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Attachment F.2 Revised Hydrology Report

2-D HYDRAULIC STUDY
SUMMARY ANALYSIS OF FINDINGS

IP PERKINS STUDY AREA
Imperial County, CA

Submitted: April 10, 2024

WRMA
WATER RESOURCES | ENGINEERING

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Section 1 IP Perkins Hydrology

1.1 Watershed Delineation

The Watershed for the study area was determined by analyzing existing watershed boundaries provided by the National Hydrologic Dataset (NHD). The NHD is a dataset created by the USGS to delineate and identify the Nation's stream networks so that federal and state agencies can quickly indentify streams using unique identifiers based on a network of rivers and streams within a defined hierarchy of watersheds. Based on the location of the IP Perkins study area, which is located within the Salton Sea Basin, the watershed was identified as “Deer Peak”, with a HUC10 ID of 1810020404 (See **Figure 1-1**).

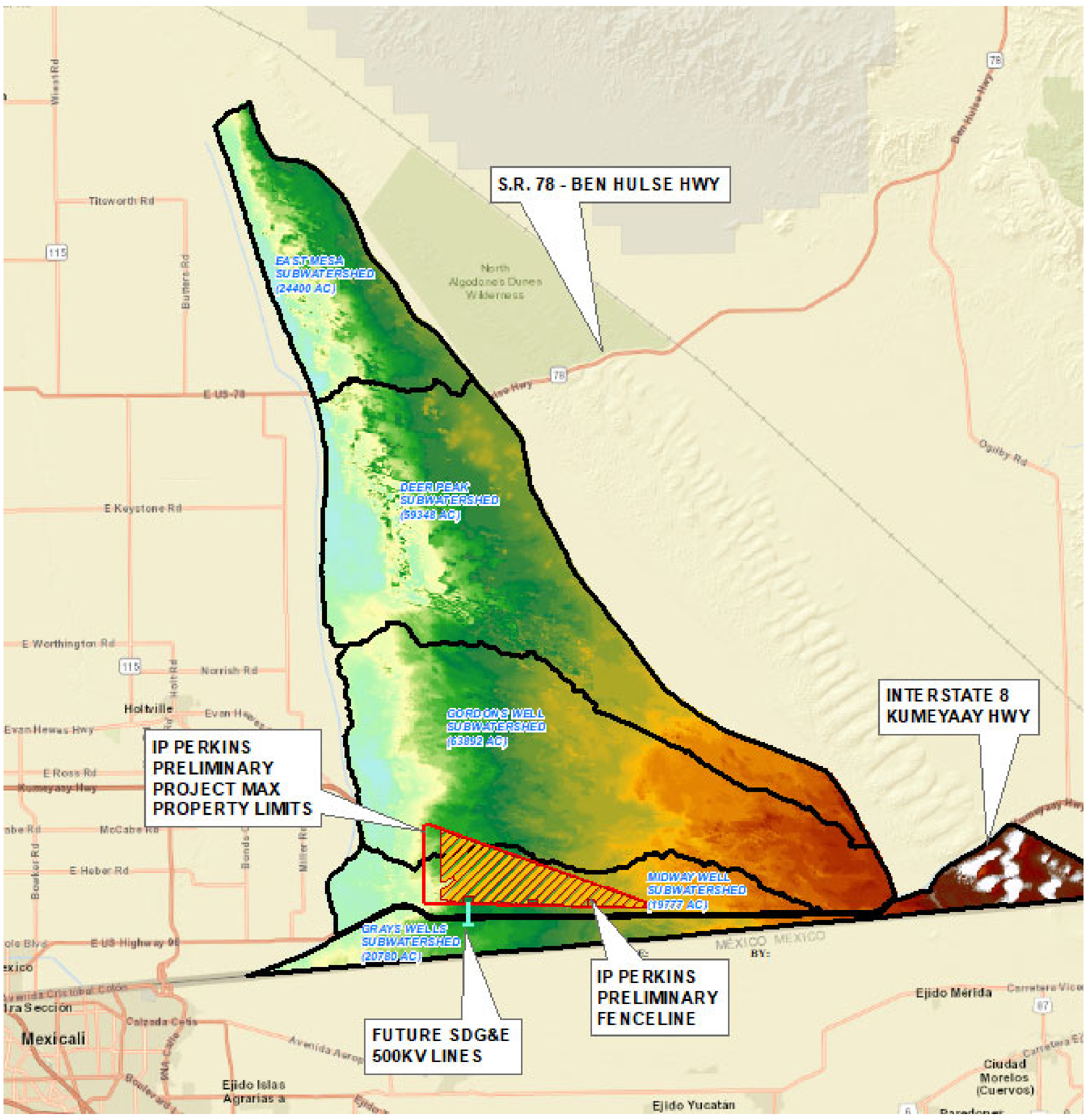

Figure 1-1 IP Perkins Study Area within Midway Well Subwatershed & Relevant Features

1.2 Subwatersheds of Interest

Based on the NHD dataset, the IP Perkins Study Area, is located in Imperial County, California, near the U.S. border with Mexico, and is located within the Deer Peak watershed which consists of four sub-watersheds including East Mesa, Deer Peak, Gordons Well, and Midway Well (See **Tables 1-1 to 1-4**). All four subwatersheds are closed basins.

Table 1-1 East Mesa Subwatershed

NHD Identification Data – East Mesa Sub-Watershed	
HUC ID No.	181002040404
Region (HUC 2):	California Region
Sub-Region (HUC 4):	Southern Mojave-Salton Sea
Basin (HUC 6):	Salton Sea
Sub-Basin (HUC 8):	Salton Sea
Watershed (HUC 10):	Deer Peak
Sub-Watershed (HUC 12):	East Mesa

East Mesa subwatershed is a closed basin totaling 24,400 Acres.

Table 1-2 Deer Peak Subwatershed

NHD Identification Data – Deer Peak Sub-Watershed	
HUC ID No.	181002040403
Region (HUC 2):	California Region
Sub-Region (HUC 4):	Southern Mojave-Salton Sea
Basin (HUC 6):	Salton Sea
Sub-Basin (HUC 8):	Salton Sea
Watershed (HUC 10):	Deer Peak
Sub-Watershed (HUC 12):	Deer Peak

Deer Peak subwatershed is a closed basin and is 59,348 Acres, located to the South of the East Mesa subwatershed.

Table 1-3 Gordons Well Subwatershed

NHD Identification Data – Gordons Well Sub-Watershed	
HUC ID No.	181002040402
Region (HUC 2):	California Region
Sub-Region (HUC 4):	Southern Mojave-Salton Sea
Basin (HUC 6):	Salton Sea
Sub-Basin (HUC 8):	Salton Sea
Watershed (HUC 10):	Deer Peak
Sub-Watershed (HUC 12):	Gordons Well

Gordons Well subwatershed is a closed basin and is 63,892 Acres. The northern most edge of the IP Perkins Study Area is located within the drainage area of Gordons Well.

Table 1-4 Midway Well Subwatershed

NHD Identification Data – Midway Well Sub-Watershed	
HUC ID No.	181002040401
Region (HUC 2):	California Region
Sub-Region (HUC 4):	Southern Mojave-Salton Sea
Basin (HUC 6):	Salton Sea
Sub-Basin (HUC 8):	Salton Sea
Watershed (HUC 10):	Deer Peak
Sub-Watershed (HUC 12):	Midway Well

Midway Well subwatershed is a closed basin and is 19,777 Acres, located on the south end of the Deer Peak watershed. The large majority of the IP Perkins study area is located within the Midway Well subwatershed.

Table 1-5 Grays Well Subwatershed

NHD Identification Data – Grays Well Sub-Watershed	
HUC ID No.	181002040301
Region (HUC 2):	California Region
Sub-Region (HUC 4):	Southern Mojave-Salton Sea
Basin (HUC 6):	Salton Sea
Sub-Basin (HUC 8):	Salton Sea
Watershed (HUC 10):	Deer Peak
Sub-Watershed (HUC 12):	Grays Well

Grays Well subwatershed is a closed basin and is 20,780 Acres, located on the south end of the Deer Peak watershed.

1.3 Hydrologic Model

Hydrologic analysis was performed using the US Army Corps of Engineers HEC-RAS 6.0 modeling software direct precipitation (Rain-on-Grid) routine. Given that all four subwatersheds of interest are closed (bowl shaped) basins and the lack of defined hydrologic features in this desert/shrub location, direct precipitation was selected as the rainfall-runoff hydrology method. HEC-RAS 6.0 provides for user input of various data sources to model the effect of infiltration of the watershed area. Data sources obtained for this analysis (See **Table 1-5**) included land cover, impervious area, soil permeability or hydrologic soil type and catchment areas. Rainfall data for the 100-year, 24-hour storm was obtained from NOAA Atlas 14, which provides the best available rainfall data statistics for the United States.

Table 1-6 Hydrologic Model Data Inputs

Physical Hydrologic Model Input	
Land Cover	USGS National Land Cover Database 2011 Land Cover Classifications
Elevation (Topography)	NextMap 5m and 10m USGS Topographic Raster in NAVD88 and NAD83
% Impervious Area	USGS National Land Cover Database 2011 Impervious Area
Hydrologic Soil Groups	NRCS gSSURGO 30 m 2018 and 10m Rasters for Dominant Conditions
Catchment Areas	Subwatersheds areas delineated by ArcHydro tools within ArcGIS and compared with NHD Plus V2.1 data layers
Curve Numbers	SCS Curve Numbers were selected based on (Moglen 2016) and the literature.

1.4 Rainfall

Using the NOAA Atlas 14 point rainfall for the 100-YR /24-HR storm, the NRCS Type II distribution (See **Figure 1-2**) was applied to determine the rainfall hyetograph over the 24 hour duration of the storm. This data was input into the HEC-RAS 6.0 precipitation (direct rainfall) model. The boundary of the 2D mesh was selected as the Deer Peak Watershed boundary. Consequently, the model applies the rainfall event based on the NRCS Type II distribution, uniformly over the entirety of the watershed area. The 24-hour rainfall was indicated to be 3.84 inches for the 100-YR event which has a 1% annual exceedance probability (See **Table 1-6**). NOAA Atlas 14 Rainfall Data are provided in **Appendix A**.

Table 1-7 Hydrologic Model Rainfall and Loss Characteristics

Rainfall Model Input	
Rainfall	NOAA Atlas 14 provides the most up to date and accurate point rainfall estimates. For the IP Perkins study area, the rainfall depth for the 100 year - 24 Hour storm is 3.84 inches.
Rainfall Distribution	NRCS Type II
Infiltration Method	Soil Conservation Services (SCS) Curve Number
Baseflow Method	Not Applicable

