

Class I Cultural Resources Inventory of the Salton Sea Region

August 2002



The Salton Sea Authority
La Quinta, California

Prepared for:

The U.S. Department of the Interior
Bureau of Reclamation
Boulder City, Nevada

Prepared by:
Tetra Tech, Inc.
San Bernardino, California
Albuquerque, New Mexico

**CLASS I CULTURAL RESOURCES INVENTORY
OF THE SALTON SEA REGION**

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Prepared for:

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1.0 INTRODUCTION

This report presents the results of a Class I Cultural Resources Inventory conducted by Tetra Tech, Inc. as supporting documentation to the Environmental Impact Statement/Environmental Impact Report (EIS/EIR) for the Salton Sea Restoration Project. The report has been prepared to compile information on the cultural resources which may be affected by further actions conducted under the Salton Sea Restoration Project. Agency responsibilities with regard to cultural resources are addressed by a number of laws, regulations, executive orders, programmatic agreements and other requirements. The Class I Cultural Resources Inventory is an initial step in compliance with the National Historic Preservation Act (NHPA) of 1966, as amended (16 United States Code [USC] Section 470), and its implementing regulations (36 Code of Federal Regulations [CFR] 800). The inventory is a summary of cultural resources literature, records, and other documents for the region within or near the proposed project area. This inclusive summary is placed into a context of environmental conditions, biotic communities, and geologic surroundings. Together, this background information allows researchers to assess potential management issues, develop predictive models anticipating future concerns, develop historic contexts for evaluating resources for listing on the National Register of Historic Places, and provide a host of other management recommendations.

1.1 INVENTORY BACKGROUND

The Salton Trough is a closed hydrologic basin which has periodically filled and emptied during the last several million years, with the most recent high stand in 1750 A.D. (Wilkie, 1978; Schaefer, 1986; Laylander, 1997). The Salton Sea, an accidental replica of this natural process, was produced when a manmade levee broke and the Colorado River flooded the trough between 1905 and 1907. The Salton Sea currently occupies about half of the area intermittently inundated by this ancient lake, alternatively known as the Blake Sea, Lake Le Conte and most commonly as Lake Cahuilla (McCown, 2001). (The term Lake Cahuilla is used throughout this document). The Sea now exists primarily due to continued agricultural drainage from the Imperial, Coachella, and Mexicali valleys and smaller contributions from municipal effluent and stormwater runoff. The Sea is enriched in dissolved nutrients that stimulate the growth of aquatic life, usually resulting in the reduction of dissolved oxygen. Currently, the Sea has a productive sport fishery and provides important migratory and resident bird habitat within the Pacific Flyway for millions of birds. Several endangered animal species, including the desert pupfish, brown pelican, and the Yuma clapper rail, inhabit the Salton Sea or adjacent habitats.

The Salton Sea ecosystem is under stress from increasing salinity, nutrient loading, oxygen depletion, and temperature fluctuations that may be threatening the reproductive ability of some biota, particularly sportfish species, and also causing additional ecosystem health problems. There are indications that the deteriorating environmental conditions may be contributing to the prominence of fish deaths and avian disease at the Sea. Without restoration, the ecosystem at the Sea will continue to deteriorate.

In 1992, Congress passed Public Law (PL) 102-575, directing the Secretary of the Interior to "conduct a research project for the development of a method or combination of methods to reduce and control salinity, provide endangered species habitat, enhance fisheries, and protect human recreational values in the area of the Salton Sea." The Salton Sea Reclamation Act of 1998 (PL 105-372) was passed to further the restoration process. This act directs the Secretary of Interior to "complete all studies, including, but not limited to environmental and other reviews, of the feasibility and benefit-cost of various options that permit the continued use of the Salton Sea as a reservoir for irrigation drainage and: (1) reduce and stabilize the overall salinity of the Salton Sea; (2) stabilize the surface elevation of the Salton Sea; (3) reclaim, in the long term, healthy fish and wildlife resources and their habitats; and (4) enhance the potential for recreational uses and economic developments of the Salton Sea" (Tetra Tech, Inc., 2000).

Developing the Salton Sea Restoration Project requires compliance with a variety of Federal, state and local laws, regulations, and requirements including the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA). To satisfy NEPA and CEQA requirements, the US Department of the Interior Bureau of Reclamation (Reclamation) and the Salton Sea Authority (Authority) contracted Tetra Tech, Inc., to complete an (EIS/EIR). The EIS/EIR describes the existing environmental and socioeconomic conditions near the Salton Sea, and the environmental consequences of the project alternatives, including the consequences of no action. In support of the EIS/EIR, and to adequately characterize the existing conditions and potential impacts to cultural resources from restoration activities, a Draft Class I Inventory was prepared and delivered in December of 1999. This inventory describes known and purported archaeological, architectural, and Native American resources within a five-mile buffer zone of the Salton Sea.

A Draft EIS/EIR was published in January of 2000. Agency and public comments on the Draft EIR/EIS have led to proposals to change the project alternatives under consideration to meet project goals and objectives. Current efforts on the project include a reassessment and revision of alternatives developed under the previous phases and an updated strategy to complete all requirements for compliance with NEPA and CEQA. In turn, the study area for the Class I Inventory has been extended beyond the original five-mile buffer zone. (Figure 1.1-1)

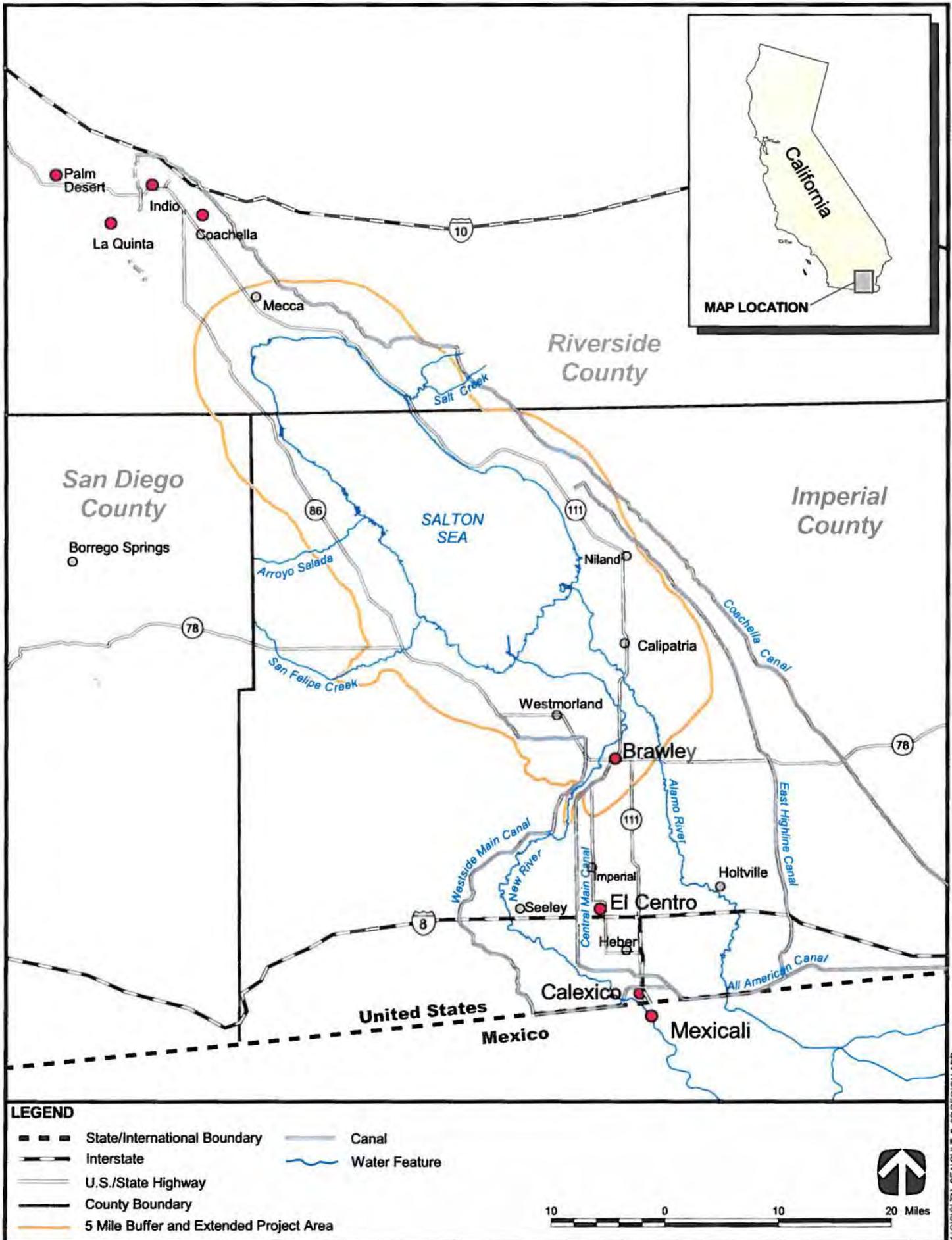


Figure 1.1-1 Salton Sea Regional Vicinity Map.



1.2 STUDY AREA

The study area for this Class I Cultural Resources Inventory encompasses much of the northern region of the Salton Trough in the vicinity of the Salton Sea. This trough is a large northwest to southeast depression within the Colorado Desert, occupying the south central portion of Riverside County, the northeast corner of San Diego County, the west central section of Imperial County and the central portion of northeastern Baja California. Historic maps show the trough to include Coachella, Imperial, and Mexicali Valleys. The west edge of the study area within the Salton Trough lies along the foot of the Jacumba, In-Ko-Pah, Coyote, Fish Creek, Vallecitos, and Santa Rosa Mountains. The north sector is in the southernmost portion of the Coachella Valley, along the west edge of the Orocopia and Chocolate Mountains and the central portion of the East Mesa Sand Hills. The southernmost portion of the study area extends up to 15 miles south of the Salton Sea (Wilkie, 1978; Schaefer, 1986; Laylander, 1997). (Figure 1.1-1).

Due to the scale of the Salton Sea Restoration Project, this inventory includes all of the area within the original five-mile wide buffer zone extending from the shore of the present Salton Sea, including the Sea itself and the extended project area below the -80' MSL elevation contour. This zone encompasses areas that may be impacted by Restoration Project Alternatives currently under consideration and their associated actions. Cultural resources located outside of the defined project were included in the data gathering and review effort when they inform the discussion of the regional resources or were geographically close to project areas which have not been surveyed.

1.3 RESULTS OF INVENTORY: A SUMMARY

A total of 1251 resources were identified as a result of this Class I Cultural Resources Inventory. The inventory includes 1179 confirmed cultural locations. Numerous purported cultural resources, including Native American villages, rancherias, agricultural fields, and trail segments; a post-contact salt mining and processing facility; numerous post-contact houses; a school; bridges; road segments; and railroad segments were identified on U.S. General Land Office plat maps from the 19th and early-20th centuries. Many of these sites are located in areas now submerged beneath the Sea. In addition to these purported cultural resources, 16 geological/natural localities with potential to have associated cultural resources have been identified through historic survey records. Research has also indicated that 24 World War II-era military aircraft crash sites exist in and around the Sea.

Native American traditional and religious use areas are present, but are not well enumerated or formally recorded as such in the Salton Sea area. During initial tribal contacts conducted in 1999, no specific Native American sacred sites, Traditional Cultural Properties or Traditional Use Areas were identified

within the original 5-mile buffer zone. Further data gathering and formal government-to government consultations with affected communities TCP and TUA issues will be conducted in conjunction with specific future Salton Sea Restoration Project activities.

Of the 1179 identified resources, 1064 are precontact sites, 4 are contact-era sites, 30 are multi-component sites, 72 are post-contact sites, and 9 sites are of unknown age. Of these 25 identified post-contact resources consist of or include standing buildings or engineering structures. One hundred and eighteen resources within the study area have been recommended or determined eligible for listing on the National Register of Historic Places (NRHP). Seventy-five of these sites are contributing elements of the Southwest Lake Cahuilla Recessional Shoreline Archaeological District, located within the boundaries of the former U.S. Navy Salton Sea Test Base. Three of the NRHP-eligible precontact sites are part of the Seventeen Palms Archaeological District. Among the 25 post-contact architectural/engineering resources, 3 early-20th century Indian Agency buildings located on the Torres-Martinez Reservation have been listed on the NRHP since 1973 as contributing elements of the Martinez Historical District.

1.4 REPORT ORGANIZATION

This report is organized into nine chapters and three appendices detailing the methods and results of the current inventory. Chapter 1 introduces the Class I Cultural Resources Inventory, summarizes the results and contents of the inventory, and presents general terminology used throughout the report. Chapters 2 details the methodology used for each of the inventory tasks. Chapter 3 and 4 present the environmental and cultural settings of the region, respectively. Chapter 5 details research contexts and questions used in the report to focus analyses, and which can guide future research in the region. Chapter 6 characterizes the results of the inventory. Chapter 7 discusses site distribution patterns and predictions, while providing recommendations for future cultural resource management activities. Chapter 8 lists references cited in the report and Chapter 9 lists the personnel involved with its compilation.

Appendix A contains an abridged print out of the confidential cultural resources database constructed for the project. Appendix B contains a bibliography of archaeological investigations conducted within the five-mile buffer zone and extended project area. Information in Appendix A is confidential and can only be revealed to persons who have the expressed permission of the California Office of Historic Preservation to view these documents. As such, Appendix A will not be included in reports given to the public. This measure is taken as a precaution for the protection of cultural resources of this region.

1.5 GENERAL TERMINOLOGY

The terms *Salton Basin* and *Salton Trough* are often used interchangeably, although technically speaking the two regions they describe are not the same. The Salton Trough is a much more comprehensive term which includes all of the area between the two major peninsular ranges of the region, and extends down into the Gulf of California as described in Section 1.2. The Salton Basin only includes the area in which Lake Cahuilla rose to highstand. The highstand of this ancient shoreline is estimated to have been at 42 feet above mean sea level.

In this report, the terms *precontact* and *post-contact* are used in place of the traditional terms prehistoric and historic. Precontact resources are recognized as those attributed to Native American groups who occupied the region before contact with Europeans. Post-contact resources are those associated primarily with Europeans and/or Americans. These resources are more than 50 years old, but date to after the time of contact between Native Americans and Europeans. Although a few explorers traversed the region earlier, in California the time of contact between Native Americans and Europeans is generally identified as the 1770s.

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2.0 METHODOLOGY

This section presents methods used for data collection purposes for the Salton Sea Restoration Project Class I Cultural Resources Inventory. Six main tasks were performed during data gathering and analysis efforts: archaeological records search, ethnographic literature review, Native American data gathering, archival research, construction and maintenance of a cultural resources database, and data analysis. This work was conducted initially in 1999 for resources within the five-mile buffer area around the Salton Sea and during 2001 and 2002 for subsequently recorded resources within the buffer zone and resources within the extended project study area. Details of these tasks and technical terminology used in the current report are discussed below.

2.1 CULTURAL RESOURCE RECORD SEARCHES

Cultural resources record searches were conducted for the portions of Imperial, Riverside, and San Diego counties that lie within the five-mile buffer area and the extended project area around the Salton Sea. Visits were made to two offices of the Office of Historic Preservation (OHP), California Historical Resources Information System (CHRIS). Records for all resources within the project area and selected relevant records in adjacent areas were reviewed and copied. After removing isolate records, the total number of resource records entered in the site databases was 1251. The Imperial county record searches were completed at the Southeast Information Center (SEIC) located in Ocotillo, California and were performed by Kevin T. Doyle, Brenda D. Smith, Cary D. Cotterman, and Daniel T. Falt of Tetra Tech, Inc. and Gary Resvaloso, Torres Martinez tribal member. Additional tasks were performed by SEIC staff members, Karen Collins and Michael Pflaum. A total of 1149 site records were reviewed and photocopied during the SEIC searches: 1072 were archaeological sites, 57 were purported (archivally derived) resources, 4 were architectural resources, and 16 were geological features that were recorded during the 1856 U.S. General Land Office (USGLO) survey of the region (Table 2.1-1). A list of technical reports detailing results of archaeological investigations conducted within the project area was also generated during the record search. This list was reviewed to determine which reports would be most pertinent to the goals of the current cultural resources inventory. Select study reports were examined to extract appropriate data useful for compilation of this Class I Inventory report.

The Riverside county record search was conducted at the Eastern Information Center (EIC) located at the University of California, Riverside. During visits to the EIC, 96 cultural resource records were collected, of which 83 were archaeological sites and 13 architectural resources (Table 5.1-1). The EIC record search was conducted by Brenda D. Smith and Valerie Van Hemelryck of Tetra Tech, Inc. who were aided by

Kay White of the EIC. An archaeological report list was also generated at the EIC for determination of which investigations would contribute the most relevant data to the current project. The record search for San Diego county was performed by personnel at the South Coastal Information Center (SCIC) located at San Diego State University. This record search identified 6 San Diego county archaeological sites located within the five-mile buffer area (Table 5.1-1).

In addition to reviewing archaeological site records at each Information Center, other data sources were inspected for identification of cultural resources. These supplementary sources included the National Register of Historic Places, the California Register of Historical Resources, National Historic Landmarks, California Historical Landmarks, and California Historical Points of Interest.

**Table 2.1-1
Cultural Resources Identified Through Record Searches Conducted for Class I Inventory**

COUNTY	ARCHAEOLOGICAL SITES	PURPORTED RESOURCES	ARCHITECTURAL RESOURCES	OTHER RESOURCES	TOTAL
Imperial	1072	57	4	16	1149
Riverside	83	-	13	-	96
San Diego	6	-	-	-	6
Total	1162	57	17	16	1251

2.2 ETHNOGRAPHIC LITERATURE REVIEW

An ethnographic literature review was conducted as a means of identifying cultural resources not formally recorded through CHRIS. Maps gathered from ethnographic sources showing ethnographically recorded villages and other use areas (Bean and Vane, 1991; Strong, 1929) were digitized and added to the Salton Sea Geographic Information System (GIS) maintained by Tetra Tech. These data were then used to generate resource maps which were analyzed to identify previously unrecorded resources, to determine overlap of formally recorded archaeological resources, and to reveal patterns in site density and distribution. Through these efforts, previously unidentified cultural resources were located.

2.3 NATIVE AMERICAN RESOURCES DATA GATHERING

Native American data gathering was conducted in 1999 as an additional means of identifying cultural resources located within the five-mile buffer area that have not been formally recorded through CHRIS. Data gathering efforts were geared towards locating unrecorded archaeological sites, traditional cultural properties (TCPs), traditional use areas (TUAs), and sacred sites. Further data gathering through tribal contacts will be conducted in conjunction with specific future Salton Sea Restoration Project activities.

Twenty-eight contemporary tribal groups (Table 2.3-1) were identified as having traditional ties to the Salton Sea region. These groups were identified in consultation with Bureau of Reclamation, Bureau of Indian Affairs, and the Native American Heritage Commission as being the groups most reasonable to contact for consultation regarding the current project. Each of the groups was contacted by letter from the Bureau of Reclamation to initiate consultation with regard to ethnographic resources that may be affected by the Salton Sea Reclamation project. Additionally, the Kumeyaay Cultural Repatriation Committee (KCRC), a consortium of twelve Ipai-Tipai bands of the Kumeyaay nation, was contacted at the request of some of the Kumeyaay groups initially contacted. The KCRC acts as a representative for Native American Graves Protection and Repatriation Act (NAGRA) and other cultural issues on behalf of the groups affiliated with the committee.

Follow-up phone calls were made by cultural resources personnel from Tetra Tech, Inc. to ensure that each tribe and the KCRC had an opportunity to directly express their concerns for implementation of the Salton Sea Restoration Project and contribute to the Class I Cultural Resources Inventory. Questionnaires were faxed to groups that were difficult to contact by phone, as an alternative means for them to express their concerns. If follow-up phone calls were thought by a tribe to be insufficient as a means of documenting the tribe's concerns and getting input for the project, meetings were scheduled with the tribe to further discuss their concerns regarding identification and potential impacts to cultural and ethnographic resources. Tribes were encouraged to formally document their concerns by submitting written comments to the Bureau of Reclamation and to Tetra Tech, Inc. All tribal comments were added to the project's Native American data gathering files and were included in the summary document entitled Salton Sea Restoration Project: Contacts with Native American Groups (Smith et al., 2000). Discussion of newly identified cultural resources as a result of this data gathering is included in this report. Additional information on the use and meaning of these lands has been developed by independent consultants with strong ties to the contemporary Native American communities and is incorporated in this document.

**Table 2.3-1
Tribal Groups/Organizations Contacted for Salton Sea Restoration Project Data Gathering Efforts**

TRIBAL ORGANIZATION	TRIBAL AFFILIATION	INITIAL POINT OF CONTACT
Agua Caliente Tribal Council	Cahuilla	Richard Milanovich, Chairperson
Augustine Band of Mission Indians	Cahuilla	Maryann Martin, Chairperson
Cabazon Band of Mission Indians	Cahuilla	John A. James, Chairperson
Cahuilla Band of Indians	Cahuilla	Michelle Salgado, Spokesperson
Campo Band of Mission Indians	Tipai	Ralph Goff, Chairperson
Chemehuevi Tribal Council	Chemehuevi	Girjle Dunlap, Chairperson

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TRIBAL ORGANIZATION	TRIBAL AFFILIATION	INITIAL POINT OF CONTACT
Cocopah Tribal Office	Cocopah	Sherry Cordova, Chairperson
Colorado River Indian Tribes	Chemehuevi, Mohave	Daniel Eddy, Jr., Chairperson
Cuyapaipe Band of Mission Indians	Tipai	Tony J. Pinto, Chairperson
Ft. McDowell Mohave-Apache Community Council	Apache, Mohave	Bernadine Boyd, President
Ft. Mojave Tribal Council	Mohave	Nora Helton, Chairperson
Inaja-Cosmit Band of Mission Indians	Ipai-Tipai	Rebecca Maxcy, Chairperson
Jamul Indian Village	Tipai	Kenneth Meza, Chairperson
Kumeyaay Cultural Repatriation Committee	Kumeyaay	Steve Banegas, Spokesperson
La Jolla Indian Reservation	Luißeño	Jack Musick, Chairperson
La Posta Band of Mission Indians	Tipai	Gwendolyn Parada, Chairperson
Los Coyotes Band of Indians	Cahuilla	Katherine Saubel, Spokesperson
Manzanita General Council	Tipai	Leroy Elliott, Chairperson
Morongo Band	Cahuilla, Cupeño, Serrano	Mary Ann Andreas, Chairperson
Pala Band of Mission Indians	Ipai, Cupeño, Luißeño	Robert Smith, Chairperson
Quechan Tribal Council	Quechan	Mike Jackson, Sr., President
Ramona Band of Indians	Cahuilla	Manuel Hamilton, Representative
Santa Rosa Band of Mission Indians	Cahuilla	Anthony Largo, Chairperson
Santa Ysabel Band of Diegueño Indians	Ipai-Tipai	Ben Scerato, Chairperson
Soboba Band of Mission Indians	Cahuilla, Luißeño	Robert Salgado, Sr., Spokesperson
Sycuan Business Committee	Tipai	Georgia Tucker, Chairperson
Torres Martinez Desert Cahuilla Indians	Cahuilla	Mary E. Belardo, Chairperson
Twenty Nine Palms Band of Mission Indians	Chemehuevi, Luißeño	Dean Mike, Chairperson
Viejas Band of Mission Indians	Ipai-Tipai	Anthony Pico, Chairperson

2.4 ARCHIVAL RESEARCH

Archival research was conducted through the Rivera Library located at the University of California, Riverside and the Pfau Library located at California State University San Bernardino. The history of the Salton Sea region was researched through these institutions and data compiled was used to construct the historical account presented in Chapter 4. The Imperial Irrigation District and the Southeastern Information Center also supplied valuable historical information for the project.

United States General Land Office (USGLO) plat maps dating from the 1850s, 1890s, and early 1900s were inspected to identify resources not formally recorded as archaeological sites. These maps were reviewed at the Bureau of Land Management Office located in Riverside, California. Data from the USGLO plat maps were digitized and incorporated as individual resource layers into the Salton Sea GIS maintained by Tetra Tech, Inc. These layers were overlaid onto other data to determine if any resources from the plat maps were recorded through the CHRIS Information Centers or described ethnographically.

2.5 CULTURAL RESOURCES DATABASE

A cultural resources database was constructed to track resources located within the five-mile buffer area. Data was entered into an Excel spreadsheet for ease of data processing and was later converted into an Access format for data inquiry. Data was input into the following database categories:

State/County	Site trinomial
Site number	P or HRA number
Primary number	Area of site
Temporal indicator	Landform/geology
HRI number	Soil
USGS 7.5' Quadrangle	Vegetation community
UTM coordinates	Disturbances
Township	Date site recorded
Range	Site recorder
Section number	Report citation
Elevation	NRHP recommendation
Type of Investigation	NRHP status
Site type	District
Site sub-type	Study
Description	Notes/Remarks
Site constituents	Entered By
Collections made?	Date Entered
Use intensity range	

Once entered and formatted, data could be sorted as needed to fit the specific criteria of each analysis that was conducted for the inventory. Appendix A contains a printout of the database. Specific locational data for archaeological sites is included in the database printout. This information is confidential and not for public viewing or use.

It should be noted here that difficulties occurred in dealing with the quality of data available from archaeological site records. Problems primarily arose from older records, or legacy data as they are often called. These records are generally inadequate by today's standards in terms of the data they contain. Rarely do they provide data for all the cultural resources database categories used for the current project, sometimes not even providing basic site information such as location and site constituents. Many of these sites were investigated by amateur archaeologists or enthusiasts rather than by trained scientists. One

example of such an investigation was a "prehistoric burial" that was excavated by a Boy Scout troop in 1950. An incomplete site record containing few details of what was recovered is all that exists for this site. No data regarding excavation methodology and results of the investigation are known to exist. Circumstances like those of this site are particularly unfortunate because few precontact-era burials have been identified and properly investigated in this region and any data collected in 1950 appears to have been lost, while the site most likely no longer exists.

While superior work is often done by avocationalists, the quality of records produced by both by professionals and amateurs in this data set is highly variable in terminology, detail, site boundary definition, functional interpretations, and familiarity with the local cultural and natural resources. A variety of site forms were used reflecting changing recording standards and practices through time and the multiple agencies and institutions which have conducted work in the area. In a majority of cases the current condition or simple existence of sites is not verifiable from the site record. When populating the database, the data as recorded by the field researcher was included with minimal editing. Inadequacies and inaccuracies in site record data were accounted for, to the extent possible, by including all known data in the database and then comparing these data to other sources. If data could not be reconciled, notation of the problem was made in the database and taken into account during analyses.

2.6 DATA ANALYSIS

A variety of software applications were utilized during the analysis of data gathered during the course of this project. The software used was dependent on the complexity of each analysis. Rapid import and export of the data was facilitated by the creation of simple tab-delimited text versions of the database. Counts, percentages, limited inquiries, and preliminary data sorts were parsimoniously calculated utilizing Microsoft Excel spreadsheet software or simply hand calculators. Microsoft Access relational database software allowed for more complex data queries utilizing a simple graphical user interface. ArcView GIS software proved to be of significant utility in the graphical representation of the data. With ArcView, maps were generated to examine the geographic relationships between resources. Generated maps also allowed researchers to identify relative site density and distribution patterns. Also, maps allowed researchers to examine any possible correlation between elevation, topographic features, and site location. Because the database included Universal Transverse Mercator location data for each site, data could be readily incorporated into a GIS environment. This allowed researchers to examine more complex relationships, such as the location of recorded precontact fish traps in comparison to the current Salton Sea shoreline.

2.6.1 Terminology

Specific or unique technical terminology used in the data analysis are defined below:

Use Intensity/Use Intensity Range. Use intensity is defined as “the extent to which a site was used, and is represented by the variety of activities within a site as indicated by cultural material diversity” (Smith, 1999:30). Use Intensity Range is an evaluation method designed to increase objectivity in typing of archaeological sites. Ideally, the result will be an unbiased figure which represents use intensity of a site and allows comparison. This method is particularly useful when analyzing a large number of sites recorded by different researchers over time. From a management standpoint, this approach is effective at revealing the cultural resources within a database for which additional investigation may be needed. Rather than simply relying on the label or an interpretation of the investigating archaeologist, use intensity, based strictly on site components, can expose those sites for which typological discrepancies exist. This is particularly important when trying to decipher whether the problem stems from poor interpretation by the investigator or the site’s constituents being inadequately accounted for in the documentation. Either case obscures the objectivity and accuracy archaeological site records need to have in order to be valuable analysis tools for cultural resource investigations.

For the current study, Use Intensity Ranges of sites were calculated by tallying total number of activities represented on a site as reflected through the artifact/feature categories on the site, regardless of the attributed significance of a particular artifact/feature category. All artifact/feature categories were given a value of 1 irrespective of the number of individual components within that category. Examples of precontact artifact categories include lithic scatter, pottery sherd fish traps, milling sites, rock art traits, and rock features. Post-contact artifact categories include refuse concentrations, road or trail segments, and mining or agriculture features.

Site Types. The site types used for the current study are defined below. Both precontact and post-contact resources were categorized as either *activity loci* or *habitation sites*. Activity loci are locations that were used for one or two specific activities other than habitation. Precontact activity loci can include lithic scatters, pottery sherd scatters, rock features, milling stations, fish traps, rock art, trails, quarries, or any sites that contain up to two of these types of artifact/feature categories. Post-contact activity loci can include refuse concentrations; wagon roads or trails; railroad, mining, or agricultural sites; and commercial/business sites, such as stores, cafes, post offices, schools, or churches.

Habitation sites must be defined separately for precontact and post-contact resources, due to the different nature of these two types of sites. For post-contact resources, sites reflecting occupation are considered

habitation sites. These would include homesteads, camp sites, and sites with remains of residential structures. Precontact habitation sites are sites that include features or artifacts that reflect three or more activities on the sites, indicating longer occupation or reuse of the site. An example is a site that contains lithic materials, milling features, and fish traps. For the purposes of analyses and comparison, precontact habitation sites were further divided into *temporary camps*, *limited habitation sites*, and *large habitation sites*. These are defined below:

- *Temporary Camp*. A location at which temporary habitation is evidenced by a use intensity range of three or four recorded activities;
- *Limited Habitation Site*. A location at which limited habitation or limited reuse is evidenced by a use intensity range of five to eight recorded activities; and
- *Large Habitation Site*. A location at which a large or long-term occupation is evidenced by a high use intensity range of nine or more recorded activities.

While this site typology is a construct that may not reflect actual patterns of use, it does allow for ready comparison of large numbers of sites that may contain varied components. For example, any precontact sites containing just lithic scatters, just fish traps, or sites containing evidence of two activities such as a fish trap and pottery sherds, or a hearth with milling features, would be classified as activity loci. Evidence of three or four precontact activities yields a classification of temporary camp. Five to eight activities represented at a precontact site indicates a limited habitation site, and precontact sites with evidence of nine or more activities are classified as large habitation sites. Likewise, post-contact resources can be analyzed by the two separate categories of activity loci versus habitation sites.



3.0 ENVIRONMENTAL SETTING

Because the study area for the Salton Sea Restoration Project Class I Inventory encompasses much of southern California's Salton Trough, that region will be the focus for discussions of the past and present environments. This geologic trough, a depression approximately 130 miles long and as much as 70 miles wide, lies in the deserts of Riverside, Imperial, and San Diego counties and extends south into Baja California. The trough is bound on the west by the Vallecito, Jacumba, and Santa Rosa Mountains, on the north-northeast by the Orocopia and Chocolate Mountains, to the southeast by the Sand Hills and Cargo Muchacho Mountains, and on the south the Laguna Salada. The highest point in the region is Blue Angel Peak in the Jacumba Mountains at 4,284 feet above mean sea level. The lowest point in the region is the bottom of the trough at 287 feet below mean sea level (Blake, 1914). Major topographic features of the basin are shown on Figure 3.0-1.

