

SETTING

CURRENT NATURAL SETTING

As mentioned above, the project area is situated on the north shore of Big Bear Lake, a man-made lake in the San Bernardino Mountains. More specifically, it lies in the relatively undeveloped eastern portion of the small mountain community of Fawnskin, along a segment of North Shore Drive (SR 38) between the intersections of Oriole Lane and Polique Canyon Road. Located within the boundaries of the San Bernardino National Forest but not owned by the U.S. Forest Service, the project area provides for public access to both the lakeshore and the forestland.

The project area is flanked by existing residential properties to its northwest and southeast, but the only improvement currently present in the project boundaries is North Shore Drive, along with various dirt roads and trails. The terrain slopes gently from south to north, and supports a Jeffrey pine forest (Fig. 3). Pebble plain habitat occurs in scattered patches in the western portion of the project area. Elevations range from 6,747 feet at the lakefront to 6,960 at the northeast boundary, with a total relief of 483 feet and slopes between 5 and 40 percent. A natural drainage occurs in the eastern portion of the project area, flowing from north to south (Fig. 2). Other small drainage courses occur throughout the property.

CULTURAL SETTING

Prehistoric Context

The project area lies in the heart of the homeland of the Serrano Indians, whose traditional territory is centered at the San Bernardino Mountains, but also includes the southern rim of the Mojave Desert, extending from today's Victorville eastward to Twentynine Palms. The name "Serrano" was derived from a Spanish term meaning "mountaineer" or "highlander." The basic written sources on Serrano culture are Kroeber (1925), Strong (1929), and Bean and Smith (1978). The following ethnographic discussion of the Serrano people is based on these sources.

Prior to European contact, the Serranos were primarily gatherers and hunters, and occasional fishers, who settled mostly where flowing water emerged from the mountains. Because of the variation in their habitat, the vegetable staples of the Serrano included both

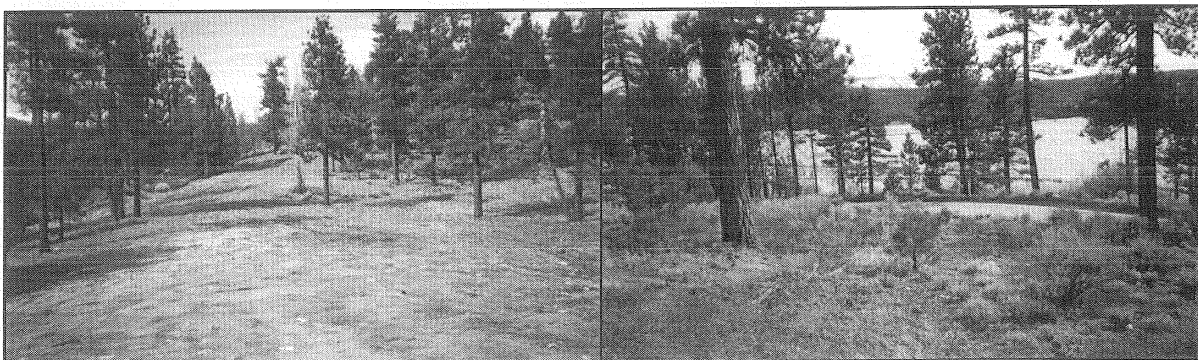


Figure 3. Typical landscapes in the project area.

plant foods common in the mountains, such as acorns and piñon nuts, and those common in the desert, such as honey mesquite, yucca roots, mesquite, and cactus fruits. Game animals, including deer, mountain sheep, antelope, birds, rabbits and other small rodents, were hunted with tools and techniques quite similar to those employed by other southern California Indians. Technologically, the Serrano were also similar to their neighbors. Shell, wood, bone, stone, and plant fibers were used in making a variety of implements, such as lavishly decorated baskets, pottery, rabbit-skin blankets, and musical instruments.

The Serrano were loosely organized into exogamous clans, led by hereditary heads, and the clans in turn were affiliated with one of two exogamous moieties. The exact nature of the clans, their structure, function, and number are not known, except that each clan was the largest autonomous political and landholding unit, the core of which was the patrilineage. There was no pan-tribal political union among the clans. The Bear Valley, in which Big Bear Lake is located, was identified by Kroeber (1925:618) to be the territory of the *Yuhaviatam* or *Kuchaviatam* clan, which occupied a village in the vicinity named *Yuhaviat*, meaning "pine place." Strong (1929:11), however, suggests that the Bear Valley was shared between the *Yuhavetum* (*Yuhaviatam*) clan and the *Pervetum* clan.

Although contact with Europeans may have occurred as early as 1771 or 1772, Spanish influence on Serrano lifeways was negligible until 1819, when an *assistencia* under the San Gabriel Mission was established in present-day Redlands, on the edge of Serrano territory. Between then and the end of the mission era in 1834, most of the Serranos in the San Bernardino Mountains were removed to the nearby missions. At present, most Serrano descendants are found on the San Manuel and the Morongo Indian Reservations, where they participate in ceremonial and political affairs with other Native American groups on an inter-reservation basis.

Historic Context

In 1772, a small force of Spanish soldiers under the command of Pedro Fages became the first Europeans to set foot in the San Bernardino Mountains, followed shortly afterwards by Francisco Garcés, the famed explorer, in 1776. During the next 70 years, however, the Spanish/Mexican colonization activities in Alta California, which concentrated predominantly in the coastal regions, left little physical impact on the San Bernardinos. Aside from occasional explorations and punitive expeditions against Indian livestock raiders, the mountainous hinterland of California remained largely beyond the attention of the missionaries, the *rancheros*, and the provincial authorities. The name "San Bernardino" was bestowed on the region at least by 1819, when a mission rancho bearing that name was established in the valley lying to the south under the supervision of Mission San Gabriel.

After the American annexation of California in 1848, the rich resources offered by the mountains brought drastic changes to the San Bernardinos, spurred by the influxes of settlers from the eastern United States. Beginning in the early 1850s, the dense forest was turned into the scene—and victim—of a booming lumber industry, which brought the first wagon roads and industrial establishments into the San Bernardinos. In 1860, the discovery of gold in the Bear and Holcomb Valleys ushered in a miniature gold rush, and with it a number of mining towns with several thousand residents. Around the same time, the lush mountain range also attracted cattlemen, sheepmen, and their herds, and within the next two decades gained the reputation of being the best summer grazing land in

southern California. Then in 1884-1885, an even more valuable resource in arid southern California, water, became the focus of development in the San Bernardinos when the Bear Valley Land and Water Company created the Big Bear Lake reservoir to ensure the success and prosperity of the Redlands colony.

By the 1890s, excessive logging and sheep grazing in the San Bernardino Mountains had given rise to a forest conservation movement among residents of the San Bernardino Valley to protect the watershed. The movement succeeded, in 1893, in persuading the U.S. government to create the San Bernardino Forest Reserve, later renamed the San Bernardino National Forest, and over the next few decades effectively brought an end to logging and sheep grazing in the San Bernardinos. In the meantime, the favorable climate, enticing scenery, and the string of man-made lakes gradually propelled the resort industry to the forefront of development in the San Bernardinos, burgeoning from the first commercial resort established on the shore of Big Bear Lake in 1888. In 1915, the budding industry received a major boost from the completion of the automobile highway known as Rim of the World Drive. Since then, the San Bernardinos have grown into—and remain—one of southern California's most popular tourism attractions.

The community of Fawnskin, the largest settlement on the north shore of Big Bear Lake, was founded in 1916, at the onset of a great building boom in Bear Valley. In that year, two Los Angeles businessmen, William Cline and Clinton E. Miller, purchased some 700 acres at this location with plans to develop a major resort surrounded by expensive summer homes. Initially named Grout after Grout Bay, which it overlooks, the community was soon renamed Fawnskin after nearby Fawnskin Valley, which had been known by that name since 1891. The Fawnskin post office was established in 1918, and Cline and Miller's resort was completed the next year. By then, Fawnskin had already grown into a community of more than 100 summer homes, with a string of other resort camps lining the lakeshore to its east. Among these resorts were Moon Camp and Wilsted's Camp, both located in the immediate vicinity of the current project area, as discussed in further detail below¹.

RESEARCH METHODS

RECORDS SEARCH

The Archaeological Information Center (AIC) at the San Bernardino County Museum, Redlands, provided the records search service for this study. The AIC is the official cultural resource records repository for San Bernardino County, and a part of the California Historical Resource Information System, established and maintained under the auspices of the Office of Historic Preservation.

During the records search, Robin Laska, AIC Assistant Coordinator, checked the Center's electronic database for previously identified historical/archaeological resources in or near the project area, and existing cultural resources reports pertaining to the vicinity. Previously identified historical/archaeological resources include properties designated as California Historical Landmarks, Points of Historical Interest, or San Bernardino County

1. For further discussion of the history of Fawnskin and the San Bernardino Mountains, see Robinson (1989) and LaFuze (1971).

Historical Landmarks, as well as those listed in the National Register of Historic Places, the California Register of Historical Resources, or the California Historical Resource Information System.

