SES Solar One

Report to Map Federal and State Surface Waters

In Response to CEC and BLM Data Request 50
Application for Certification (08-AFC-13)

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July 2009

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

Submitted to:
California Energy Commission
1516 9th Street, MS 15
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Submitted by:
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Tessera Solar™
power from stirling energy systems

July 17, 2009

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

RE: SES Solar One
Applicant's Response to CEC and BLM Data Request 50
Report to Map Federal and State Surface Waters

Dear Mr. Meyer,

Tessera Solar hereby submits the Solar One Report to Map Federal and State Surface Waters in response to CEC and BLM Data Request 50 (Data Requests Set 1, Part 1).

I certify under penalty of perjury that the foregoing it true, correct, and complete to the best of my knowledge.

Sincerely,

Camille Champion
Project Manager

R E P O R T

FIELD REPORT TO MAP POTENTIAL FEDERAL AND STATE SURFACE WATERS FOR THE STIRLING ENERGY SYSTEMS SOLAR 1 AND SOLAR 3 PROJECTS

Prepared for

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November 14, 2008

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BNSF	Burlington Northern Santa Fe Railroad
CDFG	California Department of Fish and Game
Corps	U.S. Army Corps of Engineers
CRAM	California Rapid Assessment Method
HSA	Hydrologic Subarea
I-40	Interstate 40
OHWM	ordinary high water mark
Porter Cologne	Porter Cologne Water Quality Control Act
RPW	Relatively Permanent Waters
SES	Stirling Energy Systems
TNW	Traditional Navigable Waters
U.S.	United States
URS	URS Corporation

SECTION 1 INTRODUCTION

This report describes the results of a field investigation and hydrological assessment to determine the potential presence of waters of the United States (U.S.) (*i.e.*, Federal waters), streams or lakebeds subject to regulation by the California Department of Fish and Game (CDFG) pursuant to Section 1600 of the Fish and Game Code, and surface waters of the State subject to the Porter Cologne Water Quality Control Act (Porter Cologne) within the boundaries of an area currently designated as the Stirling Energy Systems (SES) Solar 1 and Solar 3 sites. Section 2.0 of this report describes the vegetation, hydrology, and geomorphology of the project site and surrounding areas. Section 3.0 describes potential waters of the U.S., Section 4.0 describes potential CDFG jurisdiction, and Section 5.0 describes potential waters of the State.

The Solar 1 and 3 sites are located approximately 35 miles east of Barstow, California near an area called Pisgah, north of Interstate 40 (I-40) (Figure 1). The overall boundary of the combined Solar One and Three sites is shown on Figure 2. Although Solar 1 and 3 are adjacent sites, the numbers used in the names do not specifically designate a sequence of sites in the vicinity of these two sites.

SECTION 2 VEGETATION, HYDROLOGY, AND GEOMORPHOLOGY

The Solar 1 and Solar 3 project sites are located on a broad alluvial fan/plain bounded by the Cady Mountains on the north and I-40 on the south. The Burlington Northern Santa Fe (BNSF) railroad runs parallel to I-40 on its north side. The overall site is covered by desert scrub and the region is extremely xeric.

2.1 VEGETATION

The entire site supports upland vegetation without riparian or hydrophytic vegetation and no aquatic life is present on-site. Most of the area is covered by upland Mojave creosote bush scrub with one area of upland desert saltbush scrub in the southwest corner (Figure 2). Areas that are mostly off-site within the mountains are sparsely vegetated and best described as un-vegetated habitat (although some sparse vegetation is actually present).

2.2 HYDROLOGY

An evaluation of hydrology on-site, especially as it applies to flows that would be expected to occur within an ordinary high water mark (OHWM) up to the 100-year storm event, was performed and is reported on in Appendix A of this report. No surface flows are expected through the 5-year storm event, and surface flows may occur in some areas between 5- and 10-year storm events. There are discontinuous landform terraces on-site along limited portions of drainage patterns and these discontinuous terraces appear to be associated with the limits of flows that would occur with the 5- to 10-year storm events, and they likely also contain higher level flood events. No surface flows are expected to occur on the Solar 1 and 3 sites along continuous channels in most years.

2.3 GEOMORPHOLOGY

The project site consists of a broad alluvial fan/plain with relatively little topographic variation. The overall landform is relatively flat and slopes from the north to the south and in some areas to the southwest. There are occasional small hills and sand dune areas on the project site.

The project area is characterized by Holocene-age and Pleistocene-age alluvial deposition. Alluvial deposits shed off of the adjacent highlands are composed of silty sands and gravels with localized gravel and cobble. These sandy alluvial deposits may be locally interfingered with finer-grained basin deposits. Near surface soils are expected to consist primarily of gravelly sands. The bounding highlands are underlain by granitic and metamorphic terrain and by younger volcanic deposits.

Several drainage patterns occur on the Solar 1 and 3 project sites (Appendix A). These drainage patterns follow the gradient of higher elevations in the mountains north and east of the sites towards lower elevations southerly and westerly across the project site. The lands between I-40 and the BNSF railroad slope downward to the west, ultimately towards Troy Dry Lake, a playa that is located west of and beyond the project sites. There are no well-defined channels on-site, although some discontinuous flood terraces occur in a few areas on-site.

The drainage features on-site are not well defined channels resulting from active flow and consist of discontinuous floodplains with areas that exhibit a mixed pattern of sheet flow or shallow concentrated flow across isolated, wide areas of land and undefined drainage features over most of the site with evenly distributed desert scrub vegetation throughout (*i.e.*, no well defined active or flow channels, whether from low or high flows). Flow of water on-site is ephemeral and occurs during periods of brief intense rainfall. Flow of water through defined channels across the site does not occur in most years. It does not tend to occur until 5 to 10-year storm events, and does not consist of major flows at those times. Water flow on-site is not of sufficient intensity or duration to maintain channels indicative of an active stream or wash.

Rosgen (1996) provides a stream classification system that is widely accepted in the United States. The Rosgen stream classification system results in classifications based on channel morphology and hydrologic considerations. The path of shallow concentrated flow during more extreme rain events on the site does not exhibit erosion in most years, and this flow path is vegetated in most areas with upland vegetation. Therefore, the Rosgen stream classification system was applied to objectively evaluate the drainage features on-site. The Rosgen system defines hydrogeomorphological features that can be measured in the field to apply the classification. These features include consideration of bankfull depth, bankfull width, bankfull discharge, flood-prone width, entrenchment ratio, sinuosity, and slope (Rosgen 1996).

Bankfull depth, bankfull width, and bankfull discharge are associated with the bankfull stage of a stream. Dunne and Leopold (1978) define the bankfull stage of a stream as "*The bankfull stage corresponds to the discharge at which channel maintenance is the most effective, that is, the discharge at which moving sediment, forming or removing bars, forming or changing bends and meanders, and generally doing work that results in the average morphologic characteristics of channels.*" Rosgen (1996) equates the bankfull stage with the U.S. Army Corps of Engineers (Corps) definition of the OHWM. The drainage paths on-site generally exhibit relatively straight paths with surface flows absent in most years and that are only ephemeral in nature during extreme rain events sufficient enough to produce shallow concentrated flow. There are insufficient features on-site to define the bankfull stage based on guidance provided by Rosgen (1996). Bankfull depth, bankfull width, and bankfull discharge are zero along the drainage features on-site. The flood-prone width of the drainage feature defined as 2x the maximum depth at bankfull capacity is also zero, as is the entrenchment ratio defined as the flood-prone width divided by the bankfull width. Sinuosity on-site along each drain feature approaches 1.0 with respect to the general paths of gradient and topography on-site. Based on these considerations, the drainage features on-site cannot be classified as streams using the Rosgen system.

