Cultural Resource Inventory for the Vega SES LLC Solar Additional 80-Acres Project, Imperial County, California

Prepared for:

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USGS 7.5-minute Mount Signal; approximately 80 acres

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MANAGEMENT SUMMARY

Vega SES LLC proposes to develop the Vega SES LLC Solar Project (Project), a solar photovoltaic (PV) energy generation project with an integrated 100 MW battery storage project on an additional 80 acres of land in southwestern Imperial County, California. The original proposed area of the project consisted of approximately 494 acres. The electrical energy produced by the Project will be conducted through a proposed 230 kV generator intertie "gentie" line and delivered to the Imperial Irrigation District (IID) through a short interconnection with the proposed IID 230 kV "Fern" substation.

This study was performed in compliance with the California Environmental Quality Act (CEQA), the Renewable Energy and Transmission Element, County of Imperial General Plan (Imperial County Planning and Development Services Department 2015), and the Final Programmatic Environmental Impact Report, Imperial County Renewable Energy and Transmission Element Update Mitigation Monitoring and Reporting Program (MMRP). Imperial County is the lead agency.

A records search at the South Coastal Information Center (SCIC) of the California Historical Resources Information System (CHRIS), was performed for the original 494-acre project and a 1-mi. buffer on March 24, 2017. Ninety-eight cultural resources have been previously recorded within the 1-mi. record search buffer and eight cultural resources have been previously recorded within the original Project area. A record search of the Sacred Lands File held by the Native American Heritage Commission (NAHC) was conducted on March 14, 2017, and had negative results. An additional letter was sent to the NAHC on November 6, 2017, requesting a record search for the additional 80-acre parcel. As of December 1, 2017, no response has been received by ASM Affiliates, Inc.

Eight cultural resources were previously recorded within or adjacent to the original Project area: IMP-3408H, Cross Emigrant Trail, West; IMP-7834, Westside Main Canal; P-13-008983, Wormwood Canal System; P-13-012689, Fern Canal System; P-13-012692, Fern Check; P-13-013748, Fig Drain; P-13-013567, a shed at Liebert and Mandrapa Roads; and a residence at 1105 Liebert Road. Only the Wormwood Canal System was adjacent to the additional 80-acre parcel.

A systematic pedestrian survey of the 80-acre Project area was performed by ASM on November 3, 2017 by a crew of two ASM Archaeologists. During the current survey, no new cultural resources were identified. Segments of P-13-008983, Wormwood Canal System, have been evaluated and recommended not eligible for listing on the NRHP and the CRHR; this system is adjacent to the Project area and will not be impacted by the Project.

The Project area is in agricultural fields that have been subject to disturbances likely up to 2 ft. in depth. No additional historical resources were identified within the Project area either during the record searches or during the archaeological survey that will be directly impacted by the Project. The Project will not have a direct impact on or alter any of the IID's irrigation features within the Project area.

As required by the MMRP Mitigation Measures CUL-1d and CUL-3, archaeological monitoring by a qualified archaeologist and a Native American monitor is recommended for any ground-disturbing activities within the Project area.

1. INTRODUCTION

This report documents the results of a cultural resource survey for the Vega SES LLC Solar Project (Project) which was conducted to provide compliance with California Environmental Quality Act (CEQA) and the Renewable Energy and Transmission Element, County of Imperial General Plan (Imperial County Planning and Development Services Department 2015). Imperial County is the lead agency. The purpose of the study was to identify if any cultural resources are present within the Project area that are significant under CEQA and are eligible for listing on the California Register of Historical Resources (CRHR).

PROJECT DESCRIPTION AND LOCATION

Vega SES LLC (Vega SES) is proposing to develop the Vega SES LLC Solar Project, a solar photovoltaic (PV) energy generation project with an integrated 100 MW battery storage project on approximately 574 acres of land in southwestern Imperial County, California (only 80 acres covered by current survey). The Project would be located east of the Westside Main Canal, south of West Wixom Road, west of Drew Road (S29), and north of Lyons Road in Sections 35 and 36 of Township 16 S., Range 12 E., SBB&M, and Section 1 of T. 16-1/2 S., R. 12 E. The electrical energy produced by the Project would be conducted through a proposed 230 kV generator intertie ("gentie") line and delivered to the Imperial Irrigation District (IID) through a short interconnection with the proposed IID 230 kV "Fern" substation (Figures 1, 2, and 3).

The Project would be located on Imperial County assessor parcels (APNs) 051-360-021-000 (approximately 100.89 acres), 051-360-031-000 (approximately 243.37 acres), 051-390-004-000 (approximately 87.16 acres), and 051-390-013-000 (approximately 62.40 acres), all of which are currently owned by Mike Abatti Farms LLC. The proposed 230 kV gentie line would cross private lands also located northeast of the Westside Main Canal.

STUDY PERSONNEL

The following individuals were instrumental in conducting the investigations and producing this report.

Mark Becker, ASM Director (PhD, Anthropology University of Colorado-Boulder), RPA, served as Principal Investigator and Project Manager. Joel Lennen, ASM Associate Archaeologist (M.A., Anthropology, New Mexico State University), RPA, served as field director. Joe Lamoy (MsC, Forensic Anthropology, University of Sheffield, U.K.) served as archaeology crew.

South Coastal Information Center (SCIC) staff performed the record search of the California Historical Resources Information System (CHRIS).

Native American Heritage Commission (NAHC) staff performed the record search of the Sacred Lands File.

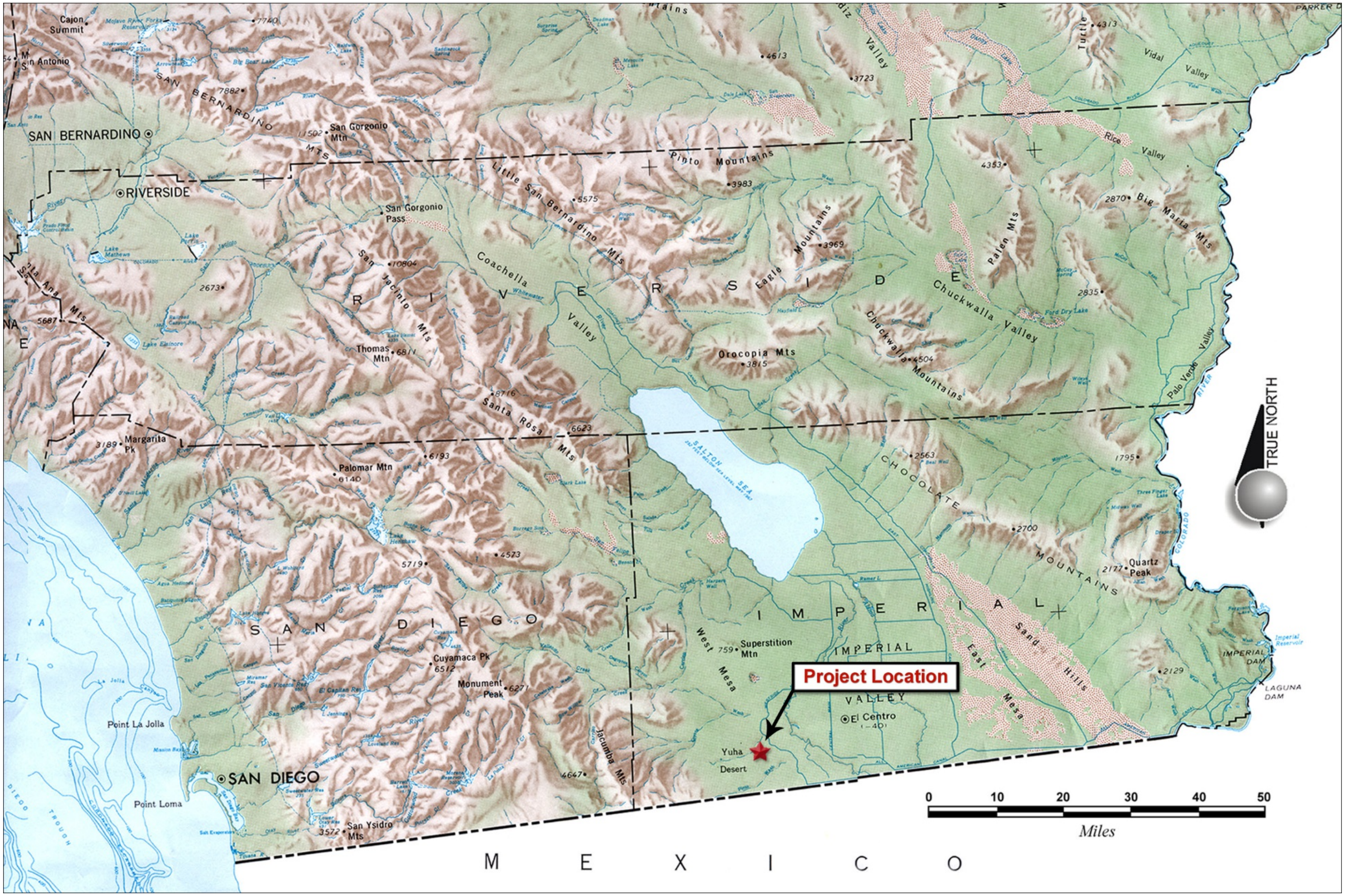

Figure 1. Project vicinity.

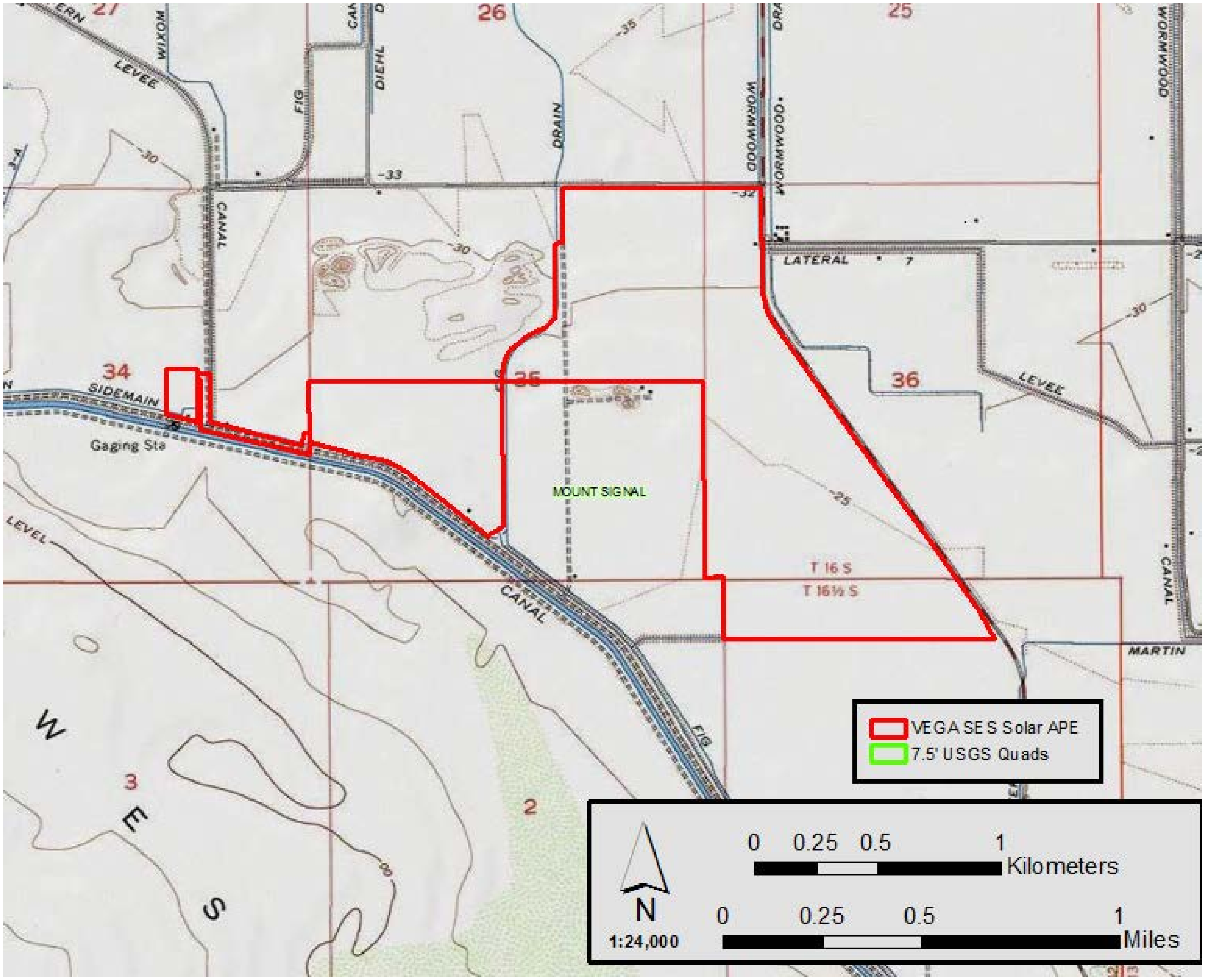

Figure 2. Location of original Project area shown on the 7.5' USGS Quad Map.