HISTORICAL RESEARCH

Historical background research for this study was conducted by CRM TECH historian Bai "Tom" Tang (see App. 1 for qualifications) on the basis of published literature in local and regional history and historic maps of the project vicinity. Among maps consulted for the research were the U.S. General Land Office's (GLO) land survey plat maps dated 1858 and 1896, and the U.S. Geological Survey's (USGS) topographic maps dated 1899 and 1954. These maps are collected at the Science Library of the University of California, Riverside, and the California Desert District of the U.S. Bureau of Land Management, also located in Riverside.

FIELD SURVEY

On March 21, 2002, CRM TECH archaeologists Adrián Sánchez Moreno and Daniel Ballester (see App. 1 for qualifications) carried out the intensive-level, on-foot field survey of the project area. During the survey, Moreno and Ballester walked the entire project area along parallel north-south transects spaced 15 meters (ca. 50 feet) apart. In this way, the ground surface was systematically inspected for any evidence of human activities dating to the prehistoric or historic periods (i.e., 50 years ago or older). Special attention was paid to animal burrow backdirt, rock outcrops, and unusual natural features. Later, Ballester revisited the property on April 2 to complete site recordation of a historic-period refuse scatter discovered during the survey (see "Field Survey Results," below).

RESULTS AND FINDINGS

RECORDS SEARCH RESULTS

According to records on file at the Archaeological Information Center, a portion of the project area, near its western end, was previously surveyed for cultural resources in 1987 (Fig. 4), and two prehistoric—i.e., Native American—artifacts were discovered during that survey (Schroth 1987:5). The two artifacts included a groundstone fragment and a chipped stone tool, and were recorded as an isolate (P36-60758). Since they were found in a deep wash, it was suspected that these artifacts did not occur *in situ* but were rather washed to that location from upper slopes (Schroth 1987:1, 5). No other cultural resources studies had taken place in the project area prior to this study, and no other cultural resources had been identified within the project boundaries.

Outside the project area but within a one-mile radius, ten other previous studies have been reported to the AIC (Fig. 4). As a result of these and other studies in the vicinity, two archaeological sites have been recorded within the one-mile scope of the records search, and four other possible cultural resources have been reported and, since they have not been formally recorded, designed by the AIC as pending sites. One of the two recorded sites, CA-SBR-4400, consisted of a scatter of chipped stone flakes, and has since been destroyed. The other site, CA-SBR-9937H, was the Miller School House in Fawnskin, a one-room

schoolhouse originally built in 1925. The four pending sites were described mainly as scattered chipped stone flakes, projectile point fragments, and/or ceramic sherds, but also included a purported Native American burial ground from the 19th century.

The majority of these previously identified cultural resources were found far enough from the project area not to be a concern for this study. However, P36-60758, the isolate recorded in 1987, was located in the western portion of the project area, as mentioned above, and the purported Native American burial ground may have been in close proximity to the eastern end of the project area, based on what little information was available at the AIC. These two potential cultural resources, therefore, were among the focal points of the field survey efforts.

HISTORICAL RESEARCH RESULTS

Historical sources consulted for this study indicate that development activities in and around the project area began in the 1910s-1920s, coinciding roughly with the birth of the nearby resort town of Fawnskin. Prior to that, the only man-made feature known to be present in the vicinity of the project area was a road "from San Bernardino to Pine Lake Post Office," the latter being located in the present-day City of Big Bear Lake (Figs. 5-7). As Figures 6 and 7 illustrate, the road skirted around the southern side of the project area, just outside the project boundary, over land that has since been inundated by the lake after construction of the current Big Bear Dam raised its water level in 1911-1912.

In 1915, the completion of Rim of the World Drive, the automobile highway that made the mountain resorts accessible to the "flatlanders," ushered in a period of phenomenal growth

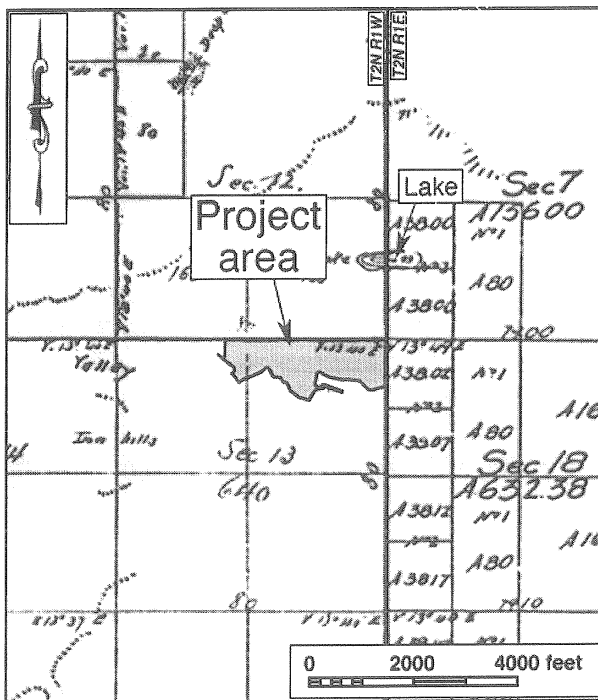


Figure 5. The project area and vicinity in 1857-1858.
(Source: GLO 1858a; 1858b)

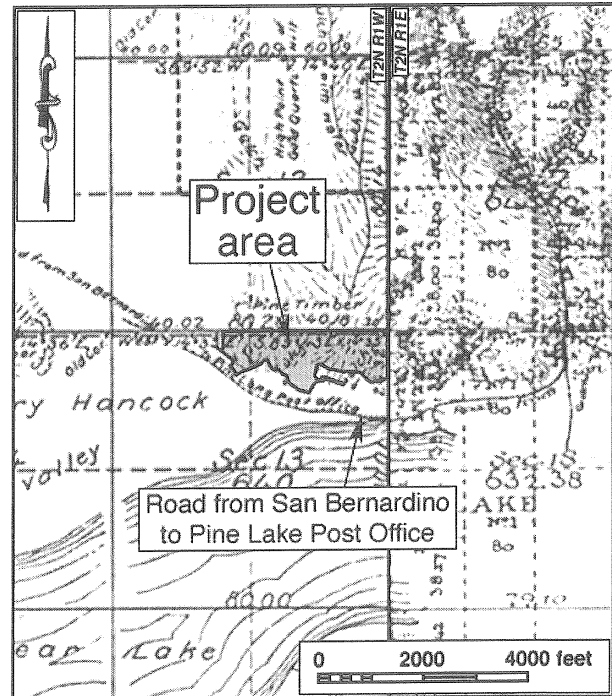


Figure 6. The project area and vicinity in 1894.
(Source: GLO 1896a; 1896b)

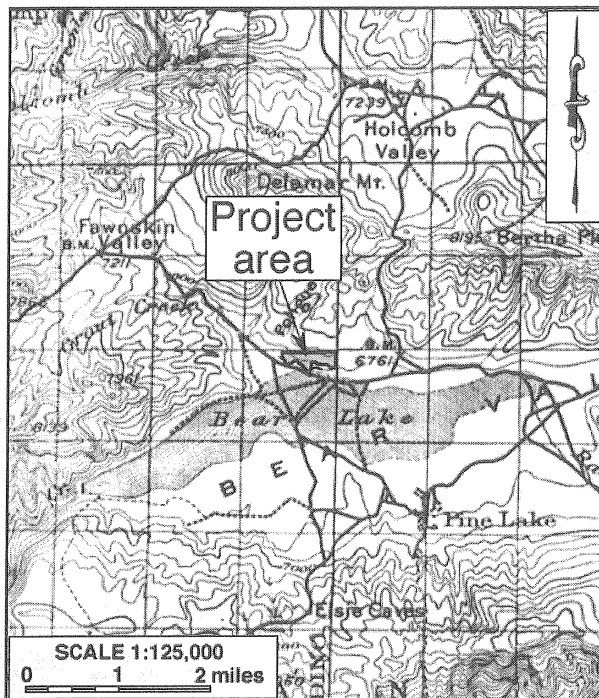


Figure 7. The project area and vicinity in 1899.
(Source: USGS 1902)



Figure 8. The project area and vicinity in 1928.
(Source: Robinson 1989:193)

in Bear Valley. Between 1913 and 1921, the number of resorts in the valley mushroomed from 2 to 52 (Drake 1949:24-26; Robinson 1989:183-185). Although the vast majority of them were concentrated on the south shore of the lake, by 1928 at least nine commercial camps or lodges were in operation along the north shore to the east of Fawnskin (Robinson 1989:187, 193 [Fig. 8]). Two of these, Wilsted's Camp and Moon Camp, were evidently located in the immediate vicinity of the project area, and possibly within the project boundaries (Fig. 8).

