Appendix 5.3F
Geoarchaeological Investigations

Summary of Findings: The Stratigraphy of Two Geotechnical Test Trenches

SolarReserve Rice Solar Energy Project

This memorandum presents the results of geoarchaeological investigations of two test trenches at the SolarReserve Rice Solar Energy Project site, located in eastern Riverside County, California, about one mile east of the abandoned former town site of Rice, which is located near State Route 62 Mile Marker 109, and near the intersection of State Route 62 and Blythe-Rice Road. To conduct these investigations, geoarchaeologist Dr. W. Geof Spaulding accompanied a geotechnical investigation crew to the site to observe the excavation of two backhoe trenches on the site and recorded and interpreted their stratigraphy. The geotechnical study was conducted on August 5, 2009 by Terracon Consultants (Terracon Consultants 2009).

Each trench was initially excavated to a depth exceeding 10 feet and then, after geotechnical sampling, backfilled to a depth of approximately 5 feet to allow safe access by the investigating geoarchaeologist. Strata and stratigraphic boundaries were then described and identified, and summarized in a stratigraphic column for each of the two trenches. Examination of the deeper portions of the trenches (>6 feet) from the surface suggested that stratigraphic variability is muted with increasing depth in the area.

Physiographically, the trenches were excavated in the southern bajada (alluvial fan system) of the low, arid Turtle Mountains. The axial portion of Rice Valley, and the distal end of the Turtle Mountains bajada, lies approximately 2.7 km to the south, while the foot of the mountains lies 3 to 4 km to the north. The two tranches are on the middle reaches of the gently sloping alluvial fan ramp that comprises the bajada.

Clasts in this location are generally cobble-size or smaller, although alluvial fans only a kilometer and a half to the west have brought common basalt boulders to this elevation. Elevations of the project site range from about 750 to 950 feet asl. Vegetation is sparse creosote bush – burrobush (*Larrea tridentata – Ambrosia dumosa*) desert scrub. Packrat middens from the Turtle Mountains, as well as the Whipple Mountains about 50 km to the east-northeast, show that effective moisture was much greater in this region and woodland persisted in the mountains until near the end of the early Holocene, about 8,000 B.P. (radiocarbon years before the present) (Van Devender, 1990; Spaulding and Graumlich, 1986).

Results

Of the two trenches, only Trench 1 provided a complete stratigraphic sequence. Grading during the development of the Army airfield affected the area where Trench 2 was located, and the upper portion of the stratigraphic sequence here was removed and replaced by 16 to 30 cm of recompacted full and rubble. Nevertheless, the preserved portion of the stratigraphy of Trench 2 accords well with observations of Trench 1 strata.

The general stratigraphy exposed by the geotechnical trenching is consistent with current understanding of alluvial fan sequences in the Mojave and Colorado Deserts where deposition occurs primarily as a consequence of hillslope instability during episodes of major environmental change (it is thought usually during deglaciations). Slopes that were relatively well-vegetated during glacial periods accumulated a relatively thick colluvial mantle over the span of approximately 50 to 70 thousand years, only to shed that mantle in response to postglacial aridity. The last episode of widespread hillslope erosion occurred at the close of the last glacial age, approximately 10,000 to 15,000 B.P. (Ponti, 1985; Dohrenwend et al., 1991).

Two alluvial units were exposed by the geotechnical trenching, although the unit itself possessed several; different horizons chiefly as a result of pedogenic processes. The following summarizes the features of the stratigraphy from top to bottom:

0 – 55 cm: Unit I. Horizontally, coarsely bedded, weakly indurated alluvial sand with gravel stringers; silty sand to coarse sand; generally poorly sorted. Moderate to weak reaction to HCl in top 15 cm, to *no* reaction to HCl below 36 cm.

0 – 20 cm: Eolian sands mixed with alluvium, fining upward to sandy silts to silts in the top 5 cm. Weak reaction to HCl. Separated by a gradational transition over 20 cm from the underlying alluvial sand:

36 - 55 cm: Distinct argyllic horizon; clays present and reddening evident Well indurated. Stringers of carbonate increasing with depth.

55 cm - >3 m: Unit II. Poorly sorted silty, sandy alluvial gravel; coarsely bedded; Stage 2 to 3 carbonate morphology with a *strong* reaction to HCl.

The silts of the top 5 cm of this section are frequently thought to be of late Holocene in age, while the top approximately 20 cm of section likely encompass the entire Holocene. This upper unit is indistinctly separated from the rest of Unit I below. The clay-rich argyillic horizon at the base of Unit I is typical of Late Pleistocene alluvial units according to Dohrenwend et al. (1991)). Unit II is likely to be Middle Pleistocene or older in age.

Thus the Holocene (the last 10,000 years) appears to be restricted to at most the top 20 cm of the stratigraphic column and, based on the results of Trench 2 and an overview of the project area, the Holocene section may have been obliterated by World War II era activities. No artifacts or ecofacts were observed during trench excavation, and no ecofacts would be expected to be preserved in this type of well-oxidized alluvial soil. Given the low-productivity desert scrub ecosystem in the vicinity, and the waterless landscape, an assessment of low subsurface archaeological potential would be consistent with the setting as well as the stratigraphy.

References Cited

Dohrenwend, J.C., W.B. Bull, L.D. McFadden, G.I. Smith, R.S.U. Smith, and S.G. Wells. 1991. Quaternary geology of the Basin and Range Province in California. In *The geology of North America, Volume K-2, Quaternary non-glacial geology: conterminous U.S.*, edited by R.B. Morrison, pp. 321-352. Geological Society of America, Boulder, CO.

Ponti, D. J. 1985. The Quaternary alluvial sequence of the Antelope Valley, California. In *Soils and Quatenary geology of the southwestern United States*, edited by D. L. Weide, pp. 79-96. Geological Society of America Special Paper 203. Boulder, CO.

Spaulding, W.G., and Graumlich, L.J. (1986). The last pluvial climatic episodes in the deserts of southwestern North America. *Nature* 320, 441-444.

Terracon Consultants, Inc. 2009. Preliminary Geotechnical Engineering Report, Rice Solar Energy Project, Former Rice Airfield Highway 62, Mile Marker 109, Rice, California August 5, 2009 Terracon Project No. 60095017. Prepared for SolarReserve, LLC.

Van Devender, T. R. 1990. Late Quaternary vegetation and climate of the Sonoran desert, United States and Mexico. In *Packrat middens: The last 40,000 years of biotic change*, edited by J. L. Betancourt, P. S. Martin, and T. R. Van Devender, pp. 134-165. University of Arizona Press, Tucson.

Endorsement

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