We also evaluated the features on-site using the California Rapid Assessment Method (CRAM) (Collins *et al.*, 2006). CRAM includes procedures for evaluating existing drainage features, and we attempted to apply those procedures on-site. Once again, it was not possible to define streams, wetlands, or similar surface waters on-site using CRAM because of the lack of a definable bankfull stage or related parameters. These results further support the findings from applying the Rosgen classification system. Therefore, the project site is considered to not contain streams or washes.

SECTION 3 DETERMINATION OF WATERS OF THE U.S.

3.1 METHODS

The project study area has the potential to contain waters of the U.S. consisting of non-wetland other waters of the U.S. subject to jurisdiction pursuant to Section 404 of the Federal Clean Water Act. Waters of the U.S. were evaluated based on the presence of an OHWM or the boundary of adjacent wetlands defining their limits as provided at 33 CFR 328.3 and 328.4:

Section 328.3 - Definitions.

For the purpose of this regulation these terms are defined as follows:

*a. The term "**waters of the United States**" means*

1. All waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;

2. All interstate waters including interstate wetlands;

3. All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation or destruction of which could affect interstate or foreign commerce including any such waters:

i. *Which are or could be used by interstate or foreign travelers for recreational or other purposes; or*

ii. *From which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or*

iii. Which are used or could be used for industrial purpose by industries in interstate commerce;

4. All impoundments of waters otherwise defined as waters of the United States under the definition;

5. Tributaries of waters identified in paragraphs (a)(1)-(4) of this section;

6. The territorial seas;

7. Wetlands adjacent to waters (other than waters that are themselves wetlands) identified in paragraphs (a)(1)-(6) of this section.

Waste treatment systems, including treatment ponds or lagoons designed to meet the requirements of CWA (other than cooling ponds as defined in 40 CFR 123.11(m) which also meet the criteria of this definition) are not waters of the United States.

8. *Waters of the United States do not include prior converted cropland. Notwithstanding the determination of an area's status as prior converted cropland by any other federal agency, for the purposes of the Clean Water Act, the final authority regarding Clean Water Act jurisdiction remains with the EPA.*

b. *The term "**wetlands**" means those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.*

c. *The term "**adjacent**" means bordering, contiguous, or neighboring. Wetlands separated from other waters of the United States by man-made dikes or barriers, natural river berms, beach dunes and the like are "adjacent wetlands."*

d. *The term "**high tide line**" means the line of intersection of the land with the water's surface at the maximum height reached by a rising tide. The high tide line may be determined, in the absence of actual data, by a line of oil or scum along shore objects, a more or less continuous deposit of fine shell or debris on the foreshore or berm, other physical markings or characteristics, vegetation lines, tidal gages, or other suitable means that delineate the general height reached by a rising tide. The line encompasses spring high tides and other high tides that occur with periodic frequency but does not include storm surges in which there is a departure from the normal or predicted reach of the tide due to the piling up of water against a coast by strong winds such as those accompanying a hurricane or other intense storm.*

e. *The term "**ordinary high water mark**" means that line on the shore established by the fluctuations of water and indicated by physical characteristics such as clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas.*

f. *The term "**tidal waters**" means those waters that rise and fall in a predictable and measurable rhythm or cycle due to the gravitational pulls of the moon and sun. Tidal waters end where the rise and fall of the water surface can no longer be practically measured in a predictable rhythm due to masking by hydrologic, wind, or other effects.*

Section 328.4 - Limits of jurisdiction.

a. ***Territorial Seas.*** *The limit of jurisdiction in the territorial seas is measured from the baseline in a seaward direction a distance of three nautical miles. (See 33 CFR 329.12)*

b. ***Tidal Waters of the United States.*** *The landward limits of jurisdiction in tidal waters:*

1. *Extends to the high tide line, or*

2. *When adjacent non-tidal waters of the United States are present, the jurisdiction extends to the limits identified in paragraph (c) of this section.*

c. ***Non-Tidal Waters of the United States.*** *The limits of jurisdiction in non-tidal waters:*

1. *In the absence of adjacent wetlands, the jurisdiction extends to the ordinary high water mark, or*

2. *When adjacent wetlands are present, the jurisdiction extends beyond the ordinary high water mark to the limit of the adjacent wetlands.*

3. *When the water of the United States consists only of wetlands the jurisdiction extends to the limit of the wetland.*

Guidance from the Corps (2001), *Final Summary Report: Guidelines for Jurisdictional Determinations for Waters of the United States in the Arid Southwest*, was also used. Guidance of relevance to this delineation includes consideration that: *"In dryland fluvial systems typical of the desert areas, the most common physical characteristics indicating the OHWM for a channel usually include, but are not limited to: a clear natural scour line impressed on the bank; recent bank erosion; destruction of native terrestrial vegetation; and the presence of litter and debris. For many small desert wash systems, the presence of continuous well-developed upland vegetation in the stream channel is a good indicator that it only conveys surface flow during extremely large storm events and, as a result, would not usually constitute a jurisdictional water of the United States."* This guidance has been further elaborated by the Corps (2004 and 2008a), and that elaboration is implemented herein. Also, Regulatory Guidance Letter 88-06 states that: *"For rivers and streams, the OHWM is meant to mark the within-channel flows, not the average annual flood elevation that generally extends beyond the channel."*

The potential for Federal wetlands was evaluated based on the presence of wetland hydrology, wetland vegetation, and hydric soils pursuant to guidance from the Federal Manual for Delineating Wetlands (Corps 1987) as augmented by the Corps (2008b). The project area does not exhibit features demonstrative of wetland hydrology, wetland vegetation, and/or hydric soils, so no wetland data points were selected and no wetland datasheets were recorded.

3.2 RESULTS

As discussed in Section 2.3, there are no channels on-site that meet the definition of a stream, wash, or similar aquatic feature that can be classified using Rosgen (1996) or CRAM (Collins *et al.*, 2006). The limited discontinuous flood terraces on-site are sparsely distributed and do not exhibit flows of surface water in most years. Water flows on-site do not occur frequently enough or with sufficient duration to form or maintain channels with a bed and bank. These flood terraces do not indicate a clear natural scour line impressed on the bank, recent bank erosion, destruction of native terrestrial vegetation, and the presence of litter and debris that is associated with indicators of an OHWM. Upland scrub vegetation that persists over long periods of time is located within these terraces, and the terraces themselves are not continuous on the project site.

The paths of shallow concentrated flow that may occur with higher level storm events on-site are not associated with distinct or continuous flood terraces across most of the site. These paths of rare shallow concentrated flow events do not indicate a clear natural scour line impressed on the bank, recent bank

erosion, destruction of native terrestrial vegetation, and the presence of litter and debris that is associated with indicators of an OHWM. Upland vegetation is prevalent throughout these areas. Therefore, no waters of the U.S. bounded by an OHWM or as otherwise defined have been found to occur on-site.

3.3 EVALUATION OF CONSIDERATIONS ON THE CORPS' JURISDICTIONAL DETERMINATION FORM

Although no jurisdictional waters of the U.S. have been found on-site, this section provides an additional level of assessment for the hypothetical situation if waters defined by an OHWM were determined to be onsite. This discussion evaluates key parameters that would be evaluated using the Corps' current jurisdictional determination form.