In the 1940s, a large number of buildings were noted in the project area, clustered mostly around the two curves in the highway (Fig. 9). While the exact nature of these buildings is not identified in sources consulted during this research, their presence probably attests to the heyday of the resort camps around Big Bear Lake, especially in the midst of the post-WWII prosperity. During the 1950s and the early

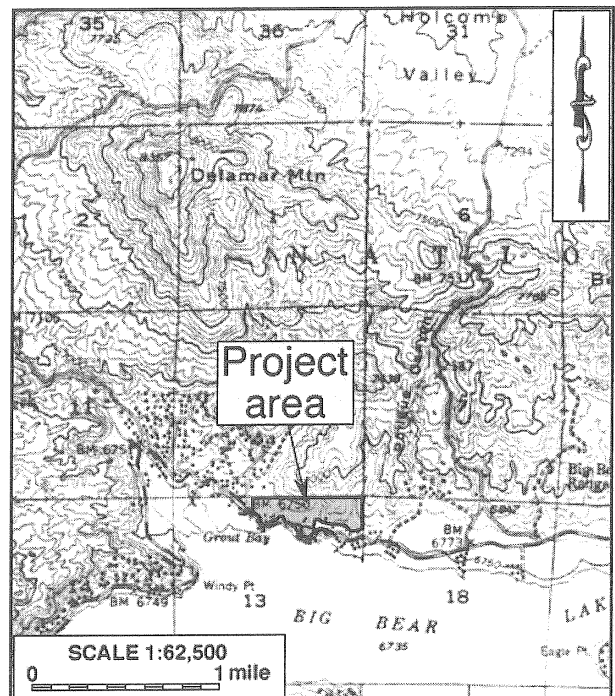


Figure 9. The project area and vicinity in 1945.
(Source: USGS 1947)

1960s, however, rapid advances in modern transportation technology and the resulting shift in American lifestyle began to erode the popularity of such resort camps. Perhaps reflecting that trend, by 1969-1971, the buildings that once occupied the western portion of the project area had disappeared (Fig. 10). Since then, all buildings on the property have been removed.

In summary, the results of historical background research suggest that the project area may have hosted one of possibly two of the early resort camps that helped transform Big Bear Lake into the popular playground it is today, and both of them date to at least the 1920s. The search for possible remains of these camps, thus, formed another focal point of the archaeological field investigations.

FIELD SURVEY RESULTS

No prehistoric sites, features, or artifacts were encountered during the field survey.

A diligent effort was made to search for any surface manifestation of the reported Native American burial ground, but none was found. Nor could either of the two prehistoric artifacts noted in the project area in 1987 (P36-60758) be located during the survey. Remnants of picnic sites were observed on the northern side of North Shore Drive, but all were determined to be of recent origin.

In the southeastern portion of the project area, the field survey revealed the presence of a historic-period refuse scatter, which was recorded as an archaeological site and subsequently designated CA-SBR-10635H (Fig. 11). The artifact deposit at this location has been heavily disturbed by apparent bottle-hunting activities, and presumably many of the more valuable artifacts have been removed. The remaining artifacts include rusted cans, glass fragments, ceramic sherds, pieces of wood or metal, and other historic-period artifacts mixed with modern trash (Figs. 12, 13). Among the more notable items are nine cone-top beer cans, seven solder drop cans, two broken glass bottles, two fragments of an aqua glass insulator, and an old battery (Fig. 14). Some of the artifacts, such as the cone-top and solder drop hole-in-cap cans, generally date to the 1930s-1940s, while others, such as the punch-top steel can, may have come from as late as the 1950s-1960s.

Most of the artifacts were found in two concentrations, each centered around a large pit dug recently by bottle hunters (Fig. 13). Several more looters' pits have been dug in and around the two larger pits. In all, the site measures approximately 61 feet along the north-south axis and 49 feet along the east-west axis within the project area, but the refuse scatter extends farther east beyond the project boundaries. In fact, CA-SBR-10635H can be seen as the edge of a much larger refuse deposit located mostly on the adjacent property, around an old structure foundation at that location.

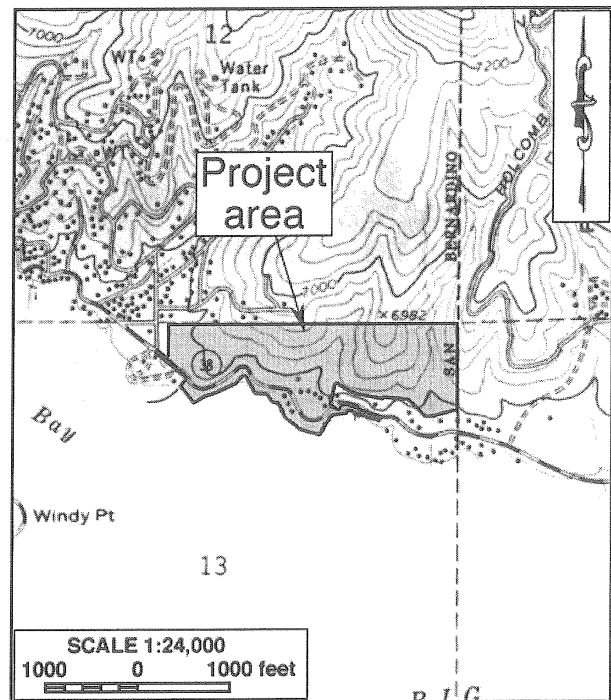


Figure 10. The project area and vicinity in 1969-1971.
(Source: USGS 1971)

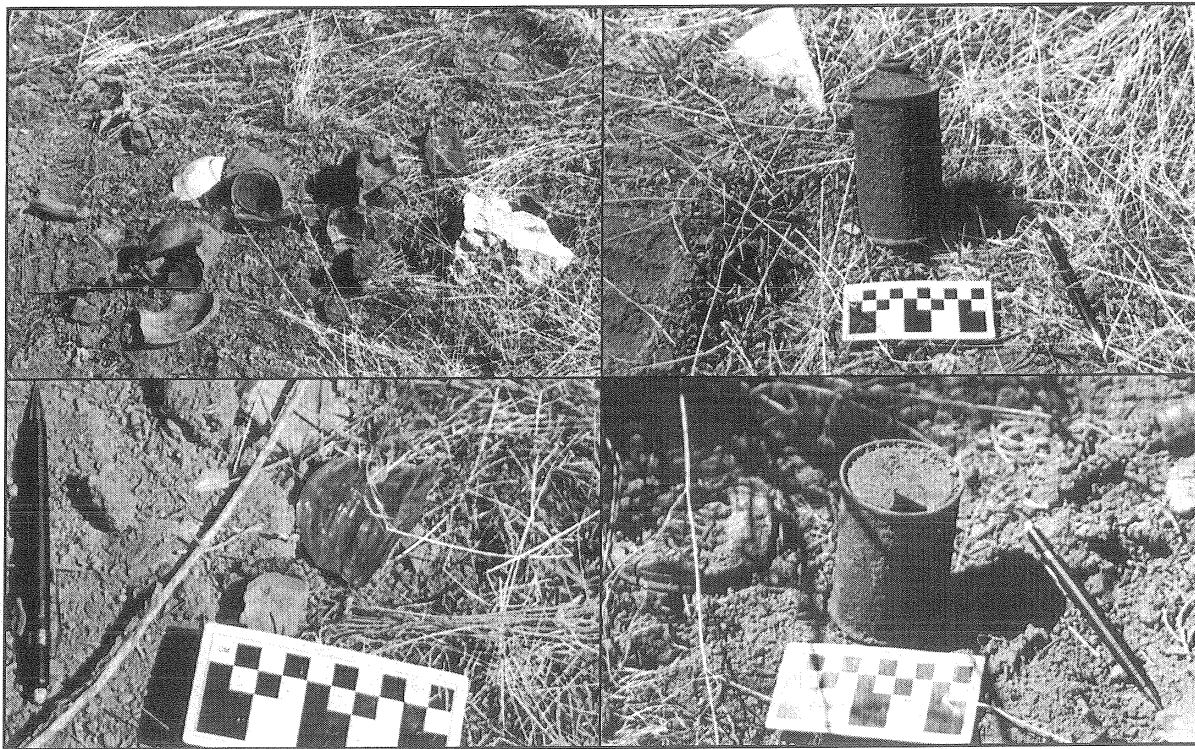


Figure 14. Typical artifacts at Site CA-SBR-10635H. *Clockwise from top left:* a cluster of broken cans and glass and ceramic fragments, apparently bottle-hunters' discards; cone-top beer can; punch-top steel can; fragment of an aqua glass insulator.

DISCUSSION

Based on the research results discussed above, the following sections present CRM TECH's conclusion on whether Site CA-SBR-110635H, the only historical/archaeological feature encountered within the project area, meets the official definitions of a "historical resource," as provided in the California Public Resources Code, in particular CEQA.

DEFINITION

According to PRC §5020.1(j), "'historical resource' includes, but is not limited to, any object, building, site, area, place, record, or manuscript which is historically or archaeologically significant, or is significant in the architectural, engineering, scientific, economic, agricultural, educational, social, political, military, or cultural annals of California." More specifically, CEQA guidelines state that the term "historical resources" applies to any such resources listed in or determined to be eligible for listing in the California Register of Historical Resources, included in a local register of historical resources, or determined to be historically significant by the Lead Agency (Title 14 CCR §15064.5(a)(1)-(3)).

