, can be radiocarbon dated. These diagnostic artifacts or features can then provide a range of dates for a particular resource.

Historical sites may also contain diagnostic artifacts such as glassware, ceramics, metal cans, etc., which often exhibit maker's marks or manufacturing style attributes for which date ranges can also be determined. Diagnostic artifacts, if identified, can provide valuable insights into the regional chronology, thereby allowing individual sites to be placed into chronological groups.

The vast majority of the resources identified on the Solar One Project site are lithic scatters that lack temporally sensitive artifact types. Due to the absence of temporally sensitive artifacts, these lithic scatters could range in age from the early period cultures (Paleoindian Period, circa 12,000 to 9,000 years before the present [ybp]) through the historical period. Therefore, only those sites with temporally diagnostic artifacts or features can be placed into chronological groups with any degree of reliability.

A new summary table has been provided to include the information requested for the 41 sites revisited during the October/November 2009 field review of a 25 percent sample of Solar One sites. The summary table includes: revision of descriptions in the Site Type column to more objectively identify the resources present; modification of the terms per the CEC-provided template; addition of a new column that categorizes each site type into a chronological subgroup when temporally diagnostic artifacts or features are present; addition of a second new column that indicates which sites contain undated, but potentially datable material (i.e., obsidian artifacts that could be subjected to source and hydration studies, charcoal from cultural contexts such as a hearth feature that could be radiocarbon dated) and, deletion of the interpretation column in this section.

Interpretations of the resources are included in the site descriptions provided in response to Data Request 99, and will be included in the *Discussions and Interpretations* section (Section 6) of the revised report

Table CUL-1 below identifies the sites included in the 25 percent sample, and includes cultural content, preliminary chronological grouping, preliminary eligibility assessment, whether it should be included in a district and potential for buried deposits based on geomorphological information.

Table CUL-1: Solar One Newly Recorded Cultural Resources Summary Table Resurveyed Sites – 25% Sample

Trinomial	Site Type	Cultural Content	Preliminary Chronological Group	Preliminary Eligibility Assessments	District	Potential for Buried Deposits Based on Geomorphologic Information
SBR-13442 (previously SBR-13001 and SBR-13043)	Complex lithic scatter	Prehistoric	Non-diagnostic	Not eligible	None	Low
SBR-13005	Complex lithic scatter	Prehistoric	Non-diagnostic	Not eligible	None	High, but in disturbed context
SBR-13009	Lithic reduction scatter	Prehistoric	Non-diagnostic	Not eligible	None	High, but in disturbed context
SBR-13012H	Historical refuse scatter	Historical	Early to mid-1900s	Not eligible	None	High depositional rate, but not likely
SBR-13015	Lithic reduction scatter	Prehistoric	Non-diagnostic	Not eligible	None	Low
SBR-13444 (previously SBR-13018 and SBR-13019)	Lithic reduction scatter	Prehistoric	Non-diagnostic	Not eligible	None	Low
SBR-13443/H (previously SBR-13023/H and SBR-13077	Complex lithic and ground stone scatter	Prehistoric	Non-diagnostic	Testing recommended	None	High, but likely in disturbed context
	Historical refuse	Historical	Early 1900s to present	Not eligible		
SBR-13026	Lithic reduction scatter	Prehistoric	Non-diagnostic	Not eligible	None	Low
SBR-13029	Lithic reduction scatter	Prehistoric	Non-diagnostic	Not eligible	None	High, but disturbed context
SBR-13032	Trail	Prehistoric	Non-diagnostic	Presumed eligible pending NA consultation	None	Low
SBR-13033 SBR-13034 SBR-13035 SBR-13036 SBR-13120 SBR-13121	Complex lithic scatter	Prehistoric	Non-diagnostic	Not eligible	None	High, but in disturbed context

Table CUL-1:
Solar One Newly Recorded Cultural Resources Summary Table
Resurveyed Sites – 25% Sample
(Continued)

Trinomial	Site Type	Cultural Content	Preliminary Chronological Group	Preliminary Eligibility Assessments	District	Potential for Buried Deposits Based on Geomorphologic Information
SBR-13041	Complex lithic scatter	Prehistoric	Non-diagnostic	Not eligible	None	Low/High but disturbed context
SBR-13053	Lithic reduction scatter	Prehistoric	Non-diagnostic	Not eligible	None	High, but disturbed context
SBR-13054	Lithic reduction scatter	Prehistoric	Non-diagnostic	Not eligible	None	High, but in disturbed context
SBR-13441 (previously SBR-13057 and SBR-13058)	Lithic reduction scatter	Prehistoric	Non-diagnostic	Not eligible	None	High, but in disturbed context
SBR-13059	Complex lithic scatter	Prehistoric	Non-diagnostic	Not eligible	None	Low
SBR-13069	Lithic reduction scatter	Prehistoric	Non-diagnostic	Not eligible	None	Low
SBR-13071	Lithic reduction scatter	Prehistoric	Non-diagnostic	Not eligible	None	Low
SBR-13073	Complex lithic scatter	Prehistoric	Non-diagnostic	More data needed	More data needed	High
SBR-13078	Lithic reduction scatter	Prehistoric	Non-diagnostic	Not eligible	None	Low
SBR-13082	Lithic reduction scatter	Prehistoric	Non-diagnostic	Not eligible	None	Low
	2 rock clusters	Historical	Non-diagnostic	Not eligible		
SBR-13087 SBR-13108H SBR-13109 SBR-13110 SBR-13112	Complex lithic and ground stone scatter	Prehistoric	Non-diagnostic	Not eligible	None	Low overall, locally high, but in highly disturbed context
	Historical refuse scatter	Historical	1930s-late 1950s	Not eligible		
SBR-13445 (previously SBR-13088 and SBR-13090)	Complex lithic scatter	Prehistoric	Non-diagnostic	Not eligible	None	Low

Table CUL-1:
Solar One Newly Recorded Cultural Resources Summary Table
Resurveyed Sites – 25% Sample
(Continued)

Trinomial	Site Type	Cultural Content	Preliminary Chronological Group	Preliminary Eligibility Assessments	District	Potential for Buried Deposits Based on Geomorphologic Information
SBR-13096	Lithic reduction scatter	Prehistoric	Non-diagnostic	Flakes only, more information needed	None	High
SBR-13125/H	Lithic reduction scatter	Prehistoric	Non-diagnostic	Not eligible	None	Moderate, but in disturbed context
	Historical refuse scatter	Historical	Early to mid-1900s	Not eligible		
P36-014519	Rock cluster feature	Historical?	1912 if associated with National Old Trails Hwy	Not eligible	None	Low
Runway	Runway	Historical	? Awaiting information from BLM	? Awaiting information from BLM	None	Low

TECHNICAL AREA: CULTURAL RESOURCES

Data Request 99. Please draft and provide a new subsections for the *Discussion/Interpretation* section of the Technical Report that include

a. a raw summary statement of the numbers of objective site types and, where feasible, of the chronological subgroups of each objective site type that are now known as a result of previous and recent pedestrian surveys, and of the numbers for relatively rare artifact classes and materials in the project area of analysis, classes and materials such as projectile points, ceramics, and obsidian, and

b. interpretations of each of the objective site types now known to be in the project area of analysis which would, at a minimum, describe each objective site type, discuss the range of variability within each type, develop behavioral interpretations for each type and any subtypes discerned, and proposed subjective descriptors, subjective site types for the suite of functions that are found to characterize each site type and subtype.

Response: Using the original format of Section 6.1.1 of the Technical Report, the 41 sites that were revisited and re-recorded during the October/ November 2009 survey of the 25 percent sample of Solar One sites are classified objectively and then interpreted more subjectively.

Site Type Classification

Of the 41 original sites in the 25 percent sample that were revisited, a total of 27 sites resulted from combining previously discrete sites into larger sites with contiguous activity loci. Of the resultant 27 archaeological sites identified, 21 are prehistoric and three are historical; three archaeological sites represent multi-component resources with both a prehistoric and historical aspect.

The 21 exclusively prehistoric sites, and prehistoric components of the three multi-component sites can be classified among four distinctive objective site types. Revised Table 6.2-1 lists prehistoric archaeological sites relocated during the October/November 2009 resurvey of 25 percent of Solar One sites, organized according to objective site type. Thirteen sites are classified as lithic reduction scatters. Another lithic reduction scatter also contains two rock cluster features. Six sites are classified as complex lithic scatters, while two others are complex lithic and ground stone scatters. Another complex lithic scatter also contains a cleared circle. Finally, one site is a trail.

While these 21 sites are presumed to be prehistoric or ethnohistoric in age because of the typical temporal association of these site types, none of the sites contains temporally diagnostic artifacts or datable material. No projectile points, ceramics, obsidian, or fire-altered rock, soil, or charcoal were observed at any of these sites. Therefore, there are no data available to ascertain when, during the last 12,000 years or so, any of these sites were used. In some cases, it is possible that the lithic reduction scatters are recent, as the result of rock-hounding activity.