The Solar project assessment area is located approximately 35 miles east of Barstow, California near Pisgah, California. An aerial photograph showing the project area in regional context is provided in Figure 3. As previously described, the landform of the project assessment area has a downward gradient sloping to the south and then west towards Troy Dry Lake (a playa that is located off-site). The project area and Troy Dry Lake are within the Troy Valley Hydrologic Subarea (628.62). Troy Dry Lake is in a flat plain with the Mojave River located on an east-west path approximately 5 miles north of the extent of Troy Dry Lake. The project area is approximately 20 miles from the Mojave River. There are no direct connections by flow channels from the project area through Troy Dry Lake to the Mojave River. No Traditional Navigable Waters (TNWs) or Relatively Permanent Waters (RPWs) occur on the project area or in connection from the project area through Troy Dry Lake to the Mojave River. Therefore, the project area is isolated and contained entirely within the State of California. As such, water features, if they existed onsite, would be isolated intra-state waters.

Flows on-site do not occur in most years and are not expected to begin to occur on-site in most circumstances until storm events occur that have a frequency of occurrence generally less than 10 percent of the years. Such flows are rare, ephemeral in nature, and not confined to continuous or repeatable channels. Therefore, the project site does not provide waters that are or could be used by interstate or foreign travelers for recreational purposes, cannot and do not support fish or shellfish populations that could be taken or sold in interstate or foreign commerce, are not and cannot be use by industries in interstate commerce, and are not interstate waters such that no significant nexus to foreign or interstate commerce occurs on the project area associated with waters. Therefore, hypothetical waters on-site defined by an OHWM would be isolated, non-federal waters.

SECTION 4 DETERMINATION OF SECTON 1600 STREAMBEDS

4.1 METHODS

Areas subject to jurisdiction pursuant to Section 1600 of the California Fish and Game Code were delineated. Section 1602(a) describes areas subject to its jurisdiction within the following text:

> *"1602 (a) An entity may not substantially divert or obstruct the natural flow of, or substantially change or use any material from the bed, channel, or bank of, any river, stream, or lake, or deposit or dispose of debris, waste, or other material containing crumbled, flaked, or ground pavement where it may pass into any river, stream, or lake, unless all of the following occur…"*

Section 1602(a) is based on Title 14 CCR 720:

> *"For the purpose of implementing Sections 1601 and 1603 of the Fish and Game Code which requires submission to the department of general plans sufficient to indicate the nature of a project for construction by or on behalf of any person, governmental agency, state or local, and any public utility, of any project which will divert, obstruct or change the natural flow or bed of any river, stream or lake designated by the department, or will use material from the streambeds designated by the department, all rivers, streams, lakes, and streambeds in the State of California, including all rivers, streams and streambeds which may have intermittent flows of water, are hereby designated for such purpose".*

Streams, including creeks and rivers, are defined at Title 14 CCR 1.72 as:

> *"A stream is a body of water that flows at least periodically or intermittently through a bed or channel having banks and supports fish or other aquatic life. This includes watercourses having a surface or subsurface flow that supports or has supported riparian vegetation."*

Lakes are defined at Title 14 CCR 1.56 as:

> *"Lakes: Includes natural lakes or man-made reservoirs."*

URS Corporation (URS) understands that these State regulations define the jurisdiction of the California Department of Fish and Game (CDFG) for the purpose of administering Section 1600 of the Fish and Game Code as within the bed, bank, and channel of stream, including intermittent streams, which are equivalent to the areas within the OHWM of a stream or watercourse. URS also understands that the California Department of Fish and Game routinely asserts jurisdiction on areas that may be adjacent to a stream with an OHWM that demonstrate: a dominance of hydrophytic vegetation, hydric soils, and/or wetland hydrology. Therefore, URS has evaluated all such conditions as potentially subject to CDFG jurisdiction.

4.2 RESULTS

As discussed in Sections 2.0 and 3.0, no streams defined by Rosgen (1996) or using CRAM (Collins *et al*., 2006) occur on-site. Also, no fish or aquatic life are known to occur on-site. Surface water flow does not occur on-site in most years. There are not bodies of water on-site that flow at least periodically or intermittently through a bed or channel having banks and supporting fish or other aquatic life, including watercourse having a surface or subsurface flow that supports or has supported riparian vegetation. No lakes occur on-site. Therefore, lakes or streams subject to jurisdiction by the CDFG pursuant to Section 1600 of the California Fish and Game Code have not been found to occur on-site.

SECTION 5 DETERMINATION OF SURFACE WATERS OF THE STATE

5.1 METHODS

Waters of the State include surface and ground waters pursuant to Porter Cologne. The following definitions of waters of the State and related items from Porter Cologne (§13050 Definitions) have been used in this report include:

(d) "Waste" includes sewage and any and all other waste substances, liquid, solid, gaseous, or radioactive, associated with human habitation, or of human or animal origin, or from any producing, manufacturing, or processing operation, including waste placed within containers of whatever nature prior to, and for purposes of, disposal.

(e) "Waters of the state" means any surface water or groundwater, including saline waters, within the boundaries of the state.

(f) "Beneficial uses" of the waters of the state that may be protected against quality degradation include, but are not limited to, domestic, municipal, agricultural and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves.

(g) "Quality of the water" refers to chemical, physical, biological, bacteriological, radiological, and other properties and characteristics of water which affect its use.

(h) "Water quality objectives" means the limits or levels of water quality constituents or characteristics which are established for the reasonable protection of beneficial uses of water or the prevention of nuisance within a specific area.

(k) "Contamination" means an impairment of the quality of the waters of the state by waste to a degree which creates a hazard to the public health through poisoning or through the spread of disease. "Contamination" includes any equivalent effect resulting from the disposal of waste, whether or not waters of the state are affected.

(l)(1) "Pollution" means an alteration of the quality of the waters of the state by waste to a degree which unreasonably affects either of the following:

(A) The waters for beneficial uses.

(B) Facilities which serve these beneficial uses.

(2) "Pollution" may include "contamination."

Additionally, potential beneficial uses that may occur on-site have also been evaluated. These beneficial uses are taken from the Lahontan Regional Water Quality Control Board Basin Plan.

5.2 RESULTS

5.2.1 Waters potentially subject to Section 401 Water Quality Certification Requirements

As discussed in Section 3.0, no waters of the U.S. occur on-site. In the absence of waters of the U.S., no waters subject to Section 401 water quality certification requirements exist on-site.

5.2.2 Surface Waters of the State

As discussed in Sections 2.0 and 3.0, no streams defined by Rosgen (1996) or using CRAM (Collins *et al.*, 2006) occur on-site. Also, no aquatic life or riparian vegetation is known to occur on-site. Surface water flow does not occur on-site in most years. No surface waters have been found to occur on-site that are confined by beds, banks, and/or channels indicative of streams, creeks, or washes subject to Porter Cologne. Stormwater runoff and flows from flash floods on-site would represent surface water in the form of storm water runoff potentially regulable pursuant to Porter Cologne.

5.2.3 Evaluation of potential Beneficial Uses

The sites are within the Troy Valley Hydrologic Subarea (HSA). No wetlands occur on-site; therefore, no potential beneficial uses for wetlands are possible on-site. Potential beneficial uses for minor surface waters listed in the Basin Plan for the Troy Valley HSA include MUN (Municipal and Domestic Supply), AGR (Agricultural Supply), GWR (Ground Water Recharge), REC-1 (Water Contact Recreation), REC-2 (Noncontact Water Recreation), WARM (Warm Freshwater Habitat), COLD (Cold Freshwater Habitat), and WILD (Wildlife Habitat). Minor amounts of ground water recharge may occur on-site through direct rainfall and infiltration, and during the periods of shallow concentrated sheet flow that occurs during extreme storm events in this very dry desert region. None of the other potential beneficial uses listed in the Basin Plan for surface waters occur on-site or have the potential to occur on-site.

