State of California – The Resources Agency ARNOLD SCHWARZENEGGER, Governor
DEPARTMENT OF FISH AND GAME
78078 Country Club Dr., Ste. 109
Bermuda Dunes, CA 92203
(760) 200-9158
http://www.dfg.ca.gov

June 13, 2008

To whom it may concern,

Title 14 of the California Code of Regulations authorizes the Department of Fish and Game (the Department) to regulate the take and possession of wildlife in the State of California.

This letter provides proof of authorization by the Department for the individual named below to take, possess, and transport Flat-tailed Horned Lizards (*Phrynosoma mcallii*), while performing the duties of biological monitor, as part of mitigation requirements for construction or other activities which place individual lizards at risk. This person is also authorized to take and possess lizards briefly for data collection, during surveys conducted for public agencies. He/she has completed Department-approved training in tracking and finding Flat-tailed Horned Lizards.

This authorization does not permit activities, such as the trapping or marking of lizards, which otherwise require the possession of a current Scientific Collecting Permit issued by the Department.

This authorization is in effect permanently, unless revoked, at the Department's discretion.

Sincerely,

CJWeightman

Craig J. Weightman
Senior Environmental Scientist (Acting)
Inland Deserts Region

<u>Authorized Individual</u>

Glenna Westbrook (Barrett)
Barrett Biological Surveys
29112 Avenida de las Flores
Quail Valley, CA 92587

Conserving California's Wildlife Since 1870

State of California – The Natural Resources Agency
DEPARTMENT OF FISH AND GAME
Inland Deserts Region
78078 Country Club Dr., Ste. 109
Bermuda Dunes, CA 92203
www.dfg.ca.gov

***EDMUND G. BROWN Jr.**, Governor*
***JOHN MCCAMMAN**, Director*

June 28, 2011

Subject: Authorization for Shawna Bishop,

To Whom It May Concern,

Title 14 of the California Code of Regulations authorizes the Department of Fish and Game (the Department) to regulate the take and possession of wildlife in the State of California.

This letter provides proof of authorization by the Department for the individual named below to take, possess, and transport **Flat-tailed Horned Lizards** (*Phrynosoma mcallii*) out of harm's way, while performing the duties of biological monitor, as part of mitigation requirements for construction or other activities which place individual lizards at risk. This person is also authorized to possess lizards briefly for data collection, during surveys conducted for public agencies. He/she has completed Department-approved training in tracking and finding Flat-tailed Horned Lizards.

This authorization does not permit activities, such trapping, marking, or sacrifice of lizards, which otherwise would require the possession of a current Scientific Collecting Permit issued by the Department.

This authorization is in effect permanently, unless revoked, at the Department's discretion.

Sincerely,

Jack Crayon

Jack Crayon
Associate Biologist
Inland Deserts Region

Authorized Individual:

Shawna Bishop
619 Rockwood Road
El Centro, CA 92243

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State of California – The Natural Resources Agency
DEPARTMENT OF FISH AND GAME
Inland Deserts Region
78078 Country Club Dr., Ste. 109
Bermuda Dunes, CA 92203
www.dfg.ca.gov

***EDMUND G. BROWN Jr.**, Governor*
***JOHN MCCAMMAN**, Director*

June 28, 2011

Subject: Authorization for Danielle Barrett,

To Whom It May Concern,

Title 14 of the California Code of Regulations authorizes the Department of Fish and Game (the Department) to regulate the take and possession of wildlife in the State of California.

This letter provides proof of authorization by the Department for the individual named below to take, possess, and transport **Flat-tailed Horned Lizards** (*Phrynosoma mcallii*) out of harm's way, while performing the duties of biological monitor, as part of mitigation requirements for construction or other activities which place individual lizards at risk. This person is also authorized to possess lizards briefly for data collection, during surveys conducted for public agencies. He/she has completed Department-approved training in tracking and finding Flat-tailed Horned Lizards.

This authorization does not permit activities, such trapping, marking, or sacrifice of lizards, which otherwise would require the possession of a current Scientific Collecting Permit issued by the Department.

This authorization is in effect permanently, unless revoked, at the Department's discretion.

Sincerely,

Jack Crayon

Jack Crayon
Associate Biologist
Inland Deserts Region

<u>Authorized Individual:</u>

Danielle Barrett
1744 Lotus Ave
El Centro, CA 92243

Conserving California's Wildlife Since 1870

State of California – The Natural Resources Agency
DEPARTMENT OF FISH AND GAME
Inland Deserts Region
78078 Country Club Dr., Ste. 109
Bermuda Dunes, CA 92203
www.dfg.ca.gov

EDMUND G. BROWN Jr., Governor
CHARLTON H. BONHAM, Director

September 26, 2012

Subject: Authorization for Jacob Jaime Calanno,

To Whom It May Concern,

Title 14 of the California Code of Regulations authorizes the Department of Fish and Game (the Department) to regulate the take and possession of wildlife in the State of California.

This letter provides proof of authorization by the Department for the individual named below to take, possess, and transport **Flat-tailed Horned Lizards** (*Phrynosoma mcallii*) out of harm's way, while performing the duties of biological monitor, as part of mitigation requirements for construction or other activities which place individual lizards at risk. This person is also authorized to possess lizards briefly for data collection, during surveys conducted for public agencies. He/she has completed Department-approved training in tracking and finding Flat-tailed Horned Lizards. Dead lizards may also be salvaged and temporarily retained for accession into a Department-approved museum or educational institution.

This authorization does not permit activities, such trapping, marking, or sacrifice of lizards, which otherwise would require the possession of a current Scientific Collecting Permit issued by the Department.

This authorization is in effect permanently, unless revoked, at the Department's discretion.

Sincerely,

Jack Crayon

Jack Crayon
Environmental Scientist
Inland Deserts Region

Authorized Individual:

Jacob Jaime Calanno
PO Box 458
Niland, CA 92257

Conserving California's Wildlife Since 1870

Wister Solar Project Waters/Wetlands Delineation Report

Preliminary Jurisdictional Waters/Wetlands Delineation Report

June 12, 2018

Rev. May 7, 2020

Prepared for:

Orni 33 LLC.

Prepared by:

Stantec Consulting Services Inc.
290 Conejo Ridge Avenue
Thousand Oaks, California 91361

This document entitled Wister Solar Project Waters/Wetlands Delineation Report was prepared by Stantec Consulting Services Inc. ("Stantec") for the account of Orni 33, LLC (the "Client"). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec's professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

Prepared by ______________________________
(signature)

Rocky Brown, Associate Biologist

Reviewed by ______________________________
(signature)

Michael Weber, Principal Scientist

Approved by ______________________________
(signature)

Jared Varonin, Principal Biologist

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Abbreviations

CDFW	California Department of Fish and Wildlife
CWA	Clean Water Act
IID	Imperial Irrigation District
GIS	Global Information Systems
GPS	Global Positioning System
JD	Jurisdictional Delineation
MSL	Mean Sea Level
NRCS	Natural Resources Conservation Service
RWQCB	Regional Water Quality Control Board
Project	Wister Solar Project
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geographical Survey

1.0 INTRODUCTION

1.1 PURPOSE OF THE REPORT

This preliminary Jurisdictional Waters/Wetlands Delineation (JD) Report serves as guidance in establishing baseline conditions for resources under the jurisdiction of the U.S. Army Corps of Engineers (USACE), the California Department of Fish and Wildlife (CDFW), and the Colorado River Basin Regional Water Quality Control Board (RWQCB) for the Wister Solar Project (Project). Specifically, the purpose of the JD was to determine the location and extent of waters and/or wetlands subject to potential jurisdictional authority within Project site, which measures approximately 123 acres; the entire Project site, along with a 100-ft buffer, was surveyed in support of this JD report and is hereafter referred to as the Survey Area.

1.2 PROJECT LOCATION

The Survey Area is located in northern Imperial County, California, approximately two miles northeast of the community of Niland, approximately five miles east of the Salton Sea and 0.5 mile southwest of the Coachella Canal (Appendix G, Figure 1). It is situated in Township 10 South, Range 14 East of the U.S. Geographical Survey (USGS) Wister 7.5-minute topographic quadrangle. The Survey Area consists of a relatively undeveloped, square parcel of land with its southwest corner near the intersection of Weist and Wilkins Roads (Appendix G, Figure 2). The unpaved Gas Line Road runs north/south, relatively parallel inside the eastern Project boundary. The majority of the Survey Area is undisturbed with exception of the aforementioned Gas Line Road and an approximately five-acre area of previously graded land in the northwest portion of the site, adjacent to the western Project boundary. There is a transmission line extending from outside the northern boundary to outside the eastern Project boundary with an associated unpaved access road.

1.3 PROJECT DESCRIPTION

Orni 33, LLC (Client) is proposing to construct, operate, and maintain a 20-Megawatt (MW) photovoltaic solar farm on approximately 100 acres within the 640-acre Project site.

1.4 LEAD AGENCY NAME AND ADDRESS

County of Imperial
Planning & Development Services Department
940 West Main Street
El Centro, California 92243

1.5 CONTACT PERSON AND PHONE NUMBER

Jim Minnick
Planning & Development Services Director 801 Main Street
El Centro, California 92243 Phone: (442) 265-1736
Email: jimminnick@co.imperial.ca.us

2.0 EXISTING CONDITIONS

2.1 TOPOGRAPHY AND SURROUNDING AND USES

The Survey Area is located in the Colorado Desert and generally slopes gradually from northeast to southwest, with elevations ranging from approximately 20 feet above mean sea level (MSL) along the northern Project boundary to -30 feet below MSL at its southwest corner. The site is bordered by agricultural land to the northwest and undeveloped land to the north, east, south, and southwest, though the land abutting the parcel to the south has been disked.

Lands within the Survey Area are zoned as Recreation/Open Space (Imperial County, 2007). Surrounding lands are zoned as a mix of Agriculture, Recreation/Open Space, and Government/Special Public. It is bordered largely by open space to the north, east, and south, with agricultural lands (orchards) occurring to the west and northwest. An existing solar generating facility occurs approximately 0.5 miles south and a County landfill is located to the east of the Survey Area. While it is largely undeveloped, the unpaved Gas Line Road passes roughly parallel to the eastern boundary of the Survey Area and a transmission line and associated unpaved access road run from outside the eastern boundary from north to south. The East Highline Canal, an Imperial Irrigation District (IID) water delivery conveyance passes through the extreme southwestern corner of the Survey Area.

2.2 VEGETATION

Generally, description of plant communities follows the MCV II classification system described in the second edition of *A Manual of California Vegetation* (Sawyer et al., 2009). Species scientific and common names correspond to those described in the second edition of *The Jepson Manual* (Baldwin et al., 2012).

The Survey Area supports three land cover types: creosote bush – white bursage scrub, blue palo verde – ironwood woodland, and arrow weed thickets. Descriptions of these land cover types are provided below and depicted on Figure 3 (Appendix G).

Creosote Bush – White Bursage Scrub

This is the primary land cover type occurring throughout most of the Survey Area. Creosote bush (*Larrea tridentata*) and white bursage (*Ambrosia dumosa*) are the co-dominant species, though vegetative cover throughout the Survey Area. Other shrub species present within this community include a number of saltbush species (*Atriplex* spp.) and desert thorn (*Lyceum brevipes*). The sparse understory consists of native and non-native herbaceous species such as desert dandelion (*Malacothrix glabrata*) and desert plantain (Plantago ovata) and non-native grasses, primarily bromes (*Bromus* spp*.)* and Mediterranean grass (*Schismus barbatus*). Approximately 175.34 acres of creosote bush – white bursage scrub occurs within the Survey Area.

Blue Palo Verde – Ironwood Woodland

This vegetation community occurs along the margins of some of the larger drainage features within the Survey Area, particularly in the southeast portion of the site. In the Survey Area, this community is dominated by desert ironwood (*Olneya tesota*) trees, though a few blue palo verde (*Parkinsonia florida*) and honey mesquite (*Prosopis glandulosa*) trees are sparsely interspersed throughout the community. Understory consists of white bursage, creosote bush, and brome grasses. Approximately 2.71 acres of blue palo verde – ironwood woodland occurs within the Survey Area.

Arrow Weed Thickets

This is the dominant vegetation along the small section of the East Highline Canal in the southwestern corner of the BSA. Arrow weed thickets within the BSA are dominated by arrow weed (*Pluchea sericea*). Other species such as cattails (*Typha* spp.), common reed (*Phragmites australis*), and saltcedar (*Tamarix ramosissima*) are also present, but much less common. Arrow weed thickets are recognized by CDFW as a sensitive vegetation type. Approximately 0.03 acres of arrow weed thickets occurs within the Survey Area.

2.3 CLIMATE

The region experiences a desert climate characterized by hot, dry summers and warm winters. Average annual temperatures range from 42 degrees Fahrenheit in December to 107 degrees Fahrenheit in July, and average annual precipitation measures 2.87 inches (US Climate Data, 2018).

2.4 HYDROLOGY AND GEOMORPHOLOGY

The Survey Area is underlain by the Colorado River Basin and is within the Imperial Hydrologic Unit and Brawley Hydrologic Area (SWRCB, 2006). The Colorado River Basin Region covers approximately 13 million acres (20,000 square miles) in the southeastern portion of California. It includes all of Imperial County and portions of San Bernardino, Riverside, and San Diego counties. It is bounded for 40 miles on the northeast by the State of Nevada, on the north by the New York, Providence, Granite, Old Dad, Bristol, Rodman, and Ord mountain ranges, on the west by the San Bernardino, San Jacinto, and Laguna mountain ranges, on the south by the Republic of Mexico, and on the east by the Colorado River and State of Arizona. Geographically, the region represents only a small portion of the total Colorado River drainage area, which includes portions of Arizona, Nevada, Utah, Wyoming, Colorado, New Mexico, and Mexico (SWRCB, 2006).

A significant geographical feature of the region is the Salton Trough, which contains the Salton Sea and the Coachella and Imperial valleys. The two valleys are separated by the Salton Sea, which covers the lowest area of the depression. The trough is a structural extension of the Gulf of California. In prehistoric times, it contained the ancient Lake Cahuilla (not to be confused with the present Lake Cahuilla which is located at the terminus of the Coachella Branch of the All- American Canal) (SWRCB, 2006).

Regional drainage waters resulting from Colorado River diversions and use, and which do not return to the Colorado River, drain into the Salton Sea. The portion of the region that does not drain into the Colorado River is referred to as the Colorado River Basin (West), or West Basin. Much of the northern portion of the West Basin drains to several individual internal sinks or playas, while the southern portion generally drains to the Salton Sea. The Imperial and Coachella Valleys contain numerous drains that transport irrigation return flows and stormwater, as well as canals for importation and distribution of Colorado River water. The Salton Sea, which is replenished principally by irrigation drainage and stormwater, is the largest body of water in the West Basin.

The Salton Sea serves as a reservoir to receive and store agricultural drainage and seepage waters, but also provides important wildlife habitat and is used for recreational purposes, which include boating and fishing. Several smaller constructed recreational lakes are located in the Imperial Valley. In addition, Lake Cahuilla in Coachella Valley is used to store Colorado River water for irrigation and recreational purposes (SWRCB, 2006).

Within the East Colorado Basin Plan, the proposed Project is located in the Imperial Valley Planning Area. This planning area comprises 2,500 square miles in the southern portion of the region, almost all of it in Imperial County. The eastern and western boundaries are contiguous with the western and eastern boundaries of the East Colorado River Basin and the Anza-Borrego Planning Area, respectively. Its northern boundary is along the Salton Sea and the Coachella Valley Planning Area, and its southern boundary follows the international boundary with Mexico. The Planning Area’s central feature is the flat, fertile Imperial Valley. The principal communities are El Centro, Brawley, Imperial, Holtville, and Calexico. Within the Imperial Valley Planning Area, surface waters drain primarily toward the Salton Sea (SWRCB, 2006).

2.5 SOILS

Soil data from the Natural Resources Conservation Service (NRCS), obtained through the Web Soil Survey, was used to determine potential soil types, including where hydric soils have historically occurred; however, soils within the Survey Area have not been mapped. As such, soils from immediately adjacent areas were considered to be representative of soils that may occur on the Survey Area (Appendix G, Figure 4). Soils predicted to be within the Survey Area are dominated by gravelly sand and silty clay, some of which are considered to be hydric soils. Characteristics of soils predicted to be present on the site are summarized in Appendix D. Table 1 below summarizes the soils predicted to occur within the Survey Area.

Table 1 Soil Units Potentially Occurring within the Survey Area

Map Unit Name	Description	Hydric Soil?
Niland gravelly sand	A moderately well-drained soil that occurs on basin floors at elevations between -230 to 300 feet; parent material consists of alluvium derived from mixed sources; gravelly sand (0-23”), silty clay (23-60”)	Yes
Niland-Imperial complex, wet	A moderately well-drained soil that occurs on basin floors at elevations between -230 to 300 feet; parent material consists of alluvium derived from mixed sources; low runoff; gravelly sand (0-23”), silty clay (23-60”)	No

3.0 REGULATORY BACKGROUND

Jurisdictional waters, wetlands, and riparian habitat are regulated by the USACE, RWQCB, and CDFW. The USACE Regulatory Program regulates activities pursuant to Section 404 of the federal Clean Water Act (CWA); the CDFW regulates activities under California Fish and Game Code Sections 1600-1617; the RWQCB regulates activities under Section 401 of the CWA and the California Porter-Cologne Water Quality Control Act. Refer to Appendix F for additional details on regulatory authorities and background.

4.0 WATERS/WETLAND DELINEATION

4.1 DELINEATION METHODOLOGY

This section describes the methods employed by Stantec during the survey conducted to determine the extent of potentially jurisdictional wetlands and/or waters that occur within the Survey Area. Prior to conducting the field assessment, Stantec reviewed current and historic aerial photographs, detailed topographic maps, soil maps of the proposed Survey Area (NRCS, 2020), and local and state hydric soil lists to evaluate the potential active channels and wetland features that occur within the Survey Area. During the field assessment, hydrology data was collected using an Apple iPad with ArcGIS Collector app and Bad Elf global positioning system (GPS) receiver. Field data was used to map drainages in the office using Global Information System (GIS) and total jurisdictional area for each jurisdictional feature was calculated.

When a large number of drainage features are present on a site, especially in the arid west, traditional methods of walking and mapping the centerline of each feature can be cumbersome and, at times, infeasible. Therefore, employing a transect methodology, which prescribes collecting data at specified intervals and is based on methodology in the USACE *Wetland Delineation Manual* (1987) and the *Arid West Supplement* (2011) allows for detailed mapping of drainage features when used in conjunction with high resolution aerial photography. The Survey Area was surveyed along pre-determined transects oriented northwest to southwest (i.e., perpendicular to flow); refer to Appendix G, Figure 5 for the location of the transects.

4.1.1 Federal Wetlands/Waters

Jurisdictional non-wetland "waters of the U.S." are delineated based on the limits of the ordinary high water mark (OHWM) as determined by changes in physical and biological features, such as bank erosion, deposited vegetation or debris, and vegetative characteristics. Jurisdictional wetlands are delineated using a routine determination in accordance with the methods outlined in the USACE *Wetland Delineation Manual* (1987) and the *Arid West Supplement* (2011) based on three wetland parameters: dominant hydrophytic vegetation, wetland hydrology, and hydric soils. Tables 1 and 2 in Appendix E (Potential Geomorphic and Vegetative Indicators of Ordinary High Water Marks for the Arid West) provide a list of key physical features for determining the OHWM identified by the arid west manual.

4.1.2 CDFW Jurisdictional Waters

CDFW jurisdiction is delineated to the top of the banks of the channel and/or to the edge of the associated riparian canopy/riparian habitat, whichever is wider. Within the Survey Area, the CDFW jurisdictional boundary of the ephemeral drainages is generally wider than the OHWM. Therefore, the total acreage of CDFW jurisdictional waters is greater than the combined acreage of federal jurisdictional waters.

4.1.3 Wetland Vegetation

Vegetation percent cover is estimated for plant species in each of the four strata (tree, sapling/shrub, herb, and woody vine) and plant species in each stratum are ranked based on canopy dominance (USACE, 2008). Species that contribute to a cumulative coverage total of at least 50 percent and any species that comprised at least 20 percent of the total coverage for each stratum are recorded on the Field Data Sheets (50/20 rule). Wetland indicator status is assigned to each dominant species using the *Region 0 List of Plant Species that Occur in Wetlands: 1996 National Summary* (USFWS, 1997), *Wetland Plants of Specialized Habitats in the Arid West* (USACE, 2007), and the *Arid West Region of The National Wetland Plant List* (USACE, 2012). If greater than 50 percent of the dominant species from all strata are Obligate, Facultative-wetland, or Facultative species, the criteria for wetland vegetation is considered to be met (refer to Appendix E, Table 3).

4.1.4 Wetland Hydrology

The presence of wetland hydrology is assessed by evaluating the presence of primary and secondary hydrology indicators (refer to Appendix E, Tables 4 and 5). These indicators are designed to determine whether an area has a high probability of being inundated or saturated (flooded, ponded, or tidally influenced) long enough during the growing season to develop anaerobic conditions in the surface soil environment, especially in the root zone (USACE, 1987 and 2008b). The *Arid West Supplement* includes two additional indicator groups that can be utilized during dry conditions or in areas where surface water/saturated soils are not present; these are Group B (evidence of recent inundation) and Group C (evidence of recent soil saturation) (USACE, 2008). The indicators are divided into two categories (primary and secondary indicators) and presence of one primary indicator from any of the groups is considered evidence of wetland hydrology. If only secondary indicators are present, two or more must be observed to conclude presence of wetland hydrology. Indicators are intended to be one-time observations of site conditions representing evidence of wetland hydrology when hydrophytic vegetation and hydric soils are present (USACE, 2008).

4.1.5 Wetland Soils

Soils data from the NRCS is referenced to determine if hydric soils have been previously documented and/or historically occurred in or near the Project Area. Based on this review hydric soils were potentially expected to occur within the Project Area. The Niland gravelly sand is considered a hydric soil. Appendix E, Tables 6 and 7, includes a complete list of hydric soils indicators.

4.2 RESULTS

Two types of jurisdictional features were documented within the Survey Area: USACE non-wetland waters and CDFW State Waters. The site is bisected from northeast to southwest by numerous ephemeral drainage channels, which contain surface water only during storm events, draining the mountains to the northeast. These drainages ultimately flow into the Salton Sea, which is considered a Traditionally Navigable Water. As such, these drainage features would likely be considered federally and state jurisdictional. Representative photographs are provided in Appendix C.

Appendix A summarizes the jurisdictional features present within the Survey Area and their acreages, and Figure 5 in Appendix G depicts their location within the Survey Area. Appendix B contains the OHWM Data Forms completed during the assessment. According to the *NRCS Hydric Soils List* (NRCS, 2020) there are likely two mapped hydric soils within the Survey Area. Table 2 lists the plant species observed onsite and lists their wetland indicator status, if applicable.

Table 2 Plant Species Observed Within the Survey Area and Wetland Indicator Status

Scientific Name	Common Name	Wetland Indicator Status
Ambrosia dumosa	white bursage	UPL
Astragalus sp.	astragalus	-
Atriplex canescens	fourwing saltbush	FACU
Cholla sp.	cholla	-
Chorizanthe sp.	chorizanthe	-
Datura wrightii	jimsonweed	UPL
Eriogonum sp.	buckwheat	-
Larrea tridentate	creosote bush	UPL
Lycium brevipes	desert thorn	-
Olneya tesota	desert ironwood	-
Parkinsonia florida	blue palo verde	-
Prosopis glandulosa	honey mesquite	FACU/UPL

Scientific Name	Common Name	Wetland Indicator Status
Suaeda nigra	bush seepweed	OBL
Tamarix ramosissima	tamarisk	FAC
Wetland Indicator Status Definitions OBL = obligate - occurs almost always in wetlands under natural conditions FAC = facultative - equally likely to occur in wetlands or non-wetlands FACU = facultative upland - usually occurs in non-wetlands, but often found in wetlands UPL = obligate upland - Occurs almost always in non-wetlands under natural conditions		

Federal Wetlands

Based on Stantec's professional opinion following an assessment of hydrology, vegetation, and soils, no jurisdictional federal wetlands were documented within the Survey Area. Ephemeral drainages present throughout the site do, however, meet the requirements for jurisdictional waters (see below).

Federal Non-Wetland Waters

Based on Stantec's professional opinion following an assessment of hydrology, vegetation, and soils, approximately 11.31 acres of the Survey Area meet the definition of "waters of the United States" as outlined in 33 CFR Part 328. This assessment is based on Stantec's professional opinion following an assessment of hydrology and the limits of the OHWM. The proposed project would potentially result in permanent impacts to 6.00 acres and temporary impacts to 0.07 acres of federal non-wetland waters within the Project site.

CDFW Waters

Based on Stantec's professional opinion following an assessment of hydrology, presence of bed and bank, and extent of riparian vegetation, approximately 15.36 acres within the Survey Area meet the definition of CDFW jurisdictional waters as outlined in Sections 1600-1617of the CDFW Code. The proposed project would potentially result in permanent impacts to 8.20 acres and temporary impacts to 0.10 acres of CDFW waters within the Project site.

Table 3 Acreage of Potential Jurisdictional Waters and Wetlands within the Survey Area and Summary of Project Impacts

Wetland Waters of the U.S. (acres)			Non-Wetland Waters of the U.S. (acres)			CDFW Jurisdictional Waters (acres)		
Survey Area	Project Temporary Impact Area	Project Permanent Impact Area	Survey Area	Project Temporary Impact Area	Project Permanent Impact Area	Survey Area	Project Temporary Impact Area	Project Permanent Impact Area
0	0	0	11.31	0.07	6.00	15.36	0.10	8.20

*Survey area is approximately 190 acres.

5.0 SUMMARY AND CONCLUSIONS

The Survey Area supports CDFW jurisdictional waters and USACE non-wetland waters. The braided drainage channels throughout the site exhibited evidence of hydrology and a discernible OHWM and were mapped as jurisdictional non-wetland “waters of the United States” (11.31 acres); the proposed Project would result in approximately 0.07 acres of temporary and 6.00 acres of permanent impacts. Proposed impact to jurisdictional non-wetland “waters of the United States.” Using a combination of bed/bank delineation and field observations, 15.36 acres of CDFW jurisdictional waters were identified within the Survey Area; the proposed Project would result in approximately 0.10 acres of temporary and 8.20 acres of permanent impacts to CDFW jurisdictional waters.

The conclusions presented above represent Stantec’s professional opinion based on our knowledge and experience with the USACE and CDFW, including their regulatory guidance documents and manuals. However, the USACE and CDFW have final authority in determining the status and presence of jurisdictional wetlands/waters and the extent of their boundaries.

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Appendix A ACREAGE SUMMARY OF JURISDICTIONAL WATERS WITHIN THE SURVEY AREA

Appendix B OHWM DATA SHEETS

Appendix C PHOTOGRAPHIC LOG

Appendix D HISTORIC SOILS INFORMATION

Appendix E ARID WEST INDICATOR TABLES

Appendix F REGULATORY BACKGROUND INFORMATION

Appendix G FIGURES

A CULTURAL RESOURCES SURVEY
OF 640-ACRES PROPOSED FOR
ALTERNATIVE ENERGY EXPLORATION,
NILAND, IMPERIAL COUNTY, CALIFORNIA

Prepared for:

The County of Imperial
940 Main Street
El Centro, CA 92243

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May 2010

National Archaeological Data Base Information
Type of Study: Cultural Resource Survey
Sites: OS27-1 through OS27-18, CA-IMP-68
USGS Quadrangles: Wister and Iris Wash 7.5'
Area: 640-Acres
Key Words: Positive Survey, Geothermal, Wister, Imperial County, Salton Buffware, Andesite, Rhyolite, Core, Flakes, Sherds, Lithic scatter, Temporary camp, Ceramic scatter

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ABSTRACT

Tierra Environmental Services, Inc (Tierra) has been hired to conduct an archaeological survey of 640-acres of land recently acquired by Ormat Nevada, Incorporated (Ormat) in the Niland area of Imperial County, California. The proposed land use of the area is for the construction of a geothermal power plant, and associated injection and production wells, within 40-acres in the northwest corner of Section 27. Additionally, the remaining portion of Section 27 could be used for a possible solar energy project. Project details are still in the planning phase and the survey of Section 27 was undertaken to provide a constraints analysis based on cultural resources.

The archaeological inventory includes archival and other background studies, in addition to the field survey for the project. The archival research consisted of a literature and records search conducted for the project in addition to an examination of historic maps and historic site inventories. This information was used to identify previously recorded resources and to determine the types of resources that might occur in the survey area.

The intensive survey of the project area was conducted throughout April 6-9, 2010 using parallel transects with 10 to 15 meter intervals. Visibility in the project area was excellent with few hindrances. A total area of 640-acres was surveyed for this project. Eighteen cultural resources (OS27-1 through OS27-18) were identified during the survey. These resources include five prehistoric archaeological sites, three historic can dumps, two trail segments, and eight prehistoric isolates. The prehistoric sites are ceramic and lithic scatters or temporary camps. The isolates include cores, flakes, and potsherds.

By definition, the eight isolates lack qualities and characteristics that would make them eligible for nomination to the California Register and are considered non-significant resources. Additionally, the three can dumps are considered non-significant resources. One of the prehistoric sites has been so disturbed as to have lost its integrity and is thus considered a non-significant resource. No further work is recommended for this resource.

Impacts to the two trail segments and the four intact prehistoric archaeological sites should be avoided. This can be accomplished by establishing a 20m buffer around the sites and flagging the buffer once project construction begins. Based on the surface expression of artifacts and associated features, the four sites may possess the characteristics and qualities necessary for inclusion on the California Register. If impacts to sites OS27-12, OS27-14, OS27-15, and OS-16 cannot be avoided, the sites will need to be tested and evaluated for their eligibility for the California Register.

Additionally, archaeological and Native American monitors should be present for initial earth disturbing activities within the recorded boundaries of sites OS27-12, OS27-14, OS27-15, and OS-16.

I. INTRODUCTION

A. PROJECT DESCRIPTION

Tierra Environmental Services, Inc (Tierra) conducted an archaeological survey of 640-acres of land recently acquired by Ormat Nevada, Incorporated (Ormat) in the Niland area of Imperial County, California (Figure 1). The proposed land use of the area is for the construction of a geothermal power plant, and associated injection and production wells, within 40-acres in the northwest corner of Section 27. Additionally, the remaining portion of Section 27 could be used for a possible solar energy project. Project details are still in the planning phase and the survey of Section 27 was undertaken to provide a constraints analysis based on cultural resources.

The project area is located in Township 10 South, Range 14 East on the Wister and Iris Wash USGS 7.5' Quadrangles, Section 27 (Figure 2). Cultural resource work was conducted in accordance with the California Environmental Quality Act (CEQA) and it respective guidelines and regulations. The County of Imperial serves as the lead agency for CEQA compliance.

B. PROJECT PERSONNEL

The cultural resource inventory has been conducted by Tierra, whose cultural resources staff meet Federal, State, and local requirements. Mr. Patrick McGinnis served as Principal Investigator for the project. Mr. McGinnis has an MA in Archaeology and Heritage from the University of Leicester and also meets the Secretary of the Interior's standards for qualified archaeologists. The survey of the project area was conducted by Mr. McGinnis, Ms. Hillary Murphy, Dr. Jackson Underwood, Ms. Eliza McMichael, Mr. James Amick, Mr. Aaron Cruz, and Mr. Martin Nienstadt during April 6-9, 2010. Resumes of lead project personnel are included in Appendix A.

C. STRUCTURE OF THE REPORT

This report follows the State Historic Preservation Office's guidelines for Archaeological Resource Management Reports (ARMR). The report introduction provides a description of the project and associated personnel. Section II provides background on the project area and previous research. Section III describes the research design and survey methods while Section IV describes the inventory results. Section V provides a summary and recommendations.

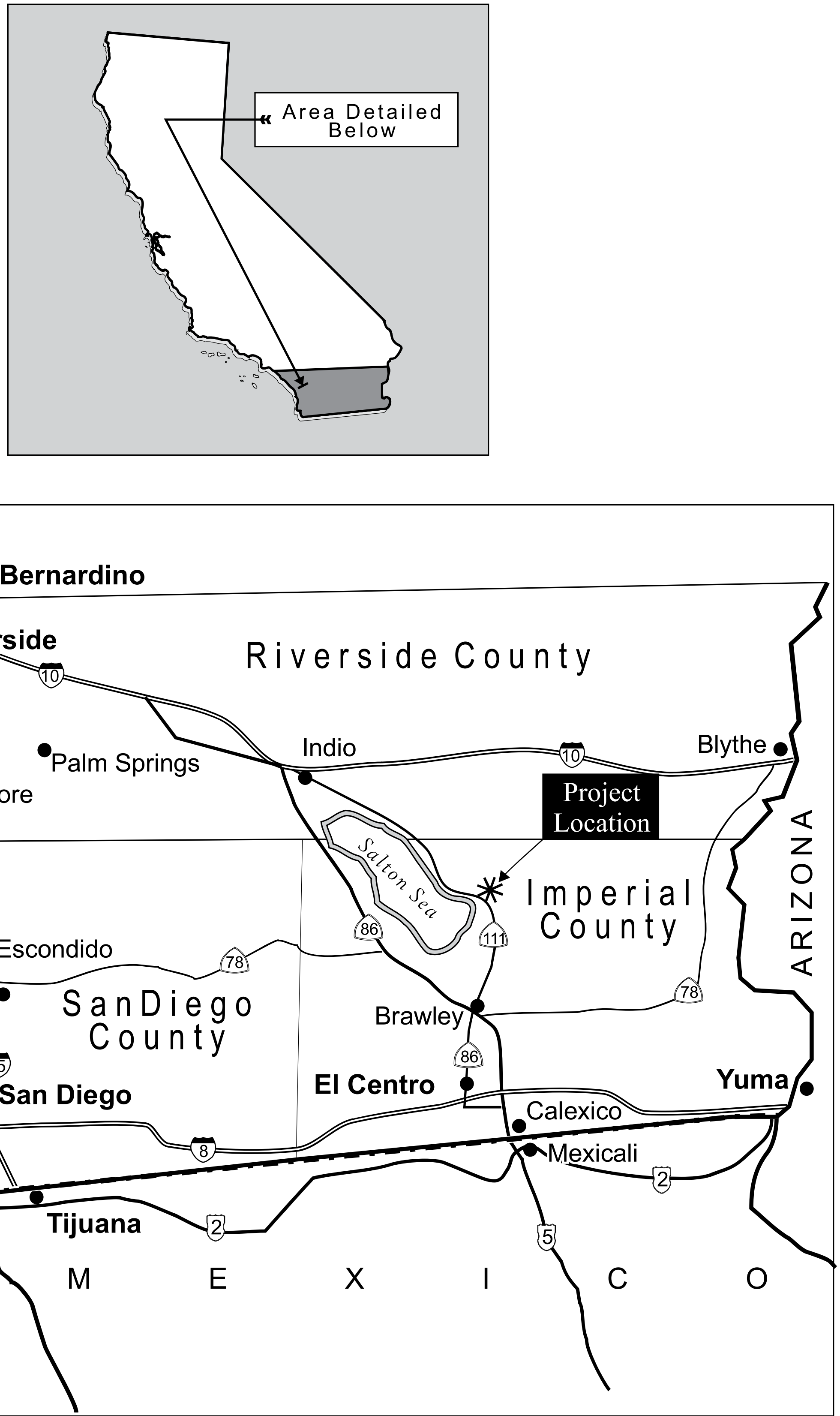
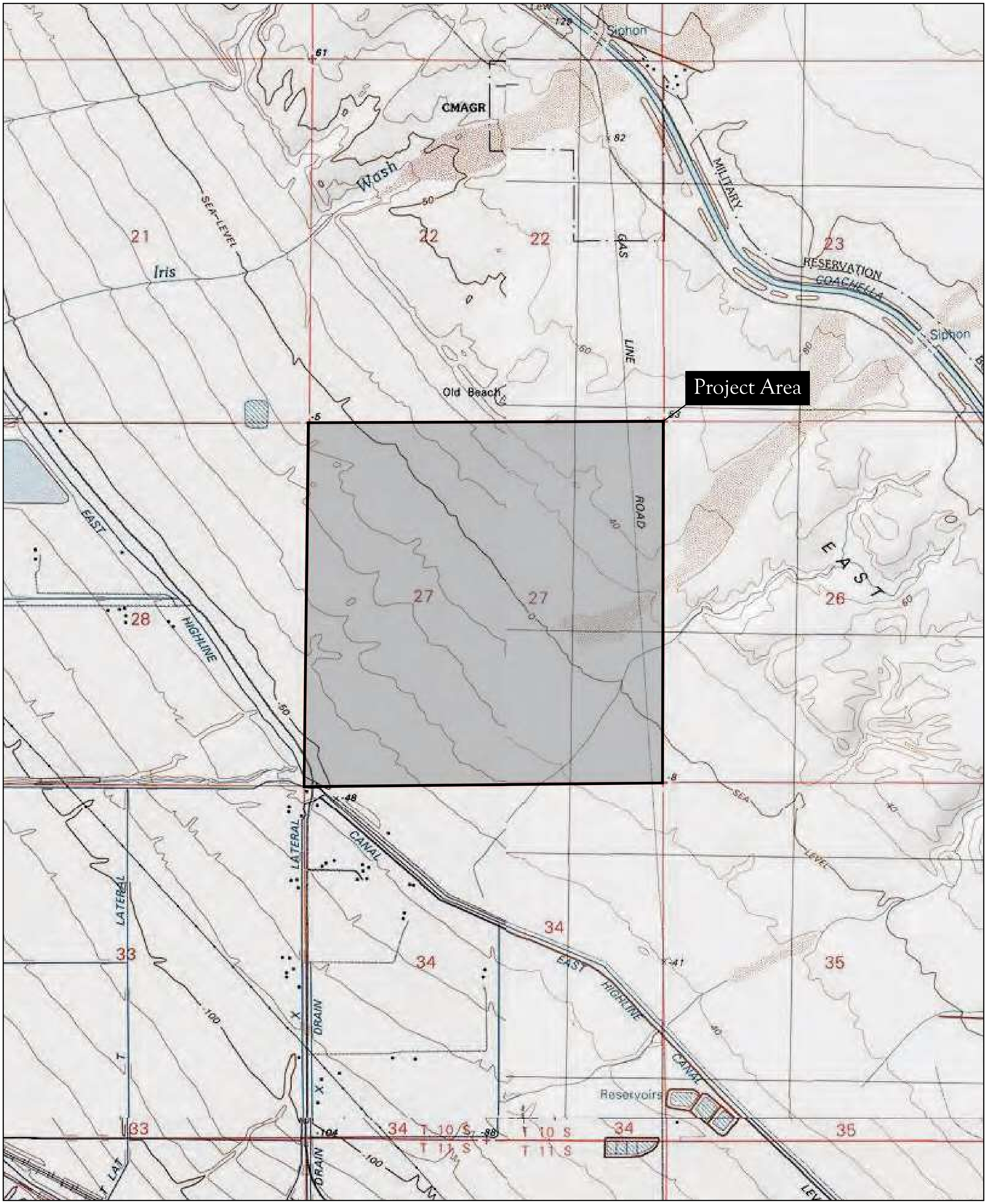


Figure 1
Regional Location Map

0 20 40
MILES

Tierra
Environmental Services



USGS 7.5' Quadrangle: Iris Wash and Wister, CA

Figure 2. Project Location Map

0 1000 2000
FEET

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ENVIRONMENTAL SERVICES

II. NATURAL AND CULTURAL SETTING

The following environmental and cultural background provides a context for the cultural resource inventory.

A. NATURAL SETTING

The project area is located in the Wister area of Imperial County, approximately 5.5 miles east of the Salton Sea. It is on the eastern side of the San Jacinto Mountains on the margin of the Salton Trough in the Coachella Valley. The landscape of the project area is largely a product of the region's geology.

During the late Cretaceous (>100 million years ago) a granitic and gabbroic batholith was being formed under and east of the project area. This batholith was uplifted and forms the granitic rocks and outcrops of the San Jacinto Mountains. At about the same time as these mountains were being uplifted, the Salton Trough was dropping, reaching points well below sea level. The Salton Trough had been slowly filling with sediments from the adjacent mountains and from the Colorado River, which shifted on its delta occasionally forming freshwater Lake Cahuilla which stretched more than 60 miles long in the lowest portion of the basin. Lake Cahuilla was a resource that had profound effects on the Cahuilla, Kamia and other groups in the surrounding region. This lake probably last existed in the 1650s (Schaefer 1994). It supplied the southern Coachella Valley and the Imperial Valley with not only water but other lacustrine resources such as freshwater mussels, waterfowl, and fish. Native Americans in the region rapidly took advantage of these resources designing "U" shaped fish traps along the shoreline and leaving behind large deposits of mussel shell as well as bird and fish bone (Wilke 1978). Cahuilla oral history tells of both the filling and drying of this lake and its important influence on the region. Even without the support of direct flow from the Colorado River, the Salton Basin, Borrego, and other dry lake basins would sometimes contain seasonal shallow ponds supplying additional water resources (Bean 1972).

The project area is located on what was once the bottom of Lake Cahuilla and includes the margins of the eastern ancient shoreline. Within the project area, the terrain gently slopes down to the southwest, with an elevation of between 10 feet above and 50 feet below mean sea level. The project consists of Holocene age alluvium. Soils are made up of fine grained silts and sand. The soils within the project area belong to the Niland soil series and include Niland gravelly sand, Niland gravelly sand wet, and Niland Imperial complex wet. Niland series soils are moderately well-drained, non-saline to moderately saline, and are located primarily in basins. Niland soils are found in alluvium derived from mixed sources (USDA 1980).

The project area is currently undeveloped open desert surrounded by reclaimed lands turned into agricultural fields. Road construction, off-road activity and the construction of the Coachella Canal have all disturbed the project area to varying degrees. In previously disturbed survey areas, the vegetation probably consisted of alkali sink scrub vegetation. This community is noted for the presence of fleshy halophytes (*Allenrolfea*, *Salicornia*, *Atriplex*, and *Suaeda*), Salt Grass (*Distichlis*) and Mesquite (*Prosopis*) (Munz 1974).

Animal resources in the region include occasional deer, fox, skunk, bobcats, coyotes, rabbits, and various rodent, reptile, and bird species. Small game, dominated by rabbits and reptiles, is relatively abundant.

B. CULTURAL SETTING

Paleoindian Period

The earliest well documented prehistoric sites in southern California are identified as belonging to the Paleoindian period, which has locally been termed the San Dieguito complex/tradition. The Paleoindian period is thought to have occurred between 9,000 years ago, or earlier, and 8,000 years ago in this region. Although varying from the well-defined fluted point complexes such as Clovis, the San Dieguito complex is still seen as a hunting focused economy with limited use of seed grinding technology. The economy is generally seen to focus on highly ranked resources such as large mammals and relatively high mobility which may be related to following large game. Archaeological evidence associated with this period has been found around inland dry lakes, on old terrace deposits of the California desert, and near the coast. The San Dieguito complex, as seen in the desert region, is generally comprised of lithic scatters and rock features associated with activities of the hunting economy. Such resources are typically located on desert pavement terraces or along ancient shorelines or major drainages (Apple et al 1997).

Early Archaic Period

Native Americans during the Archaic period had a generalized economic focus on hunting and gathering. In many parts of North America, Native Americans chose to replace this economy with others based on horticulture and agriculture. Southern California economies remained largely based on wild resource use until European contact (Willey and Phillips 1958). Changes in hunting technology and other important elements of material culture have created two distinct subdivisions within the Archaic period in southern California.

The Early Archaic period is differentiated from the earlier Paleoindian period by a shift to a more generalized economy and an increased focus on use of grinding and seed processing technology. At sites dated between approximately 5,000 and 1,500 years before present (B.P.), the increased use of groundstone artifacts and atlatl dart points, along with a mixed core-based tool assemblage, identify a range of adaptations to a more diversified set of plant and animal resources. Variations of the Pinto and Elko series projectile points, large bifaces, manos and portable metates, and core tools are characteristic of this period. However, archaeological evidence for the Archaic period is minimal throughout the desert region and major changes in technology within this relatively long chronological unit appear limited. Several scientists have considered changes in projectile point styles and artifact frequencies within the Early Archaic period to be indicative of population movements or units of cultural change (Moratto 1984), but these units are poorly defined locally due to poor site preservation.

Late Prehistoric Period

Around 2,000 B.P., Takic-speaking people from the Great Basin region began migrating into southern California, marking the beginning of what is called the Late Prehistoric period in the southern California region. The Late Prehistoric period in this portion of Imperial County is recognized archaeologically by smaller projectile points, the replacement of flexed inhumations with cremation, the introduction of ceramics, and an emphasis on inland plant food collection and processing, especially acorns and mesquite (Kroeber 1925). Inland semi-sedentary villages were established along major water courses and around springs, and montane areas were seasonally occupied to exploit mesquite, acorns, and piñon nuts. Mortars for mesquite and acorn processing increased in frequency relative to seed grinding basins.

The most numerous of the archaeological resources in the Imperial Valley date to the Late Prehistoric period. The majority of sites recorded in the region have been small temporary campsites related to processing food resources or manufacturing tools. Larger habitation sites were less common, but displayed a wider range of activities and longer periods of occupation (Jefferson 1977). Typical artifacts at these sites include Desert Side-notched and Cottonwood Triangular projectile points and Lower Colorado buffware and Tizon brownware ceramics. Lithic artifacts are typically made from chert, volcanic, or quartz material.

Ethnography

The Kamia, or Desert Kumeyaay, are believed to have occupied the project area during this period. However, it is close to the territorial boundary of the Desert Cahuilla and it is possible that both groups may have used the area.

Kamia

The Kamia are a subgroup of the Yuman family of the Hokan stock, and are therefore closely related linguistically to the Mohave, Quechan, Maricopa, Paipai, Cocopa and Kiliwa (Kendall 1983:5). Group size and the degree of social interaction varied over the course of an annual cycle. The basic unit of production was the family, which was capable of great self-sufficiency, but Kamia/Kumeyaay families, like other hunter-gatherers, moved in and out of extended family camps or villages opportunistically as problems or opportunities arose. Thus, whereas single families occasionally exploited low-density, dispersed resources on their own, camps or villages of several families formed at other times, particularly when key resources (such as water) were highly localized.

Going beyond the basic social unit of the family, the Kamia were organized by some form of descent system. From the available ethnographic data it is not immediately obvious as to whether they were organized into lineages or clans. Indeed, their features of social organization appear to have shared some qualities of both systems, and it may be speculated that the society had begun evolving from a lineage system to a clan system prior to the time of Western contact. In any case, the Kamia traced their descent patrilineally (i.e., through one's father), were exogamous at the level of the descent group (i.e., one had to marry outside one's own lineage or clan), and practiced patrilocal residence (i.e., a married woman lived with her husband's father's relatives). Descent groups apparently "owned" land and certain other resources. According to Kroeber, "It would appear that each ‘clan’ owned a tract and that each locality was inhabited by members of one clan, plus their introduced wives" (1925:720).

Regarding other resources, Spier observed that some "gens" (i.e., clans) owned patches of certain trees and "each gens owned one or more eyries from which eaglets were taken for use in the mourning ceremony" (1923:307). Apparently, however, resource ownership did not extend to the oak groves in the mountains (ibid), which probably reflects the extreme importance placed upon this resource for the adaptation and survival of the entire society. Gifford reported that the Kamia had no clan chiefs and recognized a tribal chief like the Quechan, however this form of leadership may have been introduced after European contact (1931: 50-51).

Important plant foods exploited from the Kamia’s diverse habitat included mesquite and screw beans, pinion nuts, and various cacti. Important but less utilized plants included various seeds, wild fruits and berries, tubers, roots, and greens. Women were primarily responsible for the collection and preparation of vegetal foods.

Cahuilla

The Cahuilla are a subgroup of the Takic family of the Uto-Aztecan stock, and are therefore closely related linguistically to the Gabrielino, Luiseño, and Serrano. The extreme diversity of Cahuilla territory nearly reflected the range of environmental habitats allowed in inland southern California. Topographically, their territory ranged from the summit of the San Bernardino Mountains, in excess of 11,000 feet, to the Salton Sink, well below sea level. Ecological habitats included the full range of mountains, valleys, passes, foothills, and desert area. Villages were typically situated in canyons or on alluvial fans near water and food resources, and a village’s lineage owned the immediately surrounding land (Bean 1978). Well-developed trails were used for hunting and travel to other villages. Village houses ranged from brush shelters to large huts 15-20 feet long.

Important plant foods exploited from the Cahuilla’s diverse habitat included mesquite and screw beans, pinyon nuts, and various cacti. Important but less utilized plants included various seeds, wild fruits and berries, tubers, roots, and greens. Women were instrumental in the collection and preparation of vegetal foods.

Cahuilla culture and society remained stable during the period of missionization on the coast. It was not until the American period that Cahuilla were heavily displaced. The introduction of European diseases, greatly reduced the native population of southern California and further disrupted the way of life of the native inhabitants.

Instrumental in the subsistence of the Kamia and the Cahuilla was the presence in their territory of Lake Cahuilla. Lake Cahuilla was a freshwater lake created when the Colorado River changed course from the delta into the Salton Sink and covered much of the Imperial Valley. Based on the course of the Colorado River, the lake would advance and recede numerous times throughout prehistory. When the lake receded, prehistoric people followed the receding shoreline, leaving remains of their habitation as they went. The lake would have provided the opportunity for nearly year round exploitation of floral and faunal resources and research has shown a heavy representation of shellfish, fish, aquatic birds and plant materials from sites excavated along the edge of the lake (Moratto 1984: 407). According to Cleland et al. (1997):

> The most widely accepted chronology for the stands of Lake Cahuilla (Waters 1983) identifies a series of four lake stands occurring over the past 1,500 years. The first is thought to have begun at about A.D. 700 and ended around A.D. 940, with full desiccation. The second interval is not directly dated but based on estimated sedimentation and evaporation rates is inferred to have occurred sometime between A.D. 940 and 1210, again with complete desiccation. The third interval is thought to have begun around A.D. 1210, with a partial recession to about -130 feet below sea level at about A.D. 1430. At this time the lake began to fill again, initiating the fourth interval; this interval is estimated to have terminated around A.D. 1540 based on sedimentation and evaporation rates, as well as the lack of any direct observation of the lake by Spanish explorers traveling through the area after that time. More recently, a fifth interval has been proposed based on archaeological data from a site on a recessional shoreline. This is believed to have been a partial infilling occurring sometime between A.D. 1516 and 1659 (Schaefer 1994).

The overall picture of subsistence around Lake Cahuilla suggest that the Kamia and Cahuilla, along with possibly some of the Colorado River peoples are responsible for the sites located along the lake stand shorelines. Sites excavated on the shoreline tend be shallow with low artifact quantities and diversity, and are indicative of temporary occupation. It has been suggested that groups came down from the mountains or canyons to the west and seasonally collected and processed fish and other fauna onsite before moving on to other resource locations (Apple et al. 1997).

The extent to which the Kamia practiced agriculture at the time of European contact has not been established. Gifford (1931) felt that agriculture, which had been well established among the Colorado River groups at the time of Western influence, had diffused into the Imperial Valley and was practiced by all of the Kamia lineages. Similarly, Lawton and Bean (1968) have suggested that certain Cahuilla groups cultivated corn, beans, squash and melons, like the neighboring Colorado River tribes.

Kamia culture and society remained stable during the period of missionization on the coast. It was not until the American period that Kamia were heavily displaced. The introduction of European diseases greatly reduced the native population of southern California and further disrupted the way of life of the native inhabitants.

Historic/Contact Period

Cultural activities within Imperial County between the late 1700s and the present provide a record of Native American, Spanish, Mexican, and American control, occupation, and land use. An abbreviated history of the region is presented for the purpose of providing a background on the presence, chronological significance, and historical relationship of cultural resources within the county.

Native American control of the southern California region ended in the political views of western nations with Spanish colonization of the area beginning in 1769. However, Native American control of the majority of California did not end until several decades later. In southern California Euroamerican control was firmly established by the end of the Garra uprising in the early 1850s (Phillips 1975).

The Spanish Period (1752-1821) represents a period of Euroamerican exploration and settlement. The first Europeans to arrive in this region were the Spanish, who traveled along the California Coast by ships establishing settlements and missions to secure their hold on California. Using these same ships, they traveled around the *Golfo de California* and up the Colorado River, establishing additional settlements at inland locations, such as Tubac south of modern Tucson. Communication between the coastal settlements and those in modern Arizona were slow due to the long ocean journey and the Spanish decided to pursue an a shorter and quicker overland route. In 1772, Pedro Fages, *Commandante* of California, pursued several deserters into the arid territory from his headquarters in San Diego. Fages was perhaps the first white person to see the Imperial Valley. At about the same time, Juan Bautista de Anza was *Commandante* of the Spanish settlement of Tubac. In 1774, Anza received permission to explore the Gila and Colorado rivers in search of a trans-desert route. His journey from Tubac to the San Gabriel Mission in California took approximately three months. Portions of Anza’s route were used for mail delivery by the Spanish and ran through Imperial Valley to what is now Riverside County and beyond. However, hostilities broke out between the Spanish and Colorado River tribes in 1781 and the route was abandoned (Nixon 2010). The cultural and institutional systems established by the Spanish continued beyond the year 1821, when California came under Mexican rule. During this period the Native American populations of the Colorado Desert remained relatively unaffected due to their isolation from the coast (Bean 1972).

The Mexican Period (1821-1848) includes the retention of many Spanish institutions and laws. During this period the Romero Expedition passed through Cahuilla territory looking for a new route to the Colorado River. They provided some of the earliest records of Cahuilla culture. The mission system was secularized in 1834 which dispossessed many Native Americans and increased Mexican settlement. After secularization, large tracts of land were granted to individuals and families and the rancho system was established. Cattle ranching dominated other agricultural during the early part of this period. The Pueblo of Los Angeles was established during this period and Native American influence and control greatly declined. The Mexican

Period ended when Mexico ceded California to the United States after the Mexican-American War of 1846-48 (Nixon 2010).