TECHNICAL AREA: CULTURAL RESOURCES

Data Request 100. Please provide revisions to the *Settlement Pattern* subsection of the *Discussion/Interpretation* section of the April 2009 Technical Report that describe the broader archaeological landscape of the project area and the more specific distribution or settlement patterns of the subjective archaeological site types across that landscape, and examine potential causal explanations for the structure of the local archaeological record. Please use the example questions above to formulate a more robust suite of questions to explain the structure and character of that record.

Response: Prehistoric Site Distribution

Prehistoric site distribution in the Solar One Project area is largely influenced by the availability of lithic raw materials. Water and vegetal resources are scarce in the Project area, especially compared to resource availability surrounding Troy Lake to the west, at least during certain periods of prehistory. On the other hand, the quality and quantity of readily accessible tool stone in the Project area is notable.

Geomorphic analysis (included in J. Rehor's analysis provided as Attachment CUL-1) showed that the Project area is divided into two major geomorphic regions within a semi-bolson, or open basin, with an axial channel dividing the valley into a northern and southern area. North of the axial stream is an alluvial fan piedmont consisting of a series of coalescing fans emanating from mountain valleys of the Cady Mountains. The Cady Mountains are composed of a granitic, quartz monzonite, and basaltic pluton. South of the channel are several remnant fans, inset fans, and associated alluvial flats formed from different parent material. The difference in parent material is the key variable in determining site distribution.

Coarse-grained granites and quartz monzonites dominate the lithology of the northern alluvial fan piedmont. The materials have their origins in the Cady Mountains north of the Project area, according to geologic sources (Diblee 2008; Rogers 1967). These materials are highly friable and offer little utility in terms of ground or flaked stone tool production. Outcrops of andesite and basalt are present along the mountain front and as small inselbergs in the upper piedmont; however, density of this material is rather low. The predominance of granite and quartz monzonite and lack of quality tool stone in the upper alluvial piedmont explains the scarcity of prehistoric lithic procurement sites.

Clast size decreases down-slope in the piedmont, and there is little to no availability of lithic raw material in the lower portions of the landform. The lack of lithic material is likely the result of clast sorting, in which coarse-grained or larger material settles out up-slope and progressively finer material is deposited down-slope. The lack of lithic resources along the lower slopes of the alluvial fan piedmont may explain the low density of prehistoric sites within this area.

South of the axial channel, sedimentary deposits were determined to be of a much older age and derived from a clearly different source of parent materials than the northern area. The area is composed of a series of uplifted Pleistocene fan remnants separated by a series of inset fans draining to alluvial flats along the axial channel. Cryptocrystalline silicates (CCS), including jasper and chalcedony, basalts, andesite, and other volcanic materials, make up the majority of the desert pavement covering the eroding fan remnants and eroding down into the inset fans and alluvial flats. Despite their younger age, the inset fans nevertheless harbor stable older surfaces with moderate- to well-developed desert pavement between active washes. Relict portions of the alluvial flat also have moderate- to well-developed desert pavement and they are an additional source of lithic raw material.

The majority of cultural resources identified in the Project area are associated with the cobble pavements associated with the relict formations of the southern Project area. The high-quality tool stone found throughout the pavement has been frequently assayed and reduced. The presence of polished and varnished lithic artifacts in some assemblages attests to the relative age of the sites and long-term use of the lithic raw materials as a source tool stone. Clearly, the spatial distribution of lithic reduction and quarrying sites, which constitutes the majority of the prehistoric activity in the area, is related to the location of desert pavements associated with landforms in the southern portion of the Project area.

Other site types and activities, which include later stage lithic reduction, have been identified near the periphery of the desert pavements outside of the paved areas. Two lithic scatters are located on the base of the alluvial fan piedmont on a fan skirt. The fan skirt is an area of low energy with a sandy surface, no surficial lithic raw materials, and it is located at the point where the alluvial fan piedmont transitions into alluvial flats or the banks of the axial channel. Two sites (in the 25 percent sample of resurveyed sites) are located on low interfluvial rises, which are likely subject to minimal erosion and accumulation of sediment through sheet flow and eolian deposition. Artifacts at this site include only secondary and tertiary flakes indicative of later-stage tool production. This may indicate that during exploitation of the desert pavement, temporary camps and lithic processing areas were being set up outside of the pavement area.

Similarly, along the Pisgah lava flow in the southwestern most portion of the Project area, bifaces, bifacial thinning, and a high frequency of tertiary flakes were observed. Along the base of the lava flow is a sand sheet ranging from two feet to several inches thick that extends for 15 to 30 meters out from the edge of the flow, much of which is trapped in small embayments in the face of the lava flow. The sand sheet would have served as an ideal location for carrying out tool production or as a temporary campsite without the hindrance of clearing cobbles or rocks for a temporary work area or resting place.

Trails

The functions of trails within the Project area seem to be both related to accessing the desert pavement as a lithic raw materials source in the southern portion of the Project area and as a general route of travel through the area.

The longest, continuous trail identified during the survey phase transects the Project area in the upper alluvial fan piedmont below the mountain front. The trail enters the Project area along its eastern boundary close to three miles northeast of the Pisgah Substation and crosses the area between 500 and 1,000 meters down slope of the front of the Cady Mountains and mountain valleys. Sites in this portion of the Project area are subject to high energy events as streams emanate from the mountain valleys and rework sediments in a complex network of braided channels. The effects of this phenomenon are apparent in the segmented nature of the trail.

While the longevity of portions of the trail is compromised by fluviation, the rocky nature of the surface also serves to preserve elevated and stabilized portions of the trail. The dynamic nature of this location makes the choice of positioning the trail difficult to interpret. The actual construction of the trail takes greater energy expenditure, in that clast size is much larger at this position in the landscape than further down the bajada slope. Typical clasts can be as large as small boulders. Impacts to the trail by flood events would demand that the trail be frequently repaired. Transecting the valley near the base of the mountains, where many channels are incised into the fan sediments, would be difficult and would require more energy.

Conversely, further down the valley, near the axial channel on the fan apron of the alluvial piedmont, where travel might be easier, there is a lack of surface rock. Therefore, evidence of trails in this region would not be preserved or apparent during a surface survey. In addition to eolian deposition, sheet wash and constant down-cutting by runoff from the upper portion of the alluvial fan piedmont would alter the surface sediments and render the trails undetectable. Thus, conjecture about trails in this region of the Project area is not really feasible.

The remaining two trails within the Project area appear to be leading to, and related to, the desert pavement in the southern portion of the Project area. In the eastern portion of the Project area, a short segment of trail enters the Project area 500 meters south of the previously describe trail. This second trail may be a branch of the above trail; however, no investigations were undertaken beyond the current Project limits to make this determination. The trail trends southwest toward the desert pavement before ending. While the trail does head toward the pavement, the documented portion terminates two miles from the axial channel and desert pavement; therefore, any changes in direction are unknown. In all likelihood, the trail descends the piedmont, and the trail becomes less obvious as clast size decreases. Further, longer segments of the trail are subject to further erosion as its orientation parallels the local surface drainage.

The third trail is located on the Pisgah lava flow and consists of an area cleared of cobbles on the lava surface. The pavements on the lava flow itself are very stable and subject to few fluvial effects. The surface slopes very little where sediments have accumulated. The trail terminates at a large lithic scatter in the western portion of the Project area near the western site of the of desert pavement. It trends northwest and heads toward Troy Lake, presumably where more complex settlement and villages are located.

Trails transecting the desert pavement in the southern portion of the Project should have a good chance of surviving intact to the present. The desert pavement on the surface of the fan remnants is stable and well developed, having formed in the Pleistocene and remained stable as shown by the development of soil (Rehor, this volume). Also, evidence of long term in-situ use of the pavement as a lithic raw material source observable throughout pavement based on the presence of flakes and tested cobbles with desert varnish and polish. Nonetheless, no trail remnants were identified in the desert pavement in the southern area. However, the dispersed nature of the tool stone resource that was being exploited would not have favored development of well-defined, enduring trails. Since exploiting lithic material in the desert pavement was one of the primary reasons for traveling to the area, it is possible that a trail to any one particular area within the southern Project area would lead to the depletion of materials from that specific area of useful material, thereby rendering the trail less purposeful. Rather, it is more likely that once travelers arrived at the desert pavement, time was spent exploring to seek the most quality materials. Thus trails through the area would not serve to expedite the process of lithic procurement nor reduce energy expenditure.

However, if a trail did traverse the southern Project area, it is also possible that evidence of the trail was destroyed by the ground-disturbing activities that have occurred in the area during last century. Several pipeline, roads, and a railroad transect this region of the Project area and construction of these linear features may have followed the path of least resistance through the area, which would also be a likely location for a trail.

TECHNICAL AREA: CULTURAL RESOURCES

Data Request 101. Please collect these four artifacts and submit each for expert analyses of specific artifact type, geographic origin, and age, as appropriate to each artifact type and as feasible. The analyses of the black-on-gray ceramic sherds, in particular, should be conducted by an expert in the ceramics of the North American Southwest. Please provide the results of the analyses.