SECTION 6 REFERENCES

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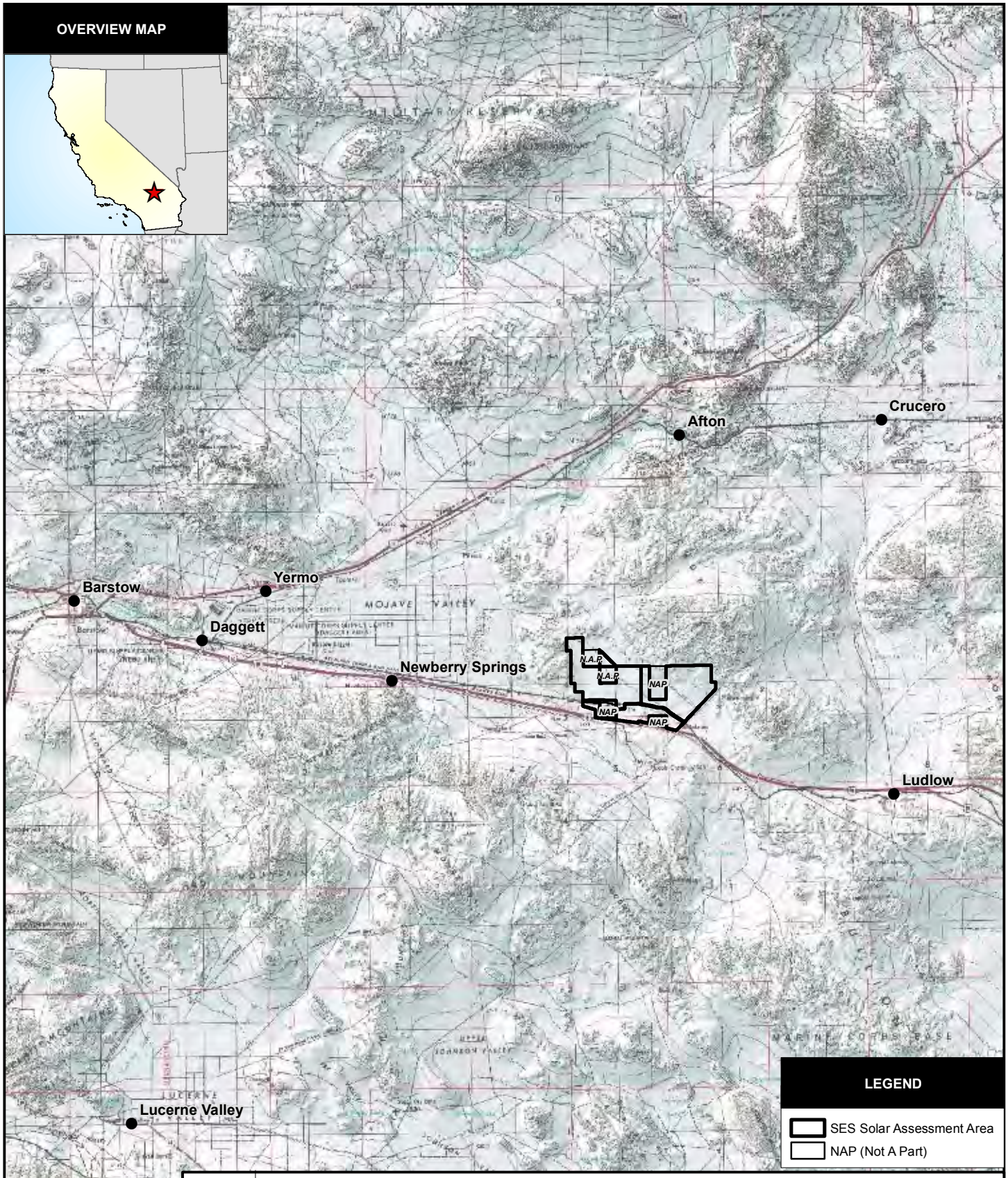

SOURCES: ESRI;
Stantec Engineering (project site Oct. 2008);
USGS (7.5' quads various dates).

REGIONAL VICINITY MAP
SOLAR ASSESSMENT AREAS

URS

4 0 4 8 Miles

SCALE: 1" = 8 Miles(1:506,880)
SCALE CORRECT WHEN PRINTED AT 8.5X11

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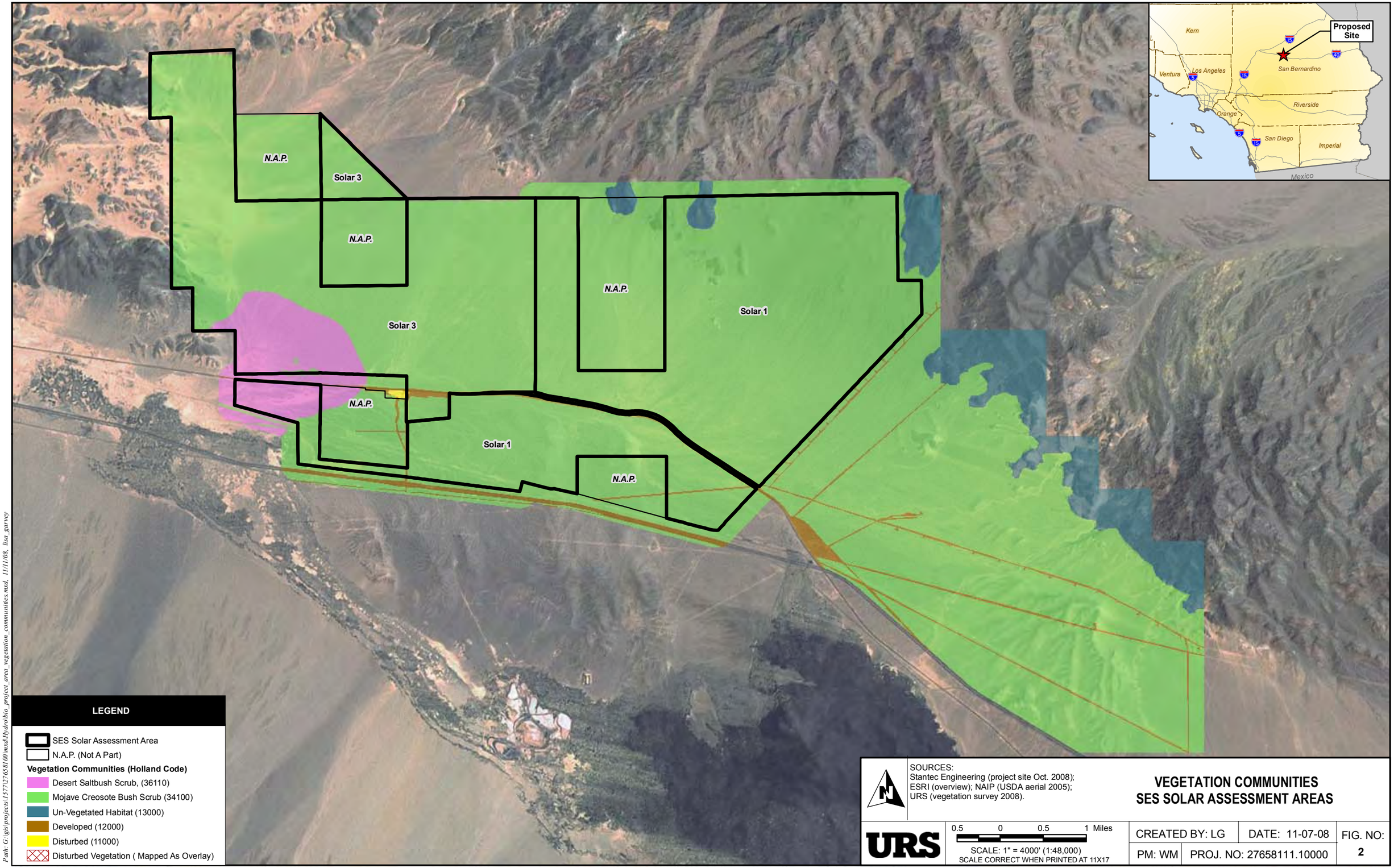