The American Period (1848-Present) began following the Mexican-American War, the U.S. assumed control of the area. Not much changed with transfer of governmental power until 1849 when gold was discovered in California. The ensuing gold rush brought an estimated 70,000 people through the desert on their way to the gold fields of northern California. Many of these people traveled along the Southern Emigrant Trail which itself was an appropriation of older Native American trails. Afterwards, gold strikes in the eastern portion of Imperial County during the early 1850s attracted some mining interests. However, few settled in the Imperial Valley.

In the 1870s, interest in the area began to pick up as the U.S. Government sent out surveying parties to investigate the potential agricultural uses of the Colorado River. It was during this time that Southern Pacific Railroad completed its line through the desert to Yuma. During the 1880s and 1890s, Imperial Valley was used as grazing lands for herds that would feed on grasses grown in areas fed by overflow from the Colorado River. However, there were few wells in Imperial Valley and most of the water had to be imported by rail from Coachella Valley. It was not until the shortage of water in the valley was overcome that white settlement in the valley began to rise (Sperry 1975). As early as the 1850s, plans to irrigate the valley using water from the Colorado River had been developed but it wasn't until the turn of the 20th century that work was begun on the Alamo Canal. The Alamo Canal coursed along the U.S-Mexico border, crossing into Mexico then back into the U.S. This required cooperation and permission from both nations' governments. From the completion of the Alamo canal in 1902 to the year 1905, the population of Imperial Valley jumped from a few hundred to 12,000 and arable land increased from 1,500 acres to 67,000 acres (City of El Centro 2010). The new water source helped to establish cities such as El Centro, Imperial, Brawley and Niland.

The Salton Sea was created in 1905 when the Colorado River breached an Imperial Valley diversion channel and began to fill the Salton Sink. Although, catastrophic for some of the residents of the valley, it created a new source of water for residents of the valley. Once the breach was closed in 1907, the population of the valley continued growing. Political instability in Mexico necessitated the construction of another canal built completely on United States soil to ensure a reliable source of water to the farmers of the Imperial Valley. The All-American canal was built to meet this need in years from 1934-1940. The completion of the All-American canal and its four tributaries, the Coachella Canal, East Highline Canal, Central Canal, and Westside Main Canal finally established a stable source of water that would reach throughout the valley. The Coachella Canal, completed in 1949, runs adjacent to portions of the project area. The construction of these canals allowed for the expansion of agriculture and reclamation of the land. Agriculture continues to dominate the region's land use, including neighboring sections.

C. PRIOR RESEARCH

The archaeological inventory includes archival and other background studies, in addition to Tierra's field survey for the project. The archival research consisted of a literature and records search conducted for the project in addition to an examination of historic maps, and historic site inventories. This information was used to identify previously recorded resources and to determine the types of resources that might occur in the survey area. The methods and results of the archival research are described below.

The records search indicated that 10 archaeological studies have been conducted within a one-mile radius of the current project. Five of those studies covered a portion of the project area. Four of these were regional overviews of the general area and only one, Sowell 2005, surveyed a portion of Section 27. This survey covered less than five percent of the project area. See Table 1 for a list of these investigations.

Eighteen previously recorded resources have been identified within a one-mile radius of Section 27. This includes CA-IMP-68, which was originally recorded as site C-20 in 1920 and 1939 by Malcolm Rogers. Since that time seven other resources (CA-IMP-118, CA-IMP-6659, CA-IMP-7866, and CA-IMP-8479 through 8482) were identified nearby and subsumed into the record for CA-IMP-68. The site is located at the edge of West Mesa along the old shoreline of Lake Cahuilla and extending west and below sea level. Rogers identified the resource as a village site, ¾ of a mile long along the 10-foot contour line. The site included housepits and freshwater mussel shell deposits. In 1951 Stuart Peck, using Roger's information, further recorded the site. Cremations were located within the site's boundaries along projectile points, knives, scrapers, pottery, shell, bone, metates, manos and painted pebbles. The artifacts were collected and stored at the San Diego Museum of Man. It appears that the site forms were updated in the 1990s using information from a 1951 update to fill in some of the data that was missing when Rogers first recorded the site. The records show the site to be 1400m long east/west and 800m north/south with the sea level contour being its furthest extent west. The site was identified as nearly destroyed at that time and later forms record this as well. CA-IMP-118 is the same as CA-IMP-68 but was erroneously given a new trinomial. It appears that the CA-IMP-68 designation was for Peck's 1951 update and CA-IMP-118 was based on Roger's notes for the same site. Both sets of site forms use the same data with the records from Peck being more complete. For example Roger's did not note the mussel shell midden or cremations that Peck found in 1951. However, the location mapping of the site on the USGS map is different. Neither of the maps are from the original recording of the site but appear to be boundaries based on the field notes and assigned by latter researchers. The remaining sites subsumed under CA-IMP-68 (sites CA-IMP-6659, CA-IMP-7866, and CA-IMP-8479 through 8482) are located in Section 26. With the exception of CA-IMP-6659, the sites were recorded during a BLM survey of land which was transferred to the County of Imperial for the currently operating Niland Landfill in 1999. The sites are comprised of individual sparse lithic and ceramic scatters.

A sensitivity map for cultural resources, prepared by Mr. Jay Von Werlhof in 1990 and presented in the County of Imperial General Plan, indicated that areas along the base of East Mesa to the East Highline Canal are very sensitive for cultural resources. Historic research included an examination of a variety of resources. The current listings of the National Register of Historic Places were checked through the National Register of Historic Places website. The California Inventory of Historic Resources and the California Historical Landmarks were also checked for historic resources.

A letter was sent to Mr. David Singleton at the Native American Heritage Commission to request a search of the sacred lands in regards to the project area on May 11, 2010. Mr. Singleton responded on May 24, 2010 that no previously identified cultural resources were known to be in the vicinity of the project area. He included a list of 11 groups or individuals associated with local Native American Tribes who may have information regarding cultural resources in the area. It is recommended that once specific project locations have been defined that letters to the 11 groups or individuals should be sent out notifying them of the project. The letter to Mr. Singleton and his response are included in Appendix B.

Table 1. Previously Recorded Cultural Investigations Within a One-Mile Radius of the Project Area

Date	Title	Author
1981	Volume I - Salton Sea Anomaly Master Environmental Impact Report and Magma Power Plant #3 (49MW) Environmental Impact Report Draft	Westec
1981	Final Salton Sea Anomaly Master Environmental Impact Report and Magma Power Plant #3 (49MW) Environmental Impact Report Comments and Responses	Westec
1981	Final Salton Sea Anomaly Master Environmental Impact Report and Magma Power Plant #3 (49MW) Environmental Impact Report Volume I	Westec
1983	Archaeological Examinations of the Republic Geothermal, Inc., 49 MW Plant Site Near the Salton Sea	Won Werlhof
1999	Draft Historic and Archaeological Resources Protection (HARP) Plan for the Chocolate Mountain Aerial Gunnery Range, Imperial County, CA	McCorkle-Apple, Cleland
2001	Draft Northern & Eastern Colorado Desert Coordinated Management Plan and Environmental Impact Statement - An Amendment to the California Desert Conservation Area Plan 1980 and Sikes Act Plan with the California Department of Fish and Game	BLM, CA DFG
2002	Evaluation of 24 FARP Archaeological Sites and Assessment of Training Effects, Chocolate Mountains Aerial Gunnery Range, Imperial County, CA	McCorkle-Apple, Deis
2003	Archaeological Survey of the Sniper Range at Camp Billy Machen Chocolate Mountains Aerial Gunnery Range, Imperial County, CA	Underwood
2003	A Class III Cultural Resource Inventory and Evaluation for the Coachella Canal Lining Project: Prehistoric and Historic Sites Along the Northern Shore of Ancient Lake Cahuilla, Imperial and Riverside Counties, CA	Schaeffer et al.
2005*	SCG Class II Project: Pipeline Erosion Repair, Niland, Imperial County	Sowell
* Investigations encompassing portions of the current effort.		

Table 2. Previously Recorded Cultural Resources Located Within a One-Mile Radius of the Project Area

Site No.	Description	Recorder	CEQA Eligibility
CA-IMP-00068	Habitation Site: Cremation, Groundstone, Lithic-Pottery Scatters, Shell, Painted Pebbles, Points, Hearths, Slabs	Rogers, Peck	N
CA-IMP-00118	Subsumed under CA-IMP-00068, Shell Midden and House Pits	Rogers	N
CA-IMP-01142	Trail and Lithic Scatter	Ritter	U
CA-IMP-06506	Lithic Scatter	Von Werlhof	U
CA-IMP-06507	Occupation Site	Von Werlhof	U
CA-IMP-06653	Ceramic Scatter	Simmons	N
CA-IMP-06654	Occupation Site	Simmons	N
CA-IMP-06655	Lithic and Ceramic Scatter	Simmons	N
CA-IMP-06656	Lithic Scatter	Simmons	N
CA-IMP-06657	Ceramic Scatter	Simmons	U
CA-IMP-06658	Temporary Campsite	Simmons	N
CA-IMP-06659	Rock Circle with sherd and lithic, Subsumed under CA-IMP-00068	Simmons	U
CA-IMP-06889	Isolate: Lithic	Posner, Broeker	N
CA-IMP-07866	Lithic Scatter, Subsumed under CA-IMP-00068	Oxendine, Hangan	U
CA-IMP-08479	Lithic Scatter, Subsumed under CA-IMP-00068	Oxendine, Hangan	U
CA-IMP-08480	Lithic Scatter, Subsumed under CA-IMP-00068	Oxendine, Hangan	U
CA-IMP-08481	Lithic Scatter, Subsumed under CA-IMP-00068	Oxendine, Hangan	U
CA-IMP-08482	Lithic Scatter, Subsumed under CA-IMP-00068	Oxendine, Hangan	P
U - Unknown P - Possibly Eligible N - Not Eligible O - On Register			

III. RESEARCH DESIGN AND METHODS

A. SURVEY RESEARCH DESIGN

The initial goal was to identify any cultural resources located within the project area so that effects of the project could be assessed. To accomplish this goal, background information was examined and assessed, and a field survey was conducted to identify cultural remains. The proximity to important water resources and an ethnographic village suggest the potential for prehistoric Native American cultural resources. Both historical and prehistoric resources were the focus of the field survey.

B. SURVEY METHODS

The survey of the project area was conducted by Mr. Patrick McGinnis, Ms. Hillary Murphy, Dr. Jackson Underwood, Ms. Eliza McMichael, Mr. James Amick, Mr. Aaron Cruz, and Mr. Martin Nienstadt during April 6-9, 2010. An intensive survey using parallel transects with 10 to 15 meter intervals was conducted throughout the project area. Visibility in the project area was excellent with few hindrances. Vegetation in the project area was sparse and the ground surface was open with nearly 100 percent visibility. Much of the project area has been disturbed particularly in the eastern half of Section 27, but numerous areas have been previously cut by bulldozers or grubbed and vegetation has only recently begun to re-establish itself. Two GPS units were running during the entire survey and used to maintain transect integrity and record cultural resources locations.

IV. SURVEY RESULTS

A total area of 640-acres was surveyed for this project. Eighteen cultural resources were located during the survey. These resources include five prehistoric archaeological sites, three historic can dumps, two prehistoric trails, and eight prehistoric isolates. The prehistoric sites are ceramic and lithic scatters or temporary camps. The isolates include cores, flakes, and potsherds. Full descriptions of the resources are provided below. Figure 3 illustrates the location of the resources on a USGS topographic map.

Isolates

OS27-1
This resource is an isolated buffware sherd measuring approximately 9.5cm by 7.8cm and 0.4cm thick. The sherd is somewhat reddish in color and was located in a relatively flat and open gravelly wash with creosote scrub habitat.

OS27-2
This resource consists of two isolated pot sherds separated by approximately 25cm that exhibit fire-clouds on their exterior surfaces. The artifacts appear to be from the same vessel. The sherds are reddish in color and located in a relatively flat and open gravelly wash with creosote scrub habitat.

OS27-3
OS27-3 is an isolated chunk of obsidian. The rock does not appear to have been altered but is a manuport brought in from off-site. The obsidian is the Obsidian Butte variety and Obsidian Butte itself is located a little over 10 miles to the southwest.

OS27-5
An isolated potsherd, OS27-5 is small measuring 2.9x2.1x.4cm. It doesn't appear to have been used for cooking as there is no evidence of carbon on its interior. It is located on a gravelly wash just east a dirt access road dividing Sections 27 and 28.

OS27-8
OS27-8 is an isolated flake of reddish basalt. The flake appears to have been struck during the primary reduction phase as it has cortex present on the distal end. It is possibly the result of a cobble test or geofact. The artifact measures 8.4 cm by 7 cm by 3.6 cm thick.

OS27-11
This resource is an isolated jasper core fragment. The fragment measures approximately 2.7 cm by 1.8 cm. The core fragment is located on an alluvial fan with open creosote scrub habitat.

Sites

IMP-68/118

CA-IMP-68/118 no longer appears to exist within Section 27. The collection of the site by Rogers coupled with earthmoving activities related to the construction of the Niland Landfill and Gas Line Road, are likely to have destroyed most, if not all of the site. Roughly, 300 to 500 feet on either side of Gas Line Road has been heavily disturbed and there are numerous large push piles, dump piles of construction materials, cuts, and graded areas adjacent to the road. Based on site record information, the main concentration of the original site was roughly in the area where the Niland Landfill now sits. Additionally, it appears that whoever mapped the site did so based on landform contours, not the actual location of artifacts or midden soils. It appears more likely that the mapped location of the site was based on a recollection of the location rather than mapped in the field. Because of the richness of the site, despite Roger's collecting the site surface in the 1920s, one would still expect to find a number of artifacts, midden soils, and fire-affected rock that would have been exposed in the intervening 70-80 years. Yet, no such evidence of extended long-term occupation was found within recorded sites boundaries located in Section 27. Therefore, it can only be concluded that the portion of the site within Section 27 has either been destroyed or was incorrectly mapped by earlier researchers. Figure 4 shows the disturbed areas within Section 27 along with the boundary of CA-IMP-68 with the section.

During the current effort the survey of the site located three ceramic scatters (OS27-12, OS-14 and OS-17), two isolated potsherds (OS27-9 and OS27-13) and two can dumps (OS-27-10 and OS27-18) within the previously identified boundaries of CA-IMP-68/118. However, none of these resources appear to be associated with one another as a larger site and appear to be independent activity areas. The resources do not appear to be remnants of a previously collected village site and do not possess any midden or other evidence of extended occupation. The sites appear to be short-term campsites at best. The can dumps are not considered part of CA-IMP-68/118, as it was recorded as a prehistoric site. The can dumps are obviously unrelated but within the previously recorded boundaries of CA-IMP-68/118. The remaining resources are discussed with their temporary number designations in the paragraphs immediately below.

OS27-9

This artifact is an isolated buffware body sherd. The sherd has been very eroded by the wind with fire-clouding on the exterior still visible. It was located in a gravelly wash.

OS27-12

This resource is comprised of a ceramic scatter. Twelve brownware sherds, seemingly from the same vessel, are located within four meters on an East/West axis. All of the sherds are body pieces ranging from the smallest (2.3x1.5cm) to the largest (6x4.5cm). None of the sherds are fire-affected and all have a medium to coarse grain temper. This site is located on a gravelly wash among a creosote scrub community.

OS27-13
OS-13 is an isolated buffware body sherd. The sherd is reddish in color and measures 6.7cm by 4cm by 1.1cm thick. The artifact was located in an area of open creosote scrub.

OS27-14
This resource is a large ceramic scatter located on creosote scrub habitat in an open floodplain. The site location is flat. The site contains over 100 sherds that are predominately buffware with a few brownware-like sherds as well. A single rhyolite flake and some burned sandstone were also present within the site's boundaries. Approximately 14 of the sherds were rim sherds and one of these had finger-nail indentations incised on the edge. The site measures approximately 30m by 40 m.

OS27-17
This site is a scatter of seven brownware pot sherds and two buffware sherds along with a few pieces of burned sandstone. The site is located in a very disturbed area west of the Niland landfill and the deposition of the artifacts is secondary as they sit atop a push pile.

Previously Unrecorded Sites

OS27-4
This resource is a 10 m segment of a prehistoric trail. The trail is approximately 45 cm wide and runs along an east/west axis in a gravelly wash. The rest of the trail appears to have been washed away in the immediate area.

OS27-6
This resource is a light scatter of historic cans and metal fragments extending approximately ten feet in diameter. Specific artifacts include condensed milk cans with side seams (3+), hole in top cans, a metal strap, a leaf spring, and handle. Based on the diagnostic features of the artifacts the site dates to somewhere between the 1930s and the 1950s. The site is located immediately east of the dirt access road that divides Section 28 from 27 at the southern end.

OS27-7
This resource is a 50 m segment of what appears to be a prehistoric trail but maybe more modern in age. The trail is approximately 45 cm wide and runs along an east/west axis along the floodplain in creosote scrub habitat. An ephemeral drainage surrounds the segment and the rest of the trail appears to have been washed away in the immediate area.

OS27-10
This resource consists of a can dump extending 11 feet N/S x 15 feet E/W. The site is located approximately 10 meters northwest of a large drainage and 70 meters west of Gas Line Rd. The historic refuse deposit consists of 30 + vent-hole, sanitary, condensed milk cans. Some had been opened with a church-key, others by a knife. Crimped ends and seams were evident on most of the cans. Additionally, condiment bottles, a ceramic whiteware cup, a sardine can, bottle glass

fragments, and Lakeshore honey bottle fragments with a honeycomb pattern on them were also located on-site.

Fragments of bottles with the Glass Containers Corp. maker's mark were located on site. The company was originally The Long Beach Glass Co. but changed names after being purchased in 1936 to Glass Containers Corp. The company moved from southern California to the San Francisco bay area in 1951. The particular maker's mark found at this site dates from 1945 to 1971. Maywood Glass Co. fragments were also located at this site. Dating from 1930 to 1961, this particular mark denotes fabrication circa 1940 out of Compton, California.

OS27-15

This site is prehistoric camp spread out along finger ridges left behind in the silt floor of Lake Cahuilla as it last receded. These ridges are steep sided, narrow on the top (less than ten meters wide), generally less than 10 meters high and may have multiple branches. OS27-15 runs along three connected branches. The site contains at least 75 buffware sherds and 36 brownware sherds. Of the buffware sherds, 16 are rim fragments. The rim sherds represented a number of vessel types including plate/bowls, wide-mouth ollas, and narrow-mouth ollas. Lithic tools on-site include at least four cores and a utilized flake. Over 125 flakes were located within site boundaries; the largest amount being secondary flakes followed by tertiary, and shatter indicating that materials were being brought to the site after primary reduction had already taken place. The lithic materials include a variety of cherts, metavolcanics, chalcedony, basalt, and quartzite. There are also three cleared circles under 2 meters in diameter in the central and most densely concentrated portion of the site. A fourth cleared circle of the same approximate size is located at the far north end of the site. The cleared circles are, as the name implies, circular areas where the gravels on the surface have been cleared away and form a boundary on the outside of the circle.

OS27-16

This site is located on a finger ridgeline, almost identical to OS27-15, which is located 100 meters to the east. The site is similar to OS-15 in the types and dispersal of artifacts. However, OS27-16 has no cleared circles and less range and density of artifacts than at OS27-15. A total of 75 buffware sherds were identified at the site including three rim sherds. No brownware sherds were identified. Lithics included two cores, an edge modified flake and 23 flakes. The flakes are primarily rhyolite (n=11) and red chert (n=8). Secondary flakes accounted for 15 out of the 23 flakes with primary and tertiary flakes accounting for four each. At the north end of the site a rock ring exists consisting of approximately 25-30 small tabular sandstone rocks set on end and measuring approximately 15cm high. The ring has an inner diameter of approximately 1m and is 2-3 courses of stone thick. The stones are not very embedded into the ground which denotes that the ring may be have been made at a later date than the rest of the site.

OS27-18

This resource is a trash dump of historic materials with more modern trash mixed in. The site measures 17 feet by 45 feet. Artifacts on site include aqua bottle glass, clear bottle glass, tin sardine cans, solder drop cans, condensed milk cans and sanitary cans. At least 50 cans are present. Some, but not all, of the cans have been opened with church-keys. Other refuse includes oil filters, bearings, engine bolts, aerosol cans and rectangular one-quart solvent cans. The site appears to date to sometime after the Second World War and before the late-1960s.

Figure 3. Cultural Resources Within the Project Area Map
(Confidential Figure; Bound Separately)

Figure 4 Disturbed Areas Within Project Area
(Confidential Figure; Bound Separately)

V. SUMMARY AND RECOMMENDATIONS

A. REGULATORY BACKGROUND

Cultural resource work was conducted in accordance with the California Environmental Quality Act (CEQA) and it respective guidelines and regulations. The County of Imperial serves as the lead agency for CEQA compliance. The importance of cultural resources under State law as defined in CEQA has been refined to coincide with those of the California Register. The criteria used to evaluate cultural resources are specified by recent revisions to CEQA. Specific to cultural resources is Section 15064.5. "Determining the Significance of Impacts to Archeological and Historical Resources."

This section introduces the term "historical resources" defining them as:

(1) A resource listed in, or determined to be eligible by the State Historical Resources Commission, for listing in the California Register of Historical Resources (Pub. Res. Code SS5024.1, Title 14 CCR, Section 4850 et seq.).

(2) A resource included in a local register of historical resources, as defined in section 5020.1(k) of the Public Resources Code or identified as significant in an historical resource survey meeting the requirements section 5024.1(g) of the Public Resources Code, shall be presumed to be historically or culturally significant. Public agencies must treat any such resource as significant unless the preponderance of evidence demonstrates that it is not historically or culturally significant.

(3) Any object, building, structure, site, area, place, record, or manuscript which a lead agency determines to be historically significant or significant in the architectural, engineering, scientific, economic, agricultural, educational, social, political, military, or cultural annals of California may be considered to be an historical resource, provided the lead agency's determination is supported by substantial evidence in light of the whole record. Generally, a resource shall be considered by the lead agency to be "historically significant" if the resource meets the criteria for listing on the California Register of Historical Resources (Pub. Res. Code SS5024.1, Title 14 CCR, Section 4852) including the following:

(A) Is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage;

(B) Is associated with the lives of persons important in our past;

(C) Embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of an important creative individual, or possesses high artistic values; or

(D) Has yielded, or may be likely to yield, information important in prehistory or history.

(4) The fact that a resource is not listed in, or determined to be eligible for listing in the California Register of Historical Resources, not included in a local register of historical resources (pursuant to section 5020.1(k) of the Public Resources Code), or identified in an historical resources survey (meeting the criteria in section 5024.1(g) of the Public Resources Code) does not preclude a lead agency from determining that the resource may be an historical resource as defined in Public Resources Code sections 5020.1(j) or 5024.1.

B. SUMMARY

Tierra conducted an archaeological investigation of 640 acres proposed for geothermal and solar energy projects. The survey identified eight isolated artifacts, three historic can dumps, three prehistoric ceramic scatters, two prehistoric trail segments, and two temporary camp sites. A previously recorded site CA-IMP-68/118 was not specifically identifiable within the project area; however, two of the isolates, two of the can dumps, and three of the light ceramic scatters were identified within the previously recorded boundaries of the site.

C. RECOMMENDATIONS

By definition, the eight isolates (OS27-1, OS27-2, OS27-3, OS27-5, OS27-8, OS27-9, OS27-11, and OS27-13) lack qualities and characteristics that would make them eligible for nomination to the California Register and are considered non-significant resources. Additionally, the three can dumps (OS27-6, OS27-10, and OS27-18) lack qualities and characteristics that would make them eligible for nomination to the California Register. The recording of these resources has exhausted any research potential they might have and the three dumps are considered non-significant resources. No further work is recommended for these resources.

One ceramic scatter (OS27-17), located within the boundaries of CA-IMP-68/118 as it was originally recorded, has been displaced from its original setting through earth-moving. Any integrity or potential significance associated with the site was destroyed when the artifacts were moved out of their original and unknown location. Therefore, OS27-17 is not recommended as eligible for the California Register. The ceramic sherds should be collected and no further work is necessary for OS27-17.

Impacts to the two trail segments (OS-27-4 and OS27-7) should be avoided. Should construction be planned within 100m of the sites, measures should be undertaken so that impacts to the trails will not occur. This can be accomplished by establishing a 20m buffer around the sites and flagging the buffer once project construction begins.

Sites, OS27-12, OS27-14, OS27-15, and OS-16 have not been evaluated for their potential eligibility for the California Register. Based on the surface expression of artifacts and associated features the four sites may possess the characteristics and qualities necessary for inclusion on the California Register. As such, impacts to these resources should be avoided and this can be done in the manner outlined for the trail segments above. Should construction be planned within 100m of the sites, measures should be undertaken so that impacts to the resources will not occur. This can be accomplished by establishing a 20m buffer around the sites and temporarily fencing the buffer once project construction begins. Construction crews should be made aware that the fenced area is sensitive and must be avoided.

If impacts to sites OS27-12, OS27-14, OS27-15, and OS-16 cannot be avoided the sites will need to be tested and evaluated for their eligibility for the California Register. If the testing and evaluation of the sites determines that are eligible for the California Register, a data recovery program will need to be implemented to mitigate for potential impacts.

CA-IMP-68/118 was not relocated within the previously mapped boundaries within Section 27. As the site was not relocated, impacts to the site are currently impossible to determine and a tests and evaluation of the site as it was originally mapped are unfeasible based on the results of the current survey. Mitigation for any possible impacts to the site can be undertaken by the identification and cataloguing of the artifacts collected by Malcolm Rogers in the 1920s. Cataloguing the artifacts would provide a measure of information that may help our understanding of what might have been present in the project area and increase our knowledge of the prehistory of Lake Cahuilla.

Additionally, archaeological and Native American monitors should be present for initial earth disturbing activities within the recorded boundaries of CA-IMP-68 and at sites OS27-12, OS27-14, OS27-15, and OS-16. Should previously unrecorded resources be identified during ground disturbing activities, the monitor(s) should have the authority to halt and redirect such activities until the significance of the find can be determined by the Principal Investigator in consultation with County staff. See Table 3 for resources located within the project area and recommended mitigation measures.

Table 3. Cultural Resources Located Within Section 27 and Recommended Mitigation

Site	Description	Recommended as California Register Eligible	Recommended Mitigation
CA-IMP-68/118	Large habitation/village site	No	Catalog previously collected artifacts, Monitor
OS27-1	Isolate buff pot sherd	No	None
OS27-2	Isolate buff pot sherds	No	None
OS27-3	Obsidian chunk manuport	No	None
OS27-4	Trail segment, 10 meters long	Possibly	Avoidance
OS27-5	Isolate buff pot sherd	No	None
OS27-6	Historic can dump	No	None
OS27-7	Trail segment, 25 meters long	Possibly	Avoidance
OS27-8	Isolate secondary flake	No	None
OS27-9	Isolate buff pot sherd	No	None
OS27-10	Historic can dump	No	None
OS27-11	Isolate jasper core fragment	No	None
OS27-12	Ceramic scatter	Possibly	Avoidance or Test and Evaluate, Monitor
OS27-13	Isolate buff pot sherd	No	None
OS27-14	Large ceramic scatter	Possibly	Avoidance or Test and Evaluate, Monitor
OS27-15	Ceramic and lithic scatter with cleared circles	Possibly	Avoidance or Test and Evaluate, Monitor
OS27-16	Ceramic and lithic scatter with a rock circle	Possibly	Avoidance or Test and Evaluate, Monitor
OS27-17	Ceramic scatter	No	None
OS27-18	Historic can dump	No	None

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APPENDICES

A. Resumes of Principal Personnel

B. Native American Contact

CONFIDENTIAL APPENDICES (Bound Separately: Not for Public Review)

C. Records Search Results

D. Figure 3

E. Department of Parks and Recreation Site Forms

APPENDIX A

Resumes of Principal Personnel

PATRICK M. McGINNIS, M.A., RPA

Senior Archaeologist
Tierra Environmental Services

Education

M.A. Archaeology and Heritage Management , University of Leicester, England,
B.A., Anthropology with a concentration in Archaeology, with honors, University of California, San Diego,
Certificate in Archaeology, San Diego City College

Professional Affiliations

Register of Professional Archaeologists
Society for California Archaeology
San Diego County Archaeological Society (Past Secretary)
San Diego Historical Society
Wheelwright Museum of the American Indian
Archaeological Conservancy
National Trust for Historic Preservation

Qualifications

Mr. McGinnis has more than ten years experience in prehistoric and historic archaeology in southern California and the Southwest. He serves as supervisor and crew for fieldwork including survey, testing, data recovery, monitoring, site recording, in addition to supervising lab analysis, and collections management. He has training in GPS/GIS mapping and spatial analysis and has surveyed and monitored for endangered biological resources including Quino checkerspot butterfly, least Bell's vireo, and California gnatcatcher. He has received training in compliance with the National Environmental Policy Act (NEPA) and Section 106 of the National Historic Preservation Act (NHPA) of 1966. His duties also include report writing and historical research projects.

Professional Experience

2002-present	Senior Archaeologist, Tierra Environmental Services, Inc.
2002	Archaeologist/Environmental Scientist, Anteon Corporation, California
1997 - 2002	Archaeologist, Mooney & Associates, San Diego, California.
1997	Archaeological field and lab crew, Center for Spanish Colonial Archaeology, San Diego, California.
1996 - 1997	Archaeology Field School, Rancho Peñasquitos site, with San Diego City College.

Relevant Projects

City of San Diego Sewer Group 744
Mr. McGinnis served as Project Archaeologist for the replacement or rehabilitation of over 14,000 feet of sewer line in the Barrio Logan community of San Diego. Mr. McGinnis' duties included directing the cultural resources survey, authorship of a historic preservation plan for historic-age sidewalk stamps, and over seeing the daily monitoring of the six-month long project. The monitoring program resulted in the identification of ten cultural resources including prehistoric and historic resources. Mr. McGinnis was responsible for participating in several community and public agency meetings. Duties also included identification, analysis and curation of all artifacts recovered during construction and authorship of the final technical report.

City of San Diego Coastal Low Flow Drainage Project
Mr. McGinnis served Senior Archaeologist and report author for a survey and monitoring report of proposed drain improvements. The project included a portion of a major prehistoric village site and construction monitoring was implemented to address potentially intact portions of this site under an existing street.

I-215/ Van Buren Avenue Interchange Replacement Project
Mr. McGinnis served as Principal Investigator for a cultural resources survey of over 70-acres associated with replacement of the Van Buren Avenue interchange and portions of Interstate 215 in Riverside County. Mr. McGinnis' duties included consultation with interested Native American groups, field direction of the cultural resources survey, and completion of the NEPA and CEQA documents.

Friendship March Restoration Project
Mr. McGinnis served as project archaeologist for a survey and test of 500-acres of land in the Tijuana Estuary for the restoration of the marsh habitat of the area. The survey required permitting and interaction with both State and Federal agencies. Project duties also included directing the excavation of 49 backhoe trenches to locate potentially buried archaeological deposits as index for the project area in general. The survey resulted in the location of ten prehistoric and historic archaeological sites. Sites included prehistoric shell middens and lithic scatters in addition to historic sites; including features related to the use of the area as a naval base during WWII, and historic structures and features related to the period of rural when the area was dominated by ranching and farming. Mr. McGinnis was responsible for the laboratory analysis of the artifacts recovered from the project and directed the cleaning and curation of the assemblages from the identified sites. Mr. McGinnis and served as report co-author of the NEPA and CEQA compliant documents.

Willow Street Bridge Rehabilitation Project
Mr. McGinnis served as Principal Investigator for the rehabilitation of Willow Street Bridge over the Sweetwater River in Bonita, California. In addition to directing the survey and authoring the reports Mr. McGinnis also conducted Native American consultation with local Native American tribes in association with any concerns they may have had regarding implementation of the project.

El Camino Real Bridge Replacement
Mr. McGinnis served as Project Archaeologist for this project directing multiple surveys of over 100-acres of land associated with the replacement of the El Camino Real Bridge over the San Dieguito River. The project included evaluation of prehistoric archaeological sites, historic research and evaluation of a number of historic buildings.

Morongo Reservation Wastewater Treatment Facility and Section 8 Master Plan
As Project Archaeologist, Mr. McGinnis directed a survey of approximately 700-acres on the Morongo Indian Reservation in association with a master plan and proposed wastewater treatment facility for the Morongo Band of Mission Indians. Duties included directing the field survey, site recording and authorship of the report.

Pine Valley Estates
Mr. McGinnis directed a survey of 38-acres for a proposed subdivision in the Pine Valley area of San Diego County. The survey resulted in recording seven prehistoric cultural resources. The sites were mostly large bedrock milling sites with multiple loci. Mr. McGinnis also served as report author for a County and CEQA compliant technical report.

Manzanita Reservation Hazardous Fuels Reduction Project
Mr. McGinnis served as project archaeologist for a survey of 1,000-acres of fee-land for the Manzanita Band of Mission Indians. The survey covered an area proposed for hazardous fuels reduction via prescribed buring and firebreak construction. The project resulted in the discovery of over 40 previously unrecorded archaeological sites and isolated artifacts. These were dominated by lithic scatters, rock cairns, habitation sites, and included rock rooms. Duties also included site recording and report authorship.

Los Coyotes Reservation-Pines Fire Archaeological Survey and Data Recovery Project
Mr. McGinnis served as Project Archaeologist and directed the survey of over 100 miles of bulldozer cuts. In addition to directing the data recovery effort at two National Register eligible sites, CA-SDI-12,006 and CA-SDI-16,834. Duties also included site recording of eight unrecorded cultural resources, historical and archival research and report authorship.

Rincon Reservation Road Improvements
Mr. McGinnis directed test and evaluation of a historic/prehistoric site in association with proposed road improvements on the Rincon Indian Reservation in northern San Diego County. Duties included survey, mapping , excavation, laboratory analysis of recovered artifacts and report authorship.

Jacumba Water System Rehabilitation Project
Mr. McGinnis directed a survey of over 8,500 linear feet for the project. The survey resulted in the recording of four historic and prehistoric archaeological sites including a turn-of the-century stone house, 1920s hotel, and prehistoric habitation sites. Information from the survey was used to direct the planning effort in order to avoid sensitive cultural resources. Mr. McGinnis also authored the report and supervised monitoring during implementation of the four month project.

Port of San Diego, Harbor Police Facility
Performed archival research and documentation for the historic Port of San Diego, Harbor Police Facility, designed by famed architect William Templeton Johnson including biographical research, title search, architectural assessment and co-authoring the report.

Hartman Residence
Mr. McGinnis conducted a historical assessment of the Hartman Residence in Encinitas, California. The residence is an early-20th century log-house and associated garage. Duties included completion of Department of Parks and Recreation forms for the resource and authorship of the report.

Bureau of Land Management Lawsuit Compliance
Manager for multiple projects for the BLM under this task. Duties included hiring, contract writing, proposal writing and cost estimating. Responsible for multiple employees, data collection, inter-agency communication and coordination, database management and development, and providing the client with weekly and monthly status reports for the project. Subtasks under the contract included monitoring of public land closures for the Ridgecrest and Needles BLM offices, a socio-economic study for a desert conservation area management plan, Saltcedar removal in highly impacted areas, Off-highway vehicle grant writing, construction and soil restoration monitoring and management plans and plant-water studies in the Death Valley Junction area.

Ramona Unified School District
Performed multiple archaeological surveys of school sites for the Ramona Unified School District. Tasks included historic and archival research of the site locations in addition to leading the surveys and co-authoring the reports of the field investigations.

San Diego Unified School District
Conducted field surveys and historic and archival research in association with planned expansion of Lincoln High School in South San Diego. Duties included inventorying and assessment of over 200 homes located within the proposed expansion areas and completion of State Historic Preservation Office forms for the historic resources located within the project area, in addition to contributing to the report.

Sycuan Hazardous Fuels Reduction
Mr. McGinnis served as project archaeologist for a survey of14-acres of fee-land for the Sycuan Band of Mission Indians. The survey covered an area proposed for hazardous fuels reduction via and firebreak construction. The project resulted in the discovery of a previously unrecorded archaeological sites. Duties included site recording and report authorship.

Barona Indian Reservation. Carried out archival research documenting the history of the Barona Band of Kumeyaay Indians. Covering the period just prior to the eviction from their traditional home at El Capitan to the establishment of the Barona and Viejas reservations. Performed laboratory analysis and cataloguing of extensive collection of prehistoric and historic artifacts purchased for the Barona Museum and Cultural Center.

Ramona Municipal Water District, Mount Woodson Pipeline. Directed Phase I and Phase II testing and evaluation of site in Ramona, CA. Assisted in the laboratory analysis of artifacts. Performed site record and literature research for project's prehistoric and historic components, in addition to historic research of the property. Conducted historic research, including oral interviews, literature searches, and tax and title searches to determine past land use. Completed necessary California Department of Parks and Recreation forms for submittal to the State Historic Preservation Office. Co-authored report.

Gregory Mountain Traditional Cultural Place
Completed National Register Nomination forms for Gregory Mountain as a traditional cultural place for the Luiseño Native American community, including archival research and co-authoring the report.

San Diego County Water Authority
Conducted site record and literature searches for multiple projects throughout the county. Directed multiple Phase I surveys and contributed or co-authored multiple reports.

City of San Diego, San Pasqual Valley Leaseholds. Participated in cultural resource surveys of City-owned parcels in the San Pasqual Valley and subsequently participated in the Phase II archaeological testing of prehistoric sites located within the project area. Performed site record, literature, and historic research including tax assessor records, title searches, oral history and biography, for multiple historic cultural resources within the leaseholds in the valley. Completed necessary California Department of Parks and Recreation forms for submittal to the State Historic Preservation Office. Contributed to authorship of the report.

San Diego Wild Animal Park. Participated in the survey, Phase II testing, Phase III data recovery, and lab analysis for multiple sites within the Wild Animal Park leasehold. Contributed to site analyses and final report.

City of San Diego Water and Wastewater Facilities Department. Provided monitoring services for cultural resources during construction trenching operations in several locations for multiple sewer and water pipeline group jobs.

City of Azusa. Performed historic research and inventory of 120 historic properties for evaluation by the City of Azusa. Tasks included**,** photography**,** architectural style identification, and archival literature searches.

San Diego Presidio Archaeology Project. Participated in field excavation and laboratory analysis of Spanish and Mexican period historic artifacts at the San Diego Presidio site, Old Town. Assisted with public education and outreach projects at the excavation.

Santa Barbara Mission. Performed as crew during survey, field excavation, site recording and laboratory analysis of lithic artifacts from the neophyte village at Santa Barbara Mission, Santa Barbara, CA. Participated in recording the historic crypt located beneath the mission. Conducted research using Spanish period records from Mission Santa Barbara archives.

Tubac Presidio Site Field. Performed as crew for excavation and laboratory analysis of prehistoric Hohokam and Spanish Colonial artifacts at the Tubac Presidio site, Tubac, Arizona.

HILLARY MURPHY

Associate Archaeologist
Tierra Environmental Services

Education

Currently working towards Certificate in Archaeology, San Diego City College
B.A., Interior Design with an Art History Minor, California State University, Sacramento
Researching Archaeology graduate programs to earn a Masters degree with the intent of continuing on towards a doctorate program.

Qualifications

Ms. Murphy has a variety of experience in cultural resources management in southern California and Central America. Ms. Murphy has been involved in surveys for a number of infrastructure and development related projects. She has served as crew for fieldwork including survey, testing, data recovery, monitoring, site recording, site and artifact illustration, and lab analysis.

Professional Experience

July 2007- Current	Associate Archaeologist, Tierra Environmental Services, Inc.
June 2007-July 2007	Archaeological field and lab crew, Programme for Belize, Belize
January 2007-June 2007	Archaeology Field School, Rancho Peñasquitos site, CA-SDI-8125 San Diego City College.

Relevant Projects

Campo Homes
Ms. Murphy served as survey crew for six one-acre parcels of land for the prospective new homes of residents in the Campo Indian Reservation. The survey resulted in two sites containing bedrock milling features and lithic scatters. The larger of the two sites containing a massive abundance of both lithic and ceramic scatter, including chalcedony and obsidian. Ms. Murphy authored the site forms and assisted in the preparation of the report.

Santa Ysabel Homes
Served as survey crew for seven parcels of land proposed for the development of single family houses on the Santa Ysabel Indian Reservation. Each parcel surveyed consisted of a one-acre allotment for the housing. One of which resulted in the location of a historic house once used at the Camp Kearny Training Base during World War I, circa 1917-1920. Ms. Murphy assisted in the completion of the report and site forms.

Augustine Land Transfer
Ms. Murphy served as survey crew for the 120-acre land transfer of three parcels on the Augustine Indian Reservation in Coachella, California, which resulted in the location of seven cultural resources including lithic scatters and a potential burial. Historic artifact scatters and deposits was located, as well. Ms. Murphy co-authored the report and site forms.

Truckhaven Geothermal
Ms. Murphy served as survey crew for a survey of 160-acres in the Ocotillo Wells State Vehicle Recreation. The survey resulted in the identification of 64 cultural resources including prehistoric fish traps, World War II era munitions, lithic scatters, historic camp sites, and sherd scatters. Ms. Murphy completed the site forms and assisted in the preparation of the report.

Pine Valley Estates
Ms. Murphy participated in a survey of 38-acres for a proposed subdivision in the Pine Valley area of San Diego County. The survey resulted in recording seven prehistoric cultural resources. The sites were mostly large bedrock milling sites with multiple loci. Ms. Murphy also served as report author for a County and CEQA compliant technical report.

Bergman Subdivision
Ms. Murphy participated in a survey of 10-acres for a proposed subdivision in the Hemet area of Riverside County. The survey resulted in recording two historic cultural resources. The resources included a turn-of -the-century homestead and associated trash deposits. Ms. Murphy also served as report co-author for a County and CEQA compliant technical report.

Jacumba Water System Rehabilitation Project
Ms. Murphy assisted in the survey and monitoring of over 8,500 linear feet for the project. The survey resulted in the recording of seventeen historic and prehistoric archaeological sites including a turn-of the-century stone house, 1920s hotel, and prehistoric habitation sites. Information from the survey was used to direct the planning effort in order to avoid sensitive cultural resources. Ms. Murphy participated in the laboratory analysis of the artifact collection recovered during monitoring for the project. She was responsible for identification and cataloguing of the artifact assemblage.

Niland Waste Water
Ms. Murphy assisted as crew for surveying two linear miles in preparation of new waste water lines and treatment facility to be implemented. She then assisted in the preparation and completion of the report.

Santiago Sedimentation Basin Project
Served as crew for the survey of 21 acres for a housing development upon which two isolated flakes were observed. Ms. Murphy completed the site forms and assisted in the preparation of the report.

Bishop Water System Upgrade
Ms. Murphy authored site forms and participated in the completion of the report for the survey of a new well and water line project that resulted in the location of seven cultural resources.

Ocotillo RV Project
Ms. Murphy assisted in the survey and monitoring of 5-acres proposed for development as an RV storage center. The survey resulted in the recording of two in-situ lithic scatters. Information from the survey was used to direct the planning effort in order to avoid sensitive cultural resources. Ms. Murphy participated in the laboratory analysis of the artifact collection recovered during monitoring for the project. She was responsible for identification and cataloguing of the artifact assemblage.

Programme for Belize, Blue Creek, Belize
Participated in field excavation and laboratory analysis of the University of Texas, Austen's excavation of the third largest Mayan site in Belize, La Milpa, under the supervision of Dr. Fred Valdez Jr. Attempts have been made to understand the chronology of the sites in the northwest region over a period of 15 years.

Rancho Peñasquitos, **CA-SDI-8125**
Participated in the field excavation under the supervision of Dr. Steve Bouscaren to unveil an eighteenth century Spanish zanja in hopes of better understanding the early water works, both agricultural and natural elements, at this historic and prehistoric site.

APPENDIX B

Native American Consultation

TIERRA
ENVIRONMENTAL SERVICES

May 11, 2010

Mr. Dave Singleton
Native American Heritage Commission
915 Capitol Mall, Room 364
Sacramento, CA 95814
(916) 653-4082

Dear Mr. Singleton,

Tierra Environmental Services (Tierra) has been obtained to conduct an intensive archaeological survey of land proposed for geothermal and or solar energy projects. The project area is located northeast of the city of Calipatria in Imperial County, California (Figure 1). The project area is located on the Iris Wash California USGS 7.5' Quadrangles and comprises the entire one-mile square Section 27, in Township 10 South and Range 14 East of the San Bernadino Base Meridian.

In addition to informing you about this project, a major purpose of this letter is to request a search of the sacred lands files in possession of the NAHC. Any information you may have about cultural resources on the property would greatly benefit our study.

If I can provide any additional information, please contact me immediately at (858) 578-9064. Thank you for your assistance.

Sincerely,

Patrick McGinnis

Patrick McGinnis, RPA
Senior Archaeologist

Enclosures

9915 Businesspark Ave., Suite C, San Diego, CA 92131-1120
Phone: (858) 578-9064 ▲ Fax: (858) 578-3646
E-mail: TierraEnv@aol.com

STATE OF CALIFORNIA Arnold Schwarzenegger, Governor

NATIVE AMERICAN HERITAGE COMMISSION
915 CAPITOL MALL, ROOM 364
SACRAMENTO, CA 95814
(916) 653-6251
Fax (916) 657-5390
Web Site www.nahc.ca.gov
ds_nahc@pacbell.net

May 24, 2010

Mr. Patrick McGinnis, Senior Archaeologist
TIERRA ENVIRONMENTAL SERVICES
9915 Businesspark Avenue, Suite C
San Diego, CA 92131-1120

Sent by FAX to 858-578-3646
No. of Pages: 4

Re: Request for a Sacred Lands File Search and Native American Contacts List **for the proposed "Geothermal and Solar Energy Projects"** located near the community of Iris; Impoerial County, California

Dear Mr. McGinnis:

The Native American Heritage Commission (NAHC), the State of California 'Trustee Agency' for the protection and preservation of Native American cultural resources (c.f. CA Public Resources Code §21070; also c.f. *Environmental Protection Information Center v. Johnson [198]) 170 Cal App. 3rd 604)*, was able to perform a record search of its Sacred Lands File (SLF) for the affected project area (APE) requested. The California Environmental Quality Act (CEQA; CA Public Resources Code Section 21000 – 21177)) requires that any project that causes a substantial adverse change in the significance of an historical resource, that includes archaeological resources, is a 'significant effect' requiring the preparation of an Environmental Impact Report (EIR) per the California Code of Regulations §15064.5(b)(c)(f) CEQA guidelines). Section 15382 of the 2007 CEQA Guidelines defines a significant impact on the environment as "a substantial, or potentially substantial, adverse change in any of physical conditions within an area affected by the proposed project, including ...objects of historic or aesthetic significance." The NAHC SLF search **did not indicate** the presence of Native American cultural resources within one-half mile of the proposed project site (APE). However, there are Native American cultural resources in close proximity to the APE.

Also, this letter includes state and federal statutes relating to Native American historic properties of religious and cultural significance to American Indian tribes and interested Native American individuals as 'consulting parties' under both state and federal law.

Early consultation with Native American tribes in your area is the best way to avoid unanticipated discoveries once a project is underway., Culturally-affiliated tribes and individuals may have knowledge of the religious and cultural significance of the historic properties in the project area (e.g. APE). We recommend that you contact persons on the attached list of Native American contacts. Furthermore we suggest that you contact the California Historic Resources Information System (CHRIS) at the Office of Historic Preservation Coordinator's office (at (916) 653-7278, for referral to the nearest Information Center of which there are 10.

Consultation with tribes and Interested Native American consulting parties, on the NAHC list ,should be conducted in compliance with the requirements of federal NEPA (42 U.S.C. 4321-43351) and Section 106 and 4(f) of federal NHPA (16 U.S.C. 470 [f)]*et seq*), 36 CFR Part 800.3 (f) (2), the President's Council on Environmental Quality (CSQ; 42 U.S.C. 4371 *et seq.*) and NAGPRA (25 U.S.C. 3001-3013), as appropriate. . The 1992 *Secretary of the Interior's Standards for the Treatment of Historic Properties* were revised so that they could be applied to all historic resource types included in the National Register of Historic Places and including *cultural landscapes.*

Lead agencies should consider avoidance, as defined in Section 15370 of the California Environmental Quality Act (CEQA) when significant cultural resources could be affected by a project. Also, Public Resources Code Section 5097.98 and Health & Safety Code Section 7050.5 provide for provisions for accidentally discovered archeological resources during construction and mandate the processes to be followed in the event of an accidental discovery of any human remains in a project location other than a 'dedicated cemetery.

Although tribal consultation under the California Environmental Quality Act (CEQA; CA Public Resources Code Section 21000 – 21177) is 'advisory' rather than mandated, the NAHC does request 'lead agencies' to work with tribes and interested Native American individuals as 'consulting parties.' However, the 2006 SB 1059 the state enabling legislation to the Federal Energy Policy Act of 2005, does mandate tribal consultation for the 'electric transmission corridors. This is codified in the California Public Resources Code, Chapter 4.3, and §25330 to Division 15, requires consultation with California Native American tribes, and identifies both federally recognized and non-federally recognized on a list maintained by the NAHC. Consultation on specific projects must be the result of an on-going relationship between Native American tribes and lead agencies, project proponents and their contractors, in the opinion of the NAHC. Regarding tribal consultation, a relationship built around regular meetings and informal involvement with local tribes will lead to more qualitative consultation tribal input on specific projects.

The response to this search for Native American cultural resources is conducted in the NAHC Sacred Lands Inventory, established by the California Legislature (CA Public Resources Code §5097.94(a) and is exempt from the CA Public Records Act (c.f. California Government Code §6254.10) although Native Americans on the attached contact list may wish to reveal the nature of identified cultural resources/historic properties. Confidentiality of "historic properties of religious and cultural significance' may also be protected the under Section 304 of the NHPA or at the Secretary of the Interior' discretion if not eligible for listing on the National Register of Historic Places. The Secretary may also be advised by the federal Indian Religious Freedom Act (cf. 42 U.S.C, 1996) in issuing a decision on whether or not to disclose items of religious and/or cultural significance identified in or near the APE and possibly threatened by proposed project activity.

If you have any questions about this response to your request, please do not hesitate to contact me at (916) 653-6251.

Sincerely,

Dave Singleton
Program Analyst

Attachment: Native American Contacts

Native American Contacts
May 24, 2010
Imperial County

Ewiiaapaayp Tribal Office
Robert Pinto, Chairperson
4054 Willows Road
Alpine , CA 91901
wmicklin@leaningrock.net
(619) 445-6315 - voice
(619) 445-9126 - fax
Dieguenо/Kumeyaay

Kwaaymii Laguna Band of Mission Indians
Carmen Lucas
P.O. Box 775
Pine Valley , CA 91962
(619) 709-4207
Diegueno -

Manzanita Band of Kumeyaay Nation
Leroy J. Elliott, Chairperson
PO Box 1302
Boulevard , CA 91905
(619) 766-4930
(619) 766-4957 Fax
Kumeyaay

Fort Yuma Quechan Indian Nation
Mike Jackson, Sr., President
PO Box 1899
Yuma , AZ 85366
qitpres@quechantribe.com
(760) 572-0213
(760) 572-2102 FAX
Quechan

Campo Kumeyaay Nation
Monique LaChappa, Chairperson
36190 Church Road, Suite 1
Campo , CA 91906
MLaChappa@campo-nsn.
(619) 478-9046
(619) 478-5818 Fax
Kumeyaay

Torres-Martinez Desert Cahuilla Indians
Diana L. Chihuahua, Cultural Resources
P.O. Boxt 1160
Thermal , CA 92274
dianac@torresmartinez.org
760) 397-0300, Ext. 1209
(760) 272-9039 - cell (Lisa)
(760) 397-8146 Fax
Cahuilla

Kumeyaay Cultural Heritage Preservation
Paul Cuero
36190 Church Road, Suite 5
Campo , CA 91906
chairman@campo-nsn.gov
(619) 478-9046
(619) 478-9505
(619) 478-5818 Fax
Diegueno/ Kumeyaay

Ewiiaapaayp Tribal Office
Will Micklin, Executive Director
4054 Willows Road
Alpine , CA 91901
wmicklin@leaningrock.net
(619) 445-6315 - voice
(619) 445-9126 - fax
Diegueno/Kumeyaay

This list is current only as of the date of this document.

Distribution of this list does not relieve any person of statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resources Code and Section 5097.98 of the Public Resources Code. Also, federal National Environmental Policy Act (NEPA), National Historic Preservation Act, Section 106 and fed eral NAGPRA. And 36 CFR Part 800.3.

This list is only applicable for contacting local Native Americans with regard to cultural resources for the proposed Geothermal and Solar Energy projects; located near the community of Iris in Imperial County, California for which a Sacred Lands File search and Native American Contacts list were requested.

Native American Contacts
May 24, 2010
Imperial County

Cocopah Museum
Jill McCormick, Tribal Archaeologist
County 15th & Ave. G — Cocopah
Sommerton , AZ 85350
culturalres@cocopah.com
(928) 530-2291 - cell
(928) 627-2280 - fax

Quenchan Indian Nation
Bridget Nash-Chrabascz, THPO
P.O. Box 1899 — Quechan
Yuma , AZ 85366
b.nash@quechantribe.com
(928) 920-6068 - CELL
(760) 572-2423

Ah-Mut-Pipa Foundation
Preston J. Arrow-weed
P.O. Box 160 — Quechan
Bard , CA 92222 — Kumeyaay
(928) 388-9456

ahmut@earthlink.net

This list is current only as of the date of this document.

Distribution of this list does not relieve any person of statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resources Code and Section 5097.98 of the Public Resources Code. Also, federal National Environmental Policy Act (NEPA), National Historic Preservation Act, Section 106 and fed eral NAGPRA. And 36 CFR Part 800.3.

This list is only applicable for contacting local Native Americans with regard to cultural resources for the proposed Geothermal and Solar Energy projects; located near the community of Iris in Imperial County, California for which a Sacred Lands File search and Native American Contacts list were requested.