Response: This data request has been deferred to a later date as directed by CEC and BLM, based on a conference call held at 10 AM on August 10, 2009 with the following individuals: Mike McGuirt, CEC Archaeologist; Jim Shearer, BLM Archaeologist; Rachael Nixon and Gary Fink, URS Archaeologists representing Tessera Solar, Inc. The CEC and BLM agreed that it was not necessary to collect the artifacts and that the collection of these artifacts could be deferred to a later phase of the Project during the testing that is to be performed prior to the issuance of the Record of Decision (Gary Fink, Meeting Minutes, 8/10/09, on file with URS Corporation).

TECHNICAL AREA: CULTURAL RESOURCES

Data Request 102. Using the *Ethnography* subsection of the April 2009 Technical Report as a point of departure, please provide a discussion of potential traditional use areas in or near the proposed project area. Please include considerations of

a. the types of domestic, economic, and ritual use areas that are known for the Serrano, the Vanyume, the Chemehuevi, and other Native American groups that have associations with the project area,

b. the material character of such use areas, and

c. the patterns of such use areas across the local landscape, and the potential archaeological signature of such use areas.

Response: This Data Request is in process and will require contact and coordination with local Native Americans to fully address the issues. This continued coordination will be ongoing and especially be advanced through the Section 106 consultation process. However, it is anticipated that a preliminary response will be provided during the first quarter of 2010. Response to Data Request 102 will identify types of domestic, economic, and traditional ritual areas used by Native American groups that were associated with the Solar One Project area. These include the Serrano/ Desert Serrano (Vanyume) and Chemehuevi, who occupied portions of the Project area in prehistoric or historic times, and the Mojave, who traveled through the area and recognized natural and cultural features within the region as having supernatural significance for them. Traditional ritual areas include places considered sacred or spiritually significant due to supernatural events and other traditional religious associations that native people have recognized for these localities. Domestic, economic, and traditional ritual areas include: desert spring and riverine habitation sites; supernaturally significant mountain promontories; cave sites; desert bighorn, deer, and pronghorn hunting localities; rock art sites; mortuary areas; trails and trail shrines; flaked stone and ground stone quarry sites; and carrizo grass sugar, mesquite, and salt gathering areas, as well as tule rush and basketry materials gathering sites.

Research and preparation of this report component will be completed by David Earle, principal of Earle and Associates, and will involve review of Mr. Earle's extensive archives regarding ethnographic/ethnohistorical research on Native American occupation and traditional use of the central Mojave Desert, as well as other archival and contemporary Native American ethnographic sources. Important ethnographic sources include field notes collected by John P. Harrington on the Serrano/Desert Serrano, Chemehuevi, and Mojave, and Isabel Kelly's Chemehuevi field notes. Information collected by Alfred Kroeber from Mojave and other consultants, including Mojave and Chemehuevi sacred song texts, will also provide important information about native use of the Solar One Project region. As part of Data Request 102, the archaeological signatures of different classes of traditional use areas will also be discussed.

TECHNICAL AREA: CULTURAL RESOURCES

Data Request 103. Please provide a discussion, on the basis of extant literature and Native American informants, of known traditional use areas such as rock art sites, shrines, or gathering places that are in sight of the project and that may be subject to the project's visual intrusion, and a discussion of the potential presence or absence of other such areas in sight of the project.

Response: This Data Request is in process and will require contact and coordination with local Native Americans to fully address the issues. This continued coordination will be ongoing and especially be advanced through the Section 106 consultation process. However, it is anticipated that a preliminary response will be provided during the first quarter of 2010. To address Data Request 103, Mr. Earle will identify known traditional use areas within or in sight of (within the view-shed of) the Solar One Project area. Particularly important are springs, hills, mountain promontories, trails, habitation sites, and other localities associated with traditional sacred stories and historical narratives of the Serrano/Desert Serrano (Vanyume), the Chemehuevi, and the Mojave. The Cady Mountains, the lower Mojave River, and the Pisgah Crater are examples of places with traditional associations for Native American groups in the region. Particularly important are religious song cycles traditional among the Chemehuevi and Mojave that describe the journeys of supernaturals in the vicinity of the Solar One Project area. There are also other documented traditional use areas in the region (springs, habitation sites, quarries, etc.) that may fall within the view-shed perimeter of the Project. Known traditional use areas will be documented using ethnographic and ethnohistorical data, including information obtained from Native American consultants.

TECHNICAL AREA: CULTURAL RESOURCES

Data Request 104. Please provide a redraft of the *Maganese Mining in the Project Vicinity* subsection of the *Environmental and Cultural Setting* section of the April 2009 Technical Report that includes a more in-depth historic context that would more soundly supports the preliminary evaluation of the Logan Mine. The revision to the subject subsection should, at a minimum, address the questions above.

Response: **Mining in the Mojave Desert**

Since the 1860s, mining has been the most important commercial industry near the Project APE. Silver was discovered in 1863, although it is possible the Spanish had mined in the area almost a century before. After the discovery, prospectors arrived to search for and claim ore deposits to sell to investors who had sufficient capital to develop the mines. In the following decade, smaller operators attempted to compete with larger corporations, but very little money was made until the early 1880s when the railroad was constructed through the eastern Mojave Desert (Brooks and others 1980; King and Casebier 1976:300-305).

The period between 1900 and 1919 was known as “the Great Years” for mining in northeastern San Bernardino County because it was more profitable than any other time (King and Casebier 1976:305). In addition to silver and gold, copper, lead, zinc, and other base metals were mined throughout the Mojave Desert and San Bernardino County. During World War I chromium, manganese, tungsten, and vanadium were mined for use in war time industries. Several large mining districts were worked, including Copper World near Valley Wells; gold mines at Hart; lead, zinc, and copper in the Mohawk mines near Mountain Pass; copper mines near Von Trigger Spring; and gold mines at the north end of Old Dad Mountain (King and Casebier 1976).

During the Great Depression, a resurgence of gold mining took place, and World War II stimulated a renewed interest in mining base metals. The Vulcan Iron mine, in the Providence Mountains northeast of the Project, was worked during that time. Since the end of World War II, mining in the area has slowed considerably. More recently, other nonmetals such as clay, talc, and cinder have been mined especially around the Kingston Mountains in the vicinity of I-15, and aggregate mining for sand and gravel is now common in the area (King and Casebier 1976).

Manganese Mining in San Bernardino County

Manganese metal is essential for manufacturing iron and steel, and it was first mined in earnest in the United States during World War I. Because of the absence of high-grade ores, more than 95 percent of the manganese used in the United States was imported from the Union of Soviet Socialist Republics, the Gold Coast of Africa, Cuba, Brazil, and India. The onset of World War I threatened the foreign supply of manganese, stimulating development of domestic manganese mining. During World War I, low-grade deposits were mined in Montana and California, and in 1918, the United States produced 16.8 percent of the world supply of manganese, 35 percent of which was used domestically (Jones 1994; Time Magazine 1940a).

After World War I, domestic manganese mining decreased substantially because of the high costs compared to foreign production. Between 1930 and 1940, about 37 percent of the manganese imported into the United States came from the Union of Soviet Socialist Republics. When World War II began in Europe in 1939, domestic manganese mining once again increased. Imports from Russia were curtailed when Italy entered the war in June 1940 and prevented Russian ore shipments from traveling through the Mediterranean Sea, and later war blockades further thwarted manganese imports (Jones 1994; Time Magazine 1940a; Tucker and Sampson 1943; Williams 1940).

Beginning in 1940, the federal government took steps to build stockpiles of strategic metals, including manganese. In June 1940, the Metals Reserve Company, a branch of the Reconstruction Finance Corporation, was established to stockpile critical metals and subsidize domestic producers. The Metals Reserve Company awarded a contract to the Anaconda Copper Company for 240,000 tons of manganese from the company's Emma Mine in Butte, Montana. The Emma Mine produced much of the domestic manganese during World War II, but the Metals Reserve Company stimulated additional domestic production by offering $48 per ton for high-grade ore (48 percent or more manganese), $35.20 per ton for low-grade A ore (44 percent manganese), and $26.00 per ton for low-grade B ore (40 percent manganese). Ores containing 35 to 39 percent manganese also were purchased at a reduced price (Jones 1994; Life Magazine 1942; Time Magazine 1940a, 1940b; Williams 1940).

During World War II, California was the second largest producer of domestic manganese, behind Montana. By the end of 1946, more than 168,000 tons had been produced from 800 known deposits in 675 locations in 44 counties. More than 80 percent of this production occurred during World War I and World War II (70,000 tons between 1915 and 1919 and 79,000 tons between 1941 and 1945). Between 1930 and 1940, production was limited to a few hundred tons because of the small size and low grade of California's deposits. Manganese mining was profitable during times of war because prices were subsidized to cover the costs of concentrating the ore and buyers were willing to accept ores with high silica content (Trask 1950). A new flotation process developed in Cuba after World War II enhanced recovery of manganese from lower-grade ores.

Between 1867, when manganese was first mined in California, and 1946, six California counties each produced more than 10,000 tons of manganese ore. San Bernardino County was sixth on the list, with 12,989 tons of low-grade ore, much of which was produced during World War II. The county with the highest production numbers was Stanislaus County with 40,647 tons, followed by San Joaquin County with 34,917 tons, Trinity County with 16,634 tons, Riverside County with 14,906 tons, and Mendocino County with 13,087 tons (Trask 1950).