3.1 PALEOENVIRONMENT

The ancient geology of the Salton Trough consists of a variety of rock and sediment formations. These formations were produced throughout the past 11 million years during numerous events of marine and fresh water inundation and intermediate periods of drying. Sediments in these formations are predominantly clays and silts deposited as near-horizontal layers on the trough floor. Up to 20,000 feet of marine and non-marine sedimentary deposits have accumulated in the trough from erosion of nearby mountains and from sediment-burdened alluvial flows of the Colorado River. The thickest set of such deposits are located occur south of present-day Brawley. The oldest rocks of the region lie on the periphery of the Salton Basin and include of Precambrian crystalline gneisses, anorthosites, and schists that have been intruded by several younger plutonic bodies (ranging from late Paleozoic to middle Cenozoic age) (Norris and Webb, 1976). Such rocks occur in the Chocolate, Cargo Muchacho, and Orocopia mountains, and at Pilot Knob, an isolated hill near the international border with Mexico.

Several major geologic formations are found in the Salton Basin. These include the Imperial, Borrego, Palm Springs, Brawley, and Lake Cahuilla Formations. Each holds fossils and sediments that relate to the specific kinds of habitats that contributed to their deposition. On the southwest end of the Salton Trough, exposure of the Imperial Formation has revealed marine sediments deposited approximately 7 million years ago that contain approximately 200 invertebrate and vertebrate species, including bat rays, sharks, giant barracudas, and whales (Scheonherr, 1992). Also included in the Imperial Formation sediments are mollusks from Caribbean waters, which presumably were deposited during a time when there was no land intervening between the Caribbean and the Gulf of California.

Eventually, the region was cut off from marine water primarily by deposition of alluvial sediments in the delta of the Colorado River. (Loeltz *et al.*, 1975). After this region was separated from the ocean, it was episodically inundated by Colorado River flood flows diverted into the trough, also as the result of deltaic barrier formation (Busch, 1995). The Borrego Formation was deposited during the Pliocene and Pleistocene under such flood conditions. This formation, believed to be the lacustral equivalent of the Palm Springs Formation (Jennings, 1967), is composed of gray clay, interbedded sandstone, and fossils of mollusks, ostracods, and Foraminifera (Morton, 1977). These fossils are indicative of lake habitats that existed during the Pliocene and Pleistocene. The Palm Springs Formation consists of pink-gray laminated sandstone that was deposited between 4 to 1.5 million years ago and contains one of the most detailed Pliocene terrestrial vertebrates records in the Southwest (Scheonherr, 1992). Vertebrate fossils from the Palm Springs Formation include camels, llamas, horses, donkeys, mammoths, mastodons, sloths, zebras, lions, sabertooth cats, and bears (Scheonherr, 1992).

The Brawley Formation developed during the Pleistocene from both lake and terrestrial habitats (Downs and Woodard, 1961; Morton, 1977). It extends into the Salton Trough north of Bombay Beach, in the Bat Caves Buttes region, and also in the western portion of the Salton Sea Test Base. Brawley Formation fossils include both vertebrate and invertebrate taxa, such as pelecypods, gastropods, freshwater mussel (*Anodonta* sp.), freshwater clam (*Corbicula* sp.), razorback sucker (*Xyrauchen texanus*), bonytail (*Gila elegans*), teleosts, western pond turtle (*Clemmys marmorata*), and Iguanidae (Jefferson, 1991a). Rancholabrean mammals have been collected from this formation in Imperial County and include mammoth (*Mammuthus* sp.), deer (*Cervidae*), horse (*Equus* sp.), camel (*Camelops* sp.), and bison (*Bison antiquus*) (Jefferson, 1991b).

Intermittent freshwater lake and lagoon habitats similar to those discussed above lasted well into the Holocene, and some, such as Mesquite Lake, Blue Lake and Silsbee Lake persisted in the Salton Trough into the twentieth century. Sediments deposited in the Salton Trough over eons developed the Lake Cahuilla Formation, of weakly consolidated siltstones and clays as thick as 300 feet on the bottom of Lake Cahuilla. The shoreline of this ancient lake can be seen along the base of the Santa Rosa Mountains on the northwest trough in algae-excreted lime deposits to 43 ft above mean sea level. From this early period of transition, ancient sand bars, and sand spits and beaches, as well as wave cut cliffs and ledges can be found. Within the last 2,000 years, the Salton Trough is believed to have been filled to highstand level at least five times (Smith, 1999; Laylander, 1997, Wilke, 1978).

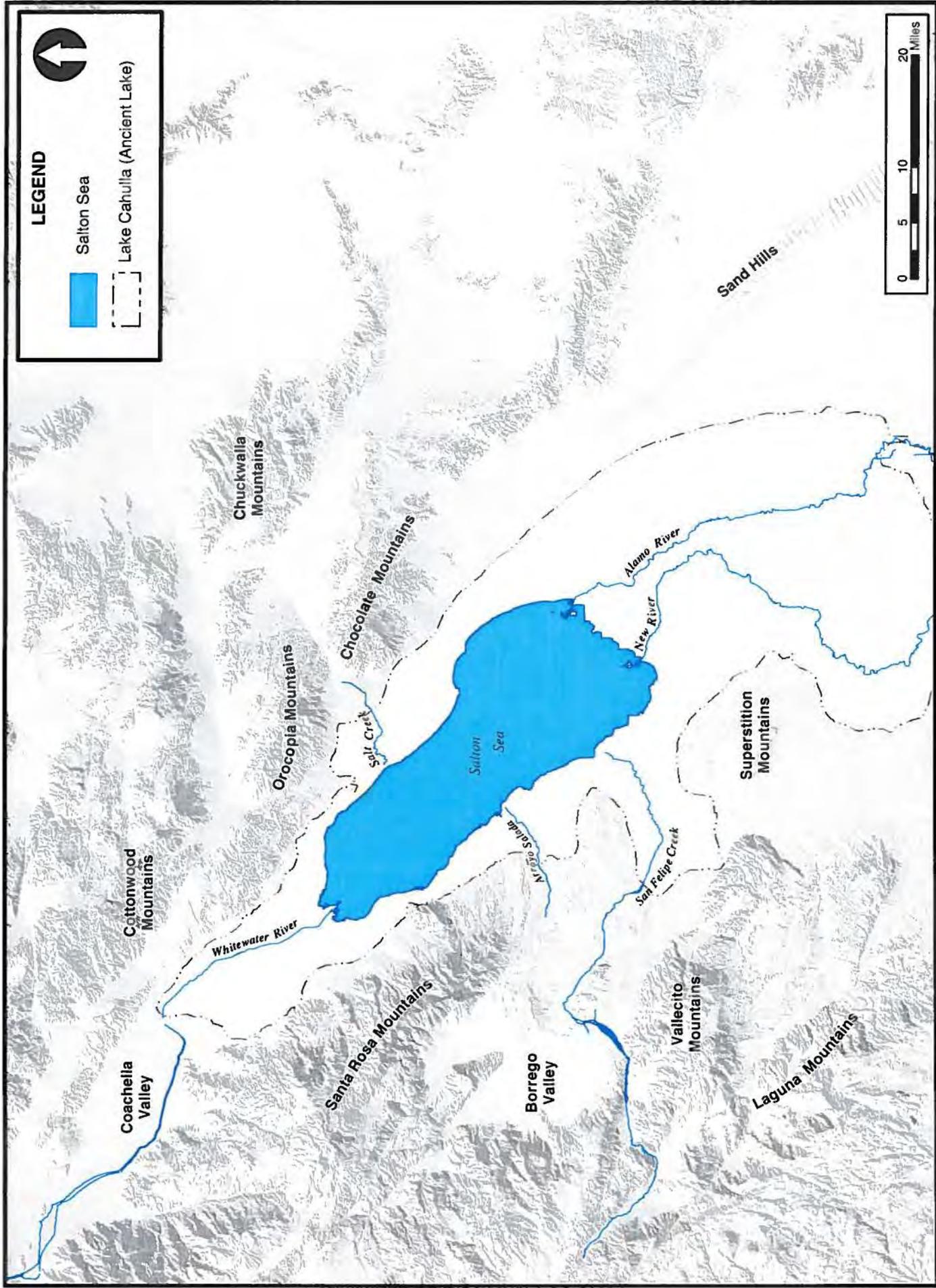


Figure 3.0-1 Topographic Features of the Salton Basin



During times when Lake Cahuilla was present in the Salton Trough, environmental conditions in the valley were significantly different from times of aridity and desiccation. Large wetland areas developed around the lake, much as they exist today around the Salton Sea. These wetlands would have provided an ample supply of vegetal resources, which could be used for food, tool production, and building of structures by precontact inhabitants. The lake, with its associated wetlands, also provided humans with a variety of faunal resources.

This huge body of water attracted countless bird species and other wildlife in search of food and water along the Pacific Flyway. Birds attracted to the region by the ancient lake included a variety of duck, grebes, coots, pelicans, geese, and gulls. Mammals present during Lake Cahuilla times were mainly those of modern times, including bighorn sheep (*Ovis canadensis*), mountain lion (*Felis concolor*), coyote (*Canis latrans*), and various rodents. Remains of Lake Cahuilla vertebrates and invertebrates are commonly found in archaeological sites associated with the ancient lake.

Likewise, evidence of a multitude of Colorado River fish species have been found in the lake and were exploited by humans. The Lake Cahuilla Formation is known to contain abundant non-marine fossils (Jennings, 1967), similar to those found within the Brawley Formation. Shellfish and Colorado River fish, including freshwater mussel (*Anodonta*), gastropods, freshwater clam (*Corbicula*), Razorback sucker (*Xyrauchen texanus*), and Bonytail (*Gila elegans*) were abundant in Lake Cahuilla

Lake Cahuilla provided the region's inhabitants with an incredibly rich and varied selection of resources, and attracted many groups from the surrounding desert. As the ancient lake evaporated, playas formed that contained important resources such as salts and minerals. Desiccation of the lake exposed other resources like the Quaternary rhyolite, pumice, and obsidian outcrops on the southeastern shore of the present Salton Sea. These outcrops extend from Mullet Island to Obsidian Butte [BDS1] and are estimated to be less than 50,000 years old (Jennings, 1967). Some of the volcanic domes which formed these deposits still produce warm gases which are mined through geothermal wells (Norris and Webb, 1976). Volcanic vents near Mullet Island are thought to have been mined in post-contact and probably precontact times for red and yellow ocher deposits that were formed by vent activity (Morton, 1977). Obsidian Butte was an important source of toolstone for native inhabitants far beyond the Salton Basin. Other unique geological formations in this area include tufa deposits. Tufa is a limestone concretion that forms underwater near areas with springs rich in calcium. In the Salton Trough, tufa can be found in areas once flooded by Ancient Lake Cahuilla.

Research on paleoenvironments of the Coachella and Imperial Valleys is almost non-existent outside the geologic context. Work with woodrat (*Neotoma* spp.) middens has aided in environmental reconstruction in regions throughout the world; however, for the Salton Trough, only one *Neotoma* midden sample has been recovered and analyzed. This came from Picacho Peak, California, located east of the Sea near the Colorado River and approximately 15 miles north of Yuma, Arizona. Data from this midden indicates that dominant plant species have become better adapted to increasing aridity of the post-glacial environment. The oldest date from Picacho Peak reveals an age of 13,400 years before present (BP) (van Devender, 1990). It appears that on this side of the Salton Trough there has been a gradual replacement of Joshua Tree woodland by Enriched Desert Scrub, consisting of creosote (*Larrea tridentata*), staghorn cholla (*Opuntia versicolor*), California barrel cactus (*Ferocactus wislizeni*), ocotillo (*Fourquieria splendens*), pygmy cedar (*Peucephyllum schottii*), ironwood (*Olneya tesota*), and desert brittle bush (*Encelia farinosa*).

In more mountainous areas, such as in the Santa Rosa Mountains on the west side of the Salton Trough, a similar pattern of plant community adaptation appears. In the early Holocene a more equable climate regime developed in the Sonoran Desert along with regularly occurring summertime monsoon rains (van Devender, 1990). These areas also experienced a gradual displacement of their glacial woodlands by desert scrub as a result of increasingly xeric climatic conditions of the Altithermal, a period of drying between 7,500 and 4,000 years BP. It appears that the coniferous woodland community that now dominates the 4,000 to 8,000 feet elevational range, was closer, and possibly as much as 3,300 feet lower in elevation (Martin and Mehringer, 1965; Flora of North America Association, 1999), to the area currently supporting desert scrub communities. These increasingly constant climatic conditions further changed the floristic character of the region, resulting in progressively enriched desert scrub communities, with stabilization of plant communities occurring around 4,000 years BP (Flora of North America Association, 1999).

3.2 PRESENT ENVIRONMENT

3.2.1 Physiography

The Salton Sea is a hypersaline lake that lies within the Salton Basin of southern California. The Sea was accidentally formed in 1905, when floodwaters overwhelmed irrigation canals built to divert water from the Colorado River. The full flow of the Colorado River emptied into the Salton Basin and in only two

years 350,000 acres of land had been flooded (Busch, 1995). The present sea thus represents an accidental replication of a process that has been occurring for thousands of years in this region.

The Salton Sea has a current water level of approximately 227 feet below mean sea level. It contains 7.5 million acre feet (maf) of water, and has a surface area of 376 square miles (Tetra Tech, Inc., 1999). Approximately 1.3 maf of water per year evaporates, which contributes to the Sea's high salinity level of 44,000 milligrams per liter (mg/L; 25% higher than sea water) (Tetra Tech, Inc., 1999). The current water level is maintained primarily by agricultural runoff. In the Imperial Valley, runoff is partially a result of the valley being a closed drainage system, in which most surface water drains into the Salton Basin rather than percolating into subsurface storage or evaporating. Drainage occurs primarily by way of natural rivers and creeks. These drainages include the Whitewater River, which drains the northeastern side of the Peninsular Ranges and the southeastern face of the Transverse Ranges; San Felipe Creek, which drains the central Peninsular Ranges; Salt Creek, which drains part of the Orocopia and Chocolate Mountains; and the New and Alamo Rivers, which drain the Imperial Valley. Some of these waterways (e.g. the New River) were typically dry prior to the flooding of the Salton Sea in 1905. The New River began to flow regularly as a result of the flooding and continues to flow today due to agricultural runoff from the U.S. and Mexico and from municipal and industrial wastes from Mexicali (Imperial Irrigation District, 1997). In addition to the natural rivers and creeks, several springs and seeps also occur in the project area and were important locations as desert oases to precontact as well as post-contact inhabitants.

At present, the Colorado River, through manmade diversions, is the primary source of water for the Salton Sea region. Ten major reservoirs along the Colorado River system provide over 50 million acre-feet of storage capacity, approximately four times the total average annual natural flow of the Colorado River (Montgomery Watson, 1995). Diversions to the Imperial and Coachella Valleys are through the All American Canal and Coachella Canal.

3.2.2 Tectonics

The Salton Trough, a rift valley or graben, is part of the Gulf of California Rift Zone, one of the most active seismic regions in the world (Tetra Tech, Inc., 1999). This region is characterized by numerous northwest-southeast trending fault zones and crustal rift areas. The major fault systems of the region are the San Andreas, to the east of the Trough, and the San Jacinto and Elsinore, to the west. Seismic activity in this region has produced innumerable events of uplift, tilting, folding, and crustal movement over millions of years (Tetra Tech, Inc., 1999), including the slow subsidence of the Trough and the gradual rising of the surrounding lands (Busch, 1995). Subsidence of the Salton Trough is not readily apparent

because of the accumulation of approximately 20,000 feet of marine and non-marine sediment deposits that cover the original trough surface. Marine fossils are often be found buried under many thousands of feet of alluvial deposits as a result of this sediment accumulation.

3.2.3 Soils

Soil associations in the Salton Trough are grouped into two major categories: 1) soils of the basins; and 2) soils of the mesas, alluvial fans, terraces, and mountains rimming the basins. Basin soils generally vary from excessively drained to poorly drained sand, silt, clay, and loam on nearly level to rolling topography (U.S. Department of Agriculture Soil Conservation Service, 1981). Soils of the mesas, alluvial fans, terraces, and mountains are very deep, well drained to excessively drained, highly stratified clays (U.S. Department of Agriculture Soil Conservation Service, 1979, 1981).

3.2.4 Climate

Located within the Colorado Desert region, the Salton Sea area has a low-elevation desert climate, characterized by hot, dry summers and mild winters. Summer temperatures typically exceed 100 degrees Fahrenheit (°F), with winter low temperatures rarely dropping below 32°F. Rainfall in the basin averages approximately 3 inches per year, with most of the rainfall occurring from November through March. Summer monsoonal thunderstorms are also common in the region. Evaporation averages over 98 inches per year in Imperial Valley, while plant evapotranspiration is as high as 60 to 72 inches per year.

Imperial Valley was so named because the image of a "valley" was more appealing to potential settlers than the terms "trough " or "basin." A valley actually has an outlet for flowing water. The only hydrologic outlet for the Imperial Valley is through evaporation or percolation as it is a closed basin. The low profile of the Imperial Valley and surrounding areas in conjunction with extreme night and day temperatures, particularly in the summer months, produce variable winds and deep thermal circulation systems. The thermal systems facilitate general dispersion of local air pollution, in contrast to coastal basins where polluted inversion layers may remain for long periods of time (County of Imperial, 1996).

3.2.5 Floral Resources

The Salton Trough lies within the Sonoran Province of the Madrean Floristic Region of North America (Flora of North America Association, 1999). This province is further divided into the Sonoran Subprovince or Sonoran Desert, in which the Salton Sea region is found. The Sonoran Desert ranges from

Baja California and Sonora, north to the southern extent of the Mojave Desert and into southern Arizona, up to elevations of approximately 3,400 feet above sea level (Flora of North America Association, 1999). Because the Sonoran Desert is generally lower in elevation than the Mojave Desert, it is typically hotter and has more rainfall in the summer and milder temperatures in the winter (Flora of North America Association, 1999). These warmer temperatures are reflected in the flora of the region which is characterized as subtropical (Flora of North America Association, 1999).

Approximately 3,000 floral species are believed to occur in the Sonoran Desert, including at least 25 genera that are localized to this subprovince (Flora of North America Association, 1999; Turner *et al.*, 1995). Thirty-six plant species of the Salton Sea region are listed as sensitive species and are documented in the California Native Diversity Database. These special status species are listed as endangered, threatened, or rare by the United States Fish and Wildlife Service, the California Department of Fish and Game, or the California Native Plant Society. The sensitive species include Coachella Valley Milk-vetch (*Astragalus lentiginosus* var. *coachellae*), Orcutt's aster (*Xylorhiza orcuttii*), and Algodones Dunes Sunflower (*Helianthus niveus*) (Tetra Tech, Inc., 1999).

Five native plant communities have been identified in the region (Bureau of Land Management and California Department of Fish and Game, ca 1980; Schoenherr, 1992).

Saltbush Scrub. This community generally occurs in the lower elevations of the region and includes honey and screwbean mesquites (*Prosopis glandulosa*, *P. pubescens*) and saltbushes (i.e. *Atriplex canescens* and *A. polycarpa*). In extreme alkali soils, pickleweeds (*Salicornia* spp.) may be the only vegetation capable of existing in such a harsh environment.

Creosote Bush Scrub. This community lies below 2,500 feet elevation and is dominated by creosote bush (*Larrea tridentata*), desert brittlebush (*Encelia farinosa*), burrobrush (*Ambrosia dumosa*), and ocotillo (*Fourquieria splendens*). Creosote Bush Scrub is the most dominant plant community in California, inhabiting more than 21 million acres (Schoenherr, 1992).

Enriched Desert Scrub. This community lies between 1,000 and 4,000 feet elevation and contains agave (*Agave desertii*), desert brittlebush (*Encelia farinosa*), creosote bush (*Larrea tridentata*), cholla and beavertail cacti (i.e. *Opuntia basilaris*, *O. bigelovii*, and *O. erinacea*), Engelmann's hedgehog cactus (*Echinocerus engelmannii*), barrel cactus (*Ferocactus acanthodes*), ocotillo (*Fourquieria splendens*), and golden bush (*Haplopappus* spp.). Desert Agave (*Agave deserti*) may also be found within this community, but it is not common within the five-mile Salton Sea buffer area.

Desert Dry Wash Woodland. This community typically lies below 1,000 feet elevation and is dominated by palo verde (*Cercidium floridum*), desert willow (*Chilopsis linearis*), desert smoketree (*Dalea spinosa*), desert ironwood (*Olneya tesota*), honey mesquite (*Prosopis glandulosa*), catclaw acacia (*Acacia gregii*), cheesebush (*Hymenoclea salsola*), and desert lavender (*Hyptis emoryi*).

Fan Palm Oasis. This community is generally found below 3,000 feet at springs and permanent streams with high water tables. Plants common to this community include California fan palm (*Washingtonia filifera*), slender willow (*Salix exigua*), and fremont cottonwood (*Populus fremontii*).

3.2.6 Faunal Resources

Native animal species of the Salton Sea region include 401 bird species, over 20 species of mammals, and 24 species of herpetiles (Patten *et al.*, 2000; U.S. Fish and Wildlife Service, 1987). Special status species include 59 bird species, 15 mammal species, and 12 herpetile species. Among the animals having federal or state special status are Yuma Clapper Rail (*Rallus longirostris yumanensis*), Brown Pelican (*Pelicanus occidentalis*), Peregrine Falcon (*Falco peregrinus*), Bighorn Sheep (*Ovis canadensis*), California Leaf-nosed Bat (*Macrotus californicus*), Flat-tailed Horned Lizard (*Phrynosoma mcalli*), and Coachella Valley Fringe-toed Lizard (*Uma notata notata*). Three of the 43 species of fish known to occupy the Salton Sea are listed as federally endangered. These include the desert pupfish (*Cyprinodon macularius*), the razorback sucker (*Xyrauchen texanus*), and the unarmored three-spine stickleback (*Gasterosteus aculeatus williamsoni*).

In terms of wildlife, the Salton Sea region is best known as a haven and breeding ground for migratory birds. The bird community at the Sea is unique in many ways including supporting species such as the Yellow-footed Gull (*Larus livens*), a Mexican bird species that is only found at this one location in the United States. The Sea, a major stopover for birds using the Pacific Flyway during migration seasons and is believed to support at least 20 million birds annually (Patten *et al.*, 2000). The Sea likewise is an important breeding ground for species including Caspian Tern (*Sterna caspia*), Forster's Tern (*Sterna forsteri*), California Gull (*Larus californicus*), Black Skimmer (*Rhyncops niger*), and the largest breeding population of Western Gull-billed Terns (*Sterna nilotica vanrossemi*) in the United States. In addition, thousands of herons, egrets, and Double-crested Cormorants (*Phalacrocorax auritus*) breed annually at this location (Patten *et al.*, 2000; Tetra Tech, Inc., 1999).



4.0 CULTURAL SETTING

This chapter provides an overview and summary of the human use of the Salton Sea region. It is organized into three sections: Precontact History, Ethnohistory and Post-contact History.

4.1 PRECONTACT HISTORY

Though it is axiomatic that far Southern California remained as Hokan linguistic territory throughout its Prehistoric Period (Moratto, 1984; Laylander, 1985), Archaeologists have not found a linear construct for cultural chronologies for Colorado Desert generally. Each has acknowledged exceptions and ruptures in the record especially when viewing localized areas (Rogers, 1939, 1966; Wallace, 1980; Waters, 1982; Warren 1984; Cordell 1984; Schaefer, 1999). While researchers and field surveyors have tended to follow the adopted schemata most recently available to them, the general result has continued to produce a broken sequence of seemingly unrelated cultural blocks of inventoried material remains. Some threads of continuity suggesting a cultural evolution occurring through migration of people, invention or diffusion of ideas through trade (as with milling equipment, and use of bow and arrow) appear in certain regions, but with no origination from deep-time. Too, a general lack of stratigraphy at most desert sites plus the absence of an areal excavation program where subsurface material is suspected has denied the researcher a possible evolutionary base needed to connect the disparate parts of the prehistoric cultural landscape.

The archaeological table in current use (e.g., Schaefer, 1999) has no room for the once touted Malpais Culture that supposedly occupied the final 10,000 - 15,000 years of the Pleistocene Era in the far southwestern deserts (Minshall, 1976). Instead, the beginnings of human occupancy here accepts the Bering Straits crossing of 14,000 years ago. Within 2,000 years the Paleoindian Period has spread throughout California, possibly from major migrations out of Great Basin (Davis, 1968). From the south coast eastward into the Arizona desert, Malcolm Rogers' San Dieguito complex subsumed this Paleoindian broad period which Rogers' evidence saw passing through three stages of uneven change in response to the gradual warming and drying of the Holocene. By 9,000 years ago, this basically hunting culture had apparently died out. Following the San Dieguito, the native people of the Archaic Period adapted to the Holocene environmental shifts until the Patayan Period and its Yuman culture occupied the wide territory from North San Diego County across Salton Trough, along Lower Colorado River Basin, and up Gila River to what is now Gila Bend (Bee, 1989). Current archaeological researches place the opening of this final prehistoric phase at about 1075 years ago—or 925 A.D. Cordell, 1997) though linguistic evidence points to a Yuman migration out of Baja California at about 3000 B.C.

Settling the center of Salton Trough northward, Takic speakers of the Uto-Aztecan family tongue had moved westward with the Numic migration from Great Basin about 5,000 years ago (Fowler, 1972) interestingly coincident with the Yuman movement. They apparently moved unopposed to the coast, pushing ancient Hokan groups to both sides, and settling along a wide belt from the Sierras to Orange and Ventura counties. Within the north portion of Salton Trough the migrants, now known as Desert-Cahuilla, occupied Coachella and Indian Valleys. The rise of Lake Cahuilla about 700 A.D. forced the lowland settlers to move onto the mesa south of Santa Rosa Mountains or join other of their clan and moiety members to the northwest (von Werlhof, 2001). The Cahuilla and Yuman tribes both refocused adaptive desert strategies within the trough to that rise (Hurd and von Werlhof, 2001).

While native people could view as mere curiosities the non-threatening early probes of European explorers in the sixteenth and seventeenth centuries (Bolton, 1930), the long prehistoric era in Southern California ended quickly following Spain's twin expansion northward along the San Diego coast and up to the inland juncture of Colorado and Gila rivers in the late eighteenth century.

Adaptation had long been a survival strategy of the prehistoric inhabitants of Southern California deserts, but the submissive changes that historical forces required were outside the cultural processes that had guided native people through the previous ten millennia. Within eighty years of Captain Anza's incursion into Yuman prehistory the native people had become aliens in their own land. Adaptation no longer served to strengthen cultural bonds and traditions; the historical adaptive process was designed to destroy them. But after 150 years of unilateral rule, the historical process admitted the reawakened Pan Native movement into the already ethnically diversified society. The political process of forgetting allowed the Native process of remembering to become a strong force once more. The value of renewing the prehistoric past and preserving its material features fused with the recognition of Native rights to exercise ceremonial and spiritual traditions. Accepting their rights, ways and past as part of America's own diversity has become official policy.

4.1.1 The Paleoindian Period (12,000 to 7,000 Years BP)

The San Dieguito complex represents the Paleoindian Period in Colorado Desert. San Dieguito technology consisted of a wide array of bifaces, choppers, scrapers, crescents, and other tools associated with a hunting-gathering economy. In 1939, Malcolm Rogers first characterized this complex which Claude Warren later refined (1967) after conducting surface surveys and an excavation of the Harris site in San Diego County. Rogers distinguished three phases of San Dieguito tool production and use that depicted a developmental sequence towards increasing technological complexity and diversity. The

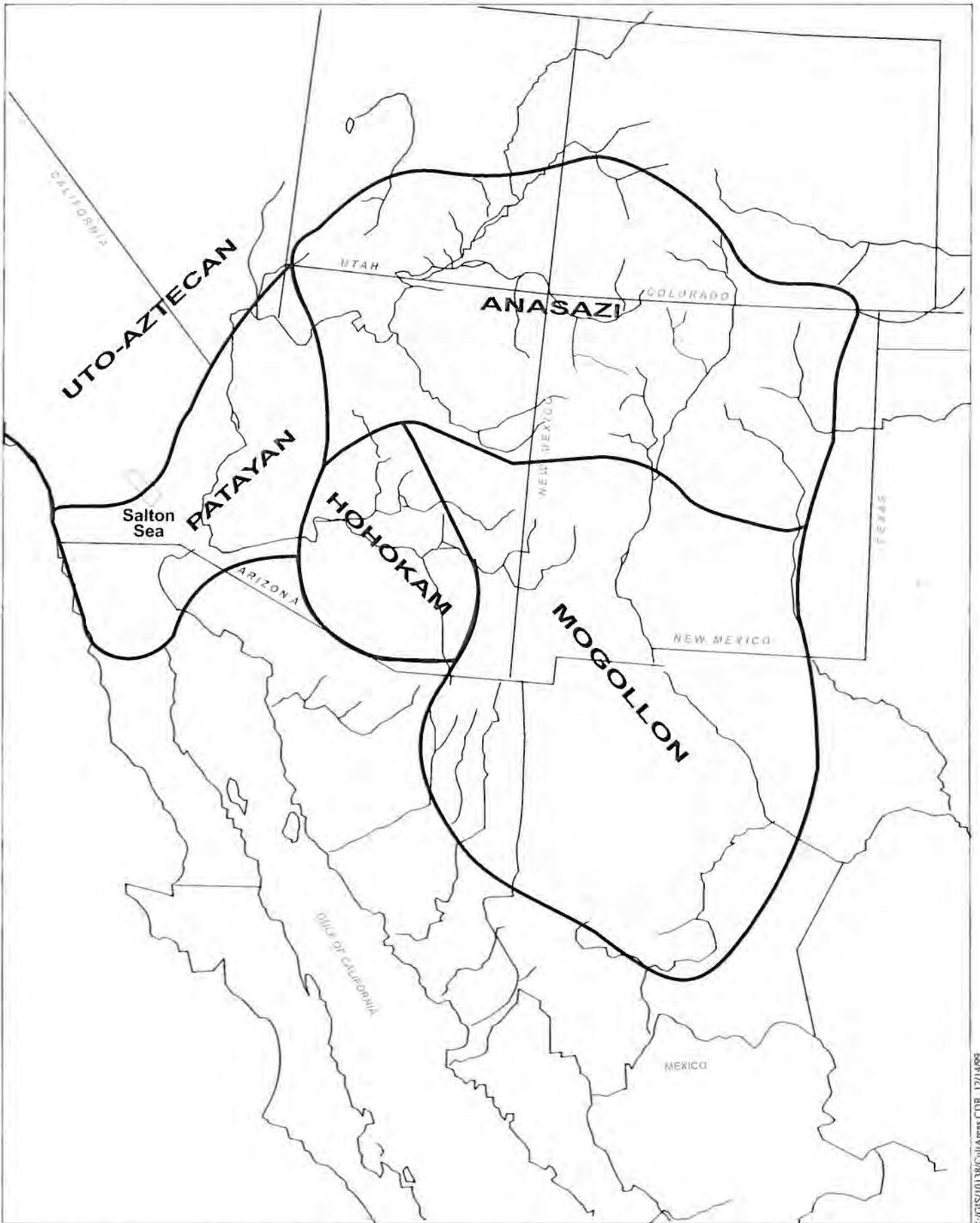


Figure 4.1-1 Precontact Culture Areas in the Southwest Region (Adapted from Cordell 1984)



earliest industry, termed San Dieguito I, consisted of chopping and scraping tools fashioned by percussion flaking. In these assemblages, spear points were crude and relatively rare. The later San Dieguito II and III industries tended to turn out greater amounts of finely flaked points, blades and other artifacts. Overall, the San Dieguito Complex shows strong affiliations with the Lake Mojave Complex to the north (Warren and True 1961). The similarity of these, and other Paleoindian industries led researchers to propose the Western Stemmed Point Tradition (WSPT), which subsumed both the San Dieguito and lake Mojave Complexes, and several other lithic industries throughout the Great Basin (Cordell, 1997). Radiocarbon dates from WSPT sites range between 11,200 and 7,500 years B.P. (Cordell, 1997). Faunal assemblages at these sites typically contain remains of artiodactyls, such as bighorn sheep, deer, and pronghorn; small game, as jackrabbits; and freshwater mollusks, indicative of exploitation of lake and marshland environments. The faunal evidence attests, at least in this region, to a generalized hunting-gathering adaptation similar to what researchers often consider to characterize the Archaic Period, not the focused adaptation to big-game hunting suspected for the Paleoindian Period in other regions. In all areas of Southern California, Paleoindian sites are rare, and generally consist of unstratified lithic scatters or rock features found on deflated desert pavements, near major drainage areas, or along shorelines of Pleistocene lakes (Apple et al., 1997). One stemmed Lake Mojave point, two crescentics, and one domed scraper were found at Salton Sea Test Base and may indicate a San Dieguito phase occupation of the Salton Sea region (Apple et al., 1997).