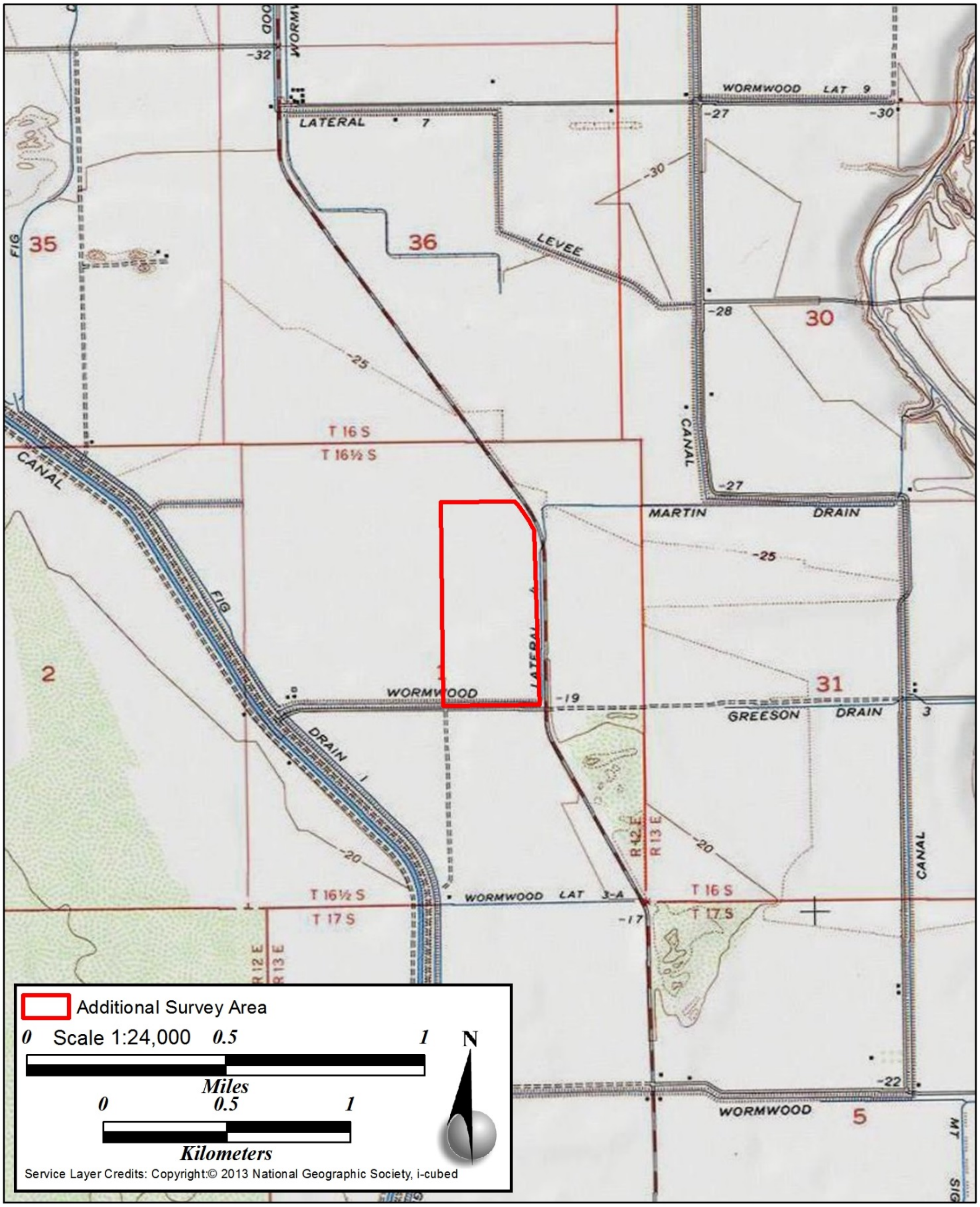

Figure 3. Location of additional 80 acres of Project area shown on the 7.5' USGS Quad Map.

2. SETTING

NATURAL SETTING

Geology and Soils

The surface geology of the Project area is relatively simple, consisting entirely of Quaternary alluvium (Jennings 1967; Morton 1977). These deposits are likely entirely Holocene in age. Additional underlying geologic formations include Lake Cahuilla Sediments and Brawley Formation, an older deposit of sedimentary rocks. Soils within the Project area include Meloland very fine sandy loam, Vint loamy very fine sand, Vint and Indio very fine sandy loams, and Imperial silty clay (USDA 2017).

Climate

The Project area is located within the western portion of the low-lying Colorado Desert, part of the larger Sonoran Desert, in the rain shadow of the Peninsular Ranges, and consequently its climate is generally very hot and dry. In El Centro, mean maximum temperatures in July reach 113ºF, and December-January mean maximum temperatures are about 70-72ºF, while low temperatures rarely fall below freezing. Annual precipitation amounts to only 3.1 in. (7.9 cm), spread through much of the year in the south but becoming more strongly concentrated during the winter in the north.

Topography

The Project area lies in the Salton Basin within the Colorado Desert. The basin is a large fault-framed graben formed at the interface of the North American and Pacific tectonic plates. The trough has been filled by immense quantities of colluvial and alluvial sediments that are in some places up to 20,000 ft. (6,000 m) deep (Morton 1977). Natural northward diversions of the Colorado River into the Salton Trough during the Holocene resulted in the periodic formation of an extensive freshwater lake known as Lake Cahuilla that drowned the locations now occupied by the modern sites of Indio, Brawley, El Centro, and Mexicali. Lake Cahuilla covered the entire project area, which lies approximately 25-35 ft. below sea level. The Project area is approximately 1.5 miles south west of the New River.

Flora and Fauna

Natural plant and animal life in the western Colorado Desert is characteristic of the Lower Sonoran Life Zone. Major vegetation communities include creosote bush scrub and saltbush scrub. Individual plants in these vegetation communities are widely spaced and provide little ground cover. Some portions of the desert have no visible plants and consist of shifting sand dunes or nearly sterile salt flats. Depending on the duration and intensity of rainfall, perennial and annual species will vary. Currently the project area is approximately 85 percent covered by agricultural vegetation communities and native and nonnative grasses and weeds. A small portion of the project area, consisting of the perimeters around the agricultural fields that were surveyed, is devoid of vegetation. Ground surface visibility across much of the Project area was 25 percent or less.

The most common low-desert animals of economic importance to native peoples were black-tailed jackrabbits (*Lepus californicus*), cottontails (*Sylvilagus audubonii*), ground squirrels and other rodents, various lizards, pronghorn antelope (*Antilocapra americana*), and mule deer (*Odocoileus hemionus*). During stands of Lake Cahuilla, prehistoric people were especially attracted to the western Colorado Desert because of the availability of various Colorado River fish species such as bonytail chub (*Gila elegans*), razorback sucker (*Xyrauchen texanus*), Colorado pike minnow (*Ptychocheilus lucius*), and striped mullet (*Mugil cephalus*). Various migratory waterfowl were also caught, including coots (*Fulica americana*) and ducks (Jaeger 1965). During the archaeological survey no native animals were noted in the Project area.

Paleoenvironments

Pleistocene and Holocene Climate and Biota

Evidence concerning earlier environmental conditions in the Colorado Desert is still very limited. Pollen-bearing, stratified deposits from caves or lakebeds are not as common in the Colorado Desert as in the Great Basin, where most of the desert climatic reconstructions have been based. The best information comes from investigations of plant microflora in fossil packrat (*Neotoma* sp.) middens along the Colorado and Gila rivers and extending across the Sonoran Desert to the east (King and Van Devender 1977; Van Devender 1990; Van Devender and Spaulding 1979, 1983). Of greatest relevance to the low elevations of the Colorado Desert are the stratified fossil packrat middens in the Wellton Hills (elevation 160-180 m), Hornaday Mountains (240 m), Butler Mountains (240-255 m), Picacho Peak (300 m), Tinajas Altas Mountains (330-580 m), and Whipple Mountains (320-525 m). Van Devender (1990) provided an authoritative review and reconstruction of climate and vegetation over the last 14,000 years from these investigations, summarized below. The focus here is on data that are specific to the lower Sonoran Desert.

The data from below 1,000 ft. (300 m) indicate that the lower Colorado River valley, and presumably the Salton Trough as well, may have been a refugium for lower Sonoran creosote scrub habitat during the Pleistocene, but also containing the frost-resistant Mojavean species (Cole 1986). The region would have resembled Joshua Tree National Monument until 9000-10,000 B.P., when the Sonoran-Mojave desert boundary moved north to its present location and modern vegetation associations were established. Mojavean species persisted at some locations in the early Holocene and indicate a transitional period from colder and wetter to more xeric conditions. Some investigators have interpreted the paleoenvironmental record to suggest that El Niño effects were more intense and stronger at this time, but with little effect from summer monsoons in the Salton Trough. The extent to which very hot and dry extremes affected the lowlands remains problematical, and such effects may have been mitigated to some extent by the Colorado River and by possible infillings of Lake Cahuilla. The same may be true of late Holocene climatic fluctuations such as the Medieval Climatic Anomaly, which lasted from around A.D. 800 through the great drought of A.D. 1209-1350 (Jones et al. 1999). Drought impacts on mountain and coastal areas are now well established from tree-ring analyses, and there may well have been direct and indirect ramifications for desert dwellers on the western side of the Salton Trough. Episodes of cooler and wetter conditions are also documented through a number of paleoenvironmental indices and in historical accounts. The most recent episode was the Little Ice Age, the effects of which were felt between about A.D. 1450 and 1850.

At higher elevations, between 1,000 and 2,000 ft. (300-600 m), packrat midden analyses indicate a juniper woodland habitat in the Late Pleistocene between 22,000 and 11,000 B.P. These xeric woodlands continued through the early Holocene, finally ascending to higher elevations during the middle Holocene. They were replaced with the current creosote scrub and desert riparian habitat at that time.

The Salton Trough, when not filled by Lake Cahuilla, probably contained much the same alkali sink habitat it now does throughout the Quaternary, although no paleoenvironmental data are available to directly confirm this.

Lake Cahuilla

As the Colorado River made its way toward the Gulf of California, it released its sediments onto a vast and growing delta. This gradual accumulation of sediments raised the overall height of the delta, particularly after large flood events. What followed during certain episodes was the diversion of the river’s flow into the Salton Trough, resulting in the formation of a vast freshwater lake, variously referred to as Blake Sea, Lake LeConte, or Lake Cahuilla. The lake continued to rise until it reached the lip of the impounding delta, currently at 12 m above sea level, and the waters, less those lost to evaporation from the lake, could again flow south to the Gulf. The low-gradient, deltaic conditions at the lake's input channel were then poised to produce a new shift in the river's course, this time away from the lake and directly south toward the Gulf.

At least six Late Pleistocene infillings of Lake Cahuilla have left relic maximum shorelines at elevations between 52 and 31 m above sea level. The latest and lowest of these shorelines is tentatively radiocarbon dated at 26,000 B.P., but none of the Pleistocene stands are known to have cultural associations. Lake Cahuilla may have continued to form and then recede throughout the middle Holocene; archaeological remains are found in association with the lake as far back as 5000 B.P. (Schaefer 1994).

Late Holocene stands of Lake Cahuilla are somewhat better documented. The lake is known to have been present at times but not continuously during the millennium prior to A.D. 1000 (Love and Dahdul 2002; Waters 1983; Wilke 1978). Radiocarbon, stratigraphic, and historical evidence indicates that the lake underwent at least three cycles of filling and recession between ca. A.D. 1200 and 1700 (Laylander 1997). When present, the lake offered a range of resources, including freshwater fish, aquatic birds, freshwater mollusks, and shoreline plants. Its rises and falls, extending over decades and radically transforming the region's resource potential, created a uniquely unstable human environment.

CULTURAL SETTING

Prehistory

The following outline of Colorado Desert culture history largely follows a summary by Jerry Schaefer (2006). It is founded on the pioneering work of Malcolm J. Rogers in many parts of the Colorado and Sonoran deserts (Rogers 1939, 1945, 1966). Since then, several overviews and syntheses have been prepared, with each succeeding effort drawing on the previous studies and adding new data and interpretations (Crabtree 1981; Schaefer 1994; Schaefer and Laylander 2007; Wallace 1962; Warren 1984; Wilke 1976).

Four successive periods, each with distinctive cultural patterns, may be defined for the prehistoric Colorado Desert, extending back in time over a period of at least 12,000 years. They include: Early Man (Malpais), Paleoindian (San Dieguito), Archaic (Pinto and Amargosa), and Late Prehistoric (Patayan).

Early Man Period (Malpais Pattern) (ca. 50,000 to 12,000 B.C.)

The Malpais Pattern is represented by archaeological materials that have been hypothesized to date between 50,000 and 10,000 B.C. (Begole 1973, 1976; Davis et al. 1980; Hayden 1976). The term was originally used by Rogers (1939, 1966) for ancient-looking cleared circles, tools, and rock alignments that he later classified as San Dieguito I. Malpais continued to be applied to heavily varnished choppers and scrapers found on desert pavements of the Colorado, Mojave, and Sonoran deserts that were thought to predate Paleoindian assemblages that included projectile points. Although few would question that most of the artifacts are culturally produced, dating methods remain extremely uncertain and have been assailed on numerous grounds (McGuire and Schiffer 1982:160-164). Arguments for early settlement of the Colorado Desert have been further eroded by the redating of the "Yuha Man." Originally dated to over 18,000 B.C. based on radiocarbon analysis of caliche deposits, more reliable dates based on the accelerator mass spectrometry (AMS) radiocarbon method applied to bone fragments now place the burial at about 3000 B.C. (Taylor et al. 1985).

Paleoindian Period (San Dieguito Pattern) (ca. 12,000 to 5000 B.C.)

The earliest chronologically distinctive archaeological pattern recognized in most of North America is the Clovis pattern. Dated to around 11,500 B.C., Clovis assemblages are distinguished by fluted projectile points and other large bifaces, as well as extinct large mammal remains. Fluted points have reportedly been found in the Yuha Desert, Cuyamaca Rancho State Park, Ocotillo Wells, Lost Valley, and Chuckwalla

Valley, although not yet in independently dated contexts (Davis and Shutler 1969; Kline 2014; Kline and Kline 2007; Rondeau et al. 2007).

Most of the lithic assemblages, rock features, and cleared circles in the Salton Basin were routinely assigned to the San Dieguito Phase III complex by many of the initial investigators. Rogers first distinguished the San Dieguito pattern in western San Diego County, based initially on surface surveys and subsequently refined through excavations at the C. W. Harris Site (Rogers 1929, 1939, 1966). His extensive surveys subsequently identified the pattern in the southern California deserts. Rogers proposed three phases of the San Dieguito complex in its Central Aspect, which encompassed the area of the Colorado and Mojave deserts and the western Great Basin. The successive phases were characterized by the addition of new, more sophisticated tool types to the pre-existing tool kit.