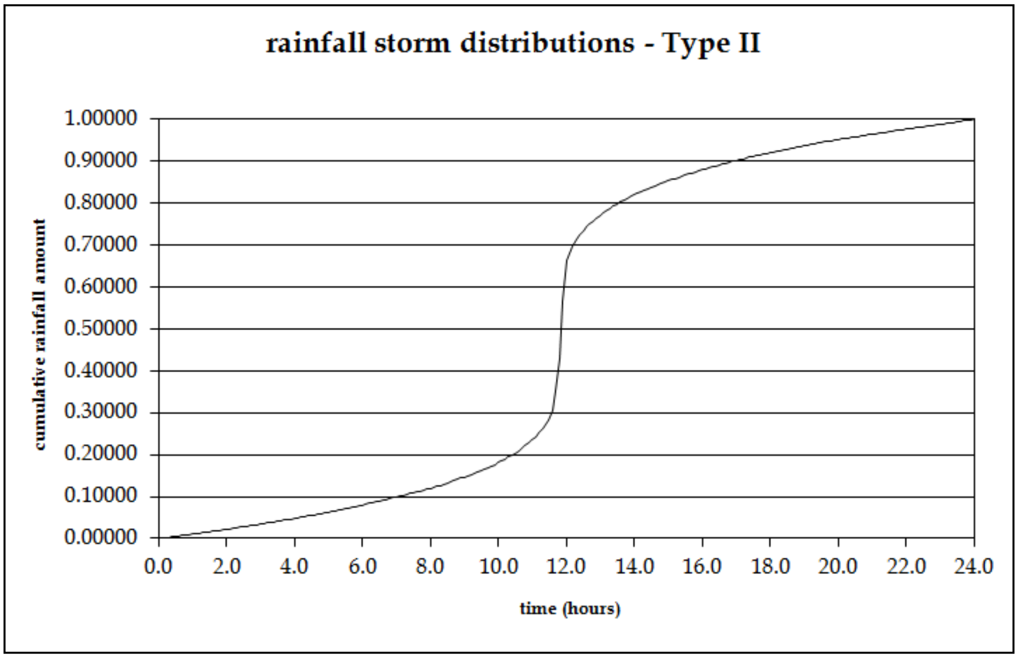

Figure 1-2 NRCS Type II Dimensionless Rainfall Distribution

Table 1-8 NOAA Atlas 14 Rainfall Data for IP Perkins Study Area

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.080 (0.068-0.096)	0.123 (0.104-0.147)	0.185 (0.156-0.222)	0.240 (0.201-0.290)	0.324 (0.261-0.406)	0.396 (0.312-0.507)	0.476 (0.366-0.626)	0.567 (0.423-0.768)	0.707 (0.504-1.00)	0.829 (0.571-1.22)
10-min	0.115 (0.098-0.137)	0.176 (0.149-0.211)	0.265 (0.224-0.318)	0.345 (0.288-0.416)	0.465 (0.375-0.582)	0.567 (0.448-0.726)	0.682 (0.524-0.897)	0.813 (0.607-1.10)	1.01 (0.723-1.43)	1.19 (0.818-1.75)
15-min	0.139 (0.118-0.166)	0.213 (0.181-0.255)	0.321 (0.271-0.384)	0.417 (0.348-0.503)	0.562 (0.453-0.703)	0.686 (0.541-0.879)	0.825 (0.634-1.09)	0.984 (0.734-1.33)	1.23 (0.874-1.73)	1.44 (0.989-2.11)
30-min	0.191 (0.162-0.228)	0.293 (0.248-0.350)	0.441 (0.372-0.528)	0.573 (0.479-0.692)	0.773 (0.623-0.967)	0.944 (0.744-1.21)	1.14 (0.872-1.49)	1.35 (1.01-1.83)	1.69 (1.20-2.38)	1.98 (1.36-2.90)
60-min	0.267 (0.226-0.318)	0.409 (0.346-0.489)	0.615 (0.519-0.737)	0.799 (0.668-0.966)	1.08 (0.869-1.35)	1.32 (1.04-1.69)	1.58 (1.22-2.08)	1.89 (1.41-2.56)	2.35 (1.68-3.33)	2.76 (1.90-4.05)
2-hr	0.371 (0.314-0.442)	0.551 (0.466-0.658)	0.809 (0.682-0.969)	1.04 (0.867-1.25)	1.38 (1.11-1.73)	1.67 (1.32-2.14)	1.99 (1.53-2.62)	2.35 (1.76-3.19)	2.91 (2.07-4.11)	3.39 (2.33-4.97)
3-hr	0.422 (0.358-0.503)	0.621 (0.525-0.741)	0.903 (0.762-1.08)	1.15 (0.963-1.39)	1.52 (1.23-1.91)	1.84 (1.45-2.35)	2.18 (1.68-2.87)	2.57 (1.92-3.49)	3.17 (2.26-4.48)	3.68 (2.53-5.40)
6-hr	0.513 (0.434-0.611)	0.747 (0.632-0.891)	1.08 (0.910-1.29)	1.37 (1.15-1.65)	1.80 (1.45-2.25)	2.16 (1.71-2.77)	2.56 (1.97-3.37)	3.01 (2.24-4.07)	3.68 (2.62-5.21)	4.25 (2.93-6.25)
12-hr	0.589 (0.499-0.702)	0.863 (0.730-1.03)	1.25 (1.06-1.50)	1.60 (1.33-1.93)	2.10 (1.70-2.63)	2.53 (1.99-3.24)	3.00 (2.30-3.94)	3.52 (2.62-4.76)	4.29 (3.06-6.07)	4.95 (3.41-7.27)
24-hr	0.732 (0.646-0.845)	1.08 (0.955-1.25)	1.58 (1.39-1.83)	2.02 (1.77-2.36)	2.68 (2.27-3.23)	3.23 (2.69-3.97)	3.84 (3.12-4.82)	4.52 (3.58-5.82)	5.53 (4.22-7.39)	6.39 (4.72-8.82)

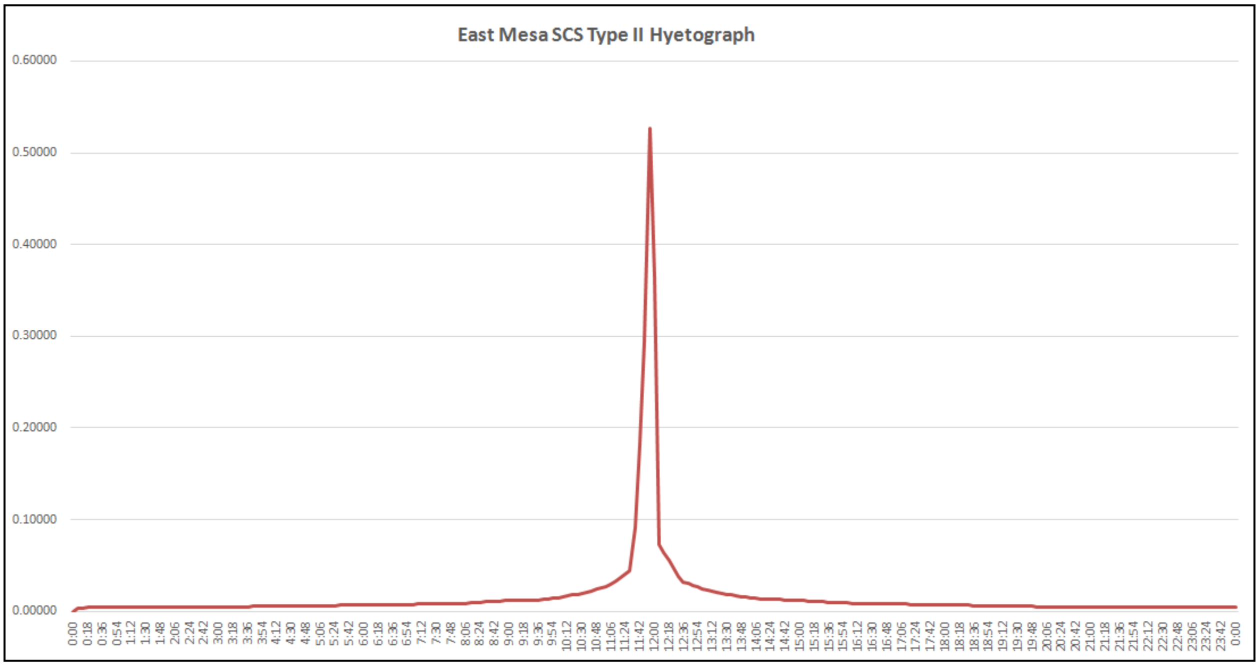

Figure 1-3 IP Perkins Study Area Rainfall Hyetograph

Rainfall data from NOAA Atlas 14 was compared with other data sources from the literature, including TP-40, which likewise indicates a 24-hour rainfall of around 3 to 4 inches for the 100-YR event (See **Figure 1-4**).

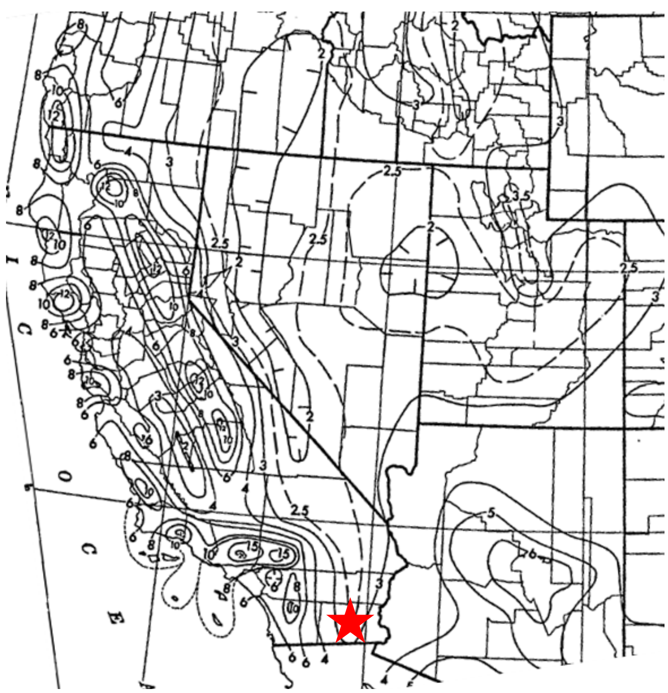

Figure 1-4 Southern California Rainfall Isolines Based on TP-40

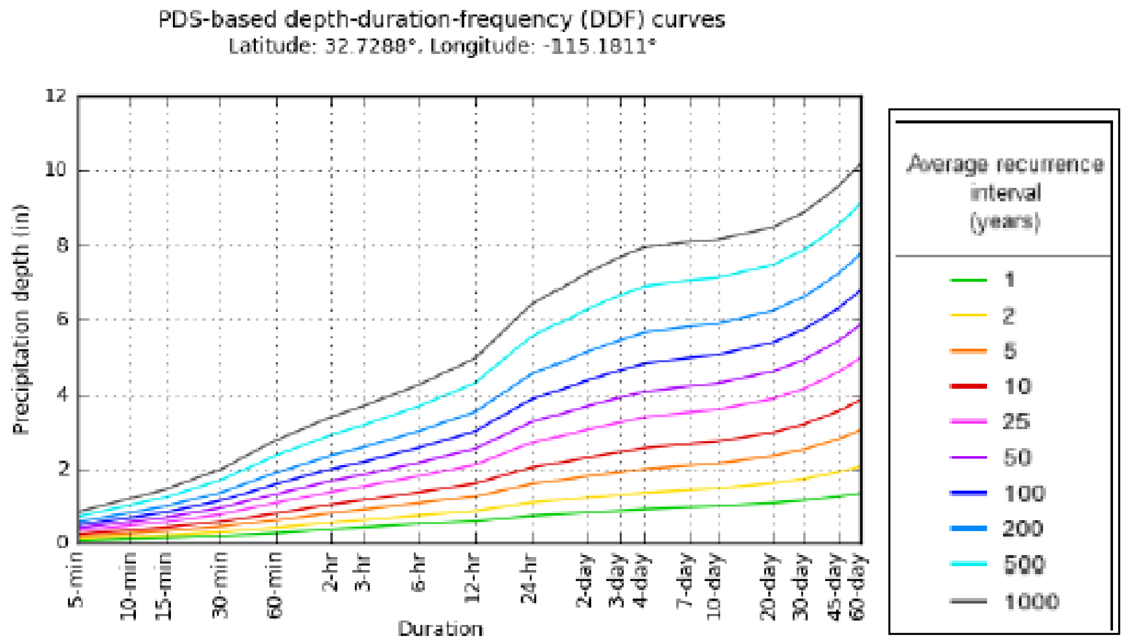

Figure 1-5 IDF Curves for the IP Perkins Study Area

1.5 Elevation & Slope

Topographic data for this analysis was obtained from two sources. For the IP Perkins study area, NextMap 5m digital terrain models were acquired from Intermap. This data source is currently the best available topographic data. For areas outside the boundaries of the study area, USGS 10m (1/3 Arc Second) bare earth digital elevation models were utilized. The composite Digital Elevation Model indicated a vertical grade change between the high (157 ft above MSL) and low points (22 ft above MSL) of the sub-watershed, over an approximate length of 98,400 feet (18.6 miles) which equates to an average slope of 0.1%. The change in grade is relatively gentle with few head cuts. The grade is sloping from East to West (See **Figure 1-6**) which is consistent given the geography of the Imperial Valley. Consequently, it would be expected that excess runoff would flow in a westerly direction.