4.1.2 The Archaic Period (7,000 to 1,300 Years BP)

The Archaic Period is not well represented in Colorado Desert areas (Schaefer, 1994), and over the years there has been considerable debate over the proper designation and temporal ranges of the period. Most current researchers incorporate the Pinto and Gypsum periods as defined for Mojave Desert region (Warren and Crabtree, 1986) into the Archaic. Rogers included the Amargosa Tradition within this frame as well (1966) as did Hayden (1976). Jennings collected these parts into a Desert Culture (1973), but Cordell (1997) more appropriately labels the general period Archaic. Cordell also sees a linear transition linking the San Dieguito, Pinto, Gypsum, and Amargosa cultural materials into the Archaic term. While this continuum is possibly correct, and would support the linkage linguists have established, the material evidence is not yet convincingly evident of that position. The Indian Hill site is the closest to an Archaic type site so far discovered, but many pieces from the other site designations are missing as well as their possessing features not common to Indian Hill. Faunal remains from this period are not generally well preserved, but do indicate an exploitation pattern similar to that of Paleoindian Period in that a variety of game was hunted, including leporids and artiodactyls (Cordell, 1997).

The changes that define the transition from Paleoindian Period to the Archaic have often been related to fluctuating climatic conditions. Regional paleoenvironmental studies (e.g. van Devender, 1990) have helped to highlight the complex nature of broad climatic changes that occurred during Holocene and adaptations that early peoples made to survive (Cordell, 1997). Of particular relevance to the Archaic Period was the Altithermal. The Altithermal was a climatic episode of hot and dry conditions that lasted from about 7,500 to 5,000 years BP. During the Middle Archaic, around 4,000 years BP, stabilization of vegetation within the Salton Sea region is believed to have occurred (Flora of North America Association, 1999) which would have been directly related to the closure of the Altithermal period.

During his investigations, Rogers found no sites within the Salton Sea region which dated to the Archaic Period (Weide, 1976, Moratto, 1984). Hayden (1976) suggests that this area may have been largely abandoned due to warm and dry conditions characterizing the Altithermal. Alternatively, if Archaic occupation of this region did occur, sites may have been lost or eliminated by natural processes or obscured by later settlements (Weide, 1976). Systematic excavations at Indian Hill Rockshelter in Anza-Borrego State Park have produced the best evidence to date for Archaic Period occupations near the Salton Sea Basin (Wallace and Wallace, 1960b). This site consisted of stratified deposits extending from early pre-ceramic to later Patayan period occupations. Large dart points were recovered from deposits below ceramic-bearing layers, suggesting the presence of hunting and gathering Archaic populations with ties to groups of Pinto Basin Complex (Moratto, 1984). The site also contained three burials, one of which dated to 4,070 +/- 100 years BP (McDonald, 1920). Salton Sea Naval Test Base (Apple et al., 1997), the Truckhaven burial site (C-14 dated over 5,500 BP) at the northwest corner of Colorado Desert, and the Yuha burial site (re-dated at over 5,000 BP, Barker et al., 1973) at the southwest corner of the desert have also produced evidence for Archaic occupation of Salton Sea region. Six Pinto series and one possible Elko series projectile points were recovered during investigations at the Test Base, and one Elko notched point was recorded on Yuha Mesa. These data all suggest that the area was not entirely abandoned during Archaic times.

At Indian Hill Rockshelter, Cottonwood Triangular and Desert Side-Notched points were uncovered along with ceramic brownware in upper strata. While it is tempting to make a case here for a transition from Archaic to Patayan periods, it is more likely that Kumeyaay utilized this sheltered site long after the earlier group abandoned it. The pictographs in a recess on the south side of the shelter are also from the later period.

4.1.3 The Patayan Period (1,300 Years BP to Contact)

A major cultural change initiated the transition from Archaic Period to Patayan Period between 1,500 and 1,300 years ago. The focal points where this significant development occurred were along lower Colorado River in Mohave and Quechan territories, and over the next three hundred years its impact reached deeply into neighboring lands through trade and travel. The riverine groups had been in close contact with the technically advanced Anasazi and Hohokam, and about 500-700 A.D. learned from them (Hicks, 1974; Moratto, 1984) the basic art of all sedentary civilizations—agriculture. Too, ceramics, a by-product of those who work with moistened soils, came with the new knowledge. Pottery soon displaced the reliance on basketry, which now expanded the range for trade and travel. Sherds are found along all desert trails, campsites, and work/ceremonial stations. These storage vessels for water, food, and material could easily be discarded when empty and replaced when needed, unlike basketry which required collecting and curing materials, and expending considerable time to weave, coil or twine into useful receptacles. Bows and arrows also replaced the atlatl during this period, adapting hunting to the small animals that survived the increased xeric environment. Cremations remained the more common means for disposing the dead as from the beginning of time, though burials were utilized if, for example, a traveler died in an area lacking incendiary growth (Lucas, 1984).

Coupled to these cultural changes which affected the course of desert life was a coincident event, the rise of Lake Cahuilla (in whose diminished basin Salton Sea now occupies). This combination of cultural and natural events introduced the last of the prehistoric periods, easing into this driest of desert environments requirements of human adaptation while challenging the inhabitants to utilize creative talents that traditions and unneeded responses had kept latent for untold generations. The riverine and mountain Yumans, and the valley Takic groups, all developed different strategies in utilizing each of these changes. But before discussing them, some historic research notes need be entered here.

The Patayan culture was first coined the “Yuman Complex” by Malcolm Rogers in 1945. This prodigious field researcher linked the archaeologically identified culture to ethnographically known Yuman speaking groups such as Quechan. But since Harold Colton believed that a direct connection could not clearly be demonstrated, he suggested that these groups be termed “Patayan,” from the Yuman term meaning “old people” (Colton, 1945). Later, Albert Schroeder presented the term “Hakataya” as a replacement for both “Yuman Complex” and “Patayan” (Schroeder, 1957). This term was also controversial as it further consolidated differing precontact groups on the basis of generalized cultural traits. Schroeder later defined Hakataya more specifically, focusing primarily on brownware pottery present throughout Arizona prior to differentiation into discrete Patayan, Hohokam, and Sinagua cultures (Schroeder, 1979). Because Schroeder’s definitions failed to note the high degree of cultural diversity within the region, Michael

Waters readopted the term Patayan (Waters, 1982) and has been used in recent syntheses of the area (Schaefer, 1994; Reid and Whittlesey, 1997; Cordell, 1997).

4.2 ETHNOHISTORY

This section presents an ethnographic review of those tribes related (though distantly in some cases) to Salton Sea basin. The primary objective is to present a synthesized account of the different ethnic groups who occupied or influenced the study area (Figure 4.2-1). Several issues are described for each group, as ethnic history, territory, subsistence, settlement patterns, socio-political organization, and ritual-spiritual features. The information reflects how groups with differing cultural traditions adapted to the arid lands of Southern California. Importantly, the knowledge or belief in one's roots and origins is a major player in unifying a culture, giving it a place in cosmology, and providing a kind of sacredness to its traditions. Both Takic and Patayan groups have placed themselves in their memory of deep-time, and can relate themselves, their customs, beliefs and art to that primordial period of origination.

4.2.1 Takic Groups

The Takic groups have linguistic ties to the Uto-Aztecan family through the Shoshone-Comanche sub-language that spread with people from the Great Basin, beginning some 5,000 years ago (Moratto, 1984). This movement eventually absorbed one-fifth of California, from Nevada to the coast. The southernmost of these diverse tribal groups was of the Takic dialect, the Cahuillan.

4.2.1.1 Cahuilla

The Cahuilla territory is located near the geographic center of Southern California. Though the Cahuilla tribe centered in the north end of the Salton Basin, tribal elements also settled in the Whitewater Pass area and the mountainous regions of San Jacinto and north Laguna. Their outlying topographic areas included portions of the San Bernardino Mountains, Orocopia Mountains and east to Palomar Mountain. Except for the southern boundary which the Kumeyaay shared, topography provided a natural enclave for these people.

Territorial diversity provided Cahuilla with a variety of foods, which encouraged intertribal trading. Dr. John Lowell Bean and Cahuillan Katherine Saubel estimated that these natives had over 500 different foods to hunt or gather from below sea level to 10,000' above (Bean and Saubel, 1972). Acorns, mesquite beans, piñon nuts, cacti, seeds, fruits, berries and greens were part of their plant diet. Deer, pronghorn antelope, big-horn sheep, rabbits, rodents, insects and reptiles were hunted as seasons and elevations allowed. During Lake Cahuilla stands, fish, migratory birds, and marshland vegetation were also taken.

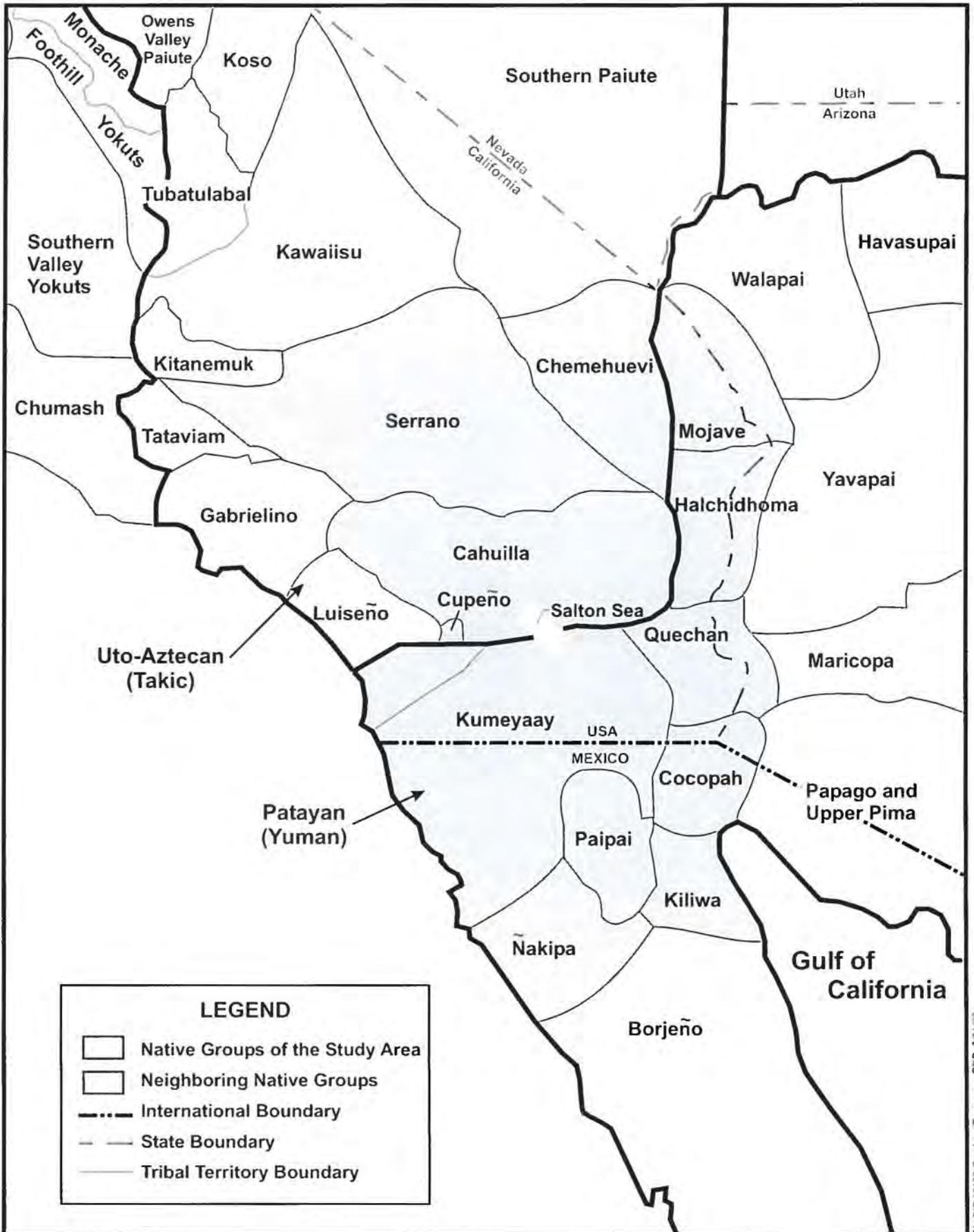


Figure 4.2-1 Ethnographic Tribal Territories of the Salton Sea Region



Anthropologists have grouped Cahuillans into four entities—the Desert, Pass, Mountain, and Cupeño—or Cupa, as the native people themselves prefer. Tribal members distinguished themselves through their moiety and clan. Cahuilla organization comprised of two patrilineal and exogamous moieties, *Istam* (coyote) and *Tuktum* (wildcat). In addition, numerous clans existed. Restricting marriageable youths to distant relatives as well as extending trading and family connections, a suitable partner had to reside outside one's own moiety and clan. Patrilocal residence assured a male continuity in family and village subsistence rights (Bean and Bourgeault, 1989).

Alejo Patencio, a spiritual leader of Cahuillans, told the story of creation to William Duncan Strong in the 1920s (Strong, 1929). The story went back before there was time or matter. There was no beginning, only a creative power, *?iva?a*, that eventually transposed the cosmos of darkness into a swirl of red, blue, white, and brown colors which united into two embryos. After working out of their respective sacs of colors, the children names themselves *Mukat* and *Temayawut*. They inherited power, and after creating such colorful things as world, sky, water, and living beings they each had a try at making people from different colored muds. *Mukat's* were the more adaptive to the world they made, so *Temayawut* stole away with his brood and was heard of no more. Though darkness had some advantages, as forming a restful mood, light was also needed for growth and activity so *Mukat* brought forth the sun. Everyone had a individual language which only caused utter confusion in this world of light, so of them *Mukat* believed that the man speaking Cahuillan was the most understandable, and so he chose him and his language as a model for mankind. This, then, was the origin of the Cahuilla, and its descendants still have for their own world the moon, sun and evening stars, with an equal share of darkness and lightness (Strong, 1929; Bean, 1972). Remembering was institutionalized through various ceremonies, usually conducted within a large community house where the sacred ceremonial bundle—the *maiswat*—was kept under control of the local leader—the *net*—and his spiritual assistant, the *puul*. The *puul* presided over the most important of Cahuilla ceremonies, the cremation followed by the annual mourning ceremony, and inherited his spiritual power from Coyote, the first *puul*, who attended to *Mukat's* cremation (Strong, 1929; Drucker, 1937; Lando and Modesto, 1977; Bean and Bourgeault, 1989).

Mukat was generous with his creative powers, acquired from original space. All created things—rock, wind, animals, people, etc.—were endowed with some level of this power. These beings, spiritually fortified and sanctified from this power are called *nukatem*, and their surrounding presence kindle the Cahuillan's memory of origins and their strong consciousness of the interrelationships of all things. Such cultural equipage brought forth artistic talents for designing symbols and icons of the spiritual past—which is ever present. With such imagery as spiritual beings from which to draw and attach to talents,

Cahuillan art and crafts never simply take on utilitarian roles. In their own ways they probably are reenactments or reminders of Cahuilla creation. Some designs in earthen art as "snake," "compartmented boxes," or spirit breaks" which are rare in Desert Cahuilla sites but are common in Patayan country might well have been adopted from Mohave or Kumeyaay through intertribal mixes (von Werlhof, 1998), much as the passing along of horticulture and ceramic technology.

Homesites within permanent villages ranged from brush shelters to domed or rectangular structures along no apparent distribution line or spacing. Villages were situated near water resources whether on mesas, in canyons or on alluvial fans. A post-lake village was formed near a man-dug walk-in well (Bean, 1972). Desert Cahuilla villages on the mesa south of Santa Rosa Mountain were along fifteen miles of the ridgeline above the lakeshore, interconnected with a well-used trail system. Today, the sites are two miles west of Salton Sea, and comprise the largest as well as best-preserved of lake habitation sites. Over 200 stone fish traps still exist between the village sites and the most easterly of the weirs. Along fans north of the mountain and in west Coachella Valley hundreds of traps have been dozed for rip-rap or agricultural development (Wilke, 1976). Similarly, many villages along Whitewater River have been destroyed through urban sprawl or clearing for water conservation (von Werlhof, 1976).

When Lake Cahuilla flooded the villages in the lower Coachella and upper Imperial valleys around 700 A.D., most Cahuillas comfortably resettled in upper Coachella Valley with other villages, but a sizeable group of perhaps 500 relocated on the mesa south of Wonderstone Wash. Archaeological evidence puts their resettlement as far south as Tarantula Ridge two miles north of present Highway 78. Here, they interconnected with Kumeyaay bands during lake intercessions exchanging goods and cultural ways. The mesa became as important to Desert Cahuilla during the lake stand as Salton Sea Naval Base area became to Kumeyaay before, during recessions, and after Lake Cahuilla.

Development of the fish trap became the most significant of all adaptations of Desert Cahuilla to the lacustrine environment. Field surveys conducted adjacent to a major mesa village located an experimental field where different designs were tested before settling upon the commonly used "check shaped" trap. As the lake receded, more technologic advances were made that allowed an even greater production of lacustrine fishing. The intensification of the lake resources shows up well in the archaeological record with the distribution of the 165 traps in one exploitation area increasing along the shore as the water receded (Hurd-von Werlhof Symposium, 2000; McCormack. Hereafter cited as Symposium, 2000).

To the tribe, ceremonialism was an important part of life. The central focus of most rituals was the performance of cosmologically oriented song cycles that placed the universe in perspective and

reaffirmed the relationship of all Cahuilla to the sacred past, the present, to one another, and to all things. A girl's first menses was the start of a vital ceremony that served as a rite of passage into womanhood. A menstrual hut was designated within the extended village but furthest east of all ceremonial and sacred features. Conversely, at the west end was a men's hut, probably a sweat lodge. Other ceremonial features included a 12' long rock alignment of a pregnant snake within a horticultural plot; rock rings, prayer circles, and shaman's hearths (Symposium, 2000: Gibson).

At one tamped ceremonial locus, a tufa-covered boulder had been brought up from the lake and placed within a larger stone arrangement that lined up as a probable winter solstice observatory. Within it were large gizzard stones that ornithologists identifies as geese or canvas-backed duck, two migratory birds on this portion of Pacific Flyway. The tufa boulder was probably a renewal symbol related to the lake's annual recovery from its fall and winter 5' rate of evaporation. Too, black basalt lithic reduction stations within the larger ceremonial grounds were power acquisition sites common to all Colorado Desert tribes (Symposium, 2000: Hurd, Dickson, and Nord).

Paired dark and light cobbles were placed at several loci within this large ceremonial ground, lined up with other such emplaced groups at distanced that varied twenty or more meters. It is probable that these were time markers to indicate when annual mourning ceremonies should commence for persons who died the previous year. When the sun's shadow aligned two pairs of these stones it was time for preparations to begin for the ceremony. Ethnographic accounts (Bean, 1972; Strong, 1929) give the Cahuilla new ear as the winter solstice. Names for calendric subunits, or "month" names are for a six month period, and repeated from summer solstice to the new year. Rock alignments within the ceremonial ground show many to be either winter or summer solstice points (Symposium, 2000, Solikoff and Hurd). At the west end of the ceremonial area, shadow and light patterns that carefully laid rock alignments permit show that several lithic reduction stations with numerous non-utilitarian flakes, cores, and hammerstones were formed at winter solstice. These were probably a purposeful part of boys' initiation rites. (Symposium, 2000: Hurd, von Werlhof, Wolinski, and Hurne).

This archaeological work focusing on the Desert Cahuilla adaptation to Lake Cahuilla is ongoing and unpublished. It is clear, however, that this Desert Cahuilla area south of Santa Rosa Mountain contains numerous traditional and sacred sites within five miles of the Salton Sea.

4.2.1.2 Cupeño

Cupeños lived in the mountainous country on the Cahuillan southern border. Kumeyaay territory is south, and Luiseño is west. With a population of 750, they were one of the smallest Indian groups in prehistoric

Southern California, and occupied a territory of only about ten miles diameter. Two permanent villages were within this territory; Kúpa, the largest, was located at the base of Warner Hot Springs mountain, and Wilákalpa, a smaller and more linguistically mixed village, was located on San Ysidro Creek. Oral history states that a Mountain Cahuilla lineage from the Soboba area moved south and founded the Cupeño group. Linguistic and other cultural evidence tends to support the oral history and indicates that the split probably occurred 800 to 1,000 years BP (Hill and Nolasquez, 1973). Cupeño dialect, like Cahuilla, belongs to the Cupan subgroup of the Takic family of Uto-Aztecan language.

Cupeño maintained the Cahuilla social system of exogamous marriages, patrilineal moieties and clans. Although clans were bound by social, religious, and territorial ties, each village maintained its own clans and respective leaders and were politically independent of each other. Kúpa, was home of four Cupeños clans and one Cahuillan, and Wilákalpa, contained one clan affiliated with Cahuilla and one of Kumeyaay (Strong, 1929). Clan members of each village utilized specific food gathering areas, and some communal areas in which all Cupeños could hunt and gather. Cupeños diet included acorns, seeds, berries, cactus fruit, deer, quail, rabbits, and other small animals (Bean and Saubel, 1978a). In late prehistory, Cupeño acquired some agrarian techniques from their Cahuillan neighbors.

Death of a clan member involved three Cahuillan ceremonies: Burning of the body; burning the deceased's possessions a few weeks to several months later; and the image burning ceremony about a year after the member's death. The cremation ceremony—*pisatuil*—could be held the night following death or within a few days (Strong, 1929). At *suuchumnil*, the possession burning ceremony, songs of death were sung during the night as the deceased's belongings were burnt. After the possessions were consumed, "enemy" songs were sung until break of day to parry the happiness rival class might feel over the death of an enemy (Strong, 1929). The annual mourning ceremony was held for a group of people who had died about the same time. This ceremony three days to a week of fasting and singing while images were being made and gifts were being prepared for those attending the burning.

First contact for the Cupeño with Europeans came in 1795 when Spanish Franciscans came into Cupeño territory. According to Cupeño oral history, they fled their settlements for the mountains at the encroachment of the Spanish. It appears that despite the establishment of Missions San Luis Rey and San Diego, and their outposts in or near Cupeño territory, a pattern of limited influence continued until secularization of the missions in 1834. In 1840, Cupeño lands were granted to Jose Antonia Pico, a

Mexican citizen. In 1844, the lands were taken from Pico and given to an American, Juan Jose Warner who established Warner's Ranch. Antonio Garra, a Cupeño, led a revolt against Warner. Garra lost the

fight and he and his followers were subsequently executed and their village burned. Warner eventually left the area, but another American, John G. Downey took possession of the land. Downey had the Cupeño evicted from the land, and, in 1902, they were forced to move to the Pala Reservation to live with the Luiseño.

4.2.1.3 Serrano

When this group advanced out of Great Basin as part of the Shoshone-Comanche migration they eventually settled into a large area including San Bernardino Mountains to Cajon Pass, north to Victorville, east as far as Twenty-nine Palms, and south to Yucaipa Valley. Like their neighbors, Serrano were mainly hunters and gatherers. Hunted game included mountain sheep, deer, antelope, rabbits, rodents, reptiles, insects, and various birds, particularly quail. Vegetable staples consisted of acorn, piñon nuts, bulbs and tubers, shoots and roots, berries, and various cacti. Water sources determined settlement locations, and most Serranos lived in small villages. Houses and ramadas were round, constructed of poles covered with bark and tule matting. Sweat houses were small earthen covered structures that a central post supported (Kroeber, 1925). Serrano pots remained undecorated.

Serrano organization was rather loose among patrilineal lines. Moieties included *Tukim* (wildcat) and *Wahilyam* (coyote). Organization of individual bands of Serrano were considered by Kroeber (1925) to be "the equivalents of the 'village communities' or political groups of northern and central California – what might be called tribes were they larger in numbers, set off by dialect, or possessed of names other than derivatives from one of the sites inhabited" (1925:617). These bands were exogamous between each other, but could marry within the moiety. Bands were under hereditary leadership of a chief—*kika*—whose shamanic assistant was *paha*. Together they organized and led the band's various ceremonies, including the important cremation ceremony.

Like many southern California Indians, the Serrano practiced cremation until Spanish contact. By 1834, most of the Serrano were relocated to Spanish missions, and today live either on the Morongo or San Manuel reservations (Bean and Smith, 1978b). In 1975, descendants of the Serrano numbered approximately 100.

4.2.1.4 Chemehuevi

Also part of the southwestward migration that came to adopt one-fifth of California, Chemehuevi were seasonally nomadic in a large territory west of Mohave country in some of the sparsest desert. Though not plentiful, large game was hunted but the chief protein source included rabbits, wood rats and other

rodents, insects, reptiles and birds. Plant foods included piñon nuts, roots, agave, seeds, berries, and what could be obtained through trade, as foods raised in Mohave plots along the Colorado River floodplain. Settlements were seasonally reoccupied, and where favorable, the environment allowed some horticultural practice in late prehistoric time (Earle, 1997).

Individual households grouped together as assemblages that traveled as units on hunting and gathering trips (Kelly and Fowler, 1986). Structures varied according to the season. During the winter, earth-covered dwellings provided adequate shelter, and caves were also used. In warmer months, many lived under trees, sometimes with extra brush added for denser shade (Kelly and Fowler, 1986). As early as the end of the 18th century, Southern Paiute-Chemehuevis were being enslaved or baptized in the Spanish settlements. In response, some Chemehuevi raided travelers along the Old Spanish Trail from the 1850s to the early 1870s. During that time, efforts were made to settle the Chemehuevi on the Colorado River Reservation, but many did not agree to move there until the 20th century. The early 1900s saw the establishment of a number of small reservations in Utah for the Southern Paiute. In 1980, the Southern Paiute-Chemehuevi numbered approximately 124 (Kelly and Fowler, 1986).

4.2.2 Patayan Groups

About 6,000 years ago, some Yumans living as far south as the 30th parallel began moving northward in response to the growing aridity of the area and the reduction of its carrying capacity. By 5,000 years ago, groups crossed into Southern California through Coyote Valley (Laylander, 1989). The "Yuha Man" was probably of this movement. From here they spread through what is now Imperial and San Diego counties, with various of them settling along Colorado River, and forming a series of riverine tribal territories. Others crossed the river into Northern Arizona and also spread along Gila River Valley into its south central area. Through the Archaic Period these adapted to the desert traded cultural traits with more technologically developed neighbors, leading into the final prehistoric period, the Patayan.

More than any other desert dwellers, Patayans evolved a dramatic art form, scraping into the surface desert pavement large spiritual designs, called geoglyphs. The oldest so far dated is CA-IMP-3045, a 2,600 year old (AMS dated) ¼ mile long snake. Most others fall within the early period of Patayan prehistory (von Werlhof et al., 1998), graphically portraying portions of the creation story. The most common of geoglyphs show in varied size the Yuman creator who gave his people knowledge, power, vision, spirituality, and land, only portions of which they own today.

The oral tradition of Patayan origin takes four days to tell (Cachora, 1990). A.M. Halpern was one of the few ethnologists to have heard the full story (Halpern, 1984). Following a lengthy introduction, we learn that *Kukumat*, the creator of all things at the beginning of time, fathered his divine son *Kumastamxo* with a woman he created, and afterward died of an illness protracted from his daughter (Halpern, 1997). The Patayan, meaning "those who descended," also called Yuman by their sub-Hokan language, were cultural heirs of the first people created on the sacred mountain *?avi kwame*. This is Newberry Mountain, or Spirit Mountain, north of present day Needles. Before dying, *Kukumat* and his devoted people along with various spirits shaped as animals lived together on their idyllic mountain. When death came, the people mourned for their creator, and after a time, the son feeling they now had recovered enough spiritual power to conduct a proper rite, let the sacred first *ker?uk* ceremony be held. This became the most important of Patayan rites. It was reenacting at the time of a tribal member's death this original *ker?uk* ceremony involving cremation, singing, dancing, and shamanic prayers. Following this first ceremony the people moved off the mountain as *Kukumat* had ordered in his last days, sending them west and south to find new homesites. The *volkerwanderung* took many into Mexico and Northern Baja California.

4.2.2.1 Mohave

Mohave comprised the northernmost and largest of Yuman-speaking tribes along lower Colorado River. Their territory was approximately 150 miles long and on both sides of the river into Nevada and Arizona as well as California. Southward was a line of Yuman tribes similar in speech, habits, appearance and disposition (Kroeber, 1925). Mohave looked on their territory as one would a nation, though it was made up of numerous small villages whose inhabitants frequently moved. Following their introduction to agriculture, this riverine people worked the floodplain of the river, developing plots into such productive units as to reduce their dependence upon hunting and gathering of wild foods to approximately 40%. These people also developed a cultural curiosity about other Indians, and came to know the coastal Chumash of Santa Barbara area, the valley Yokuts of San Joaquin, and tribes as far east as Taos.

They felt little affiliation for some of their linguistic kin, however, and frequently teamed with Quechan, their only ally, in raiding other people along the river. From the demise of Lake Cahuilla to 1835 A.D., they finally succeeded in driving Halchidoma, Kouana, Kaveltacadom, and Halikwamai from California into the Patayan country of Maricopa tribes in Arizona where they soon lost their own tribal identity. These tribal wars were not territorially motivated, apparently, and were more like troubled rivalries often leading to violent raids (Forbes, 1965). Quechan claimed the land between Picacho and Blythe that Halchidoma vacated, but did little to settle or utilize it in the short time before the land passed to foreign hands by mid-century. With the American construction of Fort Mojave and the restrictions that the

reservation imposed on native people the last glimmer of prehistory ended. But the people remembered, and as governmental rule slacked in the last quarter of 20th Century, old traditions began resurfacing.

Though cremations were the common means for disposing of the dead the *ker?uk* ceremony was not conducted in the same detail at each village. There was always wailing, singing, dancing, and the burning of personal property, but sequences differed within villages or clans. Twenty-two totemic style clans were formed within the two common moieties, but though this suggests a possible division within the tribe, there was a singular chief who kept the nation unified. This might have been ancillary to the militant life the tribe led. Trading was extensive with other tribes, and a southern trail took off near Barstow from the east-west Mojave Trail, and extended through Serrano country into Desert Cahuilla territory. Large collections of Mohave pottery have been taken from the east edge of a major Cahuilla village in north Indio, perhaps indication a place where Mohave traders were allowed to camp while visiting this site (Ezell, 1978).

The Mohave shaman acquired his position and power during one of *Kumastamxo's* creation sessions. While the shaman was not given the usual cadre of spirit helpers or allies afforded many prehistoric tribes, he possessed extraordinary controls over societal members through rituals, lore and "dreams." All Patayan were taught how to dream, one of their most important means of education. This was not a subconscious wandering of the mind, but a purposeful experience of one's soul which then would reenter the body with information and advice. Dreams brought power, also, encouraging or supporting one's activities (Stewart, 1983).

On both sides of the river are large scale geoglyphs in Mohave country, from Moab south to Blythe, depicting various episodes in the creation story. North of Blythe is a quadrant ½ mile square. At each corner is a different aspect of the creator, in frontal view, and nearly 200' in length. A snake and a coyote accompany one version. At Moab is a scene depicting the controversy of creation figures. A shaman dancing with a rattlesnake, and *Mastamxo* or *Kumastamxo* is shown at another scene creating Colorado River with his spear. Pictographs are also present at the Blythe area, as are geoglyphs of various animals discussed in the creation story, as octopus, bird, and worm. In this region is also the largest dance circle in Southern California, complete with icons of creation (von Werlhof mss: Johnson, 1984).

Mohave probably camped along the northeast shore of Lake Cahuilla within the investigation zone of Salton Sea, but the tribal identification of these sites is not conclusive. In this sector, trails originating on the bluff west of Palo Verde Valley crossed Chocolate Mountains through Indian Wells; Iris, Mammoth,

and Salvation passes, and north through Chiracoa Summit. Further studies of the northeast shore need be made to resolve whether Mohave, Halchidoma, or both utilized these trails and campsites.

The first Spaniard to reach the Mohave Valley was Father Francisco Garcés in 1776 who estimated the Mohave population at 3,000. No missions or Spanish settlements were established in Mohave territory and few changes occurred to the Mohave way of life until Anglo-American trappers began to travel through the region in the 1820s. Apprehensive of the increasing numbers of Whites entering their territory, the Mohaves attacked a wagon train in 1858. As a result, Fort Mojave was established by the Americans and soon the Mohaves were defeated by the United States Army. Disease and poverty followed the Mohaves' defeat. These conditions did not change until around the turn of the century. Today, many of the Mohave people live on the Colorado River Reservation, with income from irrigated farms and leases of reservation land to non-Indians (Stewart, 1983).