CONFIDENTIAL APPENDIX
(Not for Public Review)

A CULTURAL RESOURCES SURVEY OF 640-ACRES PROPOSED FOR ALTERNATIVE ENERGY EXPLORATION, NILAND, IMPERIAL COUNTY, CALIFORNIA

Prepared for:

The County of Imperial
940 Main Street
El Centro, CA 92243

Ormat Nevada Inc.
6225 Neil Road
Reno, NV 89511
(775) 336-0169

Submitted by:

Tierra Environmental Services
9915 Businesspark Ave., Suite C
San Diego, California 92131-1120
(858) 578-9064

Patrick McGinnis, RPA
Hillary Murphy

May 2010

National Archaeological Data Base Information
Type of Study: Cultural Resource Survey
Sites: OS27-1 through OS27-18, CA-IMP-68
USGS Quadrangles: Wister and Iris Wash 7.5'
Area: 640-Acres
Key Words: Positive Survey, Geothermal, Wister, Imperial County, Salton Buffware, Andesite, Rhyolite, Core, Flakes, Sherds, Lithic scatter, Temporary camp, Ceramic scatter

Stantec Consulting Services Inc.
735 East Carnegie Drive, Suite 280
San Bernardino, California 92408

May 20, 2019

Benjamin Orcutt
Ormat Nevada Inc.
6140 Plumas Street
Reno, Nevada 89519

Reference: CEQA LEVEL GEOTECHNICAL STUDY
Wister Solar Project
East of Wilkins Road and Weist Road
Niland, Imperial County, California
Stantec Project No. 185804156

Dear Mr. Orcutt:

Stantec Consulting Services Inc. (Stantec) has prepared this California Environmental Quality Act (CEQA) Level Geotechnical Study to provide support documentation for the "Environmental Checklist Form" in accordance with the CEQA Guidelines for the proposed Wister Solar Project, located northeast of Wilkins Road and Weist Road, near the City of Niland, California.

PURPOSE AND SCOPE OF WORK

- Review available subsurface information for the Site,
- Excavate and sample a total of 13 test pits to a maximum depth of 10 feet at the Site,
- Perform soil mechanics laboratory testing on select soil samples,
- Evaluate geotechnical properties of soils pertinent to the CEQA Guidelines, and
- Summarize findings, conclusions, and recommendations in this letter.

SITE DESCRIPTION

The proposed Wister Solar project comprises approximately 640 gross acres. The permanent disturbance acreage associated with development of the solar facility and associated infrastructure (Project Site) within the Project Area would be less than the gross acreage of the Project Area. The topography of the Project Area is relatively flat and slopes from the northeast to the southwest at approximately 1.3 percent. The site is located approximately 2 to 3 miles north-northeast of Niland, California in the area shown on Figure 1.

PRE FIELD ACTIVITIES

Test pit exploration locations were selected based on review of aerial photography and confirmed in the field at the time of field sampling. In addition, a site-specific Health and Safety Plan (HASP) was developed in accordance with California Occupational Safety and Health Administration (Cal OSHA) requirements to guide field activities.

FIELD EXPLORATION ACTIVITIES

Thirteen shallow test pits (TP1 through TP13) were advanced at selected locations throughout the site to a maximum depth of ten feet below the existing ground surface (bgs) (Figure 2). Relatively undisturbed samples were obtained using a modified California (CAL) sampler, which is a ring-lined split tube sampler with a 3-inch outer diameter and 2½-inch inner diameter. CAL sampling followed ASTM D3550 (Standard Practice for Ring-Lined Barrel Sampling of Soils) procedures. Disturbed bulk samples were also obtained from the excavation at locations where CAL sampling could not be completed. The CAL sampler was advanced with a backhoe bucket.

Samples were classified in the field using the Unified Soil Classification System (USCS), in accordance with ASTM D2488 (Standard Practice for Description and Identification of Soils [Visual-Manual Method]) procedures. The laboratory testing confirmed or modified field classifications as necessary for presentation on the boring logs. Soil samples were removed from the samplers, placed in appropriate containers, and transported in accordance with ASTM D4220 (Standard Practice for Preserving and Transporting Soil Samples).

The test pit logs are located in Attachment A. Soils are classified in accordance with the USCS, which is explained in "Symbols and Terms Used on Borehole and Test Pit Records" in Attachment A. the approximate test pit locations are shown on Figure 2.

LABORATORY SOIL TESTING

The following laboratory tests were performed on samples collected at the Site either in general accordance with the American Society for Testing and Materials (ASTM) or contemporary practices of the soil engineering profession:

Table 1 – Summary of Laboratory Tests

Type of Test	ASTM Designation	Number Performed
Materials Finer Than 75mm	ASTM D-1140	8
Sieve Analysis	ASTM D422 and ASTM C136	5

The results of the laboratory tests are presented in Attachment B.

REGIONAL GEOLOGY

The Site is located in the eastern portion of the Colorado Desert Geomorphic Province in the southern part of California. According to the California Geological Survey (CGS) website, the Colorado Desert Geomorphic Province consists of a low-lying barren desert basin separated by northwest trending valleys of the Peninsular Ranges to the west. The province is a depressed block between active branches of alluvium covered by the San Andreas Fault. It is characterized by the ancient beach lines and silt deposits of extinct Lake Cahuilla. The province extends to the southern border of California and Mexico and Mojave Desert to the east.

Based on information depicted on available geologic maps (CDMG, 1967) and shown on Figure 3 (Geologic Map), the site is located within an area underlain by Quaternary Lake Deposits (Ql).

A description of the mapped soil units is provided below.

Quaternary Lake (Ql) Deposits – Pleistocene lake deposits consisting of claystone, sand, and beach gravel deposited in former extensive lake and Salton trough (CDMG, 1967).

SUBSURFACE CONDITIONS IN TEST PIT EXPLORATIONS

The near surface (approximately 10 feet deep) soils encountered in the test pits we performed are sand with variable amount of silt and clay (SP, SP-SM, SP-SC, SC and SM USCS soil type) followed by clay with variable amounts of sand (CL USCS soil type). Near surface sandy soil with variable amounts of silt and clay were dry to the maximum depth of exploration. Clay with variable amounts of sand below the near surface sand was low in plasticity, dry to moist, and very stiff to hard in consistency.

The subsurface soils were not difficult to penetrate, and the test pit excavations did not cave to the maximum depth of exploration. Groundwater was not encountered during this investigation.

REGIONAL GROUNDWATER

East Salton Sea Groundwater Basin underlies the western portion of the Mohave Desert and is part of the Colorado River Hydrologic Region. The basin is bounded on the north and east by non-water bearing rocks of the Chocolate Mountains, on the west by the San Andreas and Banning Mission Creek Faults, and on the south by the Imperial Valley Groundwater Basin (DWR, 2004).

Static groundwater was not encountered in the test pits performed for this investigation. Groundwater data from an offsite location approximately 8 miles southwest of the site indicates the depth to groundwater is approximately 49 feet below the ground surface (DWR, 2010). The offsite location is at an elevation of approximately 120 feet above mean sea level. Groundwater levels may fluctuate in the future due to rainfall, irrigation, broken pipes, or changes in site drainage.

REGIONAL SEISMICITY

The project site is located within a highly active seismic zone. A Regional Faulting and Seismicity Map is presented in Figure 4 and a local Earthquake Fault Map is presented in Figure 5. The regional fault map also provides information regarding recent earthquakes in the project area. Several of the more recent earthquakes in the project area include the 1975 Brawley (Map No. 43) earthquake, the 1979 Imperial, Brawley, and Rico (Map No. 48) earthquake, and the 1987 Superstition Hills (Map No. 59) earthquake (CGS, 2016).

The estimated distance of the Site to the nearest expected surface expression of major active faults is presented in the table below. The purple colored faults noted in Figure 4 are either inactive or have a very low slip rate. The distance measurement was taken from a location at the southwest corner of the site which is closest to the Elmore Ranch fault (the closest active fault relative to the site). The location from which measurements were obtained has a latitude of 33.263984°, and a longitude of -115.510046°.

Fault	Distance (miles) (2)	Maximum Moment Magnitude (1)
Elmore Ranch	8.8	6.7
South San Andreas	13.1	8.2
Imperial	23.5	7.0
Superstition Hills	24.5	6.8
San Jacinto	28.1	7.9

1. 2008 National Seismic Hazard Maps – USGS.
2. Measured from approximate center of site.

REGIONAL SEISMIC HAZARDS

Fault Rupture Hazard

The Site is not located within a currently mapped Alquist-Priolo Special Studies Fault Zone (CDMG, 2002b). As noted above, the nearest active major fault is the Elmore Ranch fault, located approximately 8.8 miles northwest of the Site. Based on the fault's distance from the project site, and since the fault does not project towards the project site, it is our opinion that the potential for surface fault rupture to occur on the project site is low.

Strong Ground Shaking

Strong ground shaking can be expected at the Site during moderate to severe earthquakes in the general region. This is common to most areas in Southern California.

Information published by the Unites States Geologic Survey (USGS) indicates the Peak Ground Acceleration (PGA) with a 2 percent probability of being exceeded at the Site in 50 years is 0.5g (USGS, 2008); where g is the acceleration due to gravity; determined in accordance with the US Seismic Design Maps web site. Mitigation of strong ground shaking is typically provided by designing structures in accordance with the latest addition of the California Building Code.

Liquefaction

Liquefaction of saturated sandy soils is generally caused by the sudden decrease in soil shear strength due to vibration. During cyclic shaking, typically caused by an earthquake, the soil mass is distorted, and inter-particle stresses are transferred from the soil particles to the pore water. As pore pressure increases the bearing capacity decreases and the soil may behave temporarily as a viscous fluid (liquefaction) and, consequently, loses its capacity to support the structures founded thereon.

Engineering research of soil liquefaction potential (Seed, et. al., 1982 and 1985) indicates that generally three basic factors must exist concurrently in order for liquefaction to occur, namely:

- A source of ground shaking, such as an earthquake, capable of generating soil mass distortions.
- A relatively loose sandy soil fabric exhibiting a potential for volume reduction.
- A relative shallow groundwater table (within approximately 50 feet below ground surface) or completely saturated soil conditions that will allow positive pore pressure generation.

The Site is not located within a current, mapped California Liquefaction Hazard Zone. In addition, groundwater in the site vicinity is expected to be approximately greater than 49 feet below the ground surface (DWR, 2010). Based on the near surface soil conditions and depth to groundwater, it is our opinion that the potential for liquefaction related ground failure, including liquefaction, is low.

Lateral Spreading

Lateral spreading typically occurs as a form of horizontal displacement of relatively flat-lying alluvial material toward an open or "free" face such as an open body of water, channel, or excavation. This movement is generally due to failure along a weak plane, and may often be associated with liquefaction. As cracks develop within the weakened material, blocks of soil displace laterally toward the open face. Cracking and lateral movement may gradually propagate away from the face as blocks continue to break free.

Due to the low potential for liquefaction, the depth of groundwater, and the fact that the Site is not located near free faces or bodies of water, the potential for lateral spreading is considered low.

SUBSIDENCE

The site is not located within a mapped area of known land subsidence (USGS, 2019). Due to the depth of groundwater and the fact that the Site is not located in a mapped subsidence area, the potential for subsidence is considered low. However, strong shaking in the region could cause subsidence in the loose to medium dense sand below the site.

EXPANSIVE SOIL POTENTIAL

Expansion and contraction of volume can occur when expansive soils undergo alternating cycles of wetting (swelling) and drying (shrinking). Since near-surface soils encountered during the recent geotechnical investigation are mostly sandy soils whose expansion potential is considered low. As such, special design for expansive soils will likely not be necessary for the proposed development.

SLOPES

The Site is relatively flat, with a topographic gradient less than 2%. Permanent slopes steeper that 5:1 (horizontal to vertical) or higher than 5 feet are not anticipated for the project. Due to the existing topography and the proposed grading, landslides are not considered a potential hazard for the project. The stability of slopes, if any, should be verified when design-grading information becomes available.

EROSION

The predominately coarse-grained soils underlying the site are potentially susceptible to erosion or the loss of topsoil due to surface water flows.

Mitigation of soil erosion may include selective grading, establishment of anchoring vegetation, design of runoff control features such as drainage ditches, and construction of erosion control features such as pavements and surface mats. These mitigation options should be addressed in the design level evaluations for the project.

CONCLUSIONS

Based on the currently planned development, it is our opinion that the soils will require additional assessments to determine mitigation measures for strong ground shaking and erosion as discussed above.

Mitigation options for these hazards are provided in the preceding sections. Impacts should be mitigated through the application of standard conditions of development, which require preparation of a design-level geotechnical study as a condition of grading permit issuance.

Based on the findings of this CEQA Level Geotechnical Study, a completed CEQA questionnaire for the Geology and Soils Section has been included in Attachment C. As recommended above, items checked as "Less than Significant with Mitigation" should be addressed in the scope of a future design-level geotechnical investigation.

We trust that the information provided herein meets the project requirements. If there are any questions regarding this project, please contact the undersigned at your convenience.

Respectfully submitted,
Stantec Consulting Services Inc.

LICENSED PROFESSIONAL ENGINEER
JARET FISCHER
C 80383
EXP. 3/31/21
CIVIL
STATE OF CALIFORNIA

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Principal, Senior Geotechnical Engineer
Phone: (949) 923-6000
Evan.Hsiao@stantec.com

FIGURES

Figure 1 - Site Location Map
Figure 2 – Subsurface Exploration Map
Figure 3 – Geologic Map
Figure 4 – Regional Faulting Map
Figure 5 – Earthquake Fault Map

ATTACHMENTS
Attachment A – Test Pit Logs
Attachment B – Laboratory Test Results
Attachment C – CEQA Guidelines Form – Geology and Soils

Stantec

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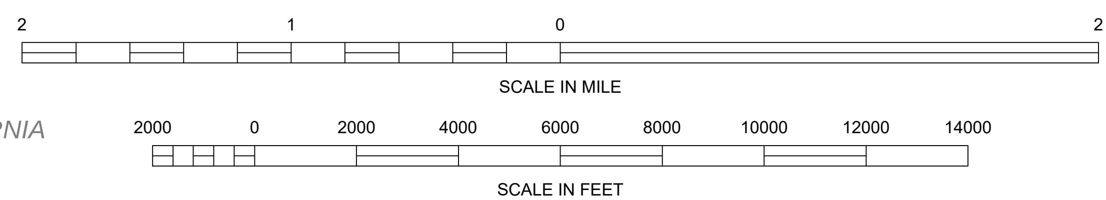
FIGURES



REFERENCE: USGS 7.5 X 15 MINUTE QUADRANGLE; IRIS WASH; 1992

Stantec	FOR: ORMAT WISTER SOLAR PROJECT NEC WILKINS ROAD AND WEIST ROAD IMPERIAL COUNTY, CALIFORNIA		SITE LOCATION MAP		FIGURE: 1
735 EAST CARNEGIE DRIVE, SUITE 280 SAN BERNARDINO, CA 92408 PHONE: (909) 335-6116 FAX: (909) 335-6120	JOB NUMBER: 185804156	DRAWN BY: JEF	CHECKED BY: JEF	APPROVED BY: JEF	DATE: 4/20/19

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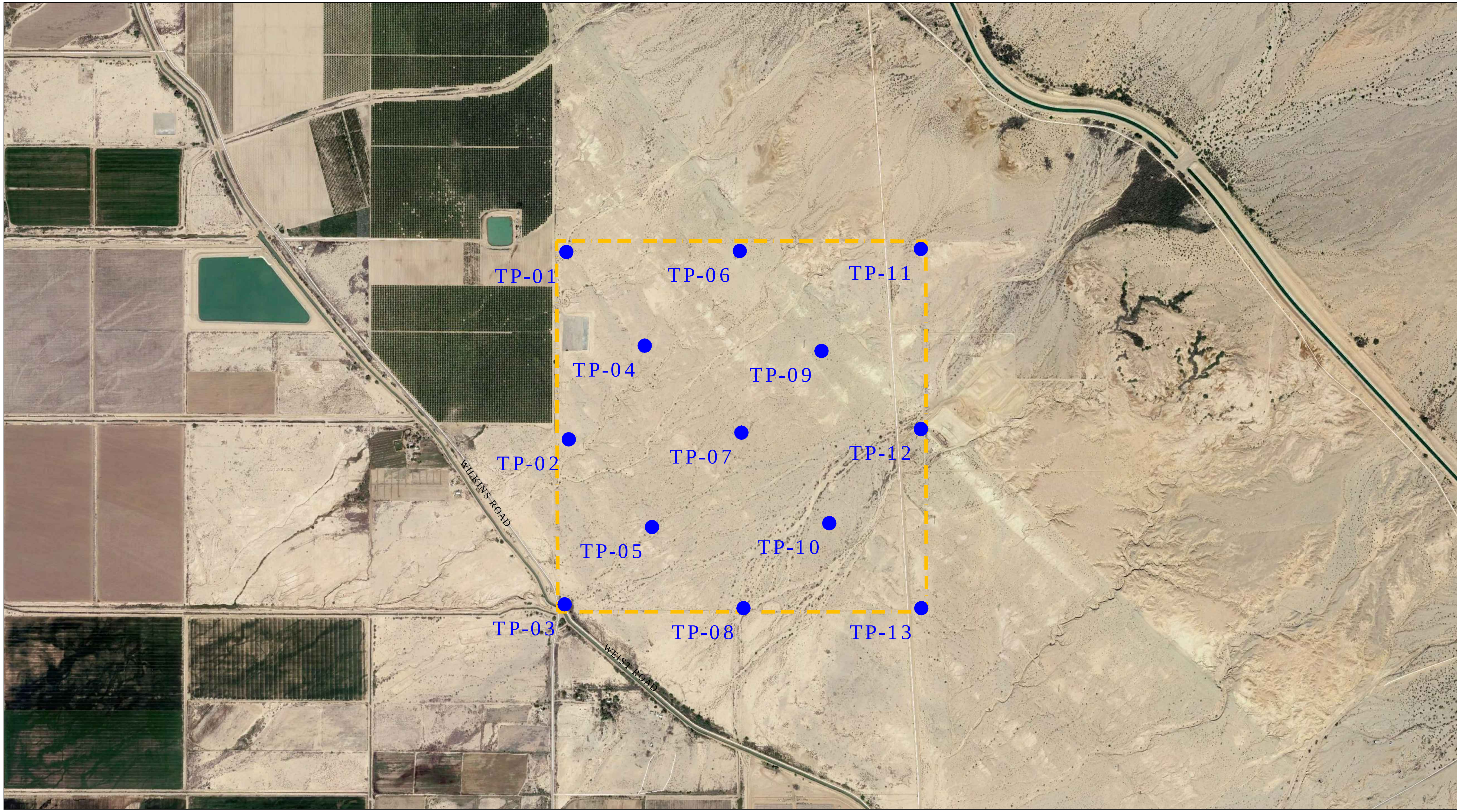


LEGEND

APPROXIMATE LIMITS OF PROPERTY

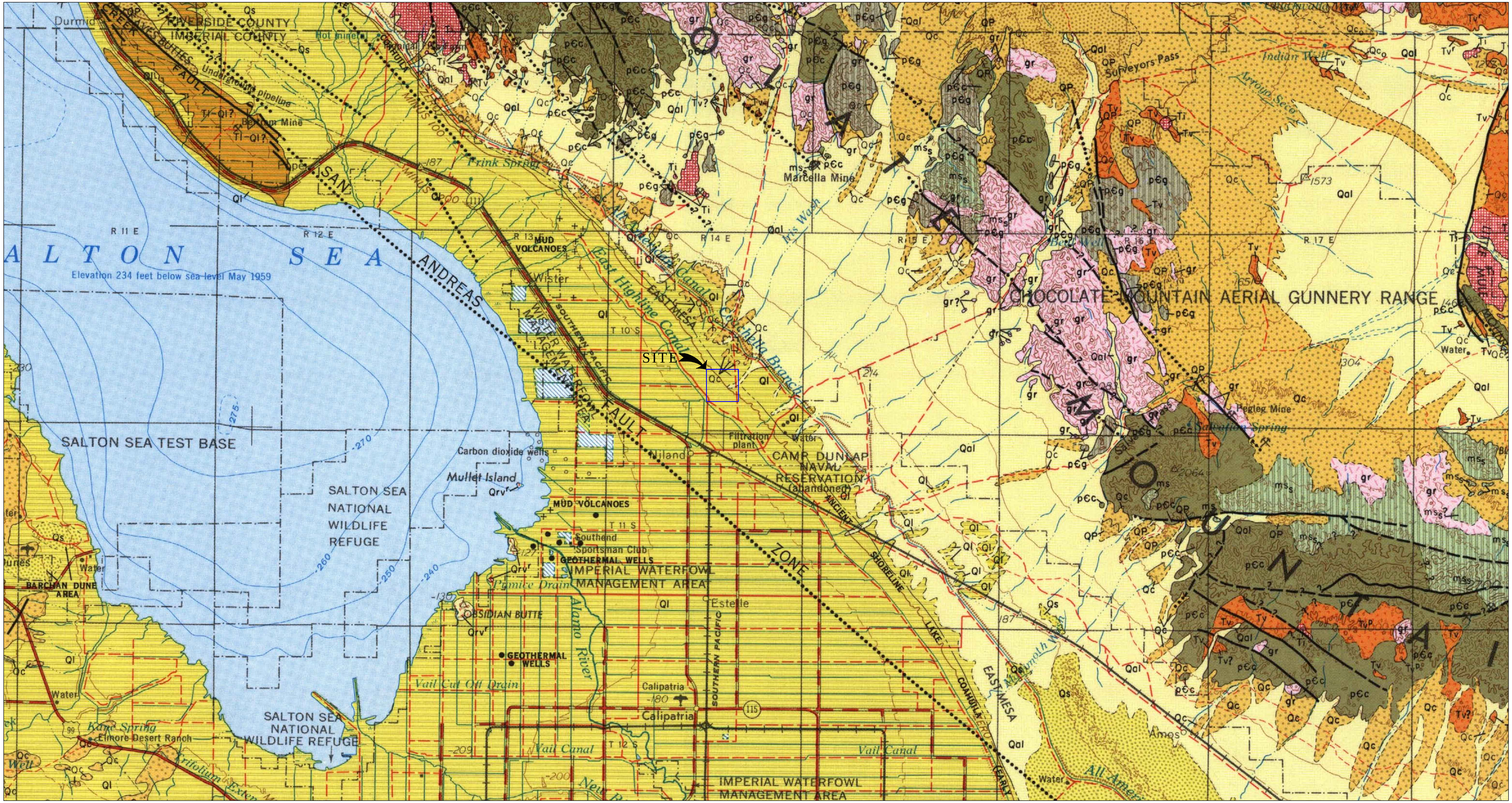
N

0 1,500 3,000

SCALE (FEET)

Stantec
735 EAST CARNEGIE DRIVE, SUITE 280
SAN BERNARDINO, CA 92408
PHONE: (909) 335-6116 FAX: (909) 335-6120

FOR: ORMAT WISTER SOLAR PROJECT NEC WILKINS ROAD AND WEIST ROAD IMPERIAL COUNTY, CALIFORNIA		SUBSURFACE EXPLORATION MAP		FIGURE: 2
JOB NUMBER: 185804156	DRAWN BY: JEF	CHECKED BY: JEF	APPROVED BY: JEF	DATE: 4/20/19



LEGEND

APPROXIMATE LIMITS OF PROPERTY

Ql — LAKE DEPOSITS CONSISITNG OF CLAYSTONE, SAND, AND BEACH GRAVEL

Qal — ALLUVIAL SAND, SILT, CLAY, AND GRAVEL

N

0 3 6

SCALE (MILES)

Stantec
735 EAST CARNEGIE DRIVE, SUITE 280
SAN BERNARDINO, CA 92408
PHONE: (909) 335-6116 FAX: (909) 335-6120

FOR:				FIGURE:
ORMAT WISTER SOLAR PROJECT NEC WILKINS ROAD AND WEIST ROAD IMPERIAL COUNTY, CALIFORNIA		GEOLOGIC MAP		3
JOB NUMBER: 185804156	DRAWN BY: JEF	CHECKED BY: JEF	APPROVED BY: JEF	DATE: 4/20/19

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SIGNIFICANT EARTHQUAKES AND FAULT RUPTURES IN CALIFORNIA

MAP NO.	EARTHQUAKE DATE AND FAULT (LOCATION)	MAG	SURFACE RUPTURE
28	1940 Imperial	7.0	40+/- mi.
30	1942 (Fish Creek Mountains)	6.4	NA
33	1952 Superstition Hills	5.8	2 +/- mi.
36	1966 Imperial	3.6	6 mi.
39	1968 Coyote Creek (Boreggo Mtn.)	6.6	19 mi.
43	1975 Brawley	4.7	6.5 mi.
48	1979 Imperial, Brawley, Rico	6.5	18; 7.8; 0.6 mi.
59	1987 Superstition Hills	6.6	16.8 mi.

FAULT WITH KNOWN ACTIVITY IN LAST 200 YEARS

FAULT WITH KNOWN ACTIVITY IN LAST 10,000 YEARS

FAULT WITH KNOWN ACTIVITY IN LAST 1,600,000 YEARS

N

0 15 30

SCALE (MILES)

Stantec
735 EAST CARNEGIE DRIVE, SUITE 280
SAN BERNARDINO, CA 92408
PHONE:(909) 335-6116 FAX:(909) 335-6120

FOR:
ORMAT WISTER SOLAR PROJECT
NEC WILKINS ROAD AND WEIST ROAD
IMPERIAL COUNTY, CALIFORNIA

REGIONAL FAULT MAP

FIGURE: 4

JOB NUMBER:	DRAWN BY:	CHECKED BY:	APPROVED BY:	DATE:
185804156	JEF	JEF	JEF	4/20/19

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LEGEND

APPROXIMATE LIMITS OF PROPERTY

N

0 8,000 16,000

SCALE (FEET)

Stantec
735 EAST CARNEGIE DRIVE, SUITE 280
SAN BERNARDINO, CA 92408
PHONE: (909) 335-6116 FAX: (909) 335-6120

FOR:		EARTHQUAKE FAULT MAP		FIGURE:
ORMAT WISTER SOLAR PROJECT NEC WILKINS ROAD AND WEIST ROAD IMPERIAL COUNTY, CALIFORNIA				5
JOB NUMBER: 185804156	DRAWN BY: JEF	CHECKED BY: JEF	APPROVED BY: JEF	DATE: 4/20/19

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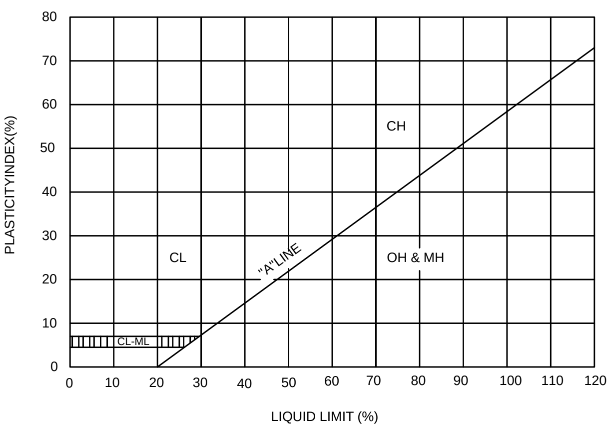
ATTACHMENT A
TEST PIT LOGS

UNIFIED SOIL CLASSIFICATION (ASTM D-2487)

MATERIAL TYPES	CRITERIA FOR ASSIGNING SOIL GROUP NAMES			GROUP SYMBOL	SOIL GROUP NAMES & LEGEND
COARSE-GRAINED SOILS >50% RETAINED ON NO. 200 SIEVE	GRAVELS >50% OF COARSE FRACTION RETAINED ON NO 4. SIEVE	*CLEAN GRAVELS <5% FINES	Cu>4 AND 1<Cc<3	GW	WELL-GRADED GRAVEL
			Cu>4 AND 1>Cc>3	GP	POORLY-GRADED GRAVEL
		*GRAVELS WITH FINES >12% FINES	FINES CLASSIFY AS ML OR CL	GM	SILTY GRAVEL
			FINES CLASSIFY AS CL OR CH	GC	CLAYEY GRAVEL
	SANDS >50% OF COARSE FRACTION PASSES ON NO 4. SIEVE	*CLEAN SANDS <5% FINES	Cu>6 AND 1<Cc<3	SW	WELL-GRADED SAND
			Cu>6 AND 1>Cc>3	SP	POORLY-GRADED SAND
		*SANDS AND FINES >12% FINES	FINES CLASSIFY AS ML OR CL	SM	SILTY SAND
			FINES CLASSIFY AS CL OR CH	SC	CLAYEY SAND
FINE-GRAINED SOILS >50% PASSES NO. 200 SIEVE	SILTS AND CLAYS LIQUID LIMIT<50	INORGANIC	PI>7 AND PLOTS>"A" LINE	CL	LEAN CLAY
			PI>4 AND PLOTS<"A" LINE	ML	SILT
		ORGANIC	LL (oven dried)/LL (not dried)<0.75	OL	ORGANIC CLAY OR SILT
	SILTS AND CLAYS LIQUID LIMIT>50	INORGANIC	PI PLOTS >"A" LINE	CH	FAT CLAY
			PI PLOTS <"A" LINE	MH	ELASTIC SILT
		ORGANIC	LL (oven dried)/LL (not dried)<0.75	OH	ORGANIC CLAY OR SILT
HIGHLY ORGANIC SOILS		PRIMARILY ORGANIC MATTER, DARK IN COLOR, AND ORGANIC ODOR		PT	PEAT

* Dual symbols required for fines content between 5% and 12%

PLASTICITY CHART



SAMPLER TYPES

- SPT
- Modified California (2.5" I.D.)
- Rock Core
- Shelby Tube
- No Recovery
- Grab Sample

ADDITIONAL TESTS

COR	-	CHEMICAL ANALYSIS (CORROSIVITY)
CD	-	CONSOLIDATED DRAINED TRIAXIAL
CN	-	CONSOLIDATION
CU	-	CONSOLIDATED UNDRAINED TRIAXIAL
DS	-	DIRECT SHEAR
PP	-	POCKET PENETROMETER (TSF)
#200	-	Percent Passing #200 SIEVE
RV	-	R-VALUE
SA	-	SIEVE ANALYSIS: % PASSING
▼	-	WATER LEVEL
PI	-	PLASTICITY INDEX
EI	-	EXPANSION INDEX
TC	-	CYCLIC TRIAXIAL
TV	-	TORVANE SHEAR
UC	-	UNCONFINED COMPRESSION
(1.5)	-	(WITH SHEAR STRENGTH IN KSF)
UU	-	UNCONSOLIDATED UNDRAINED TRIAXIAL

PENETRATION RESISTANCE (RECORDED AS BLOWS / FOOT)

SAND & GRAVEL		SILT & CLAY		
RELATIVE DENSITY	BLOWS/FOOT*	CONSISTENCY	BLOWS/FOOT*	STRENGTH** (KSF)
VERY LOOSE	0 - 4	VERY SOFT	0 - 2	0 - 0.25
LOOSE	4 - 10	SOFT	2 - 4	0.25 - 0.5
MEDIUM DENSE	10 - 30	MEDIUM STIFF	4 - 8	0.5-1.0
DENSE	30 - 50	STIFF	8 - 15	1.0 - 2.0
VERY DENSE	OVER 50	VERY STIFF	15 - 30	2.0 - 4.0
		HARD	OVER 30	OVER 4.0

* NUMBER OF BLOWS OF 140 LB HAMMER FALLING 30 INCHES TO DRIVE A 2 INCH O.D. (1-3/8 INCH I.D.) SPLIT-BARREL SAMPLER THE LAST 12 INCHES OF AN 18-INCH DRIVE (ASTM-1586 STANDARD PENETRATION TEST).

* * UNDRAINED SHEAR STRENGTH IN KIPS/SQ. FT. AS DETERMINED BY LABORATORY TESTING OR APPROXIMATED BY THE STANDARD PENETRATION TEST, POCKET PENETROMETER, TORVANE, OR VISUAL OBSERVATION.

LEGEND TO BORING LOGS AND SOIL DESCRIPTIONS

Stantec

PROJECT: **Ormat Wister Solar Project**
LOCATION: **Niland, CA**
PROJECT NUMBER: **185804156**
DRILLING: STARTED **4/25/19** COMPLETED: **4/25/19**
INSTALLATION: STARTED **4/25/19** COMPLETED: **4/25/19**
DRILLING COMPANY: **Strong Arm**
DRILLING EQUIPMENT: **Backhoe**
DRILLING METHOD: **Bucket**
SAMPLING EQUIPMENT: **Bucket**

WELL / TEST PIT / BOREHOLE NO:

TP-01

PAGE 1 OF 1

Stantec

NORTHING (ft):
EASTING (ft):
LATITUDE: **33° 16' 39.93"**
LONGITUDE: **115° 30' 35.94"**
GROUND ELEV (ft): **-7**
TOC ELEV (ft):
INITIAL DTW (ft): **NE**
BOREHOLE DEPTH (ft): **10.5**
STATIC DTW (ft): **NE**
WELL DEPTH (ft): **---**
WELL CASING DIAMETER (in): **---**
BOREHOLE DIAMETER (in):
LOGGED BY: **ND**
CHECKED BY: **JF**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Geotechnical Lab Testing	Blow Count	PID Reading (ppmv)	Depth (feet)
			QUATERNARY LAKE DEPOSITS (Ql)						
		SP	**SAND** ; SP; (10YR 4/3) brown; 90% fine to coarse-grained sand; 10% fines; loose; dry; no odor; no staining						
		SC	**CLAYEY SAND** ; SC; (10YR 4/3) brown; 10% fine to coarse-grained gravel; 60% fine to coarse grained sand; 30% low plascticity fines; dense; dry; no odor; no staining						
5		CL	**CLAY** ; CL; (10YR 4/3) brown; 3% fine grained sand; 97% fines; hard; dry; no odor; no staining (pocket penetrometer (PP) = 4.0 tons per square foot (tsf))	X	0910 TPI-5	#200			5
10				X	0900 TP1-10				10
			Hole terminated at 10.5 feet.						

PROJECT: **Ormat Wister Solar Project**	WELL / TEST PIT / BOREHOLE NO: **TP-02** PAGE 1 OF 1
LOCATION: **Niland, CA**	NORTHING (ft):
PROJECT NUMBER: **185804156**	EASTING (ft):
DRILLING: STARTED **4/25/19** COMPLETED: **4/25/19**	LATITUDE: **33° 16' 13.55"**
INSTALLATION: STARTED **4/25/19** COMPLETED: **4/25/19**	LONGITUDE: **115° 30' 35.68"**
DRILLING COMPANY: **Strong Arm**	GROUND ELEV (ft): **-30**
DRILLING EQUIPMENT: **Backhoe**	TOC ELEV (ft):
DRILLING METHOD: **Bucket**	INITIAL DTW (ft): **NE**
SAMPLING EQUIPMENT: **Bucket**	BOREHOLE DEPTH (ft): **10.5**
	STATIC DTW (ft): **NE**
	WELL DEPTH (ft): **---**
	WELL CASING DIAMETER (in): **---**
	BOREHOLE DIAMETER (in):
	LOGGED BY: **ND**
	CHECKED BY: **JF**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Geotechnical Lab Testing	Blow Count	PID Reading (ppmv)	Depth (feet)
			QUATERNARY LAKE DEPOSITS (Ql)						
		SM	**SILTY SAND** ; SM; (10YR 4/3) brown; 75% very fine to medium sand; 25% fines; coarse; dry; no odor; no staining						
5		CL	**CLAY** ; CL; (10YR 4/5) brown; 12% fine to coarse gravel; 27% fine to coarse grained sand; 61% low plasticity fines; very stiff; dry; no odor; no staining (PP = 4.0 TSF)	X	0825 TP2-5	SA			5
10				X	0835 TP2-10				10
			Hole terminated at 10.5 feet.						

GEO FORM 304 NILAND.GPJ SECOR INTL.GDT 5/17/19

PROJECT: **Ormat Wister Solar Project**	WELL / TEST PIT / BOREHOLE NO: **TP-03** PAGE 1 OF 1
LOCATION: **Niland, CA**	
PROJECT NUMBER: **185804156**	
DRILLING: STARTED **4/25/19** COMPLETED: **4/25/19**	NORTHING (ft): / EASTING (ft):
INSTALLATION: STARTED **4/25/19** COMPLETED: **4/25/19**	LATITUDE: **33° 15' 50.34"** / LONGITUDE: **115° 30' 36.17"**
DRILLING COMPANY: **Strong Arm**	GROUND ELEV (ft): **-47** / TOC ELEV (ft):
DRILLING EQUIPMENT: **Backhoe**	INITIAL DTW (ft): **NE** / BOREHOLE DEPTH (ft): **10.5**
DRILLING METHOD: **Bucket**	STATIC DTW (ft): **NE** / WELL DEPTH (ft): **---**
	WELL CASING DIAMETER (in): **---** / BOREHOLE DIAMETER (in):
SAMPLING EQUIPMENT: **Bucket**	LOGGED BY: **ND** / CHECKED BY: **JF**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Geotechnical Lab Testing	Blow Count	PID Reading (ppmv)	Depth (feet)
			QUATERNARY LAKE DEPOSITS (QI)						
		SM	**SILTY SAND** ; SM; (10YR 4/5) brown; 80% very fine - coarse-grained sand; 20% fines; lose; dry; no odor; no staining						
5				X	TP3-5	SA			5
10		CL	**CLAY** ; CL; (10YR 4/3) brown; trace gravel; very stiff (4.0); dry; no odor; no staining	X	TP3-10				10
			Hole terminated at 10.5 feet.						

PROJECT: **Ormat Wister Solar Project**
LOCATION: **Niland, CA**
PROJECT NUMBER: **185804156**
DRILLING: STARTED **4/25/19** COMPLETED: **4/25/19**
INSTALLATION: STARTED **4/25/19** COMPLETED: **4/25/19**
DRILLING COMPANY: **Strong Arm**
DRILLING EQUIPMENT: **Backhoe**
DRILLING METHOD: **Bucket**
SAMPLING EQUIPMENT: **Bucket**

WELL / TEST PIT / BOREHOLE NO:

TP-04

Stantec

NORTHING (ft):
EASTING (ft):
LATITUDE: **33° 16' 26.35"**
LONGITUDE: **115° 30' 22.55"**
GROUND ELEV (ft): **-9**
TOC ELEV (ft):
INITIAL DTW (ft): **NE**
BOREHOLE DEPTH (ft): **10.5**
STATIC DTW (ft): **NE**
WELL DEPTH (ft): **---**
WELL CASING DIAMETER (in): **---**
BOREHOLE DIAMETER (in):
LOGGED BY: **ND**
CHECKED BY: **JF**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Geotechnical Lab Testing	Blow Count	PID Reading (ppmv)	Depth (feet)
			QUATERNARY LAKE DEPOSITS (QI)						
		SP-SM	**POORLY GRADED SAND WITH SILT** ; SP-SM; (10YR 4/3) brown; 90% fine to coarse-grained sand; 10% fines; loose; dry; no odor; no staining						
5		CL	**CLAY** ; CL; (10YR 4/3) brown; 10% fine to coarse gravel; 18% fine to coarse grained sand; 72% low plasticity fines; hard; dry; no odor; no staining (PP = 4.0 TSF)	X	1220 TP4-5	#200			5
10				X	1225 TP4-10				10
			Hole terminated at 10.5 feet.						

PROJECT: **Ormat Wister Solar Project**	WELL / TEST PIT / BOREHOLE NO:
LOCATION: **Niland, CA**	**TP-05** PAGE 1 OF 1
PROJECT NUMBER: **185804156**	
DRILLING: STARTED **4/25/19** COMPLETED: **4/25/19**	NORTHING (ft): / EASTING (ft):
INSTALLATION: STARTED **4/25/19** COMPLETED: **4/25/19**	LATITUDE: **33° 16' 1.05"** / LONGITUDE: **115° 30' 21.17"**
DRILLING COMPANY: **Strong Arm**	GROUND ELEV (ft): **-31** / TOC ELEV (ft):
DRILLING EQUIPMENT: **Backhoe**	INITIAL DTW (ft): **NE** / BOREHOLE DEPTH (ft): **10.5**
DRILLING METHOD: **Bucket**	STATIC DTW (ft): **NE** / WELL DEPTH (ft): **---**
	WELL CASING DIAMETER (in): **---** / BOREHOLE DIAMETER (in):
SAMPLING EQUIPMENT: **Bucket**	LOGGED BY: **ND** / CHECKED BY: **JF**

Stantec

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Geotechnical Lab Testing	Blow Count	PID Reading (ppmv)	Depth (feet)
			QUATERNARY LAKE DEPOSITS (Ql)						
		SC	**CLAYEY SAND** ; SC; (10YR 4/5) brown; 80% very fine to coarse grained sand; 20% fines; loose; dry; no odor; no staining						
5		CL	**CLAY** ; CL; (10YR 4/3) brown; 2% fine grained sand; 98% low plasticity fines; very stiff ; dry; no odor; no staining (PP = 4.0 TSF)	X	1150 TP5-5	#200			5
10				X	1155 TP5-10				10
			Hole terminated at 10.5 feet.						

PROJECT: **Ormat Wister Solar Project**		WELL / TEST PIT / BOREHOLE NO: **TP-06** PAGE 1 OF 1
LOCATION: **Niland, CA**		
PROJECT NUMBER: **185804156**		
DRILLING: STARTED **4/25/19**	COMPLETED: **4/25/19**	NORTHING (ft): / EASTING (ft):
INSTALLATION: STARTED **4/25/19**	COMPLETED: **4/25/19**	LATITUDE: **33° 16' 40.24"** / LONGITUDE: **115° 30' 6.28"**
DRILLING COMPANY: **Strong Arm**		GROUND ELEV (ft): **28** / TOC ELEV (ft):
DRILLING EQUIPMENT: **Backhoe**		INITIAL DTW (ft): **NE** / BOREHOLE DEPTH (ft): **10.5**
DRILLING METHOD: **Bucket**		STATIC DTW (ft): **NE** / WELL DEPTH (ft): **---**
SAMPLING EQUIPMENT: **Bucket**		WELL CASING DIAMETER (in): **---** / BOREHOLE DIAMETER (in):
		LOGGED BY: **ND** / CHECKED BY: **JF**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Geotechnical Lab Testing	Blow Count	PID Reading (ppmv)	Depth (feet)
			QUATERNARY LAKE DEPOSITS (QI)						
		SP	**SAND** ; SP; (10YR 4/3) brown; 90% fine to coarse-grained sand; 10% fines; loose; dry; no odor; no staining						
		SC	**CLAYEY SAND** ; SC; (10YR 4/3) brown; 5% fine gravel; 60% fine to coarse grained sand; 35% low plasticity fines; dry; no odor; no staining						
5		CL	**CLAY** ; CL; (10YR 4/3) brown; 27% fine to coarse grained sand; 73% low plasticity fines; very stiff; moist; no odor; no staining (PP = 4.0 TSF)	X	1010 TP6-5	#200			5
10				X	1015 TP6-10				10
			Hole terminated at 10.5 feet.						

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PROJECT: **Ormat Wister Solar Project**
LOCATION: **Niland, CA**
PROJECT NUMBER: **185804156**
DRILLING: STARTED **4/25/19** COMPLETED: **4/25/19**
INSTALLATION: STARTED **4/25/19** COMPLETED: **4/25/19**
DRILLING COMPANY: **Strong Arm**
DRILLING EQUIPMENT: **Backhoe**
DRILLING METHOD: **Bucket**
SAMPLING EQUIPMENT: **Bucket**

WELL / TEST PIT / BOREHOLE NO:

TP-07

Stantec

NORTHING (ft):
EASTING (ft):
LATITUDE: **33° 16' 14.14"**
LONGITUDE: **115° 30' 5.88"**
GROUND ELEV (ft): **-3**
TOC ELEV (ft):
INITIAL DTW (ft): **NE**
BOREHOLE DEPTH (ft): **10.5**
STATIC DTW (ft): **NE**
WELL DEPTH (ft): **---**
WELL CASING DIAMETER (in): **---**
BOREHOLE DIAMETER (in):
LOGGED BY: **ND**
CHECKED BY: **JF**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Geotechnical Lab Testing	Blow Count	PID Reading (ppmv)	Depth (feet)
			QUATERNARY LAKE DEPOSITS (QI)						
		SP-SC	**POORLY GRADED SAND WITH CLAY** ; SP-SC; (10YR 4/3) brown; 90% fine to coarse-grained sand; 10% fines; loose; dry; no odor; no staining						
		SC	**CLAYEY SAND** ; SC; (10YR 4/3) brown; 5% fine gravel; 70% fine to coarse grained sand, 25% fines, dry; no odor; no staining						
5		CL	**CLAY** ; CL; (10YR 4/3) brown; 32% fine to coarse grained sand, 68% low plasticity fines, very stiff; dry; no odor; no staining (PP = 4.0 TSF)	X	1040 TP7-5	#200			5
10				X	1045 TP7-10				10
			Hole terminated at 10.5 feet.						

PROJECT: **Ormat Wister Solar Project**	WELL / TEST PIT / BOREHOLE NO:
LOCATION: **Niland, CA**	**TP-08** PAGE 1 OF 1
PROJECT NUMBER: **185804156**	
DRILLING: STARTED **4/25/19** COMPLETED: **4/25/19**	NORTHING (ft): / EASTING (ft):
INSTALLATION: STARTED **4/25/19** COMPLETED: **4/25/19**	LATITUDE: **33° 15' 49.26"** / LONGITUDE: **115° 30' 5.77"**
DRILLING COMPANY: **Strong Arm**	GROUND ELEV (ft): **-28** / TOC ELEV (ft):
DRILLING EQUIPMENT: **Backhoe**	INITIAL DTW (ft): **NE** / BOREHOLE DEPTH (ft): **10.5**
DRILLING METHOD: **Bucket**	STATIC DTW (ft): **NE** / WELL DEPTH (ft): **---**
SAMPLING EQUIPMENT: **Bucket**	WELL CASING DIAMETER (in): **---** / BOREHOLE DIAMETER (in):
	LOGGED BY: **ND** / CHECKED BY: **JF**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Geotechnical Lab Testing	Blow Count	PID Reading (ppmv)	Depth (feet)
			QUATERNARY LAKE DEPOSITS (Ql)						
		SC	**CLAYEY SAND** ; SC; (10YR 4/3) brown; 75% very fine to medium grained sand; 25% fines; dry; no odor; no staining						
5		CL	**CLAY** ; CL; (10YR 4/5) brown; 5% fine to coarse gravel; 22% fine to coarse graiend sand; 73% high plasticity fines; very stiff ; moist; no odor; no staining (PP = 4.0 TSF)	X	0945 TP8-5	#200			5
10				X	0950 TP8-10				10
			Hole terminated at 10.5 feet.						

PROJECT: **Ormat Wister Solar Project**
LOCATION: **Niland, CA**
PROJECT NUMBER: **185804156**
DRILLING: STARTED **4/25/19** COMPLETED: **4/25/19**
INSTALLATION: STARTED **4/25/19** COMPLETED: **4/25/19**
DRILLING COMPANY: **Strong Arm**
DRILLING EQUIPMENT: **Backhoe**
DRILLING METHOD: **Bucket**
SAMPLING EQUIPMENT: **Bucket**

WELL / TEST PIT / BOREHOLE NO:
TP-09 PAGE 1 OF 1

Stantec

NORTHING (ft): | EASTING (ft):
LATITUDE: **33° 16' 25.98"** | LONGITUDE: **115° 29' 52.31"**
GROUND ELEV (ft): **21** | TOC ELEV (ft):
INITIAL DTW (ft): **NE** | BOREHOLE DEPTH (ft): **10.5**
STATIC DTW (ft): **NE** | WELL DEPTH (ft): **---**
WELL CASING DIAMETER (in): **---** | BOREHOLE DIAMETER (in):
LOGGED BY: **ND** | CHECKED BY: **JF**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Geotechnical Lab Testing	Blow Count	PID Reading (ppmv)	Depth (feet)
			QUATERNARY LAKE DEPOSITS (Ql)						
		SP	**SAND** ; SP; (10YR 4/3) brown; 90% fine to coarse-grained sand; 10% fines; loose; dry; no odor; no staining						
		SC	**CLAYEY SAND** ; SC; (10YR 4/3) brown; 5% fine gravel; 80% very fine to coarse grained sand; 15% fines; dry; no odor; no staining						
5		CL	**SANDY CLAY** ; CL; (10YR 4/3) brown; 1% fine gravel, 16% fine to coarse grained sand; 83% low plasticity fines; very stiff; dry; no odor; no staining (PP = 4.0 TSF)	X	1255 TP9-5	SA			5
10				X	1300 TP9-10				10
			Hole terminated at 11 feet.						

PROJECT: **Ormat Wister Solar Project**		WELL / TEST PIT / BOREHOLE NO:	
LOCATION: **Niland, CA**		**TP-10** PAGE 1 OF 1	Stantec
PROJECT NUMBER: **185804156**		NORTHING (ft):	EASTING (ft):
DRILLING: STARTED **4/25/19**	COMPLETED: **4/25/19**	LATITUDE: **33° 16' 0.99"**	LONGITUDE: **115° 29' 51.78"**
INSTALLATION: STARTED **4/25/19**	COMPLETED: **4/25/19**	GROUND ELEV (ft): **-3**	TOC ELEV (ft):
DRILLING COMPANY: **Strong Arm**		INITIAL DTW (ft): **NE**	BOREHOLE DEPTH (ft): **10.5**
DRILLING EQUIPMENT: **Backhoe**		STATIC DTW (ft): **NE**	WELL DEPTH (ft): **---**
DRILLING METHOD: **Bucket**		WELL CASING DIAMETER (in): **---**	BOREHOLE DIAMETER (in):
SAMPLING EQUIPMENT: **Bucket**		LOGGED BY: **ND**	CHECKED BY: **JF**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Geotechnical Lab Testing	Blow Count	PID Reading (ppmv)	Depth (feet)
			QUATERNARY LAKE DEPOSITS (Ql)						
5		SC	**CLAYEY SAND** ; SC; (10YR 4/3) brown; 23% fine to coarse gravel; 64% fine to coarse grained sand; 13% fines; coarse; dry; no odor; no staining	X	1445 TP10-5	SA			5
		CL	**CLAY** ; CL; (10YR 4/5) brown; 5% fine gravel; 10% fine to coarse grained sand; 85% low plasticity fines; very stiff; dry; no odor; no staining (PP = 4.0 TSF)						
10				X	1450 TP10-10				10
			Hole terminated at 10.5 feet.						

PROJECT: **Ormat Wister Solar Project**	WELL / TEST PIT / BOREHOLE NO:
LOCATION: **Niland, CA**	**TP-11** PAGE 1 OF 1
PROJECT NUMBER: **185804156**	Stantec
DRILLING: STARTED **4/25/19** COMPLETED: **4/25/19**	NORTHING (ft): / EASTING (ft):
INSTALLATION: STARTED **4/25/19** COMPLETED: **4/25/19**	LATITUDE: **33° 16' 40.56"** / LONGITUDE: **115° 29' 35.57"**
DRILLING COMPANY: **Strong Arm**	GROUND ELEV (ft): **48** / TOC ELEV (ft):
DRILLING EQUIPMENT: **Backhoe**	INITIAL DTW (ft): **NE** / BOREHOLE DEPTH (ft): **10.5**
DRILLING METHOD: **Bucket**	STATIC DTW (ft): **NE** / WELL DEPTH (ft): **---**
SAMPLING EQUIPMENT: **Bucket**	WELL CASING DIAMETER (in): **---** / BOREHOLE DIAMETER (in):
	LOGGED BY: **ND** / CHECKED BY: **JF**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Geotechnical Lab Testing	Blow Count	PID Reading (ppmv)	Depth (feet)
			QUATERNARY LAKE DEPOSITS (QI)						
5		SC	**CLAYEY SAND** ; SC; (10YR 4/3) brown; 3% fine to coarse gravel; 63% fine to coarse grained sand; 34% fines; coarse; dry; no odor; no staining	X	1350 TP11-05	SA			5
		CL	**CLAY** ; CL; (10YR 4/3) brown; 10% fine grained sand; 90% low plasticity fines; very stiff; dry; no odor; no staining (PP = 4.0 TSF)						
10				X	1355 TP11-10				10
			Hole terminated at 10.5 feet.						

GEO FORM 304 NILAND.GPJ SECOR INTL.GDT 5/17/19

PROJECT: **Ormat Wister Solar Project**
LOCATION: **Niland, CA**
PROJECT NUMBER: **185804156**
DRILLING: STARTED **4/25/19** COMPLETED: **4/25/19**
INSTALLATION: STARTED **4/25/19** COMPLETED: **4/25/19**
DRILLING COMPANY: **Strong Arm**
DRILLING EQUIPMENT: **Backhoe**
DRILLING METHOD: **Bucket**
SAMPLING EQUIPMENT: **Bucket**

WELL / TEST PIT / BOREHOLE NO:

TP-12 PAGE 1 OF 1

Stantec

NORTHING (ft):
EASTING (ft):
LATITUDE: **33° 16' 14.64"**
LONGITUDE: **115° 29' 35.57"**
GROUND ELEV (ft): **25**
TOC ELEV (ft):
INITIAL DTW (ft): **NE**
BOREHOLE DEPTH (ft): **10.5**
STATIC DTW (ft): **NE**
WELL DEPTH (ft): **---**
WELL CASING DIAMETER (in): **---**
BOREHOLE DIAMETER (in):
LOGGED BY: **ND**
CHECKED BY: **JF**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Geotechnical Lab Testing	Blow Count	PID Reading (ppmv)	Depth (feet)
			QUATERNARY LAKE DEPOSITS (Ql)						
		SC	**CLAYEY SAND** ; SC; (10YR 4/3) brown; 75% very fine to coarse grained sand; 25% fines; dry; no odor; no staining						
5		CL	**CLAY** ; CL; (10YR 4/5) brown; 5% fine grained sand; 95% low plasticity fines; very stiff; dry; no odor; no staining (PP = 4.0 TSF)	X	1325 TP12-5	#200			5
10				X	1330 TP12-10				10
			Hole terminated at 10.5 feet.						