San Dieguito complex lithic technology was based on percussion flaking of cores and flakes. San Dieguito I and II tools include bifacially and unifacially reduced choppers and chopping tools, concave-edged scrapers (spokeshaves), bilaterally notched pebbles, and scraper planes. Appearing in the San Dieguito II phase are finely made blades, smaller bifacial points, and a larger variety of scraper and chopper types. The San Dieguito III tool kit is appreciably more diverse, with the introduction of fine pressure flaking; tools include pressure-flaked blades, leaf-shaped projectile points, scraper planes, plano-convex scrapers, crescentics, and elongated bifacial knives (Rogers 1939, 1958, 1966; Warren 1967; Warren and True 1961). Various attempts have also been made to seriate cleared circles into phases, but no convincing chronological scheme has yet emerged (Pendleton 1986).

Because of the surficial character of most desert sites and the scarcity of good chronological indicators, it has been difficult to test the validity of Rogers' San Dieguito I, II, and III phases as chronologically successive changes in the tool kit of a long-lived culture. Some of the variations may have developed contemporaneously in response to particular functional, ecological, or aesthetic requirements. Subsequent excavations at the C. W. Harris site in coastal San Diego County also failed to confirm Rogers' original observation of a stratigraphic separation between Phase II and Phase III assemblages (Warren 1967:171-172). Rogers (1966:39) also identified different settlement patterns characteristic of each phase, but as Vaughan (1982:6-11) argued, these distinctions were inadequately defined and inconsistently applied. The phase model may be tested and refined, but at present the application of phase distinctions does not appear to be warranted.

The San Dieguito pattern appears to reflect a hunter-gatherer adaptation consisting of small mobile bands exploiting small and large game and collecting seasonally available wild plants. An absence of milling stones has been seen as reflecting a lack of hard seeds and nuts in the diet, and as a diagnostic cultural trait distinguishing the San Dieguito pattern from subsequent Desert Archaic patterns (Moratto 1984; Rogers 1966; Warren 1967). Portable manos and metates are now being increasingly identified at coastal sites radiocarbon dated earlier than 6000 B.C. and in association with late San Dieguito assemblages. Arguments have also been made for the presence of a developed grinding tool assemblage during early periods, based on finds from the Trans-Pecos area of Texas (Ezell 1984). In regard to the Colorado Desert, Pendleton (1986:68-74) remarked that most ethnographically documented pounding equipment for processing hard seeds, wild mesquite, and screwbeans were made from wood and would not be preserved in the archaeological record.

Site distributions also suggest some of the basic elements of San Dieguito settlement patterns. Sites might be situated on any flat area, but the largest aggregations occurred on mesas and terraces overlooking major washes. Where lakes were present, sites are located around the edges. These were areas where a variety of plant and animal resources could be found and where water would have been at least seasonally available.

Archaic Period (Pinto and Amargosa Patterns) (ca. 5000 B.C. to A.D. 500)

The Pinto and Amargosa patterns were regional specializations within the general hunting and gathering adaptations that characterized the Archaic period. These patterns occur more frequently in the northern Great Basin, the Mojave Desert, and the Sonoran Desert east of the Colorado River. Few Pinto or Amargosa (Elko series) projectile points have been identified on the desert pavements in the Colorado Desert, although that condition is beginning to change as the number of investigations increases. Some late Archaic sites are known, indicating occupations along the boundary between the low desert and Peninsular Range and at more favored habitats.

It has been suggested that the environment in the California deserts was unstable and inhospitable during this period, particularly during the so-called Altithermal period between 5000 and 2000 B.C., and that this condition forced mobile hunter-gatherers into more hospitable regions (Crabtree 1981; Schaefer 1994; Wilke 1976). The paleoenvironmental data discussed above do not have the resolution to detect such drastic conditions. Also, as mentioned, Lake Cahuilla may have mitigated Altithermal effects on human occupation in the Colorado Desert.

Several Archaic sites have been excavated in recent years. The most substantial Colorado Desert site dated to this period is Indian Hill Rockshelter in Anza-Borrego Desert State Park. At that site, 1.5 m of cultural deposits were excavated below a Late Prehistoric component (McDonald 1992). Particularly significant were 11 rock-lined cache pits and numerous hearths indicative of either a residential base or a temporary camp where food storage was integral to the settlement-subsistence strategy. Also recovered were numerous Elko Eared dart points, flaked lithic tools, and milling stone tools, as well as three inhumations, one of which was radiocarbon dated to 4070 ±100 B.P. Two rock-lined pits similar to those at Indian Hill Rockshelter, along with an accompanying late Archaic assemblage, were excavated at a small rockshelter in Tahquitz Canyon near Palm Springs (Bean et al. 1995). The small number of artifacts at the site suggested strategically stored food processing equipment that was used by a small, mobile group. Several important late Archaic sites recently have been documented in the northern Coachella Valley (Love and Dahdul 2002). Deeply buried midden deposits with clay-lined features and living surfaces, cremations, hearths, and a rockshelter deposit have been found at various sites in association with calibrated radiocarbon dates ranging from before 1000 B.C. to A.D. 700. Radiocarbon dates of almost 1000 B.C. and associated bird and fish bone confirm a Late Archaic period Lake Cahuilla occupational horizon, as well as Archaic period interlacustral phases. Larger habitation sites remained elusive in the Colorado Desert until 2006, when a series of deeply buried midden deposits and some house features were discovered under alluvial fan and dune formations at the very northern end of the Coachella Valley at Seven Palms near Desert Hot Springs (Mariam Dahdul, personal communication to Jerry Schaefer 2006). These findings bring Colorado Desert cultural history more in line with comparable late Archaic patterns in the Mojave Desert and Owens Valley.

Early projectile points in Imperial County have generally been reported only as isolates on desert pavements, but a recent inventory at the Salton Sea Test Base produced a cluster of early projectile points including Lake Mojave, Pinto/Gatecliff, and Elko forms, and even two eccentric crescents, scattered among protohistoric sites on the bed of Lake Cahuilla 30 m below sea level (Apple et al. 1997; Wahoff 1999). If these points are in situ, as the investigators suggest, presumably they escaped burial by lake sediments or were subsequently reexposed. An alternative explanation may be that they were collected elsewhere and reused by protohistoric occupants. Several Archaic points have also been reported within the Truckhaven area. Direct evidence of an Archaic occupation comes from the Truckhaven flexed burial (IMP-109), found under a cairn and dated to 5790 ±250 B.P. (Taylor et al. 1985; Warren 1984:404).

The emerging picture of late Archaic occupation in the Salton Basin is of mobile hunter and gatherer bands with atlatls for hunting and milling stones for seed and nut processing, operating out of a limited number of base camps in optimal areas on the boundaries of the Salton Basin and on the shoreline of Lake Cahuilla.

This Archaic pattern may be viewed as a cultural precursor of the Late Prehistoric period, although linguistic data and tribal origin stories suggest some demographic displacements in the late prehistoric past.

Late Prehistoric Period (Patayan Pattern) (ca. A.D. 500 to 1700)

Sites dating to the Late Prehistoric period are probably more numerous than any other in the Colorado Desert. The period has been divided into four phases, including a pre-ceramic transitional phase from A.D. 500 to 800. The major innovations were the introduction of the bow and arrow circa A.D. 500, of pottery production using the paddle-and-anvil technique around A.D. 800, and the introduction of floodplain agriculture on the Colorado River, perhaps at about the same time (Rogers 1945). Within the Colorado Desert, according to some investigators, ceramics first appear around A.D. 1000 (Love and Dahdul 2002). Exact dating for the presence of early domesticated plants is not available (Schroeder 1979). Both these technological advancements were presumably introduced either directly from Mexico or through the Hohokam culture of the Gila River (McGuire and Schiffer 1982; Rogers 1945; Schroeder 1975, 1979). The most recent Late Holocene episodes of Lake Cahuilla have been taken to define the Patayan II phase, bracketed by Patayan I and III phases and previously dated between about A.D. 1050 to 1500. However, recent research has demonstrated that a lake infilling occurred between A.D. 1600 and 1700 (Laylander 1997; Schaefer 1994). The now-confirmed presence of lake stands both before A.D. 1050 and after A.D. 1500 casts some doubt on the viability of the perceived Patayan phase distinctions.

Hargrave (1938) coined the term “Patayan” from the Walapai word for “old people” to refer to the late prehistoric archaeology of the Colorado River Valley. In so doing, he wanted to avoid assumptions that specific prehistoric cultures in this area were directly ancestral to the modern Yuman cultures. The Patayan pattern is equally applicable to the prehistoric ancestors of the desert Cahuilla, who speak an unrelated language but whose culture shares many of the economic and technological attributes of the cultures of the Yuman speakers.

Colton (1945:118) applied a direct historical approach to developing a Patayan culture scheme. Relying on very little information, for the most part no more than surface sherd scatters, he made an initial attempt at defining a Patayan pattern. Assuming that the ethnohistoric practice of intense warfare among Colorado River peoples extended back into the prehistoric past, he postulated that the center for the dispersion of Patayan peoples to the east and west lay on the Colorado River and was brought about by high population densities of warlike communities that were circumscribed by inhospitable desert conditions. The Ipai, Kumeyaay, and Tipai of California and the Havasupai, Walapai, and Yavapai of western Arizona were some of these offshoots. The presumption was that these people had spread into other areas by the same process of warfare that later drove the Kahwan, Halyikwamai, and Halchidhoma off the river to become ultimately amalgamated with the Maricopa on the Gila River. Colton also revised Kroeber’s (1943) classification of river and delta Yuman languages to propose a southern branch (Laquish) centered on the Colorado Delta and a northern branch (Cerbat) centered on the Needles area. In another paper, Colton tentatively classified the Cohonina and Prescott patterns as branches of Patayan in the mountains of northwestern Arizona.

While Colton’s cultural scheme focused on Arizona, Rogers established the first systematic culture history and artifact typologies for the Colorado Desert in California, but also including evidence from western Arizona. Rogers’ (1936, 1945) investigations of Yuman ceramics and culture history remain fundamental for archaeological research in the region. He distinguished three phases of Late Prehistoric archaeology in the Colorado Desert as Yuman I, II, and III, with Yuman II being contemporary with the late Holocene phase of Lake Cahuilla between around A.D. 1000 and 1500.

Also included in this early period of basic archaeological research is Schroeder’s examination of lower Colorado River sites (Schroeder 1952, 1979). Schroeder (1961) excavated the Willow Beach site, located just below Boulder Canyon, one of the few stratified Late Prehistoric sites known on the Colorado River.

He developed a cultural sequence that emphasized the similarities of the Colorado River assemblages with the upland areas of western and central Arizona, lumping a number of cultural patterns into the concept of the Hakataya pattern, an expanded version of Rogers' Yuman pattern (Schroeder 1979). Some scholars found Schroeder's concept of the Hakataya to be too inclusive and also noted conflicts with Rogers' original Yuman ceramic typology (see McGuire and Schiffer 1982). Schroeder (1957, 1958, 1975) also postulated associations between subdivisions of the Hakataya pattern, certain ceramic types, and historically identified tribal groups. These branch-ceramic-tribal associations include, among others, the linking of the Roosevelt branch, Tonto Brown pottery, and the Southeast Yavapai; the Cerbat branch, Cerbat Brown, and the Walapai; the La Paz branch, Needles Buff, and the Halchidhoma; the Palo Verde branch, Tumco Buff, and the Quechan; the Amacava branch, Parker Buff, and the Mojave; and the Salton branch, Topoc Buff, and the eastern Kumeyaay. This approach may give insufficient consideration to the mobility of some groups, who may have produced different ceramic types depending on the proximity of particular clay types to seasonal settlements.

The term "Patayan" regained prominence with the publication of Hohokam and Patayan by McGuire and Schiffer (1982). They provide a critical history of the development of the terminology and cultural concepts. Michael R. Waters (1982a, 1982b) applied the term to a preliminary ceramic chronology and typology for the Colorado Desert, based on Rogers' unpublished notes and type collection at the San Diego Museum of Man. Waters also critically discussed differences between Rogers' and Schroeder's approaches, both in the definition of prehistoric cultures and in the application of a Lower Colorado River Buff ceramic typology.

Within the Late Prehistoric period, between A.D. 1000 and 1700, desert peoples of this region developed wide-spectrum and diversified resource procurement systems emphasizing a collector organization using residential bases and temporary logistical camps, scheduled according to the ripening seasons of staple plant resources. Mobility was an important element in this pattern, with frequent travel between the Colorado River and Lake Cahuilla, when the lake was present.

The diversity of sites and assemblages associated with Lake Cahuilla indicate considerable variability in Late Prehistoric and protohistoric social and ecological adaptations to the lake (Wilke 1978). The number of house pits at fish camps ranges from one to more than a dozen, perhaps indicating the number of households in residence at any one time or resume of an area. Fish traps range from single examples to long lines that are suggestive of cooperative fishing ventures.

Archaeologically excavated house pits indicate that some have developed middens and diverse artifact types, suggestive of season-long temporary camps, while others have only sparse artifact associations suggestive of short-term fishing expeditions. Faunal assemblages vary from those largely limited to fish bone or the remains of migratory water birds, to others that contain more diverse resources, including rabbit and large mammal bone. This variability in site types and assemblage contents has yet to be correlated in a systematic manner with other variables, such as the recessional stages of Lake Cahuilla (reflected in elevation), localized geography and paleoenvironments, ethnicity, or other factors.