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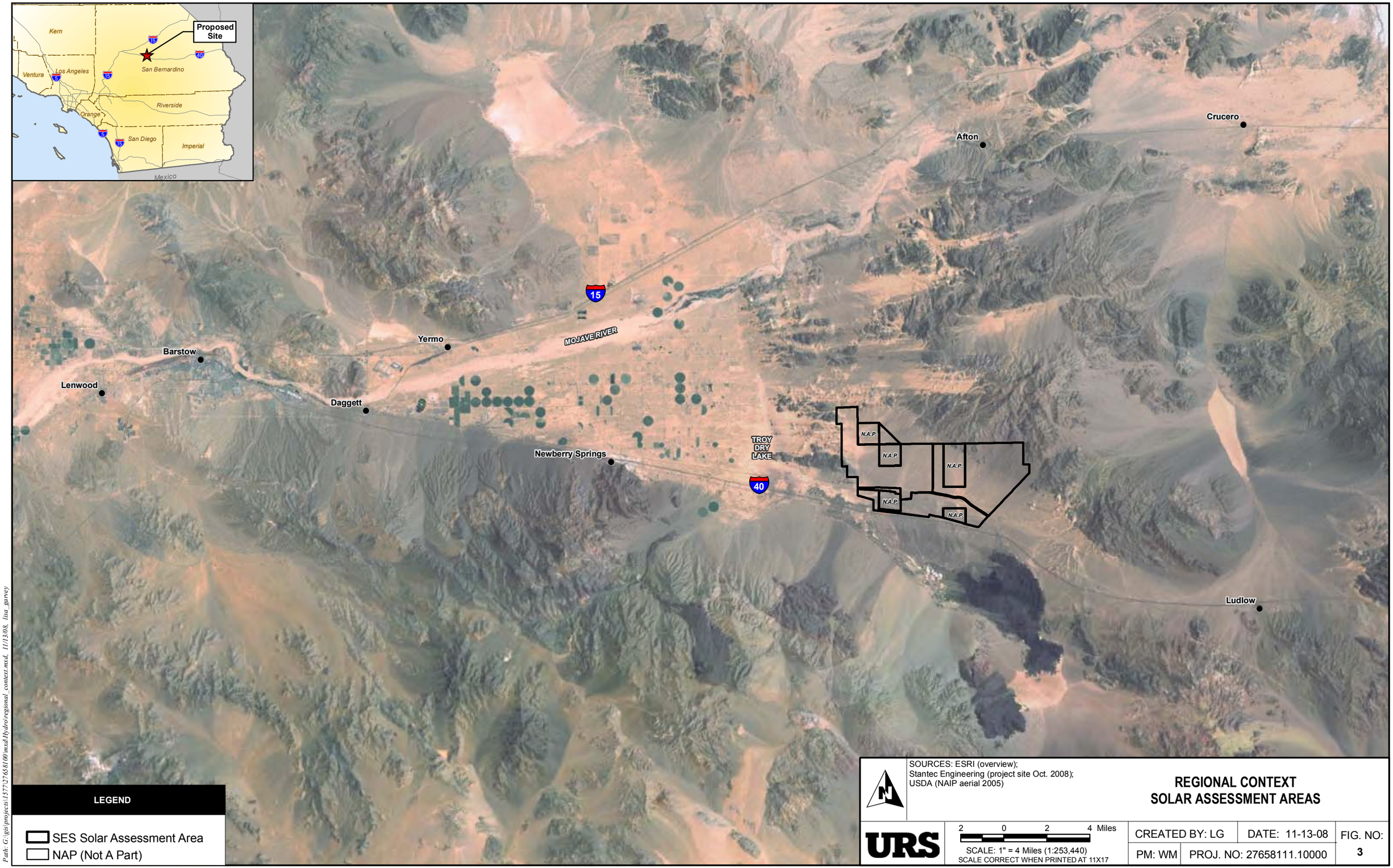

SOURCES: ESRI (overview);
Stantec Engineering (project site Oct. 2008);
USDA (NAIP aerial 2005)

REGIONAL CONTEXT
SOLAR ASSESSMENT AREAS

URS

2 0 2 4 Miles
SCALE: 1" = 4 Miles (1:253,440)
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Photo 1. Upland vegetation in non-active drainage feature

Photo 2. Upland vegetation in non-active drainage feature

Photo 3. Upland vegetation in remnant non-active drainage feature

Photo 4. Upland vegetation in remnant non-active drainage feature

Photo 5. Discontinuous remnant non-active drainage feature

Photo 6. Discontinuous remnant non-active drainage feature

Photo 7. Discontinuous remnant non-active drainage feature

Photo 8. Path of historic non-active drainage feature

Photo 9. Path of historic non-active drainage feature

Photo 10. Discontinuous remnant non-active drainage feature

Photo 11. Discontinuous remnant non-active drainage feature

Photo 12. Path of historic non-active drainage feature

Photo 13. Path of historic non-active drainage feature

Photo 14. Path of historic non-active drainage feature

Photo 15. Path of historic non-active drainage feature

Photo 16. Path of historic non-active drainage feature

SOLAR 1 AND 3 SITES HYDROLOGY ANALYSIS

HYDROLOGY METHODOLOGY

The existing condition 2-, 5-, 10-, 25-, 50, and 100-year storm event runoff values (surface flows) for the Solar 1 and 3 sites are analyzed in this study. The study area's watershed (refer to Plate 1) is approximately 80.4 square miles in area. The runoff was analyzed using the United States Army Corps of Engineers (USACE) HEC-1 hydrology model in conjunction with the Natural Resources Conservations Service (NRCS) (formerly called the Soil Conservation Service) hydrologic method. The NRCS hydrologic method was chosen for the current study because it considers the time distribution of rainfall, the initial rainfall losses to interception and depression storage, and an infiltration rate that decreases during the course of a storm. Therefore, the NRCS hydrologic method is expected to result in flow predictions that are closer approximations of actual conditions than the Rational Method.

This report calculated the potential runoff from the study area using HEC-1, within the guidelines of the 1986 San Bernardino County Hydrology Manual. LAPRE1 is a preprocessor that was used to convert input for S-graph and Los Angeles District design storms to standard input for HEC-1. The LAPRE1 calculated the rainfall distribution for the Mojave Desert summer thunderstorm for July 1958 Barstow-Rodeo pattern, which was used for the HEC-1 model. The rainfall distribution was used in HEC-1, along with rainfall based on National Oceanic and Atmospheric Administration (NOAA) point precipitation estimates to develop the flow rates. Attachments A, B, and C provide the hydrology map, hydrology model input parameters, and summary HEC-1 output, respectively.

A site investigation was conducted to measure the cross-sections along several surface crossing/drainage features to calculate flow events associated with the terraces to see if they may be more closely associated with a potential ordinary high water mark (OHWM) or a larger floodplain. Based on each cross section, a flow rate was calculated using Manning's equation within the Hydraflow Express computer program. From the calculated flow rate, the results from the HEC-1 model were used to correlate a theoretical storm event to the land form terraces for the surveyed cross-sections.