Regarding the proper criteria for the evaluation of historical significance, CEQA guidelines mandate that "a resource shall be considered by the lead agency to be 'historically significant' if the resource meets the criteria for listing on the California Register of

Historical Resources" (Title 14 CCR §15064.5(a)(3)). A resource may be listed in the California Register if it meets any of the following criteria:

- (1) Is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage.
- (2) Is associated with the lives of persons important in our past.
- (3) Embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of an important creative individual, or possesses high artistic values.
- (4) Has yielded, or may be likely to yield, information important in prehistory or history. (PRC §5024.1(c))

SITE EVALUATION

Site CA-SBR-10635H, as stated above, consists of a historic-period refuse scatter. Since many of the artifacts at the site can be dated to the pre-WWII period, it is possible—and indeed probable—that the items were deposited in connection with the early 20th century resort camps known to be in operation in the vicinity. However, due to the limited number and types of the artifacts observed, there is insufficient evidence to establish this association conclusively, or association with any persons or events of recognized historic significance. Furthermore, the site constitutes a minor component of a larger historic-period refuse deposit located outside the project area, and its limited information potential is further diminished by extensive disturbances and the intrusion of modern trash. Based on these considerations, CRM TECH concludes that Site CA-SBR-10635H, as recorded during this study, does not appear to meet any of the criteria for listing in the California Register, and thus does not qualify as a "historical resource."

RECOMMENDATIONS

CEQA establishes that "a project that may cause a substantial adverse change in the significance of a historical resource is a project that may have a significant effect on the environment" (PRC §21084.1). "Substantial adverse change," according to PRC §5020.1(q), "means demolition, destruction, relocation, or alteration such that the significance of a historical resource would be impaired."

Site CA-SBR-110635H, the only historical/archaeological feature encountered within the project area, has been determined not to constitute a "historical resource," as defined by CEQA. However, because of the reported Native American burial ground in the vicinity and the presence of early resort camps in the 1920s, the project area as a whole remains highly sensitive for possible subsurface archaeological deposits from both the prehistoric and the historic periods. Based on these considerations, CRM TECH presents the following recommendations to the County of San Bernardino:

- No historical resources have been identified within or adjacent to the project area, and therefore the project, as currently proposed, will not cause substantial adverse changes to any known historical resources.
- Project-related grading, grubbing, trenching, excavations, and/or other earth-moving activities in the project area should be monitored by a qualified archaeologist.

CONCLUSION

The foregoing report has provided background information on the project area, outlined the methods used in the current study, and presented the results of the various avenues of research. As a result of these procedures, a historic-period archaeological site, CA-SBR-10635H, was identified and recorded within the project area. The site consists of a small and heavily disturbed portion of a historic-period refuse scatter, and was determined not to meet CEQA's definition of a "historical resource." The proposed project, therefore, will have *no impact* on any known historical resources. However, due to the demonstrated sensitivity of the project area for possible subsurface cultural remains from both the prehistoric and the historic periods, archaeological monitoring is recommended during any earth-moving activities in the project area. Under this condition, the proposed project may be cleared to proceed in compliance with the cultural resources provisions of CEQA.

REFERENCES

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 1858b Plat Map: Township No. 2 North Range No. 1 West, San Bernardino Meridian; surveyed in 1857.
 1896a Plat Map: Township No. 2 North Range No. 1 East, San Bernardino Meridian, California; surveyed in 1894.
 1896b Plat Map: Township No. 2 North Range No. 1 West, San Bernardino Meridian, California; surveyed in 1894.
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 1929 *Aboriginal Society in Southern California*. University of California Publications in American Archaeology and Ethnology 26. Reprinted by Malki Museum Press, Banning, Calif., 1972.
- USGS (United States Geological Survey, U. S. Department of the Interior)
 1902 Map: San Geronio, Calif. (30', 1:125,000); surveyed in 1899.
 1947 Map: Lucerne Valley, Calif. (15', 1:62,500); aerial photographs taken in 1945.
 1969 Map: San Bernardino, Calif. (1:250,000); 1958 edition revised.
 1971 Map: Fawnskin, Calif. (7.5', 1:24,000); aerial photographs taken in 1969, field-checked in 1971.
 1994a Map: Big Bear Lake, Calif. (7.5', 1:24,000); 1970 edition photorevised in 1983 and photoinspected in 1989.
 1994b Map: Fawnskin, Calif. (7.5', 1:24,000); 1971 edition photorevised in 1980 and photoinspected in 1989.

**APPENDIX 1:
PERSONNEL QUALIFICATIONS**

PRINCIPAL INVESTIGATOR

Bruce Love, Ph.D., RPA (Register of Professional Archaeologists)

Education

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| 1986 | Ph. D., Anthropology, University of California, Los Angeles. |
| 1981 | M.A., Anthropology, University of California, Los Angeles. |
| 1976 | B.A., Anthropology, University of California, Los Angeles. |
| 1996 | "CEQA 101," presented by the Association of Environmental Professionals. |
| 1995 | "CEQA Workshop," presented by Association of Environmental Professionals. |
| 1994 | "Assessing the Significance of Historic Archaeological Sites," presented by the Historic Preservation Program, University of Nevada, Reno. |
| 1994 | "CEQA 1994: Issues, Trends, and Advanced Topics," presented by UCLA Extension. |
| 1990 | "Introduction to Federal Projects and Historic Preservation Law," presented by U.S. General Services Administration Training Center. |

Professional Experience

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| 1993- | Owner and Principal, CRM TECH, Riverside. |
| 1990-1993 | Director, Archaeological Research Unit, UC Riverside; Coordinator, Archaeological Information Center, UC Riverside. |
| 1989-1990 | Coordinator, Archaeological Information Center, UCLA. |
| 1987-1990 | Owner and Principal, Pyramid Archaeology, Palmdale, California. |
| 1986-1987 | Junior Fellow, Dumbarton Oaks Center for Pre-Columbian Research, Washington, D.C. |
| 1981-1986 | Part-time cultural resources management consultant; doctoral student at UCLA. |

Memberships

Register of Professional Archaeologists.
Association of Environmental Professionals.
American Planning Association.
Society for American Archaeology.
Society for California Archaeology.
Pacific Coast Archaeological Society.
Coachella Valley Archaeological Society.
Archaeological Survey Association.

PROJECT HISTORIAN

Bai "Tom" Tang, M.A.

Education

- 1988-1993 Graduate Program in Public History/Historic Preservation, UC Riverside.
1987 M.A., American History, Yale University, New Haven, Connecticut.
1982 B.A., History, Northwestern University, Xi'an, China.
- 2000 "Introduction to Section 106 Review," presented by the Advisory Council on Historic Preservation and the University of Nevada, Reno.
1994 "Assessing the Significance of Historic Archaeological Sites," presented by the Historic Preservation Program, University of Nevada, Reno.

Professional Experience

- 1993- Project Historian, CRM TECH, Riverside, California.
1993-1997 Project Historian, Greenwood and Associates, Pacific Palisades, California.
1991-1993 Project Historian, Archaeological Research Unit, UC Riverside.
1990 Intern Researcher, California State Office of Historic Preservation, Sacramento.
1990-1992 Teaching Assistant, History of Modern World, UC Riverside.
1988-1993 Research Assistant, American Social History, UC Riverside.
1985-1988 Research Assistant, Modern Chinese History, Yale University.
1985-1986 Teaching Assistant, Modern Chinese History, Yale University.
1982-1985 Lecturer, History, Xi'an Foreign Languages Institute, Xi'an, China.

Honors and Awards

- 1988-1990 University of California Graduate Fellowship, UC Riverside.
1985-1987 Yale University Fellowship, Yale University Graduate School.
1980, 1981 President's Honor List, Northwestern University, Xi'an, China.

Cultural Resources Management Reports

Preliminary Analyses and Recommendations Regarding California's Cultural Resources Inventory System (With Special Reference to Condition 14 of NPS 1990 Program Review Report). California State Office of Historic Preservation working paper, Sacramento, September 1990.

Numerous cultural resources management reports with the Archaeological Research Unit, Greenwood and Associates, and CRM TECH, since October 1991.

Membership

California Preservation Foundation.

PROJECT ARCHAEOLOGIST

Adrián Sánchez Moreno, B.A.

Education

1999 B.A., Anthropology (with emphasis in Archaeology), University of San Diego.

Professional Experience

2000- Project Archaeologist, CRM TECH, Riverside.
1999 Field Crew, excavation in Camp Pendleton Marine Corps Air Base, Oceanside. K.E.A. Environmental, San Diego.
1999 Field Crew, excavation at Freedmen's Cemetery site in Alexandria, Virginia. URS Greiner Woodward & Clyde.
1999 Field Crew, survey and excavation in Guerrero Negro, Mexico.

- Including identification of osteological specimens.

1999 Field Crew, excavation at Lake Chapala, Baja California, Mexico.

- Excavation and cataloguing of lithic artifacts from the oldest known site in Baja California.