The numerous trail systems throughout the Colorado Desert attest to long-range travel to special resource collecting zones and ceremonial locales, trading expeditions, and possibly warfare. Pot drops, trailside shrines, and other evidence of transitory activities are associated with these trails (McCarthy 1993). Trade and travel is also seen in the distribution of localized resources such as Obsidian Butte obsidian, wonderstone from the south end of the Santa Rosa Mountains, soapstone, marine shell from the Gulf of California and the Pacific coast, and ceramic types. The Elmore site near Kane Springs, for example, contained evidence of *Olivella* shell bead manufacturing and other shell processing, trade, craft specialization, and possibly cultural connections with delta Yumans who may have been displaced during Lake Cahuilla infillings (Laylander 1997; Rosen 1995; Schaefer 2000).

Ethnography

Ethnography refers directly to cultural patterns that were observed during the historic period, primarily during the first half of the twentieth century, or to traditional culture as remembered during that period. However, used with proper caution, it also provides an invaluable source of analogies and inferences concerning earlier, prehistoric cultural patterns.

At the time of European contact, the project area was occupied by the Kamia (also known as Kumeyaay, Tipai, and Diegueño). The principal ethnographic source for the Kamia, or desert Kumeyaay, is E. W. Gifford (1918, 1931), but considerable additional information can be gleaned from A. L. Kroeber (1920, 1925), Drucker (1937), and C. Daryll Forde (1931), given the close association between the Kamia and Quechan, and from Leslie Spier (1923) and William D. Hohenthal (2001) with regard to the Kamia's Tipai/Kumeyaay affinities. Synthetic overviews and interpretations of merit have been prepared by Frederic N. Hicks (1963), James P. Barker (1976), Martha Knack (1981), and John C. Russell and his associates (2002).

The Kamia were directly related by language and culture to the western Ipai, Kumeyaay, and Tipai groups of the mountains and coastal areas of San Diego County and northern Baja California, and a little more remotely to the Cocopa and other Yumans in the Colorado River's delta. The Kamia occupied areas along the New and Alamo Rivers, and at springs and walk-in wells in Imperial Valley. During the ethnohistoric period, they were politically and militarily associated with the Quechan-Mohave alliance in opposition to the Cocopa in the Colorado River delta and the Halchidhoma in the Palo Verde Valley portion of the lower Colorado River. They maintained particularly close relations with the Quechan at the confluence of the Colorado and Gila Rivers and were permitted a farming rancheria at the large Quechan settlement of Xuksil (Quechan: "sandstone"), located a few km south of the modern Mexican town of Algodones and north of the course with the Alamo River near the southern tip of the Imperial Dunes (Russell et al. 2002:84). These people were collectively known as the Kavely cadom or "south dwellers" and were known to the early Spanish expeditions as the rancherias of San Pablo, whose leader was also named Captain Pablo. They were estimated to number 800 people when the Anza expedition passed through in 1774 (Bolton 1930:2:51; Forde 1931:101). The Sonora Franciscans established the mission of San Pedro y San Pablo de Bicuñer near this location in 1776, along with another mission at La Purisíma Concepción, later to become Fort Yuma. Both were destroyed in a Quechan uprising on July 17, 1781, six months after their founding (Forbes 1965:191-204).

Two other Kamia encampments in Quechan territory were Espayau and Michul, located 13 km south of Pilot Knob near the modern town of San Luis in Sonora. Gifford's Kamia consultants did not recognize the names of four or five other settlements that are listed in Hodge (1907:330). The Kamia also used the Quechan occupation area of Cactus Lake (E-ce-mon), located 2-3 km southwest of the Cactus railroad stop, 1.6 km east of the dunes, and some 10 km north of the All-American Canal. This was an area where seasonal runoff from Pilot Knob Mesa would accumulate to form a large pan. The USGS maps show a zone of denser vegetation indicating shallow ground water. Quechan consultants identify this area as a cremation and burial ground (Russell et al. 2002:33, 84). A Kamia hunting and gathering territory (Xakwinimis) extended to the northern portion of the Imperial Sand Dunes and extending south past Highway 78 and across Pilot Knob Mesa to the Chocolate Mountains. This area figures in Kamia, Quechan, Kumeyaay, and Maricopa mythology (Russell et al. 2002:32, 84).

The Kamia maintained settlements at optimally watered locations on the New and Alamo Rivers, planting crops after major overflows from the Colorado River into the Salton Trough. An 1849 census counted 254 Kamia people on the New River in Imperial Valley under Chief Fernando. They included 118 men, 82 women, and 54 children (Heintzelman 1857:53). By 1860, the County of San Diego Census recorded 105 Kamia people at New River (Indian Wells or Xachupai), distributed among 11 households or rancherias and led by a Captain Zacariah (San Diego Genealogical Society n.d.:120-122). This record is especially valuable because it lists each household member by name, sex, and age. Presumably their numbers were much greater before the introduction of European diseases and probably dropped even more drastically with the rampant smallpox and measles epidemics of the 1860s. A series of prolonged droughts or floodwater failures in the nineteenth century also took their toll on the population and eventually drove most Kamia in Imperial Valley to live at the rancheria of Xatopet, possibly on an east-west portion of the Alamo River south of the Imperial Dunes near the village of Huerta, Baja California. This was an emergency planting place that the Quechan also used when the Colorado River failed to flood in the summer of 1851 (Kroeber 1980:190). The Kamia suffered additional casualties during conflicts with the Mexican military at Huerta and ultimately fled to live primarily with the Quechan.

The Kamia were organized into 10-11 non-localized exogamous patrilineages. Many Kumeyaay living to the west were also members of these same lineages, leading Gifford (1918, 1931:301) to conclude that the Kamia were, in essence, desert Kumeyaay who had assimilated may aspects of River Yuman culture. The identification of lineages with specific locations was probably more related to the settlement preferences of individual families that moved as lineage segments, rather than of any lineage territoriality. Gifford (1931:14) does suggest that some greater degree of lineage localization may have occurred in the past but was inhibited by mobility requirements of shifting arable lands. Spier's (1923) mountain Kumeyaay informants associated the clans of *Litc*, *tumau*, and *kwatL* with areas just south of the Salton Sea. As most of the totemic associations of the lineages are either to the Wildcat or the Coyote, the Kamia may have had some elements of a moiety system like that of the Cahuilla, although the Kamia were exogamous by lineage and not by totemic association. The economic unit was the extended family household consisting of a man and his wife (or wives), children, and grandparents. The 1860 census suggests households included additional adults. Probably as a result of River Yuman contact, the Kamia maintained a greater degree of "tribal" identification than their Kumeyaay kinsmen to the west, recognizing a tribal "chief" over all the lineages, an achieved rather than ascribed status functioning in the organization of economic activities, warfare, and diplomacy. It is not clear if this position may reflect a Euro-American effort to identify a responsible "captain."

Like their Yuman neighbors, the Kamia lived in rectangular, semi-subterranean structures of post-and-beam construction, with thatch and earthen roofs. They also built ramadas, lean-tos, and conical sweathouses. They dispersed their dwellings on or adjacent to arable alluvial terraces as close as possible to running water, hand-dug walk-in wells, or sloughs. There were no permanent villages, and their moves were conditioned by the availability of floodwater farming areas and the ripening of wild plants. The Kamia would move to higher terraces if flooding occurred. Seasonal overflow from the Colorado River that fed the New and Alamo River sloughs periodically failed, and the Kamia would move to other locations, including the Colorado River, during these stressful times.

The Kamia practiced a mixed economy of horticulture and hunting and gathering. Mesquite (*Prosopis glandulosa*) was the most important wild staple crop, as it was for other groups in the Colorado Desert. Seedpods were ready in July and were readily collected at Espayau, south of Pilot Knob, where the Kamia would make camp but where agriculture was not feasible. Acorns were either obtained directly in the Peninsular Range or through trade with the Kumeyaay in exchange for cultigens. The Kamia also procured baked and dried agave cakes from the Kumeyaay but otherwise did not participate in the early spring agave harvest. Tule pollen and roots were gathered from sloughs, one favorite spot being Seven Wells on the east-west portion of the Alamo River south of the International Border. Gifford (1931:24) reports on another marsh plant called *wārό*. The seed capsules were pulled off by hand over a ceramic pot and the capsules were rubbed until the seeds were freed. The pods were then winnowed away with a ceramic dish. The seeds were ground on a metate and eaten dry. Either wooden mortars or stone metates were used for many wild seeds, followed by cooking. Gifford's (1931:27) consultants apparently had no knowledge of the widespread practice of parching seeds prior to grinding, although ceramic parching trays occur at archaeological sites. Among the seeds exploited were saltbush (*Atriplex* sp.), yerba mansa (*Anemopsis californica*), and sedge (*Cyperus erythrorrhizos*).

The Imperial Dunes also provided several plant foods. These included the black stems of a short plant called *yidut*, which were boiled in a pot and then peeled (Gifford 1931:24). This was most likely the "sand food" (*Pholisma sonorae*) that Castetter and Bell (1951:209) note the Cocopa called *oy∂t* and which they and the Quechan were observed collecting as late as 1895. The ball-shaped root of a plant called *nyus* was boiled and eaten. Although not mentioned by Gifford, it is very likely that sand food, discussed above, was also dug out of the sand dunes. In fact, Gifford's list of exploited plants is very slim, and in all likelihood the Kamia gathered as diverse an array of plants as other Colorado River peoples and the Kumeyaay (Castetter and Bell 1951).

The Kamia fished for all the native species, applying the same methods as the River Yumans, except that they did not use the dip net. Also like other River Yumans, hunting was a minor activity, but prey included migratory waterfowl, squirrel, gopher, lagomorphs, deer, beaver, and bighorn sheep.

Clay for making ceramics was dug from Colorado River alluvial deposits (Gifford 1931:42). One of Clyde Wood's Quechan consultants also identified the Imperial Dunes as an area to obtain clay (Russell et al. 2002:85).

The Kamia applied the same system of floodplain agriculture as the river and delta Yumans (Castetter and Bell 1951). Their fields extended along the lower alluvial terraces of the New and Alamo Rivers, their locations shifting with each seasonal flood cycle. In a rare recording on the Township 12 North, Range 13 West U.S. General Land Office (GLO) Map from 1954-1956, a "Rancheria corn field" was documented on the west side of Section 36, about 0.4 km from the New River and about 10.5 km upstream from where the New River empties into the modern shore of the Salton Sea. Many other agricultural fields likely also existed throughout the area although this was one of the few that were bisected by a surveyed section line and was thus mapped. Indian trails, ponds of fresh water and mesquite hummocks also dot the area, suggesting other attractions to the Kamia.

As previously mentioned, the Quechan also afforded the Kamia arable land on the Colorado River near Algodones. Irrigation after planting was not practiced, but they did build earthen dams at Xatopet (Kamia: "dam") and elsewhere to channel water into higher terrace areas to saturate the soil before planting. The River Yumans also used brush weirs to divert floodwaters in order to soak specific terraces more thoroughly. The Kamia may have practiced actual irrigation agriculture in the Jacumba Valley, just south of the Mexican border near the crest of the Peninsular Range at the western extreme of Kamia occupation. Here several Kamia lineages shared the area with one Tipai lineage that did not venture into Imperial Valley. This is the only place that, at least during the early nineteenth century, sustained irrigation ditches from a spring were maintained to water crops, as contrasted with the soak-and-plant method of floodplain agriculture on the Colorado River and in Imperial Valley (Gifford 1931:22).

A 2-kg seed cache was found in a ceramic cooking pot in a dry cave at Jacumba that may shed some additional light on Kamia agriculture (Treganza 1947). It contained nine different species of seeds, each wrapped in a historic-period twined bicolor textile. The seeds include native maize (*Zea mays*), tepary beans (*Phaseolus acutifolius*), butternut squash (*Cucurbita mochata*), and pumpkin squash (*C. pepo*), as well as introduced watermelon (*Citrulus vulgaris*), muskmelon (*Cucumis melo*), sorghum (*Sorghum vulgare*), wheat (*Triticum compactum*), and barley (*Hordium vulgare*). (Adan Treganza previously discovered two other maize cob caches.) Even though the textile suggests a date after 1850, the cache has been frequently cited to support arguments for prehistoric agriculture west of the Colorado River (Bean and Lawton 1973; Forbes 1963). The seed complex matches that known for the early historic period O'odham (Pimans) who did practice irrigation agriculture like the prehistoric Hohokam who preceded them; it also matches the

River Yumans after Kino had introduced the European and Asian species in the late seventeenth century. The find may therefore suggest, as Treganza argued, that Kamia agricultural practices, including irrigation, derived from Native American sources rather than the missions. However, the introduced species and the associated textiles that Treganza dated to after 1850 without confirmation from a textiles expert (and which Jack Forbes [1963:7] only assumed to date from sometime after 1769) do not provide proof of prehistoric agriculture among the Kamia west of the Colorado River. Schaefer and Gary Huckleberry (1995) and Don Laylander (1995) provided additional rebuttals to the arguments for prehistoric agriculture west of the Colorado River. The question remains one of considerable interest for future archaeological investigations.