4.2.2.2 Quechan

The Quechan chose their own name, *kaca'n*, literally meaning "those who descended." This indicates that they believe that Quechan were the people who had descended from *avi kwami* ages ago. This also parallels the concept behind "Patayan," meaning "old people" (Colton, 1945).

As previously discussed, Quechan, along with other riverine Yumans, adopted horticulture and ceramics from their eastern neighbors about 700 A.D. (Hicks, 1974). Their core territory was along the floodplain of Colorado and Gila rivers, but because of annual spring floods, they built villages on adjacent higher valley ground, or on bordering mesas. The Spanish noted as many as 800 in a single village (Bee, 1983). Since planting replaced much of the reliance on hunting, and as much as 30-50% on gathering, the survival rate and population in late 18th Century must have been considerably higher than in the late Archaic Period. The riverine Yumans also had developed numerous intratribal trails for trade as well as exploitation, obtaining acorns and piñon from their Kumeyaay kin of San Diego and western Imperial counties prior to Lake Cahuilla and during its intercessional dry periods. It was in such a period when Quechan traders of the 10th Century brought the means for planting and ceramics to the westside Kumeyaay (von Werlhof, 1974; Warren, 1974).

Mesquite beans (*Prosopis sp.*) were the most extensive and nourishing of wild foods harvested and were not dependant upon river floods as were cultivated foods which included teparies, maize, squash and corn in prehistoric time. Portable mortars and metates were necessary wares for processing seeds, kernels and nuts, and were common household equipment. Baskets and ceramic containers were both used in cooking as well as storage, and for transporting goods. While hunting was not a main contributor to Quechan diet,

fish was a year-round prey; fresh-water clam (*Anadonta sp.*) were also collected along the river banks. Insects, snails, certain snakes, rodents, birds, and eggs were supplemental foods requiring little preparation.

Temporary quarters were constructed in bottomlands, but as annual flooding commenced in mid-spring, settlers moved into more substantial quarters on high ground. Seeds and kernels were already planted, and brush cleared just before flood time. Nothing further remained to be done until late summer when cracks appeared in the drying soil. The waiting period was the ideal time for young adults to take their annual trek to the east shore of Lake Cahuilla. The annual infilling was underway. Those living near Picacho used a trail that crossed Pilot Knob Mesa, through Cargo Muchacho Mountains at American Girl Wash, across the dunes, around the south edge of Deer Springs and to the east berm of Lake Cahuilla. Most of the seasonal migrants came from the larger and more southern settlements on the mesa, bypassed the Cargos and crossed the dunes at Buttercup Valley. At the edge of East Mesa and Lake Cahuilla a group formed a large summer camp while others spread north and south along the berm. Most camps worked the embayments behind the berm rather than on the windy and steep wave-cut side facing the lake. The campers brought little equipment with them, making do with the lithic resources gathered on the berm, and concentrating on net-fishing, clamming, harvesting mesquite, and gathering various marsh plants. Only three cremations have been found along this sixty mile berm indicating that the camps were seasonal and the campers were not elderly. Too, only three small ceremonial dance rings have been identified within this sector, indicating that the annual round of community rituals were not staged on East Mesa, and no evidence of a *ker?uk* celebration has been found. Permanent residents were simply lacking on the east side of Lake Cahuilla.

The riverine Yumans, like Kumeyaay of the west, were active in recreating stories of their origins in rock art and earthen art. Pictographs, petroglyphs, geoglyphs, and rock alignments are all found from Moab to Pilot Knob, and from Pilot Knob Mesa to Gila Bend. Nearly 300 have been recorded within this field (IVC Desert Museum; von Werlhof, 1992; Johnson, 1984).

While Quechan sustained several patrilineal clans, and marriage was exogamous, the usual identity was with the nation itself. There were two accepted levels of leadership—one for cultural affairs and the other for militant raids. Each rancheria had a headman and a council of “eminent” families (Forde, 1931). Leadership was bestowed on a person of outstanding dream abilities. The Quechan’s militant history was directed against all riverine Yumans except Mohave—their traditional allies. Aggressive as well as defensive campaigns kept the Colorado and Gila river valleys quite turbulent. The mid-nineteenth century result was the reduction of Colorado River tribes to just three—Mohave, Quechan, and Cocopa. The

others had all been driven into Arizona where they merged with Maricopa villages to a cultural point of incognito.

4.2.2.3 Kumeyaay

Kumeyaay is term used to designate closely related Yuman-speaking bands in extreme Southern California and northern Baja California. It incorporates groups called by the Spanish "Diegueño" and distinguished further as Ipai or Tipai. Their territory at contact extended north from Todos Santos Bay near Ensenada, Mexico to the mouth of the San Luis Rey River in the northern portion of San Diego County, and east to the Sand Hills in the Imperial Valley.

The primary source of subsistence was vegetal food. Seasonal travel followed the ripening of plants from the valley floor to higher elevations of the mountain slopes. Buds, blossoms, potherbs, wild seeds, cactus fruits, and wild plums were among the diet of both groups. Some agriculture within the floodplain areas of their territory. Deer, rodents, and birds provided meat as a secondary source of sustenance. Families also gathered piñon nuts and acorns in the higher altitudes. Village locations were selected for seasonal use and were occupied by exogamous, patrilineal clans. Three or four clans would winter together, but dispersed into smaller bands during the spring and summer. Structures varied with the seasons, summer shelter consisted of a wind break, trees, or a cave fronted with rocks. Winter dwellings had slightly sunken floors with dome-shaped structures made of brush thatch covered with grass and earth (Luomala, 1978).

The rise of Lake Cahuilla flooded much of the west desert that had been used for gathering and small game hunting in spring and early summer. But the presence of the lake opened new subsistence opportunities, and Kumeyaay learned from their Cahuilla neighbors the construction of fish traps. Clams were also gathered, and the lake became a garden of rushes, reeds, insects, rodents, small animals, and birds. The west edge of this lacustrine body was also the habitat of seasonal villages and their extended small exploitation campsites (Shackley, 1984; TVCDM Site Records). As the lake dried during droughts Yumans from both sides of Salton Basin exchanged goods and ideas, leading Kumeyaay to develop ceramics and horticulture about 1,000 A.D.

The riverine Yumans and Kumeyaay were interconnected with an elaborate trade and travel trail system (Davis, 1964; von Werlhof, 1982) though during intertribal strife along the river Kumeyaay tended to side with Cocopa. To escape the worst of winter scenarios, Kumeyaay in the higher mountain valleys would encamp at such lower areas as Happaha Flat, Vallecitos and Indian Hill, though Desert Cahuilla would sometimes raid their seasonal grounds (Lucas, 1984).

As with other Yumans, Kumeyaay formed mourning ceremonies around the *ker?uk*, an image of the deceased which would be burned with his or her personal possessions. Unlike other Yumans, however, was their use of datura—the *toloache*—for boys initiation rites. As elsewhere, girls were warmed with stones in a shallow pit during the first days of her initial menstrual period. Also, as with other Yumans, Kumeyaay were divided into patrilineal and exogamous clans, principally named for places rather than animals, birds, and the like. Another common custom was that men went nude while women wore a front and back apron of willow bark. Both kept long hair, and were tattooed in a random fashion. House style varied according to available materials and general weather conditions though most were elliptically shaped and a frame of poles were thatched with brush (Kroeber, 1925; Cline, 1978).

On Yuha Mesa, between the foothills of In-Ko-Pah Mountains and the desert floor, are twenty-one sacred features including trails, burial cairns, shaman hearths, spirit breaks, memorial cairns, trail cairns, and geoglyphs. Probably the latest geoglyph is of a man on horseback, perhaps inspired from Anza's caravan which crossed here in 1774. Two others are "spiritual power" stations, reminiscent of the path to *Avi-kwame*, the seat of creation and source of all power. The largest dance circle in Colorado Desert is also on the mesa, measuring over 200' diameter, and from its vantage point overlooking the whole of Salton Trough. This dated 2,700 years BP site also contains such features as a porphyry power reduction station, shaman hearth, spirit break, and four access/exit paths. In April, 2001, 28 men and women from Campo, Viejas, and Sycuanne reservations (Kumeyaay) performed a ceremonial dance at the site, honoring the spiritual reawakening of ancient Kumeyaay traditions. Another large Yuha Mesa feature is an initiation site of several geoglyph patterns that cyclists effectively erased in 1975. Bureau of Land Management has acquired a restoration grant for this very rare type site. A spiritual trail that touches Indian Hill Rockshelter at the head of Palm Wash crosses the mesa at the edge of this important site, passes Yuha Well (a Kumeyaay dug well), and disappears in the sands of Pinto Wash near International Border.

4.2.2.4 Kamia

What is actually known of these people essentially postdates the most recent stand of Lake Cahuilla. They were probably a detached group of Kumeyaay who, from mid-Eighteenth Century to the long drought of the 1840s, farmed the same overflow channels that the Colorado River used in flooding Imperial Valley in the eighth and twentieth centuries. Preston Jefferson Arrowweed is part Quechan and part Kamia, and claims that the name is a mispronunciation for Kumeyaay (Personal Communication).

Regardless, there are archaeological records of settlement activity along the overflow channels—New and Alamo rivers—after the lake dried. Such artifacts include milling equipment, stone mullers, flaked knives, scrapers, choppers, and awls. While some sites bear evidence of dwelling, the massive floods of 1905-07 widened and deepened the channels, and must have destroyed most of Kamia material evidence. The long drought of the 1840s forced these people from Imperial Valley, and tradition has it that they moved eastward and settled amongst the southern riverine groups, especially Quechan (Gifford, 1931).

4.2.2.5 Cocopah

The Cocopah tribe live in portions of northeastern Baja California, southeastern California and southwestern Arizona along Colorado River and its delta. The region provided an abundant habitat of flora and fauna for the perhaps 1,000 Indians who often relocated villages, and even the bounds of their territory. While friends with Kumeyaay and Maricopa, they were pitted against the Quechan (Kelly, 1975) whose southern territory it abutted. In the first months of the year, tribesmen traveled to the high desert to collect bisnaga cactus and agave. In spring, wild rice was harvested down river near the gulf. As with other riverine tribes, Cocopah planted corn, squash, and beans which the Colorado River's floodwaters irrigated. Wild foods and domestic harvests were stored in baskets for later use. Despite the apparent abundance of resources in Cocopah country, the native people suffered chronic food shortages when droughts diminished the flow of river water (Kelly, 1977). Dwellings varied with the seasons. The winter house was a rectangular structure supported by a four-post frame with connecting beams. The walls were made of sticks covered with arrowweed and earth. During summer, the preferred dwelling was a round or oval shaped dome-to-conical hut that inward bent poles supported (DeWilliams, 1983).

Patrilineal and exogamous clans were identified with a particular plant, animal, or symbol of a natural phenomenon considered to be its totem. As with other Southern California tribes, Cocopah cremated their dead, and burned all the deceased's possessions at a separate ceremony.

Cocopah trails extended to those of other tribes, giving opportunities for trade, travel, and raids. A major trail skirted the southern edge of Cocopah Mountains to Laguna Salada and the southern reach of Lake Cahuilla. The trails also entered Kumeyaay country where trading gave the riverine native people access to acorns, piñon, and other mountain supplies.

4.2.2.6 Other Yuman-Speaking Groups

Several other Yuman-speaking groups inhabited the Salton Trough region. Their relation to the Salton Sea is unclear, but they certainly were part of the interaction sphere of the other groups discussed. These

groups included those living along the lower Colorado and Gila Rivers, such as the Halchidhoma, Kavelchadom, Kahwan, Kohuana, and Halyikwamai; and those living in northern Baja California, including the Paipai, Kiliwa, and Ñakipa. These Yuman-speaking groups shared the commonalities of economic, ceremonial, and religious cultural practices. The mourning anniversary, use of human-hair capes, and use of tubular stone and/or pottery pipes by shamans are among the shared cultural traits of these groups (Massey, 1992).

Due to linguistic similarities between these groups, it has been suggested that they split from a larger group into these smaller tribes. Breaking into smaller groups presumably was an adaptive strategy which enabled the inhabitants of the trough region to better exploit limited resources in their individual tribal territories. This pattern was reflected in utilization of specific regions by each of these smaller tribal groups.

Subsistence of the tribes consisted of hunting, gathering, fishing, and some agriculture by groups like the Halchidhoma. As the seasons demanded, the tribes migrated to food sources. Wild honey and a variety of mescal (agave) was the main diet of the peninsula groups. Hunting with bows and arrows, or pitfalls, provided deer and rabbit for the inhabitants of the region. Distinctly localized food sources provided variation to the diet such as mountain sheep, pine nuts, acorns, and the fruit of the spiny pitahayas (*Lemaireocereus gummosus*). In addition, seafood was an important food source; the coastal shorelines and seas supplied an abundance of mollusks, fish, and marine mammals (Massey, 1992, Sauer and Meigs, 1991).

Although the necessity of food required the groups to travel daily, they lived in semi-permanent settlements or rancherías. Tribal groups were typically broken into patrilineal bands. As a result, overall tribal political leadership was minimal. Rancherías, scattered throughout the peninsula, were composed of several families and usually numbered 50-200 people. Dwellings were constructed by inserting two rows of long willows into the ground parallel to one another and then bending and fastening the tops of the rows and piling branches and brush on top creating a roof (Massey, 1992).

People settled this region for several hundred years before the arrival of the Spanish (Gorry, 1998). The arrival of the Spanish had diverse effects on these native groups, particularly the Baja Peninsula Indian populations. Missions were established throughout the peninsula and extended into California and Arizona. The primary responsibility of the Spanish religious leaders was the conversion and civil improvement of the Indians. The padres tried to maintain complete control over their subjects, in both material and spiritual matters. Until the arrival of the missionaries in the 18th century, the Indians of Baja

California had not come in contact with European diseases (Aschmann, 1991). The Spanish not only affected the people of Baja, but they brought about a transformation in the native cultural landscape that was evident in the massive buildings of sun-dried adobe bricks that dotted the region. This infrastructure was established to support two new economic systems foreign to the area; agriculture and stock raising (Sauer and Meigs, 1991). Disease and the demographic collapse of the Indian populations due to the mission programs eventually led to the destruction of the Indian peoples of the Baja California peninsula region.

The Spanish, however, were not the only destructive force in the region. Intertribal strife between groups of the lower Colorado and Gila River areas caused populations of some of these groups to dwindle to the point of non-recognition. Once their numbers were decimated, some of these groups assimilated into nearby groups in an attempt to seek refuge from their aggressors. The Maricopa of southern Arizona are an example of a group who took in fugitive populations from the Halchidhoma, Kavelchadom, Kohuana, and Halyikwamai.

Precontact-era archaeology of the Baja California peninsula is more simplified than most areas in North America because it was subjected to cultural and biological pressures from only one direction. The geography of the region suggests that archaeological evidence found below the present international boundary reflect the cultural and physical antecedents of the inhabitants in the northern two-thirds of the peninsula. Artifact assemblages containing lithic tools, projectile points, shallow basin grinding stones, and one-hand cobble stones, characterize the various periods of occupation identified in the Baja California region. Similarities in style, composition and materials indicate inherent movement from southern California and southwestern Arizona (Massey, 1992).

4.3 POST-CONTACT HISTORY

The history of the Salton Sea region since European contact can be divided into several themes, including exploration, transportation, irrigation and creation of the Salton Sea, mining, modern military, and recreation. Each of these is connected, to some degree, with the development of one of the least hospitable areas of North America into the productive population center it is today.

4.3.1 Exploration

During the 16th century, Spanish explorers ventured into the regions now known as the Southwest and the Great Plains of the United States. The expedition of Coronado in 1540 took him and his army as far as

present-day northern Arizona and Wichita, Kansas. The party of several hundred men and three women were the first Europeans to see the Grand Canyon of the Colorado River. For more than two centuries, Spain established colonial outposts in Sonora and Arizona, east of the river, and explored the coasts of Baja and Alta California, while the desert separating the two regions remained uncrossed and unknown (Pourade, 1971; Bannon, 1974).

Occasionally, ambitious groups of adventurers probed westward in search of gold, silver, Indians to convert to Christianity, and a route across the Colorado Desert to the South Sea, as they called the Pacific Ocean. In 1604, Juan de Oñate, accompanied by 30 soldiers and two Franciscan friars, reached the Colorado River from a starting point near present-day Santa Fe, New Mexico. The expedition traveled down river to the Gulf of California, but did not venture into the seemingly endless desert they saw across the river to the west. By the late 17th century, several missions had been established in Arizona, and a chain of missions was stretching northward up the peninsula of Baja California. In 1701, Fathers Eusebio Francisco Kino and Juan María Salvatierra set out to explore the Sonoran Desert in search of a land route from Mexico to Baja California that could be used to supply the new missions. On this and subsequent explorations, Kino reached the coast of the Gulf of California and the Colorado River, and once attempted to cross the river delta, but no overland route was established. The Colorado Desert and the Salton Sink remained inaccessible to Europeans (Pourade, 1971; Bannon, 1974).

In 1769, stimulated by Russian and English encroachment on the northwest Pacific Coast, Spain began to establish a series of missions and presidios along the coastal plains of Alta California that eventually stretched from San Diego to San Francisco. Transporting supplies, soldiers, and colonists to the new outposts by ship was expensive and became more time-consuming as the frontier extended northward. This provided the incentive to renew efforts to find an overland route across the Colorado Desert, and led to the first European crossing of the Imperial Valley and Salton Sink (Pourade, 1971; Bannon, 1974).

In September of 1771, Father Francisco Garcés followed the Gila River west to its confluence with the Colorado River, traveled south to the Laguna de Salada in Baja California, then turned northwest until he reached the southern end of Imperial Valley. Looking across the desert to the northwest, Garcés and his party were the first Europeans to see the Salton Sink region, the desert side of the peninsular ranges of Alta California, and the future path of the immigrant road between Yuma and San Diego. After his return to Mexico, Garcés talked to Juan Bautista de Anza, the commander of the Spanish presidio at Tubac in what is now southern Arizona. Anza was a third-generation frontier soldier who, like his father and grandfather, had spent his life patrolling the great desert of northern Mexico. His enthusiasm for finding an overland route to the South Sea coast excited by Garcés, Anza wrote to the Viceroy of Mexico,

Antonio María Bucareli Ursúa, and received permission to mount an expedition to cross the Colorado River into California (Bolton, 1935; Hoyt, 1948; Dowd, 1960; Pourade, 1971; Bannon, 1974).

On January 9, 1774, Captain Anza left Tubac accompanied by Father Garcés, a second priest named Juan Díaz, an Indian guide named Sebastián Tarabal, a Piman interpreter, 21 soldiers, a carpenter, five muleteers, and two servants. The expedition included 35 mules loaded with provisions, 65 head of cattle, and 140 horses, many of which were picked up at outposts along the way before reaching the Colorado River and entering unknown territory. After about a month of travel across the Sonoran Desert to Yuma, the Anza expedition crossed the Colorado River, entering the Colorado Desert. Rather than crossing or skirting the extensive sand dunes that lie west of Yuma, Anza decided to follow the river south into Baja California. Following 17 days of hardship, Anza reduced his force to 17 soldiers, the two friars, and six helpers, and left his cattle behind. After continuing for a short time southward through the Colorado Delta, the expedition turned northwest, passed the Laguna de Salada, and reached the Imperial Valley west of the future site of Calexico. They were led by their native guide Sebastián to the Yuha Well (Hoyt, 1948; Dowd, 1960; Pourade, 1971; Bannon, 1974).

By March 10, Anza and his party had reached an oasis he named San Sebastian, located about 12 miles west of the present southwestern shore of the Salton Sea. Indians at San Sebastian told the Spanish soldiers that they had been preceded in 1772 by Don Pedro Fages, the military governor of California, who had come through the Carrizo Corridor, skirting the Colorado Desert before recrossing the mountains to the west. Fages, who had started in San Diego, eventually found his way through the Cajon Pass, Antelope Valley, and the Tehachapi Mountains and ended up at Mission San Luís Obispo. From San Sebastián, the Anza expedition crossed Borrego Valley and entered the Santa Rosa Mountains. Anza and his men reached San Gabriel Mission on March 22, 1774, having spent 74 days traveling the 700 miles from Old Mexico. In the process they accomplished the first European crossing of the Colorado Desert. After another more crossing from Sonora to the missions of Alta California, Anza was named governor of New Mexico in 1777. He died in 1788 (Hoyt, 1948; Dowd, 1960; Pourade, 1971; Bannon, 1974).

Following the Anza expeditions, no trips through the Salton Sink region are mentioned in official records for several decades. By the Mexican Period (beginning in 1821) mail was being carried by Maricopa Indian messengers between Sonora and the California coast, via the northern Colorado Desert and the San Geronio Pass (Hoyt, 1948; Fitch, 1961; Johnston, 1977). During roughly the same period, from 1815 to the 1830s, Indians from San Gabriel Mission made annual trips into the Salton Sink to collect salt (Johnston, 1977; Nordland, 1977).

In 1823, a reconnaissance expedition led by Father Felix Caballero set out to find a land route from the mission outposts of Baja California to those of Arizona and Sonora. After crossing extensive sand dunes, Caballero traversed the Colorado River delta with the help of some Indians. From the east side of the river, the expedition continued northeast into Arizona, traveled along the Gila River, then turned south into Sonora. On the return journey to Baja California, Caballero was escorted by a group of soldiers led by Captain José Maria Romero. While crossing the Colorado River, the Indians who had been recruited to assist them abandoned the Mexicans, stealing most of their supplies. After enduring several days of difficult desert travel, the explorers succeeded in reaching the missions of Baja California again. Another land route had been pioneered from Sonora to California, south of Anza's trail of the 1770s. This would eventually be an important step in the establishment of the Yuma to San Diego route across the southern part of Imperial Valley, but at the time Romero and others believed it was unsatisfactory because of the risks of crossing the river delta and dealing with uncooperative Indian groups (Pourade, 1971).

While Caballero and Romero were making their way west, Santiago Arguello, an army lieutenant from the San Diego Presidio, found a more direct route east from San Diego while chasing deserters from the presidio. Arguello and his men rode through the Carrizo Corridor pioneered in 1772 by Fages, then through San Felipe Valley to Warner's Hot Springs. This would eventually become a segment of the Southern Route between Yuma and San Diego (Pourade, 1971).

Later in 1823, Captain Romero, who had traveled north to San Gabriel Mission in Alta California after his trip from Sonora to Baja California, left the Los Angeles area accompanied by Lieutenant José Maria Estudillo, traversed the San Gorgonio Pass, and entered the Salton Sink in search of a route directly east to the Colorado River. After several days of heat, lack of water, and trouble with their horses, the party of explorers made their way back to San Bernardino in January of 1824, having failed in their attempt. In November of 1825 Romero mounted a second expedition, this time accompanied by Sub-Lieutenant of Engineers Romualdo Pacheco, 15 soldiers, and a group of laborers to clear vegetation. Following the approximate route of the later Southern Pacific Railroad through the Coachella Valley and along the eastern side of the Salton Sink, the party then turned east and reached the Colorado River near present-day Blythe after an 18-day journey. Pacheco returned to San Diego from Yuma along the Southern Route recently established by Caballero, Romero, and Arguello, and reported that the San Gorgonio Pass route was not practical. In his opinion, a trail connecting Yuma with San Diego would be superior in spite of dangers from Indians and the necessity of crossing the mountains east of the Pacific Coast. Pacheco supervised the construction of a small army outpost along the New River six miles west of the future site of Imperial. Soldiers stationed at the post abused some Kumeyaay from San Sebastian

village several miles north. The ired native people attacked "Fort Romauldo Pacheco" (as it is now known), killed three cadre and drove off the others who joined the Mazatlan Squadron in San Diego. The post was thus abandoned within six months and the route was not regularly used again during Mexican rule, although it was still named the official road from Sonora to San Diego (Hoyt, 1948; Pourade, 1971; Johnston, 1977; Nordland, 1977, von Werlhof, 1977).

The San Gorgonio-Yuma route was little used for most of the Mexican period, which ended in 1848 when the United States took possession of Alta California. In the late 1820s, friars from San Gabriel Mission established an outpost, Rancho San Gabriel, near the present town of Beaumont at the summit of San Gorgonio Pass. They may have made forays east into the Colorado Desert to visit the Cahuillas and other groups of Indians. In the fall of 1845 Benjamin D. Wilson, "Don Benito," was dispatched with a posse by California's last Mexican Governor, Pío Pico, to capture two Indian neophytes who had escaped into the desert from Mission San Gabriel. Wilson and his 60 men rode east through San Gorgonio Pass as far as Agua Caliente (Palm Springs) where Wilson engaged a group of Cahuilla Indians to continue the chase, during which the fugitives were captured and killed (Hoyt, 1948; Nordland, 1977). The last Mexican expedition across the Salton Sink was probably that of General Flores and his men in January of 1847. Retreating from Alta California to Sonora during the Mexican War, Flores used this escape route through unfamiliar territory to avoid capture by American forces (Hoyt, 1948).

Anglo-American exploration of the Imperial Valley region began in 1827 when a trader named Richard Campbell traveled from Santa Fe, New Mexico to San Diego using the Southern Route. Campbell believed a wagon road could be opened along this trail, but at that time travelers to California preferred the Santa Fe or Old Spanish Trail that followed the Mojave River and entered the Los Angeles Basin via Cajon Pass and the San Bernardino Valley (Pourade, 1971). Around 1828, two parties of American trappers, led by Sylvester Pattie and R.W.H. Hardy, spent time in the vicinity of the Southern Route but left little in the way of a record of what they saw (Morton, 1977). The first formal record made by an American was that of Lieutenant-Colonel W.H. Emory, who traveled the Southern Route, through the southern portion of Imperial Valley and the Salton Sink, in 1846. The following year, Emory accompanied General Stephen W. Kearny's American Army of the West expedition of 200 dragoons over the same route, with Kit Carson as guide. In 1848, the Mormon Battalion, led by Lieutenant-Colonel Philip St. George Cooke, followed the Southern Route and established the first wagon road. Both Kearny and Cooke were traveling to California to aid Captain John C. Fremont in the war with Mexico over possession of Alta California (Cory, 1915; Dowd, 1960; Fitch, 1961; Pourade, 1971; Duke, 1974; Morton, 1977).

4.3.2 Transportation

During the gold rush of the late 1840s and early 1850s, thousands of prospectors and other immigrants came to California by the Southern Route. Semi-weekly stage service by the Butterfield Overland Mail Company, crossing Imperial Valley from Yuma to San Diego and Los Angeles, was begun along this route in 1858 (Dowd, 1960; Fitch, 1961).

An important event in the development of the Salton Sink occurred in 1853, when the U.S. government funded an expedition to survey a transcontinental railroad route. The survey, led by Lieutenant R.S. Williamson, included Professor William P. Blake, a geologist from the Smithsonian Institute. In November, the party traversed the San Geronio Pass, descending into the Coachella Valley on the 14th. The expedition traveled southeast through the valley, passing along what would become the eastern shore of the Salton Sea. By November 21, they had reached the confluence of the Colorado and Gila Rivers. Williamson found the route to be a feasible one for the construction of railroad tracks across the Colorado Desert from Los Angeles to Arizona. Professor Blake was the first to use the name Colorado Desert for the region, and the first to describe Lake Cahuilla, based on his observations of the vestigial shoreline and oral histories of local Indian groups. (Cory, 1915; Hoyt, 1948; Fitch, 1961; De Stanley, 1966; Duke, 1974; Nordland, 1977).

The same year as Williamson's survey, an expedition led by Colonel Henry Washington surveyed the San Bernardino Base Line and built a wagon road through San Geronio Pass and across Coachella Valley. In 1854 a few wagons and prospectors used the road. In 1858, Silas J. Cox traveled on horseback along the San Geronio Pass-Yuma route surveyed by Williamson. An 1862 gold discovery near the Colorado River in Arizona stimulated increased travel, and a direct route eastward from the San Geronio pass was needed (Fitch, 1961; Nordland, 1977).

William D. Bradshaw established this route from California to the gold fields of Arizona. Known as the Bradshaw Trail, it traversed almost all of Riverside County and passed the northern end of what would later be the Salton Sea. Bradshaw, who had served under Fremont in the war with Mexico in 1846 and 1847, also worked as a guide on the Southern Route to California and as a prospector and militia soldier during the California gold rush. In 1862, when a rich gold deposit was discovered at La Paz, north of the present site of Ehrenberg, Arizona, a group of Los Angeles businessmen hired Bradshaw to find a direct route to the gold fields. At the time only two indirect land routes, one using a portion of the Southern Route and the other an extension of the Santa Fe Trail, led there. The former crossed the Santa Rosa Mountains, entered the Salton Sink via the Carrizo Corridor, turned south, then headed east near the Mexican Border across seven miles of sand dunes to Yuma. From there, a river steamer could be taken

north to La Paz. The latter route led from San Bernardino northward through Cajon Pass, then east across the Mojave Desert on the Mojave Road across the Colorado River, and south to La Paz. A time-consuming alternative was to travel by ship around the tip of Baja California, up the Gulf of California to Port Isabel at the mouth of the Colorado River, and on to the gold fields aboard a riverboat (Johnston, 1977; Ross, 1992).

Traveling east from Los Angeles on existing roads through San Geronio Pass, Bradshaw and his party of eight men left Washington's wagon road behind at Dos Palmas Oasis, six miles east of the present northeastern shore of the Salton Sea, crossed the Orocopia and Chuckwalla Mountains, then continued along ancient Indian trails, using a map drawn for them by Cabazon, a Cahuilla chief. The trails took them past Tabaseca Tank, Chuckwalla Springs, and Mule Spring on their way to the Colorado River northeast of present-day Blythe. From there it was only four miles north to the La Paz crossing.

Bradshaw acted as a guide for parties traveling the trail and established a river ferry. At the age of 38, in December of 1864, Bradshaw died in La Paz from a wound inflicted by a carpenter's saw. His death was ruled a suicide, but he was probably murdered (Johnston, 1977; Ross, 1992). In 1874, the river changed its course leaving the La Paz boat dock high and dry. The businesses and residents of La Paz moved to a site south named for the land owner, Ehrenberg, across the river from Blythe.

Cattle men and merchants, in addition to gold prospectors, began using the Bradshaw Trail (often referred to at that time as the Bradshaw Road) to supply the gold fields. Newton Noble, a cattle rancher from San Geronio Pass, used the trail for drives to Arizona, and freight wagons carried goods over the route to La Paz, Ehrenberg, and Tucson. Big Mike and Joe Goldwater, brothers who brought supplies over the Bradshaw Trail and operated stores in La Paz and Ehrenberg, were among the better-known freighters who used the route. During the same period, the U.S. Army's "California Column" made the Bradshaw Trail one of their main communication routes (Johnston, 1977; Ross, 1992).

In September of 1862 the first of several passenger and mail stages, the Colorado Stage and Express Line, owned by David W. Alexander, began running six-horse Concord coaches between Los Angeles and La Paz over the Bradshaw Trail. Failure of the company to obtain an exclusive mail and express contract, and the murder of two of their most experienced stage men, led to the demise of the line. Soon after the failure of that company, three others attempted to use the trail commercially. The most successful of these was started by James Grant of San Bernardino, who originally followed the trail just after Bradshaw's first journey, in 1862. Grant established the Express and Saddle Train, which grew to be the California and Arizona Stage Company, the most important line between Los Angeles and Santa Fe, New Mexico

throughout the 1860s and 1870s. Before the Southern Pacific Railroad was completed to Yuma in 1877, the California and Arizona Stage Company linked with the railroad tracks, and continued on the Bradshaw Trail into Arizona. In 1875, Grant died of exposure and pneumonia while reconnoitering a new desert route to Arizona. The California and Arizona Stage Company was bought by Gilmer and Salisbury in 1878. Other stage companies that used the Bradshaw Trail included the Arizona Overland Mail, Banning and Company, and the New Mexico Stage Company. Some early maps label the trail "Butterfield Stage Route;" however, the Butterfield Overland Mail Company never used the Bradshaw Trail, but ran its Concord coaches along the Southern Route from Yuma through Imperial Valley and the Carrizo Corridor to Warner's Springs, where the route divided, leading either to San Diego or Los Angeles (Hoyt, 1948; Dowd, 1960; Fitch, 1961; Pourade, 1971; Pepper, 1973; Johnston, 1977; Ross, 1992).