Manganese deposits have been documented in San Bernardino County in the following areas:

1. South end of the Owlshead Mountains (about 60 miles north of the Project APE)
2. Avawatz and Silver Lake region about 25 miles south of the Owlshead Mountains (about 30 miles north of the Project APE)
3. South slope of the Cady Mountains between Newberry and Ludlow (includes the Project APE)
4. Newberry Mountain south of Newberry (about 15 miles east of Project APE)
5. Whipple Mountains north of Parker (about 120 to 130 miles southeast of the Project APE)
6. Needles area (about 95 miles east of the Project APE) (Tucker and Sampson 1943; Wright and others 1953).

Reports of the California Division of Mines and Geology in 1943 and 1953 provided specific information about eleven manganese mines in San Bernardino County (Table 2.9-1). (There likely were other manganese deposits worked at some point within the county that either were not substantial enough to be mentioned or were unknown to the Division of Mines and Geology.) At least four of these mines were in operation toward the end of World War I; the rest of the mines began operation during World War II, with the exception of the Logan Mine, which was located in 1930. Manganese mines in San Bernardino County typically were small operations owned by individuals residing in nearby communities. During World War II, many of the property owners leased their mines to corporations or other individuals. Only five of the documented manganese mines in San Bernardino County were part of larger mining districts. Four of these are in the Monumental District in the Whipple Mountains in the vicinity of Parker, Arizona and the fifth is in the Ibex District northwest of Needles (Tucker and Sampson 1943; Wright and others 1953).

During World War II, manganese producers in San Bernardino County shipped their ore to Metals Reserve Company stockpile points in Parker and Phoenix, Arizona and to Sacramento. Lower-grade ores with 15 to 35 percent manganese were shipped to the Kaiser Steel Corporation in Fontana, California. After the war, the U.S. government continued to stockpile manganese, but domestic production decreased. Several manganese deposits continued to be sporadically worked in San Bernardino County after World War II. California as a whole produced less high-grade ore (greater that 35 percent manganese) after World War II. In 1949 and 1950, the state produced less than 500 tons and none in 1951. Between 1952 and 1958, 70,000 tons were shipped from California mines, but no additional manganese shipments were recorded between 1959 and 1990 (Jones 1994; Tucker and Sampson 1943; Wright and others 1953).

The quality of the California manganese deposits, including those in San Bernardino County, required hand sorting to identify the higher-grade ores. Hand sorting was labor intensive and operation of the mines was cost effective only at times when manganese was in great demand and prices were high. As a result, the manganese mines were only intermittently worked by small crews, and often stood idle for extended periods of time. California Division of Mines and Geology reports indicate that the smaller mines typically employed two men, and the larger mines employed as many as six to ten men. Because of the remote locations of the mines, employees likely camped or constructed simple residential structures on site. The extraction and hand sorting of the manganese ore required little capital, and most mines were operated by individual miners who opportunistically operated their own claims or leased claims during the war periods. During World War II some mines in San Bernardino County were leased by corporations, but due to the small size of the mines and the low grade of the ore, relatively few miners were employed (Trask 1950; Wright and others 1953).

Most of the manganese deposits were shallow and often were worked to depths of 10 feet or less. The deepest mines were the New Deal Mine (90 feet) and the Stewart Mine (50 feet). Documentation indicates that equipment at most of the mines was limited to shovels, compressors, ore carts, and structures used for sorting, such as chutes and conveyor belts. Dynamite may have been used to extract ore. According to reports of the California Division of Mines and Geology, only the New Deal Mine (also known as the Owl's Hole Mine, Old Hole Mine, and Owl's Head Mine), which was the most productive mine in San Bernardino County, had its own mill. (Field investigations conducted during this study indicate that miners also operated a small mill at the Logan Mine). Although some ore from nearby mines might have been hauled to the mill at the New Deal Mine for processing, the mill was in a remote location and most of manganese ore extracted from the San Bernardino County manganese mines probably was shipped without any processing other than sorting (Jenkins 1943; Wright and others 1953).

Table CUL-2, included below, provides a list of Documented Manganese Mines in San Bernardino County.

Table CUL-2:
Documented Manganese Mines in San Bernardino County

	Name	District	# of Claims	Dates of Operation	Ownership	Grade of Ore	Location	Additional Information
1	Logan Manganese Deposit (Trans-Oceanic, Treasure)	none	6	first located in early 1930, first ore shipment in 1934; Suckow Borax Mines Consolidated, 1942-1943; continued some operations post 1943	1930: E.F. Logan, 1942-1943: to Suckow Borax Mines Consolidated	ores yielded 19 to 44 percent manganese	within Project APE, southwest slope of Cady Mountains	steep road about 0.75 mile long built to deposit
2	Black Butte Mine (Matt, Pisgah, Big Reef)	none	6 to 10	approximately 1918 to 1944	1943: C.S. and Kenneth Van Doren; leased to A. Dunaetz of Los Angeles, H.W. Wier, and Owl Springs Manganese Company	ores yielded 19 to 40 percent manganese	0.5 mile east of Project APE; southwest slope of Cady Mountains	equipment includes 300-cubic-foot compressor and 0.75-cubic-yard shovel
3	Lavic Mountain Manganese Mine (Lee Yim Manganese, Garringer Mine, Manganee 1-10, Root)	none	10	1917 to 1942	1917: I.D. Garinger and L.G. Root; 1943: Lee W. Yim and Mrs. A.N. Rabe, leased to Gold Hill Dredging Company	ores yielded 22 to 38 percent manganese	6 miles east of Project APE; southwest slope of Cady Mountains	rail tramway installed during World War I

**Table CUL-2:
Documented Manganese Mines in San Bernardino County
(Continued)**

	Name	District	# of Claims	Dates of Operation	Ownership	Grade of Ore	Location	Additional Information
4	Black Magic Mine (Emma)	none	13	recorded in 1943 report in California Journal of Mines and Geology	1943: J. Hilliard and R. Watkins, leased to H. Nasland of Beverly Hills	unknown	approximately 60 miles north of Project APE; south end of Owlshead Mountains (now within boundary of Death Valley National Park)	California Journal of Mines and Geology report noted that the ore would require considerable sorting to bring to commercial grade; lessee discontinued operation after storm damage to mine road
5	New Deal Manganese Mine (Owl's Hole, Old Hole, Owl's Head)	none	unknown	1914 to 1918; 1941 to 1946; 1956 to 1950	1943: Kern Leasing Company; leased by K.S. Mining Co., L.R. Peck, and D.A. Kendal 1953: L.K. Orwig	ores yielded 19 to 45 percent manganese (most productive manganese	Approximately 64 miles north of Project APE; south end of Owlshead Mountains (now within boundary of Death Valley National Park)	Ore hoisted and run over conveyor belts; 6 employees; 35-ton mill constructed during World War II
6	Black Mountain manganese mines (Black Mountain copper mine group)	Ibex	unknown	unknown; appears in records in 1943	1943: Black Mountain Mining Company	ores yielded 35 to 40 percent manganese on average	approximately 95 miles east of Project APE; southern slope of Dead Mountain about 10 miles northwest of Needles	no additional information found

Table CUL-2: Documented Manganese Mines in San Bernardino County (Continued)

	Name	District	# of Claims	Dates of Operation	Ownership	Grade of Ore	Location	Additional Information
6	Black Mountain manganese mines (Black Mountain copper mine group)	Ibex	unknown	unknown; appears in records in 1943	1943: Black Mountain Mining Company	ores yielded 35 to 40 percent manganese on average	approximately 95 miles east of Project APE; southern slope of Dead Mountain about 10 miles northwest of Needles	no additional information found
7	Black Tiger Manganese Deposit	none	2	unknown; appears in records in 1943	1943: A.R. Orchard	ores yielded 12 to 15 percent manganese	approximately 125 miles southeast of Project APE; in Whipple Mountains on southwest shore of Lake Havasu	no additional information found
8	Cactus Central Manganese Mine	Monumental	6	unknown; appears in records in 1943	1943: W.H. Miller	ores yielded 30 to 45 percent manganese	approximately 130 miles southeast of Project APE; Whipple Mountains about 10 miles north of Parker, Arizona	no additional information found

Table CUL-2: Documented Manganese Mines in San Bernardino County (Continued)

	Name	District	# of Claims	Dates of Operation	Ownership	Grade of Ore	Location	Additional Information
9	Juleff Manganese Mine (Willette Group)	Monumental	4	unknown; appears in records in 1943	1943: C.E. Moulton, under lease to James Juleff	ores yielded 48 percent manganese	approximately 130 miles southeast of Project APE; Whipple Mountains about 10 miles north of Parker, Arizona	adjoins Manganese King Mine; 1,000-foot aerial tram from the deposit to the mine road; 2 men employed
10	Manganese King Mine (Hidden Cross, Cross Roads, Hidden Treasure, Monument King)	Monumental	12	1917 to 1943	1943: J.W. Stewart, under lease to J.E. Vandergrift and to Mineral Materials Company	ores yielded 35 to 46 percent manganese	approximately 125 miles southeast of Project APE; Whipple Mountains, about 10 miles north of Parker, Arizona	In 1942, a 1-mile truck road was constructed up the canyon half way to loading bins; equipment consisted of tractor and trailer for hauling ore out of mine site, portable compressor, ore bins
11	Stewart Manganese Mines	Monumental	12	1942 to 1943	1943: J.W. Stewart, under lease to J.E. Vandergrift and to Mineral Materials Company	ores yielded 30 to 40 percent manganese	approximately 120 miles southeast of Project APE; 42 miles southeast of Needles	equipment included 3 portable compressors, tractor, bulldozer, and trucks; 10 men employed

NOTE: APE = area of potential effect.
SOURCES: Trask 1950; Tucker and Sampson 1943; Wright and others 1953.