The following table provides a summary of the hydrology analysis results at the downstream project boundary associated with a variety of storm events from 2-year through 100-year events:

Table 1
Solar 1 Hydrology Summary

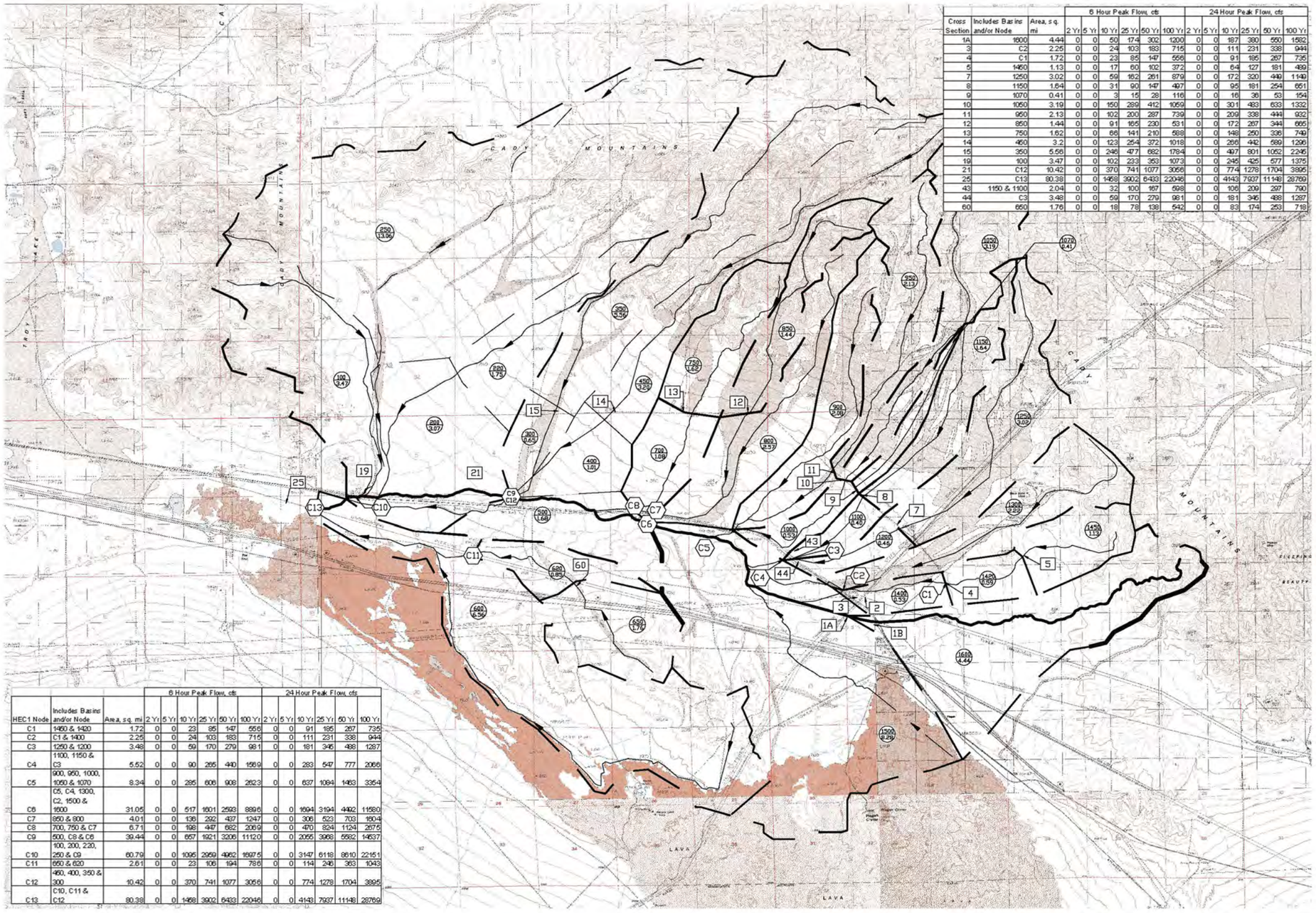
Storm Frequency	6-hour Storm Rainfall (inches)	24-hour Storm Rainfall (inches)	6-hour Storm Runoff (cfs)	24-hour Storm Runoff (cfs)
2-year	0.70	0.94	0	0
5-year	1.06	1.41	0	0
10-year	1.33	1.73	1,458	4,145
25-year	1.70	2.15	3,904	7,939
50-year	1.99	2.47	6,435	11,150
100-year	2.31	2.80	22,049	28,772

The 6- and 24-hour storm duration runoff values were both considered to give a range of runoff that has the potential to be generated from the 80.4 square mile project site. Analysis of actual monthly rainfall amounts from 1997 to 2007 (10 years of record) were taken from a Barstow weather station (Station 134,) near the project area. The 6-hour duration rainfall values shown in Table 1 have a much higher degree of incidence for a given storm frequency (2-, 5-, 10-, 25-, 50-year) than the corresponding 24-hour duration rainfall values. It appears from the analysis, that the landform terrace section surveyed downstream of the project watershed encounters flows that fall within the range of the 5- and 10-year storm event for both the 6- and 24-hour storm events.

Additionally, the runoff values from the storm events are considered conservative because they are based on standard County hydrology procedures and guidelines. The County's hydrology procedures were put in place chiefly for the design of flood control structures, storm drain pipes, and the like to provide more conservative results than one would expect to typically find in the field for the purpose of ensuring that structures and property are protected from potential flooding. Therefore, the assumptions used exceed representation of actual events that would be experienced in the Solar 1 project site area, especially with regard to events that would lead to formation of a landform terrace such as a floodplain terrace. For example, the County hydrology procedures assume a high degree of soil wetness prior to the occurrence of the design storm, which is typically not the norm, except during extremely wet years.

DISCUSSION AND CONCLUSIONS

URS' finding is that the surveyed landform terrace sections are skewed to the 5-year 24-hour storm event. The average section has a calculated capacity of 2 cubic feet per second (cfs). In order to observe flow within the landform terraces a 24-hour rainfall event must exceed 1.41 inches.



Cross Section	Includes Basins and/or Node	Area, sq. mi	6 Hour Peak Flow, cfs						24 Hour Peak Flow, cfs					
			2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr	2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
1A	1600	4.44	0	0	50	174	302	1200	0	0	187	380	550	1582
3	C2	2.25	0	0	24	103	183	715	0	0	111	231	338	944
4	C1	1.72	0	0	23	85	147	556	0	0	91	185	267	735
5	1450	1.13	0	0	17	60	102	372	0	0	64	127	181	489
7	1250	3.02	0	0	59	162	261	879	0	0	172	320	449	1149
8	1150	1.64	0	0	31	90	147	497	0	0	95	181	254	651
9	1070	0.41	0	0	3	15	28	116	0	0	16	36	53	154
10	1050	3.19	0	0	150	289	412	1059	0	0	301	483	633	1332
11	950	2.13	0	0	102	200	287	739	0	0	209	338	444	932
12	850	1.44	0	0	91	165	230	531	0	0	172	267	344	665
13	750	1.62	0	0	66	141	210	588	0	0	148	250	336	749
14	450	3.2	0	0	123	254	372	1018	0	0	266	442	589	1296
15	350	5.56	0	0	246	477	682	1784	0	0	497	801	1062	2245
19	100	3.47	0	0	102	233	353	1073	0	0	245	425	577	1375
21	C12	10.42	0	0	370	741	1077	3056	0	0	774	1278	1704	3895
25	C13	80.38	0	0	1468	3902	6433	22046	0	0	4143	7937	11148	28769
43	1150 & 1100	2.04	0	0	32	100	167	598	0	0	106	209	297	790
44	C3	3.48	0	0	59	170	279	981	0	0	181	346	488	1287
60	650	1.76	0	0	18	78	138	542	0	0	83	174	253	718