1998 Field Crew, petroglyph survey in San Pedro Atacama, Chile.

- Focusing on identification of possible habitation and petroglyph sites.

PROJECT ARCHAEOLOGIST

Daniel Ballester, B.A.

Education

1998 B.A., Anthropology, California State University, San Bernardino.
1997 Archaeological Field School, University of Las Vegas and University of California, Riverside.
1994 University of Puerto Rico, Rio Piedras, Puerto Rico.

Professional Experience

1999- Project Archaeologist, CRM TECH, Riverside.
1998-1999 Field Crew, K.E.A. Environmental, San Diego.

- Two and a half months of excavations on Topomai village site, Camp Pendleton.

1998 Field Crew, A.S.M. Affiliates, Encinitas.

- Two weeks of excavations on a site on Red Beach, Camp Pendleton, and two weeks of survey in Camp Pendleton, Otey Mesa, and Encinitas.

1998 Field Crew, Archaeological Research Unit, University of California, Riverside.

- Two weeks of survey in Anza Borrego Desert State Park and Eureka Valley, Death Valley National Park.

PALEONTOLOGICAL RESOURCES ASSESSMENT REPORT
MOON CAMP RESIDENTIAL SUBDIVISION

Tentative Tract No. 16136
Fawnskin, San Bernardino County

Submitted to:

Glenn Lajoie, AICP, Vice President
RBF Consulting
14725 Alton Parkway
Irvine, CA 92618-2027

Submitted by:

Harry M. Quinn, Geologist/Paleontologist
CRM TECH
2411 Sunset Drive
Riverside, CA 92506

Bruce Love, Principal

April 8, 2002

CRM TECH Contract #783
Approximately 62.43 Acres
Fawnskin, Calif., 7.5' Quadrangle
Section 13, T2N R1W, San Bernardino Base Meridian
APNs 0304-082-14, 0304-091-12, 0304-091-13, and 0304-091-21

MANAGEMENT SUMMARY

In March, 2002, at the request of RBF Consulting, CRM TECH performed a paleontological resource assessment on approximately 62.43 acres of vacant land in the unincorporated community of Fawnskin, San Bernardino County, California. The subject property of the study, known as Tentative Tract No. 16136 (Moon Camp), is located on the north shore of Big Bear Lake, consisting of a portion of the north half of Section 13, T2N R1W, San Bernardino Base Meridian. The study is part of the environmental review process for the proposed subdivision of the property into single-family residential lots. The County of San Bernardino, as Lead Agency for the project, required the study in compliance with the California Environmental Quality Act (CEQA).

The purpose of the study is to provide the County of San Bernardino with the necessary information and analysis to determine whether the proposed development would potentially disrupt or adversely affect any paleontological resources, as mandated by CEQA, and to design a paleontological salvage program for the project, if necessary. In order to identify any paleontological resource localities that may exist in or near the project area and to assess the possibility for such resources to be encountered in future excavation and construction activities, CRM TECH initiated records searches at the San Bernardino County Museum and the Natural History Museum of Los Angeles County, conducted a literature search, and carried out a field survey of the project area in accordance with the guidelines of the Society of Vertebrate Paleontology.

Based on the results of the records and literature search as well as the field inspection, the proposed project's potential impact on paleontological resources is determined to be *moderate* for Holocene vertebrate fossils on portions of the project area north of SR 38 and greater than five feet in depth. A paleontological resource recovery program for Holocene vertebrate fossils, limited to those areas of potential impact, is therefore recommended for the proposed project.

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INTRODUCTION

In March, 2002, at the request of RBF Consulting, CRM TECH performed a paleontological resource assessment on approximately 62.43 acres of vacant land in the unincorporated community of Fawnskin, San Bernardino County, California (Fig. 1). The subject property of the study, known as Tentative Tract No. 16136 (Moon Camp), is located on the north shore of Big Bear Lake, consisting of a portion of the north half of Section 13, T2N R1W, San Bernardino Base Meridian (Fig. 1). The study is part of the environmental review process for the proposed subdivision of the property into single-family residential lots. The County of San Bernardino, as Lead Agency for the project, required the study in compliance with the California Environmental Quality Act (CEQA; PRC §21000, et seq.).

CRM TECH performed the present study to provide the County of San Bernardino with the necessary information and analysis to determine whether the proposed development would potentially disrupt or adversely affect any paleontological resources, as mandated by CEQA, and to design a paleontological salvage program for the project, if necessary. In order to identify any paleontological resource localities that may exist in or near the project area and to assess the possibility for such resources to be encountered in future excavation and construction activities, CRM TECH initiated records searches at the San Bernardino County Museum and the Natural History Museum of Los Angeles County, conducted a literature search, and carried out a field survey of the project area in accordance with the guidelines of the Society of Vertebrate Paleontology. The following report is a complete account of the methods, results, and final conclusion of the study.

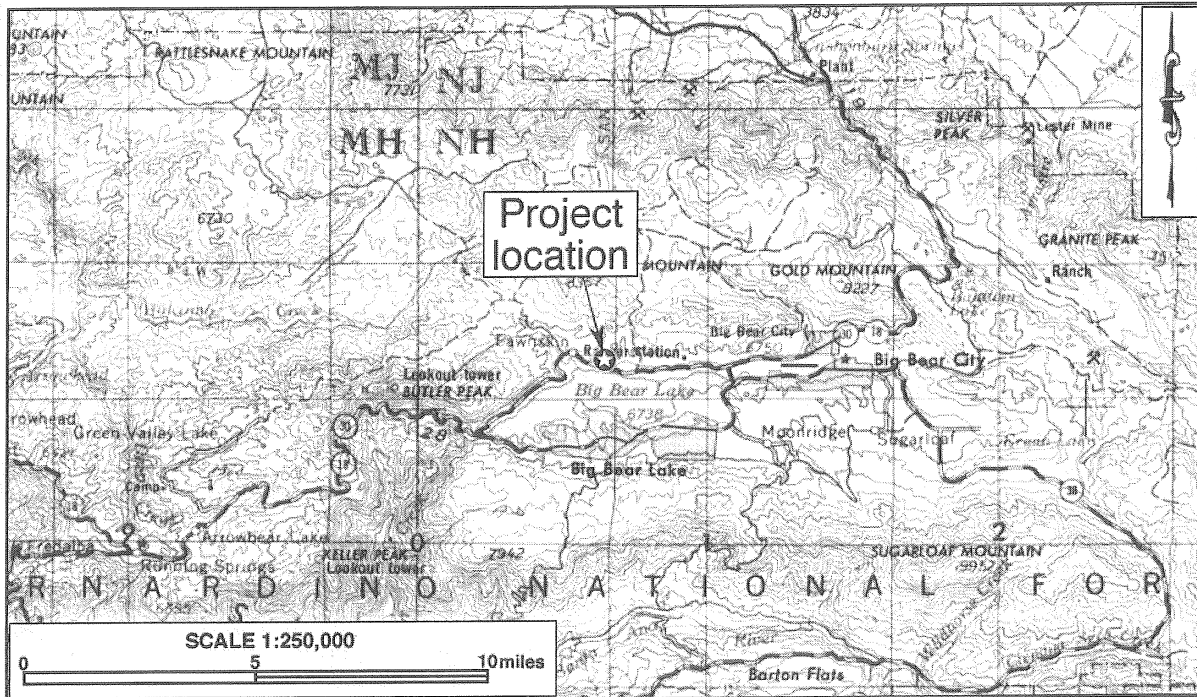


Figure 1. Project vicinity. (Based on USGS San Bernardino, Calif., 1:250,000 quadrangle [USGS 1969])



Figure 2. Project area. (Based on USGS Big Bear Lake and Fawnskin, Calif., 1:24,000 quadrangles [USGS 1994a; 1994b])

SETTING

The project area is located in the San Bernardino Mountains, which comprise a portion of the Transverse Ranges geomorphic province (Jenkins 1980:40-41), the only east-west trending province in the State of California. This portion of the Transverse Ranges province is bounded by the Peninsular Ranges province on the south, the Little San Bernardino Mountain portion of the Transverse Ranges province to the east, the Mojave Desert province on the north, and the San Gabriel Mountain portion of the Transverse Ranges province to the west (*ibid.*).

The project area lies upon the lower slopes of Delmar Mountain, on the north shore of Big Bear Lake. North Shore Drive (SR 38) passes through the property. In aerial photographs taken in 1953, 1965, and 1979, the property is shown to be covered by an open forest with ground commonly visible between the trees (aerial photo 1953; 1965; 1979). The 1965 aerial photograph shows nearby Grout Bay to be a mud flat with a wide, exposed shoreline area along the southern edge of the project area.