HYDROLOGIC & HYDRAULIC 2D ANALYSIS

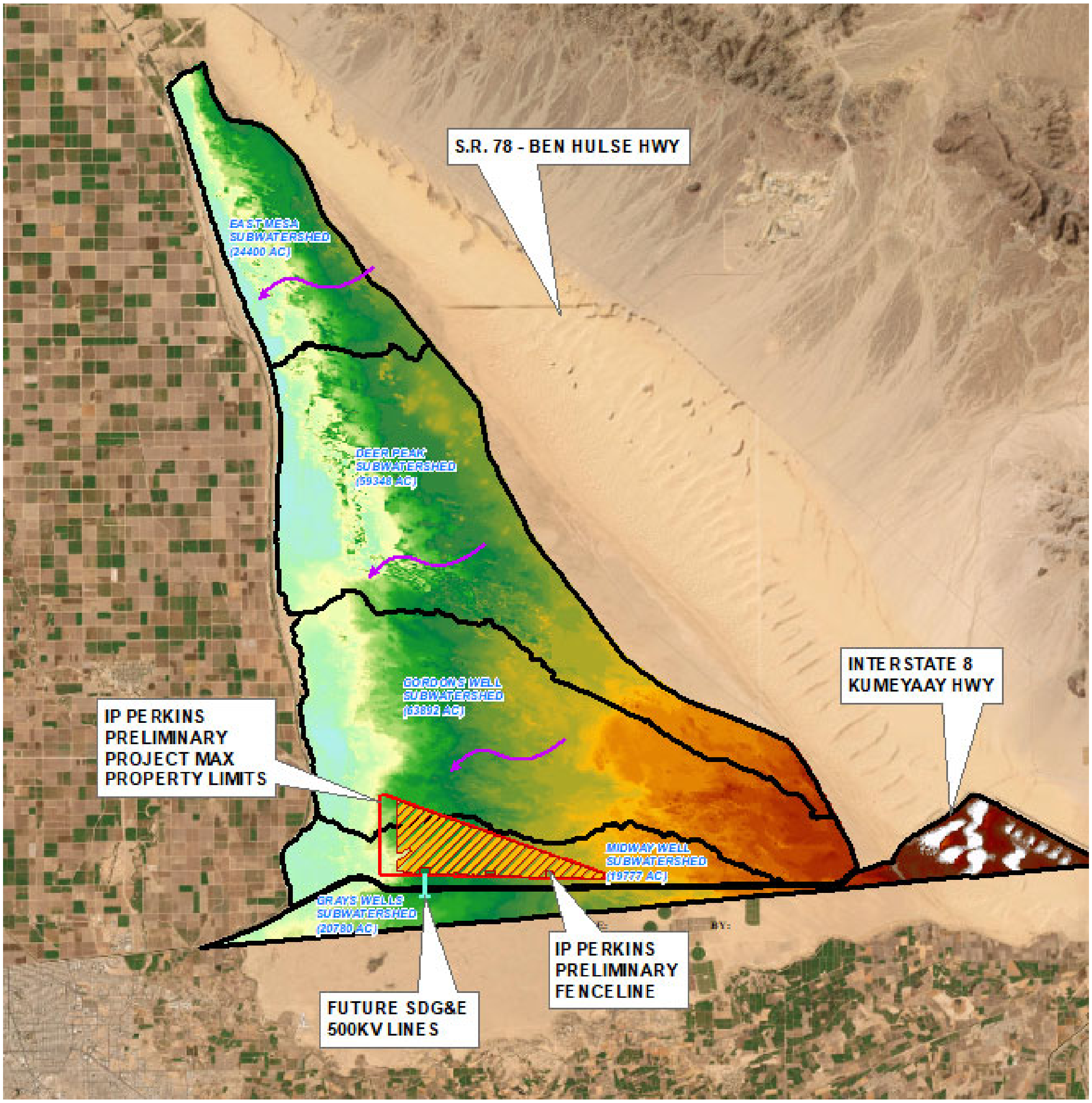

Figure 1-6 Elevation Model of the IP Perkins Study Area (Source: NextMap & USGS)

As stated, the slope of the terrain is relatively gentle with the substantial majority of the IP Perkins study area having a slope between 0 to 2.5%, with some isolated pockets of gentle rolling hills exhibiting slopes of around 5 to 8% (See **Figure 1-7**). Due to the relatively flatter slopes, there are not any particularly well-defined hydrologic features which would indicate concentrated flow through the study area. The NHD flowline data layer does not even indicate any existing intermittent or ephemeral flowlines. The watershed boundary data layer identifies all four subwatersheds within the Deer Peak watershed, as closed basins which are more or less bowl shaped basins with no existing watershed outlet. This fact then suggests that a substantial amount of any significant rainfall infiltrates into the soil strata with any remaining excess runoff then concentrating into shallow pools distributed throughout the watershed and at the lowest points on the terrain. This type of runoff response would be consistent with the HSG classification shown in **Figure 1-12**, which indicates 95% of the soils are classified by the USGS as *Group A* soils (high infiltration). The 2D hydraulic model will seek to identify the low points of runoff concentration (shallow pooling) within the study area.

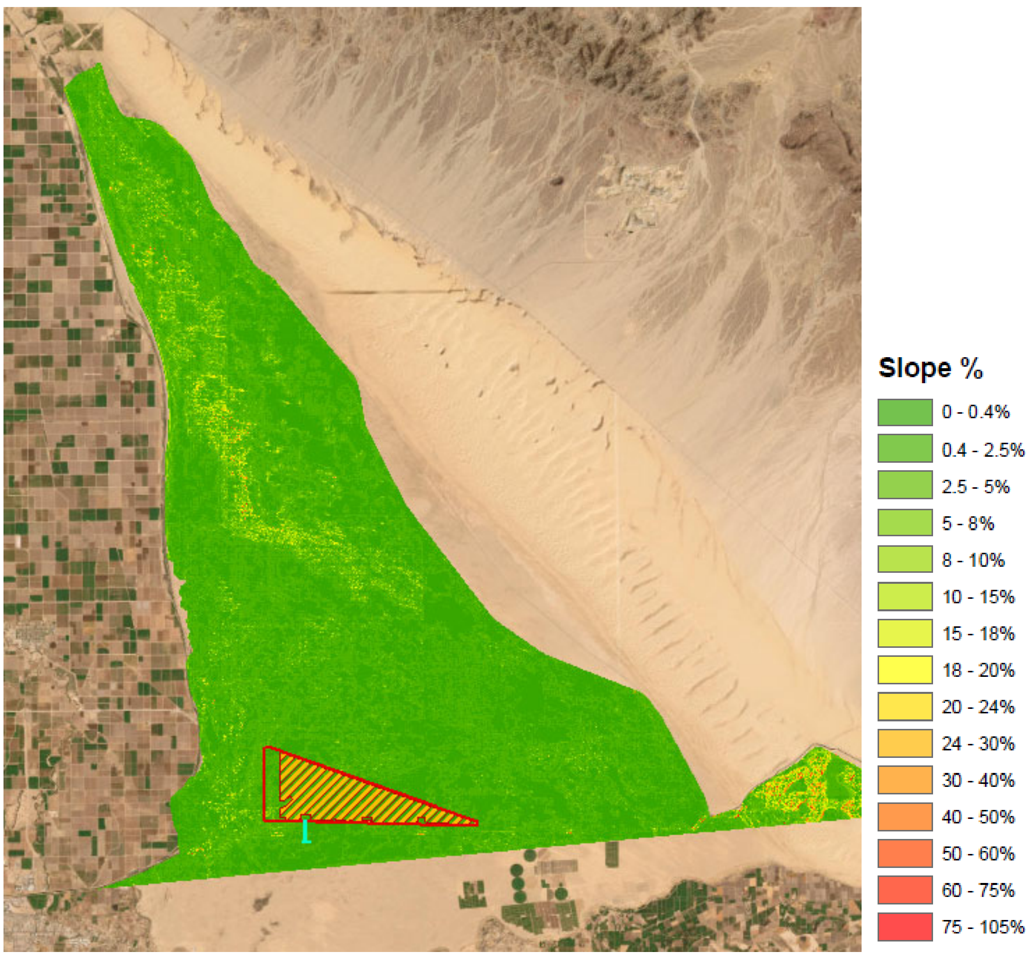

Figure 1-7 Slope Model of the IP Perkins Study Area

1.6 Land Cover

The IP Perkins study area is located in the southernmost eastern corner of Imperial County in Southern California, in an area where the land cover is best described as primarily desert shrub (See **Figure 1-8**). This area of California receives on average about 3 to 5 (See **Figure 1-4**) inches of rainfall or less annually. Therefore, the hydrologic features, where found in the vicinity are primarily "intermittent" or ephemeral features and most of the time are barren or void of any moisture. It should be noted that the National Hydrologic Dataset does not indicate the presence of any defined or intermittent features, and the entirety of the study area is barren and gently sloping from East to West over a 4 to 5 mile length. The study area is dry and arid. The hydrologic features are either non-existent or poorly defined and there is no consistent hydrologic network as the area has consistent gentle slopes which push surface runoff as sheet flow down-gradient, towards the lower western portions of these closed basins.

Figure 1-8 IP Perkins Study Area Aerial Imagery Showing Land Cover of Desert/Shrub

1.7 Manning's n

Land Cover categories are taken from the National Land Cover Database (2011) via USGS. The Land Cover categories were used to determine ground cover roughness characteristics which are necessary for performing the 2D hydraulic computations. Manning's "n" roughness values are taken from the literature and recommended roughness values provided by the NRCS (See **Table 1-8**). The two predominant land cover categories in the IP Perkins study area are Desert Shrub/Scrub (Manning's n of 0.100) and Barren Land (Manning's n of 0.025).

Table 1-9 NRCS Manning's n Coefficients for NLCD Land Cover Values

NLCD[\1] Value	Normal Manning's n Value	Allowable Range of n values	Land Cover Definition	Reference
11	**0.040**	0.025--0.05	Open Water - All areas of open water, generally with less than 25% cover or vegetation or soil	[\2] Table 5-6 D-1.a.3
21	**0.040**	0.03--0.05	Developed, Open Space - Includes areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20 percent of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes.	[\3] Figure 3-19
22	**0.100**	0.08--0.12	Developed, Low Intensity -Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20-49 percent of total cover. These areas most commonly include single-family housing units.	[\3] Figure 3-19
23	**0.080**	0.06--0.14	Developed, Medium Intensity - Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50-79 percent of the total cover. These areas most commonly include single- family housing units.	[\3] Figure 3-19
24	**0.150**	0.12-0.20	Developed, High Intensity - Includes highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses and commercial/industrial. Impervious surfaces account for 80 to 100 percent of the total cover.	[\3] Figure 3-19
31	**0.025**	0.023--0.030	Barren Land (Rock/Sand/Clay) - Barren areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits and other accumulations of earthen material. Generally, vegetation accounts for less than 15% of total cover.	[\2] Table 5-6 C.b.1
41	**0.160**	0.10--0.16	Deciduous Forest - Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75 percent of the tree species shed foliage simultaneously in response to seasonal change.	[\2] Table 5-6 D-2.d.5 Max. Debris
42	**0.160**	0.10--0.16	Evergreen Forest - Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75 percent of the tree species maintain their leaves all year. Canopy is never without green foliage.	[\2] Table 5-6 D-2.d.5 Max. Debris
43	**0.160**	0.10--0.16	Mixed Forest - Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. Neither deciduous nor evergreen species are greater than 75 percent of total tree cover.	[\2] Table 5-6 D-2.d.5 Max. Debris
52	**0.100**	0.07--0.16	Shrub/Scrub - Areas dominated by shrubs; less than 5 meters tall with shrub canopy typically greater than 20% of total vegetation. This class includes true shrubs, young trees in an early successional stage or trees stunted from environmental conditions.	[\2] Table 5-6 D-2.c.5
71	**0.035**	0.025--0.050	Grassland/Herbaceous - Areas dominated by grammanoid or herbaceous vegetation, generally greater than 80% of total vegetation. These areas are not subject to intensive management such as tilling, but can be utilized for grazing.	[\2] Table 5-6 D-2.a.2
81	**0.030**	0.025--0.050	Pasture/Hay - Areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20 percent of total vegetation.	[\2] Table 5-6 D-2.a.1
82	**0.035**	0.025--0.050	Cultivated Crops - Areas used for the production of annual crops, such as corn, soybeans, vegetables, tobacco, and cotton, and also perennial woody crops such as orchards and vineyards. Crop vegetation accounts for greater than 20 percent of total vegetation. This class also includes all land being actively tilled.	[\2] Table 5-6 D-2.b.2
90	**0.120**	0.045--0.15	Woody Wetlands - Areas Where forest or shrub land vegetation accounts for greater than 20 percent of r substrate is periodically saturated with or covered with water.	[\2] Table 5-6 D-1.a.8
95	**0.070**	0.05--0.085	Emergent Herbaceous Wetlands - Areas where perennial herbaceous vegetation accounts for greater than 80 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.	[\2] Table 5-6 D-1.a.7

[\1] 2011 National Land Cover Data Set (NLCD)
[\2] Open-Channel Hydraulics, by Chow, Ven Te, 1959
[\3] HEC-RAS River Analysis System 2D Modeling User's Manual, Version 5.0, February 2016, Figure 3-19

1.8 Impervious Area

The IP Perkins study area is located in undeveloped desert shrublands (See **Figure 1-11**). The only existing impervious areas within proximity to the study area are paved highways including, SR 78, Ben Hulse Hwy. Ben Hulse Hwy is a 2-lane paved asphalt roadway (See **Figure 1-9**) which traverses the watershed on an east-west alignment. Likewise, to the South, Interstate 8, Kumeyaay Hwy traverses the watershed on an east-west alignment, just to the north of the IP Perkins study area. Kumeyaay Hwy is a 4-lane divided asphalt paved roadway (See **Figure 1-10**). Both roadways are elevated above the existing natural ground by about 2 feet. For the purpose of the hydrologic and 2D hydraulic analysis, all low, medium, and high density-developed land cover types are assumed to be 100% impervious.