Lake Cahuilla figures notably in the Kamia's origin myth (Gifford 1931:75-83). Except among the Cahuilla, this represents the only other major recorded oral tradition regarding the prehistoric lake (Laylander 2004). The Kamia trace their origins to the north at Wikami (Mohave: Avikwame) near Needles, as do most River and Delta Yuman groups, as well as the southern Kumeyaay. The Mohave were said to have settled closest to Avikwame, and all the other groups migrated south to their respective territories. As related to Gifford (1931:79-80):

> The Kamia came part way with the Yuma, then left them and went to the eastern shore of the Salton Sea. The sea (probably Blake's Sea) was large then and where El Centro is now there was sea. Later they moved to Indian Wells (Xachupai) and to Saxnuwai (near Holtville). There were ten men of each tribe. The ten Kamia men were the ancestors of ten lineages. Some of the Kamia passed through Imperial Valley into the mountains of San Diego County and became the Diegueño. There they had no seeds to plant, but found wild plant foods, deer, and mountain sheep.
>
> The tribes of Mission Indians were also near the (presumably present) southern end of Salton Sea. They became afraid of the Kamia, hence the Cahuilla and other Shoshonean tribes fled north-westward.
>
> Later there came from the mountain Wikami three persons who were to be the Kamia leaders. They were a hermaphrodite (described by the informant as half man, half woman) call Warharmi (cf. Mohave hwami) and her twin "sons" (not really her sons, Narpai said), both called Madkwahomai. These three had learned much at Wikami. They came south along the Colorado River. They found the feathers of birds which had died, as they traveled along day after day. The feathers were of the birds kak (crow), tokwil, and kusaul. The three travelers made headdresses of these feathers and painted their faces as for war. They brought bows, arrows, and clubs.
>
> From the Colorado River at Yuma they crossed over to Imperial Valley. Their appearance so frightened the Kamia that they fled in all directions. One Kamia woman did not flee before the three. She was married by one of the Madkwahomai twins. Then the three newcomers and the woman settled at Saxnuwai.
>
> The seeds of maize and beans had been given them by Mastamho. These the three travelers brought from Wikami and planted at Saxnuwai, thus introducing cultivation in the Imperial Valley. Those Diegueño who had gone to the mountains to live failed to receive the seeds. The three travelers brought the seeds of certain wild plants as well.
>
> At Saxnuwai, Warharmi and the twins planted, for they found wet ground there. Before their departure from Wikami Mastamho had explained how everything was to be done. He had said that Warharmi and the two Madkwahomai were to be farmers and that they should go to dwell among the Kamia, whom Mastamho had sent to live on the shores of the Salton Sea.

Gifford considered the question of the phase of Lake Cahuilla to which the Kamia tradition may have been referring. He first weighed the argument that the final recession occurred before 1540 when Alarcón and Díaz sailed up the lower Colorado River. This was the prevailing view up until the 1980s. He then suggested that there certainly was enough time between Spanish *entradas* into the area for an additional infilling phase. A seventeenth-century infilling has now been substantiated archaeologically, as previously discussed above. Gifford indicated that the high degree of observed acculturation to Yuman culture does not provide a clear index to the length of time the Kamia had been in the Imperial and Colorado River valleys. The acculturation could have taken place even in the nineteenth century, after a late phase of Lake Cahuilla, he suggests. The occurrence of some western Kumeyaay lineages among the Kamia might also indicate movements into Imperial Valley by people escaping the missions or their influence. However, Gifford did not rule out the possibility that the Kamia population and cultural form may have been well established for a millennium (Gifford 1931:83, 86). In that case, many different prehistoric cultural trajectories could well have arisen from the multiple infillings and recessions of Lake Cahuilla during the late Holocene.

Trade relations were an important means of getting items not found within a tribal territory and of cementing social and political ties between different groups. Lying near the ethnohistoric boundaries between different linguistic groups, the Project area may have been on or near a corridor for the exchange of goods and knowledge. The Kamia were very favorably positioned to trade with the Quechan because they enjoyed a close social relationship with them and they had access to the resources in the mountains of the Peninsular Range into which their territory extended. They were closely related to the other Kumeyaay groups of the mountains and coast and could act as trading middlemen with the Quechan. Both directly and indirectly, the Cahuilla of the Coachella Valley, the Paipai in Baja California, The Cocopa to the east, and the O'odham in Sonora may have also participated in this network. Chris White (1974) postulated that some of the alliance patterns were linked to east-west trade relationships, across which the greatest differential distribution of natural resources was present, as opposed to north-south relationships between groups that shared the same environmental zones.

Prior to the ethnohistoric period, trade dynamics may well have been quite different; archaeological data would be the primary source for reconstructing these earlier patterns. Ceramics may have themselves been trade items, or they may have served more often as containers for trade items. Trade dynamics recorded during the ethnographic period include: from the mountain Kumeyaay, the Kamia received wild tobacco, acorns, baked agave hearts, yucca fiber sandals, baskets, eagle feathers, and cordage carrying nets. In return, the Kamia exported vegetal foods of the desert, probably mesquite cake foremost among them, and salt obtained from Imperial Valley. The Kamia also traded tobacco, an important ritual item, as well as receiving it from the Quechan. No doubt acorns and agave hearts, restricted to upper elevations, were Kumeyaay foods that would be in demand to the lowland Colorado River Yumans. The Colorado River Yumans, in return, exchanged cultigens such as dried pumpkin and corn, as well as gourds and seeds for rattles. The Cocopa, living near the Gulf of California, traded shell beads and pendants to the Kamia (Davis 1961).

Archaeological evidence indicates regular movement of obsidian for arrow points from Obsidian Butte at the southern end of the Salton Sea and soapstone arrow shaft straighteners from the Peninsular Range. Wonderstone for making flaked tools may also have had some trade value. It was obtained from the Rainbow Rock source at the southeast edge of the Santa Rosa Mountains and from Cerro Pinto, west of Mexicali and just south of the Mexican border. Not only utilitarian goods but esoteric objects, knowledge, and songs were also exchanged. Eagle feathers and even live eagles for the eagle-killing ceremony were much valued. The Cahuilla received gourd rattles and red pigment from the Colorado River Yumans. As another example of cultural exchange, very late in their history (ca. 1890), the Quechan incorporated the specific style of image from the Kamia into their *karʌúk* (mourning) ceremony (Forde 1931:221).

History

Exploration and Initial Development

The Project area has generally been marginal to major historic period events in the Colorado Desert (Lawton 1976). The wider region first came to the attention of Europeans in 1539, when Francisco de Ulloa reached the northern limit of the Gulf of California. In 1540 Hernando de Alarcón sailed up the lower Colorado River at least as far as present-day Yuma, and Melchior Díaz traveled overland from Sonora to reach and cross the river. The portions of the desert west of the Colorado River were first visited only as late as the 1770s, when Francisco Garcés and Juan Bautista de Anza pioneered a route from the Colorado River to coastal southern California, passing to the south and west of the study areas.

During the following decades, Spanish and Mexican forays into the Colorado Desert from coastal southern California and from northwestern Sonora continued, first in opening an overland route through Yuma and subsequently, after the Quechan revolt of 1781, in more limited probes to retaliate or to attempt to reopen the route. These explorations have been discussed in detail by Harry W. Lawton (1976). Most of the travel occurred well to the south of the study areas. However, in 1823-1826, José Romero led two expeditions that penetrated the Coachella Valley. With the Mexican-American War of 1846-1848, the Gold Rush in northern California, the development of the Butterfield Stage route, and explorations of potential railroad routes through the Colorado Desert, familiarity with the region steadily grew.

In 1853, Lieutenant K. S. Williamson of the U.S. Topographic Engineers and geologist William Blake surveyed the Salton Basin for railroad routes. In the process, Blake described the character of prehistoric Lake Cahuilla and recognized the potential fertility of the Salton Basin. Sporadic flooding of Colorado River waters into the basin occurred at least eight times from 1824 to 1904. Oliver Wozencraft lobbied the California legislature to gather support for the idea that the Salton Basin desert was irrigable. The state supported Wozencraft's idea and requested that Congress convey six million acres to Wozencraft. Although some members of the Public Lands Committee at least partially favored the idea, the U.S. Land Office was concerned about a huge land grant to one individual. Despite Wozencraft's continued lobbying efforts in Washington over the years, the transfer never occurred (Laflin 1995; Ní Ghabhláin and Schaefer 2005:7; Redlands Institute 2002).

In the late 1800s, the federal government sponsored individual land development in the west in the form of a series of acts, including the Homestead (1862), Timber-Culture (1873), Desert Land (1877), and Timber and Stone (1878) acts (Robinson 1948:168-172). Most settlers in the desert depended on artesian wells in 1894, which made sustained irrigation efforts difficult. Hydraulic well drilling began in Indio in 1898 and offered another method of water collection for settlers (Nordland 1978:54; Redlands Institute 2002).

Irrigation

The entire Project area is located immediately east of the Westside Main Canal and is intersected by the Fern Canal, the Fig Drain, and the Wormwood Canal. These features represent but a small portion of the complex water delivery system in the Imperial Valley that irrigates some of the most productive agricultural land in the United States. The laterals and drains adjacent to the project area are among the hundreds of similar features that make up the IID water distribution system. They provide water to irrigate these lowest-lying areas of arable lands and also drain salt-laden runoff. The main canals, most notably the Eastside, Westside, and Central Main Canals, are primary components of the irrigation system, feeding water from the All-American Canal to all of the laterals. Water flow is controlled by means of checks and delivery gates throughout the system. From these laterals, farmers then divert water to specific fields by several methods, including small irrigation ditches fed by siphon tubes, area flooding, pumps, and sprinkler systems. The main canals retain integrity of location, setting, feeling, and association more than any other elements within the IID and represent major engineering components on a scale comparable to the All-

American Canal. How this irrigation system came into existence is critical to understanding the recent history of Imperial Valley.

Early Irrigation Systems in the Imperial Valley

As previously discussed, the possibility of diverting Colorado River water to irrigate the Imperial Valley was first raised in 1853 by William Blake, a geologist with an expeditionary unit charged with surveying the southern Colorado Desert for railroad routes. Blake's geological study observed that over thousands of years overflows of the Colorado River had drained into the Salton Trough through the New and Alamo Rivers, forming ancient Lake Cahuilla. He also noted the apparent fertility of the alluvial soils of the Imperial Valley and suggested ways in which water might be brought from the Colorado River:

> If a supply of water could be obtained for irrigation, it is probable that the greater part of the desert could be made to yield crops of almost any kind... By deepening the channel of New River, or cutting a canal so low that the water of the Colorado would enter at all seasons of the year, a constant supply could be furnished to the interior portion of the desert [Blake 1853:110].

Following Blake's report, several attempts were made to finance construction of a canal to bring water to the Imperial Valley. The first diversion canal and irrigation system was constructed by the California Development Company (CDC) under the direction of Charles Rockwood and George Chaffey (Dowd 1956:10ff; Frisby 1992:29ff; Starr 1990; Tout 1931). Construction on the Alamo or Imperial Canal, as it was known, began in August 1900. An intake canal diverted water from the Colorado River south to Mexico from a point called Hanlon's Heading, adjacent to Pilot Knob just north of the U.S.-Mexico border. In Mexico, CDC made use of the Alamo overflow channel of the Colorado River to conduct the water a distance of approximately 40 mi. Minimal work was required to render the channel serviceable as a canal. Four mi. east of Calexico another canal, the Central Main Canal, was constructed to transport the water north to the Imperial Valley. On May 14, 1901, the first diversion was made from the Colorado River to the new intake canal and the first delivery of water occurred in June 1901 (Dowd 1956:20). Cultivation of 1,500 acres began in the fall of that year. By the second year, 100,000 acres were irrigated in the Imperial Valley (JRP and Caltrans 2000).

Once water was available, settlement and cultivation of the valley was possible. George Chaffey had used a system that linked land and shares in a mutual water company in San Bernardino County to develop Ontario and Etiwanda, and the CDC employed the same method in the development of the Imperial Valley (JRP and Caltrans 2000:14, 17). Settlers could purchase up to 320 acres of government-owned land at $1.25 an acre, but they also had to purchase $7,900 worth of stock from Chaffey's Imperial Land Company, established by the CDC in one of the 13 mutual water companies in the valley. Frequently settlers were unable to come up with the cash required to buy the water stock and were forced to convey to the Imperial Land Company the mortgage on the land or the water stock as security on a 6 percent note on the cost of the water stock (Starr 1990:26).

The Central Main Canal was extended from the U.S. border to the northern boundary of Mutual Water Company No. 1 at Heading 4, a few miles to the southwest of the present city of Brawley. It began service in March 1902. From this point, water was supplied to Water Company No. 4 and to Water Company No. 8 through a branch canal and flume across the New River (Dowd 1956:20).

The Westside Main Canal, was originally constructed around 1901 to supply water from the Alamo Canal to Water Company No. 6 located north of the international border and west of the New River via the Encina Flume (Corey 1915:1576). It began at Sharp's Heading, traveled across the New River by flume and crossed the international boundary at a point approximately 10 mi. west of Calexico. Additional canals included the East Side Main Canal, which supplied water to Water Company No. 7, and the Low Line or No. 5 Main

Canal, which served Water Company No. 5. By January 1, 1905, over 80 mi. of main canals and over 700 mi. of distribution canals had been constructed in the Imperial and Mexicali Valleys (Dowd 1956:21).

There were few white settlers in the Imperial Valley prior to the construction of the Alamo Canal. In 1901, the only settlers were surveyors laying out the canals. With the completion of the main canals, settlement and cultivation of the valley followed rapidly. By 1902, the population had risen to 2,000. It had reached 7,000 by 1904, and just one year later it was between 12,000 and 14,000. The number of irrigated acres during the same time period grew from 1,500 in 1901 to 100,000 acres in 1905. By 1911, 220,000 acres were under cultivation (Dowd 1956:23).

By the turn of the twentieth century, the federal government was actively attempting to wrest control of public water resources out of the hands of private enterprises. The U.S. Reclamation Service (later the Bureau of Reclamation) was established in 1902 by the Reclamation Act with the objective of fostering the construction of irrigation projects, ensuring the equitable distribution of water resources, and thereby promoting the settlement of the western states. One of the first projects recommended by the Reclamation Service was the Yuma Project, which included the construction of a dam (Laguna Dam) at the Potholes site. It appears that one of the objectives of the Yuma Project was the diversion of water to the Imperial Valley in addition to the Yuma area (Pfaff et al. 1992).

In the Imperial Valley, the Reclamation Service began to challenge the right of the CDC to appropriate and profit from a publicly owned resource. The Colorado River, being a navigable waterway, was considered a public resource under federal law, and the appropriation of its water by the CDC was not recognized by the U.S. government without congressional approval and absent any valid state law (Dowd 1956:31). Under pressure from the Reclamation Service, CDC sought to secure the right from the Mexican government to divert water from the Colorado River in Mexico. This concession was granted in June 1904.