The portion of the project area north of SR 38 is wooded to openly wooded, with most of the ground covered by a dense to moderate duff zone composed mainly of pine needles, pine cones, and oak leaves. Surface exposures were limited to roads, steep slopes, canyon bottoms, and a few open meadow-like areas. Large pines, oaks, and cedars make up the bulk of the trees. Also present are a buck brush, pinyon pines, sage, cacti, and grasses. The soil is a gravelly sand with scattered to locally dense areas of cobble or small boulder clasts in the surface float. The clasts are mainly quartzite, with only a few scattered granitic clasts. Based on the soil borings and some road cuts, the surface rocky float is probably the result of lag deposits. In other words, the larger rocks are concentrated at the surface as the smaller materials, such as sand, silt, and clay, are eroded away. This side of the highway contains at least three old dirt roads.

The area south of SR 38 is fenced along the highway, and is accessible through what appears to have been an old, partially graveled driveway. This area has a few scattered large pines, some willows near the shoreline, and is well covered by grasses and weeds. The most open area lies within portions of the access road that are not graveled. The surface soils are a gravelly sand with minor cobble float and only a few scattered small boulders. All but one of the larger rocks are quartzite. Since some buildings are known to have occupied this area in the past, it is possible that the boulders were brought in. The surface level is slightly above the beach during full stands of the lake. Soil borings found that the rock material within the saturated zone is disintegrating, which would suggest that any fossil bone material within this zone would also be disintegrating. The saturated zone should be at or above the lake level, as water tables are usually drawn upward by capillary action to roughly parallel the surface contours of the ground (Pipken and Trent 1997:274).

METHODS AND PROCEDURES

RECORDS SEARCHES

The records search service was provided by the Regional Paleontologic Locality Inventory located at the San Bernardino County Museum in Redlands and the Natural History

Museum of Los Angeles County in Los Angeles. These institutions maintain files of regional paleontological site records as well as supporting maps and documents. The records search results are used to identify previously performed paleontological resource assessments and known paleontological localities near the project area. In addition, a literature search was conducted using materials in the CRM TECH library and the personal library of the author, including unpublished reports produced from surveys of other properties in the vicinity.

FIELD SURVEY

On March 22, 2002, CRM TECH geologist/paleontologist Harry M. Quinn (see App. 1 for qualifications) conducted the field assessment of the project area. The survey was carried out by walking two east-west traverses north of SR 38 spaced approximately 50 meters apart and two east-west traverses south of the highway spaced approximately 10 meter apart. The results of the survey are incorporated into the sections below.

RESULTS AND FINDINGS

EXISTING DATA SUMMARY

The paleontology record searches conducted by the San Bernardino Museum and Natural History Museum of Los Angeles County indicate that no paleontological localities have been discovered within the boundaries of the project area, or within a one mile radius of the project area (Scott 2002; McLeod 2002). However, one paleontological locality, approximately five miles to the east, has been previously reported to have produced vertebrate fossils from sediments that could be present in the deeper levels of the current project area (Scott 2002). Based on the recent nature of the upper sediments, the San Bernardino County Museum assigns the project area a "low potential to contain significant nonrenewable paleontologic resources," and states that "no mitigation program is recommended at this time" (*ibid.*). The Natural History Museum of Los Angeles County concurs that the upper deposits have low sensitivity for paleontological resources, but points out that excavations in the deeper deposits in the portion of the property north of SR 38 "may well encounter significant fossil remains" (McLeod 2002).

REGIONAL GEOLOGY

The San Bernardino Mountains have been uplifted along the southern edge by the San Andreas Fault and by several steeply reverse dipping faults on the north (Bailey and Jahns 1954:105; Trent 1990:1-7). These mountains are composed mainly of gneisses, schists, plutonic rocks, and several kinds of hybrid rocks (Bailey and Jahns 1954:105). They also contain sequences of quartzite and marble from which Paleozoic fossils have been found (*ibid.*). The plutonic rocks are mainly of diorite to quartz monzonite to granite in composition and are considered to be Jurassic and/or Cretaceous in age (*ibid.*). Both the plutonic and metamorphic rocks are intruded by dikes of aplite, pegmatite, lamprophyre, amphibolite, and fine grained basaltic to rhyolitic rocks (*ibid.*). Some Quaternary sedimentary deposits can be found filling canyons and some late Tertiary-Quaternary sedimentary rocks are present along the San Andreas Fault along the south and southwest margins of the range (*ibid.*).

SITE GEOLOGY

Vaughan shows along the north shoreline of Big Bear Lake a strip of Qc, described as the Cabazon fanglomerate of Quaternary age (Vaughan 1922:387-388). It is comprised mainly of an unsorted angular to subangular quartzite-rich fanglomerate (*ibid.*). The rocks just to the north of the fanglomerates are mapped as the Cactus Granite of Jurassic age (Vaughan 1922).

Another geologic map of the surrounding area shows an east-west fault within the bedrock outcrops just north of the project area (Brown 1986:108). The bedrock is mapped as Precambrian metasedimentary rocks, mainly quartzite, marble, and schist (*ibid.*). The rocks between the bedrock and the north shore of Big Bear Lake are shown as Quaternary Alluvium (*ibid.*). Except for the fault, a geologic map by Dibblee (1982:150) shows the same geology for the project area.

A more detailed geologic map of the project area (Sadler 1982:F) shows most of the property to be designated as "aa" and the upper portions as "rf2m." The aa is described as alluvium and colluvium that are considered to be deposits on active surfaces (*ibid.*:A). The rf2m is described as dissected, inactive fan gravels still adjacent to the source, considered to be deposits on relict surfaces (*ibid.*). While the mapping by Sadler (1982:F) shows the rock constituent to be mainly marble, a recent geotechnical study in the same mapped material and near the project area found a large amount of quartzite, rather than marble, to be present (Hulett 2002). The presence of predominantly quartzite rock material within a gravelly sand at this location was confirmed during the field survey. The surface soils appear to become sandier toward the lake.

Portions of Hulett's (2002) geotechnical study, conducted near the project area and within the same mapped rocks, was reviewed for this report. The portions reviewed include three soil borings drilled to depths of 51, 70.5, and 72 feet below grade and three backhoe trenches dug to depths of 12.5, 11, and 13.5 feet below grade. All of these were placed in the rf2m as mapped by Sadler (1982:F) and are in line with the project area. Based on these subsurface data, the area has approximately four to five feet of recent alluvium and colluvium atop some 15 to 20 feet of gray-brown to brown-gray, slightly silty, fine- to coarse-grained sand containing some gravel (Hulett 2002).

The water table was found to be shallow, at 7 to 20 feet, and the rock material within the saturated zone was found to be highly decomposed (Hulett 2002). The ground water zone, as well as the top of the water table, appears to fluctuate with the lake level (*ibid.*). This continued wetting and drying of the rocks material within the ground water zone may be responsible for the noted decomposition of the rock. At depth, all three of these soil borings encountered sandy clays indicative of ponded sediments. These clays suggest that sometime in the geologic past there was a natural lake occupying the portion of the valley where the man-made Big Bear Lake is now located.

Big Bear Lake is a man-made feature that was built by damming up the headwaters of one of the tributaries of the Santa Ana River as it ran through Big Bear Valley. The alluvial deposits that once lined the sides and bottom of the canyon was flooded by the lake, and more recent alluvial deposits began to prograde into the lake. The project area was once on the higher portion of the canyon, in an area of active sedimentation. Such an area

would not be a favorable location for the preservation of vertebrate fossil remains, as any animal dying there would have been subject to carnivore feeding and destruction by the movement of coarse rocky material moving down-slope toward the canyon bottom. The decomposing nature of the rock within the saturated zone would suggest that any fossil material that might have survived within these rocks when they were deposited would have been destroyed along with the rock as they decomposed.

PALEONTOLOGY

The field survey confirmed the presence of recent alluvium on the ground surface. As expected, no fossil remains were found to be present in the project area during the field survey.

DISCUSSION

The field survey results, supported by literature and subsurface testing, indicate that the project area contains sediments deposited during Holocene time. Vertebrate fossils have been found in these same age sediments about five miles east of this location (Scott 2002), however, geologic studies suggest that these vertebrate fossil remains were found in sediments probably associated with a natural Holocene lake (Baldwin Lake) and not in alluvial sediments associated with alluvial fan deposits (Sadler 1982).

As mentioned above, previous geologic studies have recorded sands and some gravels at depths greater than five feet in the area north of SR 38. Based on those findings, and in view of the recent alluvium covering the surface to the depth of five feet and the ground water saturation situation south of the highway, the present study concludes that *there is a moderate potential for the presence of vertebrate fossils within the project area north of SR 38 at depths greater than five feet.*

RECOMMENDATIONS

Based on the study results presented above, the proposed project's potential impact on vertebrate fossils is determined to be *moderate* at depths greater than five feet in the area north of SR 38. Therefore, any earth-moving activities north of the existing highway in excess of five feet below surface grade should be monitored for paleontological resources under a program to mitigate impacts to fossil remains that may be exposed during such operations.

The mitigation program should be consistent with CEQA provisions, as well as with regulations currently implemented by the County of San Bernardino and the proposed guidelines of the Society of Vertebrate Paleontology. The program should include, but not be limited to, the following, as outlined by the San Bernardino County Museum for projects considered likely to have impacts on paleontological resources.