Figure 1-9 SR 78 Ben Hulse Hwy North of IP Perkins Study Area

Figure 1-10 Interstate 8, Kumeyaay Hwy North of IP Perkins Study Area

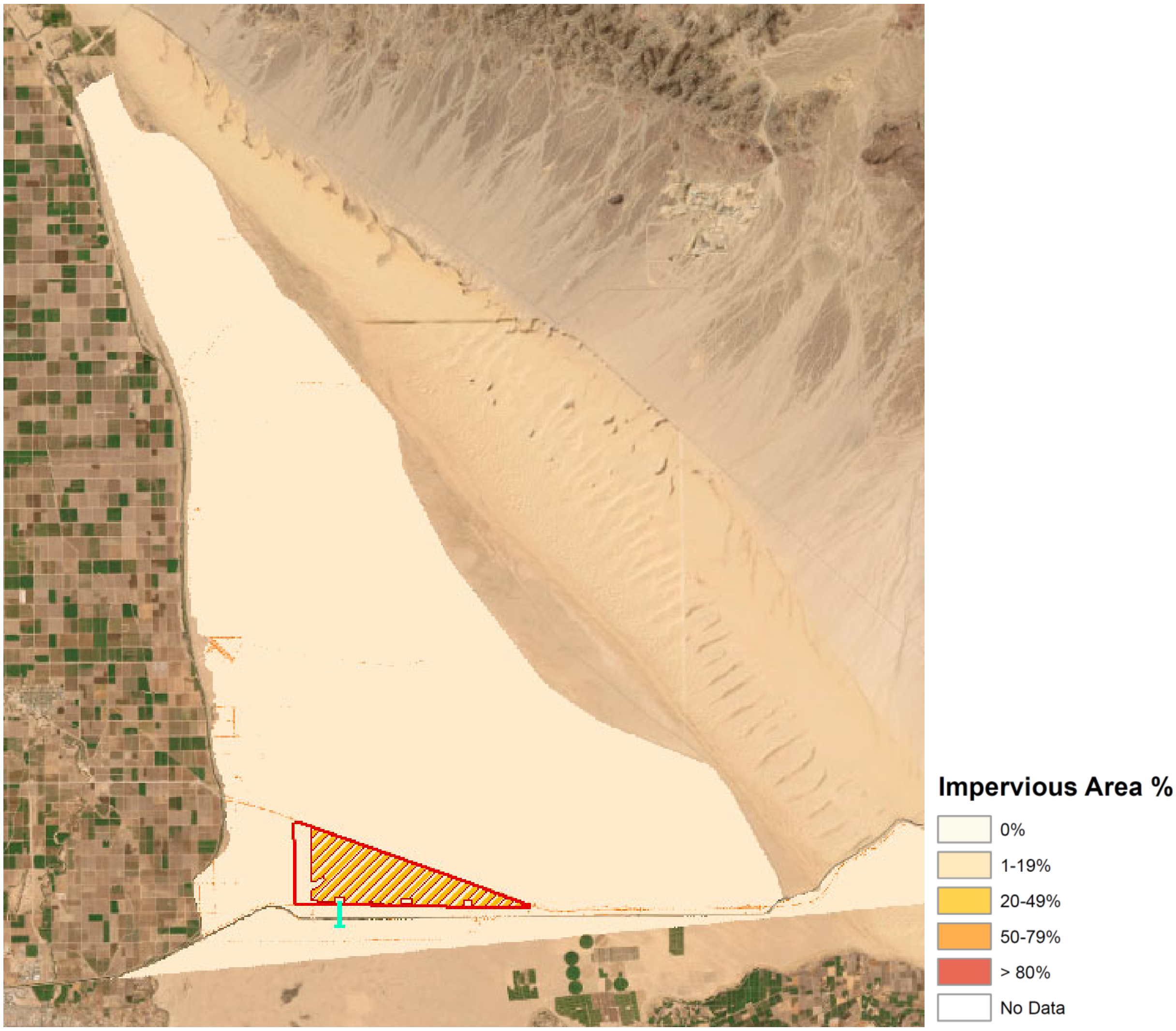

Figure 1-11 IP Perkins Study Area Impervious Area Percent Classification

1.9 Soils

Hydrologic soils were obtained from gSSURGO and the National Landcover Database, respectively. Soils data including both Hydrologic Soil Group and Map Unit symbols, were available for the entirety of the study area and NRCS soils reports are included in **Appendix B** for the study area. Any "unclassified" areas are assumed to be in hydrologic soil group D (poor infiltration). The dominant soil class for the IP Perkins Study area is primarily soil group A, which are soils with a higher rate of infiltration. The Hydrologic soil group raster data (See **Figure 1-12**) was coupled with impervious area percentages for the land cover types in order to characterize the infiltration of runoff within the model (See Infiltration). Map Books with Hydrologic Soil Group classification and Map Unit Symbols polygons are included in the map package of the deliverable. The Map Books can be cross referenced with **Tables 1-9 and 1-10** to identify soil names.

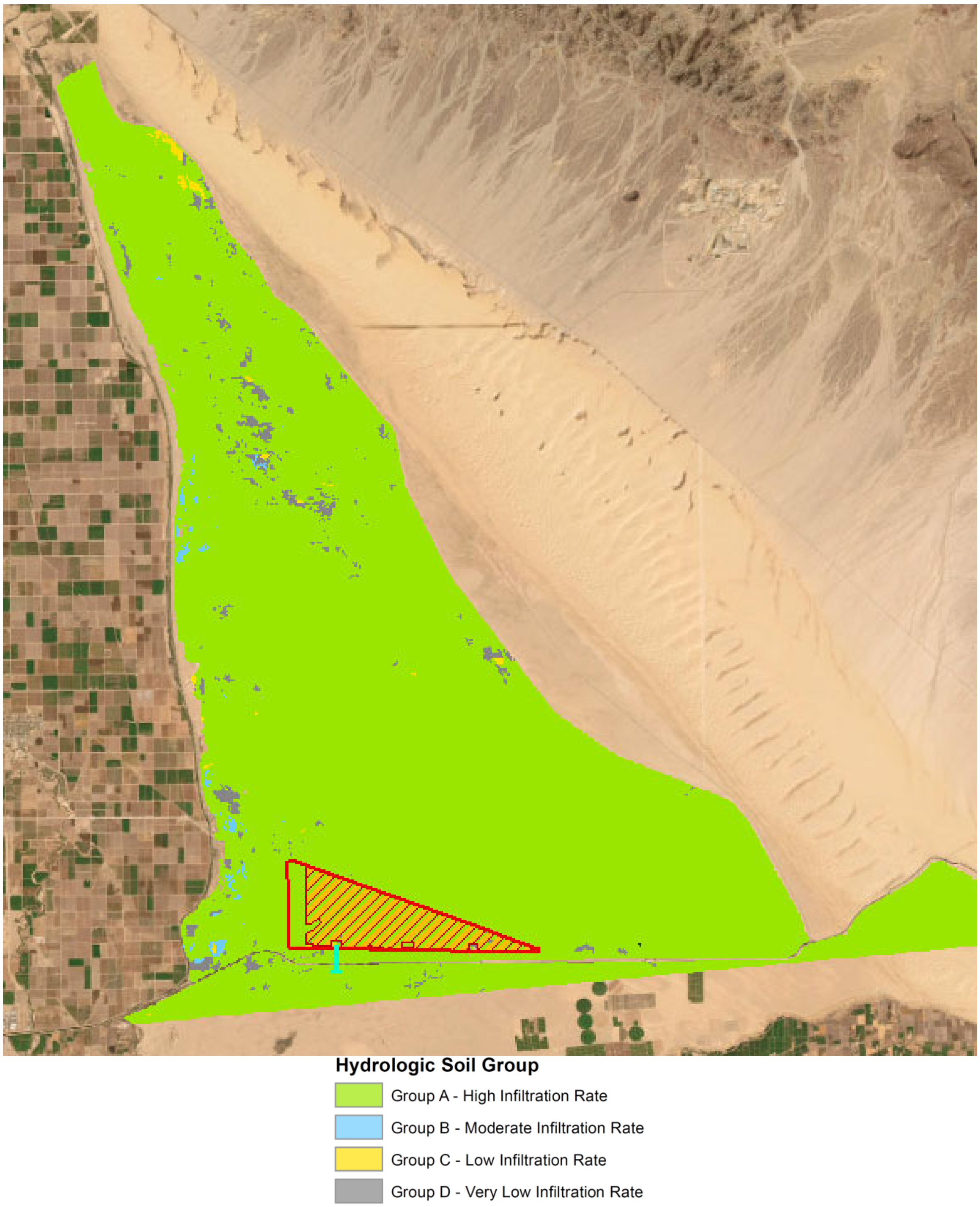

Figure 1-12 IP Perkins Study Area Hydrologic Soil Classification

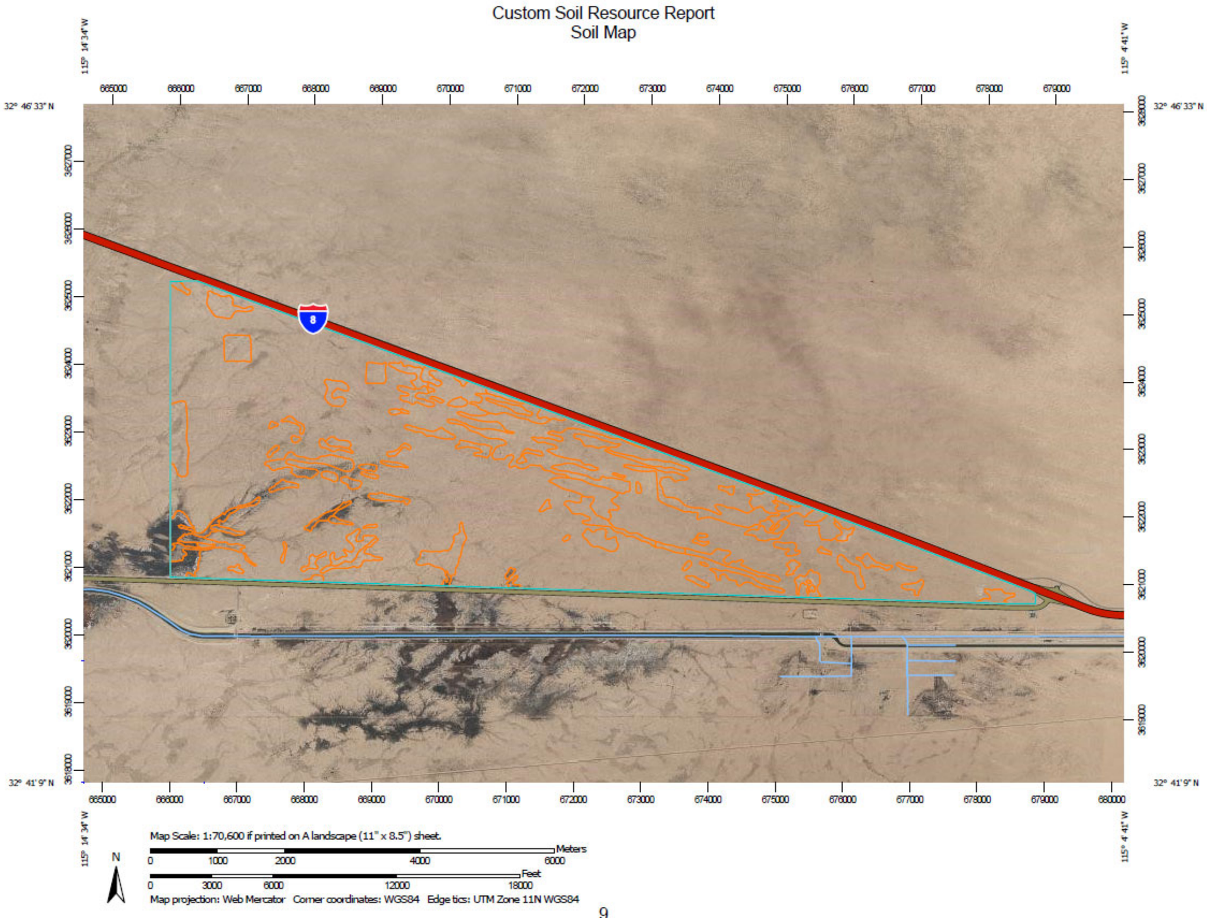

Figure 1-13 IP Perkins Soil Map Units

Table 1-10 IP Perkins Soil Percent Composition

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
100	Antho loamy fine sand	0.4	0.0%
108	Holtville loam	11.4	0.2%
111	Holtville-Imperial silty clay loams	80.5	1.1%
127	Niland loamy fine sand	35.1	0.5%
129	Pits	2.4	0.0%
132	Rositas fine sand, 0 to 2 percent slopes	852.8	11.3%
133	Rositas fine sand, 2 to 9 percent slopes	110.1	1.5%
135	Rositas fine sand, wet, 0 to 2 percent slopes	105.5	1.4%
136	Rositas loamy fine sand, 0 to 2 percent slopes	5,967.3	79.3%
139	Superstition loamy fine sand	354.7	4.7%
Totals for Area of Interest		**7,522.5**	**100.0%**

1.10 Infiltration

The selected infiltration method for the hydrologic model is the NRCS SCS Curve Number method. This method was implemented in HEC-RAS 6.0 by generating an infiltration layer through intersection of the Land Cover layer with the Soils layer. SCS Curve Numbers were taken from the literature and reflect the latest updates in Curve Number estimation. Curve Numbers were specified for each Hydrologic Soil Group given the NLCD Land Cover type. The infiltration layer in the model takes into consideration surface losses from a precipitation event in the 2D hydraulic computations. **Table 1-11** provides Curve Numbers applied in this analysis.