TECHNICAL AREA: CULTURAL RESOURCES

Data Request 105

Please provide a redraft of the preliminary evaluation of the Logan Mine so that the evaluation reflects the above revision of the manganese mining context, and more appropriately addresses the aspects of resource integrity pertinent to historical archaeological sites, as opposed to standing built environment resources.

Response:

Manganese Mining in the Project Vicinity

Three of the 11 documented manganese mines within San Bernardino County are in the Project vicinity—the Logan Mine, Black Butte Mine, and Lavic Mountain Manganese Mine The Logan Mine are the only one of these within the Project APE. The Black Butte Mine and the Lavic Mountain Manganese Mine are about 0.5 mile east and six miles east of the Project APE, respectively.

The Black Butte Mine (also known as Matt, Pisgah, and Big Reef) was established during World War I. During World War I and World War II, the mine produced a few hundred tons of manganese ore with 19 to 40 percent manganese. In 1951, the mine owners leased the property to the Owl Springs Manganese Company, which shipped 125 tons of ore with 40 percent manganese to the Geneva Steel Company in Utah. In 1943, the California Division of Mines and Geology reported that a 300-cubic-foot compressor and a 0.75-cubic-yard shovel were on site. The Lavic Mountain Manganese Mine also opened during World War I and shipped 100 tons of selected ore with 35 percent manganese to Lewellyn Iron Works in Torrence, California in 1917. The mine was leased to the Gold Hill Dredging Company of San Francisco in 1942, but no ore appears to have been shipped from the mine during World War II. The Lavic Mountain Manganese Mine also was known as the Garringer, Manganese 1-10, Root, and Lee Yim Manganese mines (Tucker and Sampson 1943; Wright and others 1953).

The Logan Mine (also referred to as the Trans-Oceanic Mine) was not located until early 1930 and its first ore shipment, 71 tons of ore with 44 percent manganese, was made in 1934. E.F. Logan of Daggett, and later of San Bernardino, owned the mine, which in 1953, consisted of six claims. During 1942 and 1943, Logan leased the mine to Suckow Borax Mines Consolidated Company of Los Angeles. In 1943, the Logan Mine shipped about 300 tons of ore with 40 percent manganese to the Metals Reserve Company. By the end of 1943, the mine was idle, and no employees were working at the mine. Subsequent to the Suckow lease, the mine produced 200 tons of ore with 19 percent manganese for the Kaiser Steel Corporation in Fontana. In 1953, the California Division of Mines and Geology reported that the Logan Mine continued to be worked occasionally (Tucker and Sampson 1943; Wright and others 1953).

The California Division of Mines and Geology rated the manganese mines located on the southwest slope of the Cady Mountains in the Project vicinity as third in terms of production in all of San Bernardino County. The New Deal Mine at the south end of the Owlshead Mountains was the largest producer, followed by the mines in the Whipple Mountains. All three mines in the Project vicinity were small operations that were only active during times when manganese was in great demand and prices were high. Of the three mines, the Logan Mine was the most productive. Although work was done at the Lavic Manganese Mine during World War II, no ore was shipped during this era and records indicate only 100 tons of ore was shipped from the mine during World War I. Both the Black Butte Mine and the Logan Mine were active during World War I and World War II. The Black Butte Mine produced approximately 425 tons while the Logan Mine produced more than 700 tons. When compared to the manganese mines county-wide, the manganese mines in the Cady Mountains produced far less manganese ore than those in the Owlshead and Whipple Mountains. The Monument King Mine in the Whipple Mountains reportedly shipped approximately 1,800 tons of ore and the New Deal Mine in the Owlshead Mountains shipped more than 15,000 tons (Tucker and Sampson 1943; Wright and others 1953).

Research identified no specific information about the men who worked the manganese mines in the Project vicinity. All three of these mines were small operations that might have employed only two or three men at a time.

Update of Information on CA-SBR-4558 H (Logan Mine)

Provided below is an update of the Logan Mine site.

The Logan Mine Site was originally recorded in 1979 and is the archaeological remnants of a surface manganese mining site. it is also referred to as the Trans-Oceanic Mine. The Logan Mine was one of three manganese mines in the Project vicinity, but the only one within the Project APE. E. F. Logan of Daggett, and later of San Bernardino, owned the mine, which by 1953 consisted of six claims. Activity at other mines in San Bernardino County began either in World War I or World War II when the demand for manganese ore was high (manganese is used in making iron and steel and foreign supplies were reduced during the wars). The Logan Mine was located in the early 1930s at a time when domestic manganese mining was at an ebb because war-time subsidies were not in place. The records are silent as to why E.F. Logan chose to begin his manganese enterprise at this time, but it may have been a means of making extra money during the Great Depression. Little capital is needed to operate a small manganese operation, and the federal government continued to stockpile the metal in limited quantities. Logan continued to at least intermittently work the mine during the 1930s, and in 1934, Logan’s first ore shipment consisted of 71 tons of ore with 44 percent manganese and 2 percent silica (Wright and others 1953).

During World War II, Logan leased the mine to Suckow Borax Mines Consolidated Company of Los Angeles. In 1943, the Logan Mine produced about 300 tons of ore with 40 percent manganese that was shipped to the Metals Reserve Company. By the end of 1943, the California Division of Mines and Geology reported that the Logan Mine was idle, and no employees were working at the mine. Subsequent to the Suckow lease, the mine produced 200 tons of ore with 19 percent manganese and shipped it to the Kaiser Steel Corporation in Fontana. In 1953, the California Division of Mines and Geology reported that the mine continued to be worked occasionally (Tucker and Sampson 1943; Wright and others 1953).

The site measures approximately 4,048 feet SW/NE by 1,243 feet SE/NW with a total area of 75 acres (GIS calculation). The site has 12 mining cairns, 11 features, two historic refuse deposits, open pit mines, and dynamite blast quarry areas. The site is situated in and along the base of the Cady Mountains. Features occur along washes and lower desert pavement terraces, as well as on ridge tops. There are several road segments that have washed out throughout the site leading to areas of surface mining and structures within the site, all of which are in ruins. The site area is bounded to the north and northwest by the Cady Mountains and to the east, west, and south by open undeveloped BLM land. Sediment across the site is typically metavolcanic rocks, desert pavement, and fine grain alluvial sand with small to medium subrounded to sub-angular gravels and cobbles ranging from 1 to 30 centimeters in size.

Of the three manganese mines in the Project vicinity, the Logan Mine appears to have been the most active, but like the other two mines appears to have been a small operation with only a few employees at a time. Historical records do not describe the equipment used on site to extract and process the ore, but during the field investigation, structures that appear to be related to the concentration of manganese ore were documented. Most manganese mines in the vicinity relied only on hand sorting to concentrate the ore. Structures and pulverized ore at the Logan Mine indicate that the mine had a more elaborate concentration system. Features 6 through 9 probably are part of a small mill operation. Features 6 and 7 are remnants of a fallen wood and concrete structure that may have been part of a conveyor that delivered ore to Feature 8. Feature 8 has a concrete structure that may have served as a base for milling equipment. Nearby timber structures probably were chutes used to store ore. Feature 9 is a concrete-lined slurry pool measuring 20 feet wide and 16 feet deep that may have been used for some type of flotation process. Waste piles of pulverized rock surround these features. The mill and associated features probably date to the World War II years of operation when subsidized prices made investment in machinery feasible.

The concentration and processing area of the mine is located near the south end of the site. Feature 5, a collapsed wood-frame structure clad with corrugated metal with plastered interior walls, wood frame awning windows, and a porch, and Feature 11, a 52- by 55-inch privy, also are in this area. Debris found in the area includes lumber; tires; bed/couch springs; truck seat springs; brown glass; and oil, paint, and gas cans. The presence of these features and the associated debris indicates that this area may have been a habitation area for the mine workers. Debris noted within the concentration and processing area included a truck frame and parts, mason jars, sheet metal, siding, metal processing parts, oil filters, gas cans, rubber, wood/lumber, melted rubber, an oil can, and paint cans.

Features 2, 3, and 4 are located south of the concentration and processing area. Feature 2, a concrete pad with mounting bolts, and Feature 3, a wood utility pole, indicate that electricity was available on site. Feature 4 is east of Features 2 and 3 and is a 300-foot-deep well pipe or stand pipe.