1. Monitoring of grading during excavation in areas identified as likely to contain paleontologic resources by a qualified paleontological monitor. Monitoring should be accomplished for any undisturbed subsurface older alluvium, which might be present in

the subsurface. The monitor should be equipped to salvage fossils as they are unearthed to avoid construction delays and to remove samples of sediments which are likely to contain the remains of small fossil invertebrates and vertebrates. The monitor must be empowered to temporarily halt or divert grading equipment to allow for removal of abundant or large specimens.

2. Preparation of recovered specimens to a point of identification and permanent preservation, including washing of sediments to recover small invertebrates and vertebrates.
3. Identification and curation of specimens into a museum repository with permanent retrievable storage.
4. Preparation of a report of findings with an appended itemized inventory of specimens. The report should include pertinent discussion of the significance of all recovered resources where appropriate. The report and inventory when submitted to the appropriate Lead Agency, would signify completion of the program to mitigate impacts to paleontologic resources.

CONCLUSION

CEQA Appendix G provides that "a project may be deemed to have a significant effect on the environment if it will . . . disrupt or adversely affect a . . . paleontological site except as a part of a scientific study." The present study, conducted in compliance with this provision, was designed to identify any significant, non-renewable paleontological resources that may exist within or adjacent to the project area, and to assess the possibility for such resources to be encountered in future excavation and construction activities.

Based on the results of the records and literature search as well as the field inspection, the proposed project's potential impact on paleontological resources is determined to be *moderate* for Holocene vertebrate fossils on portions of the project area north of SR 38 and greater than five feet in depth. A paleontological resource recovery program for Holocene vertebrate fossils, limited to those areas of potential impact, is therefore recommended for the proposed project.

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Aerial photo

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USGS (United States Geological Survey, U.S. Department of the Interior)

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APPENDIX 1:

PERSONNEL QUALIFICATIONS

PROJECT GEOLOGIST/PALEONTOLOGIST

Harry M. Quinn

Education

- 1968 M.S., Geology, University of Southern California, Los Angeles, California.
1964 B. S., Geology, Long Beach State College, Long Beach.
1962 A.A., Los Angeles Harbor College, Wilmington North Palm Springs, California.
5. Graduate work oriented toward invertebrate paleontology; M.S. thesis completed as a stratigraphic paleontology project on the Precambrian and Lower Cambrian rocks of Eastern California.

Professional Experience

- 2000-Present Project/Field Paleontologist, CRM TECH, Riverside, California.
1998-Present Project/Field Archaeologist, CRM TECH, Riverside, California.
1992-1998 Independent Geological/Geoarchaeological/Environmental Consultant, Pinyon Pines, California.
1994-1996 Environmental Geologist, E.C E.S., Inc, Redlands, California.
1988-1992 Project Geologist/Director of Environmental Services, STE, San Bernardino, California.
1987-1988 Senior Geologist, Jirsa Environmental Services, Norco, California.
1986 Consulting Petroleum Geologist, LOCO Exploration, Inc. Aurora, Colorado.
1978-1986 Senior Exploration Geologist, Tenneco Oil E & P, Englewood, Colorado.
1965-1978 Exploration and Development Geologist, Texaco, Inc., Los Angeles, California.

Previous Work Experience in Paleontology

- 1969-73 Attended Texaco company-wide seminars designed to acquaint all paleontological laboratories with the capability of one another and the procedures of mutual assistance in solving correlation and paleo-environmental reconstruction problems.
1967-1968 Attended Texaco seminars on Carboniferous coral zonation techniques and Carboniferous smaller foraminifera zonation techniques for Alaska and Nevada.
1966-1972, 1974, 1975 Conducted stratigraphic section measuring and field paleontological identification in Alaska for stratigraphic controls. Pursued more detailed fossil identification in the paleontological laboratory to establish closer stratigraphic controls, mainly with Paleozoic and Mesozoic rocks and some Tertiary rocks, including both megafossil and microfossil identification, as well as fossil plant identification.
1965 Conducted stratigraphic section measuring and field paleontological identification in Nevada for stratigraphic controls. Pursued more detailed fossil identification in the paleontological laboratory to establish closer stratigraphic controls, mainly with Paleozoic rocks and some Mesozoic and Tertiary rocks. The Tertiary work included identification of ostracods from the Humboldt and Sheep Pass Formations and vertebrate and plant remains from Miocene alluvial sediments.

Memberships

Society of Vertebrate Paleontology; American Association of Petroleum Geologists; Canadian Society of Petroleum Geologists; Rocky Mountain Association of Geologists, Pacific Section; Society of Economic Paleontologists and Mineralogists; San Bernardino County Museum.

Publications in Geology

Five publications in Geology concerning an oil field study, a ground water and earthquake study, a report on the geology of the Santa Rosa Mountain area, and papers on vertebrate and invertebrate Holocene Lake Cahuilla faunas.

15.8 Geology/Soils Information

D. SCOTT MAGORIEN, C.E.G.
ENGINEERING GEOLOGIST

August 6, 2003

Mr. Glenn Lajoie
RBF Consulting
14725 Alton Parkway
Irvine, CA 92619-2027

Subject: *Revised* Geology Soils and Seismicity Report
 Moon Camp EIR
 Fawnskin (Big Bear Lake), California

Dear Mr. Lajoie,

In general accordance with the scope of work presented in my December 19, 2001 proposal and your authorization, the following report presents my revised EIR-level evaluation of the geologic, soils and seismicity aspects for the subject project. The revisions to the November 15, 2002 report are based on edits I received from your office (via email) on August 4, 2003.

As part of this evaluation, a limited subsurface investigation program was performed to assess liquefaction susceptibility of near-shore alluvial sediments, and concerns regarding slope stability and soil erosion. The scope of work for the liquefaction susceptibility study included performing standard penetration testing (SPT) in three (3) rotary- wash borings that were drilled (logged and sampled) in areas suspected to be underlain by potentially liquefaction-prone soils as identified by RGS Geosciences (2001). In order to preliminarily assess the potential for slope instability and soil erosion, seven (7) shallow backhoe pits were excavated (by Shanahan Construction), and geologically logged. The location of the exploratory borings and test pits are presented on Figure 1- Geologic Map. Copies of the boring and test pit logs are presented in Appendix A.

Based on the results of this study, the potential for liquefaction within the limits of the project area is considered low. The major geologic/ geotechnical constraints to development within the property include future strong ground motion associated with nearby earthquakes, potential slope instability on proposed south-facing cut slopes, and erodible soils materials within the two main drainage channels that transect the property. There are no documented active or potentially active faults within or projecting towards the property.

Revised Moon Camp EIR
RBF Consulting
Page 2

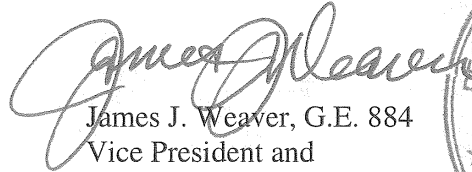
August 6, 2003

If you have any questions or require additional information, please call.

Sincerely,



D. Scott Magorien, C.E.G. 1290
Principal Engineering Geologist



James J. Weaver, G.E. 884
Vice President and
Principal Geotechnical Engineer
Geomatrix Consultants

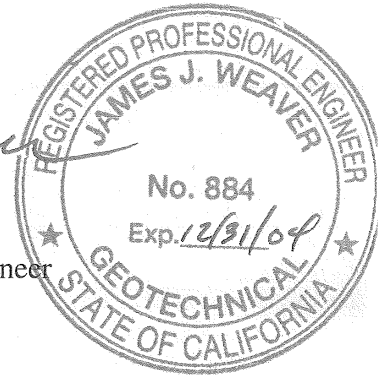


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FIGURE

Figure 1 Geologic Map

APPENDIX

Appendix A Boring and Exploratory Test Pit Logs

GEOLOGY, SOILS AND SEISMICITY MOON CAMP EIR

1.0 INTRODUCTION

The scope of work performed as part of the geology, soils and seismicity portion for the Moon Camp EIR included the following:

- Compile and review relevant reports and maps that address geotechnical, geologic and hydrogeologic conditions for the project and surrounding area. A list of the reports, maps and other relevant data reviewed for this study are presented in the References section at the end of this report.
- A field investigation for this study that included:
 1. Reconnaissance-level geologic mapping performed on February 26th and June 20th 2002.
 2. Excavation and logging of seven (7) backhoe/test pits on June 20, 2002 to assess near surface soil conditions and bedrock lithology and structure; test pit logs are presented in Appendix A.
 3. Drilling, logging and sampling three (3) exploratory rotary wash borings on June 11 and 12, 2002 for the purpose of assessing the presence of potentially liquefiable soils in the vicinity of the lake. During the drilling, Standard Penetration Tests (SPT) were performed every five (5) feet vertically in the borings, and samples from each test placed in plastic bags for later soil classification. Applicable well drilling permits were obtained from the County prior to actual drilling of each of the borings. The boring logs are presented in Appendix A.
- Various individuals who were believed to have relevant information concerning the geologic and hydrologic conditions in the area were contacted via telephone.