Table 1-11 SCS Curve Number for IP Perkins Study Area

SCS CURVE NUMBERS FOR EXCESS RUNOFF AND INFILTRATION					
NLCD ID	**NLCD Land Cover**	**A**	**B**	**C**	**D**
11	Open Water	100	100	100	100
21	Developed, Open Space	52	68	78	84
22	Developed, Low Intensity	81	88	90	93
23	Developed, Medium Intensity	84	89	93	94
24	Developed, High Intensity	88	92	93	94
31	Barren Land (Rock/Sand/Clay)	70	81	88	92
41	Deciduous Forest	30	55	70	77
42	Evergreen Forest	30	55	70	77
43	Mixed Forest	30	55	70	77
52	Shrub/Scrub	63	77	85	88
71	Grassland/Herbaceous	30	63	75	85
81	Pasture/Hay	40	61	73	79
82	Cultivated Crops	62	74	82	86
90	Woody Wetlands	86	86	86	86
95	Emergent Herbaceous Wetlands	80	80	80	80

1.11 Wetlands

Wetlands were absent from the study area due to the dry desert type land cover.

1.12 Existing Regulatory Effective FEMA Floodplains

The study area has never been mapped by FEMA and there are no existing regulatory floodplains on or near the study area.

Section 2 IP Perkins 2D Hydraulic Model

2.1 2D Hydraulic Model

A 2-Dimensional hydraulic analysis was performed in HEC-RAS Version 6.0, by generating a 2D mesh from the composite Digital Elevation Model (DEM) raster image, coupled with a land cover layer characterizing the manning's n surface roughness coefficients, the impervious area percentages for given land cover types, and the soils layer with HSG defined by the gSSURGO database. The model then generates an intersection of the Land Cover with the soils to compute infiltration losses. The model had an approximate 8 hour run time due to the large acreage involved.

2.2 Watershed Size and 2D Mesh Cell Size

The IP Perkins Study Area is approximately 7,522.5 acres (11.75 Sq. miles) total. The total contributing watershed size for IP Perkins is 83,668 Acres (130.7 Sq. miles). The 2D mesh cell size used to generate mesh is 200 ft x 200 ft for areas outside the study area boundary limits. This value is appropriate for a desktop analysis. Reasonable cell size for a watershed of this size is between 100 to 300 ft. For the IP Perkins study area within the study area boundary limit, the resolution of the 2D Mesh cell size was refined (See *refinement regions*) to 20 ft x 20 ft cells, to reflect the higher resolution of NextMap 5m terrain data used for the study area in the composite Digital Terrain Model.

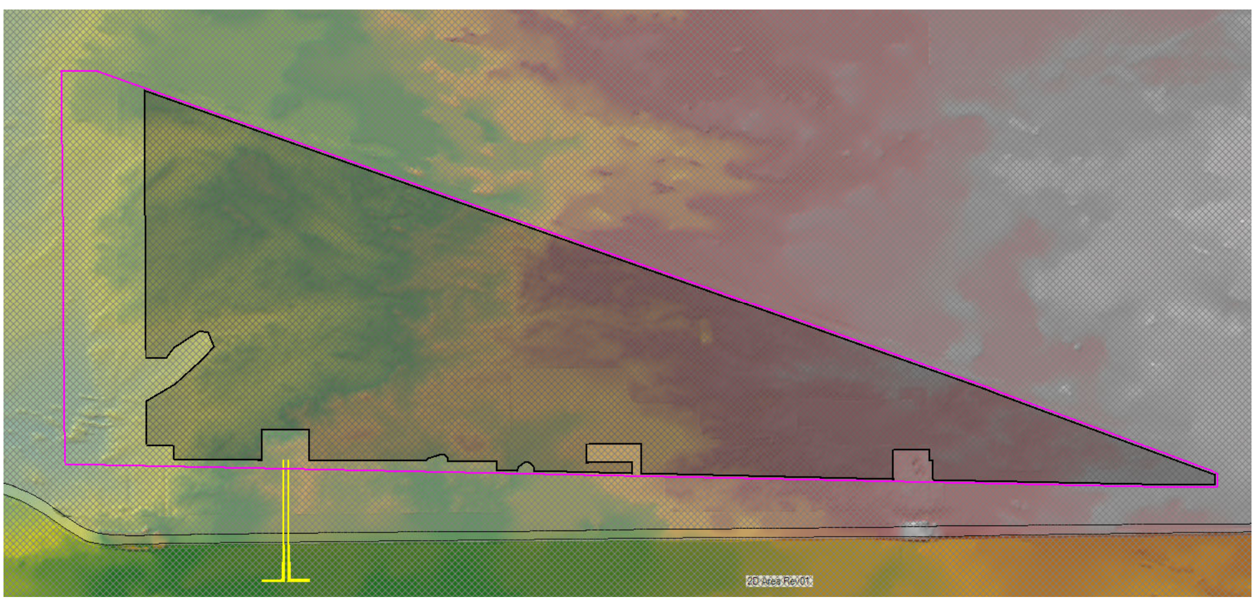

Figure 2-1 2D Mesh for IP Perkins Study Area

2.3 2D Refinement Regions

For this analysis, NextMap 5m Digital Terrain Model raster data was acquired, as this was the best available topographic data at the time of this analysis. The NextMap 5m data was merged with the USGS 10m (1/3 arc second) DEM bare earth terrain models into a composite terrain model. Since the areas within the limits of the study area have a higher resolution terrain than the areas outside the study limits, refinement regions in the 2D mesh were created with a smaller mesh cell size (20 ft x 20 ft) to reflect the higher resolution terrain within the study area limits.

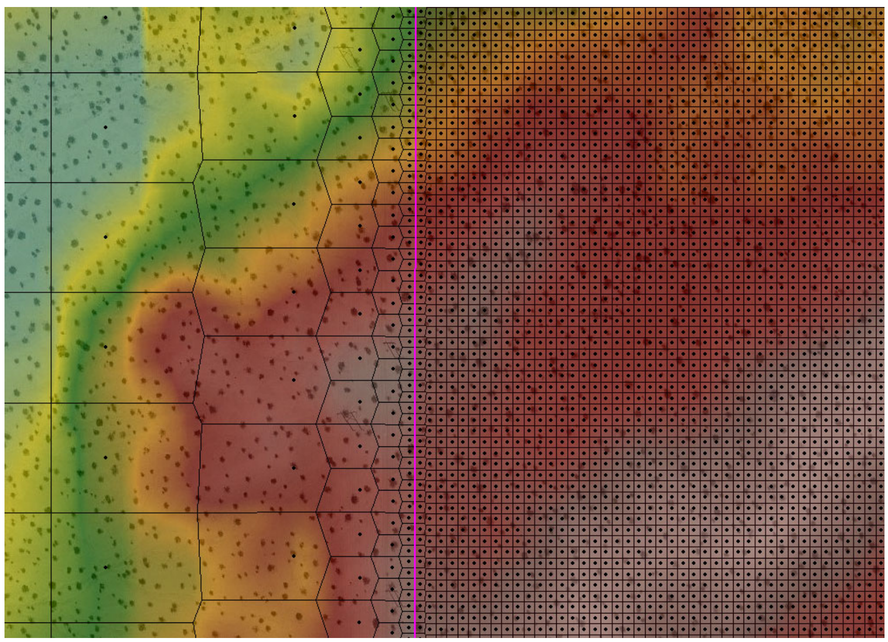

Figure 2-2 2D Mesh Refinement Region Within Study Area Limits

2.4 Boundary Conditions

Due to the hydrologic character of the subwatersheds as being closed basins, and a lack of existing defined hydrologic features the hydrology flow data was modeled using a single storage/2D Flow Area taken as the Deer Peak watershed boundary line, which was selected as the 2D flow area, with a direct precipitation boundary condition (or Rain-on-Mesh). The direct precipitation boundary condition was populated with the 100-YR event rainfall hyetograph values for a 24-hour duration. An unsteady flow date file was then generated as an input for the 2D analysis in HEC-RAS.

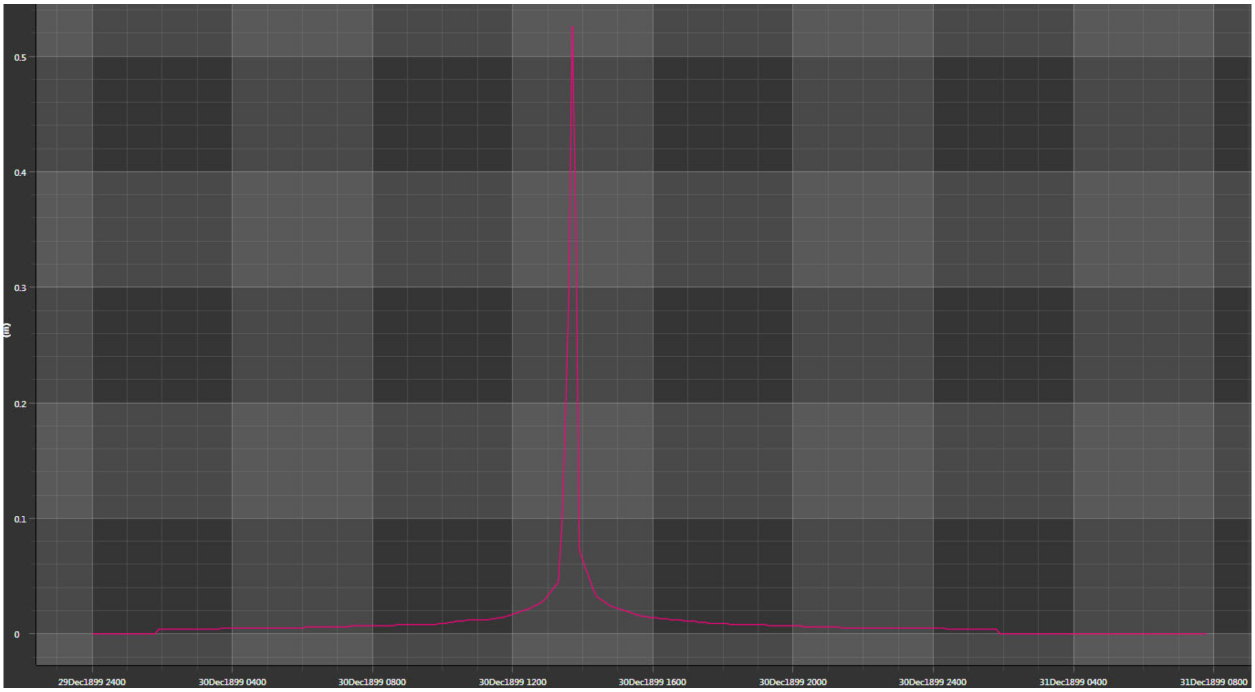

Figure 2-3 Unsteady Flow Data for the Direct Precipitation (Rain-on-Mesh) Boundary Condition

2.5 Time Step

The time step was controlled by a Courant Condition. An advanced time step control was utilized for an adjusted time step based on courant with a maximum courant of 10 seconds and a minimum courant of 0.5. The adjusted time step methodology used for the advanced time step control is the traditional Courant (Velocity * dt / Length). Maximum iterations were set at 20 with the Diffusion Wave equations set. Water Surface Tolerance 0.01, Volume Tolerance 0.01. The model's run time was approximately 8 hours, at this setting.