Feature 10, the closest feature to the surface mine itself in the north end of the site, is a rock-lined foundation with posts in situ. Structural debris was located down a nearby drainage, and a historic refuse deposit was found northwest of the feature. Historic refuse included food and kerosene containers, glass, ceramics, construction materials, and a sole of a shoe. This trash indicates that this area also was used as a worker habitation area or was a dump site. A large quantity of household debris also was located down slope from the feature.

Feature 1, located southeast of Feature 10, consists of structural debris associated with a stand pipe. The debris appears to be fallen, non-residential, wood-framed mine structures with corrugated metal siding. At the center of the eastern site boundary, an L-shaped pipe was observed that extends upward 72 inches with 36 inches exposed and west 72 inches with 9 inches exposed, with the remainder subsurface. The pipe rests atop a pocket of eroded earth consistent with water flow down through the pipe. A rock foundation is located on the northern end of the site. The foundation is a rectangular and U-shaped, and is constructed with red metavolcanic rocks typical of the area.

The Logan Mine was evaluated within the context of manganese mining in the Project vicinity and in San Bernardino County. Like other mines in the area, the Logan Mine was active during times when manganese was in great demand and worked intermittently at other times. The Logan Mine was the largest producer of the three manganese mines in the Cady Mountain area, but was not a large producer in comparison with other mines in the Owlshead and Whipple mountains in San Bernardino County. Archaeological recording documented that there was some type of small-scale milling and concentrating operation at the Logan Mine. Historic documents indicated the processing or ore at most manganese mines in the region was limited to hand sorting, and had not reported the milling operation at the Logan Mine. Because the other two Cady Mountains manganese mining sites are not within the Project APE, they were not visited to determine if similar structures are present at those mines. Although there are a few standing features at the Logan Mine, it has been abandoned for some time and vandalism and neglect has affected the condition of the site. Historical records contain much information about manganese mining in California and San Bernardino County. The site recording of the Logan Mine and historic research that was conducted as part of this study has thoroughly documented the site and further research is unlikely to yield important information. Therefore, CA-SBR-4558 is not recommended eligible for the National Register and is not a historical resource pursuant to CEQA under any of the criteria for eligibility.

Summary of Recommendations

Historically, settlers have mined in and around the Mojave Desert since the late 19th century. Such sites are frequently demarcated by simple structures, rock cairns, and/or posts. The Cady Mountains have witnessed historical various mining activity. Research indicates that the Logan Mine, a manganese mine within the Project APE, was developed in the 1930s. Production apparently peaked in 1942 when 300 tons of ore were shipped to meet war time demands. The mine, however, was idle the following year and was only intermittently worked in the 1950s.

The results of the survey found that the Logan Mine (CA-SBR-4558H) has fallen into extreme disrepair. The ruins of this site consist of dilapidated structures associated with mining, including open pit mines, dynamite blast quarry areas, mining claim/cairns (one with the original mining claim), remnants of buildings and structures, and refuse associated with the occupation and operation of the mine. Overall, the condition of the site has been compromised over time, by looting, target practice, off-highway vehicular travel, and the elements. Historical records document much information about manganese mining in California and San Bernardino County. The recording of the Logan Mine site and historic research that was conducted as part of this study has thoroughly documented the site and further investigation has little potential to yield important information. The resource is recommended not eligible for the NRHP and CRHR. There are no other mines in the Project APE.

There are various mining claim cairns in and around the northern and eastern portion of the Cady Mountains, which extend into the Project APE. Along the abandoned segment of the National Old Trails Highway two cairns also were observed (P36-014519 and P36-014520). These rock concentrations are almost exactly 400 feet apart and both are approximately 250 feet from the centerline of the former alignment of the Old National Trails Highway. The placement of the cairns and absence of known mining deposits in the area indicates that these cairns probably are associated with the highway and may have been land surveying monuments. San Bernardino County was responsible for route planning at the time the Old National Trails Highway was designated, and the route may or may not have been professionally engineered. No historical "as built" drawings of the highway have been located, and thus, we cannot make a direct association between the rock cairns and the highway. Modern surface prospects also occur in the Project APE. They are shown on modern maps (1982 U.S.G.S. 7.5-minute topographic quadrangles), but are absent from historic maps (1955 U.S.G.S. 15-minute quadrangles). All of the surface prospects lack diagnostic material (documentation and/or datable cans/refuse) and are considered modern. There are numerous modern cairns marking OHV routes and camp sites that should not be confused with historic or prehistoric cairns.

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TECHNICAL AREA: CULTURAL RESOURCES

Data Request 106. Please prepare the responses to all of the above data requests with consideration of the possible presence of these districts and this landscape, and, if the further work on the documentation for the cultural resources in the project area of analysis seems to the applicant to support their presence, please develop and provide preliminary descriptions, interpretations, and evaluations of these broader, more complex cultural resource types.

Response: The California Energy Commission (CEC) and the Bureau of Land Management (BLM) requested additional data to facilitate completion of their review of URS' April 2009 draft final of the *Class III Cultural Resources Technical Report for the Solar One Project, San Bernardino County, California*. Data Request 106 asked URS to consider whether historic districts should be defined within the Project area. The CEC and BLM identified three potential districts:

1. Southern California Edison (SCE) Historic District, including the SCE North and South Transmission Lines, Pisgah Substation, and archaeological site CA-SBR-12992H
2. Atlantic & Pacific/Atchison, Topeka, & Santa Fe Railway Historic District, including the railroad (currently Burlington Northern Santa Fe Railway) and seven historic refuse deposits that may be related to the construction, operation, and public use of the railroad
3. National Old Trails Highway/U.S. Route 66 Historic District, including the extant remnants of National Old Trails Highway, U.S. Route 66, and three rock concentrations

URS considered the potential to define districts while preparing the responses to cultural resources Data Requests 92 through 105. The potential districts also were evaluated by reviewing the State of California Department of Parks and Recreation (DPR) forms completed for the individual resources within the potential districts. The potential eligibility of those resources for the National Register of Historic Places (NRHP) or California Register of Historic Resources (CRHR) as historic districts was evaluated using guidelines of the National Park Service and the State of California.

FEDERAL AND STATE GUIDELINES

The National Park Service defines a historic district as "a significant concentration, linkage, or continuity of sites, buildings, structures, or objects united historically or aesthetically by plan or physical development" (U.S. Department of the Interior, National Park Service 2002:5). For a grouping of cultural resources to be considered eligible for listing in the NRHP as a district, those resources must be historically or functionally related and visually convey a historical theme or environment. In addition, the district must possess sufficient historical significance and integrity. Resources included within the boundaries of a historic district do not all need to have the level of significance necessary to be individually eligible for listing in the NRHP as long as the grouping of resources as a whole conveys sufficient significance within the related historic context. However, all individual resources must possess sufficient historical integrity (U.S. Department of the Interior, National Park Service 2002).

The boundaries of a historic district "must be a definable geographic area that can be distinguished from surrounding properties by changes such as density, scale, type, age, style of sites, buildings, structures and objects, or by documented differences in patterns of historic development or associations" (U.S. Department of the Interior, National Park Service 2002:6). District boundaries rarely are defined by planning or management boundaries or by ownership parcels, but rather must be based on the spatial locations of the district's contributing properties (U.S. Department of the Interior, National Park Service 2002).

The California Code of Regulations defines historic districts as "unified geographic entities which contain a concentration of historic buildings, structures, objects, or sites united historically, culturally, or architecturally. Historic districts are defined by precise geographic boundaries. Therefore, districts with unusual boundaries require a description of what lies immediately outside the area, in order to define the edge of the district and to explain the exclusion of the adjoining areas" [Title 14, California Code of Regulations, Chapter 11.5, Section 4852(a)(5)].

To be eligible for the NRHP and/or CRHR, properties must be 50 years old (unless they have special significance) and have national, state, or local significance in American history, architecture, archaeology, engineering, or culture. They also must possess integrity of location, design, setting, materials, workmanship, feeling, and association, and meet at least one of four criteria:

Criterion A/1: be associated with significant historical events or trends

Criterion B/2: be associated with historically significant people

Criterion C/3: have distinctive characteristics of a style or type, or have artistic value, or represent a significant entity whose components may lack individual distinction

Criterion D/4: have yielded or have potential to yield important information [Title 36, Code of Federal Regulations, Part 60; Title 14, California Code of Regulations, Chapter 11.5,Section 4852(b)(1)-(4)])

POTENTIAL HISTORIC DISTRICTS

Southern California Edison Historic District

Resources that could be included in the potential SCE Historic District are the SCE 220-kV North and South Transmission Lines (CA-SBR-13115H and CA-SBR-13116H), Pisgah Substation (CA-SBR-13117H), and archaeological site CA-SBR-12992H.