PROJECT: **Ormat Wister Solar Project**	WELL / TEST PIT / BOREHOLE NO:
LOCATION: **Niland, CA**	**TP-13** PAGE 1 OF 1
PROJECT NUMBER: **185804156**	
DRILLING: STARTED **4/25/19** COMPLETED: **4/25/19**	NORTHING (ft): EASTING (ft):
INSTALLATION: STARTED **4/25/19** COMPLETED: **4/25/19**	LATITUDE: **33° 15' 49.1"** LONGITUDE: **115° 29' 35.42"**
DRILLING COMPANY: **Strong Arm**	GROUND ELEV (ft): **-5** TOC ELEV (ft):
DRILLING EQUIPMENT: **Backhoe**	INITIAL DTW (ft): **NE** BOREHOLE DEPTH (ft): **10.5**
DRILLING METHOD: **Bucket**	STATIC DTW (ft): **NE** WELL DEPTH (ft): **---**
	WELL CASING DIAMETER (in): **---** BOREHOLE DIAMETER (in):
SAMPLING EQUIPMENT: **Bucket**	LOGGED BY: **ND** CHECKED BY: **JF**

Stantec

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Geotechnical Lab Testing	Blow Count	PID Reading (ppmv)	Depth (feet)
			QUATERNARY LAKE DEPOSITS (Ql)						
		SM	**SILTY SAND** ; SM; (10YR 4/5) brown; 80% very fine - coarse-grained sand; 20% fines; lose; dry; no odor; no staining						
5		CL	**CLAY** ; CL; (10YR 4/3) brown; trace gravel; very stiff (4.0); dry; no odor; no staining	X	1420 TP13-5	#200			5
10				X	1425 TP13-10				10
			Hole terminated at 10.5 feet.						

Stantec

ATTACHMENT B
LABORATORY TEST RESULTS

Materials Finer Than 75µm (No. 200) Sieve

ASTM D 1140

Project Name	Ormat Wister Solar Project	Project Number	185804156
Source	Grab	Lab ID	TP1-5'
		Date Received	05-02-2019
Preparation Method	ASTM D 1140 Method A	Test Date	05-03-2019

Initial Sample Wet Mass (g)	404.00	Moisture Content (%)	12.5
Initial Oven Dry Sample Mass (g)	359.20		
Final Oven Dry Sample Mass (g)	10.80		
Materials Finer Than 75µm (No. 200) Sieve (g)	348.40		
Percent Finer Than 75µm (No. 200) Sieve (%)	97.0		

Comments

Reviewed By JF

Gradation Analysis

ASTM D 422

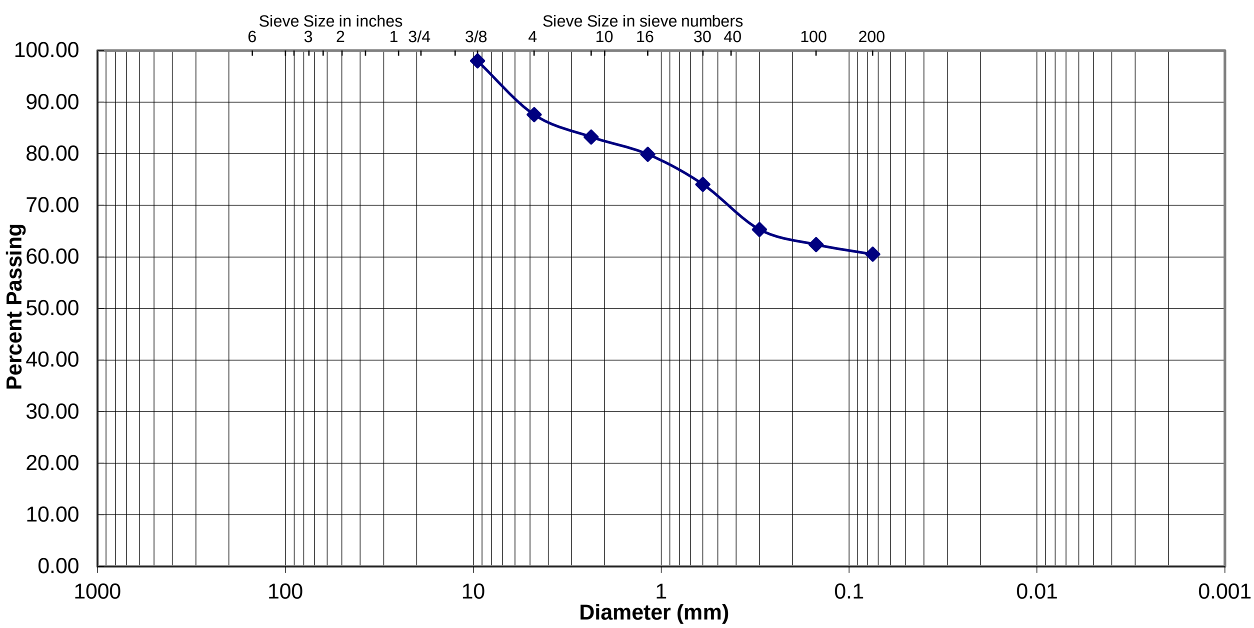
Project Name	Ormat Wister Solar Project	Project Number	185804156
Source	Grab	Lab ID	TP2-5'
		Date Received	05-02-2019
Preparation Method	ASTM D 1140 Method A	Preparation Date	05-03-2019
Particle Shape		Test Date	05-04-2019
Particle Hardness			
Sample Dry Mass (g)	406.60		
Moisture Content (%)	7.6		

Analysis based on total sample.

Sieve Size	Grams Retained	% Retained	% Passing
3/8"	8.20	2.0	98.0
No. 4	42.30	10.4	87.6
No. 8	17.60	4.3	83.3
No. 16	13.60	3.3	79.9
No. 30	23.70	5.8	74.1
No. 50	35.60	8.8	65.3
No. 100	11.90	2.9	62.4
No. 200	7.70	1.9	60.5
Pan	246.00	60.5	---

% Gravel	12.4
% Sand	27.1
% Fines	60.5
Fines Classification	CL
D_{10} (mm)	N/A
D_{30} (mm)	N/A
D_{60} (mm)	N/A
Cu	N/A
Cc	N/A

Particle Size Distribution



Comments

Reviewed By JF

Stantec

Gradation Analysis
ASTM D 422

Project Name: Ormat Wister Solar Project
Source: Grab

Preparation Method: ASTM D 1140 Method A
Particle Shape:
Particle Hardness:
Sample Dry Mass (g): 461.10
Moisture Content (%): 1.4

Project Number: 185804156
Lab ID: TP3-5'
Date Received: 05-02-2019
Preparation Date: 05-03-2019
Test Date: 05-04-2019

Analysis based on total sample.

Sieve Size	Grams Retained	% Retained	% Passing
3/8"	24.00	5.2	94.8
No. 4	44.70	9.7	85.1
No. 8	21.10	4.6	80.5
No. 16	18.80	4.1	76.4
No. 30	26.70	5.8	70.7
No. 50	112.50	24.4	46.3
No. 100	107.20	23.2	23.0
No. 200	31.30	6.8	16.2
Pan	74.80	16.2	---

% Gravel: 14.9
% Sand: 68.9
% Fines: 16.2
Fines Classification: CL

D_{10} (mm): N/A
D_{30} (mm): N/A
D_{60} (mm): N/A

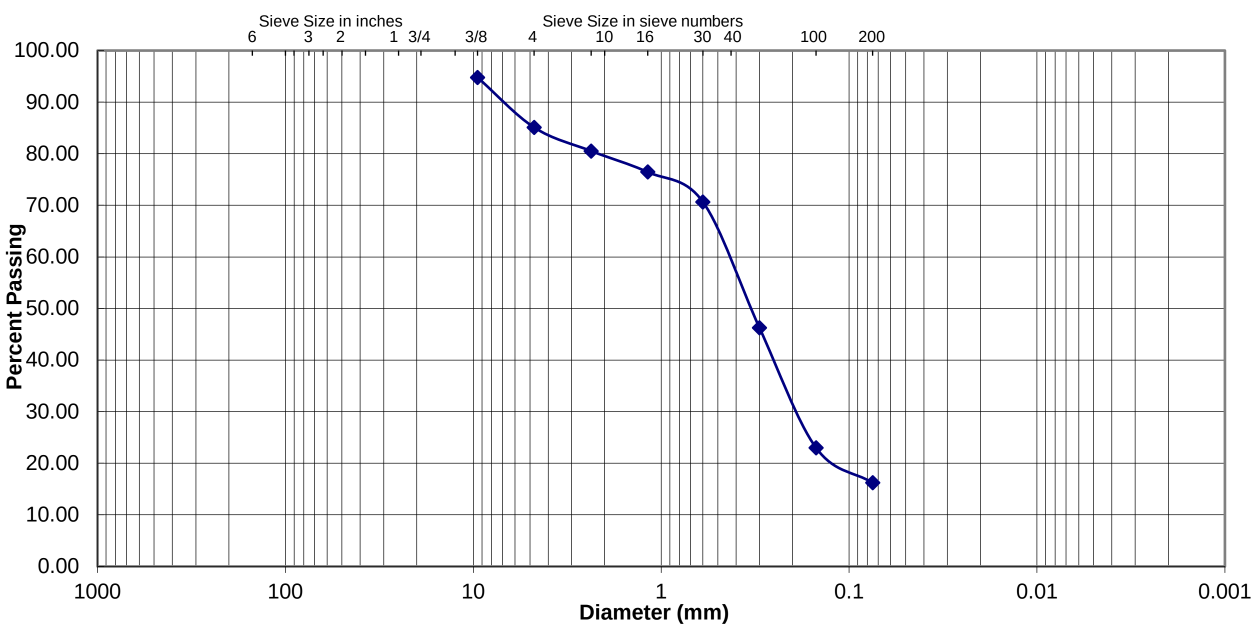
Cu: N/A
Cc: N/A

Classification

Clayey Sand (SC)

Classification determined by ASTM D 2487. -200 material classification determined by visual assessment, ASTM D 2488.

Particle Size Distribution



Comments

Reviewed By: JF

Stantec

Materials Finer Than 75µm (No. 200) Sieve

ASTM D 1140

Project Name	Ormat Wister Solar Project	Project Number	185804156
Source	Grab	Lab ID	TP4-5'
		Date Received	05-02-2019
Preparation Method	ASTM D 1140 Method A	Test Date	05-03-2019

Initial Sample Wet Mass (g)	463.70	Moisture Content (%)	12.8
Initial Oven Dry Sample Mass (g)	411.10		
Final Oven Dry Sample Mass (g)	114.70		
Materials Finer Than 75µm (No. 200) Sieve (g)	296.40		
Percent Finer Than 75µm (No. 200) Sieve (%)	72.1		

Comments

Reviewed By JF

Stantec

Materials Finer Than 75µm (No. 200) Sieve

ASTM D 1140

Project Name	Ormat Wister Solar Project	Project Number	185804156
Source	Grab	Lab ID	TP5-5'
		Date Received	05-02-2019
Preparation Method	ASTM D 1140 Method A	Test Date	05-03-2019

Initial Sample Wet Mass (g)	351.60	Moisture Content (%)	9.1
Initial Oven Dry Sample Mass (g)	322.20		
Final Oven Dry Sample Mass (g)	4.90		
Materials Finer Than 75µm (No. 200) Sieve (g)	317.30		
Percent Finer Than 75µm (No. 200) Sieve (%)	98.5		

Comments

Reviewed By JF

Materials Finer Than 75μm (No. 200) Sieve

ASTM D 1140

Project Name	Ormat Wister Solar Project	Project Number	185804156
Source	Grab	Lab ID	TP6-5'
		Date Received	05-02-2019
Preparation Method	ASTM D 1140 Method A	Test Date	05-03-2019

Initial Sample Wet Mass (g)	366.00	Moisture Content (%)	15.8
Initial Oven Dry Sample Mass (g)	316.00		
Final Oven Dry Sample Mass (g)	86.80		
Materials Finer Than 75μm (No. 200) Sieve (g)	229.20		
Percent Finer Than 75μm (No. 200) Sieve (%)	72.5		

Comments

Reviewed By JF

Materials Finer Than 75µm (No. 200) Sieve
ASTM D 1140

Project Name	Ormat Wister Solar Project	Project Number	185804156
Source	Grab	Lab ID	TP7-5'
		Date Received	05-02-2019
Preparation Method	ASTM D 1140 Method A	Test Date	05-03-2019

Initial Sample Wet Mass (g)	435.30	Moisture Content (%)	5.5
Initial Oven Dry Sample Mass (g)	412.50		
Final Oven Dry Sample Mass (g)	130.80		
Materials Finer Than 75µm (No. 200) Sieve (g)	281.70		
Percent Finer Than 75µm (No. 200) Sieve (%)	68.3		

Comments

Reviewed By JF

Stantec

Materials Finer Than 75µm (No. 200) Sieve

ASTM D 1140

Project Name	Ormat Wister Solar Project	Project Number	185804156
Source	Grab	Lab ID	TP8-5'
		Date Received	05-02-2019
Preparation Method	ASTM D 1140 Method A	Test Date	05-03-2019

Initial Sample Wet Mass (g)	516.70	Moisture Content (%)	17.2
Initial Oven Dry Sample Mass (g)	440.80		
Final Oven Dry Sample Mass (g)	117.60		
Materials Finer Than 75µm (No. 200) Sieve (g)	323.20		
Percent Finer Than 75µm (No. 200) Sieve (%)	73.3		

Comments

Reviewed By JF

Gradation Analysis

ASTM D 422

Project Name: Ormat Wister Solar Project
Source: Grab

Project Number: 185804156
Lab ID: TP9-5'
Date Received: 05-02-2019
Preparation Date: 05-03-2019
Test Date: 05-04-2019

Preparation Method: ASTM D 1140 Method A
Particle Shape:
Particle Hardness:
Sample Dry Mass (g): 377.40
Moisture Content (%): 14.5

Analysis based on total sample.

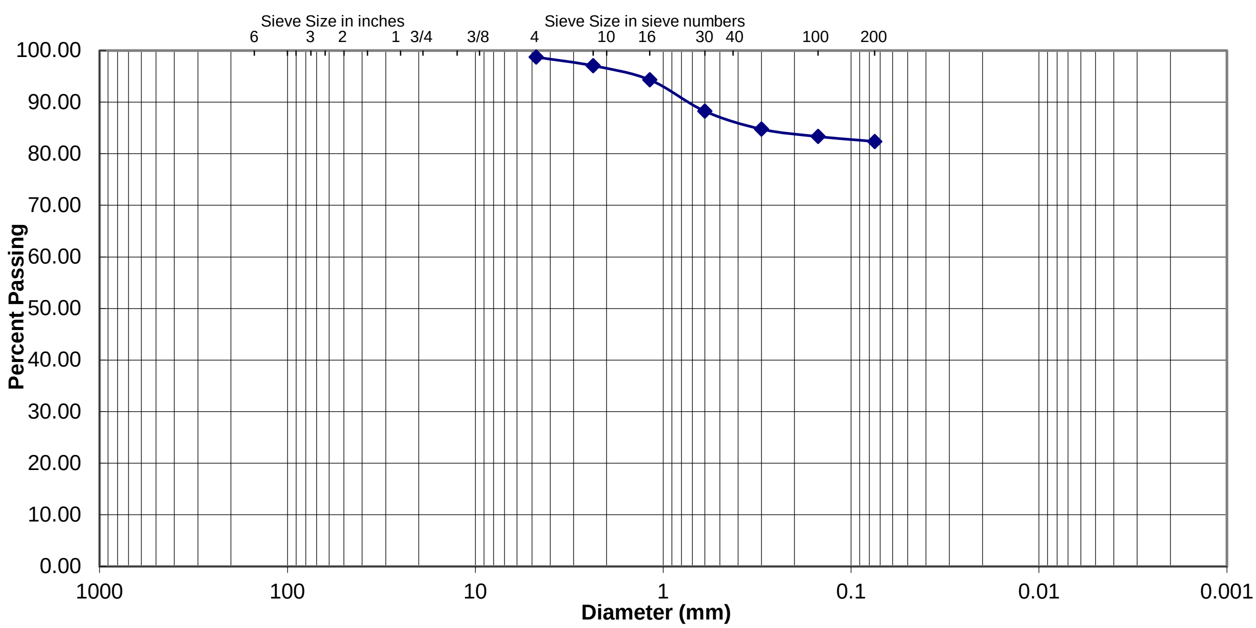
Sieve Size	Grams Retained	% Retained	% Passing
No. 4	4.80	1.3	98.7
No. 8	6.30	1.7	97.1
No. 16	10.30	2.7	94.3
No. 30	23.00	6.1	88.2
No. 50	13.10	3.5	84.8
No. 100	5.40	1.4	83.3
No. 200	3.60	1.0	82.4
Pan	310.90	82.4	---

% Gravel: 1.3
% Sand: 16.3
% Fines: 82.4
Fines Classification: CL

D_{10} (mm): N/A
D_{30} (mm): N/A
D_{60} (mm): N/A

Cu: N/A
Cc: N/A

Particle Size Distribution



Comments

Reviewed By

Stantec

Gradation Analysis
ASTM D 422

Project Name	Ormat Wister Solar Project	Project Number	185804156
Source	Grab	Lab ID	TP10-5'
		Date Received	05-02-2019
Preparation Method	ASTM D 1140 Method A	Preparation Date	05-03-2019
Particle Shape		Test Date	05-04-2019
Particle Hardness			
Sample Dry Mass (g)	462.00		
Moisture Content (%)	1.7		

Analysis based on total sample.

Sieve Size	Grams Retained	% Retained	% Passing
3/4"	17.00	3.7	96.3
1/2"	11.90	2.6	93.7
3/8"	38.30	8.3	85.5
No. 4	40.40	8.7	76.7
No. 8	48.90	10.6	66.1
No. 16	44.50	9.6	56.5
No. 30	132.40	28.7	27.8
No. 50	57.70	12.5	15.3
No. 100	11.20	2.4	12.9
No. 200	0.20	0.0	12.9
Pan	59.50	12.9	---

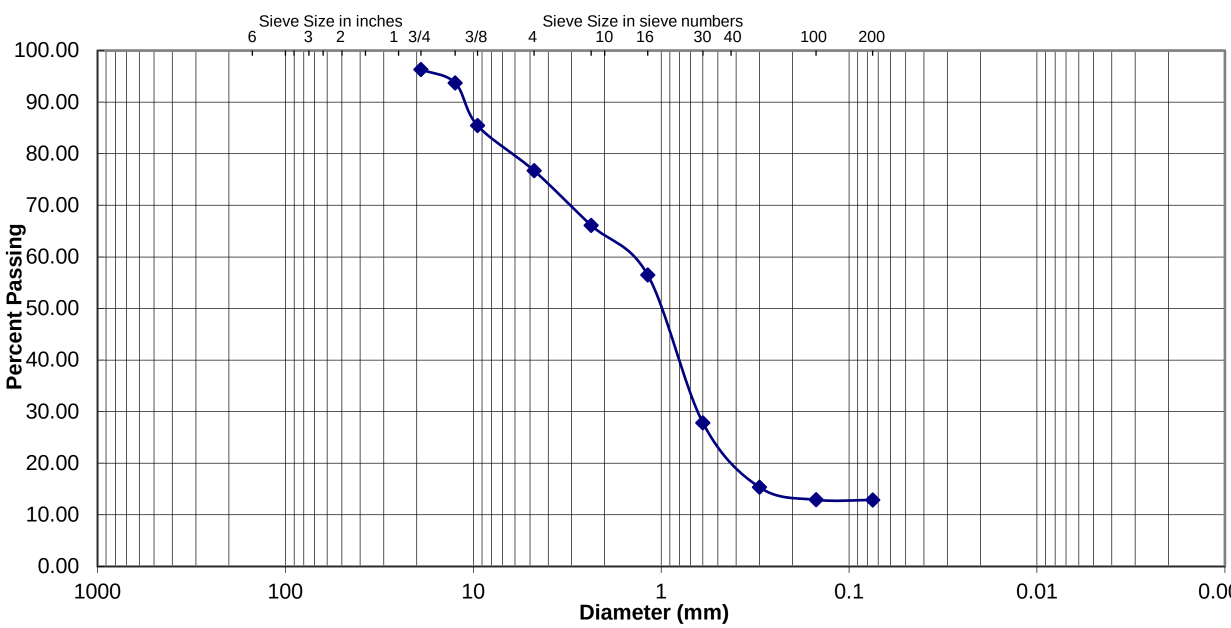
% Gravel	23.3
% Sand	63.8
% Fines	12.9
Fines Classification	CL
D_{10} (mm)	N/A
D_{30} (mm)	N/A
D_{60} (mm)	N/A
Cu	N/A
Cc	N/A

Classification

Clayey Sand (SC) with Gravel

Classification determined by ASTM D 2487. -200 material classification determined by visual assessment, ASTM D 2488.

Particle Size Distribution



Comments

Reviewed By JF

Gradation Analysis
ASTM D 422

Project Name	Ormat Wister Solar Project
Source	Grab
Preparation Method	ASTM D 1140 Method A
Particle Shape	
Particle Hardness	
Sample Dry Mass (g)	369.00
Moisture Content (%)	4.6

Project Number	185804156
Lab ID	TP11-5'
Date Received	05-02-2019
Preparation Date	05-03-2019
Test Date	05-04-2019

Analysis based on total sample.

Sieve Size	Grams Retained	% Retained	% Passing
No. 4	9.70	2.6	97.4
No. 8	0.00	0.0	97.4
No. 16	0.00	0.0	97.4
No. 30	0.00	0.0	97.4
No. 50	0.40	0.1	97.3
No. 100	29.90	8.1	89.2
No. 200	201.90	54.7	34.4
Pan	127.10	34.4	---

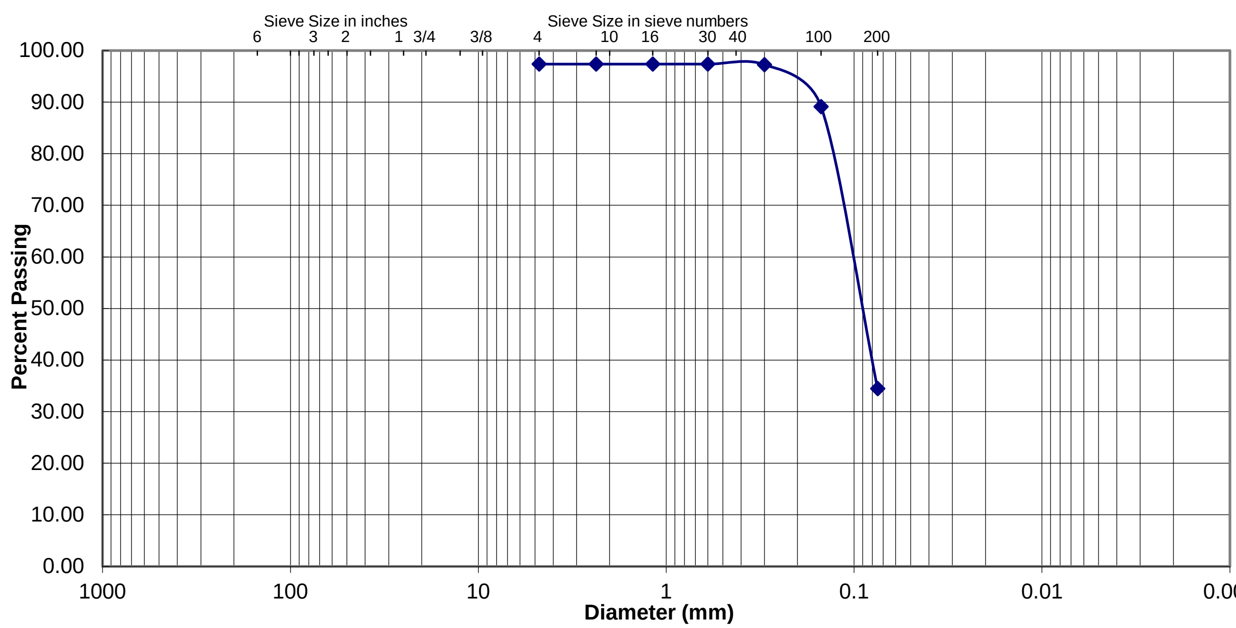
% Gravel	2.6
% Sand	62.9
% Fines	34.4
Fines Classification	CL
D_{10} (mm)	N/A
D_{30} (mm)	N/A
D_{60} (mm)	N/A
Cu	N/A
Cc	N/A

Classification

Clayey Sand (SC)

Classification determined by ASTM D 2487. -200 material classification determined by visual assessment, ASTM D 2488.

Particle Size Distribution



Comments

Reviewed By JF

Materials Finer Than 75µm (No. 200) Sieve
ASTM D 1140

Project Name	Ormat Wister Solar Project	Project Number	185804156
Source	Grab	Lab ID	TP12-5'
		Date Received	05-02-2019
Preparation Method	ASTM D 1140 Method A	Test Date	05-03-2019

Initial Sample Wet Mass (g)	355.80	Moisture Content (%)	26.8
Initial Oven Dry Sample Mass (g)	280.60		
Final Oven Dry Sample Mass (g)	53.90		
Materials Finer Than 75µm (No. 200) Sieve (g)	226.70		
Percent Finer Than 75µm (No. 200) Sieve (%)	80.8		

Comments

Reviewed By JF

Stantec

Materials Finer Than 75µm (No. 200) Sieve

ASTM D 1140

Project Name	Ormat Wister Solar Project	Project Number	185804156
Source	Grab	Lab ID	TP13-5'
		Date Received	05-02-2019
Preparation Method	ASTM D 1140 Method A	Test Date	05-03-2019

Initial Sample Wet Mass (g)	421.50	Moisture Content (%)	15.8
Initial Oven Dry Sample Mass (g)	364.00		
Final Oven Dry Sample Mass (g)	20.00		
Materials Finer Than 75µm (No. 200) Sieve (g)	344.00		
Percent Finer Than 75µm (No. 200) Sieve (%)	94.5		

Comments

Reviewed By JF

Stantec

ATTACHMENT C
CEQA GUIDELINES FORM – GEOLOGY AND SOILS

GEOLOGY AND SOILS	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact	Not Applicable
Would the project:					
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:					
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault (refer to CDMG Special Publication 42)?			X		
ii) Strong Seismic ground shaking?		X			
iii) Seismic-related ground failure, including liquefaction?			X		
iv) Landslides?			X		
b) Result in substantial soil erosion or the loss of topsoil?		X			
c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in onsite or offsite landslide, lateral spreading, subsidence, liquefaction, or collapse?			X		
d) Be located on expansive soil, as identified in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?			X		
e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for disposal of waste water?			X		

Water Quality Management Plan

Report Description

February 19, 2020

Prepared for:

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Prepared by:

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1.0 ENVIRONMENTAL SETTING

The project area lies within the Imperial Valley Planning Area of the Colorado River Basin Regional Water Quality Control Board (RWQCB). The site is situated west of Wilkins Road approximately 5.5 miles west of the Salton Sea. According to the Colorado River Basin Plan, the project site is contained within the Brawley Hydrologic Area in the Imperial Hydrologic Unit (HU 723.10). The Imperial Valley is characterized as a closed basin and, therefore, all runoff generated within the watershed discharges into the Salton Sea.

The proposed project is situated on a 640-acre parcel with APN No. 054-250-036, but only 115 acres of the site will be developed into a PV Solar Power Generation Plant. The remaining 525 acres will remain undeveloped.

The project area is characterized by a typical desert climate with dry, warm winters, and hot, dry summers. Most of the rainfall occurs in conjunction with monsoonal conditions between May and September, with an average annual rainfall of less than 3 inches for the project area. The 10-year, 24-hour estimated precipitation amount is 1.87 inches; and the 100-year, 24-hour estimated precipitation is 3.70 inches (NOAA Atlas 14).

2.0 DRAINAGE CONDITIONS

2.1 EXISTING DRAINAGE CONDITIONS

The project site is located in the County of Imperial north of the townsite of Niland, California. The project site and the surrounding terrain is generally flat and slopes down in a southwest direction at approximately 1.5 percent. Currently, off-site storm water runoff runs through the project site. The upstream tributary storm drainage area extends approximately 0.85 miles northeast of the project to the existing Coachella Canal. The storm water runoff eventually drains into the East Highline Canal.

2.2 PROPOSED DRAINAGE CONDITIONS

The project will incorporate on-site storm water retention basins to retain the 100-year, 24-hour storm event of 3 inches over the entire developed area (28.75 acre-ft of runoff volume). There are 5 retention basins to provide 30 acre-feet of storage capacity. The basins are located westerly and southerly of the developed area.

The off-site runoff will be intercepted by the proposed earthen channel at the northerly and easterly boundaries of the developed area. The earthen channel will convey off-site storm water runoff around the development and discharge in the same manner as existing condition downstream of the project site to continue its natural course and eventually into the East Highline Canal. The proposed earthen channels will provide flood protection to the development from uncontrolled off-site storm runoff.

3.0 REGULATORY SETTING

The proposed project is subjected to the following regulations:

3.1 FEDERAL

Federal plans, policies, and regulations that are applicable to the projects are presented below under the following headings.

3.1.1 Clean Water Act

The U.S. Environmental Protection Agency (U.S. EPA) is the lead Federal agency responsible for managing water quality. The Clean Water Act (CWA) of 1972 is the primary Federal law that governs and authorizes the U.S. EPA and the states to implement activities to control water quality. The various elements of the CWA that address water quality and that are applicable to the projects are discussed below. Wetland protection elements administered by the U.S. Army Corps of Engineers (USACE) under Section 404 of the CWA, including permits for the discharge of dredged and/or fill material into waters of the United States, are discussed in Chapter 4.4, Biological Resources.

Under Federal law, the U.S. EPA has published water quality regulations under Volume 40 of the Code of Federal Regulations. Section 303 of the CWA requires states to adopt water quality standards for all surface waters of the United States. As defined by the CWA, water quality standards consist of two elements: (1) designated beneficial uses of the water body in question; and (2) criteria that protect the designated uses. Section 304(a) requires the U.S. EPA to publish advisory water quality criteria that accurately reflect the latest scientific knowledge on the kind and extent of all effects on health and welfare that may be expected from the presence of pollutants in water. Where multiple uses exist, water quality standards must protect the most sensitive use. The U.S. EPA is the federal agency with primary authority for implementing regulations adopted under the CWA. The U.S. EPA has delegated the State of California the authority to implement and oversee most of the programs authorized or adopted for CWA compliance through the Porter-Cologne Water Quality Control Act of 1969 (Porter-Cologne Act), described below.

Under CWA Section 401, applicants for a federal license or permit to conduct activities that may result in the discharge of a pollutant into waters of the U.S. must obtain a water quality certification from the State Water Resources Control Board (SWRCB) in which the discharge would originate or, if appropriate, from the interstate water pollution control agency with jurisdiction over affected waters at the point where the discharge would originate.

CWA Section 402 establishes the National Pollutant Discharge Elimination System (NPDES) permit program to control point source discharges from industrial, municipal, and other facilities if their discharges go directly to surface waters. The 1987 amendments to the CWA created a new section of the CWA devoted to regulating storm water or nonpoint source discharges (Section 402[p]). The EPA has granted California primacy in administering and enforcing the provisions of the CWA and the NPDES program through the SWRCB. The SWRCB is responsible for issuing both general and individual permits for discharges from certain activities. At the local and regional levels, general and individual permits are administered by RWQCBs.

3.1.2 CWA Section 303(d) Impaired Waters List

CWA Section 303(d) requires states to develop lists of water bodies that will not attain water quality standards after implementation of minimum required levels of treatment by point-source dischargers. Section 303(d) requires states to develop a total maximum daily load (TMDL) for each of the listed pollutants and water bodies. A TMDL is the amount of loading that the water body can receive and still be in compliance with applicable water quality objectives and applied beneficial uses. TMDLs can also act as a planning framework for reducing loadings of a specific pollutant from various sources to achieve compliance with water quality objectives. TMDLs prepared by the state must include an allocation of allowable loadings to point and nonpoint sources, with consideration of background loadings and a margin of safety. The TMDL must also include an analysis that shows links between loading reductions and the attainment of water quality objectives.

The impaired water bodies listed on the 303(d) list for the New River Basin include the Imperial Valley Drains (managed by the Imperial Irrigation District), New River, and the Salton Sea. The Imperial Valley Drains are responsible for draining the area. Further discussion of specific pollutant listings is provided in Section 4.9.1.2.

3.1.3 Antidegradation Policy

The Federal Antidegradation Policy, established in 1968, is designed to protect existing uses, water quality, and national water resources. The Federal policy directs states to adopt a statewide policy that includes the following primary provisions:

- Existing in-stream uses and the water quality necessary to protect those uses shall be maintained and protected.
- Where existing water quality is better than necessary to support fishing and swimming conditions, that quality shall be maintained and protected unless the state finds that allowing lower water quality is necessary for important local economic or social development.
- Where high-quality waters constitute an outstanding national resource, such as waters of national and state parks, wildlife refuges, and waters of exceptional recreational or ecological significance, that water quality shall be maintained and protected.

The Federal Anti-Degradation Policy is applicable to the proposed on-site wastewater system and is implemented by the RWQCB and County's Public Health Department.

3.2 STATE

3.2.1 Porter-Cologne Water Quality Control Act

The Porter-Cologne Water Quality Control Act, also known as the California Water Code, is California's statutory authority for the protection of water quality. Under this act, the state must adopt water quality policies, plans, and objectives that protect the state's waters. The act sets forth the obligations of the SWRCB and RWQCBs pertaining to the adoption of Water Quality Control Plans and establishment of water quality objectives. Unlike the federal CWA, which regulates only surface water, the Porter-Cologne Act regulates both surface water and groundwater.

3.2.2 Water Quality Control Plan for the Colorado River Basin

The Water Quality Control Plan for the Colorado River Basin (or Basin Plan) prepared by the Colorado River Basin RWQCB (Region 7) identifies beneficial uses of surface waters within the Colorado River Basin region, establishes quantitative and qualitative water quality objectives for protection of beneficial uses, and establishes policies to guide the implementation of these water quality objectives (RWQCB 2005). According to the Basin Plan (RWQCB 2005), the beneficial uses established for the Imperial Valley Drains, which include the Wistaria Drain, Greeson Wash, New River, and the Salton Sea include: industrial service supply; freshwater replenishment; water contact recreation; non-contact water recreation; warm freshwater habitat; wildlife habitat; preservation of rare, threatened, or endangered species; and aquaculture.

3.2.3 California Toxics Rule

Under the California Toxics Rule (CTR), the U.S. EPA has proposed water quality criteria for priority toxic pollutants for inland surface waters, enclosed bays, and estuaries. These federally promulgated criteria create water quality standards for California waters. The CTR satisfies CWA requirements and protects public health and the environment. The U.S. EPA and the SWRCB have the authority to enforce these standards, which are incorporated into the NPDES permits that regulate the current discharges in the project area.

3.2.4 NPDES General Industrial and Construction Permits

The NPDES General Industrial Permit requirements apply to the discharge of stormwater associated with industrial sites. The permit requires implementation of management measures that will achieve the performance standard of the best available technology economically achievable and best conventional pollutant control technology. Under the statute, operators of new facilities must implement industrial Best Management Practices (BMPs) in the projects' Stormwater Pollution Prevention Plan (SWPPP) and perform monitoring of stormwater discharges and unauthorized non–stormwater discharges. Construction activities are regulated under the NPDES General Permit for Discharges of Storm Water Runoff Associated with Construction Activity (General Construction Permit) which covers stormwater runoff requirements for projects where the total amount of ground disturbance during construction exceeds one acre. Coverage under a General Construction Permit requires the preparation of a SWPPP and submittal of a Notice of Intent (NOI) to comply with the General Construction Permit. The SWPPP includes a description of BMPs to minimize the discharge of pollutants from the sites during construction. Typical BMPs include temporary soil stabilization measures (e.g., mulching and seeding), storing materials and equipment to ensure that spills or leaks cannot enter the storm drain system or stormwater, and using filtering mechanisms at drop inlets to prevent contaminants from entering storm drains. Typical post-construction management practices include street sweeping and cleaning stormwater drain inlet structures.

The NOI includes site-specific information and the certification of compliance with the terms of the General Construction Permit.

3.3 LOCAL

3.3.1 County of Imperial General Plan

Due to the economic, biological, and agricultural significance water plays in the Imperial County, the Water Element and the Conservation and Open Space Element of the General Plan contain policies and programs, created to ensure water resources are preserved and protected. Table 4.9-1 identifies General Plan policies and programs for water quality that is relevant to the proposed project and summarizes the proposed project's consistency with the General Plan. While this EIR analyzes the project's consistency with the General Plan pursuant to State CEQA Guidelines Section 15125(d), the Imperial County Board of Supervisors ultimately determines consistency with the General Plan.

3.3.2 County of Imperial Land Use Ordinance, Title 9

The County's Ordinance Code provides specific direction for the protection of water resources. Applicable ordinance requirements are contained in Division 10, Building, Sewer and Grading Regulations, and summarized below.

TABLE-1. PROJECT CONSISTENCY WITH APPLICABLE GENERAL PLAN WATER RESOURCES POLICIES

General Plan Policies	Consistency with General Plan	Analysis
Conservation and Open Space Element		
1) Structural development normally shall be prohibited in the designated floodways. Only structures which comply with specific development standards should be permitted in the floodplain.	Consistent	The projects do not contain a residential component, nor would it place housing or other structures within a 100-year flood hazard area.
Water Element		
1) The County of Imperial shall make every reasonable effort to limit or preclude the contamination or degradation of all groundwater and surface water resources in the County.	Consistent	Mitigation measures contained in Section 4.9.2.3 will require that the project applicant prepare a site-specific drainage plan and water quality management plan to minimize adverse effects to local water resources. Further, Sections 4.6 and 4.8 include additional mitigation requirements for the projects' septic waste treatment and disposal system and the management of hazardous materials and waste during the construction and operation of the projects. These mitigation requirements will be made conditions approval in conjunction with the County's approval of the Conditional Use Permit(s) (CUPs) for the projects.
2) All development proposals brought before the County of Imperial shall be reviewed for potential adverse effects on water quality and quantity and shall be required to implement appropriate mitigation measures for any significant impacts.	Consistent	See response for Water Element Policy 1) above.

3.3.3 Imperial County Engineering Guidelines Manual

Based on guidance contained in the County's Engineering Guidelines Manual, the following water quality requirements would be applicable to the projects.

III A. GENERAL REQUIREMENTS

10. An airtight or screened oil/water separator or equivalent is required prior to permitting on-site lot drainage from entering any street right of way or public storm drain system for all industrial/commercial or multi residential uses. A maximum 6-inch drain lateral can be used to tie into existing adjacent street curb inlets with some exceptions. Approval from the Director of Public Works is required.
11. The County is implementing a storm water quality program as required by the State Water Resources Control Board, which may modify or add to the requirements and guidelines presented elsewhere in this document. This can include ongoing monitoring of water quality of storm drain runoff, implementation of BMPs to reduce storm water quality impacts downstream or along adjacent properties. Attention is directed to the need to reduce any potential of vectors, mosquitoes or standing water.

Surface Water Quality

The surface waters of the Imperial Valley depend primarily on the inflow of irrigation water from the Colorado River via the All-American Canal. Excessive salinity concentrations have long been one of the major water quality problems of the Colorado River, a municipal and industrial water source to millions of people, and a source of irrigation water for approximately 700,000 acres of farmland. The heavy salt load in the Colorado River results from both natural and human activities. Land use and water resources are unequivocally linked. A variety of natural and human factors can affect the quality and use of streams, lakes, and rivers. Surface waters may be impacted from a variety of point and non-point discharges. Examples of point sources may include wastewater treatment plants, industrial discharges, or any other type of discharge from a specific location (commonly a large-diameter pipe) into a stream or water body. In contrast, non-point source pollutant sources are generally more diffuse in nature and connected to a cumulative contribution of multiple smaller sources. There are no comprehensive water quality monitoring stations located within in the project sites, and water quality data are limited.

Common non-point source contaminants within the project area may include, but are not limited to: sediment, nutrients (phosphorous and nitrogen), trace metals (e.g., lead, zinc, copper, nickel, iron, cadmium, and mercury), oil and grease, bacteria (e.g., coliform), viruses, pesticides and herbicides, organic matter, and solid debris/litter. Vehicles account for most of the heavy metals, fuel and fuel additives (e.g., benzene), motor oil, lubricants, coolants, rubber, battery acid, and other substances. Nutrients result from excessive fertilizing of agricultural areas, while pesticides and herbicides are widely used in agricultural fields and roadway shoulders for keeping right-of-way areas clear of vegetation and pests. Additionally, the use of on-site septic systems for wastewater disposal can degrade shallow groundwater by contributing nitrate. All these substances are entrained by runoff during wet weather and discharged into local drain facilities and eventually into the Salton Sea.

Based on the 305(b)/303(d) Integrated Report prepared by the Colorado River Basin RWQCB, the following water features within the Brawley Hydrologic Area includes the Imperial Valley Drains, New River, and the Salton Sea. Specific impairments listed for each of these water bodies (or Category 5) are identified below (SWRCB 2012):

- Imperial Valley Drains: Impaired for chlordane, dichlorodiphenyltrichloroethane (DDT), dieldrin, endosulfan, polychlorinated biphenyls (PCBs), sedimentation/siltation; toxaphene, and selenium;
- New River: Impaired for chlordane, chlorpyrifos, copper, DDT, diazinon, dieldrin, Hexachlorobenzene/ HCB, mercury, nutrients, organic enrichment/low dissolved oxygen, PCBs, pathogens, sediment, selenium, toxicity, toxaphene, trash, and zinc;
- Salton Sea: Impaired for arsenic, chlorpyrifos, DDT, enterococcus, nutrients, salinity, and selenium.

In relation to the Imperial Valley Drains, the listings for DDT, dieldrin, and, endosulfan only apply to drains that are not responsible for draining the immediate project sites.

4.0 POST-CONSTRUCTION BMPS

The proposed project shall be designed to include Site Design BMPs. Source Control BMPs, and Treatment Control BMPs.

4.1 SITE DESIGN BMPS

The project shall be designed to include Site Design BMPs, which reduce runoff, prevent storm water pollution associated with the project, and conserve natural areas onsite.

	DESIGN CONCEPT	DESCRIPTION
#1	MINIMIZE IMPERVIOUS FOOTPRINT	The project site will include a significant amount of undeveloped land and pervious area. The footprint for the solar arrays will be predominately pervious ground. A minimal amount of Class II base paving for access roads and parking will be constructed.
#2	CONSERVE NATURAL AREAS	Only a small amount of existing site area can be classified as natural landscape and will only be disturbed in necessary areas at the project.
#3	PROTECT SLOPES AND CHANNELS	The project site and surrounding areas is comprised of extremely flat topography. Erosion of slopes due to stabilization problems is not a concern.
#4	MIMIMIZE DCIAS (DIRECTLY CONNECTED IMPERVIOUS AREAS)	No storm drain will be constructed onsite. The site layout does not change the existing drainage pattern.

4.2 SOURCE CONTROL BMPS

"Source control BMPs (both structural and non-structural)" means land use or site planning practices, or structures that aim to prevent urban runoff pollution by reducing the potential for contamination at the source of pollution. Source Control BMPs minimize the contact between pollutants and urban runoff. The following table identifies source control BMPs that would be applicable to the proposed project.

SOURCE CONTROL BMP		DESCRIPTION
#1	DESIGN TRASH STORAGE AREAS TO REDUCE POLLUTION INTRODUCTION	Any outdoor trash storage areas will be designed not to allow run-on from adjoining areas, screened or walled to prevent off-site transport of trash.
#2	ACTIVITY RESTRICTIONS	Restrictions include activities that have the potential to create adverse impacts on water quality.
#3	NON-STORM WATER DISCHARGES	Illegal dumping educational materials as well as spill response materials will be provided to employees.
#4	OUTDOOR LOADING AND UNLOADING	Material handling will be conducted in a manner as to prevent any storm water pollution. .
#5	SPILL PREVENTION, CONTROL, AND CLEANUP	The project will require a Spill Prevention, Control, and Countermeasure (SPCC) Plan, and a Hazardous Materials Business Plan in accordance with Federal and State requirements.
#6	EDUCATION	Employees will receive materials for storm water pollution prevention in the form of brochures and other information in a format approved by the County of Imperial.
#7	INTEGRATED PEST MANAGEMENT	If any pesticide is required onsite, the need for pesticide use in the project design will be reduced by: • Keeping pests out of buildings using barriers, screens and caulking • Physical pest elimination techniques, such as squashing, trapping, washing or pruning out pests • Relying on natural enemies to eat pests • Proper use of pesticides as a last line of defense
#8	VEHICLE AND EQUIPMENT FUELING, CLEANING, AND REPAIR	All vehicles will be serviced offsite whenever possible. If servicing is required onsite, it must be conducted in an area isolated from storm drain inlets or drainage ditch inlets. The area must be bermed and precluded from run on. Any spillage must be fully contained and captured and disposed of per County of Imperial Hazardous Waste requirements.
#9	WASTE HANDLING AND DISPOSAL	Materials will be disposed of in accordance with Imperial County Hazardous Material Management guidelines and will be sent to appropriate disposal facilities. Under no circumstances shall any waste or hazardous materials be stored outside without secondary containment.

In addition to Source Controls, specific precautions will be taken when handling, storing or processing any materials during all phases of the proposed project. The utmost care and planning must be taken when using materials outside, and near any storm drain/drainage ditch inlets.

4.3 TREATMENT CONTROL BMPS

The proposed project shall incorporate post-construction Low Impact Development Treatment Control BMPs, including but not limited to infiltration trenches or bioswales, which shall be investigated and integrated into the project layout to the maximum extent practicable. The drainage plan shall provide both short-term and long-term drainage solutions to ensure the proper sequencing of drainage facilities and treatment of runoff generated from project impervious surfaces prior to off-site discharge.

The proposed project shall develop a long-term maintenance plan and implemented to support the functionality of treatment control BMPs. The facility layout shall also include sufficient container storage and on-site containment and pollution-control devices for drainage facilities to avoid the off-site release of water quality pollutants, including, but not limited to oil and grease, fertilizers, treatment chemicals, and sediment.

5.0 CONCLUSIONS

Post project site conditions reflect insignificant increase in impervious surfaces. Therefore, the peak discharge will not be significantly altered by the proposed project. The use of source control, site design and treatment BMPs in practice through the day to day function of the project will result in a decrease potential for storm water pollution.

Maintenance shall be the responsibility of the owner, who will maintain the site design, and source control, and treatment control BMPs throughout the lifetime of the proposed project.

Stantec

Hydrological Evaluation

Wister Solar Development Project

June 8, 2020

Prepared for:

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Revision	Description	Author		Quality Check	
A	Internal Draft	S Smith	5/29/20	K Kohan	5/29/20
0	Client Draft	S Smith	6/1/20	K Kohan	6/2/20
1	Final	S Smith	6/8/20	K Kohan	6/8/20

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Prepared by ______________________________

(signature)

Stanley Smith

Reviewed & Approved by ______________________________

(signature)

Kevin Kohan

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Abbreviations

°F	Degrees Fahrenheit
AAC	All American Canal
AFY	Acre-feet per year
amsl	Above mean sea level
ANL	Argonne National Laboratory
bmsl	Below mean sea level
DWR	California Department of Water Resources
IIRWMP	Imperial Integrated Regional Water Management Plan
LLNL	Lawrence Livermore National Laboratory
POD	Point of Diversion
Project	Wister Solar Development Project
Proposed Well	Wister Solar Development Project Proposed Water Distribution Well
Stantec	Stantec Consulting Services
TDS	Total dissolved solids

1.0 INTRODUCTION

ORNI 21, LLC (Ormat) is proposing to construct and operate the Wister Solar Development Project (Project) near the unincorporated community of Wister in Imperial County, California (**Figure 1**). The Project is located on a privately owned land parcel within the northwest quarter or Township (T) 10 South (S), Range (R) 14 East (E) Section 27, San Bernardino Meridian. The Project consists of 100 acres of solar installation with a production capacity of 20 megawatt (net), associated infrastructure, and a water distribution well. Commercial operations are anticipated to begin in 2021.

The proposed water distribution well (Proposed Well) would supply water for Project construction, operation and maintenance, and decommissioning. Water requirements are summarized in **Table 1**. Water needs for operation and maintenance include panel washing, backup dust suppression, and fire tank water.

This report describes the hydrology and water related aspects of the Project area and surrounding area. This report includes details of physiography, geologic setting, climate, land use, surface water features, groundwater features, and a hydrologic conceptualization. The extent of this report is generally limited to a two-mile radius around the proposed water distribution well. Where data were limited within a two-mile radius of the Project, information from beyond this radius was included.

Table 1 Estimated Project Water Needs

Phase	Water Usage Rate	Duration	Total Water Requirement (acre-feet)
1: Dirt Work	40,909 gallons per workday	1 month	2.76
2: Construction	16,136 gallons per workday	2-7 months	6.54
3: Reclamation	13,636 gallons per workday	1 month	0.92
Construction Total	**-**	**9 months**	**10.22**
Operation & Maintenance Total	**1.37 acre-feet/year**	**25-30 years**	**34.25-41.10**
Decommission Total	**-**	**1 month**	**5.0**
Project Total		**~26-31 years**	**49.47-56.32**

Assuming 22 construction days per month; Pre-construction water needs assumed to be negligible.

2.0 SITE DESCRIPTION

2.1 PHYSIOGRAPHY

The Project is located in the Basin and Range physiographic province, which includes inland portions of California, the majority of Nevada, and portions or Arizona, New Mexico, Oregon, Utah, Idaho, and Mexico. The Basin and Range is divided into several sub basins, which includes the Salton Trough, which contains the Project. The Salton Trough includes the Imperial Valley in the south and the Coachella Valley in the north. The Project is near the northeastern margin of the Imperial Valley, approximately 5 miles east of the Salton Sea, a saline lake located in Imperial Valley. Imperial Valley is bounded by the Coyote and Jacumba Mountains to the west, the Chocolate and Orocopia Mountains to the northeast, the Sand Hills and Cargo Muchacho Mountains to the southeast, and the United States of America and Mexico border to the south. Furthermore, the elevated margins of Imperial Valley are named West Mesa and East Mesa. The elevation of the Imperial Valley is mostly below sea level and the Project is at approximately 15 feet bmsl. The Chocolate Mountains, which are the closest mountains to the Project, have a maximum elevation of 2,877 feet amsl.

2.2 GEOLOGIC SETTING

The Salton Trough is a tectonically active pull-apart basin. The extensional tectonics results in crustal thinning and sinking. Fault systems near the Project include the San Andreas Fault Zone and Imperial Fault Zone, which are linked by the Brawley Seismic Zone. The trough has filled with sediments due to its topographically low setting and continued sinking. The overall vertical relief of the trough formation is estimated to exceed 14,000 feet, which has been caused by faulting, folding, and warping (Loeltz et al., 1975). The geology and geomorphology of the Imperial Valley was influenced by prehistoric Lake Cahuilla, including lacustrine sediments and paleo-shorelines. The adjacent Chocolate Mountains include outcrops Tertiary and older igneous and metamorphic rocks. The piedmont slope of the Chocolate Mountains, located northeast of the Project, includes poorly sorted alluvial and fluvial deposits with sparse vegetation (Loeltz et al., 1975).

2.3 CLIMATE

The Project area has a hot desert climate. Climate data was available from two nearby weather stations: Niland (0.9 miles west-northwest of the Project; NCEI 2020a) and Brawley (22 miles south of the Project; NCEI 2020b). Both sites report climate normals (1981 to 2010) with Niland reporting precipitation and Brawley reporting precipitation and temperature. Monthly average temperatures are between 54.9 to 91.6°F with minimum temperatures occurring in December and maximum temperatures occurring in August. Average annual precipitation at Niland was 2.88 inches and at Brawley was 2.78 inches. The majority of precipitation occurs from December through March.

Precipitation in the adjacent Chocolate Mountains are estimated at 4–6 inches/year (PRISM, 2020).

Table 2 Climate Normals near the Project

Period	Brawley[1)]		Niland[2)]
	Average Temperature (°F)	Precipitation (inches/year)	Precipitation (inches/year)
January	55.8	0.48	0.47
February	59.1	0.53	0.44
March	64.3	0.33	0.45
April	69.9	0.05	0.07
May	77.4	0.02	0.01
June	85.0	0.00[3)]	0.03
July	91.3	0.08	0.23
August	91.6	0.21	0.21
September	86.2	0.16	0.22
October	75.2	0.25	0.18
November	63.2	0.19	0.17
December	54.9	0.48	0.40
Annual	72.9	2.78	2.88

1) Brawley, CA US; GHCND: USC00041048; 32.9544°, -115.5581°; 100 ft bmsl; NCEI, 2020a

2) Niland, CA US; GHCND: USC00046197; 33.2775°, -115.5239°; 60 ft bmsl; NCEI, 2020b

3) non-zero value that rounds to zero

2.4 LAND AND WATER USE

Land use within 2 miles of the Proposed Well is available from the 2003 Land Use GAP dataset. A summary of land use is provided in **Table 3**. The land area in 2002 was 75.6% natural ecosystem, including Sonora Mojave, North American Warn Desert, and Inter-Mountain Basins Shale Badlands. Cultivated croplands, pasture/hay and developed areas accounted for 24% of the area and the remaining 0.5% was open water. Approximately 9.6% of land within this area is within the Chocolate Mountain Aerial Gunnery Range, which is under the jurisdiction of the United States Navy and United States Marine Corps. Comparing land use classification to recent aerial imagery indicates some in land use due to the expansion of agriculture and solar energy operations, with other land use changes possible. Cultivated croplands include areas under irrigation, likely derived from laterals from the East Highline Canal.

Site Description

Table 3 Land Use Within Two Miles of the Proposed Well

Ecosystem	Description	Percent of Area
Sonora Mojave	Creosote Bush White Bursage Desert Scrub	29.9%
	Mixed Salt Desert Scrub	13.3%
North American Warm Desert	Riparian Woodland and Shrubland	11.4%
	Wash	10.8%
	Bedrock Cliff and Outcrop	7.4%
	Pavement	1.0%
	Playa	0.4%
	Volcanic Rockland	0.1%
	Active and Stabilized Dune	0.0%*
Cultivated Cropland	-	13.5%
Pasture/Hay	-	8.5%
Developed	Low Intensity	1.5%
	Medium Intensity	0.0%*
	Open Space	0.5%
Inter-Mountain Basins Shale Badland	-	1.2%
Open Water	Fresh	0.5%

*non-zero value that rounds to zero

3.0 HYDROLOGICAL SYSTEM

The hydrologic system in the vicinity of the Project includes the East Salton Sea groundwater basin (**Figure 2** and further details in Section 3.3), which is influenced by the surface water system, which includes intermittent creeks and canal systems with associated distribution and storage systems (see Section 3.2). Surface water features and wells are shown in **Figure 3**.