2.6 2D Flow Area Characteristics

The hydraulic characteristics of the study area are dry, flat desert shrub. Any excess runoff concentrates in shallow pools at low points in the terrain. Pooling of excess runoff is also concentrated near the roadway due to the runoff from the impervious paved asphalt roads. The topography is more or less consistently flat with a predominant slope of 0 to 2.5%. Excess runoff is distributed or dispersed into shallow sheet flow as it traverses the surface at low velocity of less than 1 fps. The runoff eventually reaches the lowest area of elevation and begins to form shallow pools.

2.7 Depth of Flow within Floodplain

The characteristics of the terrain coupled with the low rainfall volume produced in this area of the Southwestern US, produces a floodplain that is dispersed and not particularly well defined, except in those areas where runoff begins to pool at low elevation. The 100-year rainfall for this area is determined by Atlas 14 to be 3.84 inches, which is very low. The flat and gentle sloping of the topography at the foot of the Imperial Valley is a significant distance from the nearest mountainous area and distributes the rainfall uniformly across the watershed area into very shallow sheet flows. The maximum depth of the floodplain, where the water does not pool, is for the most part between 0 and 1 ft, with most flood depths shown by the model to be less than 1 foot for the vast majority of the IP Perkins Study Area. Water begins to pool at lower elevations towards the westerly side of the study area. Man-made grade breaks in the form of agricultural water supply ditches and roads border the agricultural areas surrounding the Eastern outer limits of the City of Holtville within the Imperial Valley agricultural areas to the West of the Study Area. The ditch systems to the west and south of the study area are primarily for irrigation purposes, including the All-American Canal which is operated by the Imperial Irrigation District upstream of the study area at the Imperial Diversion Dam. The All-American Canal is a man-made canal lined with concrete on both sides. The All-American canal is outside of the Deer Peak Watershed boundary and does not contribute any discharges into the watershed.

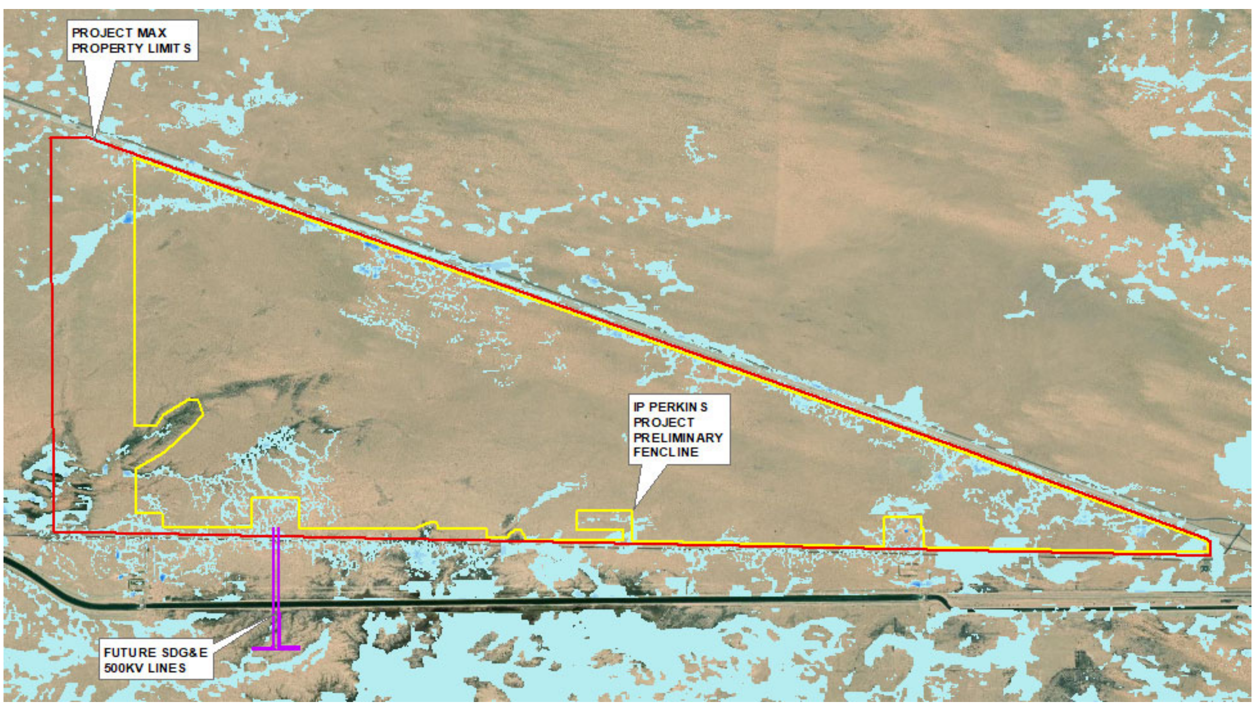

Figure 2-4 2D Max Floodplain Depth for IP Perkins

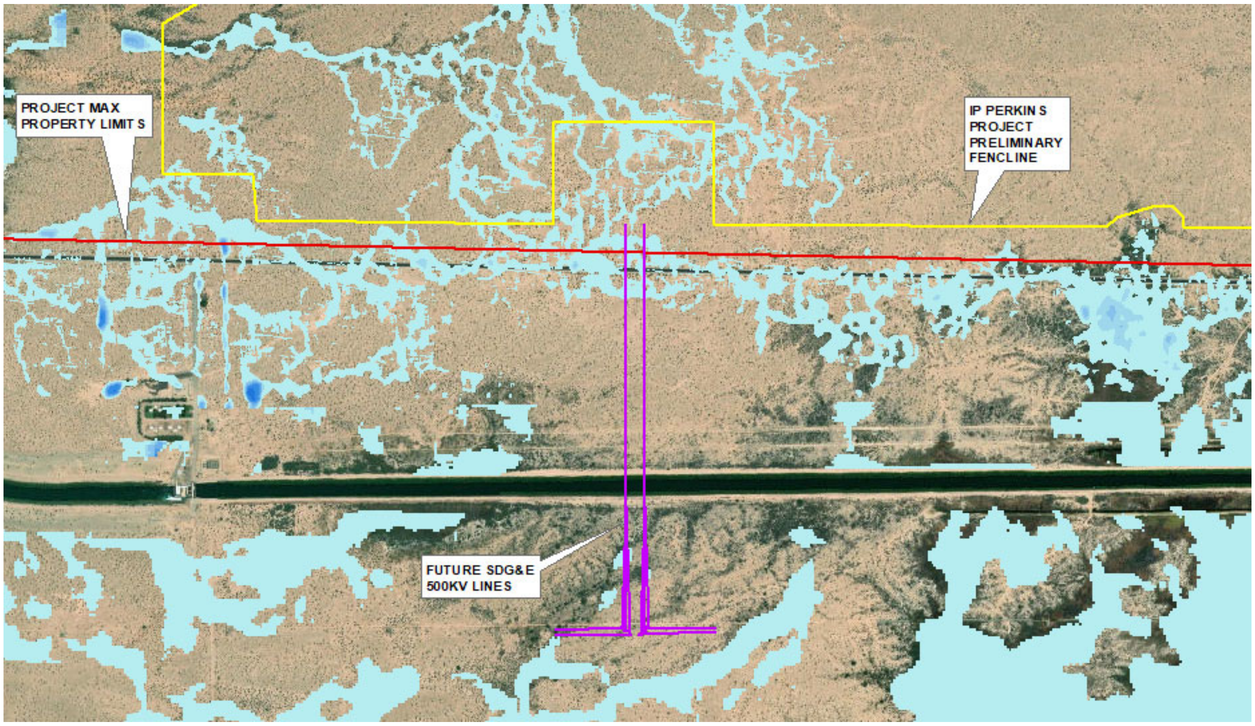

Figure 2-5 2D Max Floodplain Depth near SDG&E 500kV Lines

The locations within the study area most affected by the flood inundation from the 100-yr flood were shown to be those at the lowest elevations within the Terrain model which is consistent with a closed basin. *Given the limited extents, shallow depth and undefined character of the computed flood inundation boundaries, the desktop analysis indicates that the IP Perkins study area has a low flood risk profile, when considering that the rainfall event modeled is the 100-Yr/24-Hr (1% annual chance) storm event.*

2.8 Velocity of Flow within Floodplain

In general velocities within the floodplain were shown to be within 0 to 1 ft per second. In some isolated areas the velocity may reach 2 ft per second, however, these velocities would brief, as the flow velocity would drop significantly following the peak of the response to less than 1 fps. The flat nature of the study area effectively distributes the flow into low velocity distributed sheet flow.