Accommodations for stage passengers along the Bradshaw Trail were rudimentary and uncomfortable. Thirteen way stations were constructed, most of which were adobe, between San Bernardino in the west and Ehrenberg. Distances between these stops ranged to 26 miles and included Canyon Springs, Chuckwalla, Whitewater, and Agua Caliente (Palm Springs). In addition to stabling fresh teams of horses, the way stations offered simple meals and overnight accommodations in small private rooms or common areas. Passenger travel was expensive, costing as much as \$40.00 to ride from San Bernardino to Ehrenberg. Armed robbery and horse theft occurred frequently enough to make stage travel a risk to drivers, station operators, and passengers (Johnston, 1977; Ross, 1992).

Until the Southern Pacific Railroad was completed east to Santa Fe, the Bradshaw Trail was the main means of communication between southern California and the eastern part of the United States. During the last years of the Civil War it was the only stage route operating into and out of southern California. By the 1880s, however, passenger coaches were discontinued, and commerce took the form predominantly of express and mail contracts carried by mule trains and freight wagons. The Bradshaw Trail was used as a freight route until the 20th century, and even accommodated automobile travel until the highway that eventually became Interstate 10 was built, farther to the north (Johnston, 1977; Ross, 1992).

Southern Pacific Railroad tracks reached the San Geronio Pass by the end of 1875. By March of 1876, the railroad was in Whitewater, and was completed to Seven Palms in May. By August, the first train had reached Indian Wells (Indio). Regular service to Dos Palmas, near what would later be the northeastern shore of the Salton Sea, was in operation by March of 1877. On May 23, the tracks finally extended to the California side of the Colorado River. On September 30, construction of a wooden trestle crossing the river into Arizona was finished. A southern branch line from Old Beach (later Imperial Junction, then

Niland) to Calexico was built by the Imperial and Gulf Railroad Company and the Southern Pacific in 1904. The same year, the Holton Inter-Urban Railway was constructed to connect El Centro and Holtville. Lines from El Centro to Seely, Calipatria to Sandia, and Sandia to Holtville were completed by the Southern Pacific in 1910, 1924, and 1930. A connection between El Centro and San Diego, begun by the San Diego and Arizona Railroad in 1907, was completed in 1919 and sold to the Southern Pacific in 1932, when it became known as the San Diego and Arizona Eastern Railroad (Hoyt, 1948; Fitch, 1961; Lamb, 1992).

The early 20th century saw the development of automobile transportation across the Colorado Desert. Most car and truck traffic was along previously established wagon roads following the path of least topographic resistance from one watering place to the next between desert settlements. Most of these roads remained unpaved until the late 1920s. Crossing loose, sandy washes and sand dunes was treacherous in motor vehicles before four-wheel drive and wide tires. A unique innovation for maintaining automobile travel across sand was developed where the El Centro to Yuma road crossed the Algodones Dunes. Approximately 20 miles west of Yuma, a plank road was constructed through the sand hills in 1916 and 1917. This road segment, the first to be built expressly for automobiles in the Colorado Desert, extended 6.8 miles to a point just west of the Old County Well and Roadmen's House (Gordon's Well), where the dune sands ended and firmer ground was again encountered (Brown, 1920).

The plank road, constructed of rough, railroad-tie-like timbers laid edge-to-edge at a right angle to the direction of travel, was only wide enough for one vehicle. Turnouts, of the same materials and construction as the main road and adjacent to it, were provided for passing. To keep the planks from separating, steel strapping approximately two inches wide was attached along each edge and down the center of the road with bolts passing through every third or fourth plank. In many places, dune sand was piled several feet high on either side of the road, and would often begin to drift over the timbers. When that occurred, sections of the road, which was not anchored to the ground, could be lifted up and put back down on top of the sand, or moved aside to a new location. The plank road was used for about 10 years, until U.S. Route 80 which parallels Interstate 8 was completed through the area in 1927 (Pepper, 1973). A portion of the old wooden road can still be seen just south of the modern freeway at Gordons Well overpass.

4.3.3 Irrigation and the Creation of the Salton Sea

The first proposal to irrigate the Colorado Desert for agriculture came from Dr. Oliver M. Wozencraft after he saw Kamia Indians cultivating plots during an exploratory trip in May 1849. It was 10 years,

however, before Wozencraft secured the rights to 1,600 square miles of desert land in the Salton Sink from the California Legislature. Soon after this, he presented a bill to the U.S. Congress, which would have given him patents to the land upon completion of reclamation work, which he planned to accomplish by building a canal from the Colorado River. Wozencraft hired Ebenezer Hadley, an engineer from San Diego, to survey canal routes, most of which were used many years later when irrigation was finally accomplished. In 1859, however, the attention of Congress was diverted by the growing problems leading to the Civil War, and later by the reconstruction of the South. Wozencraft died in 1887, never having realized his dream of turning the Salton Sink into an agricultural region (Cory, 1915; Kennan, 1917; Fitch, 1961; De Stanley, 1966; Nordland, 1977).

After Wozencraft, others joined in the proposal to bring water to the Salton Sink. In 1873, Dr. J.P. Widney wrote several articles for the *Overland Monthly* on the subject of flooding the sink with Colorado River water (De Stanley, 1966). In 1875 and 1876, Lieutenant George M. Wheeler headed an examination of the feasibility of diverting irrigation water from the Colorado River between the Grand Canyon and the Mexican border. This project was supervised in the field by Lieutenant Eric Bergland, who suggested that tapping into the river just south of the international boundary would be the best plan. Bergland believed a canal should be dug from east to west in Baja California, south of the sand dunes that stretch west from Yuma, finally turning northwest into the United States to supply the Imperial Valley (Cory, 1915; Fitch, 1961). In 1891, the Colorado River Irrigation Company was formed, with engineer Charles R. Rockwood directing operations. Rockwood examined the entire Salton Sink and the river delta, and worked out a practical diversion and canal system. The financial depression of the 1890s put the company out of business, however, and Rockwood sued to obtain his salary. As part of the settlement, he was given the engineering plans and records. In 1896, Rockwood formed the California Development Company, but spent the next few years searching the United States and Europe for financial backers. Finally, in April 1900, a contract was signed by Canadian capitalist George Chaffey, the founder of Ontario, California, to provide funding and promotion (Cory, 1915; Kennan, 1917; Fitch, 1961).

Pilot Knob, about one mile north of the international boundary, was chosen as the diversion point on the Colorado River. La Sociedad de Riego y Terrenos de la Baja California, Sociedad Anónima, a Mexican subsidiary of the California Development Company, purchased 10,000 acres in Baja California from General Guillermo Andrade, along with the bed of the Alamo River. Work on the Imperial Canal was begun in April of 1900. Moving westward from camp to camp, construction crews excavated, digging new canal and utilizing portions of the Alamo River. The canal turned northward into the United States at Calexico. The Central Main Canal was built northward from that point. By June of 1901, water began

flowing through the canal to Calexico, and the Central Main Canal was brought on line in March of the following year. Irrigation of the Imperial Valley had begun. Imperial Water Companies 1 through 8 were organized to distribute the water (Cory, 1915; Kennan, 1917; Dowd, 1960; Fitch, 1961).

Agricultural development of the sink as a result of irrigation and real estate promotion by Chaffey and the California Development Company exceeded expectations. To attract settlers, Chaffey avoided use of the terms "desert" and "sink," naming the area Imperial Valley. The towns of Mexicali, Calexico, Heber, Imperial, and Brawley were formed as part of the development associated with the canal. The population of 2,000 in 1902 grew to 7,000 by 1903 and to over 10,000 by 1904. From little or no cultivation in 1900, agriculture in the Salton Sink grew to 120,000 acres under cultivation by January of 1905. The demand for irrigation meant that all efforts were focused on keeping the water flowing, leaving maintenance as a low priority. Proposed levees to protect the canal were never built. The severe winter of 1861-1862 had resulted in inundation of the Salton Sink, and flooding had submerged a 150-square-mile area again in 1891. The Alamo River channel had not eroded significantly during those flooding episodes, and engineers believed the canal/river system would be able to withstand future floods (Kennan, 1917; Fitch, 1961).

In 1903 the U.S. government tried to stop diversion of Colorado River water for use in the Imperial Valley because it was believed navigation would be a better use of the river. The California Development Company succeeded in having a bill introduced during the Congressional session of 1903-1904 that would have given irrigation priority over navigation; however, the Reclamation Service opposed the bill and Congress refused to allow further use of Colorado River water in the Imperial Valley. As a result, the California Development Company entered into a contract with the government of Mexico to build a new canal head south of the international boundary, where the U.S. government had no jurisdiction over the Colorado River. Another reason for building a new head at this location was that the first few miles of the canal had become choked with silt. Building a new canal head was cheaper and faster than dredging the old one. In October of 1904 the new, temporary, 50-foot-wide intake was built in Mexico. A larger, permanent head was planned, but was not an immediate priority because the river was not expected to rise until at least the summer of 1905 (Kennan, 1917; Fitch, 1961).

During the winter of 1904-1905, greater than usual rainfall in the watershed area of the Gila River caused a high rate of discharge into the Colorado River above the new temporary Imperial Canal intake. In February, 1905, a flood clogged the intake with silt. This had just been cleared when a second flood brought more silt and debris. A temporary dam was built out of wooden piles, sand bags, and brush to block the flow into the canal, but a third flood in March destroyed it. The dam was rebuilt, and destroyed

again by a fourth flood. By the time the fifth flood hit, the intake had been eroded from a width of 50 feet to 160 feet. Water rushed uncontrolled into the canal. With no levees, the sides were quickly overflowed along its entire length. In addition to flooding of the Alamo River-Imperial Canal system, the excess flow affected the New River, which overflowed, causing great damage to Mexicali and Calexico. The entire discharge of the Colorado River began to pour into the Salton Sink, marking the creation of the Salton Sea (Cory, 1915; Kennan, 1917; Fitch, 1961; Duke, 1974; Woerner, 1989).

The California Development Company realized the catastrophe had to be dealt with immediately, but lacked the funds to do anything. Appealing to the Southern Pacific, whose line ran through the Salton Sink, the company obtained a \$200,000.00 loan from H.E. Harriman, president of the railroad, in exchange for 51 percent of California Development Company stock until the money was repaid. In addition, Epes Randolph of the Southern Pacific became president of the California Development Company. In effect, the Southern Pacific Railroad controlled the irrigation company (Cory, 1915; Kennan, 1917; Fitch, 1961; Duke, 1974; Woerner, 1989).

In addition to the new intake gate at Pilot Knob, the Southern Pacific built a branch railroad line from a point seven miles west of Yuma to the river in order to deliver rock for the construction of levees and a series of dams across the break. The first load of rock was transported on August 15, 1906. The three rock dams built by the railroad kept the river under control for a few months, but another severe flood originating in the Gila River hit them on December 5, 1906. Three major breaks and about 90 smaller leaks occurred, and water rushed back into the Imperial Canal toward the Salton Sea. At this point the Southern Pacific realized that its interests in the region were threatened because the entire Imperial Valley faced evacuation. Harriman began negotiating with President Theodore Roosevelt for government funding to help with the expenses of fighting the Colorado River. Congress was in recess at the time, however, and negotiations with Mexico, where the original break and many miles of the flooding Imperial Canal were located, would be necessary. Instead of financing the operation, Roosevelt was only able to promise that the government would reimburse the Southern Pacific for its expenditures. On December 13, 1906, a meeting between the railroad and several Imperial Valley interests was held, and \$950,000.00 was subscribed to help control the disaster (Cory, 1915; Kennan, 1917; Fitch, 1961; Duke, 1974; Woerner, 1989).

Freight service on the Southern Pacific Railroad was suspended as the majority of its freight cars were diverted to the break in the Colorado River to bring rock, gravel, and clay from distances of up to 480 miles. The supply of log pilings in the western states was exhausted by the attempts to stop the flood, and pilings had to be imported from as far away as Louisiana. Immense quantities of rock were unloaded

along two large wooden trestles built in a curve across the river, connecting the stone levees on either side. A portion of one of the trestles was carried away in a sudden flood on December 28, 1906, but it was rebuilt, and work continued. On February 10, 1907, construction crews succeeded in closing the break. Two 1,100-foot-long trestle and rock dams, spaced 50 feet apart, had been constructed of 12,000 log pilings, 8,000 feet of 8-inch by 17-inch timbers, 2,157 railroad car loads of rock, 221 car loads of gravel, and 203 car loads of clay. The flow into the Salton Sink had ended after two years. The dam system was carefully monitored until it proved itself safe during the summer floods of 1907. In spite of its incredible effort and financial expenditure to stop the disastrous flow of the Colorado River into Imperial Valley and the Salton Sink, the Southern Pacific Railroad did not receive the promised reimbursement from the U.S. government until 1932 (Cory, 1915; Kennan, 1917; Fitch, 1961; Duke, 1974; Woerner, 1989).

After the flooding was under control, the surface of the Salton Sea was at its highest point, approximately 198 feet below sea level, covering about 470 square miles with water more than 70 feet deep at its deepest point. Evaporation soon began to lower the surface to its current elevation of approximately 230 feet below sea level. Agricultural development resumed in the Imperial and Coachella Valleys, with runoff from irrigation and inflow from the Alamo and New Rivers keeping the sea from evaporating, as earlier inundations had in 1862 and 1891. The Imperial Irrigation District was established in July 1911, covering an area of 817 square miles. In June, 1916, the Imperial Irrigation District purchased the canal system built by the California Development Company from the Southern Pacific Company. In 1922 and 1923, the district bought the distribution canals in the Imperial Valley from the various mutual water companies that owned them (Cory, 1915; Fitch, 1961; Woerner, 1989).

In 1919, a bill was introduced in Congress to authorize construction of a canal entirely within the United States due to unstable political relations with Mexico, where a large segment of the Imperial Canal-Alamo River system was located. While the Imperial Valley had been developing its agriculture and fighting the flood of 1905-1907, Coachella Valley to the north had also been growing. This region was dependent on the Whitewater River and artesian springs charged by runoff from the San Bernardino and San Jacinto Mountains. Drawing on the underground supply began to exceed replenishment by 1918 when about 418 square miles of the Coachella Valley were under cultivation. That year, the Coachella Valley County Water District was formed to conserve the valley's water supply. Because conservation was insufficient without replenishment, the district cooperated with the Imperial Irrigation District to plan and promote the new canal on the U.S. side of the international border. A large dam on the Colorado River to store water, and desilting works to prevent further flooding catastrophes were also planned. In December of 1928 Congress passed the Boulder Canyon Project Act, which initiated the construction of Boulder (Hoover)

and Imperial dams and the All-American canal system (Dowd, 1960; Fitch, 1961; Nordland, 1977, 1978a).

Hoover Dam was begun in Boulder Canyon in 1930, and water storage began in February of 1935. The Imperial Dam, located about 22 miles north of the Mexican border, was built as the diversion and desilting point for Colorado River water flowing into the All-American Canal. The canal was begun in August 1934, and by February 1942 was supplying the Imperial Valley with water, thereby eliminating the international complications of the earlier Imperial Canal-Alamo River system. After being delayed by World War II, the Coachella Canal, a branch of the All-American Canal extending northward to service the Coachella Valley, was completed in 1948 (Dowd, 1960; Fitch, 1961; Nordland, 1977, 1978a).

From 1901 to 1922 the Imperial Valley was irrigated without drainage. Under such conditions, the water table would sometimes be high enough to interfere with the root zones of crops. A bond issue was passed in 1922 providing \$2.5 million to begin construction of an arterial drainage system, into which tile pipe drainage lines constructed by individual farmers emptied. Excess irrigation water runs through the system into the New and Alamo Rivers, which in turn flow into the Salton Sea (Dowd, 1960). A similar underground system, constructed in the late 1940s, drains agricultural fields in the Coachella Valley (Fitch, 1961; Nordland, 1978a; Coachella Valley Water District, 1999).

Today, the Imperial Irrigation District provides water for 6,471 square miles in the Imperial Valley (Imperial Irrigation District, 1998). The Coachella Valley Water District services approximately 1,000 square miles (Coachella Valley Water District, 1999).

Electric power generation, which is related to irrigation in the Salton Sink region, was begun by the Imperial Irrigation District in 1936, when a three-unit diesel plant was constructed at Brawley. By 1943, the district had obtained \$6 million through a bond issue to buy the Imperial and Coachella Valley facilities of the California Electrical Power Company and make additions to the existing system. In addition to the Brawley diesel plant, four hydroelectric plants were built on the All-American canal and a steam plant began operating in El Centro. The Imperial Irrigation District continues to supply electric power to the Imperial and Coachella Valleys today (Fitch, 1961; Imperial Irrigation District, 1998).

4.3.4 Mining

While gold and salt mining are the most well-known mineral extraction activities, gypsum quarrying for the production of plaster wall board and sheet rock has been the highest dollar-value mining industry in the Salton Sea region. Approximately \$24 million worth of gypsum was mined between the beginning of

production in the early 1920s and 1961, far more money than was made from gold or salt. Gypsum mining in this area accounts for about 33 percent of California's production and 5 percent of the gypsum mined in the United States (Morton, 1977).

Almost all the area's gypsum comes from the Fish Creek Mountains southwest of the Salton Sea. After the San Diego and Arizona Railroad was completed through southern Imperial County in 1919, the Imperial Valley Gypsum and Oil Corporation began gypsum quarrying. The company built a mill 16 miles west of El Centro on the San Diego and Arizona line, establishing Plaster City. In 1922, the gypsum deposits were connected to the mill and the main railroad line with a narrow-gauge rail spur. The 3-foot-gauge tracks transported men, water, food, supplies, and raw gypsum over 26 miles of mostly flat desert (Fitch, 1961; Morton, 1977; Lamb, 1992).

In 1924, the Pacific Portland Cement Company bought the Fish Creek Mountain gypsum quarry and built a new calcinating plant capable of processing 300 tons of crude gypsum per day. In 1945, the United States Gypsum Company purchased the operation, expanding and modernizing the Plaster City facility (Morton, 1977). Gypsum production has continued in the Fish Creek Mountains and at Plaster City to the present day.

Salt mining was once important in the immediate Salton Sea area, since salt has accumulated for millennia at the bottom of the Salton Sink. The first European-American exploitation of salt deposits was in 1884, when the New Liverpool Salt Company built a plant at the north end of the sink. A one-mile rail spur connected the plant with the Southern Pacific Railroad at Salton. Large steam-powered salt plows were used to cut wide, shallow furrows in the playa bed. Only 10-acre plots were worked at one time, where about 700 tons of salt were plowed up in parallel ridges each day, exposing saltwater spring seepage below. Cahuilla Indian laborers used hoes to work the salt loose from the soil in the accumulated spring water. When that task was complete, the separated salt was piled in conical mounds prior to transportation to the nearby mill. To augment the supply of natural spring water, a 900-foot-deep well was drilled. Both spring and well water were so saline that a new salt crust would form in the plowed areas almost immediately. In addition to being the Southern Pacific rail connection, the settlement of Salton was the location of the salt milling works. The salt left in conical mounds on the playa was hauled by flatbed trucks to the spur line, over which small rail cars transported it to the mill. After being poured through a breaker to reduce it to smaller particles, the salt was ground into powder, sifted, and bagged for transport to the marketplace in sacks sown at the mill by Japanese workers. In addition to the refined salt produced for use with food, unrefined salt was sold for industrial use (Fitch, 1961; De Stanley, 1966).

Another salt operation, the Standard Company, soon began mining near the New Liverpool Salt Company's plant, and a rivalry developed between the two. When the Standard Company discovered that New Liverpool's mine was on government land for which there was no title, they pressed the government to evict their competitors. Instead, a law requiring claims to be filed on saline deposits was established in 1901. Anticipating the passage of the new requirement, each company prepared to beat the other in staking claim to the best salt deposits. On the day the bill was signed, the news reached Mecca by telegraph but had to be brought to the salt plants by other means. Messengers for New Liverpool set out from Mecca on a hand-pumped rail car, but were beat by the Standard Company's men, who had set up a series of signal mirrors between Mecca and their plant for instant communication. In spite of the Standard Company's head start in claiming choice deposits, both it and the New Liverpool Salt Company operated profitably, continuing their rivalry until 1905 when the two salt works were inundated by the rising Salton Sea (Fitch, 1961; De Stanley, 1966).

In 1919 the Mullet Island Paint Company began extracting salt from salt springs at Mullet Island, near the eastern shore of the Salton Sea, west of Niland. Salt was concentrated in three evaporation ponds, then pumped to crystallizing ponds. In 1934, the Mullet Island Development Company continued the operation, augmenting the salt springs and sea water with salt from well brine. The Mullet Island plant was run by the Reeder Salt Company from 1940 through 1942. A large portion of the salt produced at this location was used in the Imperial Valley as part of the process of icing railroad refrigerator cars (Fitch, 1961; Morton, 1977).

The Bertram salt deposit was discovered on Southern Pacific Railroad property west of Niland in 1903, but no salt was mined until 1923, when E.W. Otto and Company made the first shipment. No further shipments were made until the American Sulfates Company produced 250 tons of salt in 1941 and 1942. Salt was originally extracted at this location from a 600-foot-long, 20-foot-wide, 15-foot-deep pit. During the 1941-1942 operation, a second pit measuring 700 feet long, 20 feet wide, and 20 feet deep was excavated (Morton, 1977).

In 1927, an experimental solar evaporation salt plant was built near Caleb at the north end of the sea by Seth Hartley. By 1929, this plant was closed. Hartley built two more evaporation plants, including the Imperial Salt Works, 12 miles northwest of Niland, in the early 1930s. By 1935 the Imperial Salt Works was producing salt in nine evaporation and crystallizing ponds. The salt harvest was scraped into rail cars once a year. The Western Salt Company bought Hartley's plant in 1943 and operated it until 1947, when problems with sodium sulfate spoiled an entire year's production and led to permanent closure (Fitch, 1961; Morton, 1977).

While the desert area immediately surrounding the Salton Sea has yielded no gold, the mountains to the north, east, and southeast of the Salton Sink have been the site of gold mining activity. The most important gold-producing deposits have been found in the Cargo Muchacho Mountains district, in the southeastern corner of Imperial County; the Picacho and Potholes districts, near the Colorado River in the southeastern Chocolate Mountains; and the Paymaster district, in the Chocolate Mountains northeast of Glamis (Morton, 1977). Other gold mines have been worked in the Little San Bernardino Mountains north of the Salton Sink, and a small amount of gold mining has taken place in the mountains west of the sink (Fitch, 1961).

The earliest known gold mining was carried out by the Spanish, in the Potholes area, beginning in 1779. Activity ended in 1781, when the Mission de la Purísima Concepción, its Spanish settlement, and the nearby mine were destroyed by Indians. Mining in the Potholes area was resumed during the 1820s, and continued until the end of the Mexican period in 1848. After the region became United States territory, American miners continued working the deposits, and had prospected extensively at Picacho, farther up the Colorado River, by 1857 (Morton, 1977). As discussed above, a major gold strike was found in 1862 near La Paz, Arizona leading to the establishment of the Bradshaw Trail, which became the first commercial road connecting San Geronio Pass and the Los Angeles area with Arizona, via the upper Salton Sink and the Colorado Desert (Fitch, 1961).

The completion of the Southern Pacific Railroad between Los Angeles and Yuma in 1877 enabled mining companies to ship equipment, supplies, and bullion to and from the mines easily. By the 1890s, gold mining was established on an industrial level in all the districts in the vicinity of the Salton Sink and nearby Colorado River. Most gold production in these areas occurred from about 1890 to 1910, and from the late 1930s until America's entry into World War II, when gold mining was suspended as a non-essential industry (Fitch, 1961; Morton, 1977).

A greater quantity of manganese is produced in the Imperial County area of the Colorado Desert than in any other location in California. Most of the manganese in the region comes from the Chocolate Mountains, northeast of Brawley, and the Palo Verde Mountains, southwest of Blythe, but deposits have also been mined in the Coyote and Fish Creek Mountains (Morton, 1977).

Before World War I, the majority of the world's manganese supply came from German territories. Great Britain and its allies, including the United States, lost this source at the beginning of the war, in 1914. Manganese, important for the production of steel and clear glass, among other uses, was sought elsewhere. Manganese extraction from the mountains of the Colorado Desert reached its peak as a result

of military need in the World War I years of 1917 and 1918; in the early 1940s during World War II; and during the U.S. government's Strategic Mineral Stockpiling Program from 1952 through 1959 (Morton, 1977).

The earliest manganese exploitation in the Colorado Desert took place in 1917 at the Chocolate Drop mine in the Palo Verde Mountains and the Pioneer mine in the Chocolate Mountains. The Chocolate Drop operated again in 1942 and during the 1950s, when it was expanded under the names Alaska mine, War Eagle mine, and Chipmunk mine. The Pioneer mine comprised a group of claims including the Curly M., Everharty, Pacific Coast Manganese, Tolbard, Tres Amigos, Whedon, and War Manganese mines. Like the Chocolate Drop mine, the Pioneer mine shut down production after World War I, but intensive mining was resumed from 1941 through 1945, and during the Cold War period of the 1950s (Morton, 1977).

Sand and gravel production also accounts for a large portion of the mining output of the Salton Sea region. Most sand and gravel are extracted from the ancient shoreline deposits of Lake Cahuilla, but a small amount comes from alluvial fans at the bases of desert mountain ranges. Fine-quality sand and gravel come mostly from the east shore deposits, stretching southward from a point east of Brawley to the Mexican border. West shoreline deposits, stretching from Plaster City to Salton City, are more coarse, and are used mainly for roadbeds, subbase, asphalt aggregate, and imported borrow. The first sand and gravel production in the area was probably the Orange County Rock Company's operation 18 miles northwest of Niland in 1926. The mine included a crushing and washing plant that used water from Frink Spring, located one mile northeast. The majority of sand and gravel exploitation, however, has taken place since World War II (Morton, 1977).

Wells drilled near bubbling mud pots along the southeastern shore of the Salton Sea once tapped into carbon dioxide (CO₂) deposits that were used to produce California's main source of dry ice. In 1927, while drilling exploratory wells for geothermal steam on Mullet Island, the Pioneer Development Company discovered CO₂. In September of 1932, the first hole in California solely for the purpose of tapping into CO₂ was drilled by the Salton Sea Chemical Products Corporation about seven miles southwest of Niland. In October of the same year, a more successful well was drilled, but sufficient CO₂ for the first commercial production came from the third well. Gas from this well was formed into CO₂ blocks in a small plant, built nearby in August 1934. In 1935, Salton Sea Chemical Products Corporation became Pacific Imperial Dri-ice, Incorporated. In February 1940 the dry ice plant and six CO₂ wells were sold to Natural Carbonic Products, Incorporated, which continued production until 1944 (Fitch, 1961; Morton, 1977).

During late 1934, elsewhere within the Salton Sea carbon dioxide field along the southeastern shore, the Imperial Carb-Ice Corporation had four wells producing CO₂ that was sold to the Salton Sea Chemical Products Corporation. In 1936 Imperial Carb-Ice built their own CO₂ block plant in Niland, connected to the CO₂ wells by a pipeline three and one-half miles long. The company sold its interests to the National Dry Ice Corporation at the beginning of 1937. National Dry Ice eventually changed its name to Cardox Corporation, and produced CO₂ for dry ice until 1954 (Fitch, 1961; Morton, 1977).

To make one ton of dry ice, used primarily in refrigerator railroad cars for the shipment of produce out of the Imperial Valley, 20,000 cubic feet of carbon dioxide had to be liquefied and compressed into blocks. The plants in the CO₂ field and Niland could make about 20 to 25 tons of dry ice per day. In the early 1950s, sea level began to rise, submerging the CO₂ well heads and field plants. For a while, the CO₂ companies attempted to continue production, servicing the wells and valves from boats. Eventually, the cost of this difficult operation began to exceed profits, and modern refrigeration techniques were replacing the use of dry ice. By 1954 production of CO₂ at the Salton Sea had ended (Fitch, 1961; Morton, 1977).

Calcite was discovered in the mountains west of the Salton Sea by John W. Hilton. The deposit of high-quality optical calcite is reported to be the only one in the United States. The mineral was mined by crews of Indians and U.S. Marines, and was used in the manufacture of optical gun sites during World War II. Because of the military secrecy surrounding this operation, very little information is available (Fitch, 1961).

Other minerals have been extracted from the desert and mountains of the Salton Sea region in small quantities. Among these are silver, copper, lead, nickel, mica, barite, silica, pumice, building stone, tungsten, sulfur, volcanic granules for roofing, and kyanite. Wells have been drilled, mostly in the southeastern portion of the Salton Sea, to explore for geothermal steam as a source of energy production. Between about 1907 and World War II, numerous oil exploration wells were drilled in the Salton Sea area, but no oil was discovered.

4.3.5 Military

The California-Arizona Maneuver Area and the Desert Training Center were established by General George S. Patton in the Colorado Desert in 1942. Used to prepare more than 1 million American soldiers for desert warfare in North Africa, the maneuver area was the largest simulated land-war area in history, stretching from the deserts of western Arizona, northwest to the central Mojave Desert of California, and

crossing the study area several miles east of the Salton Sea. Camp Young, headquarters of the Desert Training Center, was located near Chiriaco Summit, approximately 25 miles northeast of the Salton Sea. During World War II, army divisions were often seen training in the vicinity of the sea (Fitch, 1961; Ross, 1992).

Two other World War II military operations were the Old Sandy Beach Naval Station and the Naval Auxiliary Air Station, both located on the southwestern shore of the Salton Sea. In 1950, the State Lands Commission leased the Naval Auxiliary Air Station facility, which had been a small sea plane base during the war, to the Atomic Energy Commission (AEC). The AEC enlisted the Sandia Corporation, a division of Western Electric Company, to test the ballistic characteristics of nuclear bomb casings. A total of approximately 75 square miles was eventually set aside for this use. A target located in the Salton Sea 1.5 miles from the shore was used during the tests by Strategic Air Command bombers flying from Kirtland Air Force Base near Albuquerque, New Mexico. Increasing population in the area, as well as protests from the public, which did not understand that the bombs were only unarmed casings, resulted in the cessation of testing in 1961 (Fitch, 1961; Dowd, 1960).

Since World War II, the U.S. Navy has maintained the extensive Chocolate Mountain Naval Aerial Gunnery Range, occupying most of the mountainous area east of the Salton Sink. The Navy also reserves several smaller areas both to the east and west of Brawley and El Centro. These areas comprise the Naval Air Station, El Centro.

4.3.6 Recreation

Recreation has been the reason for several of the developments around the Salton Sea shore. Fishing was advertised by the Southern Pacific Railroad and local newspapers as early as 1907, and the Department of Fish and Game was stocking the sea with numerous game species by the 1920s. Several Federal and state wildlife refuges were established, and these were opened to duck and goose hunting in 1952. Other recreational activities that take place in the Salton Sea area include swimming, boat racing, water skiing, birding, hiking, and mineral and fossil collecting. Several movies have been filmed at the sea and in the nearby desert (Fitch, 1961; De Stanley, 1966).

Recreational development on the shores of the Salton Sea accelerated significantly in 1958. Communities such as Salton City, Salton Beach Estates, Desert Shores, and North Shore Beach Estates were all established at about that time. These settlements offered restaurants, motels and hotels, golfing, and boat-launching facilities for visitors, as well as planned residential communities, schools, shopping

centers, marinas, and yacht clubs for residents (De Stanley, 1966). For various reasons including distance from southern California population centers, increasing salinity and pollution of the Salton Sea, and rising sea level that has inundated some of the facilities, these resorts have not achieved the success their developers envisioned.

4.3.7 Settlements in the Salton Sea Area

After leaving San Bernardino and traversing San Gorgonio Pass, the first settlement encountered is Palm Springs, one of the best-known desert resort cities in the world. Palm Springs, situated 32 miles northwest of the Salton Sea just east of San Jacinto Mountain, is a gateway to the Salton Sink and Colorado Desert region. In December of 1872, Judge J.G. McCallum bought land in the vicinity of a cluster of desert springs that had been called Agua Caliente by the Spanish and Mexicans. McCallum, H.C. Campbell, and other investors gradually added to their lands, forming the Palm Valley Land and Water Company. In 1884, the company conducted a survey for a town site called Palm City, named for the trees in nearby Palm Canyon. The town was resurveyed and recorded in 1887 under the new name Palm Springs. Despite advertising, settlement began slowly due to lack of water, but an eight-mile canal was eventually built from the Whitewater River. Land was first sold at an auction on October 31, 1887, and went for \$45.00 to \$175.00 per acre. The first Palm Springs post office opened in 1890, and the City of Palm Springs was incorporated in 1938 (Gunther, 1984).