HEC1 Node	Includes Basins and/or Node	Area, sq. mi	6 Hour Peak Flow, cfs						24 Hour Peak Flow, cfs					
			2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr	2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
C1	1450 & 1420	1.72	0	0	23	85	147	556	0	0	91	185	267	735
C2	C1 & 1400	2.25	0	0	24	103	183	715	0	0	111	231	338	944
C3	1250 & 1200	3.48	0	0	59	170	279	981	0	0	181	346	488	1287
C4	1100, 1150 & C3	5.52	0	0	90	265	440	1569	0	0	283	547	777	2066
C5	900, 950, 1000, 1050 & 1070	8.34	0	0	285	606	908	2623	0	0	637	1094	1463	3354
C6	C5, C4, 1300, C2, 1500 & 1600	31.05	0	0	517	1601	2593	8896	0	0	1694	3194	4492	11580
C7	850 & 800	4.01	0	0	136	292	437	1247	0	0	306	523	703	1604
C8	700, 750 & C7	6.71	0	0	198	447	682	2069	0	0	470	824	1124	2675
C9	500, C8 & C6	39.44	0	0	657	1921	3206	11120	0	0	2055	3968	5582	14637
C10	100, 200, 220, 250 & C9	60.79	0	0	1095	2959	4962	16975	0	0	3147	6119	8610	22151
C11	650 & 620	2.61	0	0	23	106	194	786	0	0	114	246	363	1043
C12	460, 400, 350 & 300	10.42	0	0	370	741	1077	3056	0	0	774	1278	1704	3895
C13	C10, C11 & C12	80.38	0	0	1468	3902	6433	22046	0	0	4143	7937	11148	28769

ATTACHMENT A
SOLAR 1 AND 3 WATERSHED BOUNDARIES OVERLAIN ON TOPO

URS

3500 0 3500 7000 Feet
APPROXIMATE SCALE: 1"= 7000'

CHECKED BY: MM | DATE: 11-12-08
PM: WPM | PROJ. NO: 276580111.40000

ATT. A

ATTACHMENT 'B'

HEC-1 Input Parameters

Basin	Area (mi^2)	Hi (ft)	Low (ft)	Slope (ft/mi)	Length (mi)	Length (ft)	Lcentroid (mi)	LagTime (hrs)	Basin "n"	CN (AMC 2)	CN (AMC 1)	CN (AMC 3)
100	3.47	2643	1802	195.88	4.29	22,669	2.38	0.85	0.04	72	53	89
200	3.07	1920	1802	57.77	2.04	10,785	0.77	0.40	0.03	65	45	83
220	1.75	2440	1920	198.17	2.62	13,855	1	0.51	0.04	68	49	85
250	13.06	3520	1860	260.35	6.38	33,665	2.5	0.96	0.04	74	56	90
300	0.65	2000	1850	157.27	0.95	5,036	0.4	0.19	0.03	65	45	83
350	5.56	4325	2000	354.56	6.56	34,623	3.35	1.02	0.04	76	58	92
400	1.01	2040	1835	173.5	1.18	6,238	0.83	0.27	0.03	65	45	83
450	3.2	4406	2040	387.5	6.11	32,240	2.39	0.86	0.04	74	56	90
500	1.68	2000	1849	79.9	1.89	9,975	1.3	0.44	0.03	65	45	83
600	6.56	2195	1800	46.5	8.50	44,871	3.41	1.25	0.03	66	46	84
620	0.85	1920	1860	40.8	1.47	7,759	1.32	0.46	0.03	65	45	83
650	1.76	2185	1920	157.2	1.69	8,899	0.89	0.32	0.03	65	45	83
700	1.08	2150	1937	140.0	1.52	8,035	0.83	0.31	0.03	65	45	83
750	1.62	3220	2150	448.8	2.38	12,588	0.96	0.41	0.04	72	53	89
800	2.57	3736	1940	378.0	4.75	25,090	2.86	0.84	0.04	69	50	86
850	1.44	3220	2160	310.1	3.42	18,046	1.51	0.60	0.04	77	59	92
900	2.08	3450	1998	359.5	4.04	21,328	2.72	0.59	0.03	69	50	86
950	2.13	4200	2190	471.8	4.26	22,494	2.18	0.70	0.04	75	57	91
1000	0.53	2190	1998	99.1	1.94	10,228	1.25	0.42	0.03	65	45	83
1050	3.19	4520	2190	399.0	5.84	30,834	2.93	0.91	0.04	76	58	92
1070	0.41	2840	2190	256.1	2.54	13,402	1.32	0.53	0.04	65	45	83
1100	0.4	2180	2040	102.5	1.37	7,211	0.97	0.33	0.03	65	45	83
1150	1.64	3703	2180	565.8	2.69	14,213	1.96	0.54	0.04	68	49	85
1200	0.46	2180	2040	95.9	1.46	7,709	1.15	0.37	0.03	65	45	83
1250	3.02	3945	2180	431.7	4.09	21,585	2.48	0.73	0.04	69	50	86
1300	2.22	2991	2068	202.5	4.56	24,064	2.69	0.68	0.03	68	49	85
1400	0.53	2200	2090	82.2	1.34	7,066	0.62	0.29	0.03	65	45	83
1420	0.59	2451	2200	217.7	1.15	6,089	0.55	0.22	0.03	65	45	83
1450	1.13	2990	2451	364.0	1.48	7,819	0.69	0.24	0.03	66	46	84
1500	8.28	2200	1937	47.7	5.52	29,122	3.24	1.03	0.03	70	51	87
1600	4.44	3360	2080	253.8	5.04	26,627	1.91	0.79	0.04	67	47	85
Overall	**80.36**	**3360**	**1800**	**123.13**	**12.67**		**5.01**	**1.40**	**0.03**	**70**	**51**	**87**

ATTACHMENT 'C'