HYDROLOGIC & HYDRAULIC 2D ANALYSIS

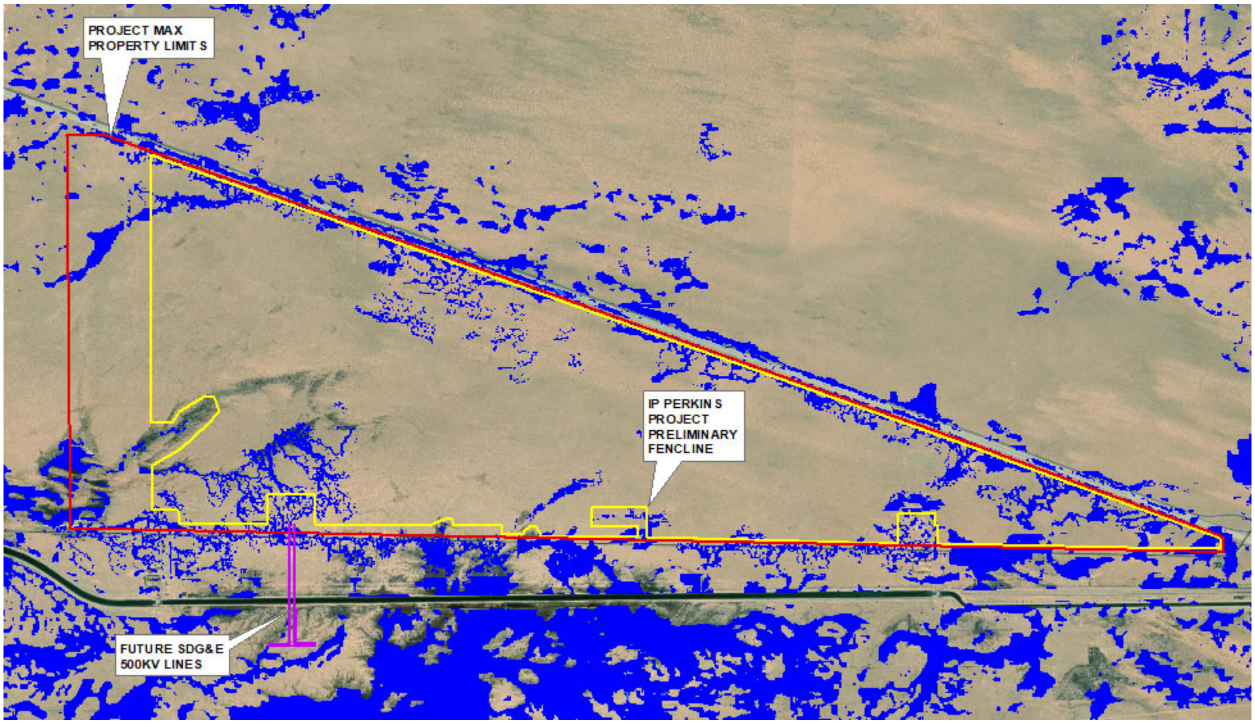

Figure 2-6 2D Max Floodplain Velocity for IP Perkins

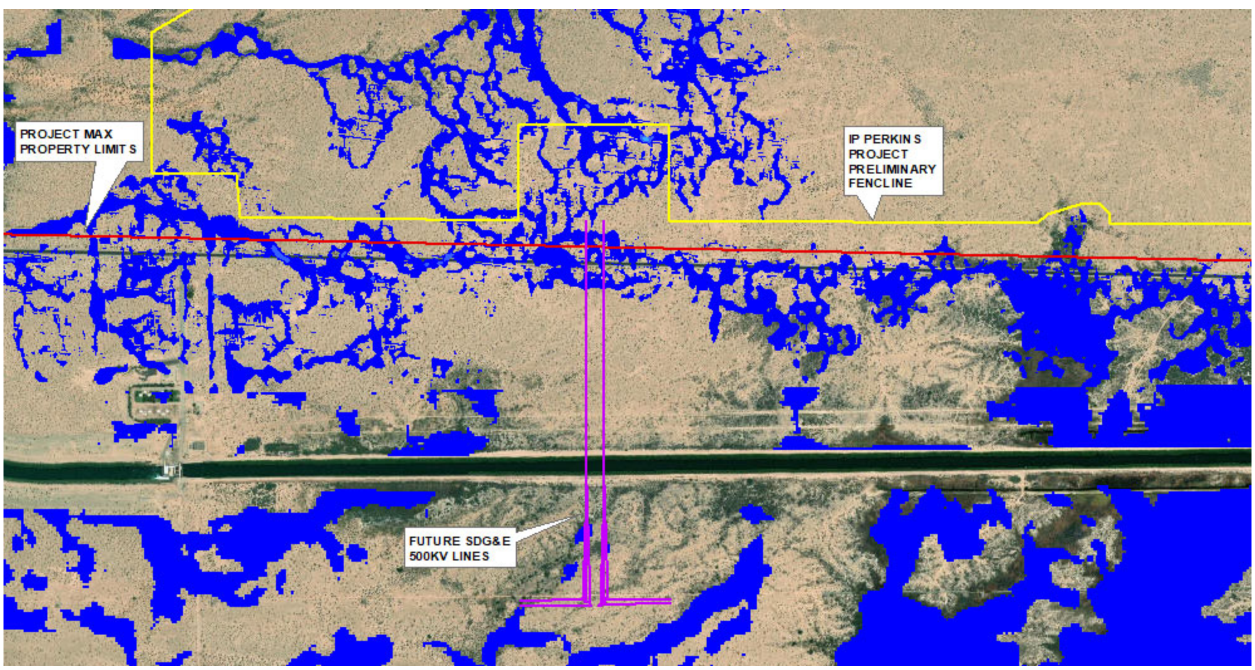

Figure 2-7 Max Floodplain Velocity near SDG&E 500kV Lines

2.9 Discussion of Results

The IP Perkins study area has a generally low maximum floodplain inundation depth of 1 foot or less, with velocities of 1 fps or less. Consequently, the IP Perkins Study area *has a low flood risk* which is consistent with the hydrologic characteristics, including Group A soils (high infiltration), low annual rainfall (3 inches +/-), and a low 100-YR/24-Hr point rainfall volume of 3.84 inches (NOAA Atlas 14).

The results shown by the model are in line with expectations given the dry and mostly flat topography of the study area. Due to the flat nature of the terrain in the vicinity of the study area, and the relatively low rainfall for the 100-year storm event, a more detailed analysis would likely not yield results that would produce a significantly different output. However, for the purposes of a desktop analysis, these results appear to show a reasonable output based on terrain and climate, the data sets utilized, the quality of the digital elevation model and the underlying assumptions used in the hydrologic and hydraulic models. Once LiDAR data becomes publicly available for the study area, this model might be enhanced with the 1-meter topographic data, and a 2-D analysis re-run to provide a more refined 2-D model. When and if this study area warrants a more detailed analysis, and at the request of the owner, the additional analysis and more refined topographic data could be taken and implemented into the existing model to ascertain a higher level of analysis and output.

NOAA Atlas 14, Volume 6, Version 2
Location name: Holtville, California, USA*
Latitude: 32.7288°, Longitude: -115.1811°
Elevation: 96.58 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.080** (0.068-0.096)	**0.123** (0.104-0.147)	**0.185** (0.156-0.222)	**0.240** (0.201-0.290)	**0.324** (0.261-0.406)	**0.396** (0.312-0.507)	**0.476** (0.366-0.626)	**0.567** (0.423-0.768)	**0.707** (0.504-1.00)	**0.829** (0.571-1.22)
10-min	**0.115** (0.098-0.137)	**0.176** (0.149-0.211)	**0.265** (0.224-0.318)	**0.345** (0.288-0.416)	**0.465** (0.375-0.582)	**0.567** (0.448-0.726)	**0.682** (0.524-0.897)	**0.813** (0.607-1.10)	**1.01** (0.723-1.43)	**1.19** (0.818-1.75)
15-min	**0.139** (0.118-0.166)	**0.213** (0.181-0.255)	**0.321** (0.271-0.384)	**0.417** (0.348-0.503)	**0.562** (0.453-0.703)	**0.686** (0.541-0.879)	**0.825** (0.634-1.09)	**0.984** (0.734-1.33)	**1.23** (0.874-1.73)	**1.44** (0.989-2.11)
30-min	**0.191** (0.162-0.228)	**0.293** (0.248-0.350)	**0.441** (0.372-0.528)	**0.573** (0.479-0.692)	**0.773** (0.623-0.967)	**0.944** (0.744-1.21)	**1.14** (0.872-1.49)	**1.35** (1.01-1.83)	**1.69** (1.20-2.38)	**1.98** (1.36-2.90)
60-min	**0.267** (0.226-0.318)	**0.409** (0.346-0.489)	**0.615** (0.519-0.737)	**0.799** (0.668-0.966)	**1.08** (0.869-1.35)	**1.32** (1.04-1.69)	**1.58** (1.22-2.08)	**1.89** (1.41-2.56)	**2.35** (1.68-3.33)	**2.76** (1.90-4.05)
2-hr	**0.371** (0.314-0.442)	**0.551** (0.466-0.658)	**0.809** (0.682-0.969)	**1.04** (0.867-1.25)	**1.38** (1.11-1.73)	**1.67** (1.32-2.14)	**1.99** (1.53-2.62)	**2.35** (1.76-3.19)	**2.91** (2.07-4.11)	**3.39** (2.33-4.97)
3-hr	**0.422** (0.358-0.503)	**0.621** (0.525-0.741)	**0.903** (0.762-1.08)	**1.15** (0.963-1.39)	**1.52** (1.23-1.91)	**1.84** (1.45-2.35)	**2.18** (1.68-2.87)	**2.57** (1.92-3.49)	**3.17** (2.26-4.48)	**3.68** (2.53-5.40)
6-hr	**0.513** (0.434-0.611)	**0.747** (0.632-0.891)	**1.08** (0.910-1.29)	**1.37** (1.15-1.65)	**1.80** (1.45-2.25)	**2.16** (1.71-2.77)	**2.56** (1.97-3.37)	**3.01** (2.24-4.07)	**3.68** (2.62-5.21)	**4.25** (2.93-6.25)
12-hr	**0.589** (0.499-0.702)	**0.863** (0.730-1.03)	**1.25** (1.06-1.50)	**1.60** (1.33-1.93)	**2.10** (1.70-2.63)	**2.53** (1.99-3.24)	**3.00** (2.30-3.94)	**3.52** (2.62-4.76)	**4.29** (3.06-6.07)	**4.95** (3.41-7.27)
24-hr	**0.732** (0.646-0.845)	**1.08** (0.955-1.25)	**1.58** (1.39-1.83)	**2.02** (1.77-2.36)	**2.68** (2.27-3.23)	**3.23** (2.69-3.97)	**3.84** (3.12-4.82)	**4.52** (3.58-5.82)	**5.53** (4.22-7.39)	**6.39** (4.72-8.82)
2-day	**0.821** (0.726-0.948)	**1.22** (1.08-1.41)	**1.79** (1.58-2.08)	**2.30** (2.01-2.68)	**3.05** (2.59-3.67)	**3.68** (3.06-4.51)	**4.37** (3.56-5.48)	**5.14** (4.08-6.62)	**6.29** (4.80-8.41)	**7.26** (5.37-10.0)
3-day	**0.870** (0.769-1.00)	**1.30** (1.14-1.50)	**1.91** (1.68-2.21)	**2.44** (2.13-2.85)	**3.24** (2.75-3.90)	**3.91** (3.25-4.79)	**4.64** (3.77-5.82)	**5.45** (4.32-7.02)	**6.66** (5.08-8.90)	**7.68** (5.68-10.6)
4-day	**0.909** (0.803-1.05)	**1.35** (1.20-1.56)	**1.99** (1.75-2.30)	**2.55** (2.23-2.97)	**3.37** (2.86-4.06)	**4.06** (3.38-4.98)	**4.81** (3.92-6.04)	**5.65** (4.48-7.27)	**6.88** (5.25-9.21)	**7.93** (5.86-10.9)
7-day	**0.961** (0.849-1.11)	**1.43** (1.26-1.65)	**2.09** (1.84-2.42)	**2.66** (2.33-3.11)	**3.51** (2.97-4.22)	**4.21** (3.50-5.16)	**4.97** (4.04-6.24)	**5.81** (4.61-7.48)	**7.05** (5.38-9.43)	**8.09** (5.98-11.2)
10-day	**0.990** (0.875-1.14)	**1.47** (1.30-1.70)	**2.14** (1.89-2.48)	**2.73** (2.38-3.18)	**3.58** (3.04-4.31)	**4.29** (3.57-5.26)	**5.05** (4.11-6.34)	**5.89** (4.67-7.58)	**7.12** (5.43-9.52)	**8.15** (6.02-11.2)
20-day	**1.08** (0.950-1.24)	**1.60** (1.42-1.85)	**2.34** (2.06-2.71)	**2.96** (2.59-3.46)	**3.87** (3.28-4.65)	**4.60** (3.83-5.64)	**5.39** (4.38-6.76)	**6.24** (4.95-8.03)	**7.46** (5.70-9.98)	**8.47** (6.26-11.7)
30-day	**1.15** (1.01-1.32)	**1.72** (1.52-1.99)	**2.52** (2.22-2.92)	**3.19** (2.79-3.73)	**4.16** (3.52-5.00)	**4.93** (4.10-6.05)	**5.75** (4.68-7.21)	**6.63** (5.26-8.53)	**7.88** (6.01-10.5)	**8.89** (6.58-12.3)
45-day	**1.25** (1.10-1.44)	**1.90** (1.68-2.20)	**2.78** (2.45-3.23)	**3.53** (3.08-4.12)	**4.58** (3.88-5.51)	**5.41** (4.50-6.64)	**6.28** (5.11-7.88)	**7.21** (5.72-9.28)	**8.51** (6.49-11.4)	**9.55** (7.06-13.2)
60-day	**1.34** (1.18-1.55)	**2.06** (1.82-2.38)	**3.03** (2.66-3.51)	**3.84** (3.35-4.48)	**4.96** (4.21-5.97)	**5.86** (4.87-7.19)	**6.78** (5.52-8.51)	**7.76** (6.15-9.98)	**9.11** (6.95-12.2)	**10.2** (7.52-14.1)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.
Please refer to NOAA Atlas 14 document for more information.