In the winter of 1902-1903, and again in 1904, there were water shortages caused primarily by silting of the intake canal. These problems, coupled with general dissatisfaction on the part of Imperial Valley farmers with CDC, led to growing support in the valley for federal control of the project. The Imperial Water Users Association, formed in 1904 by valley farmers to promote a Reclamation takeover of the project, negotiated the sale of the CDC and its properties to Reclamation for $3 million. The Reclamation Service recommended against the purchase to the Secretary of the Interior, due in part to an adverse soil survey report filed by the U.S. Department of Agriculture in 1901 and 1903.

In an effort to overcome the problems with silting of the canal and channel and to prevent water shortages during the coming winter, CDC excavated a new channel without constructing a head gate to control the flow of water. As a result, winter flooding in 1905 caused the Colorado River to break its banks, overflowing through the New River and Alamo channels, flooding the Imperial Valley and creating the Salton Sea. Repeated attempts to stem the flow failed, and the river continued to flow into the valley over a period of two years. The CDC, already in financial difficulty prior to the canal break, was taken over by the Southern Pacific Company (SPC) in June 1905. Following personal intervention by President Theodore Roosevelt, and assurances by him that the costs of damming the channel would be reimbursed by the U.S. Government, SPC finally managed to close the break in February 1907 (Corey 1915).

As a result of the flooding, the western half of Imperial Valley was under water and approximately 13,000 acres of irrigable land was destroyed. By 1907, the Salton Sea was a lake 50 mi. in length and 10 to 15 mi. wide. An additional 30,000 acres, including 12,000 acres under cultivation, was left without a water supply, and all crops from this land were lost. The eastern part of the Valley was protected only by the banks of the Central Main Canal. The wooden flume that carried the West Side Main Canal across the New River was also destroyed.

Organization of Imperial Irrigation District

The CDC declared bankruptcy in 1909, as a result of litigation arising from the 1905 river break. The people of the Imperial Valley voted to establish the IID in order to protect their interests. The IID was organized for the purpose of acquiring the rights and properties of the CDC and its Mexican subsidiaries. When established, the IID included 513,368 acres and an additional 65,000 acres of water stock of the mutual water companies (Dowd 1956:53). At this time, claims and judgments against the CDC amounted to some $3 million. In addition, funds would be needed to complete improvements and repairs to the canal and distribution system. In 1914, the IID voted a bond issue of $3.5 million to purchase the CDC and its Mexican subsidiaries from the Southern Pacific Company and to undertake improvements to the canals and levees. Consequently the entire Westside Main Canal and Encina Flume were rebuilt and extended to serve the area to the west of New River, including the Project area south of the Salton Sea (Dowd 1956:20, 40; Frisby 1992). In June 1916, the Southern Pacific Company deeded all of the properties of the CDC and its Mexican subsidiaries to the IID. Between November 1922 and March 1923, IID acquired each of the 13 mutual water companies for a total sum of over $4.7 million.

Among the early projects that occurred in the vicinity of the project area under IID management was the closure of the Low Line (No. 5 Main) Canal, from which seepage was waterlogging arable lands at the southeastern end of the Salton Sea. In its place, irrigation laterals were constructed at 0.5-mi. intervals from the newly enlarged East Highline Canal. This work occurred between 1923 and 1927, which probably dates the Vail Laterals and Pumice Drain. It was also in 1922 that the IID began efforts to channelize the outlets of both the New and Alamo Rivers into the Salton Sea, cutting off bends and controlling bank erosion with new levees.

All-American Canal

The Fourth Annual Report of the U.S. Reclamation Service in 1904 included plans for an All-American Canal from Laguna Dam to Imperial Valley. This alignment required a 15.5-mi. tunnel through the East Mesa Sand Hills, which would require an expenditure of $20 million. The cost of the tunnel rendered this proposal financially infeasible. Following the 1905 river breach, President Roosevelt recommended that the U.S. acquire the properties of the CDC, construct an All-American Canal, and develop the Imperial Valley.

As soon as it was formed, IID began to examine alternatives to the existing Alamo Canal. Because of the legal uncertainties of diverting water from a foreign country and dealing with a foreign government, IID looked closely at the possibility of constructing an “all-American canal.” In 1913, the District conducted a field survey for an all-American canal that would divert water from Laguna Dam and would parallel the international boundary to the East Highline Canal. In a report to the IID Board of Directors in 1913, P. N. Nunn proposed that a realignment of the canal could shorten the length of the proposed tunnel through the Sand Hills to 8 mi., thereby reducing the cost. He also proposed that the construction of an open cut through the Sand Hills would cost a fraction of the cost of a tunnel. His estimate for the construction of the canal and two power plants was $12 million. The following year IID began negotiations with the Secretary of the Interior with the objective of acquiring rights to divert water from Laguna Dam. The Imperial Laguna Water Company, formed in 1914 to develop East Mesa lands, also proposed construction of a canal from Laguna Dam to East Mesa. By 1918, IID and the Imperial Laguna Water Company had agreed to cooperate in the construction of a canal to service both East Mesa and the remainder of the Imperial Valley.

In 1919, the All-American Canal Board submitted a survey and cost estimate to the Secretary of the Interior. This was followed by the Fall-Davis report, which recommended control of the Colorado River by a multiple-purpose reservoir project near Boulder Canyon, and the construction of a highline canal, together with a diversion dam and de-silting works, located entirely within the U.S. (Wilbur and Ely 1933). The Coachella Valley Water District (CVWD) was formed in 1918 to protect the interests of Coachella Valley farmers. During deliberations on the Boulder Canyon Act, the CVWD lobbied vigorously for inclusion of the Coachella Canal in the project, to deliver water to the Coachella Valley. The Boulder Canyon Project Act was finally approved by an act of Congress on December 21, 1928, following seven years of deliberations (Wilbur and Ely 1933). It ratified the Colorado River Compact and authorized the construction of Boulder Dam and the All-American and Coachella Canals at a total estimated cost of $165 million.

Detailed surveys for the All-American Canal route began in 1929 and were completed in 1930. As a result of these surveys, it was discovered that by constructing a diversion dam 5 mi. north of Laguna Dam (Imperial Dam), an additional 22 ft. of elevation would be accrued, less excavation would be required at Pilot Knob, and an additional 26,000 acres could be irrigated in the Sand Hills. Furthermore, in spite of the cost of building the Imperial Dam, the upper route would result in a savings of $2.5 million.

Construction of the All-American Canal began in 1934, following the construction of Boulder (Hoover) Dam. The construction of Imperial Dam and Desilting Works began in January 1936, and was completed in July 1938. The first irrigation water was delivered through the All-American Canal in 1940 (Bureau of Reclamation 1948). For a history of the construction of the All-American Canal, see Schaefer and O'Neill (2001). The Coachella Canal was constructed between 1938 and 1948 (Schaefer and Ní Ghabhláin 2003). It was at this time that the lands in the project area would have become arable.

At the time that the All-American Canal first started delivery of water to the Imperial Valley, on October 12, 1940, much of the land in the Imperial Valley (approximately 414,000 acres) was already under irrigation. By 1954, an additional 38,000 acres was brought into production. The real benefit of the All-American Canal water supply to the Imperial Valley was its dependability, allowing farmers to produce intensive high-risk crops with a higher per acre value. Unpredictable water flows prior to the completion to the All-American Canal had resulted in devastating crop losses. Unparalleled growth in agricultural production followed the completion of the All-American Canal in Imperial Valley.

Creation of the Salton Sea

The 1905 flood was simultaneously destructive and creative: it destroyed the irrigation system in the Imperial Valley and created the contemporary Salton Sea. The flooding occurred from the Alamo Canal and extended through the Imperial and Coachella Valleys to fill a portion of the Salton Sink. This story begins with the development of the Imperial or Alamo Canal as an effort by the California Development Company (CDC), headed by Charles Rockwood and George Chaffey, to channel Colorado River water to Imperial Valley (Dowd 1956; MacDougal 1914; Rockwood 1909). They began operation in August 1900. The CDC's right to tap the Colorado River was jeopardized in 1903 when the river was declared a navigable waterway and therefore under federal control. These actions led to a period of conflict between the CDC and the Reclamation Service. The CDC pursued an alternate route outside the United States, since it would be impossible to obtain a water diversion permit from Reclamation. A new intake south of the U.S.-Mexican border was expected to solve the problem of the silted and ineffective Alamo Canal. Efforts to open this diversion without a permanent concrete headgate coincided in 1905 with an unusually rainy year, causing the Colorado River to redirect itself westward, forcing 360 million $ft.^3$ of water per hour into the Imperial Valley (Ní Ghabhláin and Schaefer 2005:7-8; Starr 1990:36-37). The series of floods in the spring of 1905 forced the CDC to close the Mexican cut with a series of dams, but money ran out and limited engineering capabilities further burdened the situation. The Southern Pacific Railroad, which owned the CDC after June 1905, fought the disastrous floods during 1905-1907. Only monumental and extremely expensive efforts from the Southern Pacific Railroad finally diverted the Colorado River back to the Gulf of California (Ní Ghabhláin and Schaefer 2005:8; Starr 1990:36, 40). In the spring of 1907, the flooding caused the Southern Pacific to reroute 40 mi. of the railroad track located within the Salton Sea from Mecca to Niland. Fill and rock protected the Salt Creek trestle and the water lapped at the railroad embankment at Mecca and other locations (Laflin 1995).

Since the 1905 flood, the depth and shape of the Salton Sea have changed. Several islands were created, including South Island (1907-1913), Rocky Hill (1907-1914), and Mullet Island. By 1915, the floodwaters of the Salton Sea receded and prompted the transformation of South Island and Rocky Hill into parts of the mainland (Redlands Institute 2002:29). In 1943, surface water level was at 241 ft. below sea level. The contemporary outlet from the New River did not extend into the Salton Sea within protective levees. Mullet Island had become incorporated into the mainland as a small peninsula. In August 1955, the surface water level was at 234.5 ft. below sea level (Blackburn 1936).

The incoming floodwaters that created the Salton Sea began as fresh water. However, the lower portion of the Salton Sink already contained significant levels of salt and the floodwaters crossed over saline agricultural fields in the Imperial Valley. A high ongoing rate of evaporation progressively concentrated the salts, and the Sea became increasingly saline. In the summer of 1914, the salt levels took a toll on the fish that had been carried in during the 1905 flood. Dead carp and bass washed ashore (Laflin 1995). The first saltwater fish introduced and successfully established in the Salton Sea was the orangemouth corvina, with shortfin corvina and gulf croaker introduced at a later stage. Establishing an ecological balance has been an inherent part of the challenge in maintaining the Salton Sea.

Over the years, the Salton Sea became a recreational hotspot in the desert. The lake in the desert attracted entrepreneurs such as Gus Eilers and John Goldthwaite, a bay area promoter. They acquired land from the Southern Pacific Railroad along the North Shore from the Mortmar train stop to the Sea in 1926. They planned Date Palm Beach, a development that started out small, trying to attract motorboat racers. In 1929, boat racers set five world records at the first boat races at Date Palm Beach. Hydroplane racing innovations took place on the Salton Sea in the late 1920s because the low elevation aided carburetion. Eilers survived the 1929 stock market crash and built his first set of guesthouses in 1932. He still catered to the motorboat enthusiasts, and Mrs. Eilers served the small community. She included Coachella Valley produce – grapefruits and dates – as part of her hospitality. In 1946, cinematographer C. Roy Hunter bought the resort and renamed it Desert Beach. Hunter founded the Desert Beach Yacht Club, but the rising Sea in 1948 stunted recreational growth. The additional waters from floods and agricultural runoff ultimately overtook the Desert Beach improvements (Laflin 1995; Redlands Institute 2002).

The Desert Beach hosted the Salton Sea Speed Boat Regatta in 1949 and again in 1951. Helen’s Beach House offered 1950s tourists and real estate speculators a lakeside retreat and relaxation. In 1955, the Salton Sea State Park was dedicated as the second largest California State Park. In the late 1950s, A. Penn Phillips founded Salton City, expecting the same success he achieved in developing the desert community of Hesperia. The first nine holes of a champion golf course opened in 1963, and the addition of a Salton Bay Yacht Club seemed to signify resurgence at the Salton Sea. Penn’s desert community project sold numerous lots with few homes built on them. During 1950 to 1970, the recreational activities made the State Park the second most popular destination in California, but the popularity eventually faded due to the imbalances of the Sea (Laflin 1995; Redlands Institute 2002).

One year after the establishment of the Salton Sea State Park, the Sea stood at 234.5 ft. below sea level. Although the Imperial Irrigation District made efforts to stabilize it, salinity levels increased in the 1980s. The Salton Sea Task Force grew out of the recognition that the quality of the water required action, and in 1993 that task force became the Salton Sea Authority. This newly established coalition combined the efforts of Riverside and Imperial Counties, the CVWD, and the IID. Additionally, Congressman Sonny Bono formed a Congressional Salton Sea Task Force in 1997, and in 1998 the Salton Sea National Wildlife Refuge was renamed after the late congressman (Salton Sea Authority 1997).