3.1 PRECIPITATION AND EVAPOTRANSPIRATION

Precipitation near the Project is recorded at approximately 2.8 to 2.9 inches/year. Modeled precipitation is higher in the Chocolate Mountains at approximately 4 to 6 inches/year. Potential evapotranspiration (PET) is between 80 and 100 inches/year within 2 miles of the Proposed Well (Esri, 2015). In the Chocolate Mountains, PET is higher at 100 to 110 inches/year. High PET rates combined with low precipitation rates limits the potential for groundwater recharge. However, recharge is possible during high precipitation storm events when PET is low.

3.2 SURFACE WATER SYSTEM

Surface water features within 2 miles of the Proposed Well include natural drainages and manmade features including canals, laterals, drains and ponds/reservoirs (**Figure 3**). Natural drainages include Iris Wash and unnamed minor drainages, which convey runoff from the Chocolate Mountains to the Imperial Valley. These drainages ultimately flow towards the Salton Sea, which is the low point of the basin. All-natural drainages are classified as intermittent (USFWS, 2020). All natural drainages are classified as intermittent (USFWS, 2020).

Canals include the Coachella Canal and the East Highline Canal (**Figure 3**). Both canals deliver water from the All American Canal (AAC), located approximately 40 miles south of the Project. The Coachella Canal is located approximately 1.3 miles from the Proposed Well. The Coachella Canal was initially unlined in the Imperial Valley, which lead to water losses into the alluvial sediments. In the late 1970s, the first 49 miles of the Coachella Canal was replaced with a concrete lined channel. This end of this segment is located approximately 3.6 miles east southeast of the Proposed Well. In the mid-2000s, the remaining 36.5 miles of the Coachella Canal (including the section near the Project; see **Figure 3**) was replaced with a concrete lined channel, reducing seepage losses into alluvial sediments.

The East Highline Canal is located approximately 0.5 miles from the Proposed Well. Furthermore, the East Highline Canal crosses the southwest corner of the Project (**Figure 1**). The East Highline Canal is unlined and likely results in seepage to alluvial sediments. The water distribution system in the Imperial Valley, near the Project, include laterals and ponds for distribution and storage, respectively, and drains to convey unused water from distribution system, farmland, and discharging groundwater to the Salton Sea (IIRWMP, 2012). The East Highline Canal is downgradient from the Project though a seepage mound in the shallow aquifer may be present upgradient of the canal, as identified along unlined sections of the AAC and Coachella Canal (Loeltz et al., 1975).

3.3 GROUNDWATER SYSTEM

The Project is located in the East Salton Sea Basin (basin 7-033) (**Figure 2**). The basin occupies the northeastern margin of the Imperial Valley, including the East Mesa, and alluvial surficial deposits of the Chocolate Mountains. The basin covers 279,824 acres. Adjacent basins include Chocolate Valley to the north, Arroyo Seco Valley to the east, Amos Valley to the southeast, and Imperial Valley to the south. No groundwater basin is defined in the footprint of the Salton Sea.

3.3.1 Aquifer Extent and Properties

Aquifers in the East Salton Sea Basin include alluvial aquifers, which are present as valley fill with maximum thicknesses of at least 400 feet (Willets et al., 1954). Water bearing units include unconsolidated Quaternary alluvium and semi-consolidated Tertiary to Quaternary alluvium. The groundwater storage capacity was estimated at 360,000 acre-feet (DWR, 1975). High permeability units likely include coarse sands and gravels, where present. Aquifer extents are bounded by outcropping bedrock in the Chocolate Mountains and possibly low-permeability fault zones such as the San Andreas Fault Zone, the Banning Mission Fault, and other unnamed faults.

Specific to East Mesa, aquifers in this area are generally unconfined, homogenous, and composed of sediments deposited by the Colorado River (IIWMP, 2012).

A geothermal test well was previously drilled at the Project by Ormat (well 12-27) to a depth of 3401 feet bgs. The shallow groundwater system was not specifically characterized during drilling and testing. However, static temperature logs from the well may indicate the presence of an aquifer zone as shallow as 40 to 50 feet bgs. Other aquifer zones are likely present but were not identified due to the limitations of temperature logs. Geothermal properties of the test well were non-economical, and the well was abandoned.

The nearest East Mesa well with a lithological log is 12S/16E-9A, which is located 9 miles to the southwest of the Proposed Well (**Figure 3**). Lithological details are provided in **Table 4**. In the 1000-foot log, 61% of the thickness is dominated by sand, 34% dominated by clay and approximately 1% dominated by sandstone. Sand and clay intervals also include silts and gravels. Coarse sands and gravels, likely having high hydraulic conductivities, are intermittently present throughout the logged sequence. The perforated interval of the well was placed at 150-1,000 feet and the static water level was recorded at 154.5 feet bgs, which is an elevation of 65.5 feet bgs. Other nearby wells with lithological logs were completed in the Imperial Valley and contain higher percentages of clay (Loeltz et al., 1975).

Table 4 Lithological Log of 12S/16E-9A (9 Miles Southwest of the Proposed Well)

Lithology	Thickness (feet)	Depth Interval (feet)
Sand, silty, very fine, and brown clay	10	0-10
Sand, very coarse to fine, and very fine gravel	102	10-112
Clay, light-brown, and very fine silty sand	5	112-117
Sand, fine to medium, and silt	14	117-131
Clay, silty, yellow-brown	5	131-136
Sand, coarse to very coarse	15	136-151
Sand, very coarse to coarse, and very fine and larger gravel	45	151-196
Sand, fine to very coarse, and yellow-brown clay	19	196-215
Clay, yellow-brown, and fine sand	17	215-232
Sand, very fine to very coarse, and thin layers of gravel	48	232-280
Clay, yellow-brown; some light-gray clay	20	280-300
Clay, light-gray, and yellow-brown clay	40	300-340
Sand, medium to very coarse, and gravel	3	340-343
Clay, light-gray	13	343-356
Sand, fine to medium, and light-gray clay	15	356-371
Clay, silty, light-gray	13	371-384
Sand, very fine to medium, and thin layers of gray clay	33	384-417
Sand, fine to very coarse, and very fine to fine gravel	10	417-427
Sand, very fine to medium, and thin layers of gray clay	59	427-486
Clay, light-gray, and fine sand	6	486-492
Sand, silty, very fine to medium	24	492-516
Clay, light-gray	31	516-547
Sand, very fine to medium	15	547-562
Sand, very fine to medium, and light-gray clay	18	562-580
Clay, light-gray and yellow-brown	60	580-640
Sand, fine to very coarse, and light-gray clay	42	640-682
Clay, light-gray, and layers of fine to very coarse sand	30	682-712
Sandstone, very fine to medium, and fine to coarse sand	53	712-765
Clay, light-gray, and very fine to medium sandstone	17	765-782
Clay, light-gray; some yellow brown	38	782-820
Clay, gray and brown, and fine to very coarse sand	46	820-866
Sand, silty, fine to medium	61	866-927
Sand, silty, fine, and light-gray clay, in alternating layers	73	927-1,000

Source: Loeltz et al., 1975

3.3.2 Well Inventory

Only one well was identified within two miles of the Proposed Well. The well is located at 10S/14E-20N, approximately 2.0 miles west of the Proposed Well (**Figure 3**). Few details are available for this well and there are no records of construction details. However, water quality samples were collected in 1961 (see Section 3.3.8).

3.3.3 Recharge

Groundwater recharge in the East Mesa area was historically dominated by seepage from the Coachella Canal, prior to replacement with concrete lined channels in the late 1970s and mid-2000s. Prior to lining, seepage from the 36.5 mile section near the Project has been estimated at 26,000 acre-feet per year. Unlined sections of the AAC continue to recharge the East Mesa groundwater aquifer. However, the unlined section is approximately 45 miles from the Project. In the absence of canal seepage, recharge to the East Mesa aquifer from direct precipitation is estimated to be near zero (Leroy Crandall and Associates, 1983).

Groundwater recharge in the Chocolate Mountains may include mountain front recharge and stream flow runoff (Tompson et al., 2008). The Lawrence Livermore National Laboratory (LLNL) groundwater model (Tompson et al., 2008) estimated that recharge from precipitation within the Imperial Valley and portions of surrounding ranges was 0.019 inches/year, which is less than 1% of precipitation. Furthermore, the LLNL model did not include additional recharge along the mountain fronts. The 2013 groundwater model, which was updated by Argonne National Laboratory (ANL; Greer et al., 2013) estimated recharge at 0.056 inches/year in Imperial Valley and 7.2 inches/year along the mountain-front area of the Chocolate Mountain. This estimate of mountain-front recharge may not be supported by the estimated precipitation rates for the Chocolate Mountains (4-6 inches/year; PRISM, 2020).

In 2003, the DWR classified the East Salton Sea Basin groundwater budget type as ‘C’, which indicates that groundwater data is insufficient to estimate the groundwater budget or groundwater extraction (DWR, 2003).

3.3.4 Discharge and Extraction

Discharge from the East Salton Sea Basin includes springs, discharge into irrigation drains, and extractions from wells. Spring discharge, and water losses from associated vegetation, is likely limited based on the occurrence of few springs (see **Figure 3**). Irrigation drains in the Imperial Valley (including the western margin of the East Salton Sea Basin) primarily return excess irrigation water to the Salton but also function to remove discharging groundwater. Water well extraction rates were last estimated in 1952 at 6 acre-feet/year (DWR, 1975). Due to the lack of development in this basin, current extraction rates may be similar. However, this statement is speculative due to a lack of recent information (DWR, 2003).

3.3.5 Seeps and Springs

No identified springs or seepage are present within two miles of the Proposed Well. The closest identified spring is an unnamed spring located approximately 6.5 miles southeast of the Proposed Well (**Figure 3**) (USGS, 2020).

3.3.6 Underflow

Underflow seepage likely conveys water from the East Salton Sea Basin, downgradient into the Imperial Valley. The quantity of water flow between basins would require details of hydraulic gradients and transmissivities of adjoining aquifers and the impact of transmissive or impeding zones such as faults. Groundwater flow between other surrounding basins in unknown as hydraulic head and hydraulic gradient information is sparse.

3.3.7 Groundwater Levels

Groundwater levels in the vicinity of the Project have been influenced by the presence of the canal systems, including the Coachella Canal, East Highline Canal, and associated laterals and drains. Seepage from the unlined Coachella Canal created a groundwater mound in the shallow alluvial aquifer of East Mesa, with water levels rising over 70 feet in some areas (Loeltz et al., 1975).

Groundwater level decline in the vicinity of the Coachella Canal has been monitored since the late 1970s when the first 49 miles of the earthen canal channel was replaced with a concrete channel. United States Geological Survey (USGS) well 11S/15E-23M, which is approximately 9 miles southeast of the Proposed Well (**Figure 3**), shows an asymptomatic groundwater level decline from 20.68 feet bgs in 1979 to approximately 50 feet bgs at present. The water level elevations as of March 2020 were approximately 70 feet amsl. No groundwater levels have been reported along the Coachella Canal section that was lined in the late 2000s. However, a similar asymptotic decline could be expected.

Groundwater levels in Imperial Valley have been historically measured at two multi-level wells located approximately 6.5 to 7.5 miles southwest of the Proposed Well (11S14E30C and 11S14E19N; **Figure 3**). Water levels at these locations were within 10 feet of the ground surface in 1989. The groundwater elevation at that time was approximately 215 feet bmsl. Groundwater levels in the irrigated areas have been controlled by the drain systems (IIRWMP, 2012).

Current groundwater levels, although sparse, generally agree with historical groundwater elevation distributions. Groundwater elevations are higher in mountainous areas and East Mesa and decline towards Imperial Valley and the Salton Sea. This distribution of groundwater elevations suggests groundwater flow directions roughly coincide with topography. However, the flow of groundwater and distribution of groundwater levels is likely influenced by faults, which act as barriers, and changes in transmissivity.

3.3.8 Groundwater Quality

Groundwater quality in the East Salton Sea Basin is generally reported as poor and not suitable for domestic, municipal, or agricultural purposes (DWR, 2004). Water types include sodium chloride and sodium sulfate. Total dissolved solids (TDS) concentrations are reported as 356 to 51,632 mg/L, whereas the National Secondary Drinking Water Regulations limit TDS to 500 mg/L. Groundwater quality is generally considered better in the vicinity of the unlined canals due to the recharge of lower TDS water.

The closest well to the Proposed Well with available water quality data is located 2 miles to the west (Loeltz et al., 1975). A limited number of water quality constituents were measured in 1961, including pH (8.0), specific conductivity (19,200 µS/cm), bicarbonate (210 mg/L), chloride (6,050 mg/L), calcium-magnesium hardness (2,440 mg/L), and non-carbonate hardness 2,270 mg/L). The screened interval depth of this well is unknown.

The next closest well to the Proposed Well with available water quality data is an inactive USGS monitoring well (11S/14E-2A) located approximately 2.8 miles to the southeast (USGS, 2020). The well is located in a Basin and Range basin-fill aquifer. The total depth was 825 feet bgs, however, the depth of the screened interval is unknown. Water quality was measured in the late 1960s and early 1970s. The latest water quality sample that includes all major ions (calcium, magnesium, sodium, potassium, bicarbonate, sulfate and chloride) was collected in 1969. This sample had sodium-chloride type water and a TDS concentration of 1,760 mg/L. Furthermore, temperatures were elevated above ambient temperatures at 44.4°C.

3.3.9 Transmissivity and Well Yield

Well yield information for the East Salton Sea Basin is limited. The only identified value is 25 gpm at well 11S/15E-23M, located approximately 9 miles southeast of the Proposed Well (**Figure 3**) (Loeltz et al., 1975). Hydraulic properties in East Mesa were summarized in the mid-1990s (Montgomery Watson, 1995). The range of hydraulic conductivities was 32 to 1,337 feet/day, which included wells several miles southeast of the Project.

3.4 WATER RIGHTS AND POINTS OF DIVERSION

No points of diversion (POD) are identified within two miles of the Proposed Well, (California Water Boards, 2020). However, this two-mile radius includes seven laterals from the East Highline Canal, which may have associated water rights and points of diversion. The closest identified POD is 5.7 miles southwest of the Proposed Well (California Water Boards, 2020). This POD is owned by the Metropolitan Water District of Southern California and is located along the N Lateral, which originates from the East Highline Canal. More distal PODs are associated with laterals and the Alamo River.

4.0 HYDROLOGIC EVALUATION SUMMARY

The Wister Solar Development Project is located within the East Salton Sea Basin, which includes the Chocolate Mountains and the northeastern margin of the Imperial Valley (**Figure 2**). The groundwater storage capacity of the East Salton Sea Basin was estimated at 360,000 acre-feet. Groundwater usage in the East Salton Sea Basin is limited due to generally poor water quality and limited inhabitants. Extraction rates for the East Salton Sea Basin were last estimated in 1952 at 6 acre-feet/year, which is 3% of the estimated recharge rate of 200 acre-feet/year (DWR, 1975). Limited development in the East Salton Sea Basin suggests that current extraction rates are similar. However, a lack of recent data limits the ability update this estimate. Furthermore, surface water from the Colorado River is conveyed into the Imperial Valley through a network of canals, laterals, and reservoirs, which has further reduced the need to develop groundwater resources.

Groundwater in the East Salton Sea Basin is present in alluvial aquifers at depths up to several hundred feet, and with generally high transmissivities (Montgomery Watson, 1995). At the Project, groundwater may also be present in an alluvial aquifer 40-50 feet bgs. Historically, groundwater recharge was significant in the vicinity of the earthen lined Coachella Canal. The replacement of the canal with a concrete lined channel has greatly reduced recharge to the adjacent alluvial aquifers. Near the Project, the Coachella Canal was concrete lined in the late 2000s. The East Highline Canal remains earthen-lined, which likely leads to recharge into the shallow alluvial aquifers near the Project. Recharge from precipitation is generally limited due to low precipitation rates and high evaporation potential. Recharge rates may be higher in the Chocolate Mountains due to higher precipitation rates at higher elevations (4-6 inches/year; PRISM, 2020). Recharge events are likely limited to larger storm events, which may generate runoff and seepage along ephemeral channels. Recharge rates from precipitation were estimated at 0.019 inches/year (Tompson et al., 2008).

The water needs for the Project are estimated at 10.22 acre-feet for construction in the first year, 1.37 acre-feet/year for the subsequent 25 to 30 years of operation, and 5 acre-feet for decommissioning at the end of operations (**Table 1**). Overall, the proposed extraction for the Project are significantly lower than recharge rates in an area where groundwater usage is limited.

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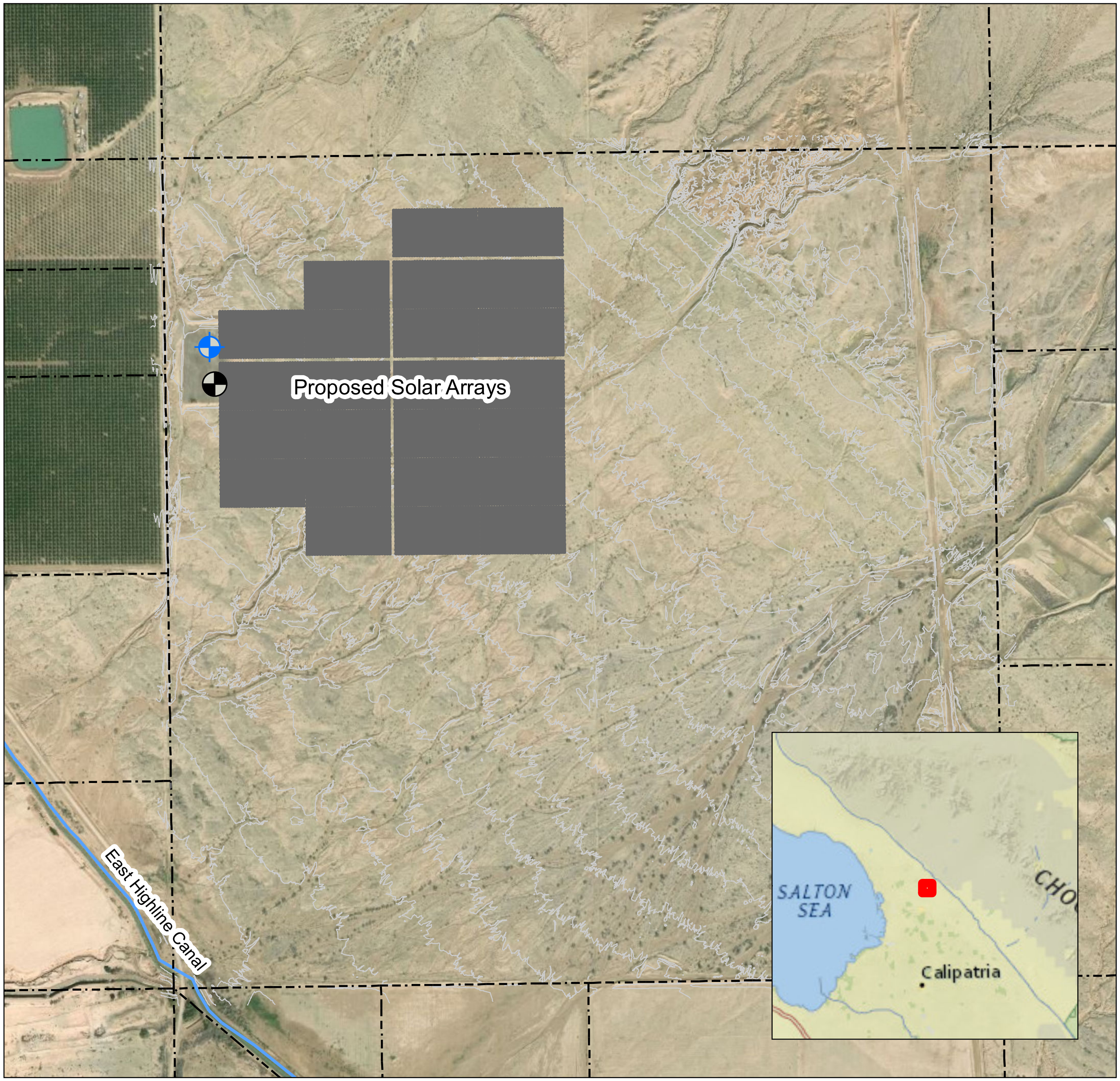
FIGURES



Stantec

Legend

- Proposed Water Distrubution Well
- Geothermal Test Well 12-27
- Property Line
- Contour-major
- Project Location

N

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(At original document size of 8.5x11)
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2. Data Sources:
3. Background: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.
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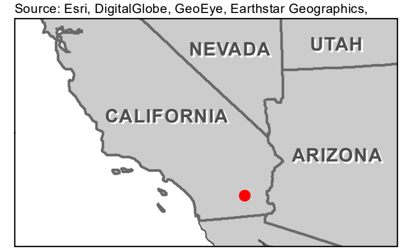

Project Location
T10S, R14E, S27
Imperial County, CA

Prepared by LR on 2020-05-29
TR by SS on 2020-05-29
IR Review by KK on 2020-05-29

Client/Project
185804209 REVA
ORNI 21, LLC
Wister Solar Development Project
Hydrologic Evaluation

Figure No.
1

Title
Project Location and Overview

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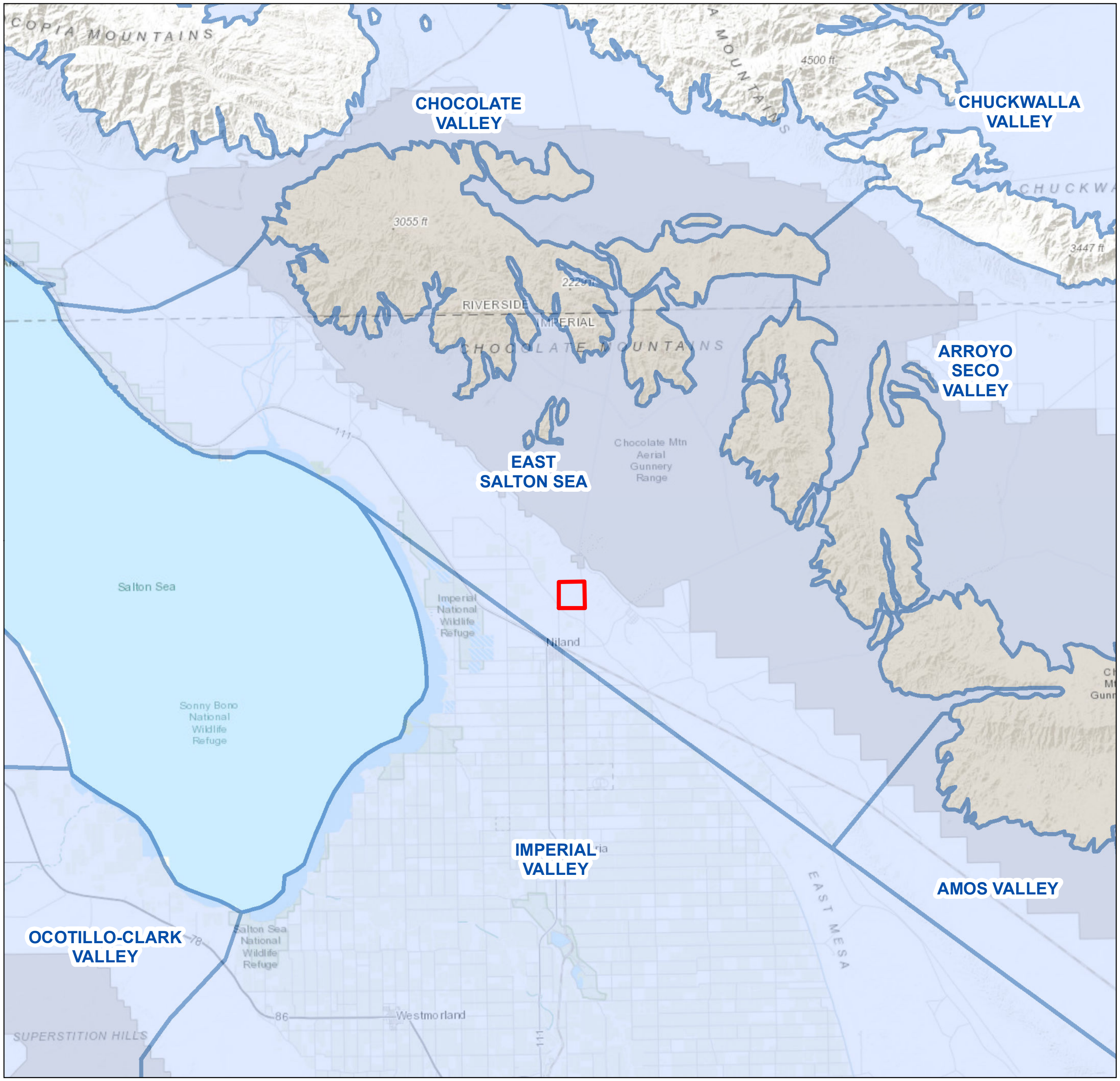

Stantec

Legend

Project Location

Groundwater Basin

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2. Data Sources:
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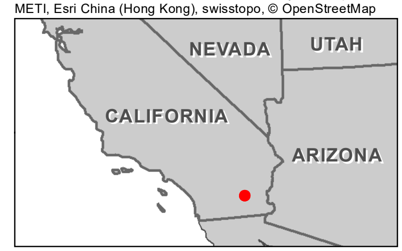

Project Location
T10S, R14E, S27
Imperial County, CA

Prepared by LR on 2020-05-29
TR by SS on 2020-05-29
IR Review by KK on 2020-05-29

Client/Project
185804209 REVA
ORNI 21, LLC
Wister Solar Development Project
Hydrologic Evaluation

Figure No.
2

Title
Groundwater Basins

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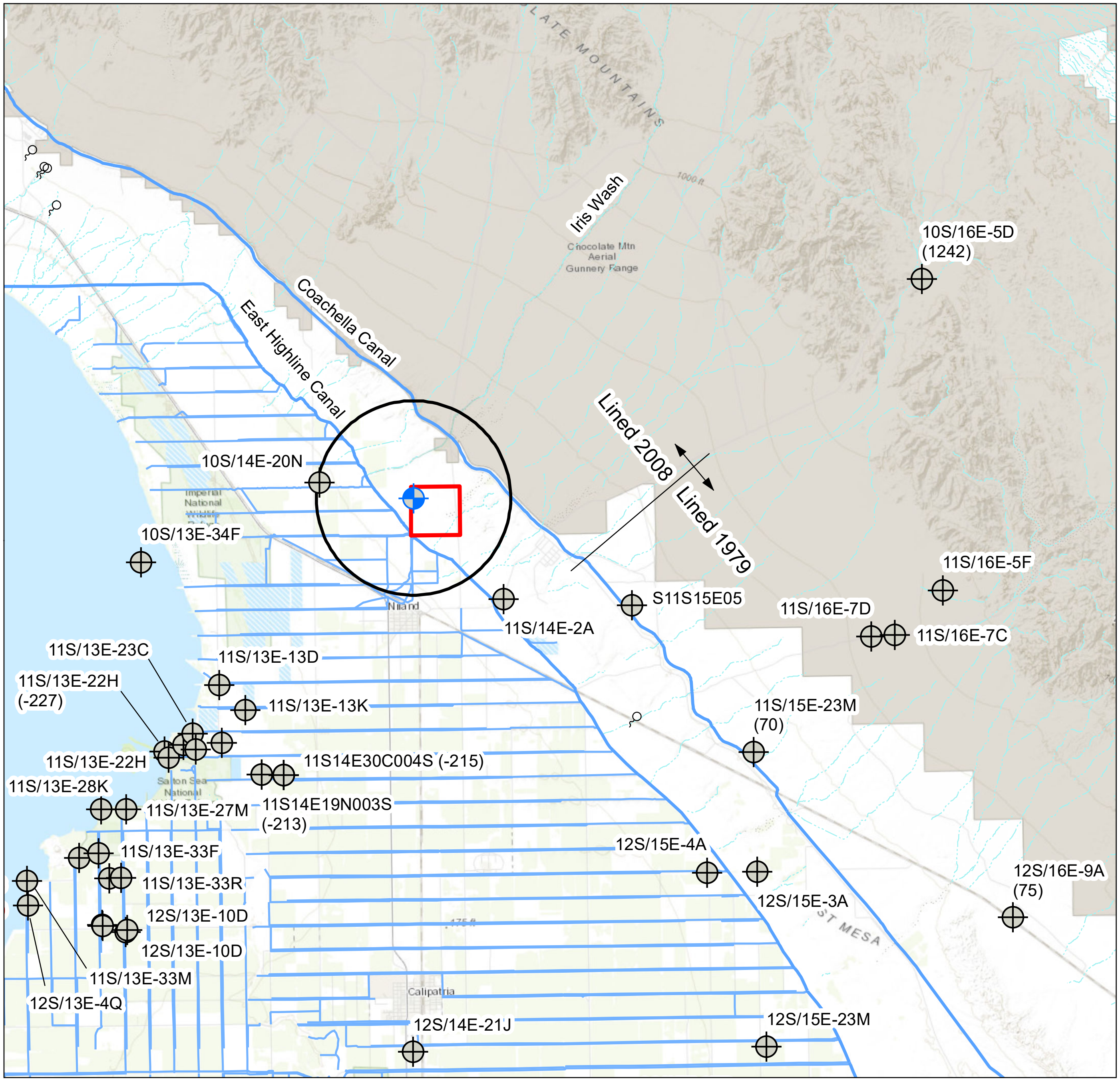

Stantec

Legend

- Proposed Water Distribution Well
- Existing or Historical Well (Water Level Elevation ft amsl)
- Spring
- Canal
- Lateral
- Intermittent Creek
- Proposed Well 2-Mile Buffer
- Project Location

N

0 2,500 5,000 metres

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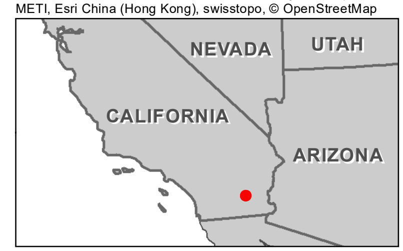
Notes

1. Coordinate System: NAD 1983 UTM Zone 11N
2. Data Sources:
3. Background: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap



Project Location
T10S, R14E, S27
Imperial County, CA

Prepared by LR on 2020-05-29
TR by SS on 2020-05-29
IR Review by KK on 2020-05-29

185804209 REVA

Client/Project
ORNI 21, LLC
Wister Solar Development Project
Hydrologic Evaluation

Figure No.
3

Title
Well and Water Resources Inventory

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2020

Water Supply Assessment -Wister Solar Development Project

DRAFT – JUNE 2020

PREPARED FOR IMPERIAL COUNTY PLANNING & DEVELOPMENT SERVICES

BY DUBOSE DESIGN GROUP, INC.

1 CONTENTS

2 ACRONYMS

AB	Assembly Bill
AC	Alternating Current
AAC	All-American Canal
AF	Acre-Foot or Acre-Feet
AFY	Acre-Feet per Year
AOP	Annual Operations Plan
APN	Assessor's Parcel Number
CDPH	California Department of Public Health
CDWR	California Department of Water Resources
CEQA	California Environmental Quality Act
CUP	Conditional Use Permit
CU	Consumptive Use
CVWD	Coachella Valley Water District
CWC	California Water Code
DC	Direct Current
EIR	Environmental Impact Report
ET	Evapotranspiration
GenTie	Generation Intertie
ICPDS	Imperial County Planning and Development Services
IID	Imperial Irrigation District
In	Inches
IRWMP	Integrated Regional Water Management Plan
kV	Kilovolt
LAFCO	Local Agency Formation Commission
MGD	Million Gallons per Day
MW	Megawatt
MWD	Metropolitan Water District of Southern California
O&M	Operation and Maintenance
POI	Point of Interconnection
PPA	Power Purchase Agreement
PV	Photo Voltaic
RE	Renewable Energy
RPS	Renewable Portfolio Standard
SB	Senate Bill
US	United States
USBR	United States Bureau of Reclamation
USEPA	United States Environmental Protection Agency
WSA	Water Supply Assessment

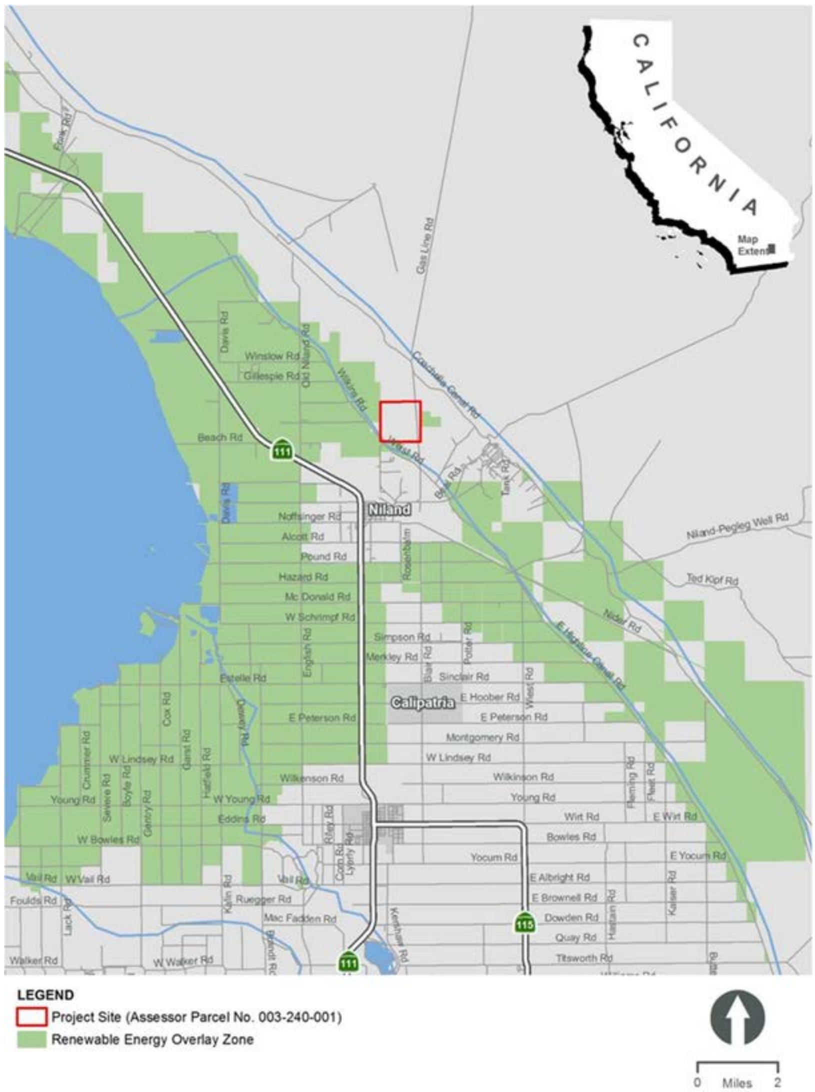
3 PURPOSE OF WATER SUPPLY ASSESSMENT & APPLICABILITY

This Water-Supply Assessment (WSA), SB 610 was prepared for the Imperial County Planning and Development Services (ICPDS) and ORNI 21, LLC (The “Applicant”) by water supply experts at DuBose Design Group, Inc (DDG) for the proposed Wister Solar Energy Project (“The Project”). The proposed project consists of three primary components: 1) Solar energy generation equipment and associated facilities including a substation and access roads (herein referred to as “solar energy facility”); 2) gen-tie line that would connect the proposed on-site substation to the Point of Interconnection (POI) at the existing Imperial Irrigation District (IID) 92-kilovolt (kV) “K” line; and, 3) fiberoptic cable. California Water Code section 10912. For the purposes of this part, the following terms have the following meanings: (a) "Project" means any of the following: (5) A proposed industrial, manufacturing, or processing plant, or industrial park planned to house more than 1,000 persons, occupying more than 40 acres of land, or having more than 650,000 square feet of floor area This study is a requirement of California law, specifically Senate Bill 610 (referred to as SB 610).1 SB 610 is an act that amended Section 21151.9 of the Public Resources Code, and Sections 10631, 10656, 10910, 10911, 10912, and 10915 of the California Water Code (CWC). SB 221 is an act that amended Section 11010 of the Business and Professions Code, while amending Section 65867.5 and adding Sections 66455.3 and 66473.7 to the Government Code. SB 610, which was approved by the Governor and filed with the Secretary of State on October 9, 2001, and became effective January 1, 2002, requires a lead agency, to determine that a project (as defined in CWC Section 10912) subject to California Environmental Quality Act (CEQA), to identify any public water system, or groundwater that may supply water for the project and to request the applicants to prepare a specified water supply assessment.

4 DESCRIPTION OF PROPOSED PROJECT AREA

Imperial County is in the southeast of California and borders Arizona and Mexico. The County is in an arid region and a part of the Sonoran Desert. The proposed Project is in the Imperial Valley, approximately 3 miles north of Niland, 5 miles southeast of the Salton Sea, and 4 miles east of what is known as the “Wister Unit.” The Wister Unit is part of the Imperial County Wildlife Area, which is a California Department of Fish and Wildlife recreational area. The most prominent water feature in the Valley is the Salton Sea, California’s largest inland surface water. Figure 1, below, shows the general location of the Project.

Figure 1 – Project Location



Niland is an unincorporated community. The Imperial Valley is characterized by high summer temperatures (> 110F) and very little precipitation. Its main industry is agriculture, which generates over $2 billion annually. The Valley has nearly 500,000 acres of agricultural land, which are typically farmed year-round and irrigated with Colorado River water. In fact, Colorado River water is the source of drinking water for most residents in the Valley. Good groundwater in the Valley is scarce. Imperial County's Code of Ordinances states, in relevant part, that "…the preservation and protection of the County's ground water resources are extremely critical… The Board of Supervisors has, therefore, determined to regulate the use, consumption and development of ground water on a County-wide basis. Further, it is the intent of the Board of Supervisors to protect the health, safety, and general welfare of the people of Imperial County by ensuring that the ground water of this County will not be polluted or contaminated. To this end, minimum requirements have been prescribed in this Ordinance for the construction, re-construction, repair, replacement, re-perforation, re-activation, operation, and destruction of a well or wells."[1] Section X of this WSA report describes in more detail the hydrologic setting for the Project.

4.1 CLIMATE FACTORS

Imperial Valley is located in the Northern Sonoran Desert, which has a subtropical desert climate characterized by hot, dry summers and mild winters. Clear and sunny conditions typically prevail, and frost is rare. The region receives 85 to 90 percent of possible sunshine each year, the highest in the United States. Winter temperatures are mild rarely dropping below 32°F, but summer temperatures are very hot, with more than 100 days over 100°F each year. The remainder of the year has a relatively mild climate with temperatures averaging in the mid-70s. The 100-year average climate characteristics are provided in Table below. Rainfall contributes around 50,000 AF of effective agricultural water per inch of rain. Most rainfall occurs from November through March; however, summer storms can be significant in some years. Annual areawide rainfall is shown in Table below. The thirty-year, 1988-2017, average annual air temperature was 74.1°F, and average annual rainfall was 2.59 inches. This record shows that while average annual rainfall has fluctuated, the 10-year average temperatures have slightly increased over the 30-year averages.[2]

Table 1: *Climate Characteristics, Imperial, CA 100-Year Record, 1918-2017*

Climate Characteristic	Annual Value
Average Precipitation (100-year record, 1918-2017)	2.96 inches (In)
Minimum Temperature, Jan 1937	16 °F
Maximum Temperature, July 1995 & June 2017	121 °F
Average Minimum Temperature, 1918-2017	47.9 °F
Average Maximum Temperature, 1918-2017	98.3 °F
Average Temperature, 1918-2017	72.9 °F

Source: IID Imperial Weather Station Record

[1] HTTP://IMPERIALCO-CA.ELAWS.US/CODE/COOR_TITLE9_DIV21_CH1, (ORD. 1415 § 320, 2006); RETRIEVED, JUNE, 2020
2 IID WSA BOILERPLATE

Table 2: Monthly Mean Temperature (ºF) – Imperial, CA 10-Year, 30-Year & 100-Year (2008-2017, 1988-2017, 1918-2017)

	Jan			Feb			Mar			Apr		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
10-year	82	32	56	86	36	61	95	41	67	100	46	72
30-year	81	33	56	84	37	60	93	41	66	99	47	71
100-year	80	31	55	84	35	59	91	40	64	99	46	71
	May			Jun			Jul			Aug		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
10-year	107	53	78	115	61	87	114	69	92	114	67	91
30-year	106	54	79	113	60	86	114	68	92	113	69	92
100-year	105	52	78	113	59	86	114	68	92	113	68	91
	Sep			Oct			Nov			Dec		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
10-year	114	67	92	103	51	76	92	38	64	82	30	55
30-year	113	69	92	102	51	76	90	39	64	80	32	55
100-year	113	68	91	101	49	75	90	38	63	80	32	56

Source: IID Imperial Headquarters Station Record (Data provided by IID staff)

Table 3: Monthly Mean Rainfall (In) – Imperial, CA 10-Year, 30-Year & 100-Year (2008-2017, 1988-2017, 1918-2017)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
10-year	0.54	0.30	0.13	0.04	0.08	0.01	0.26	0.31	0.16	0.13	0.14	0.44	2.53
30-year	0.50	0.44	0.26	0.07	0.06	0.00	0.15	0.22	0.22	0.16	0.18	0.34	2.59
100-year	0.40	0.39	0.25	0.10	0.03	0.00	0.12	0.34	0.37	0.26	0.20	0.50	2.96

Source: IID WIS: CIMIS stations polygon calculation (Data provided by IID staff).

4.2 POPULATION TRENDS

The Imperial County Housing Element states, "According to the 2010 US Census, the total population of Imperial County was 174,528 in 2010, an increase of 23 percent since 2000. The population of the unincorporated county increased 15 percent over the same period, from 32,865 to 37,778. Heber was the most populated townsite in the unincorporated county, with a population of 4,275 in 2010; however, Salton City saw the most growth from 2000 to 2010. The Salton City population increased from 944 residents to 3,763, an increase of 299 percent.[3]" Refer to Table indicated below titled Population Trends identifies the unincorporated county.

The Southern California Association of Governments (SCAG) prepares a population forecast as part of its Regional Transportation Plan/Sustainable Growth Strategy. The population in the unincorporated areas of the county grew nearly 80 percent from 2010 to 2020 and another 26 percent from 2020 to 2035. Refer to Table 4 for population projections for the unincorporated county and Imperial County as a whole for 2020 and 2035."[4]

Table 4: Unincorporated Population Trend[5]

Year	2000	2010	2020	2035
Population	32,865	37,778	67,900	73,400

Imperial County Housing Element, 2013

5 WISTER SOLAR ENERGY PROJECT DESCRIPTION

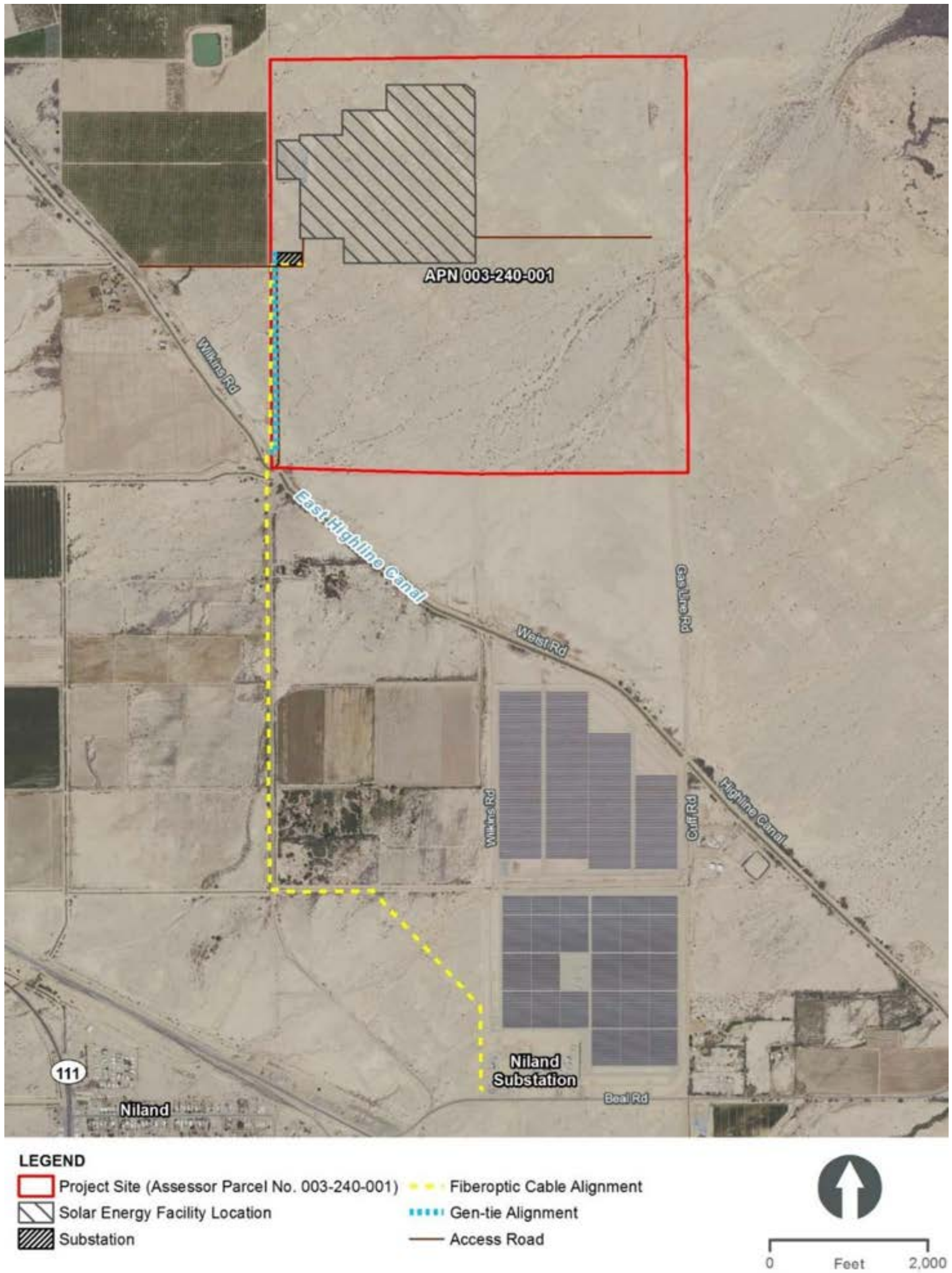
5.1 Project Location

5.1.1 Solar Energy Facility and Gen-Tie Line

The Project site is located approximately three miles north of Niland, a census-designated place, in the unincorporated area of Imperial County. The Project site is located on one parcel of land identified as Assessor's Parcel Number 003-240-001. The parcel is comprised of approximately 640 acres of land and is currently zoned Open Space/Preservation with a geothermal overlay (S-2-G). The proposed solar energy facility component of the project would be located on approximately 100 acres within the northwest portion of the larger 640-acre project site parcel. More specifically, the Project site is located east of the intersection of Wilkins Road and an unnamed county road. The project footprint (physical area where proposed project components are to be located) is generally located east of Wilkins Road, north of the East Highline Canal, and west of Gas Line Road. Figure 2, below, shows the location and alignment of key associated infrastructure.

[3] http://www.icpds.com/CMS/Media/3_ImperialCountyHE_-FINAL_9-27-13.pdf, Retrieved June, 2020
[4] http://www.icpds.com/CMS/Media/3_ImperialCountyHE_-FINAL_9-27-13.pdf, Retrieved June, 2020
[5] http://www.icpds.com/CMS/Media/3_ImperialCountyHE_-FINAL_9-27-13.pdf, Retrieved June, 2020

Figure 2: Project Location, Depicting Fiberoptic Cable Line Route & Substation



5.2 Project Objectives

- Construct, operate and maintain an efficient, economic, reliable, safe and environmentally sound solar-powered electricity generating facility.
- Help meet California's Renewable Portfolio Standard (RPS) requirements, which require that by 2030, California's electric utilities are to obtain 50 percent of the electricity they supply from renewable sources.
- Generate renewable solar-generated electricity from proven technology, at a competitive cost, with low environmental impact, and deliver it to the local markets as soon as possible.
- Develop, construct, own and operate the Wister Solar Energy Facility, and ultimately sell its electricity and all renewable and environmental attributes to an electric utility purchaser under a long-term contract to meet California's RPS goals.
- Utilize a location that is in close proximity to an existing switching station and powerlines.
- Minimize and mitigate any potential impact to sensitive environmental resources within the project area.

5.3 Project Characteristics

The proposed Project involves the construction and operation of a 20-Megawatt (MW) photovoltaic (PV) solar energy facility on approximately 100 acres within APN No. 003-240-001 (privately-owned land) north of Niland. The Facility would be comprised of solar PV panels on single-axis horizontal trackers, an on-site 92-kV power substation (a.k.a. "Wister Substation"), power inverters, power transformers, and underground electrical cables. depicts the proposed site plan.

The power produced by the Facility would be conveyed to the local power grid via the on-site 92-kV substation (hereafter referred to as the "Wister Substation"), which will be tied directly to the Imperial Irrigation District's 92-kV transmission line. A gen-tie line would connect the Wister substation to the POI at the existing IID 92-kV "K" line. The Project Applicant has secured a Power Purchase Agreement (PPA) with San Diego Gas and Electric for the sale of power from the Facility.

5.3.1 Wister Substation

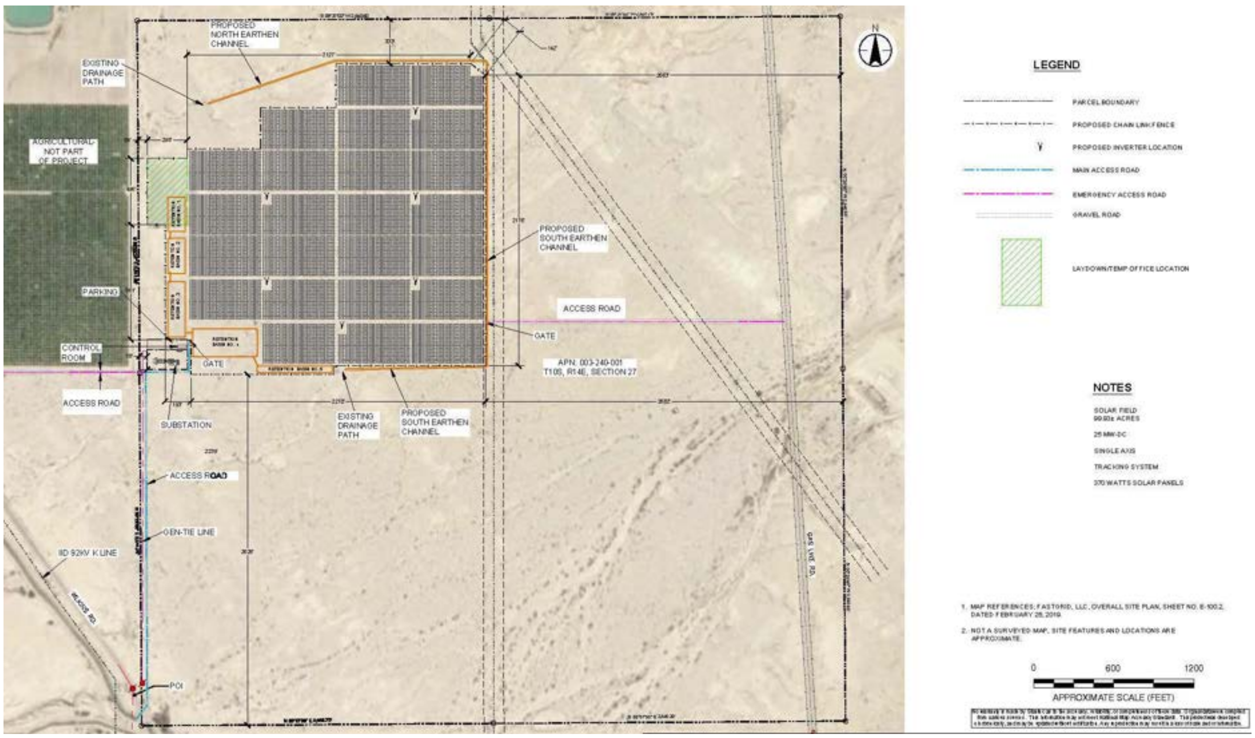
The proposed Wister Substation would be a new 92/12-kV unstaffed, automated, low-profile substation. The dimensions of the fenced substation would be approximately 300 feet by 175 feet. The enclosed substation footprint would encompass approximately 1.2 acres of the approximately 640-acre project parcel, and it will be located at the northwest quarter of the parcel, immediately southwest of the solar field. The California Building Code and the Institute of Electrical and Electronics Engineers (IEEE) 693, Recommended Practices for Seismic Design of Substations, will be followed for the substation's design, structures, and equipment.

5.3.2 Fiberoptic Cable

A proposed fiberoptic line from the proposed Wister Substation would be connected with the existing Niland Substation approximately two miles to the south, which would then be added to connect the proposed Wister Substation to the region's telecommunications system. Overall, this would provide Supervisory Control and Data

Acquisition (SCADA), protective relaying, data transmission, and telephone services for the proposed Wister Substation and associated facilities. New telecommunications equipment would be installed at the proposed Wister Substation within the Mechanical and Electrical Equipment Room (MEER). The proposed fiber optic telecommunications cable would utilize existing transmission lines to connect to the Niland Substation. The length of the proposed fiber optic telecommunications cable route would be approximately two miles. Figure 4, below, shows the preliminary site plan.

Figure 3: Site Plan



5.3.3 Gen-Tie Line

A proposed gen-tie line would connect the Wister Substation to the POI at the existing IID 92-kV “K” line. The proposed gen-tie line would originate at the proposed Wister substation and would terminate at the POI, at a distance of approximately 2,500 feet to the south-southwest. Steel poles, standing at a maximum height of 70 feet tall, will be spaced approximately every 300 feet along the route, and would support the 92-kV conductor and fiberoptic cable to the POI. Construction of the 2,500-foot gen-tie line to the POI would utilize overland travel via an all-weather improved access road along the entire route.