Indio, located about 15 miles northwest of the Salton Sea, is the largest town in the Salton Sink. In 1870, a San Bernardino County well was drilled near an existing Indian well, which gave the settlement its first name, Indian Wells. The well was used as a watering stop on the Bradshaw Trail, and in August of 1876 became a stop on the Southern Pacific Railroad, which was then extending its line from Los Angeles toward Yuma. The settlement was renamed Indio the next year, possibly because of the existence of a small Cahuilla village nearby. A plat map for the town site of Indio was filed with the San Diego County Recorder in 1888. In 1890, the U.S. Department of Agriculture imported the first date palms to America, and many of the seedlings were planted near Indio. The town, which is considered the date capital of the United States, has been the site of the U.S. Date and Citrus Station since 1907, when it was moved from Mecca due to the rising Salton Sea. Indio hosted the National Date Festival in 1921 and 1922. The Date Festival was discontinued until 1938, when it was combined with the Riverside County Fair and became an annual event. The City of Indio was incorporated in 1930 (Fitch, 1961; De Stanley, 1966; Pepper, 1973; Patterson, 1977; Nixon, 1978; Gunther, 1984).

Another settlement called Indian Wells, located about six miles west of Indio, was a small village consisting of a post office, established in 1915, and a few houses. By 1933, the population in the area had decreased to the point that mail service was transferred to Indio. Named after a famous Indian well near a Cahuilla village, Indian Wells was called Palma Seca by the Spanish, and Old Rancheria when it was made a stage stop in the pre-railroad year of 1866. After World War II, Indian Wells was revived as a resort development, promoted largely by nightclub and television performer Desi Arnaz. The City of Indian Wells was incorporated in 1967 (Fitch, 1961; Gunther, 1984).

Coachella is located four miles southeast of Indio along the Southern Pacific Railroad line. Both the Coachella Valley Water District and the northern division of the Imperial Irrigation District have their headquarters there. Coachella began as a railroad stop called Woodspur, but in 1901 the name was changed to Coachella during a meeting of local settlers. The name was formed from the "Coa" in Coahuilla (an early spelling of Cahuilla) and the "chilla" in conchilla (Spanish for small shells), with the final "i" changed to an "e." Coachella, like Indio, is primarily a date-producing community (Fitch, 1961; Pepper, 1973; Nordland, 1978b).

Thermal, a few miles farther southeast along the Southern Pacific Railroad from Coachella, was founded by Horace A. Green in 1902 at the site of Kokell, a railroad water stop. The name Thermal was chosen to describe the air temperature, which on many days is the highest recorded in the United States. Thermal, like Indio and Coachella, is a date growing center. Cotton and grapes are also major crops, and Thermal is Riverside County's leading livestock feed center (Fitch, 1961; De Stanley, 1966; Pepper, 1973; Nordland, 1978c; Gunther, 1984).

Mecca was originally known as Walters, which was a spur on the Southern Pacific Railroad about six miles southeast of Thermal. Walters was probably the name of a foreman during the railroad construction period of the 1870s. Coachella Valley's first artesian well, called the "500-foot flowing well," was drilled by the Southern Pacific Railroad in 1894. The well made Walters an important oasis and water stop not only for the railroad, but for desert travelers, including prospectors on their way to claims in the Little San Bernardino, Orocopia, and Eagle Mountains. Following a 1903 trip to Algeria and the Middle East, Bernard Johnson brought the first commercially successful date palms to Mecca, where the United States Date Gardens were established in 1904 as a date agriculture experimental station. Following the suggestion of R. Holtby Myers, a member of the California State Legislature and developer who had financed Johnson's trip, the name of the town was changed from Walters to Mecca in 1904 to promote the desert date culture. When the Salton Sea was formed between 1905 and 1907, water reached all the way north to the small settlement. As a result, the U.S. Date and Citrus Station, as the U.S. Date Gardens had

become known, was moved north to Indio. Eventually, the shoreline receded and the old town center of Mecca is now a few miles from the northern tip of the sea (Fitch, 1961; De Stanley, 1966; Pepper, 1973; Nordland, 1977; Gunther, 1984).

La Quinta, located just south of Indian Wells, is a 20th-century resort and retirement development. The name is a Spanish term for the rest stops established at five-day travel intervals on early desert trails; however, there is no evidence that the modern La Quinta was one of these way stations. In 1927, land owned by the Desert Development Company became the site of a hotel and golf course. A post office was established in 1930, and La Quinta was incorporated in 1982 (Fitch, 1961; Gunther, 1984).

Palm Desert, located about 10 miles west of Indio, was originally a water stop on the Bradshaw Trail called Sand Hole. The modern resort and residential community that eventually developed began as two villages. Palm Village, on the north side of Highway 111, was started in 1938 by W.A. Johnson and expanded by the Molin Investment Company in 1940. Palm Desert, on the south side of the highway, was started by brothers Clifford and Randall Henderson in 1946. Randall Henderson, who had started *Desert Magazine* in El Centro in 1937, moved his publishing offices to Palm Desert and eventually opened the Desert Magazine Art Gallery. A post office was opened in 1947, and Palm Desert was incorporated in 1973 (Fitch, 1961; Gunther, 1984).

The City of Brawley, located approximately 12 miles southeast of the Salton Sea, is one of the Imperial Valley's major population centers. The town was surveyed in 1902 by F.C. Paulin of the Imperial Land Company, and was reached by a branch line of the Southern Pacific Railroad in 1903. Brawley was incorporated as a city in 1908. Originally, the town was to be called Braley, after a Los Angeles investor. Mr. Braley, however, declined to be immortalized by a sparsely inhabited desert real estate venture. Another investor, Mr. Carter, suggested the similar name Brawley, after a friend of his who lived in Chicago. Mr. Brawley of Chicago never traveled to the town, but the local residents accepted his name for their community. Brawley is the center of the largest cattle feed area in the world, a fact reflected in its annual Cattle Call Rodeo and Imperial Valley Rodeo. In addition to livestock, cotton, sugar, vegetables, and recreational tourism form the economy of the area (Fitch, 1961; Pepper, 1973; Lamb, 1992).

Calipatria, located 184 feet below sea level 9 miles east of the southern tip of the Salton Sea, became a settlement as a result of the agricultural development and increasing rural population between Brawley and the Southern Pacific Railroad main line, located to the north. A branch line to the area was completed by the Southern Pacific and the Imperial and Gulf Railroad Company in 1903. As parcels of 47,000 acres of railroad land in the vicinity were bought, the necessity for a trade center arose. In 1914, Luther Brown,

an attorney from Los Angeles, had a town site plotted and began development. The town, originally called Date City, was incorporated as the City of Calipatria in 1919. Livestock feed, vegetables, bee keeping, tourism and a state prison are the main industries in this settlement. (Fitch, 1961; Pepper, 1973; Lamb, 1992).

Westmorland, situated halfway between Brawley and the southern tip of the Salton Sea, was surveyed in 1910 by the Oakley Company. A branch line of the Southern Pacific Railroad was completed from Calipatria to Westmorland in 1917. The town was incorporated in April of 1932, but disincorporated the following July. Two years later, in June 1934, the City of Westmorland was reincorporated. Westmorland is at the center of one of the state's leading cotton and watermelon producing areas (Fitch, 1961; Pepper, 1973).

El Centro, the largest city in Imperial County, has also been the county seat since 1907. In 1903, a branch of the Southern Pacific Railroad was completed to the area by the Southern Pacific and the Imperial and Gulf Railroad Company. Originally called Cabarker, El Centro was founded in 1904 by W.F. Holt and C.A. Barker, who bought land for \$40.00 per acre and made \$100,000.00 worth of improvements. Located 13 miles south of Brawley and 9 miles north of the international boundary, El Centro, as its name implies, is in the center of the Imperial Valley. After the name change and incorporation as a city in 1905, El Centro's population grew to 1,610 by 1910 and 5,646 by 1920. In addition to being the county seat, the administrative headquarters of the Imperial Irrigation District are located in the city. El Centro is a major agricultural center with lettuce the main crop. It is also the shipping center for agricultural products from the southern portion of Imperial Valley. In recent decades, El Centro has also become the region's leading government administration, wholesale, and retail trade center. Naval Air Station, El Centro is headquartered there, and maintains several large tracts of land in the desert to the northwest and northeast of the city (Fitch, 1961; Pepper, 1973; Lamb, 1992; City of El Centro, 1999).

Imperial, located just north of El Centro, was originally a base camp for prospectors seeking gold in the mountains of the eastern Imperial Valley. By 1900, the focus of attention in the region had changed to agriculture, and a town site was planned by the Imperial Land Company. Imperial had the earliest incorporation of any city in the Imperial Valley, dating originally to 1901. Two years later, the city lost its charter, but was reincorporated in 1904. In addition to being an agricultural center, Imperial is the site of the California Mid-Winter Fair, held every February (Fitch, 1961; Pepper, 1973).

Calexico, located south of the Salton Sea just north of the U.S.-Mexico border, was founded in 1900 following a donation of 160 acres by George Chaffey, the chief financier and promoter of the California

Development Company that brought irrigation, as well as the disastrous 1905-1907 flood, to the Imperial Valley. A town site was surveyed and the name Calexico was given to the settlement by L.M. Holt. In 1904, the southern branch line built by the Southern Pacific Railroad and the Imperial and Gulf Railroad Company reached the settlement. The City of Calexico was incorporated in 1908. Calexico is a major port of entry between Mexico and the United States, especially for agricultural goods. It is also a regional commercial center for Mexicali, located immediately across the border (Fitch, 1961; Pepper, 1973; Lamb, 1992).

Niland is approximately six miles east of the southeastern shore of the Salton Sea, the closest to the sea of any Imperial Valley town. Originally called Hobgood, Niland was known as Old Beach when the Southern Pacific Railroad tracks reached there in 1877 on their way to Yuma, Arizona. When the Southern Pacific branched off from Old Beach toward Brawley, El Centro, and Calexico in 1903, the settlement was renamed Imperial Junction. The official founding of the town took place in 1914. The same year, the name Niland, a contraction of "Nile Land," was won in a contest between Imperial Valley communities when the soil in the area was compared to the fertile ground along the North African river. Niland is the terminal for produce shipments being sent east and west on the Southern Pacific Railroad from the Imperial Valley (Fitch, 1961; Pepper, 1973).

Holtville, situated 10 miles east of El Centro on the east side of the Alamo River, was originally named Holton after W.F. Holt, a stockholder in the Imperial Water Company who founded the town in 1903 as a Swiss colony. In 1904, the Holton Inter-Urban Railway was constructed, connecting the town with El Centro. Holton was incorporated as Holtville in 1908. Known as "The Carrot Capital of the World," Holtville is also a livestock raising center and holds an annual gem and mineral show (Fitch, 1961; Pepper, 1973; Lamb, 1992).

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5.0 RESEARCH CONTEXTS

In addition to identifying the types and distribution of cultural resources in the Salton Sea study area, another objective of this investigation is to guide additional cultural resource studies and compliance activities in support of the Salton Sea Restoration Project. Research contexts define issues in the study area that are important to researchers and how the available data may be used to address specific questions. Research contexts also establish a standard for assessing the research potential of archaeological resources which are most commonly evaluated for National Register of Historic Places (NRHP) eligibility under Criterion D. This criterion recognizes resources which "have yielded or may be likely to yield information important in prehistory or history" (36 CFR 60.4). Research contexts indicate the types of information that may be important and the level of resource integrity required for eligibility determinations. Thus, future cultural resource work can be organized to address concrete research issues and compliance decisions can be guided by more objective standards.

An outline of regional research projects, issues and questions relevant to the study area are described below as a guide for future research. Data needs and test implications are discussed in terms of the applicability of identified cultural resources to address these research priorities. As alternatives are developed for the Salton Sea Restoration Project, further refinement of research questions, data needs and test implications would be made on a site-specific or project specific basis.

5.1 PRECONTACT HISTORY

5.1.1 Previous Regional Research

The earliest information about Native American occupation of the study area comes from the accounts of early explorers and travelers. Indian villages were visited by the Spanish, including Anza and Garces (Pourade, 1971), and later by Americans including Blake (1854). Early 20th century ethnographers such as Kroeber (1925) collected information on oral history and material culture from the remaining populations of the desert areas. Later researchers, including Treganza (1942, 1945) and McCown (1954, 1955, 1957, 2001) provided ethnographic and archaeological data on the Lake Cahuilla area. During the 1930s and 1940s, Rogers proposed the first cultural chronology of the Salton Sea region (Rogers, 1938, 1939, 1945). Some of the first absolute dates for the Lake Cahuilla region were provided in the 1960s by radiocarbon studies (Hubbs et al., 1963, 1965).

During the early 1970s, True and Casteel (1973) conducted an academic study of the lake shoreline. Wilke later provided the first comprehensive summaries of desert research in the region of the study area. In 1976, Wilke edited a summary of research on the Yuha Desert, which he followed in 1978 with a dissertation on the northern shoreline of Lake Cahuilla. Imperial Valley College field classes under the direction of von Werlhof conducted the first comprehensive survey of fish traps in the Salton Sea area in 1978 and 1980. The first research-oriented contract archaeology conducted in the Salton Sea region was done by Shackley (1984) and Pendleton (1984) as part of a utility line project.

Several other studies of the archaeology of the Salton Sea region were completed in the 1980s. The sample survey and overview of East and West Mesas done by Gallegos in 1980 was one of the first investigations of the region during this decade (Gallegos, 1980). WESTEC Services conducted investigations on the west side of the Sea that tried to identify patterns of occupation related to the Lake Cahuilla shoreline (Carrico et al., 1980; Phillips, 1982). In the late 1980s, archaeological field work was done along the western side of the Lake Cahuilla shoreline near Dunaway Road, at seasonally water-filled claypans and at an ethnographic village site at San Sebastian Marsh (von Werlhof, 1982, Schaefer, 1986, 1988; Schaefer et al., 1987). Settlement patterns along the northwest shoreline of the lake were further defined by investigations in the La Quinta area (Jertberg and Farrell, 1980; Sutton and Wilke, 1988). Other 1980s projects near the southern portion of the study area were related to geothermal development and aggregate mining (Gallegos, 1984, 1986, 1989; von Werlhof, 1982).

In the 1990s, numerous cultural resource management studies have been undertaken in the region. These include major investigations located at the former U.S. Navy Salton Sea Test Base (Apple et al., 1997), along Highway 86 (Rosen, 1985), at the Truckhaven geothermal development (Gallegos and Pignuolo, 1990), near the City of La Quinta (Brock and Smith, 1999; Love, 1996; Smith and Brock, 1999), in the Kane Spring area (Laylander, 1991), at the off-road vehicle recreation area (Clewlow et al., 1992), and at the proposed Monofill land exchange (Pignuolo, 1994). A study of the Elmore Site by Laylander (1994) provided important information on a site located below the highstand shoreline of Lake Cahuilla. In the mid-1990s, regional syntheses of recent precontact discoveries, research issues, and ceramics were completed by Schaefer (1994a).

5.1.2 Research Issues Pertinent to the Study Area

Previous investigators have identified research issues relevant to future studies of precontact history in the study area. These research contexts include chronology, ethnic affiliation, settlement patterns, and subsistence, and are discussed below.

5.1.2.1 Chronology

Chronology is the placement in time of artifact types, sites, and/or site strata. Determination of chronological placement of sites and contemporaneous occupations are fundamental regional research issues. For the Colorado Desert and Salton Trough, chronology is a research topic for which much more investigation is required. A small amount of evidence exists for Paleoindian or San Dieguito Period (pre-7,000 years before present [BP]), and Archaic Period (7,000 to 1,075 years BP) occupation of the Colorado Desert. Evidence for San Dieguito occupation of the Colorado Desert has been limited to cleared circles and tool typology (Rogers, 1945; McCown, 1957; Laylander, 1991; Pignolo, 1994). Since well-defined San Dieguito sites have been recorded to the east and west of the Salton Trough, such sites may exist in the Salton Sink. If these sites do exist, however, they are probably buried under a large amount of Holocene alluvium (Apple et al., 1997). Likewise, if Early Archaic sites are present in the Colorado Desert, they may also be deeply buried under alluvial deposits. Other than isolated artifacts, only one stratified, well-investigated Archaic Period site has been documented in the Salton Trough. The presence of Elko projectile points at this site, and the absence of Pinto points, indicate that Indian Hill Rockshelter represents late Archaic Period activity in the basin (4,000-1,500 years BP) (McDonald, 1992, Schaefer, 1994b).

Understanding the transition from the Archaic to the Patayan Period is an issue which requires further study. Throughout Southern California there are several contrasting views suggested about the transition from the Late Archaic cultural traditions to the more recent prehistoric past. It has been alternatively been suggested that later prehistoric manifestations either evolved from the Archaic without outside influences; that the Archaic evolved under the influence of groups from the eastern desert; that Archaic peoples were displaced by new groups; or that there was a long hiatus that occurred between the dying out of the Archaic groups and the arrival of a different group or groups (Laylander, 1993).

The majority of precontact sites in the Salton Sea area date to the Patayan period (1300 years BP to European contact). Adaptation to alternating lacustrine and desert environments has been a major area of research involving archaeological sites dating to this period that have been found within the Salton Trough. Patayan Period settlement and subsistence, projectile point manufacture, rock features, and burial practices have also been studied. Areas of study that are not as well understood include the technology of tool and ceramic production, and exchange patterns as indicated by the presence of wonderstone and obsidian. Ceramic typology and chronology, in particular, are areas of research that have produced conflicting results and still require extensive research (Apple et al., 1997). Specific research questions on regional chronology include the following:

- When was the Salton Basin first occupied? Is there evidence supporting early (Pre-Paleoindian, Paleoindian and Archaic Periods) habitation of the region?
- If there was early occupation of this region, to what extent was the basin occupied during the Paleoindian (San Dieguito) and Archaic periods ?
- Does the transition between the Archaic and Patayan indicate an independent cultural evolution, gradual influence or replacement by other groups, or a long cultural hiatus followed by a rapid influx?
- What are the correlations between infilling and recessions of Lake Cahuilla and cultural use?
- What is this evidence for precisely defining the end of the most recent stand of Lake Cahuilla?
- Is the use of certain types of lithic materials or lithic reduction technologies indicative of time period?
- How can ceramic and projectile point typologies be used to help determine chronological sequences for Patayan sites? Do these markers parallel or differ from surrounding areas?
- In what ways does the chronological history of the Salton Basin parallel or differ from surrounding areas?

Test Implications/Data Needs: Chronology. Some Paleoindian and Archaic Period resources have been documented in the Salton Trough, although occupation during these early periods has not been well established throughout the region. Some older sites may not be discernible and it is likely that many sites in the basin have been buried under alluvium or plowed under (Schaefer, 1994a). Further investigation is needed to define diagnostic artifact sets and other associations for distinguishing these earlier sites in the environment. The cultural resource database for the study area may have some utility in helping identify sites for further study which potentially date to earlier periods, but many of the site records contain limited or inadequate data.

Where datable materials are present, and there is confidence in the dating technique, studies should be undertaken to further refine local chronologies. To address issues regarding the transition from the Archaic to Patayan, studies should focus on dates for sites from the very late Archaic to very early Patayan and sites which possess some, but not all of the characteristics of Patayan. There should be a critical evaluation of the stratigraphic evidence for or against continuity and an examination of the indicators of environmental change during this transition (Laylander, 1993). Environmental data for the Patayan period should be correlated with both absolute dates and point and ceramic typologies to further clarify the local chronology.

5.1.2.2 Ethnic Affiliation

Determination of ethnic affiliation of peoples who occupied the Imperial and Coachella Valleys during precontact times remains an important regional research issue. Based on ethnographic tribal boundaries the assumption is often made that sites found within the southern portion of the study area are affiliated with the Kumeyaay (Laylander, 1997; Wilke, 1976) and those in the northern portion with the Cahuilla (Schaefer, 1986). However, disagreement has occurred regarding application of such a simplistic model to the region. The growing body of cultural knowledge of the region seems to indicate that movement

occurred often throughout the region and that cultural influences from neighboring groups was a result of such movement. Gifford (1931) suggested a close tie between the people who occupied the southeast part of the Salton Sea area and the Quechan, evidenced by movement to and from the Colorado river and shared horticultural practices. Other researchers have postulated seasonal movement between the desert and the Santa Rosa and San Jacinto Mountains to the west (Cline, 1980; Treganza, 1942). With movement probably taking place between the study area and both the western mountains and the Colorado River area, the population may have represented a blending of several peoples (Apple et al., 1997).

An attempt has also been made to link relative frequencies of wonderstone and obsidian at archaeological sites with ethnic identity. Sites in the northern portion of the study area tend to have more wonderstone, a lithic material having a source within Cahuilla territory, while southern sites are more likely to contain Obsidian Butte obsidian, a material found within an area occupied by the Kumeyaay (Apple et al., 1997; Laylander, 1994). Likewise, ethnic affiliation has also been ascribed to fishing practices and styles of fish traps. Specific research questions on ethnic affiliation include the following:

- To what degree can ethnic affiliation of sites be determined from site constituents and mortuary practices?
- Is the use of certain types of lithic materials or lithic reduction technologies indicative of ethnic affiliation?
- Are there stylistic differences in fish traps that can be associated with ethnic affiliation?
- Are sites of a specific ethnic affiliation limited to certain portions of the Salton Basin?
- To what degree do oral traditions confirm or differ with archaeological assumptions about ethnic affiliation and the political geography of native peoples?

Test Implications/Data Needs: Ethnic Affiliation Studies have suggested that a boundary existed between the Cahuilla to the north and the Kumeyaay to the south. It has been hypothesized that ethnic affiliation of sites may be determined according to frequency of wonderstone (presumably Cahuilla) or obsidian (presumably Kumeyaay) artifacts at a given site (Laylander, 1994). The cultural resources database for the current study has several gaps in information on lithic artifacts, particularly in data which does not provide detail on lithic materials and how they have been worked. Further study of recorded sites will be necessary to obtain these data and test the hypothesis that lithic materials can be linked to a particular native group. Various rock features are also recorded in the site database which may be associated with ceremonial activities or fishing practices indicative of the practices of particular ethnic groups. Descriptive information recorded on site forms regarding these features in most instances is not adequate to speculate on ethnic affiliation. To a lesser degree, pottery types and stylistic elements are also associated with particular ethnic groups and their movements. Additional work is needed to identify and plot distributions of pottery types to test the interpretation of regional pottery sources conducted by Ron May (May, 2001). Further complicating the matter is cross-cultural interaction which blurs the line of

distinction and makes it difficult to detect specific cultural affiliation, especially considering that most southern California groups have similar material cultural traits. Research should be targeted to sites or locales which are included in tribal oral traditions, sites with multiple rock features, and those sites which include diverse assemblages of artifacts manufactured from non-local material.

5.1.2.3 Settlement Patterns

Precontact settlement patterns have been the focus of much research in the Salton Sea area. This research has largely centered on the effects that flooding and recession events of Lake Cahuilla had on settlement patterns. Major population movements undoubtedly accompanied inundation of the Salton Trough. For instance, groups who lost access to the Colorado River through diversion of its course into the Salton Basin, in all likelihood moved closer to the nearest dependable freshwater source, which was Lake Cahuilla. Changes in ceramic technology indicative of the Archaic-Patayan transition were concomitant with population shifts of Colorado River groups (Rogers, 1945) and is supporting evidence that this movement took place.

The desiccation of Lake Cahuilla has also been proposed as an impetus for major population movement in the region. Several models have been developed to interpret perceived patterns of movement in the Salton Basin. Wilke (1978) suggested that there was permanent settlement of the Cahuilla in the Salton Sea region during the Patayan period and that during lake recessions, people simply moved into upland areas surrounding the valley. Other models of Lake Cahuilla fluctuations are more complex (Laylander, 1994), suggesting that a small number of large population movements occurred in response to single inundation and recession events. Settlement in the lake area may have been part of a larger seasonal rounds that included the desert and highland areas.

There has been disagreement among researchers as to whether the lakeshore environment was stable, providing a reliable habitat, or fluctuated, making springs and streams more desirable and dependable water sources than the lake. Weide (1976) believed the shoreline of Lake Cahuilla to have been unstable, and therefore relatively unproductive. He based his hypothesis on calculations of evaporation rates and river inflow. Wilke's (1978) reconstruction of the lake's hydrologic history indicates a more stable shoreline that provided a reliable habitat for marsh resources to develop. Schaefer (1994a) agrees with Weide's model, stating that archaeological sites along the ancient shoreline lack the size, depth, and intensity of use to have been anything other than temporary habitations, and therefore represent stops along seasonal rounds. The appearance, however, that sites were short term occupations does not necessarily indicate that they were not permanent habitations (Smith, 1999). Furthermore, evidence from

the north shore of Lake Cahuilla indicates that rather than permanently relocating habitation sites, shifts were made to subsistence strategies to accommodate recessional environments (Brock and Smith, 1999). For example, as the lake's shoreline receded, habitation sites could have been established closer to the shore for periods of one or two years and then moved as needed, resulting in an artifact density which might resemble that of a temporary habitation, but would actually represent nearly year-round occupation (Apple et al., 1997). Once following the receding shoreline was no longer feasible for procuring freshwater resources, movement to more secure water sources, such as highland springs and rivers, presumably occurred (Smith, 1999). Specific research questions on settlement and mobility include the following:

- What were the broad settlement and mobility patterns of the inhabitants of the region?
- What archaeological evidence indicates the existence of large groups or segmentation into smaller economic units?
- What role did the trail system play in a settlement and seasonal rounds?
- What evidence is there indicating long-term, year-round occupations of the Basin and how are these sites distinguished from seasonal habitations?
- What are the relationships between site location, elevation, landform, topography and lake fluctuations in the study area?
- Are there correlations with changes in settlement at Lake Cahuilla with flood or drought events at the Colorado River?
- What accounts for an apparent population increase after AD 1600?

Test Implications/Data Needs: Settlement . To address these questions, site data indicating temporary, seasonal-round occupation (seasonal faunal remains; focused function, lack of midden development; relatively small, non-complex sites), or long-term, year-round occupation (well-developed middens; larger, more complex sites, artifact variability, multiple cremations) are required. In spite of data gaps in the project's cultural resources database, site use intensity can be compared and plotted onto topographic maps so that site density and distribution can be analyzed. Regional studies focusing on presumed village or base camps should be conducted. As the study of the San Sebastian area indicates, settlement descriptions on the site level fail to adequately address the complexity of the relationships of seasonal camps, population and demographic shifts and local environmental dynamics (Schaefer, 1994). Site morphology can also be compared to ethnographically documented examples. Relations of sites to shoreline and other topographic features can also be examined using the database in conjunction with other environmental and paleoenvironmental data.

5.1.2.4 Subsistence

Much of the research that has been conducted in the Salton Trough has been devoted to addressing the question of how precontact populations made use of Lake Cahuilla when it was present in the trough. An

equally important research issue is how these groups adapted to the drastically altered environmental conditions during periods of desiccation (von Werlhof, 1980).

Archaeological evidence indicates that resources along the shoreline of the ancient lake were readily exploited by the region's inhabitants. Numerous rock features located in the vicinity of the ancient shoreline have been interpreted to be fishing weirs (Wilke, 1978). These features indicate that fishing was an important subsistence activity during periods of inundation. Further supporting this notion are the many middens containing freshwater shell and bones from water birds and fish that have been found near the ancient shore. Freshwater marshland vegetation has also been recovered from botanical samples and from human coprolites excavated from archeological sites, which suggest a stable lakeside environment (Brock and Smith, 1999; Laylander, 1994; Smith and Brock, 1999; Wilke, 1978). When the recession of Lake Cahuilla had gotten far enough along that freshwater resources could no longer be harvested, the region's inhabitants were forced to make a decision that would alter their existing lifeway. Two main options existed: leave the area in hopes of finding a new territory that could provide an ample supply of resources similar to those of Lake Cahuilla, or adapt to an increasingly dry environment. Recent evidence suggests that the latter option was chosen, probably because these populations had made adjustments to the changing environment all the while (Brock and Smith, 1999). Faunal evidence from sites in La Quinta indicated that desert mammals were being exploited prior to desiccation of the lake and that eventually this resource that was once a dietary supplement became a dietary staple. It appears then, that these populations simply chose to replace lacustrine resources with those of the open desert rather than expending the effort of moving to a potentially more productive environment (Wake, 1999). Specific research questions on subsistence include the following:

- What are the patterns of the use of lake resources by the Patayan occupants of the Salton Trough?
- What roles did upland and desert plants and animals play in the diet of the occupants of the Salton Basin?
- To what degree was the basin utilized by agriculturalists?
- What are the differences in subsistence patterns by location, topography and landform?
- As Lake Cahuilla receded, did fish continue to be a major resource?
- What does the lithic inventory indicate about subsistence activities?
- How do site components reflect presence of and activities related to the shoreline environment?
- To what extent were lacustrine-associated plant foods used?
- How far could the lake recede before fish could no longer be exploited?

Test Implications/Data Needs: Subsistence. To address these questions, additional data on shell middens, faunal remains, lithic tool types and uses, milling activities, and fish procurement and processing are required. Coprolite data has provided the most compelling and detailed information on subsistence and further analysis should be conducted of these data when available. More data also need to be collected regarding correlation of archaeological sites to shoreline topography and hydrology, such as the low

embayment ridge investigated at the Salton Sea Test Base (Apple et al., 1997). While the current database includes information on many fish trap and fish processing sites, further study of these and other sites is necessary to understand the full implications of their presence in this region. Further investigations into the elevational range at which fish traps became obsolete would contribute much to the knowledge of regional subsistence patterns.

5.1.2.5 Social Organization

Classic ethnographic research into the social organization and spiritual life of the native groups who utilized the project area was conducted by Strong (1929), Drucker (1937), Kroeber (1925), and Gifford (1931). More recent work by Lowell Bean (Bean, 1972, Bean, 1978, Bean and Bourgeault, 1989, Bean and Saubel, 1990, Bean and Vane, 1991), Fowler (Kelly and Fowler, 1986), Halpern (1984), Stewart (1983) and von Werlhof (2000, Symposium, 2000) has continued this research thread and further extended its focus to the interpretation of archaeological sites and landscapes.

The use of archaeological data to address questions of social organization follows two general themes. The first is the attempt to determine how local populations were organized (size of local groups, leadership structure) in the course of carrying out household and subsistence activities. The second is the attempt to determine status differentiation. In the prevailing materialistic orientation, religion and ideology are seen as functioning to support social organization by providing individuals with the symbolic tools for perceiving the aspects of social structures with which they interact (Binford, 1962).

While differences exist among the native groups relating to social and political organization and religious practices, ethnographic sources indicate many shared elements of adaptive social patterns, cosmology, and ceremonialism. The size and social composition of local groups probably reflects adaptations for optimally exploiting dynamic subsistence environments. Thus some aspects of social organization may be seen as linked to environmental adaptations and settlement patterns and research questions can be framed in that context. The centrality of religious ideology, ceremonialism and symbols in the life of the native inhabitants should not be underestimated, especially in the Salton Sea region. The desert environment is rich with spirit-oriented features such as geoglyphs, prayer circles, dance circles, spirit breaks, rock art, rock alignments, quartz reduction stations, and trails (von Werlhof, 2001). The meaning of these archaeological features cannot be properly addressed without the context of the cosmology of the native inhabitants. While cross-cultural interaction and the depopulation and other devastating effects of historic contact have interrupted cultural practices and social structure, knowledge and meaning continue to be passed on. Specific research questions on social organization include the following:

work both archivally and archaeologically could be conducted to determine the termini and function of the resource.

5.2.2.2 Economic Development

As described in Chapter 4, growth and economic development in the Salton Sea region was stimulated by a number of factors including the coming of the railroad, the development of irrigation agriculture, the mining of various minerals, the establishment of military installations and the building of lakeshore recreational facilities. Like much of southern California, emigrants from other parts of the United States and elsewhere seeking a better way of life fueled explosive growth in the early years of the 20th Century. For example, Imperial County grew rapidly between 1900 and 1930, but experienced flat growth through the 1950s. These patterns of economic growth and stasis are an important research issue. Post-contact resources which represent economic development of the region include irrigation and transportation infrastructure, community centers, schools, and business and industrial properties. Documentation of these resources contributes to the knowledge of why, when and where people began settling in the region, what sources of economic growth and employment were available, and how these changed over time.