The results of the investigation for this study, as well as pertinent impacts and mitigating measures are provided in the following report.

2.0 EXISTING CONDITIONS

2.1 GEOLOGIC SETTING

The Moon Camp project area is situated within the central portion of the Southern California physiographic province known as the Transverse Ranges Geomorphic Province. This province consists of an east-west trending set of mountain ranges, which include from east to west, San Bernardino, San Gabriel and Santa Inez mountains. This alignment of youthful mountains

owes its existence to ongoing tectonic activity associated with the San Andres Fault system. The geomorphology of the San Bernardino Mountains attests to the youthful nature of this uplifted structural block which is bordered on the north by the North Frontal Fault system and on the south by the San Andreas fault.

Big Bear Valley is one of a series of east-west trending valleys in the eastern San Bernardino Mountains, believed to have formed largely by both high angle and low angle faults in the region. The valley is considered to be a bedrock enclosed basin filled with more than 500 feet of lacustrine and alluvial sediments derived from the surrounding mountainous areas.

Big Bear Lake, which borders the project area on the south, was created by construction of a dam in 1884 across Bear Creek. In 1912, an 80-foot high multiple-arch dam was constructed to replace the lower older dam. In the late 1980s, the Big Bear Lake Dam underwent a seismic retrofit, which included improvement of the foundation conditions beneath the downstream side of the dam. When full, the lake has an area of 2,960 acres, a volume of about 72,200 acre-feet, and a water surface elevation of 6,745 feet.

Topographically, the project area occupies the southernmost margin of a lobe-shaped, south-facing hillside that descends into Big Bear Lake. Natural slopes within the area display surface gradients ranging from 2:1 (horizontal to vertical) along the eastern margin of the site, to about 4:1 within the central and western portions, to more gentle gradients near the shoreline of Big Bear Lake. The highest point within the project area is at an elevation 6,962 feet above mean sea level (msl). Maximum relief between the northern margin of the property and the high water line (i.e. 6,745 feet msl) is approximately 215 feet.

There are two prominent, southerly flowing drainages transecting the project area. Surface gradients within these ephemeral drainage courses average of about 0.08 foot/foot.

The two major geologic units, that comprise the project area include older alluvium of Pliocene-late Miocene age (i.e. 1.5 to 5 million years old), and lesser amounts of Holocene age (present to 11,000 years ago) alluvium that occupies the bottom of the major active stream channels. The older alluvial deposits comprise approximately 90 percent of the project area and extend to the northern shoreline of the Big Bear Lake.

Based on a review of published relevant geologic, geotechnical data, as well as the findings from exploratory drilling, excavation of test pits and reconnaissance-level geologic mapping,

there appears to be only limited geologic hazards on the property as it relates to site development. Possible geologic/geotechnical constraints to proposed residential development include potential instability of large cut slopes, soil erosion within the two major drainages that transect the property, and possible earthquake-induced seiche along the near shore portions of the site. Although the project area is located within the seismically active region of southern California, there are no documented active or potentially active faults transecting or projecting towards the project area.

2.2 GEOLOGIC MATERIALS

Surficial materials within the site consist of topsoil, slopewash materials and recent stream-laid alluvial deposits within the active stream channels. Older alluvial deposits underlie the entire site at relatively shallow depths. The distribution of the more significant deposits is shown on Figure 1 (Geologic Map). The designations shown below, in parenthesis, correspond to those shown on the Geologic Map.

Topsoil (not designated on Geologic Map)

Native topsoil which blankets much of the site consists mainly of sandy loam with angular gravel-to cobble-size fragments of quartzite derived from older bedrock formations. These soils are typically dry, porous, and loose, contain varying amounts of organic material, and range in thickness from about eight to ten inches. These soils are considered to be moderately erodible in their natural condition and considered too gravelly and cobbly for use as topsoil for landscaping.

Slopewash (Qsw)

Slopewash deposits consist of the downslope accumulation of eroded topsoil and sediments derived from the underlying older alluvial materials. Slopewash typically contains abundant organic debris and is considered moderately to highly compressible.

Slopewash occurs within broad drainage swales, and as widespread blanket deposits on the gentler, natural slope in the south central portion of the area. The compositions of these soil-like deposits reflect the composition of the older alluvial soils from which they are derived. Where observed in the exploratory test pits, slopewash deposits consist largely of an admixture of silty sand, angular gravel to cobble-size fragments of hard, crystalline bedrock. These soils range in thickness from one to four and a half feet, and are commonly dark brown to dark yellowish-brown in color, loose to medium dense, dry to slightly moist, porous, and contain

varying amounts of roots and rootlets, and considered low to moderately compressible. Erodibility in their natural state is considered to be slight to moderate.

Alluvium (Qal)

Alluvial deposits occupy the bottom of two major and one minor drainage channels that transect the project area (see Geologic Map). These Holocene age, soil-like materials have been deposited, eroded and re-deposited by intermittently flowing streams within these drainages. Where encountered in exploratory borings B-2 and B-3, and exploratory test pit TP-7, these soils consist of crudely stratified layers and lenses of silty sand with varying amounts of angular gravel to cobble-size fragments of quartzite and marble. The alluvial soils are dark brown to dark yellowish-brown in color, comprised of fine to medium grain sand, dry to slightly moist, loose and moderately porous and contain numerous roots and rootlets. Where noted in the two borings and the test pit, the thickness of the alluvial soils in the study area ranges from about 3.5 to 17 feet ($\pm$). Exploratory boring B-1 encountered only surficial slopewash-type deposits (as described above).

Prior to this investigation, RGS Geosciences' (2001) geologic feasibility study indicated that these alluvial soils near the shoreline of Big Bear Lake are potentially susceptible to seismically-induced liquefaction. Each of these drainages was targeted, as close to the shoreline as considered practical, for exploratory drilling and standard penetration testing (SPT) testing in three (3) exploratory borings. These borings have been designated B-1, B-2 and B-3, the locations of which are shown on the Geologic Map.

The primary approach used in this study to assess liquefaction potential of the alluvial soils was based on an empirically based approach as presented by Seed and Idriss (1982). For this approach, SPT blowcounts (e.g. drive energy of a 140 pound weight falling a distance of 18 inches), as well as other seismic and overburden pressures at the point(s) of interest are needed for the assessment. For this study, SPT blowcounts were obtained at about five intervals in each of the three rotary-wash borings.

Based on the results of the SPT and visual observations of the soil samples, the recent (i.e. Holocene age) alluvial soils below a depth of approximately eight feet are not considered prone to settlement or seismically-induced liquefaction. The upper eight feet are considered moderately compressible, and are highly erodible. Given the gravelly/cobbly nature of the near surface alluvium, and the relative elevation as it relates to high water level in the lake

(elevation 6,745 feet msl), the likelihood of seismically induced liquefaction of these sediments along, or inland, of the lake front is considered remote.

Older Alluvium (Toa, Toa)

The entire project area is underlain to significant depths (greater than 400 feet) by what is referred to as Older Alluvium of Plio-Miocene age (as identified by Miller, et. al., 2001). These ancient deposits represent what remains of an extensive accumulation of alluvial (stream-laid) soil materials that had been eroded from adjacent bedrock highlands north of the project area. According to geologic mapping by the U.S. Geologic Survey (Miller, 2001), these alluvial deposits rest unconformably above granitic bedrock of Cretaceous age. Although well dissected, these deposits form an increasingly thickening wedge from north to south. According to water well logs (Geoscience Support Services, Inc., 2000), these sediments are over 400 feet thick near the shoreline and serve as the principal groundwater reservoir beneath the site.

Exposures of the older alluvial deposits are limited to small areas on the road cuts along Highway 38, and on several 12- to 18-foot high road cuts on Polique Canyon Road that leads in Holcomb Valley. No evidence of significant surficial or gross instability was observed either within the project area or along the roadway cuts. Many of these road cuts were quite steep, having inclinations exceeding 45°. However, the lower portions of these cut slopes were commonly covered with a talus apron displaying an inclination of about 33°.

In order to evaluate the near-surface lithologic makeup and bedding plane structure of these sedimentary deposits for the purpose of preliminarily assessing slope stability issues, six (6) exploratory backhoe pits were excavated within the property using a rubber-tired, Case 580 extend-a-hoe equipped with a 3 foot wide bucket. Each of the pits was situated within an area characterized by a certain type of topographic terrain and/or near a proposed cut slope, and varied in depth from about two to six feet below ground surface. All the pits were geologically logged and backfilled with the excavated materials. The location of each pit is shown on the Geologic Map.

The main lithologic character of these ancient soils is represented by layers of clayey sand (labeled Toa_s on the Geologic Map) that contains varying amounts (up to about 10%) of angular, gravel to cobble-size fragments of quartzite derived from older bedrock that now forms discontinuous exposures along the ridgeline to the north of the project area. These older alluvial soils are commonly dark yellowish-brown to strong brown in color, are very dense (i.e.