5.3.4 Groundwater Well

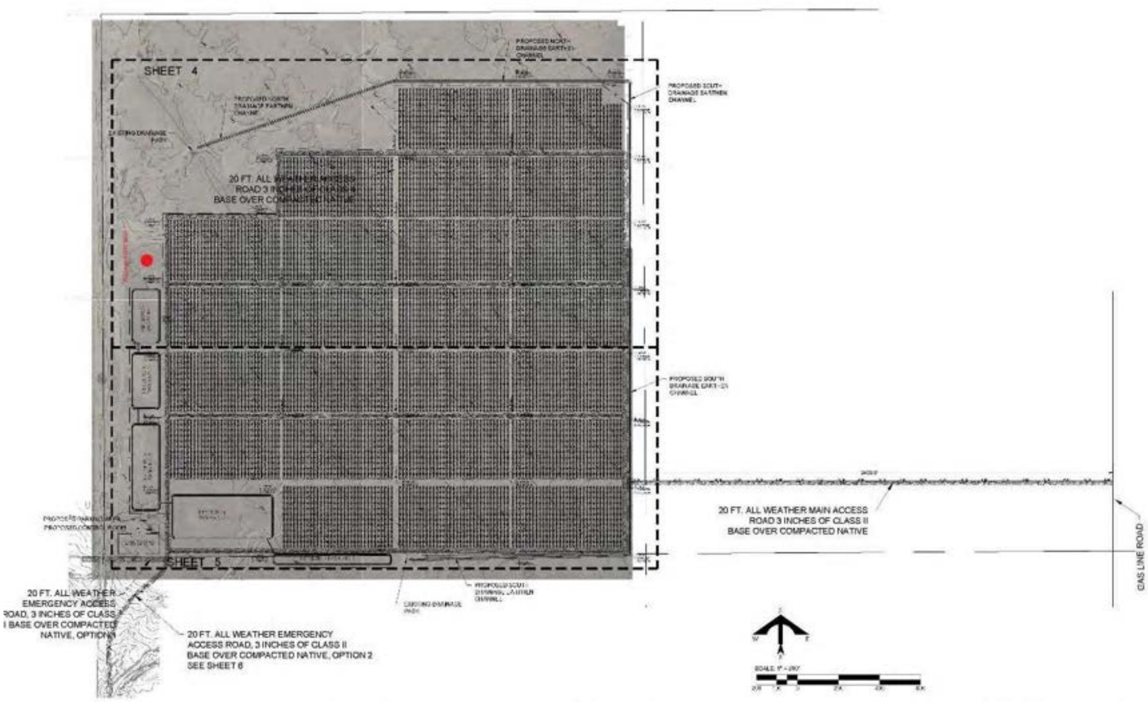
There is groundwater onsite. The proposed Project may utilize the groundwater for project construction, and potentially limited operational activities. A groundwater well would be constructed and operated on the existing geothermal well pad (and proposed Project construction staging area) located in the north-western portion of the project site, See Figure 5.

5.4 Project Construction

5.4.1 Construction Sequence

Construction activities would be sequenced and conducted in a manner that addresses storm water management and soil conservation. During construction, electrical equipment would be placed in service at the completion of each 2,500-kW power-block. The activation of the power-blocks is turned over to interconnection following the installation of transformer and interconnection equipment upgrades. This in-service timing is critical because PV panels can produce power as soon as they are exposed to sunlight, and because the large number of blocks and the amount of time needed to commission each block requires commissioning to be integrated closely with construction on a block-by-block basis.

Figure 4: Proposed Groundwater Well Location



Construction would generally occur during daylight hours, Monday through Friday. However, non- daylight work hours may be necessary to make up schedule deficiencies, or to complete critical construction activities. For example, during hot weather, it may be necessary to start work earlier to avoid pouring concrete during high ambient temperatures. If construction is to occur outside of the County's specified working hours, permission in writing will be sought at the time. Construction of the proposed project would occur in phases beginning with site preparation and grading and ending with equipment setup and commencement of commercial operations. Overall, construction would consist of three major phases over a period of approximately 6-9 months:

1. Site Preparation, which includes clearing grubbing, grading, service roads, fences, drainage, and concrete pads; (1 month)
2. PV system installation and testing, which includes installation of mounting posts, assembling the structural components, mounting the PV modules, wiring; (7 months) and

3. Site clean-up and restoration. (1 month)

Construction activities would be conducted in a manner consistent with Imperial County Codified Ordinance. Noise generating sources in Imperial County are regulated under the County of Imperial Codified Ordinances, Title 9, Division 7 (Noise Abatement and Control). Noise limits are established in Chapter 2 of this ordinance. Under Section 90702.00 of this rule, average hourly noise in residential areas is limited to 50 to 55 dB(A) from 7 AM to 10 PM, and to 45 to 50 dB(A) from 10 PM to 7 AM. The Applicant will also obtain coverage under the State Water Resources Control Board General Storm Water NPDES Permit for Construction Activities and prepare a Storm Water Pollution Prevention Plan (SWPPP) to prevent adverse water quality impacts during construction. Similarly, the Applicant will obtain the necessary permits from California Department of Fish and Wildlife should there be a need to obtain a Section 1602 Streambed Alteration Agreement during construction.

5.4.2 WORKFORCE

The on-site workforce would consist of laborers, electricians, supervisory personnel, support personnel and construction management personnel. The average number of construction workers would be approximately 50-60 people per day.

5.4.3 MATERIALS

The proposed Project would require general construction materials (i.e., concrete, wood, metal, fuel, etc.) as well as the materials necessary to construct the proposed PV arrays. Most construction waste is expected to be non-hazardous and to consist primarily of cardboard, wood pallets, copper wire, scrap steel, common trash and wood wire spools. Although field equipment used during construction activities could contain various hazardous materials (i.e., hydraulic oil, diesel fuel, grease, lubricants, solvents, adhesives, paints, etc.), these materials are not considered to be acutely hazardous and would be used in accordance with the manufacturer's specifications and all applicable regulations.

Each PV module would be constructed out of poly-crystalline silicon semiconductor material encapsulated in glass. Construction of the PV arrays will include installation of support beams, module rail assemblies, PV modules, inverters, transformers, and underground electrical cables. Concrete will be required for the footings, foundations, pads for transformers, and substation equipment. Concrete will be purchased from a local supplier and transported to the proposed project site by truck. The PCS housing the inverters will have a precast concrete base. Final concrete specifications will be determined during detailed design engineering in accordance with applicable building codes.

5.4.4 SITE PREPARATION

Project construction would include the renovation of existing dirt roads to all-weather surfaces (to meet the County standards) from Wilkins Road just south of the orchard, and a new road would be graded west from Gas Line Road and a new road graded north from the southwest corner of the parcel off Wilkins Road. Construction of the proposed project would begin with clearing of existing brush and installation of fencing around the project boundary. A 20' road of engineering-approved aggregate will surround the site within the fencing. Site preparation would be in compliance and consistent with the above-cited SWPPP.

Material and equipment staging areas would be established on-site within an approximate 4-acre area. The staging area would include an air-conditioned temporary construction office, a first-aid station and other temporary facilities including, but not limited to, sanitary facilities, worker parking, truck loading and unloading, and a designated area for assembling the support structures for the placement of PV modules. The location of the staging area would change as construction progresses throughout the project site. The project construction contractor would then survey, clear and grade road corridors in order to bring equipment, materials, and workers to the various areas under construction within the project site. Road corridors buried electrical lines, PV array locations and locations of other facilities may be flagged and staked in order to guide construction activities. In addition, water truck reloading stations would be established for dust control.

5.4.5 CONSTRUCTION WATER REQUIREMENTS

Construction of the proposed Project is anticipated to take approximately 6-9 months. from the commencement of the construction process to complete. Construction water needs would be limited to earthwork, soil conditioning, dust suppression, and compaction efforts. During construction, on-site groundwater is proposed to be utilizedwill be used. It is estimated that approximately 900,000 gallons (2.76 acre-feet [af]) of water (40,909 gallons per work day) would be required during the first phase of construction for site preparation and grading, The second phase of construction (PV system installation and testing) would take approximately 6 months and require approximately 2,130,000 gallons (6.54 af) of water (16,136 gallons per work day). Water would drop to approximately 300,000 gallons (0.92 af) (13,636 gallons per workday) of water during the last phase of the construction (clean-up and restoration). The proposed project would require a total of 3,330,000 gallons (10.22 af) of water during the construction period. To the extent necessary, non-potable water would be obtained from the Golden State Water Company's hydrant/meter near 1st Street and Memphis Street in Niland and trucked to the project site to meet construction water needs.

5.4.6 DUST SUPPRESSION

The Project would comply with all applicable air pollution control regulations. During the construction phase of the project, standard dust control measures would be used to mitigate emissions of fugitive dust. These may include watering or applying dust palliatives with low environmental toxicity to suppress dust during construction.

5.4.7 OPERATIONS AND MAINTENANCE

Once fully constructed, the proposed Project would be operated on an unstaffed basis and be monitored remotely, with periodic on-site personnel visitations for security, maintenance and system monitoring. Therefore, no full-time site personnel would be required on-site during operations, and employees would only be on-site four times per year to wash the panels.

As the project's PV arrays produce electricity passively, maintenance requirements are anticipated to be very minimal. Any required planned maintenance activities would generally consist of equipment inspection and replacement and would be scheduled to avoid peak load periods. Any unplanned maintenance would be responded to as needed, depending on the event.

Estimated annual water consumption for operation and maintenance of the proposed Project, including periodic PV module washing, would be approximately 0.81-acre feet annually (af/y). As discussed previously, the project will use groundwater from an on-site groundwater well. Alternatively, non-potable water would be obtained from the Golden State Water Company's hydrant/meter near 1st Street and Memphis Street in Niland and trucked to the Project site.

5.4.8 FACILITY DECOMMISSIONING

Solar equipment has a lifespan of approximately 20 to 25 years. At the end of the Project's operation term, the Applicant may determine that the Project should be decommissioned and deconstructed. Should the Project be decommissioned, concrete footings, foundations, and pads would be removed using heavy equipment and recycled at an off-site location. All remaining components would be removed, and all disturbed areas would be reclaimed and recontoured.

6 PREPARATION OF SB 610 ASSESSMENTS – GROUNDWATER

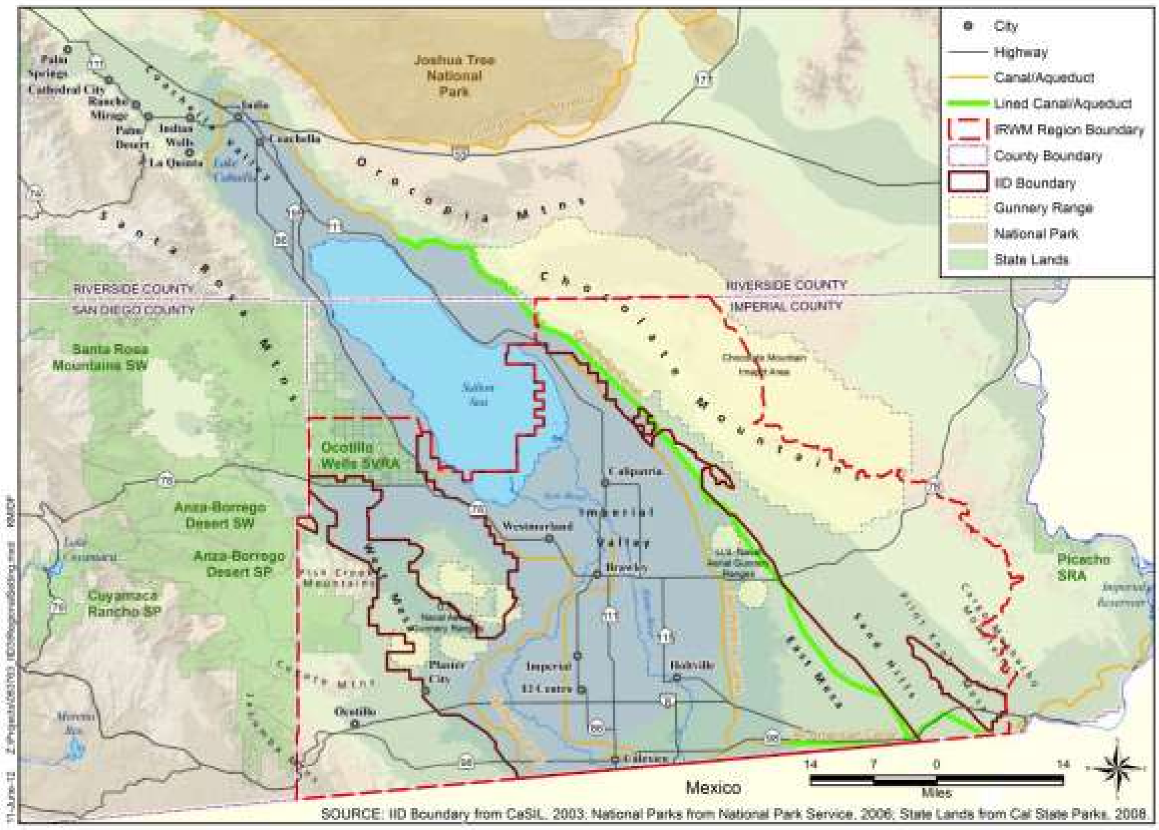
6.1 EXECUTIVE SUMMARY

6.2 IMPERIAL INTEGRATED REGIONAL WATER MANAGEMENT PLAN (OCTOBER 2012)

Imperial County has an Integrated Regional Water Management Plan (IRWMP) which was adopted in October of 2012, . As stated in the IRWMP, "…The Imperial IRWMP area lies within the Salton Trough of southern California as shown on Figure X. The Salton Trough is the dominant feature of the Colorado Desert geomorphic province of California. The trough is about 130 miles long and up to 70 miles wide, and is generally considered the northwesterly landward extension of the Gulf of California (Loeltz et al., 1975). The term Salton Basin (Basin) applies to the broad region draining directly into the Salton Sea. The Imperial Valley lies in the central part of the Basin south of the Salton Sea. Most of the IID service area overlies the area defined as the Imperial Valle. The Salton Sea is a critical component of the Pacific Flyway migratory corridor as it is an essential overwintering site for thousands of migratory waterfowl. Its marsh areas provide significant habitat for the endangered Yuma clapper rail…[6]"

[6] https://www.iid.com/water/water-supply/water-plans/imperial-integrated-regional-water-management-plan, Retrieved , June 2020

Figure 5: Imperial IRWMP Area



The IRWMP encompasses three principal physiographic and hydrologic areas: (1) the Imperial Valley which lies within the valley floor generally inside the boundaries of the Westside Main and East Highline Canals and north of the Mexico; (2) the East Mesa which is generally east of the East Highline Canal; and (3) the West Mesa generally west of the Westside Main canal. The proposed Project is in the East Mesa, which is in the southeastern portion of the Salton Basin. The IRWMP describes this area as the broad area east of the East Highline Canal and east margin of pre-historic Lake Cahuilla, and west of the Sand Hills Fault. The East Mesa is also roughly bordered by the Coachella Canal on the east and the AAC on the south. The East Mesa is an alluvial surface that slopes gently west-southwest, covered with thin veneers of wind-blown sand. The East Mesa aquifer is chiefly unconfined, homogenous, and composed of coarsegrained deposits of gravels, sands, silts, and silty clays that were deposited by the Colorado River. Faults in East Mesa (e.g., San Andreas Fault and Algodones Fault) act as partial barriers to the westward flow of groundwater from this area. The Calipatria Fault also crosses a small portion of the East Mesa along the southwest margin and also impedes the flow of groundwater out of East Mesa.

According to the IRWMP, the East Mesa has the greatest amount of available data on groundwater quality, and it includes a large number of groundwater wells. It also has a small number (12) of water supply wells, some of which are used for agricultural purposes. It has two aquifers: a shallow unconfined zone from 0 to 85 feet and a deeper semi-confined zone from 85 to 160 feet (Crandall, 1983). The aquifers were differentiated based on chemistry of their waters and the perforated interval of the particular well. The Table below provides the analysis and characterization of the water quality[7].

Table 5: East Mesa Water Quality from IRWMP

Table B-1. East Mesa Water Quality

	Zone A (85 to 160 Feet)		Zone B (0 to 85 Feet)	
Chemical Character	Sodium Chloride	15 wells	Sodium Chloride	13 wells
	Sodium Sulfate	3 wells	Sodium Sulfate	10 wells
	Sodium Bicarbonate	0 wells	Sodium Bicarbonate	6 wells
pH	Range: 7.4- 8.6	17 wells	Range: 4.3-11.2	17 wells
	Common 7.4- 8.6		Common 6.9- 9.0	
	4.3- 6.4	0 wells	4.3- 6.4	4 wells
	6.5- 7.5	1 well	6.5- 7.5	5 wells
	7.6- 8.6	16 wells	7.6- 8.6	11 wells
	8.7- 9.7	0 wells	8.7- 9.7	3 wells
	9.8-11.2	0 wells	9.8-11.2	4 wells
TDS (ppm)	Range 589-2860	17 wells	Range: 250-2620	27 wells
	Common: 750- 995	9 wells	Common: 434- 787	16 wells
	589	1 well	250	1 well
	1270	1 well	882-1413	7 wells
	1710-2860	6 wells	1750-2620	3 wells
	7112	1 well	7151	1 well
F (ppm)	Range: 0.2-1.4	10 wells	Range 0.1-1.6	22 wells
	1.9	1 well	3	1 well
B	0.26 and 0.46	2 wells	0.41	1 well

Source: Crandall, 1983

According to the IRWMP, hydraulic conductivity values for the shallow and deeper aquifers values varied from a low value of 0.5 foot per day in the central irrigated area of the to a high value of 80 feet per day in East Mesa, where sediments are highly transmissive sands and gravels. Therefore, the IRWMP concludes that on average, new wells in the East Mesa would be expected to have higher yields than those in the West Mesa[8].

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[7] https://www.iid.com/water/water-supply/water-plans/imperial-integrated-regional-water-management-plan, Retrieved, June 2020.

[8] https://www.iid.com/water/water-supply/water-plans/imperial-integrated-regional-water-management-plan

The IRWMP states, “Data available in the IRWMP for wells in the East Mesa include well yields and specific capacities. Reported well yields varied from 80 to 3,000 gpm, depending on depth and location. In general, yields in excess of 900 gpm were associated with depths of 200 feet or more. Specific capacity data reported for seven wells in the East Mesa, varied from 0.8 to 85 gpm/ft. The well with the highest specific capacity was located at the junction of the AAC and Coachella Canal. Specific capacities were highest to the east, and diminished to the west. Higher specific capacities were associated with wells deeper than 200 feet (Crandall, 1983). Consistent with the overall geologic model for the Imperial IRWMP area, the highest transmissivities are associated with the East and West Mesas where aquifer formations are generally more homogenous and include a much higher proportion of coarse sands and gravels then the Imperial Valley floor, allowing groundwater to move at higher rates.”[9]

The direction of groundwater movement in the East Mesa is controlled primarily by contours of groundwater level elevation; the rate of groundwater movement is proportional to the gradient or slope of the groundwater table. Groundwater levels and flow have changed with lining of the canals; therefore, two temporal sets of water level data are presented: one for 1960 representing conditions with recharge from the canals and one for 1993 after the southerly portions of the Coachella Canal was lined. Lining of portions of the AAC, generally about six miles east of the East Highline Canal to about five miles east of the Coachella Canal was not started until 2006 so neither set of maps reflect the reduction of seepage from the AAC. A portion of the AAC still contributes recharge to East Mesa. Additional details groundwater contour maps are also provided for both the East and West Mesas.

6.3 TITLE 9, DIVISION 21, WATER WELL REGULATION [DIVISION 21 ADOPTED NOVEMBER 24, 1998 (AMENDED OCTOBER 31, 2006)]

TITLE 9, DIVISION 21, WATER WELL REGILATION, DIVISION 21, § 92102.00 PERMIT(S) REQUIRED

Imperial County Ordinance XXXXX states, in relevant part, that “No person shall (1) drill a new well, (2) activate a previously drilled but unused well, (unused shall mean a well or wells that have not been used for a 12 month) period by installing pumps, motors, pressure tanks, piping, or other equipment necessary or intended to make the well operational, (3) increase the pumping capacity of a well, or (4) change the

[9] https://www.iid.com/water/water-supply/water-plans/imperial-integrated-regional-water-management-plan

use of a well, without first obtaining a Conditional Use Permit (CUP) through the County Planning & Development Services Department. The pumping capacity shall mean the "permitted amount" or in the absence of a permit the annual acreage, over 3-year period." Therefore, the Applicant would need to obtain a Conditional Use Permit from the County for the onsite well.

Additionally, Imperial County Ordinance XXXXX states that:

"(B) Well Construction Permit. No person shall dig, bore, drill, deepen, enlarge, refurbish, or destroy a water well, cathodic protection well, observation well, monitoring wells or any other excavation that intersects ground water without first obtaining a well construction permit through the Planning & Development Services Department…" The Applicant would also have to obtain a Well Construction Permit from the County.

6.3.1 TITLE 9, DIVISION 21, WATER WELL REGILATION, DIVISION 21, § 92102.05 SUSPENSION AND REVOCATION

A. Circumstances for such action: Enforcement agency may suspend or revoke any permit issued pursuant to this Ordinance, whenever it finds that the permittee has violated any of the provisions of this Ordinance, or has misrepresented any material fact in his/her application or any supporting documents for such a permit. Prior to ordering any such suspension or revocation, the enforcement agency shall give permittee an opportunity for a hearing thereon, after reasonable notice. The hearing shall be before the enforcement agency, the director, or his designated representative.

B. Consequences: No person whose permit has been suspended or revoke shall continue to perform the work for which the permit was granted until, in case of suspension, such permit has been reinstated by the enforcement agency.

C. Additional Work: Upon suspending or revoking any permit, the enforcement agency may order permittee to perform any work reasonably necessary to protect the ground water from pollution or contamination, if any work already done by permittee has left a well in such a condition as to constitute a hazard to the quality of the ground water. No permittee or person who has obtained a permit issued pursuant to this Ordinance shall fail to comply with such order

In the event the applicant be denied the Conditional Use Permit for the groundwater well, The applicant will have to take the following actions. Find another legal water source per California Water Code. The applicant will then need to submit a revised Water Supply Assessment to the Lead Agency.

This project is outside the IID's service area and therefore the IID cannot service the project with water.

6.3.2 TITLE 9, DIVISION 21, WATER WELL REGILATION, DIVISION 21, § 92103.01 REPORTS

Completion Reports: The driller shall provide the enforcement agency a completion report within 30 days of the completion of any well construction, reconstruction, or destruction job. A. Submittal of State "Report of Completion": A copy of the "Report of Completion" (Driller's well log) required by California Water Code, Section 13751, shall be submitted by the well driller to the enforcement agency within 30 days of construction or destruction of any well (except driven wells). This report shall document that the work was completed in accordance with all applicable standards and additional permit conditions. This section shall not be deemed to release any person from the requirement to file said report with the State Department of Water Resources. B. Confidentiality of Report: With the exception of the well driller's name, the date the well was drilled and the well yield, all information contained in this report shall remain "Confidential". C. Other Agency's Requirements: Nothing in this Ordinance shall be deemed to excuse any person from compliance with the provisions of California Water Code, Section 13752, relating to notices and reports of completion or any other federal, state, or local reporting regulations.

6.3.3 TITLE 9, DIVISION 21, WATER WELL REGILATION, DIVISION 21, § 92103.00 REGISTRATION OF WELL

Any person who uses a new or existing well shall first register said well with the Imperial County Planning & Development Services Department. If a well is under an active conditional use permit, the well shall be deemed to be registered. Any well that is not under an Imperial County CUP shall be registered with the Planning & Development Services Department and the State pursuant to California Water Code, Section 13750.. An application to register any well shall be filed with the Planning & Development Services Department and said application shall contain all information required upon said form.

6.3.4 TITLE 9, DIVISION 21, WATER WELL REGILATION, DIVISION 21, § 92103.02 WELL STANDARDS

Except as otherwise specified, the standards for the construction, repair, reconstruction, alteration, reactivation, operation, or abandonment of wells shall be as set forth in: A. The California Department of Water Resources Bulletin 74-81 entitled, "Water Well Standards, State of California", except as modified by subsequent supplements or revisions issued by the Department of Water Resources. Division 21 Adopted November 24, 1998 (Amended October 31, 2006) B. The California Department of Water Resources Bulletin 74-90 and any subsequent supplements or revisions issued by the Department of Water Resources. C. The following factors, to the extent necessary to avoid conditions of overdraft, subsidence, well interference, water quality degradation, or other environmental degradation: 1. The type of use or uses served. 2. The number of users served. 3. Wasteful or inefficient use. 4. Water conservation activities. 5. Reasonable need of the extractor and other affected water users. 6. The quality of groundwater. 7. The affected groundwater basin or sub-basins. 8. Environmental impact as determined through the CEQA review. 9. Any other factors that the Planning & Development Services Department reasonably believes it should consider in order to reach an equitable result within the entire County in accordance with the provisions of this Ordinance, and of California Law.

6.4 COLORADO RIVER BASIN REGION OF CALIFORNIA (BASIN PLAN) (2019)[11]

For water quality planning and protection purposes, the Project is within the Colorado River Basin Region of the California Regional Water Quality Control Board. The Water Quality Control Plan for the Colorado River Basin (Basin Plan) is the Board's master plan for water quality protection. The Basin Plan identifies the waters in the Region, theor beneficial uses, and water quality objectives to protect those uses. The Basin Plan fulfills state and federal statutory requirements for water quality planning, thereby preserving and protecting ground and surface waters of the Colorado River Basin Region. The proposed Project is in the Imperial Valley Hydrologic Unit.

6.4.1 BENEFICIAL USE DESIGNATIONS OF AQUIFERS

[11] https://www.waterboards.ca.gov/coloradoriver/water_issues/programs/basin_planning/docs/bp032014/r7_bp2019fullbp.pdf, Retrieved, June 2020

6.5 HISTORIC USE IN THE BASIN- RECORDS

The closest historical records of related to groundwater pumping on record belongs to the Western Mesquite Mines, with a ORDER R7-2014-0032, Waste Discharge Requirements And Monitoring And Reporting Program permit with the California Regional Water Quality Control Board Colorado River Basin Region. The Water Quality Control Plan for the Colorado River Basin Region of California (Basin Plan), which was adopted on November 17, 1993, and amended on November 16, 2012, designates the beneficial uses of ground and surface waters in this Region.

According to the IRWMP there is proof that farmers did use groundwater wells at one point to water crops, however there are no records on file at the County of Imperial of such permits. The majority of farmers rely on the Imperial Irrigation Districts water conveyance system for water deliveries.

The proposed well would be new and therefore has no other historical use. All water being pumped will from this proposed ground water well will be a net increase.

7 PROJECT WELL HYDRAULIC EVALUATION [13]

7.1 SURFACE WATER SYSTEM

Surface water features within 2 miles of the Proposed Well include natural drainages and manmade features including canals, laterals, IID drains and ponds/reservoirs. Natural drainages include Iris Wash and unnamed minor drainages, which convey runoff from the Chocolate Mountains to the Imperial Valley. These drainages ultimately flow towards the Salton Sea, which is the low point of the basin. All natural drainages are classified as intermittent (USFWS, 2020). Canals include the Coachella Canal and the East Highline Canal (Figure 3). Both canals deliver water from the All American Canal (AAC), located approximately 40 miles south of the Project. The Coachella Canal is located approximately 1.3 miles from the Proposed Well. The Coachella Canal was initially unlined in the Imperial Valley, which lead to water losses into the alluvial sediments. In the late 1970s, the first 49 miles of the Coachella Canal was replaced with a concrete lined channel. This end of this segment is located approximately 3.6 miles east southeast of the Proposed Well. In the mid-2000s, the remaining 36.5 miles of the Coachella Canal (including the section near the Project; see Figure 3) was replaced with a concrete lined channel, reducing seepage losses into alluvial sediments. The East Highline Canal is located approximately 0.5 miles from the Proposed Well.

[13] STANTEC STUDY

Furthermore, the East Highline Canal crosses the southwest corner of the Project (Figure 1). The East Highline Canal is unlined and likely results in seepage to alluvial sediments. The water distribution system in the Imperial Valley, near the Project, include laterals and ponds for distribution and storage, respectively, and drains to convey unused water from distribution system, farmland, and discharging groundwater to the Salton Sea (IIRWMP, 2012). The East Highline Canal is downgradient from the Project though a seepage mound in the shallow aquifer may be present upgradient of the canal, as identified along unlined sections of the AAC and Coachella Canal (Loeltz et al., 1975).

Please identify and name the closest IID Drain to the Project site.

7.2 Aquifer Extent and Properties

Aquifers in the East Salton Sea Basin include alluvial aquifers, which are present as valley fill with maximum thicknesses of at least 400 feet (Willets et al., 1954). Water bearing units include unconsolidated Quaternary alluvium and semi-consolidated Tertiary to Quaternary alluvium. The groundwater storage capacity was estimated at 360,000 acre-feet (DWR, 1975). High permeability units likely include coarse sands and gravels, where present. Aquifer extents are bounded by outcropping bedrock in the Chocolate Mountains and possibly low-permeability fault zones such as the San Andreas Fault Zone, the Banning Mission Fault, and other unnamed faults. Specific to East Mesa, aquifers in this area are generally unconfined, homogenous, and composed of sediments deposited by the Colorado River (IIWMP, 2012). A geothermal test well was previously drilled at the Project by Ormat (well 12-27) to a depth of 3401 feet bgs. The shallow groundwater system was not specifically characterized during drilling and testing. However, static temperature logs from the well may indicate the presence of an aquifer zone as shallow as 40 to 50 feet bgs. Other aquifer zones are likely present but were not identified due to the limitations of temperature logs. Geothermal properties of the test well were non-economical, and the well was abandoned. The nearest East Mesa well with a lithological log is 12S/16E-9A, which is located 9 miles to the southwest of the Proposed Well. In the 1000-foot log, 61% of the thickness is dominated by sand, 34% dominated by clay and approximately 1% dominated by sandstone. Sand and clay intervals also include silts and gravels. Coarse sands and gravels, likely having high hydraulic conductivities, are intermittently present throughout the logged sequence. The perforated interval of the well was placed at 150-1,000 feet and the static water level was recorded at 154.5 feet bgs, which is an elevation of 65.5 feet bgs. Other nearby wells with lithological logs were completed in the Imperial Valley and contain higher percentages of clay (Loeltz et al., 1975).

7.3 RECHARGE

Groundwater recharge in the East Mesa area was historically dominated by seepage from the Coachella Canal, prior to replacement with concrete lined channels in the late 1970s and mid-2000s. Prior to lining, seepage from the 36.5-mile section near the Project has been estimated at 26,000 acre-feet per year. Unlined sections of the AAC continue to recharge the East Mesa groundwater aquifer. However, the unlined section is approximately 45 miles from the Project. In the absence of canal seepage, recharge to the East Mesa aquifer from direct precipitation is estimated to be near zero (Leroy Crandall and Associates, 1983). Groundwater recharge in the Chocolate Mountains may include mountain front recharge and stream flow runoff (Tompson et al., 2008). The Lawrence Livermore National Laboratory (LLNL) groundwater model (Tompson et al., 2008) estimated that recharge from precipitation within the Imperial Valley and portions of surrounding ranges was 0.019 inches/year, which is less than 1% of precipitation. Furthermore, the LLNL model did not include additional recharge along the mountain fronts. The 2013 groundwater model, which was updated by Argonne National Laboratory (ANL; Greer et al., 2013) estimated recharge at 0.056 inches/year in Imperial Valley and 7.2 inches/year along the mountain-front area of the Chocolate Mountain. This estimate of mountain-front recharge may not be supported by the estimated precipitation rates for the Chocolate Mountains (4-6 inches/year; PRISM, 2020). In 2003, the DWR classified the East Salton Sea Basin groundwater budget type as 'C', which indicates that groundwater data is insufficient to estimate the groundwater budget or groundwater extraction (DWR, 2003)

DISCHARGE AND EXTRACTION

Discharge from the East Salton Sea Basin includes springs, discharge into irrigation drains, and extractions from wells. Spring discharge, and water losses from associated vegetation, is likely limited based on the occurrence of few springs (see Figure 3). Irrigation drains in the Imperial Valley (including the western margin of the East Salton Sea Basin) primarily return excess irrigation water to the Salton but also function to remove discharging groundwater. Water well extraction rates were last estimated in 1952 at 6 acre feet/year (DWR, 1975). Due to the lack of development in this basin, current extraction rates may be similar. However, this statement is speculative due to a lack of recent information (DWR, 2003).

7.4 GROUNDWATER LEVELS

Groundwater levels in the vicinity of the Project have been influenced by the presence of the canal systems, including the Coachella Canal, East Highline Canal, and associated laterals and drains. Seepage from the unlined Coachella Canal created a groundwater mound in the shallow alluvial aquifer of East Mesa, with water levels rising over 70 feet in some areas (Loeltz et al., 1975). Groundwater level decline in the vicinity of the Coachella Canal has been monitored since the late 1970s when the first 49 miles of the earthen canal channel was replaced with a concrete channel. United States Geological Survey (USGS) well 11S/15E-23M, which is approximately 9 miles southeast of the Proposed Well (Figure 3), shows an asymptomatic groundwater level decline from 20.68 feet bgs in 1979 to approximately 50 feet bgs at present. The water level elevations as of March 2020 were approximately 70 feet amsl. No groundwater levels have been reported along the Coachella Canal section that was lined in the late 2000s. However, a similar asymptotic decline could be expected. Groundwater levels in Imperial Valley have been historically measured at two multi-level wells located approximately 6.5 to 7.5 miles southwest of the Proposed Well (11S14E30C and 11S14E19N; Figure 3). Water levels at these locations were within 10 feet of the ground surface in 1989. The groundwater elevation at that time was approximately 215 feet bmsl. Groundwater levels in the irrigated areas have been controlled by the drain systems (IIRWMP, 2012). Current groundwater levels, although sparse, generally agree with historical groundwater elevation distributions. Groundwater elevations are higher in mountainous areas and East Mesa and decline towards Imperial Valley and the Salton Sea. This distribution of groundwater elevations suggests groundwater flow directions roughly coincide with topography. However, the flow of groundwater and distribution of groundwater levels is likely influenced by faults, which act as barriers, and changes in transmissivity.

7.5 GROUNDWATER QUALITY

Groundwater quality in the East Salton Sea Basin is generally reported as poor and not suitable for domestic, municipal, or agricultural purposes (DWR, 2004). Water types include sodium chloride and sodium sulfate. Total dissolved solids (TDS) concentrations are reported as 356 to 51,632 mg/L, whereas the National Secondary Drinking Water Regulations limit TDS to 500 mg/L. Groundwater quality is generally considered better in the vicinity of the unlined canals due to the recharge of lower TDS water. The closest well to the Proposed Well with available water quality data is located 2 miles to the west (Loeltz et al., 1975). A limited number of water quality constituents were measured in 1961, including pH (8.0), specific conductivity (19,200 µS/cm), bicarbonate (210 mg/L), chloride (6,050 mg/L), calcium-magnesium hardness (2,440 mg/L), and non-carbonate hardness 2,270 mg/L). The screened interval depth of this well is unknown.

The next closest well to the Proposed Well with available water quality data is an inactive USGS monitoring well (11S/14E-2A) located approximately 2.8 miles to the southeast (USGS, 2020). The well is located in a Basin and Range basin-fill aquifer. The total depth was 825 feet bgs, however, the depth of the screened interval is unknown. Water quality was measured in the late 1960s and early 1970s. The latest water quality sample that includes all major ions (calcium, magnesium, sodium, potassium, bicarbonate, sulfate and chloride) was collected in 1969. This sample had sodium-chloride type water and a TDS concentration of 1,760 mg/L. Furthermore, temperatures were elevated above ambient temperatures at 44.4°C.

8 PROJECT WATER DEMAND

Project Engineers estimate that the water usaged for the Project will be for construction, operational, mitigation measures and decommissioning of the Project. Water from the aquifer can be supplied to the project via the proposed well in accordance with County and State regulations. The Project is anticipated to use approximately 1.87 AFY Amortized **(see Table- 8) and associated tables below** for a summary of water usage to be supplied to the Project. The project will increase the demand for water from this water source by 100%.

Table 6: Wister Project Demands- Construction

Wister Water Project Demand		
Construction Needs		
Phases	Per Day in Gallons	ACFT/DAY
Phase 1	900,000	2.76
Phase 2 *	2,130,000	6.54
Phase 3 *	300,000	.92
Total	3,330,000	10.22

Table 7: Wister Project Demands- Operational Water Use

Wister Water Project Demand		
Operational Needs		
Phases	ACFT/YR	ACFT 30 YEAR PROJECT LIFE
Operational Water Needs, for Dust and Fire Suppression	1.37	41.1
Decommissioning Water	5	5

Table 8:Amortized Wister Project Demand

Wister Water Project Demand	
Amortized Wister Project Demand	
Phase	ACFT/YR Total for 30 Years
Construction	10.22
Operational	41.1
Decommissioning	5
Total	56.32/30=1.87 AFY

9 PROJECT SPECIFIC HYDROLOGIC EVALUATION

At the request of the Applicant, Stantec conducted a hydrological evaluation for the proposed Project. It also prepared a report with titled "Hydrological Evaluation, Wister Solar Development Project. June 8, 2020." The report presents the findings of the evaluation. This following paragraphs summarize the findings.

The Wister Solar Development Project is located within the East Salton Sea Basin, which includes the Chocolate Mountains and the northeastern margin of the Imperial Valley (Figure 2). The groundwater storage capacity of the East Salton Sea Basin was estimated at 360,000 acre-feet. Groundwater usage in the East Salton Sea Basin is limited due to generally poor water quality and limited inhabitants. Extraction rates for the East Salton Sea Basin were last estimated in 1952 at 6 acre-feet/year, which is 3% of the estimated recharge rate of 200 acre-feet/year (DWR, 1975). Limited development in the East Salton Sea

Basin suggests that current extraction rates are similar. However, a lack of recent data limits the ability update this estimate. Furthermore, surface water from the Colorado River is conveyed into the Imperial Valley through a network of canals, laterals, and reservoirs, which has further reduced the need to develop groundwater resources. Groundwater in the East Salton Sea Basin is present in alluvial aquifers at depths up to several hundred feet, and with generally high transmissivities (Montgomery Watson, 1995). At the Project, groundwater may also be present in an alluvial aquifer 40-50 feet bgs. Historically, groundwater recharge was significant in the vicinity of the earthen lined Coachella Canal. The replacement of the canal with a concrete lined channel has greatly reduced recharge to the adjacent alluvial aquifers. Near the Project, the Coachella Canal was concrete lined in the late 2000s. The East Highline Canal remains earthen-lined, which likely leads to recharge into the shallow alluvial aquifers near the Project. Recharge from precipitation is generally limited due to low precipitation rates and high evaporation potential. Recharge rates may be higher in the Chocolate Mountains due to higher precipitation rates at higher elevations (4-6 inches/year; PRISM, 2020). Recharge events are likely limited to larger storm events, which may generate runoff and seepage along ephemeral channels. Recharge rates from precipitation were estimated at 0.019 inches/year (Tompson et al., 2008). The water needs for the Project are estimated at 10.22 acre-feet for construction in the first year, 1.37 acre-feet/year for the subsequent 25 to 30 years of operation, and 5 acre-feet for decommissioning at the end of operations (Table 7). Overall, the proposed extraction for the Project are significantly lower than recharge rates in an area where groundwater usage is limited.

10 PROJECT SPECIFIC PERMITTING REQUIREMENTS

Construction activities would be sequenced and conducted in a manner that addresses storm water management and soil conservation. During construction, electrical equipment would be placed in service at the completion of each 2,500-kW power-block. The activation of the power-blocks is turned over to interconnection following the installation of transformer and interconnection equipment upgrades. This in-service timing is critical because PV panels can produce power as soon as they are exposed to sunlight, and because the large number of blocks and the amount of time needed to commission each block requires commissioning to be integrated closely with construction on a block-by-block basis.

Construction would generally occur during daylight hours, Monday through Friday. However, non- daylight work hours may be necessary to make up schedule deficiencies, or to complete critical construction activities. For example, during hot weather, it may be necessary to start work earlier to avoid pouring concrete during high ambient temperatures. If construction is to occur outside of the County's specified working hours, permission in writing will be sought at the time. Construction of the proposed project would occur in phases beginning with site preparation and grading and ending with equipment setup and commencement of commercial operations. Overall, construction would consist of three major phases over a period of approximately 6-9 months:

4. Site Preparation, which includes clearing grubbing, grading, service roads, fences, drainage, and concrete pads; (1 month)
5. PV system installation and testing, which includes installation of mounting posts, assembling the structural components, mounting the PV modules, wiring; (7 months) and
6. Site clean-up and restoration. (1 month)

Construction activities would be conducted in a manner consistent with Imperial County Codified Ordinance. Noise generating sources in Imperial County are regulated under the County of Imperial Codified Ordinances, Title 9, Division 7 (Noise Abatement and Control). Noise limits are established in Chapter 2 of this ordinance. Under Section 90702.00 of this rule, average hourly noise in residential areas is limited to 50 to 55 dB(A) from 7 AM to 10 PM, and to 45 to 50 dB(A) from 10 PM to 7 AM.

10.1 STATE PERMITS REQUIRED

The State Water Resources Control Board and the Regional Water Quality Control Board (Region 7) regulate potential water quality impacts from discharges of wastes, including storm water runoff and wastewater runoff from the site from O&M activities. The Applicant will have to obtain coverage under the State Water Resources Control Board General Storm Water NPDES Permit for Construction Activities and prepare a Storm Water Pollution Prevention Plan (SWPPP) to prevent adverse water quality impacts during construction.

The California Department of Fish and Wildlife (CDFW) is responsible for conserving, protecting, and managing California's fish, wildlife, and native plant resources. To meet this responsibility, the California Fish and Game Code (F&GC) requires that the CDFW be consulted if the proposed Project has the potential to adversely impact a stream and thereby wildlife resources that depend on a stream for continued viability (F&GC Division 2, Chapter 5, section 1600-1616). A Section 1602 Lake or Streambed Alteration Agreement may be required for the Project, should the CDFW determine that the proposed Project may do one or more of the following:

- Substantially divert or obstruct the natural flow of any river, stream or lake;
- Substantially change or use any material from the bed, channel or bank of any river, stream, or lake; or
- Deposit debris, waste or other materials that could pass into any river, stream or lake, or
- Remove or disturb vegetation and/or habitat.

For the purposes of clarification, a stream is defined by CDFW as “a body of water that flows perennially or episodically and that is defined by the area in which water currently flows, or has flowed, over a given course during the historic hydrologic regime, and where the width of its course can reasonably be identified by physical or biological indicators.” The historic hydrologic regime is defined as circa 1800 to the present (CDFW 2010). The East Highline Canal is a Water of the United States (federal jurisdiction). There may be also nearby IID Drains that are also jurisdictional waters. Therefore, the Applicant should, at a minimum, delineate jurisdictional waters that may be affected by the Project (during and post construction), and consult with CDFW to determine whether a Section 1602 Streambed Alteration Agreement is required. Also, it should also consult with the Regional Water Board to determine whether Clean Water Act Section 401 Water Quality Certification is required to prevent adverse water quality impacts as well.

11 PROJECT WATER SUPPLY

According to the Hydrological Evaluation, “The groundwater storage capacity of the East Salton Sea Basin was estimated at 360,000 acre-feet. Groundwater usage in the East Salton Sea Basin is limited due to generally poor water quality and limited inhabitants. Extraction rates for the East Salton Sea Basin were last estimated in 1952 at 6 acre-feet/year, which is 3% of the estimated recharge rate of 200 acre-feet/year (DWR, 1975).[14]” The project amortized over a 30-year term water demand is assessed at 56.32 ACFT TOTAL, divided by 30 Years equates to 1.88 ACFT/YR over 30 Years. Although the basin contains a groundwater storage capacity of 360,000 acre-feet, with the recharge rate of 200 ACFT per year it is up to the local enforcement agencies to police the amount of water allowed to the applicant. The applicant is subject to all Local, State, and Federal water laws. In sum, the aquifer beneath the site is capable of serving the water demands of the project.

[14] Hydrological Evaluation, Wister Solar development Project, June, 2020

12 SUMMARY AND CONCLUSIONS

- The proposed Project has an estimated total water demand of 56.32 AF or AFY amortized over a 30-year term). Thus, the proposed Project demand is an increase of AFY from the historical 10-year average or percent (100 %)than the historic 10-year average.
- Based on the amount of groundwater within the basin and the recharge rate of 200 acre-feet/year the project supply is able to meet the project demand of the project.
- Based on the Environmental Impact Report (EIR) prepared for this proposed Project pursuant to the CEQA, California Public Resources Code sections 21000, *et seq*., the Lead Agency hereby finds that the IID projected water supply will be sufficient to satisfy the demands of this proposed Project in addition to existing and planned future uses, including agricultural and non-agricultural uses for a 30-year Water Supply Assessment period and for the year proposed Project life.
- Permitting, The applicant is subject to all Local, State and Federal Laws during construction and operations for the Wister Solar Development Project.
- Approval of Conditional Use Permit – Groundwater Well. Pursuant to Title 9 Division 21: Water Well Regulations, §92102.00, the Applicant will be required to obtain a Conditional Use Permit for the proposed on-site groundwater well. As required by §92102.00, no person shall (1) drill a new well, (2) activate a previously drilled but unused well, (unused shall mean a well or wells that have not been used for a 12 month) period by installing pumps, motors, pressure tanks, piping, or other equipment necessary or intended to make the well operational, (3) increase the pumping capacity of a well, or (4) change the use of a well, without first obtaining a Conditional Use Permit (CUP) through the County Planning & Development Services Department.
- It is suggested that the applicant run water quality analysis for precautionary purposes.

13 WORK CITED

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7. Hydrological Evaluation, Wister Solar development Project, June, 2020

14 APPENDICES

APPENDIX A

Hydrological Evaluation

Wister Solar Development Project

June 8, 2020

Prepared for:

ORNI 21, LLC
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Revision	Description	Author		Quality Check	
A	Internal Draft	S Smith	5/29/20	K Kohan	5/29/20
0	Client Draft	S Smith	6/1/20	K Kohan	6/2/20
1	Final	S Smith	6/8/20	K Kohan	6/8/20

This document entitled Hydrological Evaluation was prepared by Stantec Consulting Services Inc. ("Stantec") for the account of ORNI 21, LLC (the "Client"). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec's professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

Prepared by ______________________________________

(signature)

Stanley Smith

Reviewed & Approved by ____________________________

(signature)

Kevin Kohan

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Abbreviations

°F	Degrees Fahrenheit
AAC	All American Canal
AFY	Acre-feet per year
amsl	Above mean sea level
ANL	Argonne National Laboratory
bmsl	Below mean sea level
DWR	California Department of Water Resources
IIRWMP	Imperial Integrated Regional Water Management Plan
LLNL	Lawrence Livermore National Laboratory
POD	Point of Diversion
Project	Wister Solar Development Project
Proposed Well	Wister Solar Development Project Proposed Water Distribution Well
Stantec	Stantec Consulting Services
TDS	Total dissolved solids

1.0 INTRODUCTION

ORNI 21, LLC (Ormat) is proposing to construct and operate the Wister Solar Development Project (Project) near the unincorporated community of Wister in Imperial County, California (**Figure 1**). The Project is located on a privately owned land parcel within the northwest quarter or Township (T) 10 South (S), Range (R) 14 East (E) Section 27, San Bernardino Meridian. The Project consists of 100 acres of solar installation with a production capacity of 20 megawatt (net), associated infrastructure, and a water distribution well. Commercial operations are anticipated to begin in 2021.

The proposed water distribution well (Proposed Well) would supply water for Project construction, operation and maintenance, and decommissioning. Water requirements are summarized in **Table 1**. Water needs for operation and maintenance include panel washing, backup dust suppression, and fire tank water.

This report describes the hydrology and water related aspects of the Project area and surrounding area. This report includes details of physiography, geologic setting, climate, land use, surface water features, groundwater features, and a hydrologic conceptualization. The extent of this report is generally limited to a two-mile radius around the proposed water distribution well. Where data were limited within a two-mile radius of the Project, information from beyond this radius was included.

Table 1 Estimated Project Water Needs

Phase	Water Usage Rate	Duration	Total Water Requirement (acre-feet)
1: Dirt Work	40,909 gallons per workday	1 month	2.76
2: Construction	16,136 gallons per workday	2-7 months	6.54
3: Reclamation	13,636 gallons per workday	1 month	0.92
Construction Total	**-**	**9 months**	**10.22**
Operation & Maintenance Total	**1.37 acre-feet/year**	**25-30 years**	**34.25-41.10**
Decommission Total	**-**	**1 month**	**5.0**
Project Total		**~26-31 years**	**49.47-56.32**

Assuming 22 construction days per month; Pre-construction water needs assumed to be negligible.

2.0 SITE DESCRIPTION

2.1 PHYSIOGRAPHY

The Project is located in the Basin and Range physiographic province, which includes inland portions of California, the majority of Nevada, and portions or Arizona, New Mexico, Oregon, Utah, Idaho, and Mexico. The Basin and Range is divided into several sub basins, which includes the Salton Trough, which contains the Project. The Salton Trough includes the Imperial Valley in the south and the Coachella Valley in the north. The Project is near the northeastern margin of the Imperial Valley, approximately 5 miles east of the Salton Sea, a saline lake located in Imperial Valley. Imperial Valley is bounded by the Coyote and Jacumba Mountains to the west, the Chocolate and Orocopia Mountains to the northeast, the Sand Hills and Cargo Muchacho Mountains to the southeast, and the United States of America and Mexico border to the south. Furthermore, the elevated margins of Imperial Valley are named West Mesa and East Mesa. The elevation of the Imperial Valley is mostly below sea level and the Project is at approximately 15 feet bmsl. The Chocolate Mountains, which are the closest mountains to the Project, have a maximum elevation of 2,877 feet amsl.

2.2 GEOLOGIC SETTING

The Salton Trough is a tectonically active pull-apart basin. The extensional tectonics results in crustal thinning and sinking. Fault systems near the Project include the San Andreas Fault Zone and Imperial Fault Zone, which are linked by the Brawley Seismic Zone. The trough has filled with sediments due to its topographically low setting and continued sinking. The overall vertical relief of the trough formation is estimated to exceed 14,000 feet, which has been caused by faulting, folding, and warping (Loeltz et al., 1975). The geology and geomorphology of the Imperial Valley was influenced by prehistoric Lake Cahuilla, including lacustrine sediments and paleo-shorelines. The adjacent Chocolate Mountains include outcrops Tertiary and older igneous and metamorphic rocks. The piedmont slope of the Chocolate Mountains, located northeast of the Project, includes poorly sorted alluvial and fluvial deposits with sparse vegetation (Loeltz et al., 1975).

2.3 CLIMATE

The Project area has a hot desert climate. Climate data was available from two nearby weather stations: Niland (0.9 miles west-northwest of the Project; NCEI 2020a) and Brawley (22 miles south of the Project; NCEI 2020b). Both sites report climate normals (1981 to 2010) with Niland reporting precipitation and Brawley reporting precipitation and temperature. Monthly average temperatures are between 54.9 to 91.6°F with minimum temperatures occurring in December and maximum temperatures occurring in August. Average annual precipitation at Niland was 2.88 inches and at Brawley was 2.78 inches. The majority of precipitation occurs from December through March.

Precipitation in the adjacent Chocolate Mountains are estimated at 4–6 inches/year (PRISM, 2020).

Table 2 Climate Normals near the Project

Period	Brawley[1)]		Niland[2)]
	Average Temperature (°F)	Precipitation (inches/year)	Precipitation (inches/year)
January	55.8	0.48	0.47
February	59.1	0.53	0.44
March	64.3	0.33	0.45
April	69.9	0.05	0.07
May	77.4	0.02	0.01
June	85.0	0.00[3)]	0.03
July	91.3	0.08	0.23
August	91.6	0.21	0.21
September	86.2	0.16	0.22
October	75.2	0.25	0.18
November	63.2	0.19	0.17
December	54.9	0.48	0.40
Annual	72.9	2.78	2.88

1) Brawley, CA US; GHCND: USC00041048; 32.9544°, -115.5581°; 100 ft bmsl; NCEI, 2020a

2) Niland, CA US; GHCND: USC00046197; 33.2775°, -115.5239°; 60 ft bmsl; NCEI, 2020b

3) non-zero value that rounds to zero

2.4 LAND AND WATER USE

Land use within 2 miles of the Proposed Well is available from the 2003 Land Use GAP dataset. A summary of land use is provided in **Table 3**. The land area in 2002 was 75.6% natural ecosystem, including Sonora Mojave, North American Warn Desert, and Inter-Mountain Basins Shale Badlands. Cultivated croplands, pasture/hay and developed areas accounted for 24% of the area and the remaining 0.5% was open water. Approximately 9.6% of land within this area is within the Chocolate Mountain Aerial Gunnery Range, which is under the jurisdiction of the United States Navy and United States Marine Corps. Comparing land use classification to recent aerial imagery indicates some in land use due to the expansion of agriculture and solar energy operations, with other land use changes possible. Cultivated croplands include areas under irrigation, likely derived from laterals from the East Highline Canal.

Site Description

Table 3 Land Use Within Two Miles of the Proposed Well

Ecosystem	Description	Percent of Area
Sonora Mojave	Creosote Bush White Bursage Desert Scrub	29.9%
	Mixed Salt Desert Scrub	13.3%
North American Warm Desert	Riparian Woodland and Shrubland	11.4%
	Wash	10.8%
	Bedrock Cliff and Outcrop	7.4%
	Pavement	1.0%
	Playa	0.4%
	Volcanic Rockland	0.1%
	Active and Stabilized Dune	0.0%*
Cultivated Cropland	-	13.5%
Pasture/Hay	-	8.5%
Developed	Low Intensity	1.5%
	Medium Intensity	0.0%*
	Open Space	0.5%
Inter-Mountain Basins Shale Badland	-	1.2%
Open Water	Fresh	0.5%

*non-zero value that rounds to zero

3.0 HYDROLOGICAL SYSTEM

The hydrologic system in the vicinity of the Project includes the East Salton Sea groundwater basin (**Figure 2** and further details in Section 3.3), which is influenced by the surface water system, which includes intermittent creeks and canal systems with associated distribution and storage systems (see Section 3.2). Surface water features and wells are shown in **Figure 3**.