3. METHODS AND RESULTS

RECORDS SEARCHES

Record searches of the CHRIS system were conducted at the SCIC on March 14, 2017. The search encompassed the original Project area and a 1-mi. record search radius around it. Forty previously conducted cultural resource studies have been conducted within the original Project area and 1-mile record search radius, two of which addressed the Project area directly (Table 1). Less than 25 percent of the Project area has been previously surveyed for cultural resources

Table 1. Cultural Resource Surveys within the Record Search Area

Report No.	Authors	Date	Title	Relation to Project Area
IM-00199	Walker, Carol, Charles Bull, and Jay Von Werlhof	1979	Cultural Resource Study of a Proposed Electric Transmission Line from Jade to the Sand Hills, Imperial County, California	Outside
IM-00203	Gallegos, Dennis	1979	Class II Cultural Resource Inventory East Mesa and West Mesa Regions Imperial Valley, California, Volume I	Outside
IM-00207	Davis, Emma Lou	1980	Class II Cultural Resource Inventory East Mesa and West Mesa Regions Imperial Valley, California	Outside
IM-00210	Von Werlhof, Jay and Karen McNitt	1980	Archaeological Examinations of the Republic Geothermal Field, East Mesa, Imperial County	Outside
IM-00213	Bull, Charles S.	1980	A Cultural Resource Survey of the Proposed Imperial Valley Substation	Outside
IM-00233	Walker, Carol, Charles Bull, And Jay Von Werlhof	1981	Cultural Resource Study of a Proposed Electric Transmission Line from Jade to the Sand Hills, Imperial County, California	Outside
IM-00235	Bureau of Land Management	1981	APS/SDG&E Interconnection Project - Supplement to the Draft Environmental Document	Outside
IM-00252	Schaefer, Jerome	1981	Volume II Appendix; Phase II; Archaeological Survey of the La Rosita 230 Kv Interconnection Project	Outside
IM-00262	Cultural Systems Research, Inc.	1982	Archaeological Field Investigation of Cultural Resources Associated with the Proposed Imperial Valley Substation (7a) Access Road, Cultural Resource Report	Outside
IM-00279	Shackley, M. Steven	1982	Phase III Archaeological Survey of the Mountain Springs (Jade) to Sand Hills Portion of the APS/SDG&E Interconnection Project 500 Kv Transmission Line	Outside
IM-00289	Foster, John and Roberta Greenwood	1983	Cultural Resource Inventory of the La Rosita to Imperial Valley Interconnection Project 230 Kv Transmission Line, Imperial Valley, California	Outside
IM-00301	Welch, Patrick	1983	Cultural Resource Inventory for Thirty Proposed Asset Management Parcels in Imperial County, California	Outside
IM-00319	Shackley, M. Steven	1984	Archaeological Investigations in the Western Colorado Desert: A Socioecological Approach - Volume I	Outside
IM-00536	Burkenroad, David	1979	Phase One Regional Studies APS/SDG&E Interconnection Project Transmission System Environmental Study Cultural Resources: History	Outside

Report No.	Authors	Date	Title	Relation to Project Area
IM-00537	Wirth Associates, Inc.	1979	Phase One Regional Studies APS/SDG&E Interconnection Project Transmission System Environmental Study Cultural Resources: Archaeology	Outside
IM-00538	Imperial County	1979	Proposed Workscope Phase II Cultural Resources Studies APS-SDG&E Transmission Interconnect Project, Miguel to Sand Hills	Outside
IM-00547	Cultural Systems Research, Inc.	1982	Draft Archaeological Research Design and Data Recovery Program for Cultural Resources within the Mountain Springs (Jade) to Sand Hills Portion of the APS/SDG&E Interconnection Project 500kv Transmission Line	Outside
IM-00595	CSRI	1982	Mountain Springs (Jade) to Sand Hills Data Recovery Preliminary Report	Outside
IM-00906	Bureau of Land Management	2001	Environmental Assessment for Presidential Permit Applications for Baja California Power, Inc. and Sempra Energy Resources	Outside
IM-00960	Bureau of Land Management	2004	Draft Environmental Impact Statement for the Imperial-Mexicali 230-Kv Transmission Lines	Outside
IM-00980	Berryman, Judy A.	2001	Cultural Resource Survey of a 230-Kv Transmission Corridor from the Imperial Valley Substation to the International Border with Mexico	Outside
IM-01072	Berryman, Judy A.	2001	Cultural Resource Treatment Plan in Support of the Construction of Two 230-Kv Transmission Lines from the Imperial Valley Substation to the International Border with Mexico	Outside
IM-01073	Berryman, Judy A.	2001	Cultural Resource Survey of a 230-Kv Transmission Corridor from the Imperial Valley Substation to the International Border with Mexico	Outside
IM-01275	Ritter, Eric W.	1975	An Analysis of Culture Resources along the Proposed Yuha Desert Orv Courses	Outside
IM-01306	Wirth Associates, Inc	1980	APS/SDG&E Interconnection Project Environmental Study Phase Ii Corridor Studies - Native American Cultural Resources Appendices	Outside
IM-01311	Various		Miscellaneous Documents for the SDG&E La Rosita Line	Outside
IM-01313	Wirth Associates, Inc	1980	APS/SDG&E Interconnection Project (Phase II Corridor Studies) - Cultural Resources: Archaeology	Outside
IM-01315	Shackley, Steven	1982	Volume II - Phase Iii Archaeological Survey of the Mountain Springs (Jade) to Sand Hills Portion of the APS/SDG&E Interconnection Project 500 Kv Transmission Line Confidential Technical Appendices	Outside
IM-01330	SWCA Environmental Consultants	2008	Final Cultural Resources Survey of Alternatives for the Sunrise Powerlink Project in Imperial, Orange, Riverside, and San Diego Counties, California	Outside
IM-01350	Noah, Anna and Dennis Gallegos	2008	Final Class III Archaeological Inventory for the SDG&E Sunrise Powerlink Project, San Diego and Imperial Counties, California	Outside
IM-01388	Olech, Lilliana	1981	Yuha Basin Area of Critical Environmental Concern (ACEC) Management Plan	Outside

Report No.	Authors	Date	Title	Relation to Project Area
IM-01433	Zepeda-Herman, Carmen	2011	Class III Cultural Resources Survey for the Imperial Solar Energy Center South Project, Imperial County, California	Outside
IM-01464	Mitchell, Patricia T.	2011	Inventory Report of the Cultural Resources within the Centinela Solar Energy Gen-Tie Line, Imperial County, California	Outside
IM-01486	Mitchell. Patricia T.	2012	Inventory Report of the Cultural Resources within the Campo Verde Solar Project BLM Gen-Tie Option Alternatives, Imperial County, California	Inside
IM-01487	Mitchell, Patricia T.	2011	Inventory Report of the Cultural Resources Recorded within the Campo Verde Solar Project, Imperial County, California	Inside
IM-01488	Mitchell, Patricia T.	2011	Addendum Letter Report for the Centinela Solar Energy Gen-Tie Line Cultural Resources Inventory Report, Imperial County, California	Outside
IM-01516	Davis, Shannon	2011	Final Inventory, Evaluation and Analysis of Effects on Historic Built Environment Properties within the Area of Potential Effect of the Imperial Solar Energy Center South Imperial County, California	Outside
IM-01517	Davis, Shannon, Jennifer Krintz, Sinead Ni Ghabhlain, and Michael Pumphrey	2011	Final Inventory, Evaluation and Analysis of Effects on Historic Built Environment Properties within the Area of Potential Effect of the Imperial Solar Energy Center West Imperial County, California	Outside
IM-01645	N/A	2011	Paleontological Resources Assessment Report Imperial Solar Energy Center - South, near the Community of Mount Signal Imperial County, California	Outside
SD-12711	Garcia-Herbst, Arleen, David Iversen, Don Laylander, and Brian Williams	2010	Final Inventory Report of the Cultural Resources within the Approved San Diego Gas & Electric Sunrise Powerlink Final Environmentally Superior Southern Route, San Diego and Imperial Counties, California	Outside

Ninety-eight cultural resources have been previously recorded within the record search area. Six cultural resources have been previously recorded within or adjacent to the original Project area (Table 2). One cultural resource has been previously recorded within or adjacent to the additional 80-acre parcel.

Table 2. Previously Recorded Cultural Resources within the Record Search Area

Primary Number	Trinomial	Contents	Recorder, Date	Relation to the Project Area
P-13-001401	CA-IMP-001401	AP2: Lithic scatter, AP3: Ceramic scatter	McI, 1976	Outside
P-13-001402	CA-IMP-001402	AP3: Ceramic scatter	Wessel, 1976	Outside
P-13-001403	CA-IMP-001403	AP3: Ceramic scatter	Wessel, 1976	Outside
P-13-001747	CA-IMP-001747	AP13: Trails/ Linear earthworks	N/A	Outside
P-13-001748	CA-IMP-001748	AP13: Trails/ Linear earthworks	N/A	Outside
P-13-001749	CA-IMP-001749	AP13: Trails/ Linear earthworks	N/A	Outside

Primary Number	Trinomial	Contents	Recorder, Date	Relation to the Project Area
P-13-001750	CA-IMP-001750	AP13: Trails/ Linear earthworks	N/A	Outside
P-13-001751	CA-IMP-001751	AP13: Trails/ Linear earthworks	N/A	Outside
P-13-001752	CA-IMP-001752	AP13: Trails/ Linear earthworks	N/A	Outside
P-13-003176	CA-IMP-003176	AP2: Lithic scatter, AP3: Ceramic scatter, AP16: Other	Von Werlhof, 1979	Outside
P-13-003407	CA-IMP-003407	AH7: Road/Trail	N/A, 1957	Outside
P-13-003408	CA-IMP-003408	AH7: Road/Trail	N/A	Outside
P-13-003409	CA-IMP-003409	AH7: Road/Trail	N/A	Outside
P-13-003410	CA-IMP-003410	AH7: Road/Trail	N/A	Outside
P-13-003411	CA-IMP-003411	AH7: Road/Trail	N/A	Outside
P-13-003412	CA-IMP-003412	AH7: Road/Trail	N/A	Outside
P-13-003792	CA-IMP-003792	AP2: Lithic scatter	Walker and Ferguson, 1979	Outside
P-13-004244	CA-IMP-004244	AP2: Lithic scatter	Foster, Foster, and Ross, 1983	Outside
P-13-004245	CA-IMP-004245	AH4: Privies/Dumps/Trash scatters	Gonzalez, 1980	Outside
P-13-004246	CA-IMP-004246	AP2: Lithic scatter	Collins, 1980	Outside
P-13-004510	CA-IMP-004510	AP2: Lithic scatter	Nagle, 1981	Outside
P-13-004511	CA-IMP-004511	AP2: Lithic scatter	Nagle, 1981	Outside
P-13-004512	CA-IMP-004512	AP2: Lithic scatter	Nagle, 1981	Outside
P-13-004515	CA-IMP-004515	AP2: Lithic scatter, AP3: Ceramic scatter	Nagle, 1981	Outside
P-13-004516	CA-IMP-004516	AP2: Lithic scatter	Ainsworth, 1981	Outside
P-13-005297	CA-IMP-005297	AP2: Lithic scatter	Apple et al., 1982	Outside
P-13-005298	CA-IMP-005298	AP2: Lithic scatter	Apple et al., 1982	Outside
P-13-005585	CA-IMP-005585	AP2: Lithic scatter	Foster, 1983	Outside
P-13-005586	CA-IMP-005586	AP2: Lithic scatter	Foster, 1983	Outside
P-13-005587	CA-IMP-005587	AP2: Lithic scatter	Foster, 1983	Outside
P-13-005588	CA-IMP-005588	AP2: Lithic scatter	Foster, 1983	Outside
P-13-005648	CA-IMP-005648	AP2: Lithic scatter	Thesken, 1984	Outside
P-13-008334	CA-IMP-007834	HP20: Canal/Aqueduct, Westside Main Canal	AECOM, 2011	Outside
P-13-008983	-	HP20: Canal/Aqueduct, Wormwood Canal	Krintz, 2011	Adjacent
P-13-009121	CA-IMP-008793	AP2: Lithic scatter, AP3: Ceramic scatter	Noah, 2008	Outside
P-13-009122	-	AP2: Lithic scatter	Thomson and Anderson, 2006	Outside
P-13-009710	CA-IMP-008720	AP2: Lithic scatter	Doose, Spelts, and Linton, 2007	Outside
P-13-009711	CA-IMP-008721	AP2: Lithic scatter	Doose, Spelts, and Linton, 2007	Outside

Primary Number	Trinomial	Contents	Recorder, Date	Relation to the Project Area
P-13-009855	-	AP16: Other	Underbrink, 2007	Outside
P-13-009861	-	AP16: Other	Corey et al, 2007	Outside
P-13-012168	CA-IMP-010851	AP3: Ceramic scatter	Comeau et al, 2009	Outside
P-13-012240	-	AP16: Other	Piek, 2008	Outside
P-13-012688	-	HP20: Canal/Aqueduct	Krintz, 2011	Outside
P-13-012689	-	HP20: Canal/Aqueduct, Fern Canal	Krintz, 2011	Outside
P-13-012692	-	HP20: Canal/Aqueduct	Bodmer et al, 2011	Outside
P-13-012693	-	HP20: Canal/Aqueduct	Bodmer et al, 2011	Outside
P-13-012695	-	AP2: Lithic Scatter	Kowalski, Mattiussi, and Sowles, 2010	Outside
P-13-012696	-	AP3: Ceramic Scatter	McLean, 2009	Outside
P-13-013105	-	AH16: Other	Glenny and Kry, 2009	Outside
P-13-013106	-	AP2: Lithic scatter	Glenny and Kry, 2009	Outside
P-13-013107	-	AP2: Lithic scatter	Glenny and Kry, 2009	Outside
P-13-013129	CA-IMP-011440	AP2: Lithic scatter	Glenny, Cooley, and Kry, 2009	Outside
P-13-013133	CA-IMP-011444	AP2: Lithic scatter	Glenny et al, 2009	Outside
P-13-013134	CA-IMP-011445	AP2: Lithic scatter	Glenny et al, 2009	Outside
P-13-013179	-	AP16: Other	Schultz, Sowles, and Vader, 2010	Outside
P-13-013180	-	AP2: Lithic scatter	Schultz, Sowles, and Vader, 2010	Outside
P-13-013195	CA-IMP-011469	AP2: Lithic scatter, AP3: Ceramic scatter	Schultz, Sowles, and Vader, 2010	Outside
P-13-013197	-	AP2: Lithic scatter	Schultz, Sowles, and Vader, 2010	Outside
P-13-013198	-	AP2: Lithic scatter	Schultz, Sowles, and Vader, 2010	Outside
P-13-013199	-	AP2: Lithic scatter	Schultz, Sowles, and Vader, 2010	Outside
P-13-013200	-	AP16: Other	Schultz, Sowles, and Vader, 2010	Outside
P-13-013201	-	AP2: Lithic scatter	Schultz, Sowles, and Vader, 2010	Outside
P-13-013202	-	AP3: Ceramic scatter	Schultz, Sowles, and Vader, 2010	Outside
P-13-013247	-	AP3: Ceramic scatter	Schultz, Sowles, and Vader, 2010	Outside
P-13-013283	CA-IMP-011471	AP2: Lithic scatter, AP3: Ceramic scatter	Schultz, Sowles, and Vader, 2010	Outside
P-13-013284	CA-IMP-011472	AP2: Lithic scatter, AP3: Ceramic scatter	Schultz, Sowles, and Vader, 2010	Outside
P-13-013313	CA-IMP-011501	AP3: Ceramic scatter	Schultz, Sowles, and Vader, 2010	Outside
P-13-013548	CA-IMP-011638	AP2: Lithic scatter	Maier, 2011	Outside
P-13-013559	-	AP2: Lithic scatter	Thomson and Maier, 2011	Outside
P-13-013560	-	AP2: Lithic scatter	Thomson and Maier, 2011	Outside