HEC-1 OUTPUT SUMMARY

Map			6 Hour Peak Flow, cfs						24 Hour Peak Flow, cfs					
Designation	Basin	Area, sq. mi	2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr	2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
X Section 1A	1600	4.44	0	0	50	174	302	1200	0	0	187	380	550	1582
	Route 1	4.44	0	0	54	174	301	1197	0	0	186	379	548	1579
	1500	8.28	0	0	155	409	654	2241	0	0	433	804	1125	2919
	Combine 1500&1600	12.72	0	0	158	543	915	3406	0	0	575	1144	1634	4463
5	1450	1.13	0	0	17	60	102	372	0	0	64	127	181	489
	Route 14a	1.13	0	0	18	60	102	372	0	0	64	126	181	489
	1420	0.59	0	0	7	28	49	188	0	0	30	62	89	249
C1 & 4	Combine 1450&1420	1.72	0	0	23	85	147	556	0	0	91	185	267	735
	Route 14b	1.72	0	0	23	85	147	557	0	0	91	185	266	736
	1400	0.53	0	0	6	24	42	165	0	0	26	53	78	219
C2 & 3	Combine 1420&1400	2.25	0	0	24	103	183	715	0	0	111	231	338	944
	Route 2	2.25	0	0	25	125	182	710	0	0	119	230	336	944
	Combine 1500&1400	14.97	0	0	158	660	1094	4104	0	0	693	1374	1970	5387
	1300	2.22	0	0	36	110	182	636	0	0	117	225	319	837
	Route 3	2.22	0	0	42	109	181	633	0	0	117	224	318	834
	Combine 1500&1300	17.19	0	0	187	768	1274	4727	0	0	808	1595	2282	6214
7	1250	3.02	0	0	59	162	261	879	0	0	172	320	449	1149
	Route 12a	3.02	0	0	58	162	261	880	0	0	171	320	449	1149
	1200	0.46	0	0	5	20	35	139	0	0	21	44	65	184
C3 & 44	Combine 1250&1200	3.48	0	0	59	170	279	981	0	0	181	345	488	1287
	Route 4	3.48			59	170	278	980	0	0	180	345	486	1286
8	1150	1.64	0	0	31	90	147	497	0	0	95	181	254	651
	Route 11a	1.64	0	0	30	90	146	495	0	0	95	181	254	651
	1100	0.4	0	0	4	17	31	123	0	0	19	39	57	163
43	Combine 1150&1100	2.04	0	0	32	100	167	598	0	0	106	209	297	790
C4	Combine 1100&1200	5.52	0	0	90	265	440	1569	0	0	283	547	777	2066
	Route 5	5.52	0	0	99	266	440	1565	0	0	283	546	775	2064
	Combine 1500&1200	22.71	0	0	269	1032	1707	6293	0	0	1087	2137	3055	8264
9	1070	0.41	0	0	3	15	28	116	0	0	16	36	53	154
	Route 10a	0.41	0	0	4	16	28	115	0	0	17	36	52	154
10	1050	3.19	0	0	150	289	412	1059	0	0	301	483	633	1332
	Route 10b	3.19	0	0	150	289	411	1059	0	0	301	484	634	1332
	1000	0.53	0	0	5	22	39	157	0	0	23	49	72	208
	Combine 1070-1000	4.13	0	0	152	312	456	1279	0	0	326	541	723	1627
11	950	2.13	0	0	102	200	287	739	0	0	209	338	444	932
	Route 9a	2.13	0	0	102	200	287	737	0	0	208	338	443	930
	900	2.08	0	0	45	122	196	640	0	0	129	240	334	834
	Combine 950&900	4.21	0	0	143	314	471	1361	0	0	329	563	762	1746
C5	Combine 1000&900	8.34	0	0	285	606	908	2623	0	0	637	1084	1463	3354
	Route 6	8.34	0	0	285	605	905	2622	0	0	636	1085	1460	3353
C6	Combine 1500&1000	31.05	0	0	517	1601	2593	8896	0	0	1694	3194	4492	11580
	Route 7	31.05	0	0	509	1571	2596	8887	0	0	1689	3190	4486	11588
	500	1.68	0	0	15	67	122	493	0	0	73	155	227	655
	Combine 500&1500	32.73	0	0	510	1578	2621	9149	0	0	1699	3232	4566	11970
12	850	1.44	0	0	91	165	230	531	0	0	172	267	344	665
	Route 8a	1.44	0	0	91	165	229	530	0	0	171	267	344	664
	800	2.57	0	0	46	128	208	718	0	0	136	256	361	940
C7	Combine 850&800	4.01	0	0	136	292	437	1247	0	0	306	523	703	1604
	Route 8	4.01	0	0	135	292	435	1245	0	0	305	521	703	1599
13	750	1.62	0	0	66	141	210	588	0	0	148	250	336	749
	Route 7a	1.62	0	0	66	142	209	589	0	0	148	250	335	750
	700	1.08	0	0	11	48	85	333	0	0	52	107	157	442
	Combine 750&700	2.7	0	0	75	183	285	904	0	0	193	346	478	1171
C8	Combine 700&800	6.71	0	0	198	447	682	2069	0	0	470	824	1124	2675
	Route 9a	6.71	0	0	198	447	682	2070	0	0	469	821	1123	2674
C9	Combine 500&800	39.44	0	0	657	1921	3206	11120	0	0	2055	3968	5582	14537
	Route 10	39.44	0	0	646	1912	3196	11091	0	0	2042	3952	5561	14485
	250	13.06	0	0	471	982	1444	4019	0	0	1028	1719	2297	5121
	Route 2a	13.06	0	0	471	981	1444	4015	0	0	1027	1716	2295	5111
	220	1.75	0	0	34	98	159	536	0	0	104	196	276	702
	Route 2b	1.75	0	0	35	97	159	535	0	0	103	195	275	701
	200	3.07	0	0	29	128	228	913	0	0	137	289	424	1213
	Combine 250-200	17.88	0	0	512	1119	1689	5136	0	0	1174	2034	2766	6638
	Combine 500&200	57.32	0	0	1043	2815	4695	15963	0	0	2997	5773	8105	20812
19	100	3.47	0	0	102	233	353	1073	0	0	245	425	577	1375
C10	Combine 100&200	60.79	0	0	1095	2959	4962	16975	0	0	3147	6118	8610	22151
	Route 11	60.79	0	0	1057	2913	4879	16798	0	0	3100	6034	8510	21969
60	650	1.76	0	0	18	78	138	542	0	0	83	174	253	718
	Route 6a	1.76	0	0	20	77	137	541	0	0	82	174	252	718
	620	0.85	0	0	7	34	61	247	0	0	36	77	114	329
C11	Combine 650&620	2.61	0	0	23	106	194	786	0	0	114	246	363	1043
	Route 6b	2.61	0	0	21	104	191	779	0	0	111	244	359	1036
	600	6.56	0	0	39	170	314	1457	0	0	183	406	608	1951
	Combine 620&600	9.17	0	0	42	274	505	2213	0	0	294	646	960	2951
	Combine 600&100	69.96	0	0	1093	3173	5365	19011	0	0	3377	6667	9454	24906
14	450	3.2	0	0	123	254	372	1018	0	0	266	442	589	1296
	Route 4a	3.2	0	0	123	254	373	1018	0	0	266	442	589	1296
	400	1.01	0	0	11	46	82	317	0	0	50	103	150	421
	Combine 450&400	4.21	0	0	125	269	405	1230	0	0	282	488	664	1586
15	350	5.56	0	0	246	477	682	1784	0	0	497	801	1052	2245
	Route 3a	5.56	0	0	246	476	681	1781	0	0	497	801	1053	2241
	300	0.65	0	0	8	32	55	209	0	0	34	69	100	278
	Combine 350&300	6.21	0	0	246	478	684	1837	0	0	499	806	1062	2323
C12 & 21	Combine 400&300	10.42	0	0	370	741	1077	3056	0	0	774	1278	1704	3895
	Route 12	10.42	0	0	365	734	1069	3035	0	0	766	1270	1694	3871
C13 & 25	Combine 600&400	80.38	0	0	1458	3902	6433	22046	0	0	4143	7937	11148	28769
	OVERALL	**80.38**	**0**	**0**	**1458**	**3902**	**6433**	**22046**	**0**	**0**	**4143**	**7937**	**11148**	**28769**

BEFORE THE ENERGY RESOURCES CONSERVATION AND DEVELOPMENT COMMISSION OF THE STATE OF CALIFORNIA
1516 NINTH STREET, SACRAMENTO, CA 95814
1-800-822-6228 – WWW.ENERGY.CA.GOV

APPLICATION FOR CERTIFICATION
For the SES SOLAR ONE PROJECT

Docket No. 08-AFC-13

PROOF OF SERVICE
(Revised 7/14/09)

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DECLARATION OF SERVICE

I, Corinne Lytle declare that on July 17 , 2009, I served and filed copies of the attached Report to Map Federal and State Surface Waters, dated July 14 , 2009. 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 document has 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:

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

_____ by personal delivery or by depositing in the United States mail at _____ 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:

__X__ 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

docket@energy.state.ca.us

I declare under penalty of perjury that the foregoing is true and correct.

Original Signed By
Corinne Lytle