3.1 PRECIPITATION AND EVAPOTRANSPIRATION

Precipitation near the Project is recorded at approximately 2.8 to 2.9 inches/year. Modeled precipitation is higher in the Chocolate Mountains at approximately 4 to 6 inches/year. Potential evapotranspiration (PET) is between 80 and 100 inches/year within 2 miles of the Proposed Well (Esri, 2015). In the Chocolate Mountains, PET is higher at 100 to 110 inches/year. High PET rates combined with low precipitation rates limits the potential for groundwater recharge. However, recharge is possible during high precipitation storm events when PET is low.

3.2 SURFACE WATER SYSTEM

Surface water features within 2 miles of the Proposed Well include natural drainages and manmade features including canals, laterals, drains and ponds/reservoirs (**Figure 3**). Natural drainages include Iris Wash and unnamed minor drainages, which convey runoff from the Chocolate Mountains to the Imperial Valley. These drainages ultimately flow towards the Salton Sea, which is the low point of the basin. All-natural drainages are classified as intermittent (USFWS, 2020). All natural drainages are classified as intermittent (USFWS, 2020).

Canals include the Coachella Canal and the East Highline Canal (**Figure 3**). Both canals deliver water from the All American Canal (AAC), located approximately 40 miles south of the Project. The Coachella Canal is located approximately 1.3 miles from the Proposed Well. The Coachella Canal was initially unlined in the Imperial Valley, which lead to water losses into the alluvial sediments. In the late 1970s, the first 49 miles of the Coachella Canal was replaced with a concrete lined channel. This end of this segment is located approximately 3.6 miles east southeast of the Proposed Well. In the mid-2000s, the remaining 36.5 miles of the Coachella Canal (including the section near the Project; see **Figure 3**) was replaced with a concrete lined channel, reducing seepage losses into alluvial sediments.

The East Highline Canal is located approximately 0.5 miles from the Proposed Well. Furthermore, the East Highline Canal crosses the southwest corner of the Project (**Figure 1**). The East Highline Canal is unlined and likely results in seepage to alluvial sediments. The water distribution system in the Imperial Valley, near the Project, include laterals and ponds for distribution and storage, respectively, and drains to convey unused water from distribution system, farmland, and discharging groundwater to the Salton Sea (IIRWMP, 2012). The East Highline Canal is downgradient from the Project though a seepage mound in the shallow aquifer may be present upgradient of the canal, as identified along unlined sections of the AAC and Coachella Canal (Loeltz et al., 1975).

3.3 GROUNDWATER SYSTEM

The Project is located in the East Salton Sea Basin (basin 7-033) (**Figure 2**). The basin occupies the northeastern margin of the Imperial Valley, including the East Mesa, and alluvial surficial deposits of the Chocolate Mountains. The basin covers 279,824 acres. Adjacent basins include Chocolate Valley to the north, Arroyo Seco Valley to the east, Amos Valley to the southeast, and Imperial Valley to the south. No groundwater basin is defined in the footprint of the Salton Sea.

3.3.1 Aquifer Extent and Properties

Aquifers in the East Salton Sea Basin include alluvial aquifers, which are present as valley fill with maximum thicknesses of at least 400 feet (Willets et al., 1954). Water bearing units include unconsolidated Quaternary alluvium and semi-consolidated Tertiary to Quaternary alluvium. The groundwater storage capacity was estimated at 360,000 acre-feet (DWR, 1975). High permeability units likely include coarse sands and gravels, where present. Aquifer extents are bounded by outcropping bedrock in the Chocolate Mountains and possibly low-permeability fault zones such as the San Andreas Fault Zone, the Banning Mission Fault, and other unnamed faults.

Specific to East Mesa, aquifers in this area are generally unconfined, homogenous, and composed of sediments deposited by the Colorado River (IIWMP, 2012).

A geothermal test well was previously drilled at the Project by Ormat (well 12-27) to a depth of 3401 feet bgs. The shallow groundwater system was not specifically characterized during drilling and testing. However, static temperature logs from the well may indicate the presence of an aquifer zone as shallow as 40 to 50 feet bgs. Other aquifer zones are likely present but were not identified due to the limitations of temperature logs. Geothermal properties of the test well were non-economical, and the well was abandoned.

The nearest East Mesa well with a lithological log is 12S/16E-9A, which is located 9 miles to the southwest of the Proposed Well (**Figure 3**). Lithological details are provided in **Table 4**. In the 1000-foot log, 61% of the thickness is dominated by sand, 34% dominated by clay and approximately 1% dominated by sandstone. Sand and clay intervals also include silts and gravels. Coarse sands and gravels, likely having high hydraulic conductivities, are intermittently present throughout the logged sequence. The perforated interval of the well was placed at 150-1,000 feet and the static water level was recorded at 154.5 feet bgs, which is an elevation of 65.5 feet bgs. Other nearby wells with lithological logs were completed in the Imperial Valley and contain higher percentages of clay (Loeltz et al., 1975).

Table 4 Lithological Log of 12S/16E-9A (9 Miles Southwest of the Proposed Well)

Lithology	Thickness (feet)	Depth Interval (feet)
Sand, silty, very fine, and brown clay	10	0-10
Sand, very coarse to fine, and very fine gravel	102	10-112
Clay, light-brown, and very fine silty sand	5	112-117
Sand, fine to medium, and silt	14	117-131
Clay, silty, yellow-brown	5	131-136
Sand, coarse to very coarse	15	136-151
Sand, very coarse to coarse, and very fine and larger gravel	45	151-196
Sand, fine to very coarse, and yellow-brown clay	19	196-215
Clay, yellow-brown, and fine sand	17	215-232
Sand, very fine to very coarse, and thin layers of gravel	48	232-280
Clay, yellow-brown; some light-gray clay	20	280-300
Clay, light-gray, and yellow-brown clay	40	300-340
Sand, medium to very coarse, and gravel	3	340-343
Clay, light-gray	13	343-356
Sand, fine to medium, and light-gray clay	15	356-371
Clay, silty, light-gray	13	371-384
Sand, very fine to medium, and thin layers of gray clay	33	384-417
Sand, fine to very coarse, and very fine to fine gravel	10	417-427
Sand, very fine to medium, and thin layers of gray clay	59	427-486
Clay, light-gray, and fine sand	6	486-492
Sand, silty, very fine to medium	24	492-516
Clay, light-gray	31	516-547
Sand, very fine to medium	15	547-562
Sand, very fine to medium, and light-gray clay	18	562-580
Clay, light-gray and yellow-brown	60	580-640
Sand, fine to very coarse, and light-gray clay	42	640-682
Clay, light-gray, and layers of fine to very coarse sand	30	682-712
Sandstone, very fine to medium, and fine to coarse sand	53	712-765
Clay, light-gray, and very fine to medium sandstone	17	765-782
Clay, light-gray; some yellow brown	38	782-820
Clay, gray and brown, and fine to very coarse sand	46	820-866
Sand, silty, fine to medium	61	866-927
Sand, silty, fine, and light-gray clay, in alternating layers	73	927-1,000

Source: Loeltz et al., 1975

3.3.2 Well Inventory

Only one well was identified within two miles of the Proposed Well. The well is located at 10S/14E-20N, approximately 2.0 miles west of the Proposed Well (**Figure 3**). Few details are available for this well and there are no records of construction details. However, water quality samples were collected in 1961 (see Section 3.3.8).

3.3.3 Recharge

Groundwater recharge in the East Mesa area was historically dominated by seepage from the Coachella Canal, prior to replacement with concrete lined channels in the late 1970s and mid-2000s. Prior to lining, seepage from the 36.5 mile section near the Project has been estimated at 26,000 acre-feet per year. Unlined sections of the AAC continue to recharge the East Mesa groundwater aquifer. However, the unlined section is approximately 45 miles from the Project. In the absence of canal seepage, recharge to the East Mesa aquifer from direct precipitation is estimated to be near zero (Leroy Crandall and Associates, 1983).

Groundwater recharge in the Chocolate Mountains may include mountain front recharge and stream flow runoff (Tompson et al., 2008). The Lawrence Livermore National Laboratory (LLNL) groundwater model (Tompson et al., 2008) estimated that recharge from precipitation within the Imperial Valley and portions of surrounding ranges was 0.019 inches/year, which is less than 1% of precipitation. Furthermore, the LLNL model did not include additional recharge along the mountain fronts. The 2013 groundwater model, which was updated by Argonne National Laboratory (ANL; Greer et al., 2013) estimated recharge at 0.056 inches/year in Imperial Valley and 7.2 inches/year along the mountain-front area of the Chocolate Mountain. This estimate of mountain-front recharge may not be supported by the estimated precipitation rates for the Chocolate Mountains (4-6 inches/year; PRISM, 2020).

In 2003, the DWR classified the East Salton Sea Basin groundwater budget type as ‘C’, which indicates that groundwater data is insufficient to estimate the groundwater budget or groundwater extraction (DWR, 2003).

3.3.4 Discharge and Extraction

Discharge from the East Salton Sea Basin includes springs, discharge into irrigation drains, and extractions from wells. Spring discharge, and water losses from associated vegetation, is likely limited based on the occurrence of few springs (see **Figure 3**). Irrigation drains in the Imperial Valley (including the western margin of the East Salton Sea Basin) primarily return excess irrigation water to the Salton but also function to remove discharging groundwater. Water well extraction rates were last estimated in 1952 at 6 acre-feet/year (DWR, 1975). Due to the lack of development in this basin, current extraction rates may be similar. However, this statement is speculative due to a lack of recent information (DWR, 2003).

3.3.5 Seeps and Springs

No identified springs or seepage are present within two miles of the Proposed Well. The closest identified spring is an unnamed spring located approximately 6.5 miles southeast of the Proposed Well (**Figure 3**) (USGS, 2020).

3.3.6 Underflow

Underflow seepage likely conveys water from the East Salton Sea Basin, downgradient into the Imperial Valley. The quantity of water flow between basins would require details of hydraulic gradients and transmissivities of adjoining aquifers and the impact of transmissive or impeding zones such as faults. Groundwater flow between other surrounding basins in unknown as hydraulic head and hydraulic gradient information is sparse.

3.3.7 Groundwater Levels

Groundwater levels in the vicinity of the Project have been influenced by the presence of the canal systems, including the Coachella Canal, East Highline Canal, and associated laterals and drains. Seepage from the unlined Coachella Canal created a groundwater mound in the shallow alluvial aquifer of East Mesa, with water levels rising over 70 feet in some areas (Loeltz et al., 1975).

Groundwater level decline in the vicinity of the Coachella Canal has been monitored since the late 1970s when the first 49 miles of the earthen canal channel was replaced with a concrete channel. United States Geological Survey (USGS) well 11S/15E-23M, which is approximately 9 miles southeast of the Proposed Well (**Figure 3**), shows an asymptomatic groundwater level decline from 20.68 feet bgs in 1979 to approximately 50 feet bgs at present. The water level elevations as of March 2020 were approximately 70 feet amsl. No groundwater levels have been reported along the Coachella Canal section that was lined in the late 2000s. However, a similar asymptotic decline could be expected.

Groundwater levels in Imperial Valley have been historically measured at two multi-level wells located approximately 6.5 to 7.5 miles southwest of the Proposed Well (11S14E30C and 11S14E19N; **Figure 3**). Water levels at these locations were within 10 feet of the ground surface in 1989. The groundwater elevation at that time was approximately 215 feet bmsl. Groundwater levels in the irrigated areas have been controlled by the drain systems (IIRWMP, 2012).

Current groundwater levels, although sparse, generally agree with historical groundwater elevation distributions. Groundwater elevations are higher in mountainous areas and East Mesa and decline towards Imperial Valley and the Salton Sea. This distribution of groundwater elevations suggests groundwater flow directions roughly coincide with topography. However, the flow of groundwater and distribution of groundwater levels is likely influenced by faults, which act as barriers, and changes in transmissivity.

3.3.8 Groundwater Quality

Groundwater quality in the East Salton Sea Basin is generally reported as poor and not suitable for domestic, municipal, or agricultural purposes (DWR, 2004). Water types include sodium chloride and sodium sulfate. Total dissolved solids (TDS) concentrations are reported as 356 to 51,632 mg/L, whereas the National Secondary Drinking Water Regulations limit TDS to 500 mg/L. Groundwater quality is generally considered better in the vicinity of the unlined canals due to the recharge of lower TDS water.

The closest well to the Proposed Well with available water quality data is located 2 miles to the west (Loeltz et al., 1975). A limited number of water quality constituents were measured in 1961, including pH (8.0), specific conductivity (19,200 µS/cm), bicarbonate (210 mg/L), chloride (6,050 mg/L), calcium-magnesium hardness (2,440 mg/L), and non-carbonate hardness 2,270 mg/L). The screened interval depth of this well is unknown.

The next closest well to the Proposed Well with available water quality data is an inactive USGS monitoring well (11S/14E-2A) located approximately 2.8 miles to the southeast (USGS, 2020). The well is located in a Basin and Range basin-fill aquifer. The total depth was 825 feet bgs, however, the depth of the screened interval is unknown. Water quality was measured in the late 1960s and early 1970s. The latest water quality sample that includes all major ions (calcium, magnesium, sodium, potassium, bicarbonate, sulfate and chloride) was collected in 1969. This sample had sodium-chloride type water and a TDS concentration of 1,760 mg/L. Furthermore, temperatures were elevated above ambient temperatures at 44.4°C.

3.3.9 Transmissivity and Well Yield

Well yield information for the East Salton Sea Basin is limited. The only identified value is 25 gpm at well 11S/15E-23M, located approximately 9 miles southeast of the Proposed Well (**Figure 3**) (Loeltz et al., 1975). Hydraulic properties in East Mesa were summarized in the mid-1990s (Montgomery Watson, 1995). The range of hydraulic conductivities was 32 to 1,337 feet/day, which included wells several miles southeast of the Project.

3.4 WATER RIGHTS AND POINTS OF DIVERSION

No points of diversion (POD) are identified within two miles of the Proposed Well, (California Water Boards, 2020). However, this two-mile radius includes seven laterals from the East Highline Canal, which may have associated water rights and points of diversion. The closest identified POD is 5.7 miles southwest of the Proposed Well (California Water Boards, 2020). This POD is owned by the Metropolitan Water District of Southern California and is located along the N Lateral, which originates from the East Highline Canal. More distal PODs are associated with laterals and the Alamo River.

4.0 HYDROLOGIC EVALUATION SUMMARY

The Wister Solar Development Project is located within the East Salton Sea Basin, which includes the Chocolate Mountains and the northeastern margin of the Imperial Valley (**Figure 2**). The groundwater storage capacity of the East Salton Sea Basin was estimated at 360,000 acre-feet. Groundwater usage in the East Salton Sea Basin is limited due to generally poor water quality and limited inhabitants. Extraction rates for the East Salton Sea Basin were last estimated in 1952 at 6 acre-feet/year, which is 3% of the estimated recharge rate of 200 acre-feet/year (DWR, 1975). Limited development in the East Salton Sea Basin suggests that current extraction rates are similar. However, a lack of recent data limits the ability update this estimate. Furthermore, surface water from the Colorado River is conveyed into the Imperial Valley through a network of canals, laterals, and reservoirs, which has further reduced the need to develop groundwater resources.

Groundwater in the East Salton Sea Basin is present in alluvial aquifers at depths up to several hundred feet, and with generally high transmissivities (Montgomery Watson, 1995). At the Project, groundwater may also be present in an alluvial aquifer 40-50 feet bgs. Historically, groundwater recharge was significant in the vicinity of the earthen lined Coachella Canal. The replacement of the canal with a concrete lined channel has greatly reduced recharge to the adjacent alluvial aquifers. Near the Project, the Coachella Canal was concrete lined in the late 2000s. The East Highline Canal remains earthen-lined, which likely leads to recharge into the shallow alluvial aquifers near the Project. Recharge from precipitation is generally limited due to low precipitation rates and high evaporation potential. Recharge rates may be higher in the Chocolate Mountains due to higher precipitation rates at higher elevations (4-6 inches/year; PRISM, 2020). Recharge events are likely limited to larger storm events, which may generate runoff and seepage along ephemeral channels. Recharge rates from precipitation were estimated at 0.019 inches/year (Tompson et al., 2008).

The water needs for the Project are estimated at 10.22 acre-feet for construction in the first year, 1.37 acre-feet/year for the subsequent 25 to 30 years of operation, and 5 acre-feet for decommissioning at the end of operations (**Table 1**). Overall, the proposed extraction for the Project are significantly lower than recharge rates in an area where groundwater usage is limited.

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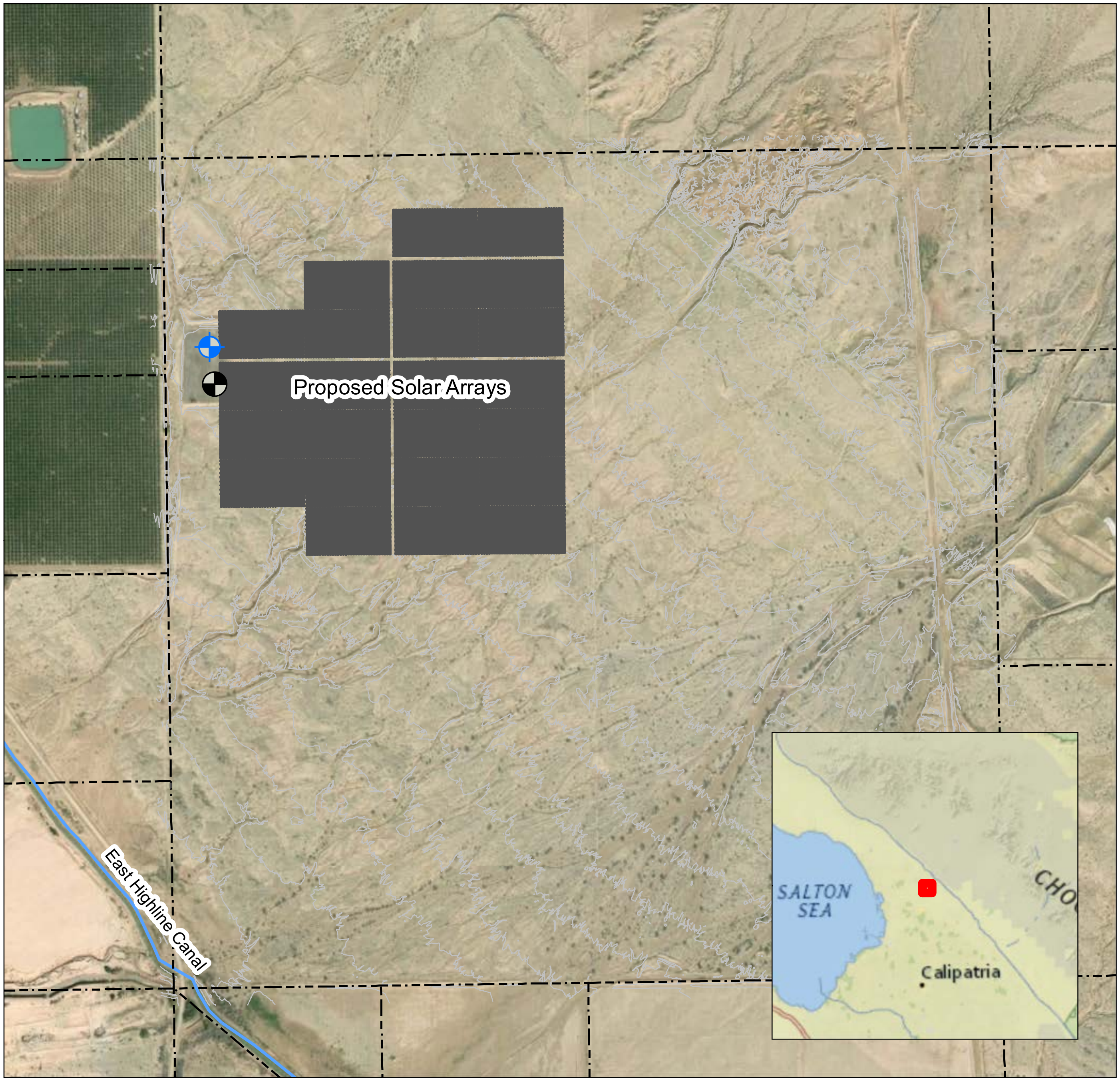
FIGURES



Stantec

Legend

- Proposed Water Distrubution Well
- Geothermal Test Well 12-27
- Property Line
- Contour-major
- Project Location

N

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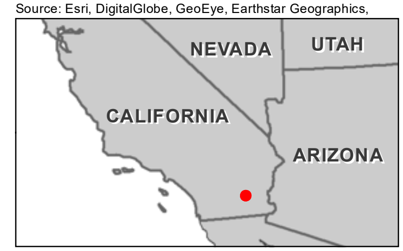
Notes
1. Coordinate System: NAD 1983 UTM Zone 11N
2. Data Sources:
3. Background: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics,



Project Location
T10S, R14E, S27
Imperial County, CA

Prepared by LR on 2020-05-29
TR by SS on 2020-05-29
IR Review by KK on 2020-05-29

Client/Project
185804209 REVA
ORNI 21, LLC
Wister Solar Development Project
Hydrologic Evaluation

Figure No.
1

Title
Project Location and Overview

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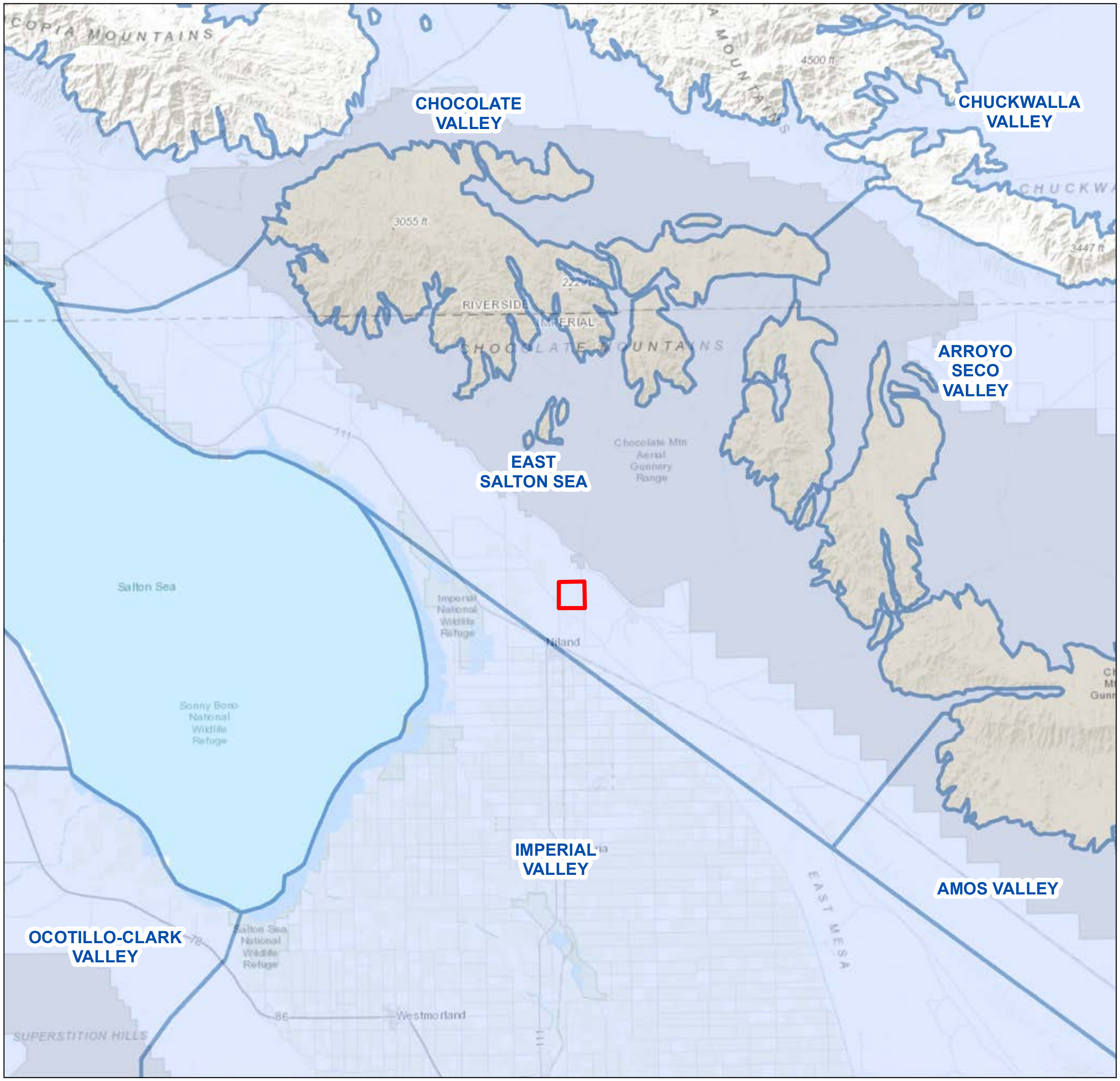

Stantec

Legend

- Project Location
- Groundwater Basin

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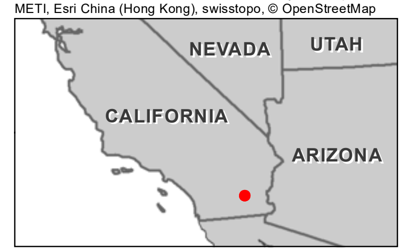
Notes

1. Coordinate System: NAD 1983 UTM Zone 11N
2. Data Sources:
3. Background: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap



Project Location
T10S, R14E, S27
Imperial County, CA

Prepared by LR on 2020-05-29
TR by SS on 2020-05-29
IR Review by KK on 2020-05-29

Client/Project
185804209 REVA
ORNI 21, LLC
Wister Solar Development Project
Hydrologic Evaluation

Figure No.
2

Title
Groundwater Basins

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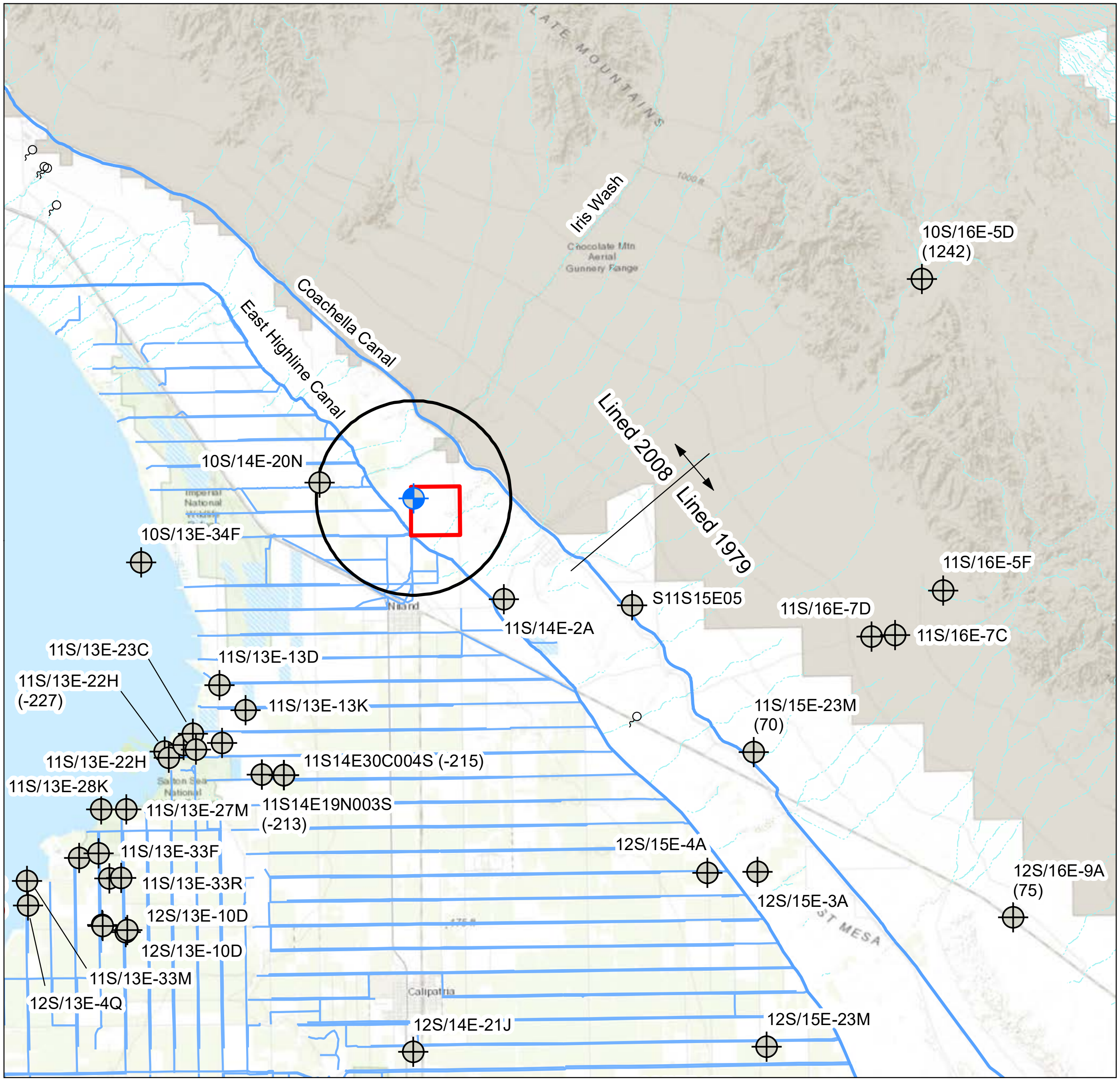

Stantec

Legend

- Proposed Water Distribution Well
- Existing or Historical Well (Water Level Elevation ft amsl)
- Spring
- Canal
- Lateral
- Intermittent Creek
- Proposed Well 2-Mile Buffer
- Project Location

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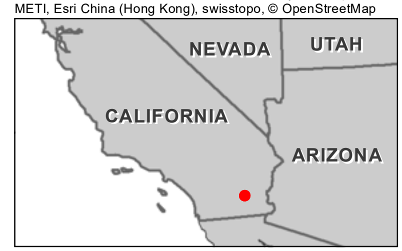
Notes

1. Coordinate System: NAD 1983 UTM Zone 11N
2. Data Sources:
3. Background: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap



Project Location
T10S, R14E, S27
Imperial County, CA

Prepared by LR on 2020-05-29
TR by SS on 2020-05-29
IR Review by KK on 2020-05-29

Client/Project
185804209 REVA
ORNI 21, LLC
Wister Solar Development Project
Hydrologic Evaluation

Figure No.
3

Title
Well and Water Resources Inventory

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APPENDIX B

TITLE 9

DIVISION 21: WATER WELL REGULATIONS

CHAPTER 1: GENERAL

§ 92101.00 PURPOSE

Imperial County is an arid region located in the Southeastern portion of the State of California and the preservation and protection of the County's ground water resources are extremely critical. The Board of Supervisors hereby finds and declares that the preservation, protection and management of the groundwater within the County for the protection of domestic, commercial, agricultural, industrial, municipal, wildlife habitat, and other uses is in the public interest, that protection is necessary to ensure availability of groundwater reasonably required to meet the present and future beneficial needs of the County, and that the adoption of a system of regulation of groundwater is for the common benefit of all County water users. The Board of Supervisors has, therefore, determined to regulate the use, consumption and development of ground water on a County-wide basis. Further, it is the intent of the Board of Supervisors to protect the health, safety, and general welfare of the people of Imperial County by insuring that the ground water of this County will not be polluted or contaminated. To this end, minimum requirements have been prescribed in this Ordinance for the construction, re-construction, repair, replacement, re-perforation, re-activation, operation, and destruction of a well or wells.

§ 92101.01 DEFINITIONS

A. Cathodic Protection Well: Any artificial excavation constructed by any method for the purpose of installing equipment or facilities for the electrical protection of metallic equipment in contact with the ground.

B. Commercial Well (Small): A water well used to supply a single commercial establishment, consuming less than 10 acre feet per year ("AF/Y") of ground water.

C. Commercial Well (Large): A water well used to supply more than one (1) commercial establishment, or utilizing more than 10 AF/Y.

D. Community Water Supply Well: A water well used to supply water for domestic, commercial industrial purposes in systems subject to Chapter 7 of Part I of Division 5 of the California Health and Safety Code (Section 4010 et. seq.), i.e. more than five (5) service connections.

E. Construct, Reconstruct, (Construction, Reconstruction): To dig, drive, bore, drill, or deepen a well, or to re-perforate, remove, replace, or extend a well casing.

F. Contamination: An impairment of the quality of water to a degree that creates a hazard to the public health through poisoning or spread of disease.

G. Deep Anode Bed Well: Any cathodic protection well more than 50 feet.

H. Destruction: A proper filling and sealing of a well no longer useful so as to assure that ground water is protected and to eliminate a potential physical hazard.

I. Electrical Grounding Well: Any artificial excavation in excess of 20 feet constructed by any method for the purpose of establishing an electrical ground.

J. Enforcement Agency: An agency designated by the Board of Supervisors to administer and enforce this Ordinance. For the purpose of this Division it shall be the Planning & Development Services Department.

K. Individual Domestic Well: A water well used to supply water for domestic needs of an individual residential, utilizing less than the (10) AF/Y.

L. Modification, Repair, or Reconstruction: The deepening of a well, the re-perforation, or replacement of a well casing and all well repairs and modifications that can affect ground water quality.

M. Observation Well: A well used for monitoring or sampling the conditions of a water-bearing aquifer, such as water pressure, depth, movement or quality.

N. Permit: A Building Permit issued by the County of Imperial Planning & Development Services Department, permitting the construction, reconstruction, destruction, or abandonment of a well.

O. Person: Any person, firm, corporation, or governmental agency, to the extent authorized by law.

P. Planning Director: The Planning Director of Imperial County or his designee.

Q. Pollution: An alteration of the quality of water to a degree which unreasonably affects: (1) such waters for beneficial uses; or (2) facilities which serve such beneficial uses. Pollution may contain contamination.

R. Potable: Water generally intended for human consumption and/or meeting safe drinking water standards by State or Federal regulations.

S. Public Nuisance: The term "Public Nuisance", when applied to a well, shall mean any well which threatens to impair the quality of ground water or otherwise jeopardize the health and safety of the public.

T. Shallow Anode Bed Well: Any cathodic protection well more than 20 feet deep, but less than 50 feet deep.

U. Test or Exploratory Well: An excavation used for determining the nature of underground geological or hydrological conditions, whether by seismic safety, direct observation or any other means.

V. Well: An artificial excavation constructed by any method for the purpose of extracting water from or injecting water underground, or providing cathodic protection or electrical grounding of equipment, for making tests for observation of underground conditions, or for any other similar purposes. Wells shall include, but shall not be limited to, community water supply wells, individual domestic water wells, commercial wells, industrial wells, cathodic protection wells, electrical grounding wells, test or exploratory holes, observation wells and other wells whose regulation is necessary to accomplish purposes of this Chapter.

Wells shall not include: (1) oil and gas wells, geothermal wells, or other wells that are constructed under the jurisdiction of the State Department of Conservation, except oil wells converted to use as water wells; or (b) wells used for the purpose of de-watering excavations during construction, or stabilizing earth embankments.

DIVISION 21: WATER WELL REGULATIONS

CHAPTER 2: PERMITS

§ 92102.00 PERMIT(S) REQUIRED

A. Conditional Use Permit:

No person shall (1) drill a new well, (2) activate a previously drilled but unused well, (unused shall mean a well or wells that have not been used for a 12 month) period by installing pumps, motors, pressure tanks, piping, or other equipment necessary or intended to make the well operational, (3) increase the pumping capacity of a well, or (4) change the use of a well, without first obtaining a Conditional Use Permit (CUP) through the County Planning & Development Services Department.

The pumping capacity shall mean the “permitted amount” or in the absence of a permit the annual acreage, over 3 year period.

Notwithstanding the above, a CUP is not required prior to drilling the following types of wells.

1. A test/monitoring/research well where no continued water use will result. Upon completion of the tests, the well shall be sealed/abandoned in compliance with the most current edition of State Water Resources Control Board Bulletin #74-81;

2. Any new well which will replace an existing inoperable well, provided that the inoperable well is serving an existing water user and is already properly permitted through the CUP process and provided the replacement well shall be the same or smaller size, diameter, and capacity as measured by gallons per minute ("GMP") as the inoperable well. In an emergency and even if the inoperable well was not permitted, the Director may approve replacing a well provided that the replacement well meets the requirements for the last approved CUP and does not exceed 1 acre feet per year.

3. A well that is drilled by or for the Department of Fish and Game provided however that they shall register each such well with the Planning & Development Services Department.

B. Well Construction Permit. No person shall dig, bore, drill, deepen, enlarge, refurbish, or destroy a water well, cathodic protection well, observation well, monitoring wells or any other excavation that intersects ground water without first obtaining a well construction permit through the Planning & Development Services Department. As a prerequisite to applying for a water well construction permit, the Planning & Development Services Department shall first determine whether a conditional use permit is required.

§ 92102.01 APPLICATION PROCEDURES

A. Project information: The application for both a CUP and/or a Construction Permit shall be made to the Planning & Development Services Department on the forms approved or provided by the Department and shall, at a minimum, contain the following information:

1. Site Plan drawn to scale.

    a. Location of well on property.
    b. Size of property (all dimensions).
    c. Distance from well to all property lines.
    d. Distance from well to all septic/leach fields.
    e. Distance from well to all structures.
    f. All intermittent or perennial natural or artificial bodies of water or water sources.
    g. The approximate drainage pattern of the property.
    h. Other wells.
    i. Structures--surface or subsurface.

2. Location of property, Assessor's Parcel Number.
3. Name of person who will construct the well.
4. The proposed minimum and proposed maximum depth of well.
5. The proposed minimum depth and type of casings and maximum depths of perforation to be used.

    a. Pump type
    b. Size (Diameter/horsepower)
    c. gpm capacity
    d. Water pressure

6. The proposed use of well.
7. Other information as may as necessary to determine if ground water will be adequately protected.

B. Filing Fee(s): A filing fee shall be paid by the applicant. Said fee shall be as set forth in the Codified Ordinances of the County of Imperial. No filing or permit fee shall be required to abandon or destroy a well.

C. Emergency Work: In an emergency in order to maintain drinking water or agricultural supply systems as determined by the Planning Director, the following procedures shall apply:

1. Permittee shall notify the Planning & Development Services Department that an emergency exists that necessitates the immediate repair or replacement of a well or associated water system. Permittee shall provide all pertinent information as to why it is an emergency.

2. Permittee shall within 72 hours apply for and obtain all required permits.

3. Permittee will demonstrate by providing logs or other reports that all work performed was in conformance with all regulations and standards as designated herein, and will further report or correct any part of the system that does not comply with this Ordinance, other applicable laws or codes.

§ 92102.02 PERMIT CONDITIONS

A. Limitation: When the enforcement agency issues or otherwise approves a conditional use permit or well construction permit, pursuant to this ordinance, it may condition the permit in any manner necessary to carry out the purposes of this Ordinance.

B. CEQA Review: The processing of a Conditional Use Permit and/or a well construction permit shall be in compliance with the California Environmental Quality Act (CEQA) and Imperial County's Rules and Regulations to Implement CEQA, as amended.

C. Performance Bond: The enforcement agency may require such bond or other security as determined necessary to assure compliance with this Ordinance.

D. License Required: All construction, reconstruction or destruction work on wells shall be by a person/firm who possesses an active California Contractor's license in accordance with Business and Professions Code, Section 7000 et. seq.

E. Disposal of Drilling Fluids/Materials: The well driller shall be required to provide for the safe and appropriate handling and disposal of all drilling fluids or other drilling materials associated with the permitted project.

F. Abandoned Wells: As a condition to any approval for a permit for the construction or reconstruction of a well, any abandoned well(s) on the property shall be destroyed in accordance with the standards provided in this Ordinance.

G. Posting of Permit: It shall be the responsibility of the well driller to maintain a copy of the approved permit on the drilling site during all stages of construction or destruction of a well and have then available for general inspection.

H. Provide Copies: It shall be the responsibility of the well driller to maintain and provide copies to the Planning & Development Services Department, Public Works Department and Environmental Health Department of all drilling logs, testing reports and/or abandonment logs.

§ 92102.03 PERMIT DENIAL

The enforcement agency shall deny any application for a permit if, in its judgment, issuance of a permit is not in the public interest, violates health and safety concerns, or in compliance with the intent of this Ordinance.

§ 92102.04 EXPIRATION OF PERMIT

The permittee shall commence work authorized by the permit within 180 days from the effective date of issue and shall complete the work within one (1) year from date issued. The enforcement agency may grant a one-time extension for a period of up to one year if requested in writing by applicant at least 60 days prior to the expiration of the permit.

All permits that have not received a final inspection approval from the enforcement agency within one year from date of issue shall expire unless an extension is granted by the Planning & Development Services Department. If a permit has expired, no further work shall be done until a new permit is requested, approved, and issued to applicant.

§ 92102.05 SUSPENSION AND REVOCATION

A. Circumstances for such action: Enforcement agency may suspend or revoke any permit issued pursuant to this Ordinance, whenever it finds that the permittee has violated any of the provisions of this Ordinance, or has misrepresented any material fact in his/her application or any supporting documents for such a permit. Prior to ordering any such suspension or revocation, the enforcement agency shall give permittee an opportunity for a hearing thereon, after reasonable notice. The hearing shall be before the enforcement agency, the director, or his designated representative.

B. Consequences: No person whose permit has been suspended or revoke shall continue to perform the work for which the permit was granted until, in case of suspension, such permit has been reinstated by the enforcement agency.

C. Additional Work: Upon suspending or revoking any permit, the enforcement agency may order permittee to perform any work reasonably necessary to protect the ground water from pollution or contamination, if any work already done by permittee has left a well in such a condition as to constitute a hazard to the quality of the ground water. No permittee or person who has obtained a permit issued pursuant to this Ordinance shall fail to comply with such order.

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TITLE 9

DIVISION 21: WATER WELL REGULATIONS

CHAPTER 3: WELLS

§ 92103.00 REGISTRATION OF WELL

Any person who uses a new or existing well shall first register said well with the Imperial County Planning & Development Services Department. If a well is under an active conditional use permit, the well shall be deemed to be registered. Any well that is not under an Imperial County CUP shall be registered with the Planning & Development Services Department and the State pursuant to California Water Code, Section 13750..

An application to register any well shall be filed with the Planning & Development Services Department and said application shall contain all information required upon said form.

§ 92103.01 REPORTS

Completion Reports: The driller shall provide the enforcement agency a completion report within 30 days of the completion of any well construction, reconstruction, or destruction job.

A. Submittal of State "Report of Completion": A copy of the "Report of Completion" (Driller's well log) required by California Water Code, Section 13751, shall be submitted by the well driller to the enforcement agency within 30 days of construction or destruction of any well (except driven wells). This report shall document that the work was completed in accordance with all applicable standards and additional permit conditions.

   This section shall not be deemed to release any person from the requirement to file said report with the State Department of Water Resources.

B. Confidentiality of Report: With the exception of the well driller's name, the date the well was drilled and the well yield, all information contained in this report shall remain "Confidential".

C. Other Agency's Requirements: Nothing in this Ordinance shall be deemed to excuse any person from compliance with the provisions of California Water Code, Section 13752, relating to notices and reports of completion or any other federal, state, or local reporting regulations.

§ 92103.02 WELL STANDARDS

Except as otherwise specified, the standards for the construction, repair, reconstruction, alteration, reactivation, operation, or abandonment of wells shall be as set forth in:

A. The California Department of Water Resources Bulletin 74-81 entitled, "Water Well Standards, State of California", except as modified by subsequent supplements or revisions issued by the Department of Water Resources.

B. The California Department of Water Resources Bulletin 74-90 and any subsequent supplements or revisions issued by the Department of Water Resources.

C. The following factors, to the extent necessary to avoid conditions of overdraft, subsidence, well interference, water quality degradation, or other environmental degradation:

1. The type of use or uses served.

2. The number of users served.

3. Wasteful or inefficient use.

4. Water conservation activities.

5. Reasonable need of the extractor and other affected water users.

6. The quality of groundwater.

7. The affected groundwater basin or sub-basins.

8. Environmental impact as determined through the CEQA review.

9. Any other factors that the Planning & Development Services Department reasonably believes it should consider in order to reach an equitable result within the entire County in accordance with the provisions of this Ordinance, and of California Law.

§ 92103.03 VARIANCES

The enforcement agency shall have the power under the following specified conditions to grant a variance from any provision of the standards referred to above and to prescribe alternate requirements in their place. There is no appeal from a denial of a variance request, unless:

A. Special Circumstances: There must be, in a specific case, special circumstances where practical difficulties or unnecessary hardship would result from the strict interpretation enforcement of any standard. Economic expense will not be considered "unnecessary hardship".

B. Intent of Ordinance not Compromised: The granting of any variance is to be consistent with the purpose and intent of this Ordinance and State Law.

§ 92103.04 SPECIAL GROUND WATER PROTECTION

The enforcement agency may designate areas where potable ground water quality is known to exist and where a well will penetrate more than one aquifer. The enforcement agency may require in these designated areas special well seals to prevent mixing of water from several aquifers. Where an applicant proposes well construction, reconstruction, alteration, repair or construction work, in such an area, the enforcement agency may require the applicant to provide a report prepared by a registered geologist or a registered civil engineer that identifies all strata containing poor quality water and recommends the location and specification of seal or seals needed to prevent entrance of poor quality water or its mitigation into other aquifers.

The enforcement agency may take such other action as it determines reasonably necessary to protect the degradation of both quantity and quality of any known aquifer resulting from the installation, modification, refurbishing, construction, repair or destruction of well or from improper well operations, maintenance, and/or from excessive pumping capacity.

§ 92103.05 APPEALS

A. Any person whose application for a permit has been denied, granted conditionally, or whose permit has been suspended or revoked, may appeal said determination to the Imperial County Planning Commission, provided the appeal is in writing, within ten (10) days after any such denials, conditional granting, suspension, or revocation. Such appeal shall specify the grounds upon which it is being requested and shall be accompanied by a filing fee as set forth in the County's Codified Ordinances. The Planning Director shall set such an appeal for hearing before the Planning Commission at the earliest practicable time, and shall notify the appellant and all interested parties in writing at least ten (10) days prior to the hearing.

B. After such hearing the Planning Commission may uphold, or may reverse, wholly or in part, or may modify any such determination.

C. The decision of the Planning Commission shall be final unless it is appealed to the Board of Supervisors within ten (10) days from the date of the Planning Commission's decision.

D. Any decision made by the Board of Supervisors on an appeal from the Planning Commission shall be final.

§ 92103.06 RIGHT OF ENTRY AND INSPECTION

Representatives of the enforcement agency shall have the right to enter upon any premises at all reasonable times to make inspections and tests for the purpose of such enforcement and administration. If any such premises are occupied, the representative shall first present proper credentials and demand entry. If the same is unoccupied, the representative shall first make a reasonable effort to locate the owner or other person having charge or control of same representative shall have recourse to such remedies as are provided by law to secure entry.

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CHAPTER 4: ENFORCEMENT

§ 92104.00 ENFORCEMENT

A. Penalty: Any person who commences work for which a permit is required by this Ordinance, without first obtaining such permits and approvals, shall be required, if subsequently granted a permit, to pay double all standard permit fees. The payment of such double fee shall, however, in no way excuse compliance with this Ordinance or other applicable codes.

B. Violations is a Misdemeanor: Any person who violates any of the provisions of this Ordinance is guilty of a misdemeanor and upon conviction, thereof, shall be punishable by a fine of, not to exceed, $500.00 and/or by imprisonment in County Jail for a time not to exceed six (6) months.

C. Civil Enforcement - Nuisance

1. "Notice of Violation" Recordation: Whenever the enforcement agency determines that a well: (1) has not been completed in accordance with a well permit or the plans and specification relating thereto or (2) has been constructed without the required permit, or (3) has not been properly abandoned in accordance with the standards, the enforcement agency may record a "Notice of Violation" with the Office of the County Recorder.

2. Removal of Violation Notice: The enforcement agency shall submit a removal of the "notice of Violation" to the County Recorder when: (1) it is determined by the enforcement agency or the Board of Supervisors, after review, that no violation of this Ordinance exists; or (2) all required and corrective work has been completed and approved by the enforcement agency.

D. Remedies Cumulative: The remedies available to the County to enforce this Ordinance are in addition of any other remedies available under this Ordinance or other statute, and do not replace or supplant any other remedy, but are cumulative thereto.

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APPENDIX C

Appendix B

IID Desalination/Groundwater Development Feasibility Study

Appendix B – IID Desalination/Groundwater Development Feasibility Study

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TECHNICAL MEMORANDUM

Subject: Desalination/Groundwater Development Feasibility Study

From: Ryan Alward, Richard Shatz (CHG 84)

Date: July 2009

Updated: July 2012

B.1 INTRODUCTION

This Technical Memorandum (TM) presents a compiled summary of the geology and occurrence of groundwater in the Imperial IRWMP area. The purpose of this TM is to summarize the hydrogeologic information that is relevant in assessing possible groundwater development and conjunctive use and banking opportunities in the area. Groundwater development and conjunctive use opportunities were identified for high water demand areas, specifically for geothermal and future municipal, commercial and industrial (MCI) development. Using local aquifer characteristics, the number of wells needed in each known geothermal resource area (K.G.R.A.) was determined along with the depths required to dispose of the desalination plant brine stream. The location of the desalination plants were picked to coincide with locations that have favorable aquifer characteristics and if possible, recharge potential. Preliminary design of well fields and recharge facilities has been conducted to evaluate whether groundwater could be a viable water supply for the area. Such opportunities are a key element under consideration as a possible means of augmenting existing water supplies for IID. This TM costs the well fields, brine injection wells and pipeline for 17 capital project alternatives.

B.2 SETTING

The Imperial IRWMP area lies within the Salton Trough of southern California as shown on Figure B-1. The Salton Trough is the dominant feature of the Colorado Desert geomorphic province of California. The trough is about 130 miles long and up to 70 miles wide, and is generally considered the northwesterly landward extension of the Gulf of California (Loeltz et al., 1975). The term Salton Basin (Basin) applies to the broad region draining directly into the Salton Sea. The Imperial Valley lies in the central part of the Basin south of the Salton Sea. Most of the IID service area overlies the area defined as the Imperial Valley.

The Basin is bounded to the west by the Coyote and Jacumba Mountains, to the northeast by the Orocopia and Chocolate Mountains, to the southeast by the Sand Hills and Cargo Muchacho

Mountains, and to the south by the U.S.-Mexican border. Other major hills and mountain ranges are shown on Figure B-1. The highest point along the Basin watershed boundary is Blue Angel Peak in the Jacumba Mountains at 4,284 feet above sea level. The lowest feature in the Basin is the surface of the Salton Sea, which lies more than 231 feet below sea level. Elevations along the Imperial Valley floor range from approximately sea level near Calexico to approximately 230 feet below sea level at the south shore of the Salton Sea to the north-northeast, a slope of approximately seven feet per mile. The Mexicali Valley is a southern extension of the same general topographic feature into Mexico. The northern Mexicali Valley is part of the Salton Basin and drains north across the U.S. border. The southern Mexicali Valley drains to the Gulf of California.

The present day Salton Sea was formed in 1905, when Colorado River water flowed through a break in an irrigation diversion structure that had been constructed along the US/Mexican border to divert the river's flow to agricultural lands in the Imperial Valley. Until that break was repaired in 1907, the uncontrolled diversions of river water drained into the Salton Basin, a closed interior basin whose lowest point is about 278 feet below mean sea level.

Historically, the Colorado River's course has changed several times. At times, the river discharged to the Gulf of California as it does today. At other times it flowed into the Salton Trough. Lake Cahuilla, the name used for any of the several prehistoric lakes to have occupied the Salton Trough, dried up some 300 years ago. In the past 2000 years, archaeological records indicate that the Colorado River headed northwest into the Salton Trough more often than it headed south into the Gulf of California (IID, 2007).

The Salton Sea is a critical component of the Pacific Flyway migratory corridor as it is an essential over-wintering site for thousands of migratory waterfowl. Its marsh areas provide significant habitat for the endangered yuma clapper rail.