Primary Number	Trinomial	Contents	Recorder, Date	Relation to the Project Area
P-13-013747	-	HP20: Canal Aqueduct	Krintz, 2011	Outside
P-13-013748	-	HP20: Canal/Aqueduct, Fig Drain	Thomson and Adame, 2011	Outside
P-13-013755	-	AH16: Isolate	Thomson and Adame, 2011	Outside
P-13-013757	-	AH16: Other	Thomson and Adame, 2011	Outside
P-13-013761	-	HP20: Canal/ Aqueduct	Thomson, 2011	Outside
P-13-013844	-	AP3: Ceramic Scatter	Mitchell, Thomson, and Maier, 2012	Outside
P-13-013845	-	AP16: Other	Mitchell, Thomson, and Maier, 2012	Outside
P-13-013846	-	AP2: Lithic scatter	Mitchell, Thomson, and Maier, 2012	Outside
P-13-013847	-	AP16: Other	Mitchell, Thomson, and Maier, 2012	Outside
P-13-013848	-	AP16: Other	Mitchell, Thomson, and Maier, 2012	Outside
P-13-013849	-	AP16: Other	Mitchell, Thomson, and Maier, 2012	Outside
P-13-013850	-	AP16: Other	Mitchell, Thomson, and Maier, 2012	Outside
P-13-013851	-	AP16: Other	Mitchell, Thomson, and Maier, 2012	Outside
P-13-013852	CA-IMP-011789	AP3: Ceramic scatter, AP16: Other	Mitchell, Thomson, and Maier, 2012	Outside
P-13-013853	CA-IMP-011790	AP2: Lithic scatter	Mitchell, Thomson, and Maier, 2012	Outside
P-13-013854	-	AP16: Other	Mitchell, Thomson, and Maier, 2012	Outside
P-13-013855	CA-IMP-011791	AP2: Lithic scatter	Mitchell, Thomson, and Maier, 2012	Outside
P-13-013856	-	AP16: Other	Mitchell, Thomson, and Maier, 2012	Outside
P-13-013857	CA-IMP-011792	AP2: Lithic scatter	Mitchell, 2012	Outside
P-13-014267	-	AH4: Privies/Dumps/Trash scatters	Bodmer, 2011	Outside
P-13-014268	-	AH4: Privies/Dumps/Trash scatters	Bodmer, 2011	Outside
P-13-014269	-	AH4: Privies/Dumps/Trash scatters	Bodmer, 2011	Outside
P-13-014975	-	HP20: Canal/ Aqueduct	Krintz, 2011	Outside
P-13-014976	-	HP2: Single family property	Krintz, 2011	Outside
P-13-014977	-	HP2: Single family property	Krintz, 2011	Outside
P-13-014978	-	HP2: Single family property	Krintz, 2011	Outside
P-13-014979	-	HP2: Single family property	Krintz, 2011	Outside
P-13-014983	CA-IMP-001401	HP2: Single family property	Krintz, 2011	Outside

Of the six previously recorded cultural resources that intersect the original Project area, all are historic and five are irrigation features. Only one of these resources (P-13-008334, Wormwood Canal System) intersects the additional 80-acre parcel.

P-13-008983, Wormwood Canal System

The Wormwood Canal is an irrigation canal that was constructed around 1911. It is located east of the Westside Main Canal and flows east and north in the Imperial Valley. Modifications were added to the canal in the 1960s. The entire canal is approximately 6 mi. long, with its northern terminus at the Wormwood Drain and the southern terminus at the intersection of Drew Road and SR98. The Wormwood Canal System was first recorded by Hupp in 1999 and recommended not eligible to the NRHP and the CRHR due to a lack of integrity. Hupp reported that the Wormwood Canal had been realigned and lined with concrete in place of its original earthen materials. The recordation was updated by Laguna Mountain in 2011. ASM also updated the recordation of the Wormwood Canal System in 2011 and recommended that it is not eligible to the NRHP and the CRHR. In 2011, Thomson and Adame of KPE recorded a segment of the Wormwood Canal that begins north of West Diehl Road, and ends 2.19 mi. south at the intersection of Drew Road and West Wixom Road. The southern terminus of this section is located just outside of the current Project area.

The California NAHC was contacted on March 8, 2017 to conduct a record search of the Sacred Lands File for the Project area. On March 14, 2017 the NAHC responded that the record search of the Sacred Lands File had negative results. The NAHC response included a list of 15 Native American individuals and organization to contact for further information regarding the Project area, including sacred sites, tribal cultural resources and traditional cultural properties. Letters were sent to the 15 contacts on April 3, 2017. To date, no responses have been received.

The 1953 historic aerial photograph of the Project area shows that all the irrigation features were in place prior to 1953. A portion of the area between Vogel Road and Drew Road appeared to have not yet been in use for agricultural and may have been open desert. The 1996 aerial photograph shows the Project area in its current land use, being primarily used for agriculture. No changes were noted on the 2002, 2005, 2009, 2010, and 2012 aerial photographs.

The 1945 and 1956 USGS topographic maps show the irrigation features in their current alignments. No changes are noted on the 1977 and 1991 USGS topographic maps.

SURVEY METHODS AND RESULTS

Field Methods

The archaeological survey was performed by ASM Associate Archaeologist Joel Lennen and Assistant Archaeologist Joe Lamoy on November 3, 2017. The Project area was systematically surveyed in 15-m intervals running primarily east-west. The survey included all elements of the Project area. Any isolates, sites, and features were to be recorded. All site and isolate locations were to be recorded in Universal Transverse Mercator (UTM) coordinates using handheld GeoExplorer Trimble units with sub-meter accuracy. Resources were plotted on project maps using NAD 83 UTM coordinates (Confidential Appendix C). As applicable, site information was recorded on State of California DPR 523 series forms to State of California standards (Confidential Appendix D). Overview photographs were also taken of the Project area and the adjacent irrigation systems.

Field Conditions and Results

The entirety of Project area is comprised of agricultural fields and IID features, including canals, drainages, and dirt roads (Figure 4). Drew Road is located at the eastern portion of the Project area, and Lyons Road along the southern portion. The entirety of the Project area was surveyed on November 3, 2017. The survey took place in an agricultural field with grounds surface visibility of approximately 10-15 percent. Along the perimeters of the agricultural field there was some standing water and modern refuse. Modern trash was present along some portions of the access roads.

Figure 4. Overview of the Project area from the south-east corner, facing north-west.

For the additional 80 acres that was surveyed, only the Wormwood Canal System (P-13-008983) was identified as adjacent to the Project area, but did not extend into the Project area. This irrigation feature was found to be in fair condition, with some deterioration of the concrete walls and the check-gates. During the survey, the feature was partially filled with standing water. Some modern refuse was identified along portions of the Wormwood Canal System that was adjacent to the additional 80-acre parcel.

Figure 5. Overview of the Wormwood Canal adjacent to the east side of the Project area, facing north

P-13-008983, Wormwood Canal System

The Wormwood Canal System was constructed around 1911 and modified in the 1960s. Previous evaluations of the Wormwood Canal System have recommended it not eligible to the NRHP and the CRHR due to a lack of integrity.

The current survey identified a segment of the Wormwood Canal System on the west side of Drew Road, outside of the Project area to the east. The Wormwood Drain is located on the east side of Drew Road, outside of the Project area to the east. Therefore, the Wormwood Canal System does not extend into the Project area.

4. REGULATORY FRAMEWORK AND MANAGEMENT CONSIDERATIONS

REGULATORY FRAMEWORK

California Environmental Quality Act and the California Register of Historical Resources

CEQA requires that all private and public activities not specifically exempted be evaluated against the potential for environmental damage, including effects to historical resources. Historical resources are recognized as part of the environment under CEQA. The act defines historical resources as "any object, building, structure, site, area, or place that is historically significant in the architectural, engineering, scientific, economic, agricultural, educational, social, political, military, or cultural annals of California" (Division I, Public Resources Code, Section 5021.1[b]).

Lead agencies have a responsibility to evaluate historical resources against the CRHR criteria prior to making a finding as to a proposed project's impacts to historical resources. Mitigation of adverse impacts is required if the proposed project will cause substantial adverse change. Substantial adverse change includes demolition, destruction, relocation, or alteration such that the significance of an historical resource would be impaired. While demolition and destruction are fairly obvious significant impacts, it is more difficult to assess when change, alteration, or relocation crosses the threshold of substantial adverse change. The CEQA Guidelines provide that a project that demolishes or alters those physical characteristics of an historical resource that convey its historical significance (i.e., its character-defining features) is considered to materially impair the resource's significance. The CRHR is used in the consideration of historical resources relative to significance for purposes of CEQA. The CRHR includes resources listed in, or formally determined eligible for listing in, the NRHP and some California State Landmarks and Points of Historical Interest. Properties of local significance that have been designated under a local preservation ordinance (local landmarks or landmark districts), or that have been identified in a local historical resources inventory, may be eligible for listing in the CRHR and are presumed to be significant resources for purposes of CEQA unless a preponderance of evidence indicates otherwise.

Generally, a resource shall be considered by the lead agency to be "historically significant" if the resource meets the criteria for listing on the CRHR (Pub. Res. Code SS5024.1, Title 14 CCR, Section 4852) consisting of the following:

a) it is associated with events that have made a significant contribution to the broad patterns of local or regional history, or the cultural heritage of California or the United States; or

b) it is associated with the lives of persons important to local, California, or national history; or

c) it embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of a master, or possesses high artistic values; or

d) it has yielded, or has the potential to yield, information important to the prehistory or history of the local area, California, or the nation.

Imperial County

The Renewable Energy and Transmission Element of the County of Imperial General Plan (Element) (Imperial County Planning and Development Services Department 2015) provides guidance and approaches with respect to the future siting of renewable energy projects and electrical transmission lines in the County. The goals of the Element include: supporting the safe and orderly development of renewable energy while providing for the protection of environmental resources; encourage development of electrical transmission lines along routes which minimize potential environmental effects; develop overlay zones that will facilitate the development of renewable energy resources while preserving and protecting agricultural, natural, and cultural resources. In addition, the Open Space Element of the General Plan includes goals, objectives, and policies for the protection of cultural resources and scientific sites that emphasize identification, documentation, and protection of cultural resources.

The Mitigation, Monitoring and Reporting Program (MMRP) of the Renewable Energy and Transmission Element includes five mitigation measures relating to cultural resources:

- CUL-1a: Agency Coordination;
- CUL-1b: Cultural Resources Records Searches;
- CUL-1c: Cultural Resources Pedestrian Surveys;
- CUL-1d: Site Characterization, Siting and Design, and Construction;
- CUL-1e: Reclamation and Decommissioning; and
- CUL-3: Proper Treatment of Human Remains.

One cultural resource has been recorded within or directly adjacent to the Project area. The results of any previous evaluations to the NRHP, the CRHR, and significance under CEQA, if the Project will have a direct effect to any historical resources, and management recommendations are summarized below and in Table 5.

P-13-008983, WORMWOOD CANAL SYSTEM

Segments of the Wormwood Canal system have been previously recommended as not eligible to the NRHP and the CRHR due to a lack of integrity. The current survey identified a segment of the Wormwood Canal on the west side of Drew Road, just outside of the eastern boundary of the Project area; the canal then continues north away from the Project area. A segment of the Wormwood Drain is located on the east side of Drew Road, outside of the Project area to the east. Therefore, the Wormwood Canal System is located in close proximity, but outside of the Project area, and will not be altered or impacted directly by the Project. Project implementation will not result in a direct effect to historic resources. No further work is recommended.

Table 3. Summary of the Direct Effect on Cultural Resource(s) within the Project Area

Trinomial (CA-IMP-)	Primary # (P-13-)	Temp Site #	Type	Description	Within the Project Area?	Evaluation	Direct Effect?	Recommendation
--	008983	--	HP20: Canal/Aqueduct	Wormwood Canal System	No	Segments recommended not eligible	No	No further work

No historical resources were identified within the Project area either during the record searches or during the archaeological survey that will be directly impacted by the Project. The Project will not have a direct impact on or alter any of the IID's irrigation features within the Project area.

Construction monitoring of all ground disturbance by a qualified archaeologist and a Native American monitor is required under mitigation measures CUL-1d and CUL-3 of the MMRP for the Final

Programmatic Environmental Impact Report for the Imperial County Renewable Energy and Transmission Element Update, Imperial County, California. Construction monitoring by a qualified archaeologist of all ground disturbance is also recommended due to the presence of numerous prehistoric cultural resources within the 1-mi. record search radius surrounding the Project and the minimal ground surface visibility because of agricultural uses of the Project area.

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