The SCE 220-kV North and South Transmission Lines are single-circuit transmission lines that originate at the SCE switchyard at Hoover Dam and terminate in Chino, California. Both transmission lines played significant roles in providing electricity that was essential to World War II industries located in southern California. The transmission lines were previously recorded in Nevada (site numbers 26CK6249 and 26CK6250) during the Boulder City/U.S. 93 Corridor Study, and the Federal Highway

Administration and Nevada State Historic Preservation Office made a consensus determination that they are eligible for the NRHP. Both transmission lines are in service and are regularly maintained in the Project area, but they retain historical integrity. Because of the association of the transmission lines to Hoover Dam and their significance in the World War II effort, the SCE 220-Kilovolt North and South Lines were evaluated as eligible for the NRHP under Criterion A and the CRHR under Criterion 1.

The Pisgah Substation is an SCE switching station that was constructed in 1940 (personal communication, Thomas Taylor, Manager, Biological and Archaeological Resources, Southern California Edison, 18 September 2008). In addition to the equipment associated with the function of the substation, including switch gears and bus bars, the Pisgah Substation also has three buildings, which house the relay station and battery equipment. Because the Pisgah Substation is a component of the SCE 220-kV North and South Transmission Lines, the substation also was evaluated as eligible for the NRHP under Criterion A and for the CRHR under Criterion 1.

Archaeological site CA-SBR-12992H is a small, low-density scatter of historic trash with approximately 750 items, including glass fragments, animal bone fragments, tableware, ceramics, cans, wire, leather, and wood. The site has four concentrations of historic refuse. The site is near the SCE North and South Transmission Lines, and may be the remains of a work camp related to the construction of the transmission lines and the Pisgah Substation. The site was evaluated as not eligible for the NRHP and CRHR because of the low quantity of artifacts, lack of integrity, low probability of subsurface artifacts and features, and little potential for the site to yield important information.

The SCE 220-kV North and South Transmission Lines and Pisgah Substation are historically and functionally related and visually convey a historic theme in the Project vicinity. Both resources also possess historical significance and integrity and were recommended as individually eligible for the NRHP and CRHR. No artifacts were found that directly associate archaeological site CA-SBR-12992H to the SCE facilities, but its proximity to the transmission lines suggests it is related. However, the archaeological site was evaluated as not eligible and would not be a contributor to the potential historic district.

Both the National Park Service and State of California definitions indicate that historic districts must have definable and precise boundaries and that these boundaries rarely are defined by planning or management boundaries, or by ownership parcels, but rather must be based upon the spatial locations of the district's contributing properties (Title 14, California Code of Regulations, Chapter 11.5, Section 4852(a)(5); U.S. Department of the Interior, National Park Service 2002). The SCE 220-kV North and South Transmission Lines are long, linear resources that extend more than 200 miles between Hoover Dam in Nevada to Chino, California. Only about 4.7 miles of the transmission lines were recorded as part of this Project within the Pisgah Substation Triangle area and the historic built environment 0.5-mile buffer. Because the entire route of the transmission line was not studied as part of this Project, it is impossible to delineate a boundary that is not arbitrarily defined by the Project and buffer areas. Therefore, it seems inappropriate to define a district. Both transmission lines and the substation were recommended as individually eligible for listing in the NRHP and CRHR, and inclusion in a historic district would not upgrade their status for preservation purposes.

Atlantic & Pacific (Atchison, Topeka, & Santa Fe) Railroad Historic District

Resources that could be included in a potential Atlantic & Pacific (Atchison, Topeka, & Santa Fe) Railroad Historic District are the railroad (CA-SBR-6693H) and seven nearby refuse deposits. The Atlantic & Pacific Railroad was originally recorded as a historic resource in California in 1990. The Southern Pacific Railroad Company originally constructed the segment of the railroad in the Project vicinity as part of the Mojave to Needles branch in 1882 and 1883. In 1884, the Atlantic & Pacific Railroad, a subsidiary of the Santa Fe Pacific Railroad, leased the Mojave to Needles branch and purchased the single-track branch in 1911. In 1897, the branch was redesignated as the Santa Fe Pacific Railroad and later became known as the Atchison, Topeka, & Santa Fe Railway. In 1923, a second track was added. The railroad currently is used and maintained as the Burlington Northern Santa Fe Railway. In the Project area, the railroad has a double trackway on a raised, ballasted bed. The railroad has been previously evaluated as eligible for the NRHP and CRHR under Criterion A/1 for its association with the history of transportation in California. Although much of the railroad has been upgraded for continued use and few historical materials remain in place, the segment in the Project vicinity retains integrity of location. Thirteen previously unrecorded bridges were identified during the Class III intensive field survey along the railroad within the Project APE and the 1/2-mile built environment buffer. Five of the bridges retain sufficient integrity to be considered contributing elements to the railroad. The other eight are either modern replacement bridges or have been highly modified.

As of 2006, about 1,800 railroad-related properties had been listed in the NRHP. Most of these properties included depots, railroad cars, and locomotives. The only listed railways are shorter spur lines (Railway Preservation Resources 2006). Historic railroad districts that have been established in other locations typically include buildings and structures, such as homes, depots, warehouses, and commercial buildings, which were built as a result of the railroad and rarely include the railroad structure itself as a contributing property. Both the National Park Service and State of California definitions indicate that historic districts must have definable and precise boundaries and that these boundaries rarely are defined by planning or management boundaries (Title 14, California Code of Regulations, Chapter 11.5, Section 4852(a)(5); U.S. Department of the Interior, National Park Service 2002). The railroad is a long, linear resource that extends across seven states, and only about 10.5 miles of the railroad were recorded as part of this Project within the historic built environment 0.5-mile buffer. Because the entire route of the railroad was not studied as part of this Project, it is impossible to delineate a boundary for a segment of the railroad in the Project vicinity that would not be arbitrarily defined by the Project and buffer areas. Therefore, it seems inappropriate to define a district.

URS reviewed the site descriptions for the seven historic refuse sites located in the vicinity of the railroad, including CA-SBR-13002/H, -13012H, -13014H, -13017H, -13023/H, -13101, and -13108H. Because the sites have few temporally diagnostic artifacts, it is unclear whether these sites are contemporaneous. In addition, the types of artifacts do not indicate clear associations with the railroad. Three of these sites were evaluated as not eligible for the NRHP and CRHR because of the low quantity of artifacts, lack of integrity, low probability of subsurface artifacts and features, and little potential to yield important information. Four of these sites (CA-SBR-13002/H, -13012H, -13014H, -13017H) were recommended as eligible for the NRHP and CRHR for their potential to yield important information, and testing was recommended to provide the lead agency with additional data necessary to determine eligibility. The recommended limited subsurface testing at four of the historic refuse sites should be conducted to determine if additional information can be obtained to support the hypothesis that these sites are related to railroad activities or some other activity.

In summary, defining a railroad district seems inappropriate because any boundary on a segment of the railroad would be arbitrary, and the associations of the trash scatters have not been confirmed. The railroad in the Project area and the four trash scatters that have potential to yield important information were recommended eligible for listing in the NRHP and CRHR. Inclusion of those properties in a historic district would not upgrade their status for preservation purposes.

National Old Trails Highway/U.S. Route 66 Historic District

Resources that could be included in the potential National Old Trails Highway /U.S. Route 66 Historic District are extant segments of National Old Trails Highway, U.S. Route 66, and two rock concentrations. (The CEC and BLM identified a third rock concentration, P36-014578, in their data request, but it is located well to the north of the highways in the vicinity of the Logan Mine and almost certainly is unrelated to the highways).

U.S. Route 66 in the Solar 1 historic built environment 0.5 mile buffer area is a two-lane, paved roadway that currently serves as a frontage road for Interstate 40. This segment was originally constructed in the 1930s, south of the highway's original alignment, which was known as the National Old Trails Highway. The National Old Trails Highway in the Project area is represented by eight remnant segments of a batched mix oil road. The condition of the road segments is poor—most of the road surface is crumbled and cracked, and in places has eroded. Some segments buried by sand may be partially intact.

The National Old Trails Highway was designated by "booster" organizations in 1912, and by the late 1920s much of the highway was either oiled or surfaced with gravel. In 1926, the National Old Trails Highway was designated as U.S. Route 66, but in the 1930s the segment in the Project area was abandoned in favor of a route to the south, which is the current alignment of historical U.S. Route 66. Both the National Old Trails Highway and 1930s alignment of U.S. Route 66 have been recorded under site number CA-SBR-2910H, and previously evaluated as eligible for the NRHP under Criterion A as one of the first all-weather highways in the United States. The segment of U.S. Route 66 in the study area retains historical integrity and is considered eligible. The National Old Trails Highway in the study area is isolated, segmented, in generally poor condition, and is recommended as a non-contributing element of the highway.

Two cairns also were recorded (P36-014519 and P36-014520) along the abandoned segment of the National Old Trails Highway. These rock concentrations are almost exactly 400 feet apart and both are approximately 250 feet from the centerline of the former alignment of the Old National Trails Highway. The placement of the cairns and absence of known mining deposits in the area suggests that these cairns may have been survey markers associated with the highway. San Bernardino County was responsible for route planning at the time the Old National Trails Highway was designated, and the route may or may not have been professionally engineered. No historical as-built drawings of the highway have been located, and thus, a direct association between the rock cairns and the highway remains ambiguous. The cairns are recommended ineligible for the NRHP and not significant historical resources eligible for listing in the CRHR.