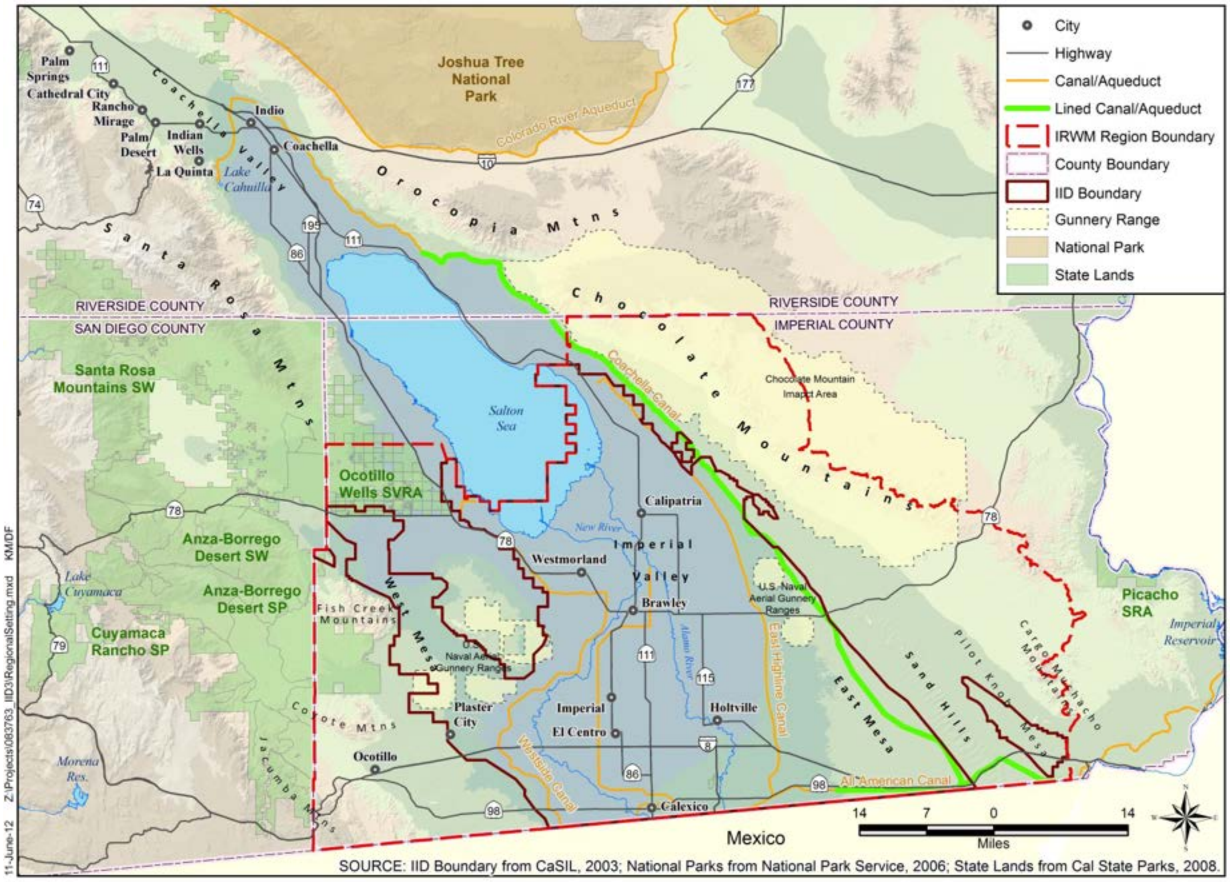


Figure B-1.Regional Setting

In general, the Imperial IRWMP area can be discussed in terms of three principal physiographic and hydrologic areas: (1) the Imperial Valley which lies within the valley floor generally inside the boundaries of the Westside Main and East Highline Canals and north of the Mexico; (2) the East Mesa which is generally east of the East Highline Canal; and (3) the West Mesa generally west of the Westside Main canal. The Ocotillo-Coyote Wells Groundwater Basin is located adjacent to the southwest corner of the West Mesa but is separated from the West Mesa by two faults which act as partial barriers to groundwater flow and is designated as a sole source aquifer (USEPA, 1996). These areas will be discussed in detail later.

B.3 CLIMATE

The Salton Basin has a typical desert climate, characterized by hot, dry summers and mild winters. Summer temperatures typically exceed 100°F, with winter low temperatures rarely dropping below 32°F. Rainfall in the Basin averages less than three inches per year, with the majority of the rainfall occurring from November through March. Total recharge to the groundwater system from precipitation within the valley was estimated to be somewhat less than 10,000 acre-feet per year

(Loeltz et al., 1975). Evaporation averages over 98 inches per year in Imperial Valley, while plant evapotranspiration is as high as 60 to 72 inches per year.

B.4 SURFACE WATER AND DRAINAGE

A generalized schematic diagram of the flow of imported surface water into and through the central Imperial Valley is shown on Figure B-2. Effectively all of the surface water coming into Imperial Valley is a result of diversions from the Colorado River. In fact, with the exception of San Felipe Creek and groundwater discharging springs to the northeast of the Salton Sea, the existence of surface water anywhere in the Basin is dependent upon the inflow of irrigation water from the Colorado River. Diversions to the Imperial Valley and lower part of the Coachella Valley are through the All-American Canal (AAC) and Coachella Canal.

Initially both the AAC and the Coachella Canal were unlined canals through the IRWMP area. A 49-mile long section of the old unlined Coachella Canal, starting at the AAC and through East Mesa, was abandoned in 1979 when a new lined canal was constructed. An additional 36.5-mile segment of the canal, continuing northward from the 1979 lining project, was lined during the Coachella Canal Lining Project which began in October 2004 and was completed in December 2006, when 26,000 acre-feet per year of conserved water began flowing to project beneficiaries. The All-American Canal Lining Project began construction in June 2007 and was completed in April 2010, when its full yield of 67,700 acre-feet per year was made available to project beneficiaries. The project lined a portion of the canal from about six miles east of the East Highline Canal to about five miles east of the Coachella Canal.

IID operates three primary branches out of the AAC to the central irrigated area of Imperial Valley. These are the East Highline, Central and Westside Main Canals. Because the Salton Basin is a closed drainage system, all surface flow not percolating into subsurface storage, evaporating or being consumed by vegetation eventually flow to the Salton Sea as part of environmental commitments. The major drainage features in the Salton Basin are the north flowing New and Alamo Rivers, San Felipe Creek, and Tule Wash. The New and Alamo Rivers, which are essentially collector drains, account for approximately 75 percent of the total surface runoff from the Imperial Valley, and nearly all of the discharge to the Salton Sea (Montgomery Watson, 1995). Both rivers cross the central area of irrigated farmland, and intercept the area's elaborate system of drains to convey water to the Salton Sea. Total flow from the New and Alamo Rivers, and the drains, into the Salton Sea between 2007 and 2011 averaged about 1.0 million acre-feet per year (MAFY) with 0.85 MAFY from Mexico.

The Imperial Valley consists of approximately 475,000 acres of irrigated and drained farmland (IID, 2012). Water is imported into the Imperial Valley via the AAC. In addition, three primary canals feed off the AAC into Imperial Valley: the Westside Main, the Central Main and East Highline canals. From these main canals, irrigation water is distributed throughout the central irrigated area via supply canals, laterals, and turnouts. The irrigated portion of the Imperial Valley also contains an extensive network of farm-gate lateral drains and subsurface tile drains. Tile drains were installed below the fields to prevent water logging of crops, and salt buildup in the clay-rich soils. The system of lateral drains and tile drains therefore determines and maintains the level of the groundwater table throughout most of the central Imperial Valley. Typically at a depth of five to seven feet, the tile drains carry subsurface water to sumps at the tail end of selected fields or discharge directly into lateral drains. The lateral drains receive both tailwater and tilewater drainage. All drain water is ultimately discharged to the Salton Sea, either directly from drainage ditches, or by way of the New and Alamo Rivers. Therefore, the vast majority of the flow in the drain system is agricultural runoff (IID, 2012).

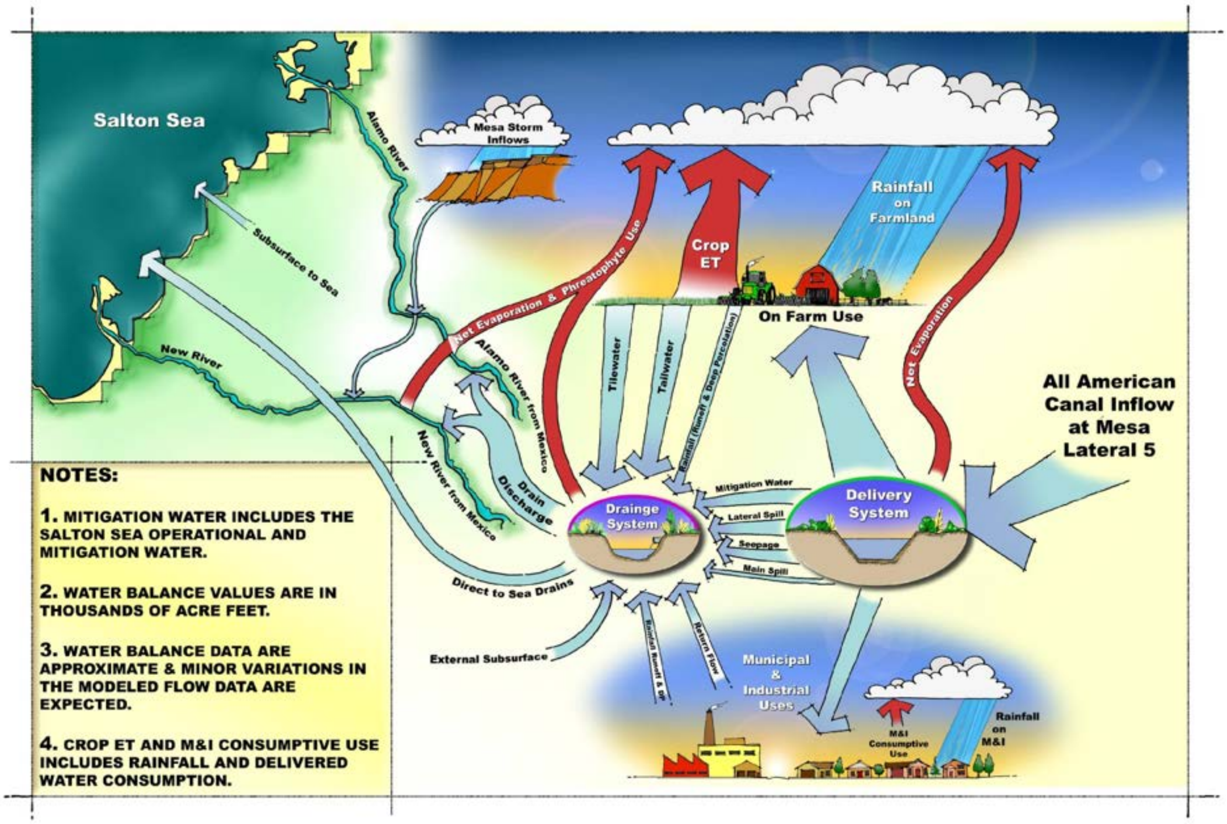


Figure B-2. Water Balance Components and Flow Paths, Imperial Valley

Source: Davids Engineering, et al., May 2007, IID Delivery System Analyses (Vol 2) Technical App. 1.b, p 2

B.5 SOIL TYPES

Soils in the Imperial IRWMP area were mapped and described by Zimmerman (1981). As previously mentioned, the Imperial IRWMP area can be broadly viewed in terms of three different physiographic areas: the Imperial Valley, and the East and West Mesas. The ten mapped units in this survey have been grouped into two general kinds for broad interpretive purposes, as indicated on Figure B-3. A generalized map of soil types in area is provided on Figure B-4. Zimmerman (1981) identifies ten generalized soil units in the area. Consistent with the three physiographic regions above, these two groups and the map units in each group are described below.

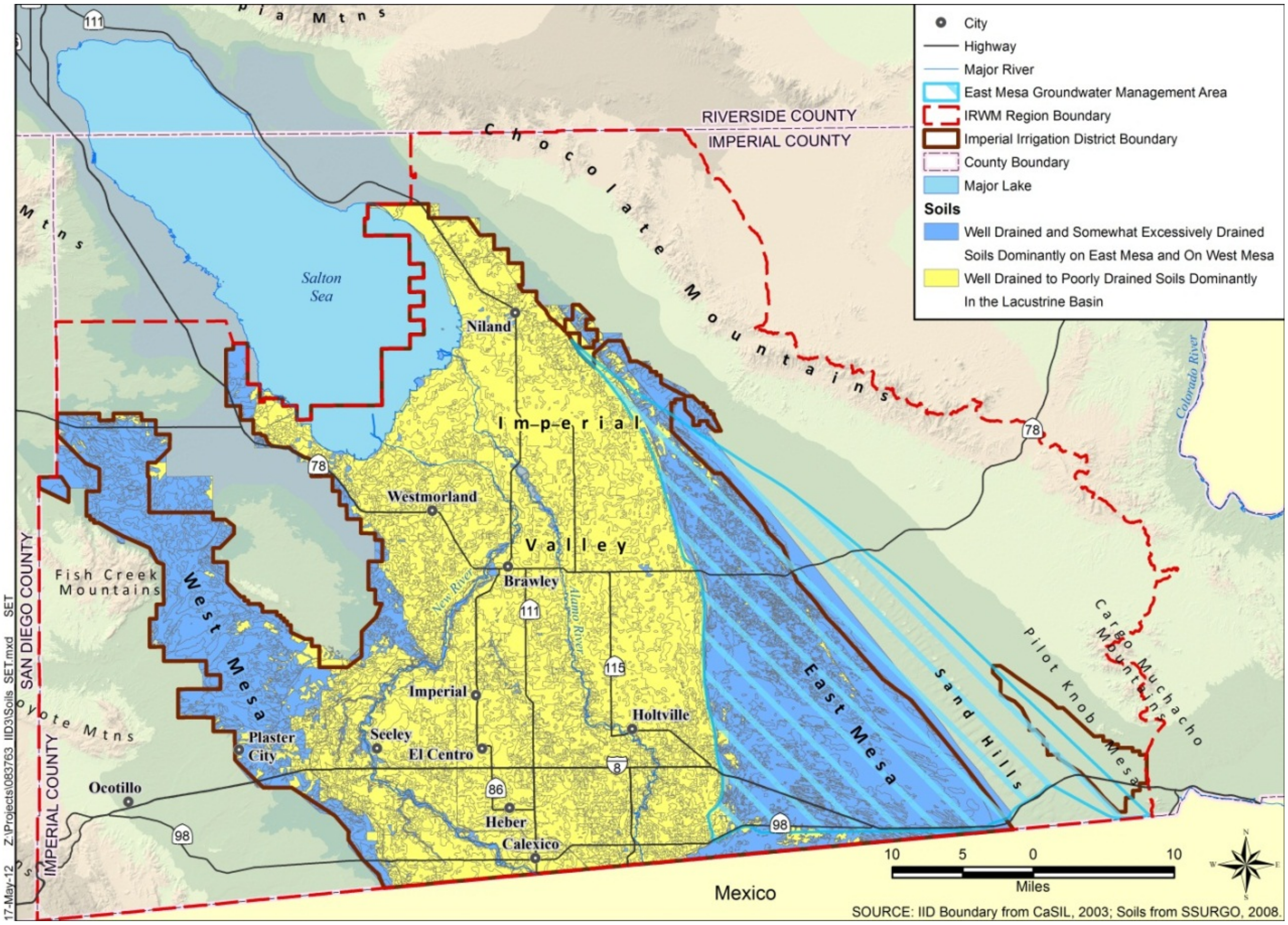


Figure B-3. Generalized Soil Types, Imperial IRWMP Area

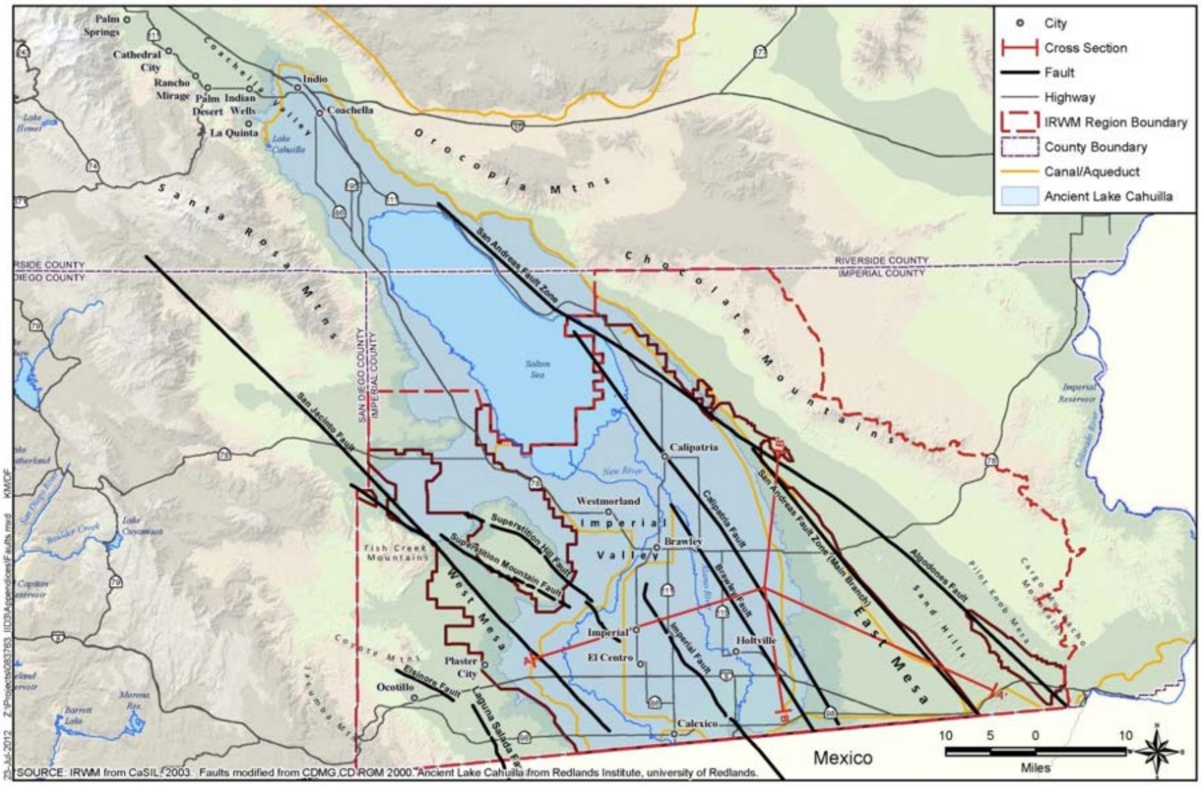


Figure B-4. Faults in Imperial Basin

<u>Imperial Valley</u>. Soils in this area are predominantly well drained to poorly drained soils. The soils in this group occupy the area of prehistoric Lake Cahuilla in the central valley, but also a few areas on West Mesa. The soils in this area are nearly level. Elevation is about 230 feet below sea level adjacent to the Salton Sea and about 200 feet above sea level on West Mesa. They are mainly moderately well drained to well drained, but some soils adjacent to the Salton Sea are poorly drained. A perched water table is present in most soils in the central area because of the extensive irrigation practices and underlying poorly drained clayey soils. The surface layer ranges from gravelly sand to silty clay. Soils in this group are used mainly for irrigated cropland. Although water can percolate through these soils, it typically doesn't reach the deeper aquifers because it is intercepted by the extensive network of drains.

<u>East and West Mesas.</u> Soils in the areas of the East and West Mesas are predominantly well drained to excessively drained and occur on the mesas adjacent to the old Lake Cahuilla lakebed. These soils have developed due to different geologic processes than the central valley area. In the East and West Mesas, sediments have been deposited not as a result of lakebed deposition, but rather chiefly as a result of stream/flood and wind processes. For these reasons, soils in the East and West Mesas are more coarse grained and hydraulically transmissive than the Central Irrigated Area. The soils in the

mesas are nearly level to moderately steep, depending on location. The surface layer ranges from sand to silty clay. Soils in this group are mainly used for desert recreation or as desert wildlife habitat.

Ocotillo-Coyote Wells Groundwater Basin. Soils in the areas of the Ocotillo-Coyote Wells Groundwater Basin East and West Mesas are predominantly well drained to excessively drained

B.6 GENERAL GEOLOGIC FRAMEWORK

The Salton Trough is a sediment-filled fault block bounded by the Elsinore and San Jacinto Faults on the west and the San Andreas Fault zone on the east (Loeltz et. al, 1975; Norris and Webb, 1976), as shown on Figure B-4. The trough is structurally controlled by the San Andreas Fault system, and is related to the rifting of the Baja California peninsula away from mainland Mexico. The bottom of the sediment-filled basin is thousands to tens of thousands of feet below the current ground surface (Loeltz et al., 1975). Beneath the sediments and exposed in the surrounding mountains is the basement complex which is composed of igneous, volcanic and metamorphic rocks.

The San Andreas Fault system includes numerous parallel or en-echelon faults that traverse the valley in a northwest-southeast trending manner. Related faults that are present within the trough in the central valley area include the Imperial, Brawley, and Calipatria Faults. The southern extension of the Elsinore Fault is the Laguna Salada Fault which forms the eastern boundary of the Ocotillo-Coyote Wells Groundwater Basin.

The trough has been filled with marine and non-marine sediments that overlie a pre-Tertiary bedrock complex. Up to 20,000 feet of marine and non-marine Cenozoic deposits underlie the Imperial Valley, with the thickest deposits occurring in the central part of the Imperial Valley. Non-marine sediments in the Imperial Valley include horizontally stratified lacustrine silts and clays deposited by ancient Lake Cahuilla, and alluvial sands and gravels associated with seasonal floods from the Colorado River (Loeltz et al., 1975). The known extent of Lake Cahuilla, which was present in the Basin as recently as a few hundred years ago, is shown on Figure B-4 as a light blue color.

The broad Imperial Valley area is bordered to the east and west by the East and West Mesas, respectively. These areas of the mesas represent gently sloping elevated terrains on which alluvial and wind-blown deposits of a more coarse nature have been accumulated. The West Mesa is chiefly underlain by an assemblage of alluvial fans shed from the mountain ranges to the west of the mesa. The East Mesa is primarily a relic of Colorado River flood and fan delta deposits overlain by more recent wind-blown sands. The extent of these mesas roughly coincides with the traceable shoreline of pre-historic Lake Cahuilla (Loeltz et al., 1975) and, thus, roughly defines the areas where the fine-grained, lake bed deposits give way laterally to coarser grained deposits. This general geologic model for the Basin has strong influence on the occurrence and movement of groundwater.

B.7 GROUNDWATER

This section describes the geology, aquifer characteristics and water quality in the Imperial IRWMP area.

B.7.1 Aquifers and Hydrostratigraphy

Imperial Valley. Most studies of groundwater conditions in the Imperial Valley focus exclusively on the upper 1,000 feet of water-bearing strata. Data are limited on groundwater in the area, owing to the fact that groundwater in the upper 300 feet is generally of poor quality and well yields are relatively quite low. In addition, though it exists in large quantities, historically there has been little need to investigate and develop the groundwater in the valley area due to the availability and low cost of imported Colorado River water. Studies show that groundwater in the Imperial Valley generally occurs in two water-bearing zones: (1) a shallow (0 to 300 feet), unconfined, aquifer that is bounded at depth by a low permeability clay (aquitard); and (2) a intermediate (300 to 1,500 feet), semi-confined aquifer that is bounded above by the aquitard and at depth by the older marine and non-marine sediments (Tetra Tech, 1999; Montgomery Watson, 1995). A third, deeper aquifer has been identified by some authors, and may be present at depths greater than 1,500 feet, but is likely impractical in terms of water supply resources because of its poor water quality (Durbin and Imhoff, 1993) and water temperature. The following diagrams present generalized geologic cross-sections across the Imperial Valley. The locations of the cross-section lines with respect to the valley are shown on Figure B-5. Cross-section A-A' (Figure B-6) provides an east-west profile of the sediments, and cross-section B-B' (Figure B-7) represents a north-south profile of sediments across the Imperial Valley and into East Mesa.

The cross-sections illustrate in a generalized way the horizontal stratification in the Imperial Valley and East Mesa, and the depth relationships between the water-bearing aquifers and the intervening aquitards.

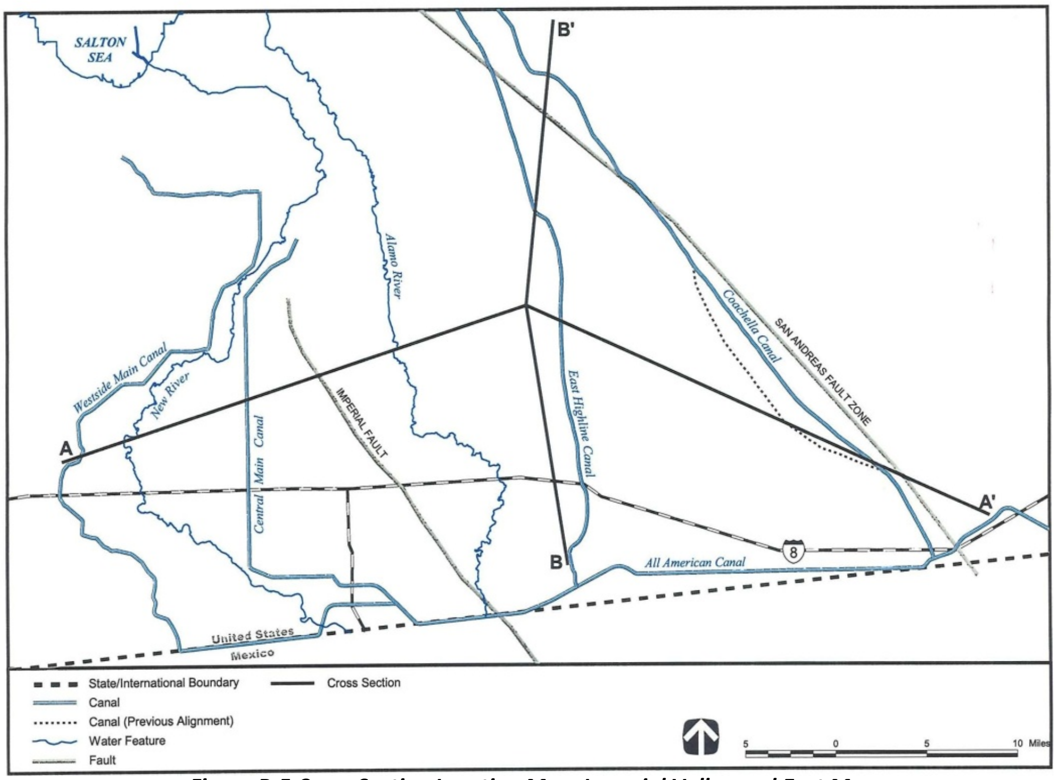


Figure B-5.Cross-Section Location Map, Imperial Valley and East Mesa

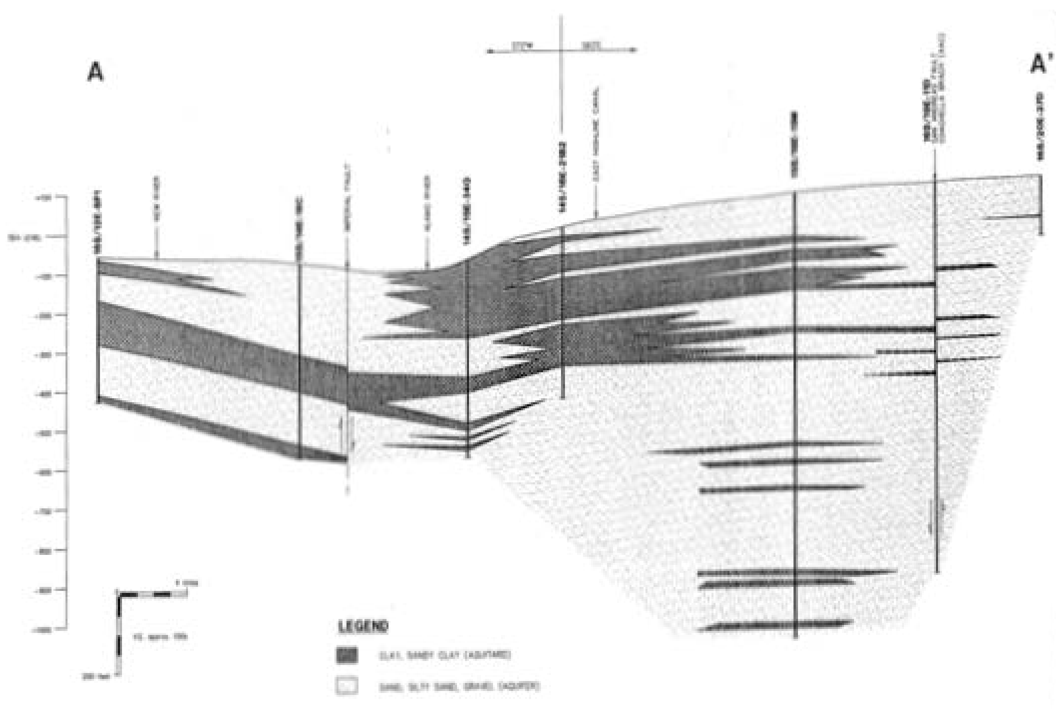


Figure B-6.Cross-section A-A'

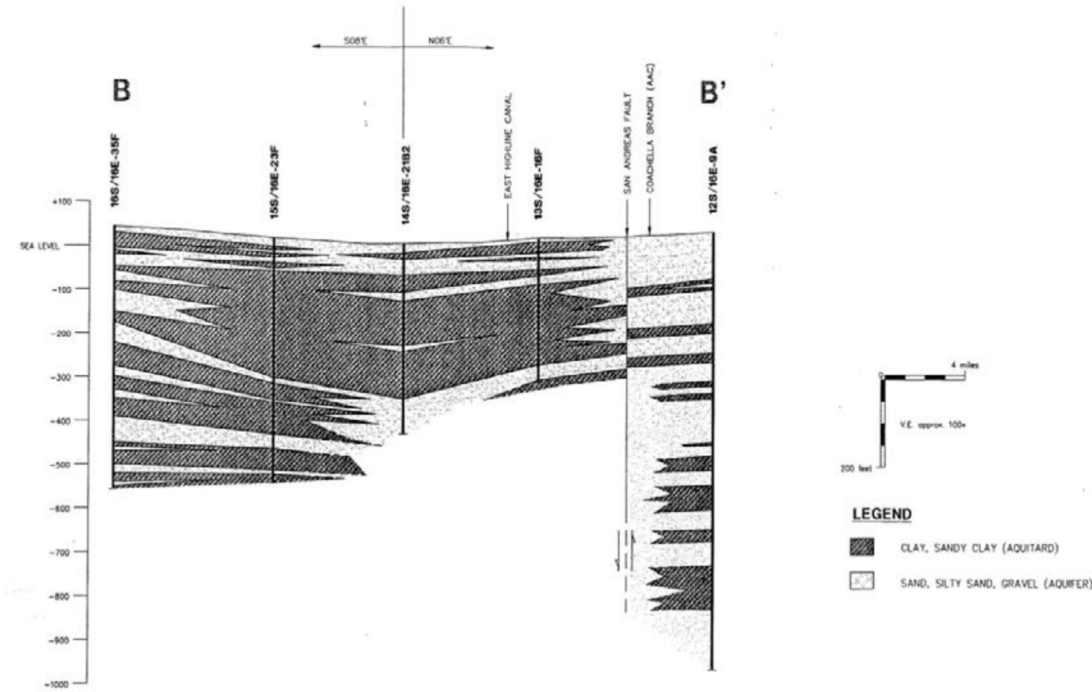


Figure B-7. Cross-section B-B'

Hydraulic communication between the upper (unconfined) and lower (semi-confined) water- bearing zones is reportedly weak, but likely varies depending on geographic location. Elevations of the base of the deeper aquifer vary from -800 feet mean sea level (MSL) in the center of the Imperial Valley to -200 feet MSL in the northeast. The upper aquifer averages 250 feet in thickness, and the deeper aquifer averages 550 feet in thickness. The aquitard separating the two water-bearing zones varies in thickness from 0 to 260 feet. This aquitard lies under the Imperial Valley but reportedly pinches out beneath East Mesa near the San Andreas Fault (and likely toward the West Mesa as well) such that only one, chiefly homogenous aquifer is present beneath the mesas. The homogeneity of the aquifer from the east to the west is interrupted by the Calipatria and the Brawley Faults. Historically, there has been up to a 10 foot head difference across the Calipatria Fault with the water levels lower on the west side of the fault (Crandall, 1983). The Brawley Fault creates about a two-foot difference in water levels, indicating that the fault is not as much of a barrier to flow as the Calipatria Fault (Crandall, 1983). The water surface gradient between the Calipatria Fault and the Brawley Fault north of the East Highline Canal have been recorded as decreasing to the northwest which indicates the flow of the water parallel to the faults, indicating the faults are at least a partial barrier to flow (Crandall, 1983).

West Mesa. The West Mesa is a somewhat loosely defined region of gently sloping desert land that lies south of the Salton Sea, west of the western shoreline of Lake Cahuilla, and east of the Coyote and Jacumba Mountains. The area includes portions of several relatively small groundwater subbasins for which little direct information is known. The exception to that is the Ocotillo-Coyote Wells Groundwater Basin, for which studies on both the quality and quantity of available groundwater exist (Bookman-Edmonston, 1996; Bookman-Edmonston, 2004). This area of West Mesa includes the area around the towns of Ocotillo and Plaster City where the U.S. Gypsum plant operates. The groundwater aquifer in the Ocotillo-Coyote Wells Groundwater Basin is characterized as unconfined, with a saturated thickness of about 400 feet and an average depth to groundwater of approximately 100 feet. The aquifer is generally homogenous and of a more coarse-grained nature than the central valley area. Thus, the data does not indicate separate water-bearing zones or intervening aquitards of any regional significance. Groundwater and surface water flow mimic the topography, flowing generally east, toward discharge areas in the Imperial Valley and Salton Sea.

Faults play a key role in the occurrence and movement of groundwater in all areas of Imperial IRWMP area. Figure B-4, shows the locations of the faults. In the West Mesa area, the Elsinore Fault and its southerly extension the Laguna Salada Fault, transect the Ocotillo-Coyote Wells Groundwater Basin act as partial barriers to the flow of groundwater out of this area toward the Imperial Valley.

East Mesa. East Mesa is located in the southeastern portion of the Salton Basin, and is described as the broad area east of the East Highline Canal and east margin of pre-historic Lake Cahuilla, and west of the Sand Hills Fault. The Sand Hills Fault (also named the Algodones Fault), an easterly splay of the San Andreas Fault system, is mapped as bordering the east side of the Sand Hills (Loeltz et. al., 1975). The East Mesa is also roughly bordered by the Coachella Canal on the east and the AAC on the south. The East Mesa is an alluvial surface that slopes gently west-southwest, covered with thin veneers of wind-blown sand. The East Mesa aquifer is chiefly unconfined, homogenous, and composed of coarse-grained deposits of gravels, sands, silts, and silty clays that were deposited by the Colorado River.

In East Mesa, the San Andreas Fault zone includes a main branch along the west margin of the Sand Hills, and an easterly splay identified as the Algodones Fault (Loeltz et. al., 1975). These faults act as partial barriers to the westward flow of groundwater from this area. The Calipatria Fault also crosses a small portion of the East Mesa along the southwest margin and also impedes the flow of groundwater out of East Mesa.

B.8 Aquifer Recharge and Discharge

In the Imperial Valley, recharge to the groundwater reservoir by subsurface inflow from tributary areas is small compared with recharge from the imported Colorado River water. Total recharge to the groundwater system from precipitation within the valley was estimated to be somewhat less than 10,000 acre-feet per year (Loeltz et al., 1975). However, Montgomery Watson (1995) cites a more likely recharge rate of 0.02 inch per year for the Ocotillo area, which equates to approximately 800 acre-feet of recharge per year, over the 500,000 acres of un-irrigated land in the West Mesa. Major sources of groundwater discharge from Imperial Valley aquifers include groundwater discharging directly into the New and Alamo Rivers, pumping in Mexicali Valley to the south, intercepted shallow groundwater from the agricultural fields by drains and the extensive tile drain network, and subsurface discharge into the Salton Sea. Phreatophytes also remove groundwater by evapotranspiration in areas where the groundwater table is shallow, especially in the rivers and drains and by wetlands (Tetra Tech, 1999). Artesian groundwater conditions exist in the Imperial Valley, primarily east of the Alamo River in a band extending roughly from Holtville in the south to Calipatria in the north.

In the West Mesa area, recharge to the aquifer is from two sources: precipitation falling directly on the area and percolation of stream runoff from the Coyote and Jacumba Mountains to the west. Sources of discharge in the West Mesa include pumpage by U.S. Gypsum, limited urban water use into the town of Ocotillo, and subsurface outflow across the Elsinore/Laguna Salada faults and toward Mexico (Bookman- Edmonston, 1996).

In the East Mesa, the source of water supply recharge to the groundwater aquifer was from canal seepage from the old unlined Coachella Canal and the AAC. However, recharge has essentially ceased when portions of unlined Coachella Canal were lined in 1979. Although portions of the AAC were lined between 2006 and 2010, the project did not complete lining of the canal completely through the East Mesa area, so some recharge from the canal to the mesa still continues. Due to the arid conditions, virtually no direct precipitation reaches the groundwater aquifer in the East Mesa (Crandall, 1983). Groundwater from the East Mesa is discharged at ground surface in springs and in the subsurface into Imperial Valley aquifers. Discharge of groundwater onto ground surface in springs occurs at areas of shallow groundwater along the AAC. In these areas, where wetlands have been created from canal seepage, discharged groundwater consumptive use is mainly attributable to evapotranspiration by phreatophytes and surface evaporation. Subsurface outflow in the East Mesa occurs toward the Imperial Valley, toward Mexico, and into a portion of the East Highline Canal.

B.8.1 Aquifer Storage

The storage capacity of the Imperial Valley has been estimated at approximately 14 MAF of water (CDWR, 1975). Available aquifer storage within the East Mesa in between the East Highline Canal and the old unlined Coachella Canal is estimated to be one (1) MAF (USBR, 1988). The aquifer storage potential of the West Mesa has not been quantified; however, aquifer conditions in the area appear favorable for storage of water. However, it will be more difficult to supply the water to the West Mesa area as there are no canals along the topographical higher areas where permeable sediments are present.

B.8.2 Groundwater Quality

The Imperial Valley contains a large area of poor quality groundwater that is generally regarded as unsuitable for domestic or irrigation use without treatment. The chemical quality of groundwater differs greatly from place to place, and salinity is the primary water quality issue. Total dissolved solids (TDS) range from several hundreds to more than 10,000 milligrams per liter (mg/L). Generally, Ocotillo-Coyote Wells Groundwater Basin sole source aquifers, which receive recharge from precipitation on the Jacumba Mountains, contains only a few hundred mg/L of dissolved solids. Beneath East Mesa the water quality is moderate to poor and has been locally influence by seepage from the old unlined reaches of the Coachella Canal and AAC.

In Imperial Valley, concentrations of nitrate and fluoride higher than the concentration recommended for drinking water are common. High concentrations of sulfate may also be present. Concentrations of boron are typically higher than those recommended for certain agricultural crops. Selenium, also a constituent of concern in the Imperial Valley drains, is thought to be a principally imported contaminant from the Colorado River supply.

In the Imperial IRWMP area, water quality was interpreted to define the areal and vertical distribution of salt within the aquifers (Durbin and Imhoff, 1993). TDS concentrations were summarized for three distinct water-bearing zones, shallow (80' to 300'), intermediate (300' to 1,500') and deep (>1,500') as shown on Figure B-8 through Figure B-10, respectively. The shallow aquifer contains highly variable water quality ranging from about 800 to over 10,000 mg/L TDS. Relatively consistent water quality is present in the shallow aquifer beneath East Mesa ranging from about 800 to 2,200 mg/L TDS. The intermediate aquifer beneath the Imperial Valley contains water that is fairly uniform averaging about 2,200 mg/L, while the deep aquifer contains more uniform the poorest quality water.

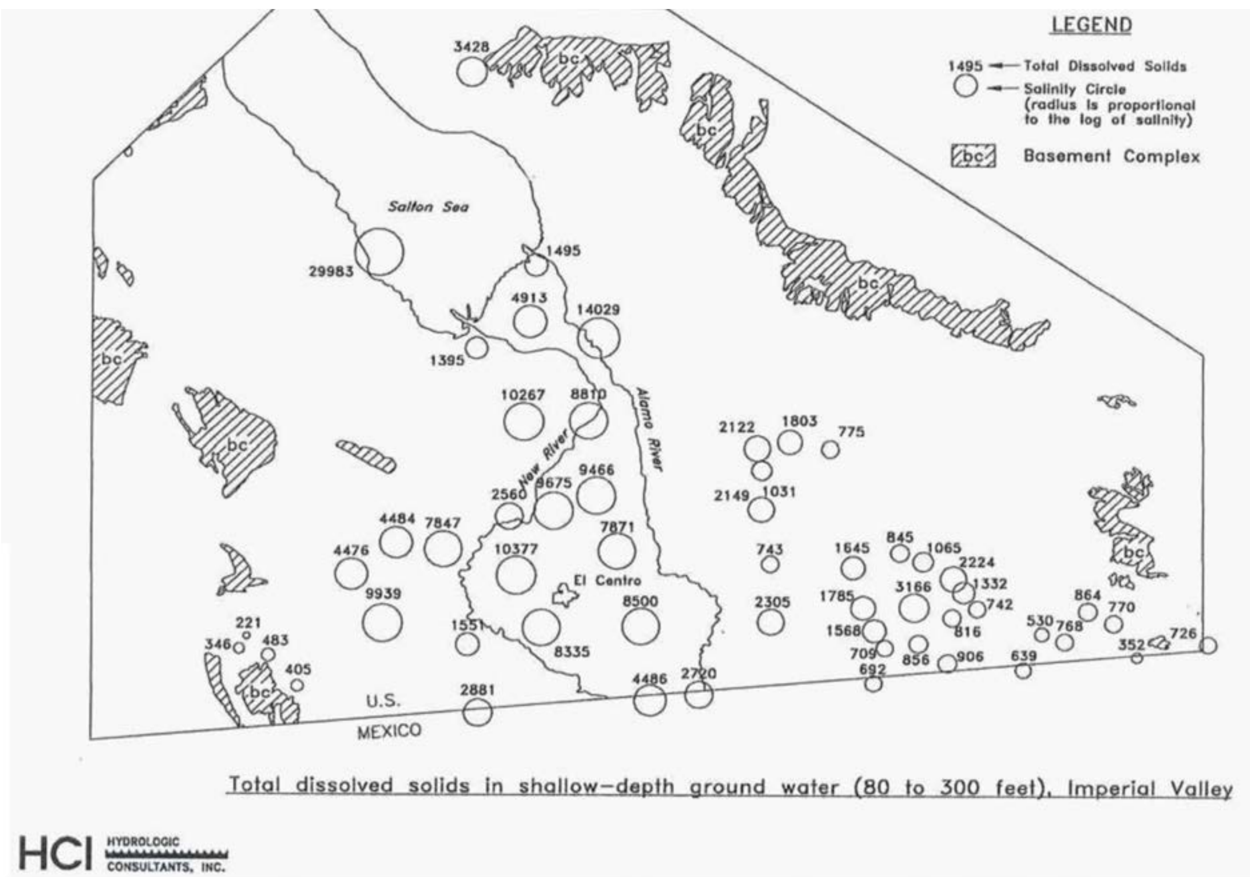


Figure B-8.Shallow Aquifer Water Quality

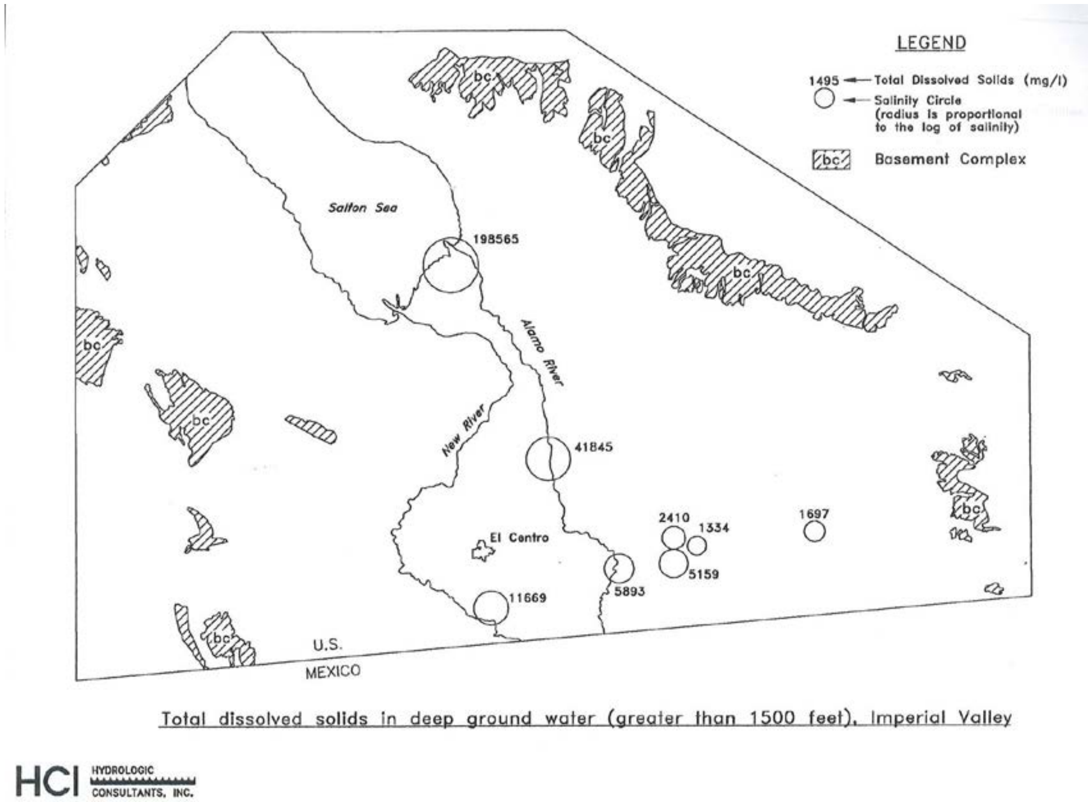


Figure B-9. Shallow Aquifer Water Quality

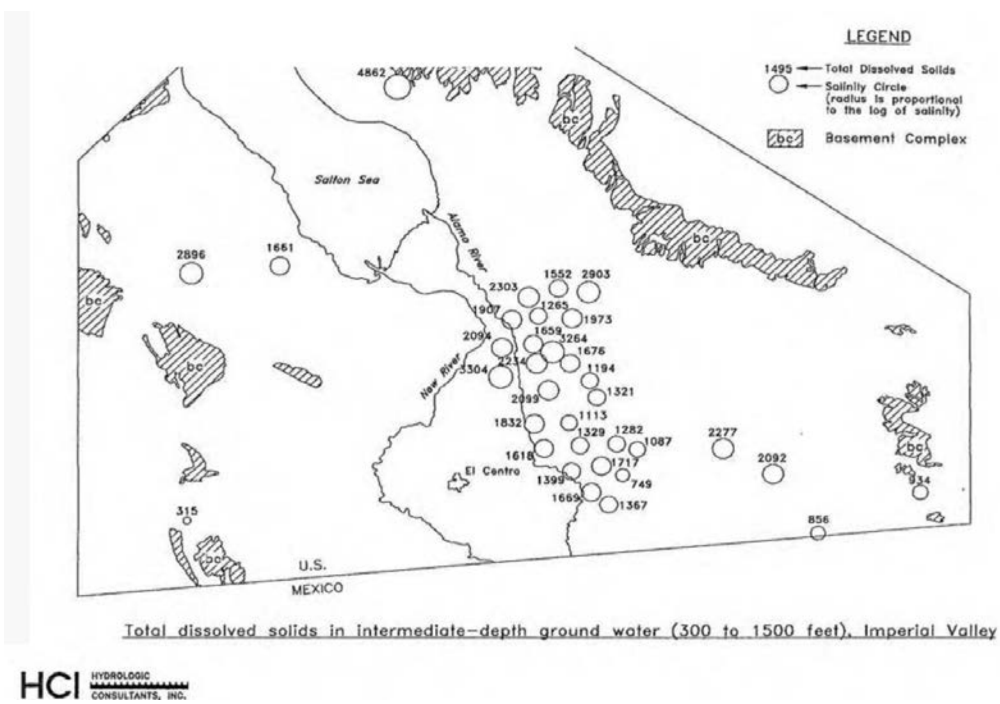
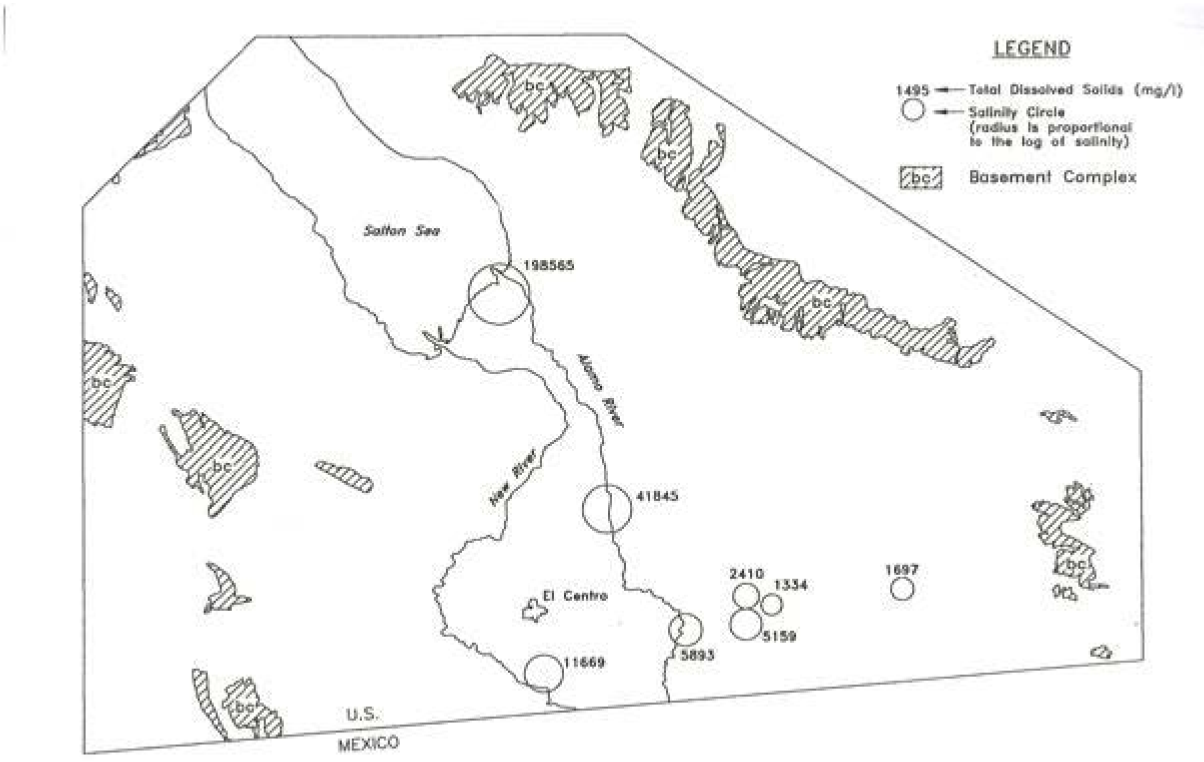


Figure B-10.Intermediate Aquifer Water Quality



Total dissolved solids in deep ground water (greater than 1500 feet), Imperial Valley

HCI HYDROLOGIC CONSULTANTS, INC.

Figure B-11.Deep Aquifer Water Quality

Additional water quality investigations were performed in the East and West Mesas that refine the previous regional studies. In the West Mesa, groundwater is pumped for industrial use at the U.S. Gypsum plant at Plaster City. The quality of the groundwater pumped in this area is reportedly good. In addition, the U.S. Geological Survey has conducted water quality sampling in the Ocotillo-Coyote Wells Groundwater Basin since 1977 (Bookman-Edmonston, 1996). Water quality data for this sole source aquifer suggest average TDS concentrations range from 300 to 400 mg/L due to recharge being derived from precipitation on the adjacent Jacumba mountains. As previously discussed, the Elsinore-Laguna Salada fault complex comprises a partial barrier to the flow from east to west of groundwater from the Ocotillo-Coyote Wells Groundwater Basin to West Mesa. TDS concentrations are notably higher on the east side of the faults (i.e., toward the Imperial Valley), ranging up to 15,000 mg/L in some wells. On the east side of the faults, shallow wells have higher TDS concentrations than deeper wells, indicating that poorer quality groundwater overlies better quality.

The greatest amount of available data on groundwater quality pertains to the East Mesa area. While there is little to no permanent groundwater pumping, the East Mesa area includes a large number of wells and has been the subject of investigation for possible groundwater development and banking for several decades. There are oil and gas exploration wells, geothermal wells, test holes, monitoring wells associated with canal seepage from the AAC and Coachella Canal, and a small number (12) of water supply wells, some of which are used for agricultural purposes. The majority of the wells are located in the southern portion of the East Mesa area, along the AAC. Two aquifers were identified in the area: a shallow unconfined zone from 0 to 85 feet and a deeper *semi*-confined zone from 85 to 160 feet (Crandall, 1983). The two water-bearing zones were differentiated based on chemical character, pH, TDS, and the perforated interval of the particular well. Overall, the median TDS is slightly higher in the shallow aquifer than in the deeper aquifer, and the water in the deeper aquifer contains water (sodium bicarbonate in character) from a different source. Table B-1 provides the analysis and characterization of the water quality.[1]

1

Table B-1. East Mesa Water Quality

	Zone A (85 to 160 Feet)		Zone B (0 to 85 Feet)	
Chemical Character	Sodium Chloride	15 wells	Sodium Chloride	13 wells
	Sodium Sulfate	3 wells	Sodium Sulfate	10 wells
	Sodium Bicarbonate	0 wells	Sodium Bicarbonate	6 wells
pH	Range: 7.4- 8.6	17 wells	Range: 4.3-11.2	17 wells
	Common 7.4- 8.6		Common 6.9- 9.0	
	4.3- 6.4	0 wells	4.3- 6.4	4 wells
	6.5- 7.5	1 well	6.5- 7.5	5 wells
	7.6- 8.6	16 wells	7.6- 8.6	11 wells
	8.7- 9.7	0 wells	8.7- 9.7	3 wells
	9.8-11.2	0 wells	9.8-11.2	4 wells
TDS (ppm)	Range 589-2860	17 wells	Range: 250-2620	27 wells
	Common: 750- 995	9 wells	Common: 434- 787	16 wells
	589	1 well	250	1 well
	1270	1 well	882-1413	7 wells
	1710-2860	6 wells	1750-2620	3 wells
	7112	1 well	7151	1 well
F (ppm)	Range: 0.2-1.4	10 wells	Range 0.1-1.6	22 wells
	1.9	1 well	3	1 well
B	0.26 and 0.46	2 wells	0.41	1 well

Source: Crandall, 1983

Groundwater Temperature

Along with varying TDS, local groundwater also has varying temperatures. Geothermal heat in the Imperial Valley and the East Mesa is used to generate geothermal energy. Figure B-11 shows the Known Geothermal Resource Areas (K.G.R.A). The California Department of Conservation Division of Oil, Gas & Geothermal (DOGGR) has temperature logs for wells within the K.G.R.A.s. Several of these temperature logs were gathered and used to estimate the groundwater temperature that can be expected in different portions of the Imperial Valley. The data for the East Mesa is confidential so temperatures were estimated from the available logs for the shallow and intermediate aquifers in the Imperial Valley and extrapolated into areas where the information was not available.