Research topics on the issue of economic development include the following:

- Where are the earliest settlements in the region? Are these associated with railroad stops and transportation routes?
- Was irrigation and agriculture the one dominant stimulus to economic growth, or one among many?
- What kinds of businesses were established at the onset of regional economic development? What community services and institutions did people feel were important to their new communities?
- Was there a "boomtown" mentality associated with the rapid growth or were more stable economic and social patterns put in place from the beginning?
- What were the respective roles of agriculture, extractive industries, transportation, military and recreational industries in the economy and how did these change over time?
- What was the role of land promotion and speculation in the economic history of the region?
- Who were the emigrants to the area? What capital was available to them? What roles did ethnic or racial minorities play in the economy?

Test Implications/Data Needs: Economic Development Additional archival research is needed to address many of the above questions. This review of historic maps and documents may identify previously unknown locations of early settlements and properties related to economic development and the history of communities. The mapping of resource locations, may reveal patterns of regional development. Standing structures can be examined for time of construction and period of use; architectural styles; function; indications of economic or functional success; historic associations; and change through time. Institutional archives and local histories can be accessed to clarify the roles of irrigation, the railroad, and mines in the economy.

5.2.2.3 Refuse Deposits

Refuse deposits or concentrations are the most-represented type of post-contact archaeological site found within the study area. Although treated as a single resource type, refuse deposits can be isolated or associated with other resources such as residences, mining sites, or railroad features. Their interpretive and informational context is changed based on these associations. Refuse deposition is typically found to follow two patterns of discard, intentional and incidental. Intentional discard occurs when items such as broken china and empty food containers are no longer functional and are accumulated at a specific location. Incidental discard occurs when items such as alcoholic beverage bottles are casually tossed aside rather than accumulated for disposal. Intentional discard may occur at primary or secondary locations. Primary refuse concentrations represent refuse deposited during limited activities away from residential sites. Artifact types represent activities that took place on these sites. Secondary dumping occurs when refuse is accumulated at a residential site and later transported to a dump location. Secondary refuse concentrations usually reflect diverse activities at the residential site. Dates obtained from artifacts at primary refuse concentrations usually represent the time of deposition. Secondary dumps, however, may represent deposition after the time range indicated by temporally diagnostic artifacts (Schiffer, 1972; Stevenson 1982; Rogers, 1985).

Over the past thirty years, many investigators have conducted research on refuse disposal in nearby desert areas that are generally applicable to the Salton Sea region. Schiffer (1972), Stevenson (1982), and Rogers (1985) studied patterns of post-contact refuse deposition as the result of intentional or incidental discard. Ward et al. (1977) and Hill (1982) conducted research on time lag factors for glass bottle dates and Wessel (1989) studied the relationship of the presence of locally and nonlocally produced items to distribution of goods. A model of behavioral and cultural variability for secondary refuse concentrations has been proposed by Wilson (1994). Guerrero and Bupp (1996) applied all of these issues to their study of post-contact refuse deposits in the western Mojave Desert.

In an analysis of post-contact sites done by Hill (1982), differential time lags were identified for various categories of bottles depending on the perishability of their contents (e.g., milk, beer, cleaning products) (Hill, 1982). Overall, manufacture-deposition lag time ranged between 10 and 18 years (Hill, 1982). Delays in implementing new styles and technologies, continued use of existing styles and technologies after new ones were introduced, storage time at a manufacturing plant, transportation time from the source to the frontier, storage time on a merchant's shelf, and reuse prior to discard are all factors that can influence temporal determinations of refuse concentrations (Ward et al., 1977).

Deriving historic information from refuse deposits requires that the researcher first define the characteristics of the deposit itself and determine what kinds of activities the refuse is associated with. At that point a detailed analysis of the artifactual components can be undertaken to address more specific questions depending on the association of the deposit. As an example, artifact analysis and interpretation of household or domestic refuse deposits can be used to define the time period(s) of the deposit; household composition, economic status, ethnicity, consumption patterns, and source and distribution of goods (Earle et al., 1997). Data from individual deposits can be compared with each other and with archival information to provide a clearer picture of domestic life in the Salton Sea area.

- What time period is represented by the deposit? Is it a long-term disposal site containing refuse deposited periodically, or does it represent a single dumping episode? Does the deposit contain temporally discrete dumping episodes?
- Why was the refuse deposited at the chosen locale? Does the deposit represent intentional dumping or incidental discard? Is the deposit associated with occupation or activities that occurred in that location (primary deposit), or does it reflect items that were accumulated elsewhere and later moved to the deposit site (secondary deposit)?
- What are the functional domains represented in the deposit? Are the domains economic (agricultural, industrial, transportation related, etc.) or domestic (household related)?
- For household or domestic deposits: Does the location or time period indicate likelihood that the deposit is associated with a particular family? Are there indications of the ages and genders of those producing the refuse? Do food containers, butchery practices or other artifacts indicate ethnic background? Are there artifacts which indicate higher or lower income? Are there patterns in the artifacts which indicate self-sufficiency, such as a homemade items? What goods were purchased and what were their sources? How does the composition of this deposit compare with others in the Salton Sea area and other regions?
- For deposits associated with transportation networks, mines and irrigation features: Are there deposits which are related to construction camps, abandoned rail stops, or early use? What time period of use is represented? Do deposits indicate or confirm records of ethnicity of workers? Do deposits indicate the presence of expensive or leisure goods?

Test Implications/Data Needs: Refuse Deposits. In most cases, current site records provide only limited information regarding refuse concentrations. More detailed information is required to both define the characteristics of these deposits and record the temporally and functionally diagnostic artifacts needed before research questions can be adequately addressed. In order to obtain such information, more pre-field archival research and more rigorous methods of recording these sites is necessary.

5.2.2.4 Residential and Farming Sites

Residential and farming sites include standing structures and associated agricultural and/or ranching features or the ruins of sites where these activities occurred. Typically these resources represent an occupation and activities of an individual or family for an extended period of time. The assemblage of features and artifacts within these sites can provide data on the types of economic activities that were pursued. These sites often reflect a variety of economic activities such as stock and poultry raising,

farming, truck gardens, roadside stands, canning, and general development of the property. Generally, the more diverse the economic activities were that occurred on a site, the greater the chance for success of the family enterprise.

Standing structures can be examined for time of construction and period of use; architectural styles; function; indications of economic or functional success; historic associations; and change through time. The type and extent of features can provide information on those activities which were pursued for the use or consumption of the occupants or for sale to an outside markets. The site assemblage and refuse deposits may also provide information on the period of occupation, technology, household composition, subsistence, socioeconomic status, gender, and ethnicity of the occupants. Archival data can also provide valuable information on the ethnicity, age, and gender of the occupants, as well as on the type of land acquisition (e.g., purchase, use of a claim on public land), and period of occupation. Data from these individual economic units can be compared with each other and brought into the discussion of the overall regional history.

Research issues associated with residential and farming sites in desert environments have been addressed by Panelli (1984), Bupp et al. (1998), Guerrero (1998), and Guerrero et al. (1998). Panelli's study was an ethnoarchaeological investigation of homestead sites in central Nevada. The research conducted by Bupp and Guerrero was of desert homestead sites within the Antelope Valley of the western Mojave Desert in southern California. Many of the ranches and farms in these studies were never irrigated and were more isolated from communities than those in the Salton Sea area. Specific research topics related to these sites include:

- Why did people settle in the Salton Sea area? To what degree was it the possibility of making a family living from the land or for more speculative opportunity?
- How much of the acquisition of property in the Salton Sea area was through claims on public lands and how much was through private purchase or resulted from real estate promotion? Are there differences between those settlers who acquired public land through homesteading and those who purchased?
- To what degree did ethnic or religiously based groups acquire land and assist each other mutually?
- Did the settlers who occupied the sites engage in multiple economic activities? What economic activities are represented on individual sites?
- Did the economic pursuits evidenced by the sites merely provide subsistence for the settlers, or were significant materials sold for cash income?
- For standing structures, does the architectural style or construction indicate economic success? Does the site contain large or high-quality structures indicating available monetary resources? Are there changes to structures such as additions which reflect change through time?
- What technologies are represented on the site? Are they indicative of well-capitalized operation?
- What were the time period(s) of the occupation; household composition, economic status, ethnicity, consumption patterns, and source and distribution of goods?

Test Implications/Data Needs: Residential and Farming Sites. Archival sources are the principal means of addressing both the broad regional level questions and providing background for addressing individual residential and farming properties. The current cultural resources database for the study area contains only a few records of residential or farmstead sites. Purported homestead sites were identified using historic plat maps; however, no data was found to identify the owners of these properties. Further research could be conducted to determine the history of these resources. For standing structures and archaeological sites, more systematic recording of these resources needed to address the above research questions including architectural details, the number, type, and size of features and the functional and temporal analysis of artifacts.

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7.0 RESULTS AND MANAGEMENT RECOMMENDATIONS

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8.0 REFERENCES

Apple, Rebecca

- 1997 Archaeological District Record for the Southwest Lake Cahuilla Recessional Shoreline Archaeological District. On file at the Eastern Information Center, California Historical Resources Information System (CHRIS), University of California, Riverside.

Apple, R., A. York, A. Pigniolo, J. Cleland, and S. Van Wormer

- N.D. Archaeological Survey and Evaluation Program for the Salton Sea Test Base, Imperial County, California. On file at the Imperial Valley College Desert Museum and Information Center.

Arrowweed, Preston

- 2000 Personal communication with Jay von Werlhof.

Aschmann, Homer

- 1991 Causes of the Decline in Mission Population. In *Spanish Borderlands Sourcebooks*, Volume 16. Edited by Robert H. Jackson, p. 227. David Hurst Thomas, general editor. Garland Publishing, Inc., New York & London.

Bannon, John F.

- 1974 *The Spanish Borderlands Frontier, 1513-1821*. University of New Mexico Press, Albuquerque.

Barker, M., E. Burton, and W.M. Childers

- 1974 *A Preliminary Report on a Burial Excavated in the Yuha Desert of Imperial County, California*. Manuscript. Riverside: Bureau of Land Management.

Bean, Lowell John

- 1972 *Mukat's People: The Cahuilla Indians of Southern California*. University of California Press, Berkeley.
- 1978 Cahuilla. In *Handbook of North American Indians*, Volume 8, California. Edited by Robert F. Heizer, pp. 575-587. W.C. Sturtevant, general editor. Smithsonian Institution, Washington, DC.

Bean, Lowell John, and Katherine Siva Saubel

- 1978a Cupeño. In *Handbook of North American Indians*, Volume 8, California. Edited by Robert F. Heizer, pp. 588-591. W.C. Sturtevant, general editor. Smithsonian Institution, Washington, DC.
- 1978b Serrano. In *Handbook of North American Indians*, Volume 8, California. Edited by Robert F. Heizer, pp. 570-574. W.C. Sturtevant, general editor. Smithsonian Institution, Washington, DC.

Bean, Lowell John and H.S.A. Bourgeault

- 1989 *The Cahuilla* Chelsea House Publishers, New York, New York.

Bean, Lowell John, and Sylvia Brakke Vane, eds.

- 1991 Unpublished Report on the Tahquitz Canyon Project. Report being prepared for the Riverside County Water and Flood Control District, by Cultural Systems Research.

- Bedwell, S.F.
 1970 *Prehistory and Environment of the Pluvial Fork Rock Lake Area of South-Central Oregon*. Ph.D. dissertation. Department of Anthropology, University of Oregon, Eugene.
 1973 *Fort Rock Basin Prehistory and Environment*. University of Oregon Books, Eugene.
- Bee, Robert L.
 1983 Quechan. In *Handbook of North American Indians*, Volume 10, Southwest. Edited by Alfonso Ortiz, pp. 86-98. W.C. Sturtevant, general editor. Smithsonian Institution, Washington, DC.
- Binford, Lewis R.
 1962 Archaeology as Anthropology. In *American Antiquity* 28: 217-225.
- Blake, William Phipps
 1854 Ancient Lake in the Colorado Desert. *American Journal of Science* (second series) 17:435-438.
 1914 In *Salton Sea: A Study of the Geography, the Geology, the Floristics, and the Ecology of the Desert Basin*. Daniel T. MacDougal, pp. 1-12. Washington DC.
- Bolton, Herbert (editor)
 1930 *Anza's California Expeditions*. University of California Press, Berkeley.
- Brock, James and Brenda D. Smith
 1998 *Investigations for the Village on the Green Project, La Quinta, California*. Ms. on file at Eastern Information Center, U.C. Riverside.
- Brown, John S.
 1920 *Routes to Desert Watering Places in the Salton Sea Region, California*. Department of the Interior, United States Geological Survey Water Supply Paper 490-A. U.S. Government Printing Office, Washington, D.C.
- Bupp, Susan L., Evelyn N. Chandler, Cary D. Cotterman, Kevin T. Doyle, Kyle M. Guerrero, Valerie M. Hallett, and Brenda D. Smith
 1998 *Final The Legacy of Buckhorn Springs: Phase I and Phase II Cultural Resource Investigations, Edwards AFB, Kern County, California*. Prepared for the U.S. Army Corps of Engineers, Sacramento District, and the Air Force Flight Test Center, Environmental Management Office, Edwards Air Force Base, California. Prepared by Tetra Tech, Inc., San Bernardino, California.
- Bureau of Land Management and California Department of Fish and Game
 ca1980 Santa Rosa Mountains Wildlife Habitat Management Plan. A Sikes Act Project.
- Busch, Richard
 1995 *The Salton Sea (Now You "Sea" It - Now You Don't)*. Fallbrook Gem and Mineral Society, Inc., Fallbrook, CA.
- Byrd, Brian F., Drew Pallette, and Carol Serr
 1994 *Prehistoric Settlement Along the Eastern Margin of Rogers Dry Lake, Western Mojave Desert, California*. Brian F. Mooney Associates. Anthropological Technical Series No. 2.

CLASS I CULTURAL RESOURCES INVENTORY OF THE SALTON SEA REGION

- Cachora, Lorey
1990 Personal communication, J. Von Werlhof
- Carrico, Richard L., D.K. Quillen, and R. Phillips
1978 *Archaeological Investigation: IT Corporation Imperial Valley Site*. Manuscript on file at Imperial Valley College, Barker Museum, El Centro, California.
- Chandler, Evelyn N., Susan L. Bupp, Cary D. Cotterman, Kyle M. Guerrero, Dena S. Komporlides, and Ayse Taskiran
1995 *Cultural Resources Evaluation of Selected Archaeological Sites in the Off-Road Vehicle (ORV) Area, Edwards Air Force Base, California*. Prepared for the U.S. Army Corps of Engineers, Sacramento District, and the Air Force Flight Test Center, Environmental Management Office, Edwards Air Force Base, California. Prepared by Tetra Tech, Inc., San Bernardino, California.
- Chandler, Evelyn N., Dena S. Komporlides, and Susan L. Bupp
1994 *Cultural Resources Inventory for Portions of the Off-Road Vehicle (ORV) Area, Edwards Air Force Base, California*. Final Report, Volume I with Supplementary Report, Volume II. Prepared for the U.S. Army Corps of Engineers, Sacramento District, and the Air Force Flight Test Center, Environmental Management Office, Edwards Air Force Base, California. Prepared by Tetra Tech, Inc., San Bernardino, California.
- City of El Centro
1998 *El Centro's History*. City of El Centro, El Centro, California.
- Clewlow, C. William, Jr., Theresa A. Clewlow, and Hazel Wald
1991 Final Report for Archaeological Sites CA-IMP-5959, CA-IMP-5961, and CA-IMP-5963, Imperial County, California. On file at the Southeast Information Center, Imperial Valley College Museum, El Centro, California.
- Cline, Lora
1978 *The Kwaaymi: Reflections on a Lost Culture*. *Imperial Valley College Museum Society Occasional Paper No. 5*. El Centro, California.
- Coachella Valley Water District
1999 *Water and the Coachella Valley*. Coachella Valley Water District, Coachella, California.
- Colton, Harold S.
1945 *The Patayan Problem in the Colorado River Valley*. *Southwestern Journal of Anthropology* 1(1):114-121.
- Cordell, Linda S.
1983 *Prehistory of the Southwest*. Academic Press, Orlando.
1997 *Archaeology of the Southwest*. Academic Press, Orlando.
- Cory, H. T.
1914 *The Imperial Valley and the Salton Sink*. John J. Newbegin, San Francisco.
- County of Imperial General Plan
1914 *General Plan*. County of Imperial, California.

- David, James
1964 "Trade and Trails." *Archaeological Survey Report*. University of California, Berkeley.
- DeStanley, Mildred
1966 *The Salton Sea Yesterday and Today*. Triumph Press, Inc., Los Angeles.
- DeWilliams, Anita Alvarez
1983 Cocopah. In *Handbook of North American Indians*, Volume 10, Southwest. Edited by Alfonso Ortiz, pp. 99-112. W.C. Sturtevant, general editor. Smithsonian Institution, Washington, DC.
- Dowd, M.J.
1960 *Historic Salton Sea*. Office of Public Information, Imperial Irrigation District, El Centro, California.
- Downs, Theodore, and Woodard G.D.
1961 *Middle Pleistocene Extension of the Gulf of California into the Imperial Valley*. In Abstracts for 1961: Geological Society of America Spec. Paper 68, p.21.
- Drucker, Philip
1937 Culture Element Distributions, V: Southern California. *University of California Anthropological Records* 1(1):1-52.
- Duke, Alton
1973 *When the Colorado River Quit the Ocean*. Southwest Printers, Yuma, Arizona.
- Earle, David D.
1994 *Ethnohistoric Overview of the Edwards Air Force Base Region and the Western Mojave Desert*. Prepared for the U.S. Air Force Flight Test Center, Edwards Air Force Base, and the U.S. Army Corps of Engineers, Los Angeles District, Los Angeles, California. Report on file, Environmental Management Office, Edwards Air Force Base, California.
- Earle, David D., B. Boyer, R.A. Bryson, R.U. Bryson, M.M. Campbell, J.D. Johannesmeyer, K.A. Lark, C.J. Parker, M.D. Pittman, L.M. Ramirez, M.R. Ronning, and J. Underwood
1997 Cultural Resources Overview and Management Plan for Edwards AFB, California. Volume 1: Overview of Prehistoric Cultural Resources. Computer Sciences Corporation, El Segundo, California. Prepared for the U.S. Air Force Flight Test Center, Edwards Air Force Base, California. Report of file, Environmental Management Office, Edwards Air Force Base, California.
- Earle, David D., K.A. Lark, C.J. Parker, M.R. Ronning, and J. Underwood
1998 Cultural Resources Overview and Management Plan for Edwards AFB, California. Volume 2: Overview of Historic Cultural Resources. Prepared for the U.S. Air Force Flight Test Center, Environmental Management Office, Edwards Air Force Base, California. Prepared by Computer Sciences Corporation, El Segundo, California.
- Ezell, Paul
Field notes, J. Von Werholf.
- Fitch, Marcella K. E.
1961 History of the Economic Development of the Salton Sea Area. Unpublished thesis presented to the faculty of the Department of History, University of Southern California.

- Flora of North America Association
1999 Flora of North America. Internet site <http://www.fna.org>.
- Forbes, Jack D.
1965 *Warriors of the Colorado*. University of Oklahoma Press.
- Forde, Daryll
"Ethnography of the Yuma Indians" *University of California Publications in Anthropology and Ethnology* 28 (4): 83-278.
- Fowler, Catherine
1972 *Comparative Numic Ethnobiology*. Doctoral Thesis, University of Pittsburg, PA.
- Gallegos, Dennis R.
1980 Class II Cultural Resource Inventory of the East Mesa and West Mesa Regions, Imperial Valley, California. Volume I. WESTEC Services, San Diego.
1984 West Mesa Cultural Resource Survey and Site Evaluation, Imperial Valley, California. On file at the Bureau of Land Management, El Centro, California.
1986 Patayan II and Patayan III Occupation of IMP-4434 and IMP-5167, East Mesa, Imperial County, California. On file at the Southeast Information Center, Imperial Valley College Museum, El Centro, California.
1989 A Cultural Resource Inventory of IH Study Area, East Mesa, Imperial County, California. Prepared for ORMAT Energy Systems. Prepared by ERC Environmental and Energy Services Company.
- Gallegos, Dennis R., and Andrew Pignoli
1990 *Cultural Resource Survey of Eight Geothermal Well Sites and Access Roads in the Truckhaven Project Area, Imperial County, California*. Prepared for Freeport-McMoRan Resource Partners. Prepared by ERC Environmental and Energy Services Company, San Diego.
- Gifford, Edward W.
1931 The Kamia of Imperial Valley. *Bureau of American Ethnology Bulletin* 97.
- Gorry, Conner
1998 In *Gale Encyclopedia of Native American Tribes*, Volume IV. Malinawski, Sharon, Anne Sheets, Jefferey Lehman, and Melissa Walsh Doig, editors. Pp. 86-88.
- Guerrero, Kyle M.
1998 *The Homestead Factor: Criteria for Evaluating Desert Homesteads*. Paper presented at the meeting of the Society for California Archaeology, San Diego, California.
- Guerrero, Kyle M., and Susan L. Bupp
1996 *Behavior Patterning: Dumping in the Desert*. Paper presented at the meeting of the Society for California Archaeology, Bakersfield, California.
- Guerrero, Kyle M., Susan L. Bupp, Evelyn N. Chandler, and Dena S. Kompordides
1998 *Cultural Resources Evaluations of Ten Desert Homesteads, Edwards Air Force Base, California*. Report submitted to the U.S. Army Corps of Engineers, Los Angeles, and the

Air Force Flight Test Center, Environmental Management Office, Edwards Air Force Base, California. Prepared by Tetra Tech, Inc., San Bernardino, California.

Gunther, Jane D.

1984 *Riverside County, California, Place Names: Their Origins and Their Stories*. Rubidoux Printing Company, Riverside, California.

Halpern, A.

1997 *Linguistics Vol. 128*, University of California, Berkeley.

Hayden, Julian D.

1976 Pre-Altitherman Archaeology in the Sierra Pinacates, Sonora, Mexico. *American Antiquity* 41(3):274-289.

Hester, T.R.

1973 *Chronological Ordering of Great Basin Prehistory*. Contributions of the Archaeological Research Facility 17, University of California, Berkeley.

Hicks, Frederic

1974 "Influence of Agriculture on Aboriginal Socio-Political Organization in the Lower Colorado River Valley." *Journal of California Anthropology* 1, No. 2, 133-144.

Hill, Jane and Rosinda Nolasquez, editors

1973 *The First People, Cupeño Oral History and Language*. Malki Museum, Banning, California.

Hill, Sarah H.

1982 An Examination of Manufacture-Deposition Lag for Glass Bottles from Late Historic Sites. In *Archaeology of Urban America: The Search for Pattern and Process*. Edited by Roy S. Dickens, Jr. Academic Press, New York, pp. 291-327.

Hoyt, Franklyn

1948 A History of the Desert Region of Riverside County From 1540 to the Completion of the Railroad to Yuma in 1877. Unpublished thesis presented to the faculty of the Department of History, University of Southern California.

Hubbs, Carl L., George S. Bien, and Hans E. Suess

1963 La Jolla Natural Radiocarbon Measurements III. *Radiocarbon* 5:254-272.

1965 La Jolla Natural Radiocarbon Measurements IV. *Radiocarbon* 7:66-117.

Hurd, Gary

2001 Field notes, On file at the Southeast Information Center, Imperial Valley College Museum, El Centro, California.

Imperial Irrigation District

1997 *New River and IID Drains*. Imperial Irrigation District, Imperial, California.

1998 *Imperial Irrigation District History*. Imperial Irrigation District, El Centro, California.

Jefferson, George T.

1991a *A Catalogue of Late Quaternary Vertebrates from California: Part One, Nonmarine Lower Vertebrate and Avian Taxa*. Natural History Museum of Los Angeles County Technical Reports Number 5. Los Angeles.

- 1991b *A Catalogue of Late Quarternary Vertebrates from California: Part Two, Mammals.* Natural History Museum of Los Angeles County Technical Reports Number 7. Los Angeles.
- Jennings, Charles W.
 1967 Geologic Map of California, Salton Sea Sheet. State of California Division of Mines and Geology.
- Jennings, Jesse D.
 1957 *Danger Cave.* Anthropological Papers No. 27. University of Utah, Salt Lake City.
 1973 The Short Simple Life of a Useful Hypothesis. *Tebiwa* 16(1)1-19.
- Jertberg, Patricia, and Nancy Farrell
 1980 *A Study of Late Prehistoric Subsistence and Settlement Patterns along the Northwestern Shoreline of Lake Cahuilla.* Prepared for the Coachella Valley Water District. Prepared by Archaeological Resources Management.
- Johnson, Boma
 1984 Earth figures, notes in von Werlhof library.
- Johnston, Francis J.
 1977 The Bradshaw Trail: Narrative and Notes. *Historical Portraits of Riverside County.* Edited by John R. Brumgardt. Historical Commission Press, Riverside, California. Pp. 32-39.
- Kelly, William H.
 1977 Cocopa Ethnography. *Anthropological Papers of the University of Arizona* 29. Tucson.
- Kelly, Isabel T., and Catherine S. Fowler
 1986 Southern Paiute. In *Handbook of North American Indians*, Volume 11, Great Basin, edited by Warren L. D'Azevedo, pp. 368-397. Smithsonian Institution, Washington, DC.
- Kennan, George
 1917 *The Salton Sea: An Account of Harriman's Fight with the Colorado River.* The Macmillan Company, New York.
- Kirkesh et al.
 2000 Cultural Resources Overview and Survey for the proposed Alignment of the North Baja Gas Pipeline.
- Kroeber, Alfred L.
 1925 Handbook of the Indians of California. *Bureau of Ethnology Bulletin* 78. Washington, DC.
- Lamb, Blaine P.
 1992 High Iron Below Sea Level: Railroading in California's Colorado Desert. *Journal of the West*, 31(1):20-30.
- Lando, Richard and Ruby E. Modesto
 1977 *Temal Wakhish: A Desert Cahuilla Village.* *Journal of California Anthropology* 4:95-112.

Laylander, Don

- 1989 Yuma Linguistics, San Diego State University.
- 1991 *Phase II and Extended Phase I Tests at Seven Prehistoric Archaeological Sites (CA-IMP-6297/6298, -6417, -6419, -6422/6423, -6425, -6427, and -6429) in the Kane Spring Area, Imperial County, California.* Prepared for Caltrans District 11, San Diego.
- 1993 *Research Issues in San Diego Prehistory.* San Diego County Archaeological Society, San Diego
- 1994 Phase III Data Recovery at the Elmore Site (CA-IMP-6427), Imperial County, California. Prepared for Caltrans District 11, San Diego.
- 1997 The Last Days of Lake Cahuilla: The Elmore Site. *Pacific Coast Archaeological Society Quarterly* 33(1&2):1-38.

Loeltz, O.J., Burdge Irelan, J.H. Robinson, and F.H. Olmsted

- 1975 *Geohydrologic Reconnaissance of the Imperial Valley, California.* U.S. Geological Survey Professional Paper 486-K. P 54.

Los Angeles Times

- 1999 "Sunken Plane Is Matched to Crash Report." P. A-23. June 16.

Love, Bruce

- 1996 Archaeology of the North Shoreline of Ancient Lake Cahuilla: Final Results from Survey, Testing, and Mitigation-Monitoring. CRM TECH Report #168. Ms. on file at Eastern Information Center. U.C. Riverside.

Luomala, Katharine

- 1978 Tipai-Ipai. In *Handbook of North American Indians*, Volume 8, California. Edited by Robert F. Heizer, pp. 592-609. W.C. Sturtevant, general editor. Smithsonian Institution, Washington, DC.

Martin, P.S. and Mehringer, P.J., Jr.

- 1965 Pleistocene Pollen Analysis and Biogeography of the Southwest. In *Quaternary of the United States*. Edited by H.E. Wright, Jr. and D.G. Frey, pp. 433-451. Princeton University Press.

Massey, William C.

- 1992 Archaeology and Ethnohistory of Lower California. In *Spanish Borderlands Sourcebooks*, Volume 5. Edited by W. Michael Mathes, pp. 334-353. David Hurst Thomas, general editor. Garland Publishing, Inc., New York & London.

McCown, B.E.

- 1954 Archaeological Survey of (Salton Sea) Beach Line. Archaeological Survey Association of Southern California, *Newsletter* 1(3):10-11.
- 1955 The Lake LeConte Beach Line Survey. *The Masterkey* 29:89-92.
- 1957 The Lake LeConte Survey. Archaeological Survey Association of Southern California, *Newsletter* 4(3-4):3-4.

McCown, Lucille R

- 2001 Introduction: The Archaeological Survey Association of Southern California's Lake Le Conte Survey. *San Bernardino County Museum Association Quarterly* Volume 48, Number 3, Fall 2001.

McDonald, Alison Meg

- 1992 Indian Hill Rockshelter and Aboriginal Cultural Adaptation in Anza-Borrego Desert State Park, Southeastern California. Unpublished Ph.D. Dissertation. Department of Anthropology, University of California, Riverside.

McGuire, Randall H. and Michael B. Schiffer, editors

- 1982 *Hohokam and Patayan: Prehistory of Southwestern Arizona*. Academic Press, New York.

Montgomery Watson

- 1995 Imperial County Groundwater Study, Final Report.

Moratto, Michael J.

- 1984 *California Archaeology*. Academic Press, Inc., New York.

Morton, Paul K.

- 1977 *Geology and Mineral Resources of Imperial County, California*. County Report Number 7. California Division of Mines and Geology, Sacramento.

National Academy of Sciences

- 1987 *Paleontological Collecting*. National Academy Press, Washington, DC.

Nixon, Roy

- 1978 First Dates Imported in 1890 to Indio. In *Coachella Valley's Golden Years: The Early History of the Coachella Valley County Water District and Stories about the Discovery and Development of This Section of the Colorado Desert*. Revised Edition. Edited by Ole J. Nordland. Coachella Valley County Water District, Coachella, California. Pp. 50-51.

Nordland, Ole J.

- 1977 Three Words That Built the Coachella Valley: Water, Will, Vision. *Historical Portraits of Riverside County*. Edited by John R. Brumgardt. Historical Commission Press, Riverside, California. Pp. 54-64.
- 1978a Highpoints in District's History. In *Coachella Valley's Golden Years: The Early History of the Coachella Valley County Water District and Stories about the Discovery and Development of This Section of the Colorado Desert*. Revised Edition. Edited by Ole J. Nordland. Coachella Valley County Water District, Coachella, California. P. 10.
- 1978b Cahuilla, Coahuilla, Conchella, Coachella? In *Coachella Valley's Golden Years: The Early History of the Coachella Valley County Water District and Stories about the Discovery and Development of This Section of the Colorado Desert*. Revised Edition. Edited by Ole J. Nordland. Coachella Valley County Water District, Coachella, California. Pp. 67-68.
- 1978c Coachella Valley Was in Three Counties: Capsule History Reveals Colorful Early Days. In *Coachella Valley's Golden Years: The Early History of the Coachella Valley County Water District and Stories about the Discovery and Development of This Section of the Colorado Desert*. Revised Edition. Edited by Ole J. Nordland. Coachella Valley County Water District, Coachella, California. Pp. 110-119.