Segments of U.S. Route 66 and the National Old Trails Highway have been listed in the NRHP in several states. U.S. Route 66 related districts have been listed but they include properties such as roadside businesses related to the development of the highway within the boundaries of a specific town or locality. There are no such properties in the Project vicinity. A statewide inventory of U.S. Route 66 has not been conducted for California. If a historic district or multiple property listing of the highway was defined in California, the segment of the 1930s U.S. Route 66 in the Project vicinity probably would be considered a contributing element. However, defining a U.S. Route

66 district at the Project limits would be arbitrary for a highway that ran through Illinois, Missouri, Kansas, Oklahoma, Texas, New Mexico, Arizona, and California. Because the other associated properties have little historic value, there seems to be little justification for defining a National Old Trails Highway/U.S. Route 66 Historic District.

POTENTIAL PREHISTORIC ARCHAEOLOGICAL LANDSCAPE

Data Request 106 asked whether a major portion of the Project area represents a part of a prehistoric archaeological landscape or district related to the exploitation of a consequential source of tool stone along the toe of the Cady Mountain bajada and south along the channels with ephemeral streams that drop into Troy Lake.

As was done to evaluate the potential for historic districts, above, URS considered the potential to define a prehistoric archaeological landscape while preparing the responses to cultural resources Data Requests 92 through 105. The potential landscape also was evaluated by reviewing the State of California Department of Parks and Recreation (DPR) forms completed for the individual resources within the potential landscape. The potential eligibility of those resources for the National Register of Historic Places (NRHP) or California Register of Historic Resources (CRHR), as a landscape that would include a large suite of flaked stone artifact scatters was evaluated for their potential to represent a significant and distinguishable entity, even if many of the scatters lack individual distinction. The potential landscape was evaluated using guidelines of the National Park Service and the State of California.

As discussed above, a grouping of cultural resources and their setting must be historically or functionally related and visually convey a historical theme or environment to be considered eligible for listing in the NRHP as a landscape. In addition, the landscape must possess sufficient historical significance and integrity. Clearly, the archaeological resources within the Project area, individually, and as a group, display a functional uniformity. All sites, presumed prehistoric in age, were used primarily, if not exclusively for exploitation of the tool stone that is ubiquitous on the desert pavements within the bolson. For this reason, the sites are inherently and directly linked to the landscape. Thus, the bolson in which the Project area is situated can be characterized as an archaeological landscape.

The mere presence of an archaeological landscape, does not, alone, qualify it for listing on the NRHP or CRHR. Several other criteria must be met for register eligibility. These are examined and evaluated, below.

The boundaries of a district or landscape "must be a definable geographic area that can be distinguished from surrounding properties by changes such as density, scale, type, age, style of sites, buildings, structures and objects, or by documented differences in patterns of historic development or associations" (U.S. Department of the Interior, National Park Service 2002:6). While distinctive for the direct relationship between tool stone and archaeological evidence of utilization of these lithic resources, the archaeological landscape within the Project area cannot be well-bounded, nor can it be distinguished from similar landscapes that occur throughout this portion of the Mojave Desert. The portion of the Project area that contains the majority of the lithic reduction sites is south of the axial channel, where sedimentary deposits are composed of a series of uplifted Pleistocene fan remnants and younger inset fans. Cryptocrystalline silicates, including jasper and chalcedony, basalts, andesite, and other volcanic materials constitute the majority of the desert pavement. The pavement occurs on the eroding fan remnants and the inset fans, as well as on relict portions of the alluvial flat. These desert pavements provide a ready source of high quality tool stone. However, such rich sources of tool stone are not confined to the Project area, nor are they unique.

The source of the tool stone is thought to be fanglomerate and gravel (Qof) and volcanic fanglomerate (Tvf) as mapped by Diblee (2008), which are not confined to the Project area or vicinity. Thus, the tool stone source and landscape is not well bounded. Furthermore, similar formations, with equally high quality tool stone occur throughout the southern California deserts. Like the sources in the Project area, these were utilized throughout prehistory. Thus, the archaeological landscape in the Project area is not sufficiently bounded nor distinguished from surrounding areas to meet NRHP standards. Furthermore, the characteristic theme of the archaeological landscape cannot be dated. Only a handful of temporally diagnostic artifacts have been recorded among the lithic reduction sites. It is presumed, but unknowable, that this tool stone source was utilized throughout prehistory. Therefore, this archaeological landscape does not have the distinctive or significant qualities required for eligibility under Criterion C/3.

Again, the lack of datable material at the sites within the Project area precludes their consideration for eligibility under Criteria A/1 and B/2. Both criteria require information that could link the landscape with particular events and trends, or with historically significant people. Absent information about who used these sites, and when they were used, neither of these criteria can be met. Further, the registers require that a period of significance be identified for the district or landscape.

Finally, the lack of datable material also severely limits the utility of the assemblages to address important research issues. Data from the lithic reduction sites in the Project area can address only two, fairly insignificant questions: what materials were being exploited and what reduction residue was produced? These are insignificant because: (1) the source material is well-documented and obvious, and (2) debris from lithic reduction is of predictable forms that can inform on the methods and products of reduction, unless, as is the case in the Project area, assemblages from different reduction episodes may be mixed. Components must be well dated to provide information about trends in resource procurement, artifact/tool forms, and technological changes through time. In fact, for a number of reasons, these issues can be addressed much more productively using data from sites where the tool stone was taken and used. First, the source locality only bears the residues of reduction, while the use site will bear evidence of the forms in which the stone arrived, and the types of tools manufactured. Second, diachronic changes in technology are best addressed using data from destination sites where components are well-dated, not at mixed tool stone procurement sites. Third, the presence of certain source materials in destination/use sites provides an indication of the direction and distances the materials traveled, either through trade or direct procurement; source sites rarely bear evidence of who used the tool stone. Lastly, destination sites that are well-dated, typically bear other artifacts and ecofacts that can inform on reasons why patterns of lithic resource procurement may change through time (e.g., climate change, resource stress, technological change, circumscribed territories, etc.). In sum, the lithic reduction sites and landscape do not have sufficient data potential to qualify for listing under Criterion D/4.

References Cited

Railway Preservation Resources

2006 *A Survey of Railway Cars and Locomotives on the National Register of Historic Places*. Electronic document: http://www.railwaypreservation.com/NationalRegister.htm, accessed 6 November 2009.

U.S. Department of the Interior, National Park Service

2002 *Bulletin 15: How to Apply the National Register Criteria for Evaluation*. U.S. Department of the Interior, National Park Service, National Register of Historic Places, Washington, D.C.

TECHNICAL AREA: CULTURAL RESOURCES

Data Request 107. Please provide an update on the status of the application for the Caltrans encroachment permit and a preliminary schedule for the completion of the pedestrian survey of the I-40 ROW.

Response: The Caltrans right-of-way is in the Not a Part (NAP) portion of the Project site and will not be developed as a part of the Project. Therefore, there is no need to obtain an encroachment permit nor is there a need to conduct a pedestrian survey in the I-40 right-of-way.

TECHNICAL AREA: CULTURAL RESOURCES

Data Request 108. Please provide more specific information on the size and the location of the PG&E parcel, and describe the anticipated use of the parcel for the proposed project.

Response: The PG&E parcel is Not a Part (NAP) of the Project and will not be developed or fenced as a part of the Project.

BEFORE THE ENERGY RESOURCES CONSERVATION AND DEVELOPMENT COMMISSION OF THE STATE OF CALIFORNIA
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APPLICATION FOR CERTIFICATION
For the SES SOLAR ONE PROJECT

Docket No. 08-AFC-13

PROOF OF SERVICE
(Revised 11/5/09)

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DECLARATION OF SERVICE

I, Corinne Lytle, declare that on November 19, 2009, I served and filed copies of the attached, Applicant's Responses to CEC and BLM Data Request Set 1, Part 2, Data Requests 92-108. The original document, filed with the Docket Unit, is accompanied by a copy of the most recent Proof of Service list, located on the web page for this project at: **[www.energy.ca.gov/sitingcases/solarone]**.

The documents have been sent to both the other parties in this proceeding (as shown on the Proof of Service list) and to the Commission's Docket Unit, in the following manner:

(***Check all that Apply***)

FOR SERVICE TO ALL OTHER PARTIES:

_____ sent electronically to all email addresses on the Proof of Service list;

_____ by personal delivery or by depositing in the United States mail at Sacramento, California with first-class postage thereon fully prepaid and addressed as provided on the Proof of Service list above to those addresses **NOT** marked "email preferred."

AND

FOR FILING WITH THE ENERGY COMMISSION:

_____ sending an original paper copy and one electronic copy, mailed and emailed respectively, to the address below (***preferred method***);

OR

_____ depositing in the mail an original and 12 paper copies, as follows:

CALIFORNIA ENERGY COMMISSION
Attn: Docket No. 08-AFC-13
1516 Ninth Street, MS-4
Sacramento, CA 95814-5512
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I declare under penalty of perjury that the foregoing is true and correct.

Original Signed By

____

Corinne Lytle