- 1978d Coachella Valley's Golden Years: The Early History of the Coachella Valley County Water District and Stories about the Discovery and Development of This Section of the Colorado Desert. Revised edition. Coachella Valley County Water District, Coachella.
- Norris, Robert M. and Robert W. Webb
1976 *Geology of California*. University of California, Santa Barbara. John Wiley & Sons, New York.
- Panelli, Mary D.
1984 *An Ethnoarchaeological Study of Homesteading in Central Nevada*. Masters thesis, Department of Anthropology, University of Nevada, Reno. University Microfilms International, Ann Arbor, Michigan.
- Parker, P.L., and T.F. King
1990 *Guidelines for Evaluating and Documenting Traditional Cultural Properties*. National Register Bulletin 38, U.S. Department of the Interior, National Park Service, Interagency Resources Division.
- Patten, Michael A., Philip Unitt, and Guy McCaskie
2000 *Birds of the Salton Sea: Status, Biogeography, and Ecology*. *University of California Press*, Berkeley and U.S. Geological Survey, Riverside, California, in press.
- Patterson, Tom
1977 *Underlying Issues in the Creation of Riverside County*. *Historical Portraits of Riverside County*. Edited by John R. Brumgardt. Historical Commission Press, Riverside, California. Pp. 40-64.
- Pendleton, Lorann
1984 *Archaeological Investigations in the Pichaco Basin*. On file at the Southeast Information Center, Imperial Valley College Museum, El Centro, California.
- Pepper, Choral
1973 *Guidebook to the Colorado Desert of California, Including Palm Springs, Salton Sea, Indio, and the Colorado River*. The Ward Ritchie Press, Los Angeles.
- Perry, Tony
1999 "Divers Examine Wreck of Plane in Salton Sea." *Los Angeles Times*, p.A-3. June 15.
- Phillips, Roxana
1982 *Archaeological Data Recovery Program: Northern Portion of IT Corporation Imperial Valley Site*. Report on file at the Southeast Information Center, Imperial Valley College Museum, El Centro, California.
- Pignuolo, Andrew R.
1994 *Historic Properties Inventory and Resource Evaluation of the Proposed Monofill Land Exchange, Imperial County, California*. Prepared for Magma Operating Company. Prepared by Ogden Environmental and Energy Services.
- Pourade, Richard F.
1971 *Anza Conquers the Desert: The Anza Expeditions from Mexico to California and the Founding of San Francisco, 1774 to 1776*. Copley Books, San Diego.

- Reid, Jefferson and Stephanie Whittlesey
 1997 *The Archaeology of Ancient Arizona*. The University of Arizona Press: Tucson.
- Rogers, Leah D.
 1985 *The Analysis of Changing Patterns of Refuse Disposal and Site Utilization on a Mid-Nineteenth to Early-Twentieth Century Homesite in Mississippi*. Unpublished Masters thesis, Michigan State University, East Lansing.
- Rogers, Malcolm J.
 1938 The Aborigines of the Desert. In *The California Deserts: A Visitor's Handbook*. Edmund C. Jaeger, ed. Stanford University Press.
 1939 Early Lithic Industries of the Lower Basin of the Colorado River and Adjacent Desert Areas. *San Diego Museum Papers*. Number 3.
 1945 An Outline of Yuman Prehistory. *Southwestern Journal of Anthropology* 1(2):157-198.
 1958 San Dieguito Implements from the Terraces of the Rincon-Patano and Rillito Drainage System. *The Kiva* 24(1):1-23.
 1966 Ancient Hunters of the Far West. Copley Publishers, Sand Diego.
- Rosen, Martin D.
 1985 *Report of Archaeological Test Excavations at Five Sites Located Along Highway 86 in Imperial County, California: CA-IMP-3675, CA-IMP-3676, CA-IMP-3678, CA-IMP-5099, and CA-IMP-5101*. Prepared for Caltrans District 11, San Diego.
- Ross, Delmer G.
 1992 *Gold Road to La Paz: An Interpretive Guide to the Bradshaw Trail*. Tales of the Mojave Road Number Nineteen. Tales of the Mojave Road Publishing Company, Essex, California.
- Schaefer, Jerry
 1986 *Later Prehistoric Adaptations During the Final Recessions of Lake Cahuilla: Fish Camps and Quarries on West Mesa, Imperial County, California*. Mooney-Levine and Associates, San Diego. Submitted to the Bureau of Land Management, Department of the Interior, El Centro, California.
 1988 Lowland Patayan Adaptations to Ephemeral Alkalai Pans at Superstition Mountain, West Mesa, Imperial County, California. On file at the Southeast Information Center, Imperial Valley College Museum, El Centro, California.
 1994 The Challenge of Archaeological Research in the Colorado Desert: Recent Approaches and Discoveries. *Journal of California and Great Basin Anthropology* 16(1):60-80.
- Schaefer, Jerry, Lowell J. Bean, and C. Michael Elling
 1987 *Settlement and Subsistence at San Sebastián: A Desert Oasis on San Felipe Creek, Imperial County, California*. Brian F. Mooney Associates, San Diego. Submitted to the Bureau of Reclamation, Department of the Interior.
- Schiffer, Michael B.
 1972 Archaeological Context and Systematic Context. *American Antiquity* 37:156-165.

Schneider, Joan

- 1987 Archaeological Site Record for site CA-RIV-3217. On file at the Eastern Information Center, University of California, Riverside.

Schoenherr, Allan A.

- 1992 *A Natural History of California*. California Natural History Guides: 56. University of California Press, Berkeley.

Schroeder, Albert H.

- 1957 The Hatakaya Cultural Tradition. *American Antiquity* 23:176-178.
- 1960 The Archaeological Excavations at Willow Beach, Arizona, 1950. *University of Utah, Anthropological Papers* 50.
- 1979 *Hatakaya and Patayan*. On file at the Southeast Information Center, Imperial Valley College Museum, El Centro, California.

Science Applications International Corporation (SAIC)

- 1994 *Paleontology Resources: A Key to Unlocking the Past*. Prepared for Edwards Air Force Base, California.

Shackley, M.S.

- 1984 Archaeological Investigations in the Western Colorado Desert: A Socio-ecological Approach. On file at the Southeast Information Center, Imperial Valley College Museum, El Centro, California.

Shutler, R., Jr.

- 1961 *Lost City, Pueblo Grande de Nevada*. Nevada State Museum Anthropological Papers 5, Carson City, Nevada.
- 1968 The Great Basic Archaic. In *Archaic Prehistory in the Western United States. Contributions in Anthropology* 1(3):24-26. Edited By C. Irwin-Williams, Eastern New Mexico University.

Smith, Brenda D.

- 1999 *Leveling the Ground: Cultural Investigations into Precontact Use of the Northern Shoreline of Ancient Lake Cahuilla*. Unpublished MA Thesis. Department of American Indian Studies, University of California, Los Angeles.

Smith, Brenda D. and James Brock

- 1999 From Shoreline to Mesquite Dune: Changing Subsistence Strategies at CA-RIV-4754, La Quinta. *Proceedings of the Society of California Archaeology* 12:1-5.

Smith, Brenda D., Evelyn N. Chandler, Cary D. Cotterman, Valerie M. Van Hemelryck

- 2000 *Salton Sea Restoration Project: Contacts with Native American Groups*. Prepared for the U.S. Department of the Interior, Bureau of Reclamation, Lower Colorado Regional Office, Boulder City, Nevada.

Stevenson, Marc G.

- 1982 Toward an Understanding of Site Abandonment Behavior: Evidence from Historic Mining Camps in the Southwest Yukon. *Journal of Anthropological Archaeology* 3(1):237-265.

- Stewart, Kenneth M.
 1983 Mohave. In *Handbook of North American Indians*, Volume 10, Southwest. Edited by Alfonso Ortiz, pp. 55-70. W.C. Sturtevant, general editor. Smithsonian Institution, Washington DC.
- Stone, Connie L.
 1991 *The Linear Oasis: Managing Cultural Resources Along the Lower Colorado River*. Bureau of Land Management, Phoenix, Arizona. Monograph No. 6.
- Strong, W.D.
 1929 Aboriginal Society in Southern California. *University of California Publications in American Archaeology and Ethnology* 26.
- Sutton, Mark Q.
 1988a On the Late Prehistory of the Western Mojave Desert. In *Pacific Coast Archaeological Society Quarterly* 24(1), January 1988, pp. 22-29.
 1988b An Introduction to the Archaeology of the Western Mojave Desert, California. Coyote Press Archives of California Prehistory No. 14.
- Sutton, Mark Q., and Philip J. Wilke (editors)
 1988 *Archaeological Investigations at CA-RIV-1179, CA-RIV-2823, and CA-RIV-2827, La Quinta, Riverside County, California*. Coyote Press Archives of California Prehistory 20.
- Symposium, 2000
 Society for California Archaeology Annual Meeting at Riverside, California. Co-Chairs, Gary Hurd and Jay von Werlhof. Presenters Steve McCormack, Leslie Gibson, Gregory Dickson, R. Nord, Christopher Greenwood, Kalie Harden, Clifford Zolikoff, Pat King, Hurd, and von Werlhof.
- Tetra Tech, Inc.
 1994 *Cultural Resources Investigations at Phillips Laboratory, Edwards Air Force Base, California, Installation Restoration Program (IRP) Site Inspection Activities*. Volumes I and II. Tetra Tech, Inc., San Bernardino, California.
 1999 *Salton Sea Restoration Project, Environmental Impact Statement/Environmental Impact Report*. Administrative Draft, August 1999. Prepared for the Salton Sea Authority and the U.S. Department of the Interior, Bureau of Reclamation, Lower Colorado Regional Office, Boulder City, Nevada.
- Treganza, Adan E.
 1942 An Archaeological Reconnaissance of Northeastern Baja California and Southeastern California. *American Antiquity* 8:152-163.
 1945 The "Ancient Stone Fish Traps" of the Coachella Valley, Southern California. *American Antiquity* 10:285-294.
- True, D.L., and Richard Casteel
 1973 *Archaeological Investigations in the Vicinity of the Salton Sea: Preliminary Report*. Unpublished manuscript on file at the Bureau of Land Management, Riverside District, Riverside, California.

- Turner, Raymond M., Janice E. Bowers, and Tony L. Burgess
 1995 *Sonoran Desert Plants: An Ecological Atlas*. University of Arizona Press, Tucson.
- U.S. Fish and Wildlife Service
 1987 *Wildlife of Salton Sea National Wildlife Refuge, California*. Department of the Interior, U.S. Fish and Wildlife Service. June.
- van Devender, Thomas
 1990 Late Quarternary Vegetation and Climate of the Sonoran Desert, United States and Mexico. In *Packrat Middens: The Last 40,000 Years of Biotic Change*. Edited by Julio L. Betancourt, Thomas R. Van Devender, and Paul S. Martin. University of Arizona Press, Tucson.
- von Werlhof, Jay
 2001 Notes on the Desert Cahuilla and their Yuman Neighbors. The Archaeological Survey Association of Southern California's Lake Le Conte Survey. *San Bernardino County Museum Association Quarterly*, Volume 48, Number 3, Fall 2001.
- Wake, Thomas A.
 1999 Faunal Resources. In *Investigations for the Village on the Green Project, La Quinta, California*. Ms. on file at Eastern Information Center, U.C. Riverside.
- Wallace, W.J. and E. Wallace
 1978 *Ancient Peoples and Cultures of Death Valley National Monument*. Ramona: Acoma Books.
- Ward, Albert E., Emily K. Abbink, and John R. Stein
 1977 Ethnohistorical and Chronological Basis of the Navajo Material Culture. In *Settlement and Subsistence along the Lower Chaco River, the CGP Survey*. Edited by Charles A. Reher, pp. 217-278.
- 1967 The San Dieguito Complex: A Review and Hypothesis. *American Antiquity* 32 (2):168-185.
- 1984 The Desert Region. In *California Archaeology*. Edited by M.J. Moratto, pp. 339-430. Academic Press, Orlando, Florida.
- Warren, Claude N.
 1966 The San Dieguito Type Site: M.J. Rogers' 1938 Excavation on the San Dieguito River. *San Diego Museum Papers* 5:1-39.
- 1986 *Fort Irwin Historic Preservation Plan, Volume 2, The Research Overview*. U.S. Department of the Interior, National Park Service, Washington DC.
- Warren, Claude N. and R.H. Crabtree
 1986 The Prehistory of the Southwestern Area. In *Handbook of North American Indians*. Volume 11. Great Basin. Edited by W.L. d'Azevedo. W.C. Sturtevant, Series Editor. Smithsonian Institution, Washington DC.
- Warren, Claude N., and Delbert L. True
 1961 The San Dieguito Complex and Its Place in California Prehistory. *Annual Reports of the University of California Archaeological Survey* 3:246-338. Los Angeles

- Waters, Michael R.
1982 *The Lowland Patayan Tradition*. In *Hohokam and Patayan: Prehistory of Southwestern Arizona*. Edited by McGuire, Randall H. and Michael B. Schiffer, pp. 275-297. Academic Press, New York.
- Weide, David
1976 *A Cultural Sequence for the Yuha Desert*. In *Background to Prehistory of the Yuha Desert Region*, edited by P.J. Wilke, Ballena Press Anthropological Papers No. 5.
1976 *Regional Environmental History of the Yuha Desert Region*. In *Background to the Prehistory of the Yuha Desert Region*, edited by P.J. Wilke, pp. 9-20. Ballena Press Anthropological Papers No. 5.
- Wessel, Richard L.
1989 *Significance of Isolated Historic Dumps*. Manuscript on file at Computer Sciences Corporation, Edwards Air Force Base, California.
- White, Chris
1980 *Regional Research Design*. In *Class II Cultural Resource Inventory of the East Mesa and West Mesa Regions, Imperial Valley, California*. Volume I, edited by Dennis Gallegos. WESTEC Services, San Diego.
- Wilke, Philip J. (editor)
1976 *Background to Prehistory of the Yuha Desert Region*. Ballena Press Anthropological Papers 2. Ballena Press, Ramona, California.
- Wilke, Philip J.
1978 *Late Prehistoric Human Ecology at Lake Cahuilla, Coachella Valley, California*. *Contributions of the University of California Archaeological Research Facility* 38. University of California, Berkeley.
- Wilson, Douglas C.
1994 *Identification and Assessment of Secondary Refuse Aggregates*. In *Journal of Archaeological Method and Theory* 1. Pp. 41-68. Plenum Press, New York.
- Woerner, Lloyd
1989 *The Creation of the Salton Sea: An Engineering Folly*. *Journal of the West*, 28(1):109-112.
- York, A.
2000 *Overview and Cultural Resources Survey for the De Anza Natural Gas Pipeline*;

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APPENDIX B BIBLIOGRAPHY OF INVESTIGATIONS

APPENDIX B

Bibliography of Investigations

American Pacific Environmental Consultants

1981A Cultural Resource Survey and Evaluation of the Torres Martinez Indian Reservation, Riverside County, California. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.

Apple, R., A. York, A. Pignuolo, J. Cleland, and S. Van Wormer

1997 Archaeological Survey and Evaluation Program for the Salton Sea Test Base Imperial County, California. On file at the Imperial Valley College Desert Museum and Information Center.

Archaeological Research Unit, U.C. Riverside

1986 Letter Report: Archaeological Assessment of the Proposed Biomass-Fueled. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.

Barker, Michael A.

1974 Preliminary Archaeological Assessment of the East Mesa, Imperial County, California. Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.

1975 Elements of Natural History and Archaeology for the Environmental Impact Report for Clean Water Grant for Wastewater System Improvements to the City of Westmorland, California. Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.

Bell, Daniel A., Joan R. Smith, and G. Portillo

1974 An Archaeological Survey of the Proposed Right-of-Way of the Realignment of the Coachella Canal, with Supplement. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.

Bissell, Ronald M.

1993 Cultural Resources Reconnaissance of a Parcel of Land near Mecca, Riverside County, California. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.

1993 Letter Report: CA-RIV-859. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.

1994 Cultural Resources Reconnaissance of a 41.03 Parcel of Land near Mecca, Riverside County, California. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.

Breece, William A. and Jany Rosenthal

1989 Results of the Phase II Archaeological Program at CA-IMP-6300, Imperial County, California. Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.

Brock, James

- 1993 A Cultural Resources Assessment of Lots 7 through 12, Block 25 of the Amended Map of the Mecca Townsite, County of Riverside, California. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.
- 1993 A Cultural Resources Assessment of Lots 21 Through 25 in Tract No. 2538, North Shore of the Salton Sea, County of Riverside, California. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.
- 1995 A Cultural Resources Assessment for the Lincoln Street Housing Project in Mecca, County of Riverside, California. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.
- 1996 A Cultural Resources Assessment of Lots 5 and 6, Block 25 of the Amended Map of the Mecca Townsite, County of Riverside, California. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.

Broeker, Gale

- 1991 Dos Palmas Wetlands Restoration Project; Rancho Rehabilitation Project; Gravesite Fence Project. BLM Palm Springs/South Coast Resource Area. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.
- 1991 Memorandum for Cultural Clearance, Dos Palmas Project 166805. BLM Palm Springs/South Coast Resource Area. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.
- 1991 Memorandum for Cultural Clearance, Dos Palmas Project 166805 – Addendum. BLM Palm Springs/South Coast Resource Area. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.

Bull, Charles S., Sue A. Wade, and McMillan Davis

- 1991 Cultural Resource Survey of the Eagle Mountain Mine and the Kaiser Industrial Railroad, Cultural Resource Permit #CA881916. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.

Bureau of Land Management

- 1978 California Desert Program: Archaeological Sample Unit Records for the Orocopia Planning Unit. Bureau of Land Management, Orocopia Planning Unit. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.

Chace, Paul G.

- 1985 An Archaeological Survey – American Agri-Corp. Airstrip Project. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.

Childers, Morlin, Guy Bianchi and Jay von Werlhof

- 1978 Archaeological Examinations of Proposed Geothermal Test Sites near Frink. Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.

Clewlow, C. William, Jr., Theresa A. Clewlow, and Hazel Wald

- 1992 Final Report for Archaeological Sites CA-IMP-5959, CA-IMP-5961, and CA-IMP-5963, Imperial County, California. On file at the Southeast Information Center, Imperial Valley College Museum, El Centro, California.

Colarich, Pam

- 1978 Archaeological Evaluation of the Proposed Reconstruction of Loftus Creek Bridge and Almas Ditch (P.M. 4.3 and 4.7), Riverside County, California. Caltrans Environmental Planning, Sacramento. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.

Cupples, Sue Ann

- 1977 Supplementary Archaeological Survey Report for a Proposed Material Site (Travertine). Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.

Davis, Alan

- 1983 An Archaeological Assessment of Tentative Parcel 18541, West of Oasis in the Coachella Valley, Riverside County, California. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.

De Barros, Philip

- 1991 An Archaeological Survey of Pacific Telephone's Salton Sea Cellular Site, Parcel APN-725-160-005. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.

Dominici, Debra A.

- 1985 Report of an Archaeological Survey for the Proposed 86 Expressway in Riverside County. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.
- 1987 Phase II Archaeological Test Excavation Report on Ten Prehistoric Sites Located within the Proposed Riverside 86 Expressway Project's Study Corridor. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.
- 1988 Negative Archaeological Survey Report First Addendum - Route 11-RIV-86 P.M. 2.9/22.0. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.
- 1991 Historic Property Survey Report (Negative Findings), Third Supplemental, 11-RIV-86, P.M. 2.9-22.0, 11208-179800. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.

- 1992 Negative Archaeological Survey Report – Sixth Addendum. Caltrans District 11, San Diego. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.
- 1992 Negative Archaeological Survey Report – Seventh Addendum, Riverside 86 Expressway Project. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.
- 1994 Negative Archaeological Survey Report – Eleventh Addendum: Additional Study Area for a Biological Mitigation Parcel. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.
- Dominici, Debra and Jan Kasper
- 1994 Negative Archaeological Survey Report: Highway Route 195. Caltrans. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.
- Drover, Christopher E.
- 1990 An Archaeological Assessment of Mecca II Sanitary Landfill Expansion, Riverside County, California. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.
- Duffield, Anne and Gale Broeker
- 1990 Letter Report: Cultural Resources Inventory of Martinez Canyon Parcel No. 2, T7S R8E Section 32. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.
- Eighmey, James D. and Deyle M. Cheever
- 1990 A Phase I Archaeological Survey for the Proposed State Route 86 Widening and Bridge Replacement from Kane Spring to Brawley. Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.
- Eighmey, James D. and William R. Manley, Dayle M. Cheever
- 1990 Historic Property Survey Report 11-IMP-86, County of Imperial, California 11-IMP-86 P.M. 33.6/43.2. Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.
- 1990 Historic Property Survey Report 11-IMP-86, County of Imperial, California. Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.
- ENSR Consulting and Engineering
- 1990 Environmental Assessment/Initial Study for the Placement of Fibre Optic Facilities between Salton Microwave Station and Calexico, California. Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.
- Gallegos, Dennis R.
- 1984 West Mesa Cultural Resource Survey and Site Evaluation, Imperial Valley, California. On file at the Bureau of Land Management, El Centro, California.

- 1986 Patayan II and Patayan III Occupation of IMP-4434 and IMP-5167, East Mesa, Imperial County, California. On file at the Southeast Information Center, Imperial Valley College Museum, El Centro, California.
- 1989 A Cultural Resource Inventory of IH Study Area, East Mesa, Imperial County, California. Prepared for ORMAT Energy Systems. Prepared by ERC Environmental and Energy Services Company.
- Gallegos, Dennis and Andrew Pigniolo
- 1990 Cultural Resource Survey of Eight Geothermal Well Sites and Access Roads in the Truckhaven Project Area, Imperial County, California. Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.
- Gigson, W.R.
- 1986 Interim Mining and Reclamation Plan for the Bluff Material Site, Imperial County. Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.
- Graham, William R.
- 1982 Archaeological Survey Report for the Proposed Frink Material Site. Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.
- Hogan, Michael
- 1993 Cultural Resources Assessment, Archaeological Survey for Upgrading Imperial Irrigation District Lattice Towers Along the KN/KS Transmission Line Between the Coachella Valley Substation and the Midway Substation, Riverside and Imperial County. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.
- Keller, Jean A.
- 1992 An Archaeological Assessment of Tentative Parcel Map 27054, 40.68 Acres of Land Near Mecca, Riverside County, California. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.
- 1994 A Phase I Archaeological Assessment of Tentative Parcel Map 27265. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.
- Lando, Richard
- 1979 Cultural Resources Reconnaissance (Stage II) of Flood Control Alternatives Proposed for the Whitewater River Basin, Riverside County, California. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.
- Laylander, Don
- 1993 Negative Archaeological Survey Report: Widen Bridge #56-0236 Where State Route 111 Crosses Salt Creek, Southeastern Riverside County. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.

- 1994 Phase III Data Recovery at the Elmore Site (CA-IMP-6427), Imperial County, California. Prepared for Caltrans District 11, San Diego.
- Love, Bruce
- 1993 Cultural Resources Monitoring – Torres Martinez Indian Reservation Allotment No. TM-276, Riverside County, California. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.
- 1993 Monitoring at Transmission Tower 24-2 KN/KS Transmission Line between Coachella Valley and the Midway Substation. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.
- 1993 Cultural Resources Evaluation: Torres Martinez Indian Reservation, Allotment No. TM-276, Riverside County. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.
- Love, Bruce and Bai Tom Tang
- 1996 Identification and Evaluation of Historic Properties: Torres Martinez Recycling Center Project, Alternative Sites I & B, Torres Martinez Indian Reservation, Riverside County, California. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.
- Magma Power Company
- 1979 Environmental Impact Report: Forty-Nine Megawatt Geothermal Power Plant and Facilities Niland Area. Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.
- Moffitt, Steven A.
- 1993 Cultural Resources Assessment: Hidden Beach Resorts (Tentative Tract 27582) Located in the City of Blythe, Riverside County, California. Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.
- Napton, Kyle L.
- 1979 Archaeological Reconnaissance on the Torres Martinez Indian Reservation, Riverside County, California. Unpublished report on file, Eastern Information Center,
- Napton, L. Kyle and E.A. Greathouse
- 1982 Cultural Resource Investigations on the Torres Martinez Indian Reservation. American Indian Resource Organization, Inc. Southern California Agency, Riverside. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.
- 1993 Cultural Resources Investigations of the Proposed Indio to Salton Lightguide System Project, 46.2 Miles in Riverside and Imperial Counties, California. Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.
- 1993 Cultural Resources Investigations of the Proposed Indio to Salton Lightguide System Project, AT&T Fiber Optic Route, 46.2 Miles in Riverside and Imperial Counties,

California. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.

Parr, Robert E.

- 1985 An Archaeological Assessment of a Proposed Wastewater Treatment Plant Site and Pipeline Alignment, La Quinta Area of Riverside County, California. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.

Pendleton, Lorann

- 1984 Archaeological Investigations in the Pichaco Basin. On file at the Southeast Information Center, Imperial Valley College Museum, El Centro, California.

Phillips, Roxanna

- 1982 Archaeological Data Recovery Program: Northern Portion of IT Corporation Imperial Valley Site. Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.

Pigniolo, Andrew R.

- 1994 Historic Properties Inventory and Resource Evaluation of the Proposed Monofill Land Exchange, Imperial County, California. Prepared for Magma Operating Company. Prepared by Ogden Environmental and Energy Services.

Pritchett, Howard E. and Lorraine Pritchett

- 1977 Archaeological Examinations of a Proposed Site for a Commercial Research Aquacultural Farm at Salton City, California. Unpublished report on file, Southwest Information Center, California Historical Resources Information System, Ocotillo, California.

Reed, Judyth E.

- 1984 Cultural Resources Inventory and Evaluation of Several Parcels near Oasis, California. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.

Rhode, David

- 1979 Report of an Archaeological Survey of a Proposed Highway Widening Project on Highway 86, Imperial County. Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.

Rosen, Martin D.

- 1983 Report of an Archaeological Survey on State Route 86 in Imperial County. Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.

- 1984 First Addendum Report of an Archaeological Survey on State Route 86 in Imperial and Riverside Counties. Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.

- 1984 First Addendum Report of an Archaeological Survey on State Route 86 in Imperial and Riverside Counties from Campbell Wash to Oasis (11-IMP-86, P.M. 51.87 - 11 RIV-86, P.M. 3.2). Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.

CLASS I CULTURAL RESOURCES INVENTORY OF THE SALTON SEA REGION

- 1984 Second Addendum Archaeological Survey Report Imperial/Riverside Expressway "San Felipe Wash Material Site". Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.
- 1985 First Addendum Archaeological Survey Report (Extended Phase I) Investigation of Circular Rock Features Located at CA-IMP-3680 and CA-IMP-3688. Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.
- 1985 Interim Mining and Reclamation Plan for the Hazard Fish Springs Material Site, Imperial County, California. Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.
- 1985 Report of Archaeological Test Excavations at Five Sites Located along Highway 86 in Imperial County, California. Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.
- 1986 Archaeological Survey Report "Travertine Material Site" 11-IMP-86-60.9/67.8. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.
- 1986 Archaeological Survey Report for the Truckhaven and Bluff Material Sites. Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.
- 1987 Forth Addendum: Archaeological Survey Report for Units 1, 2, and 3 of the Proposed State Route 86 Expressway. Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.
- 1987 Fifth Addendum Archaeological Survey Report for Units 4 and 5 of the Proposed State Route 86 Expressway. Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.
- 1988 Highway 86 Expressway Phase II Archaeological Test Excavation Report Truckhaven Material Site. Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.
- 1988 Historic Property Survey Report, Units 4 & 5 of the State Route 86 Expressway (Interchanges and Frontage Roads), 11-IMP-86, P.M. 60.9/67.8, 11208-182841; 11-RIV-86, 0.0/R2.9, 11208-094161; and The Truckhaven and Bluff Material Sites, 11-IMP-86. Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.
- 1988 Interim Mining and Reclamation Plan for the Six and One Half Mile Material Site (Imperial County). Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.
- 1988 Interim Mining and Reclamation Plan for the San Felipe Wash Material Site (Imperial County). Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.

- 1988 Interim Mining and Reclamation Plan for the Truckhaven Material Site (Imperial County). Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.
- 1991 Negative Archaeological Survey Report: Fourth Addendum, 11-RIV-86, PM R2.9-R22.0, 11208, 179800; Vicinity of Avenue 81 to Vicinity of Dillon Road. Caltrans District 11, Riverside. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.
- Schaefer, Jerry
- 1986 Later Prehistoric Adaptations During the Final Recessions of Lake Cahuilla: Fish Camps and Quarries on West Mesa, Imperial County, California. Mooney-Levine and Associates, San Diego. Submitted to the Bureau of Land Management, Department of the Interior, El Centro, California.
- 1988 Lowland Patayan Adaptations to Ephemeral Alkalai Pans at Superstition Mountain, West Mesa, Imperial County, California. On file at the Southeast Information Center, Imperial Valley College Museum, El Centro, California.
- Schaefer, Jerry, Lowell J. Bean, and C. Michael Elling
- 1987 *Settlement and Subsistence at San Sebastian: A Desert Oasis on San Felipe Creek, Imperial County, California*. Brian F. Mooney Associates, San Diego. Submitted to the Bureau of Reclamation, Department of the Interior.
- Shackley, M. S.
- 1984 Archaeological Investigations in the Western Colorado Desert: A Socio-ecological Approach. On file at the Southeast Information Center, Imperial Valley College Museum, El Centro, California.
- Shafer, Phil
- 1984 Draft Environmental Impact Report for the Niland Geothermal Energy Program. Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.
- Singer, Clay A. and John E. Atwood and Shelly Marie Gomes
- 1993 Cultural Resource Records Search for Southern California Gas Company Line 6902 South, Imperial County, California. Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.
- Swenson, James
- 1977 Environmental Impact Evaluation: Archaeological Assessment of the Proposed Mecca Sanitary Landfill Site, Riverside County, California. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.
- 1980 An Archaeological Assessment of 40 Acres of Land Near Oasis, Riverside County, California (SW ¼ of the SE ¼ of Section 24, T8S, R8E, SBBM). Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.
- 1982 An Archaeological/Historical/Paleontological Evaluation of the East ½ of Section 27, T7S, R10 E, SBBM, Riverside County, California. Unpublished report on file, Eastern

Information Center, California Historical Resources Information System, University of California, Riverside.

Taylor, Thomas T.

- 1987 Archaeological Survey Report and National Register of Historic Places Eligibility Assessment – Imperial Irrigation District Coachella–Midway-East Mesa 230 KV Transmission Line Project, Riverside and Imperial Counties, California. Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.

Townsend, Jan

- 1984 Southwest Powerlink Cultural Management Plan Volume III-A. Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.

True, D.L., and Richard Casteel

- 1973 Archaeological Investigations in the Vicinity of the Salton Sea: Preliminary Report. Unpublished manuscript on file at the Bureau of Land Management, Riverside District, Riverside, California.

Turner, David G.

- 1974 Archaeological Examination of a Proposed Extension of Walker Road, Imperial County. Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.

von Werlhof, Jay

- 1974 Heritage Resources Survey Report: Route 11 – RIV-86-6-422.6, Thermal to Dillon Road. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.
- 1977 Archaeological Examinations of the Jardin Del Valle Development in West Calexico. Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.
- 1978 Archaeological Examinations of Republic Geothermal Sweetwater Drill Sites. Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.
- 1983 Archaeological Examinations of the Republic Geothermal, Inc. Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.
- 1983 Letter of Clearance to Imperial County Planning Commission from Jay von Werlhof regarding: Bear Creek Mining Company Well Resource Area near Niland. Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.
- 1983 Archaeological Examinations of Petty Ray Geophysical Transects on West Mesa. Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.

- 1996 Archaeological Investigation of Aggregate Products, Inc. Gravel Pit, Imperial County. Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.

von Werlhof, Jay and Sherilee von Werlhof

- 1975 An Archaeological Examination of the Desert Shores Area, Imperial County. Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.
- 1977 Archaeological Examinations of Ten Proposed Geothermal Drill Test Sites near Salton Sea. Unpublished report on file, Southwest Information Center, California Historical Resources Information System, Ocotillo, California.
- 1977 Archaeological Examinations of a Waste-Water Treatment System for the City of Calipatria. Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.
- 1977 Archaeological Examinations of the Obsidian Butte Quarry Site, Imperial County. Unpublished report on file, Southwest Information Center, California Historical Resources Information System, Ocotillo, California.
- 1978 Archaeological Examinations of Ten Geothermal Test Sites near Salton Sea. Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.

Welch, Pat

- 1985 Cultural Resources Report for Caltrans Highway 86 Material Sites. Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.

Wells, Helen and Patricia Martz

- 1972 Cultural Resource Inventory for the Cabazon Indian Reservation. Archaeological Research Unit, U.C. Riverside. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.

WESTEC Services, Inc.

- 1979 Superstition Hills Class II-I Disposal Site – Draft Environmental Impact Report –Volume I. Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.
- 1981 Truckhaven Prospect Geothermal Exploratory Wells – Draft Environmental Impact Report. Unpublished report on file, Southeast Information Center, California Historical Resources Information System, Ocotillo, California.

White, Robert S.

- 1990 An Archaeological Assessment of a 340+ Acre Parcel as Shown on TPM 24750 Located Near Mecca, Riverside County, California. Unpublished report on file, Eastern Information Center, California Historical Resources Information System, University of California, Riverside.

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