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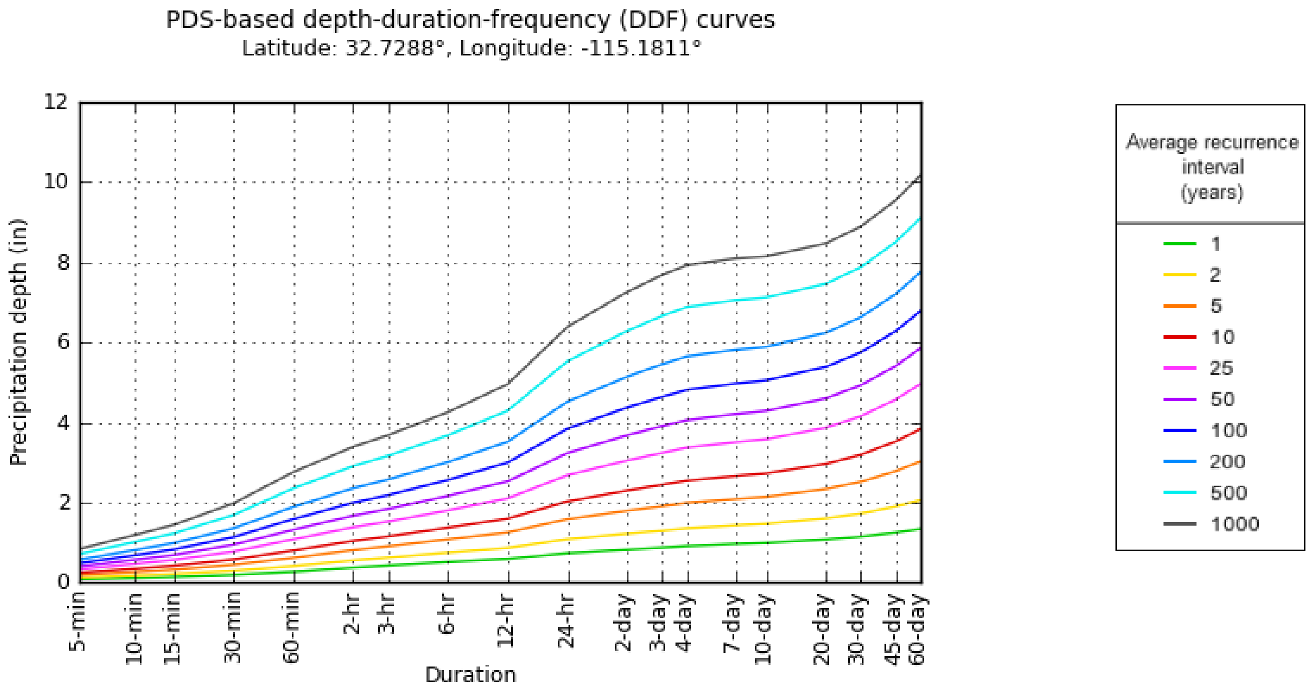
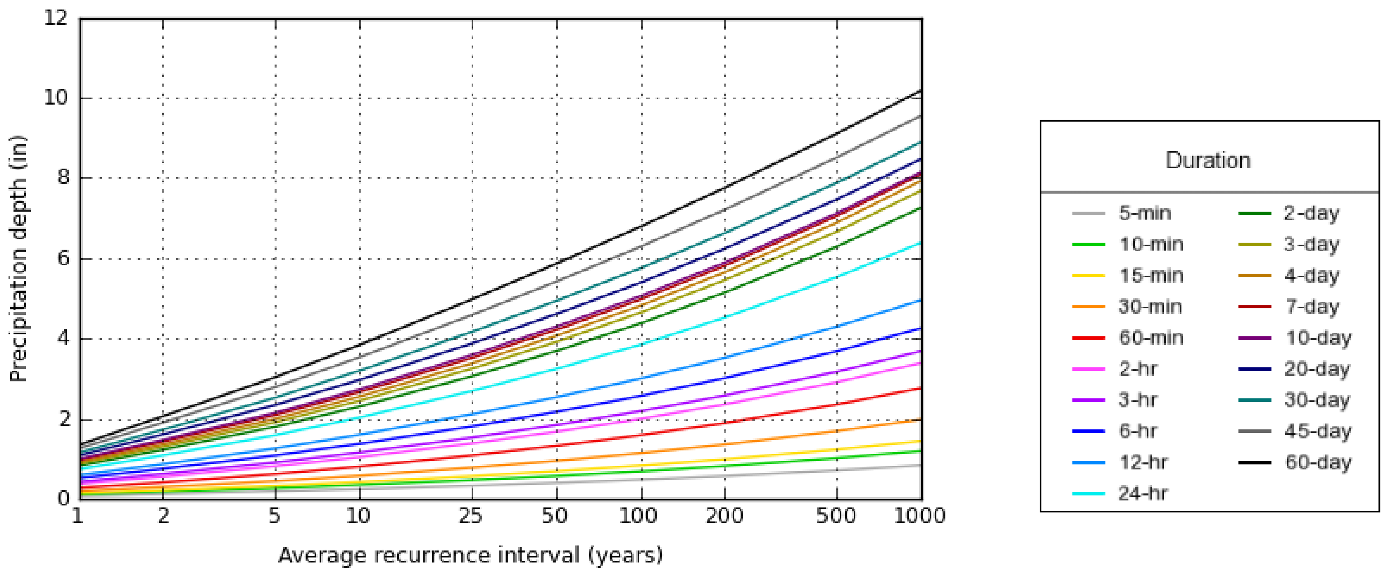
PF graphical





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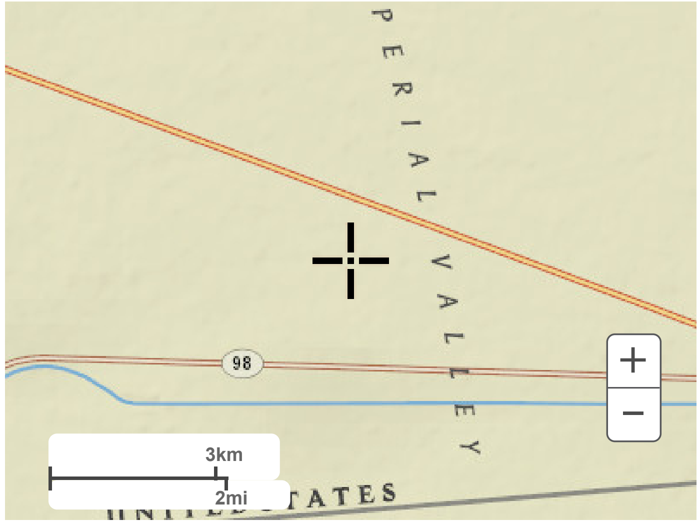
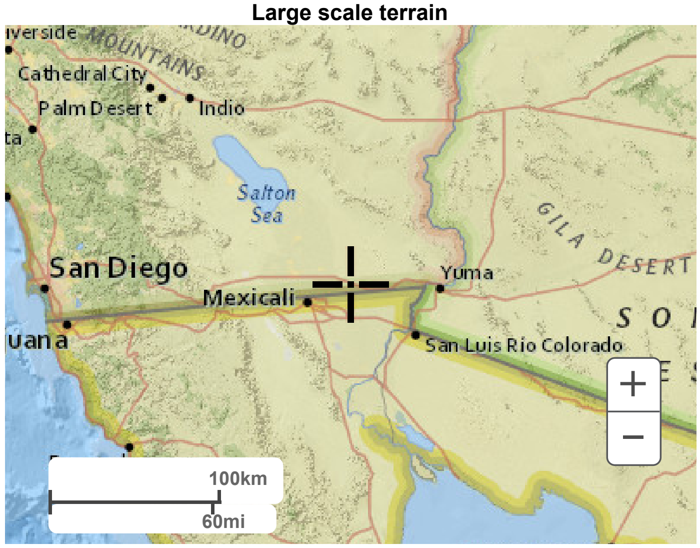
Maps & aerials

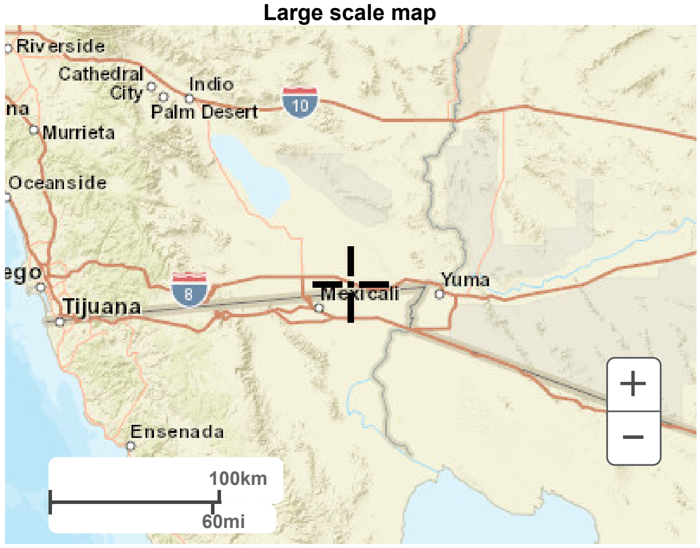
Small scale terrain



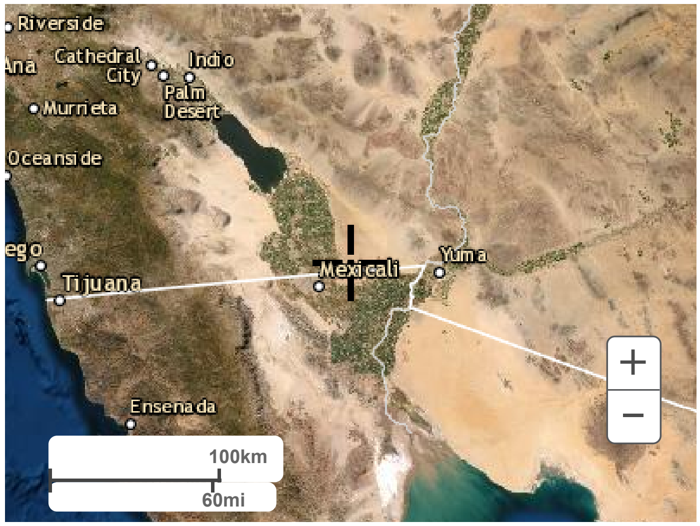
Large scale terrain



Large scale map



Large scale aerial



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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

United States
Department of
Agriculture

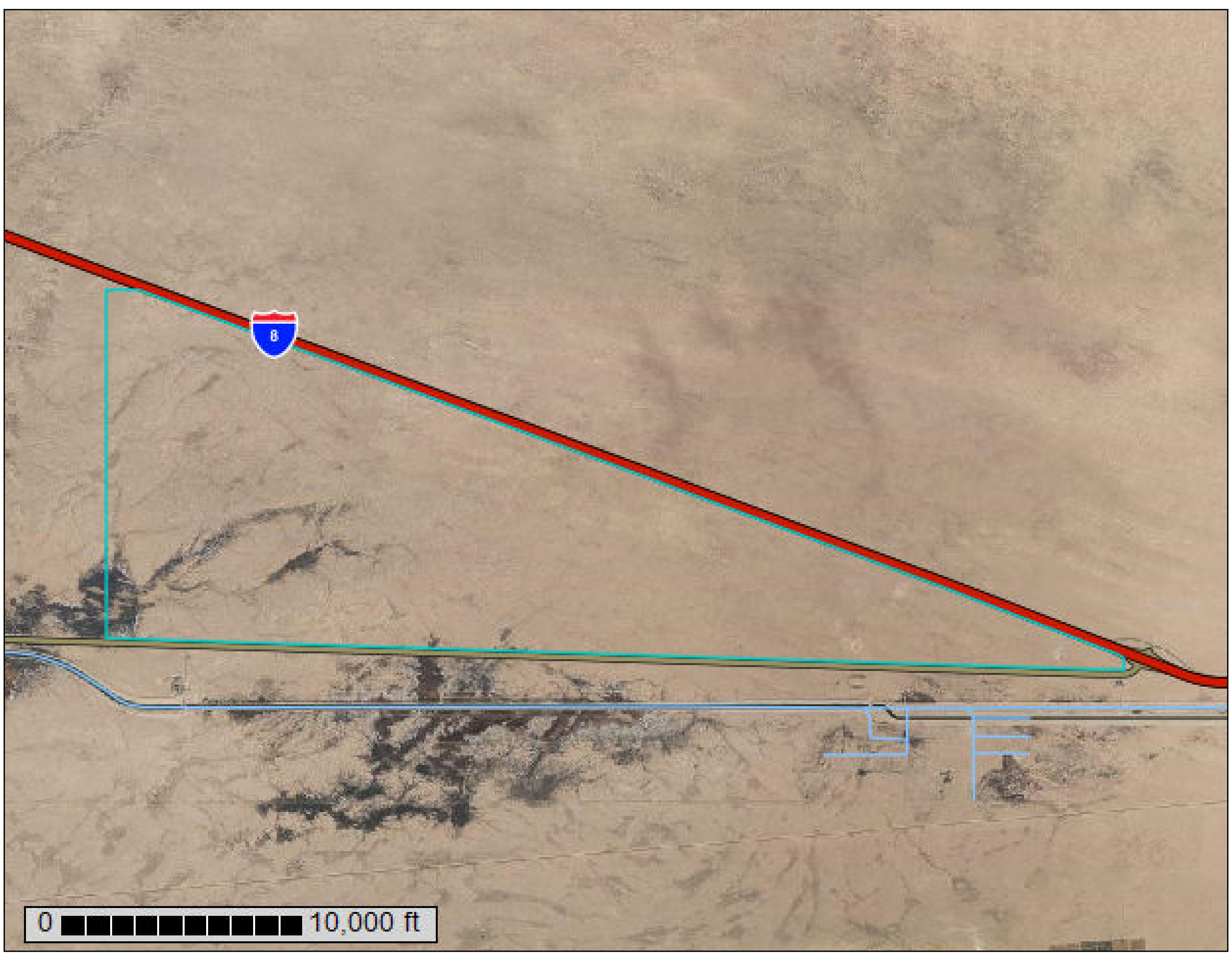
NRCS

Natural
Resources
Conservation
Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Imperial County, California, Imperial Valley Area

IP Perkins



January 19, 2024

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

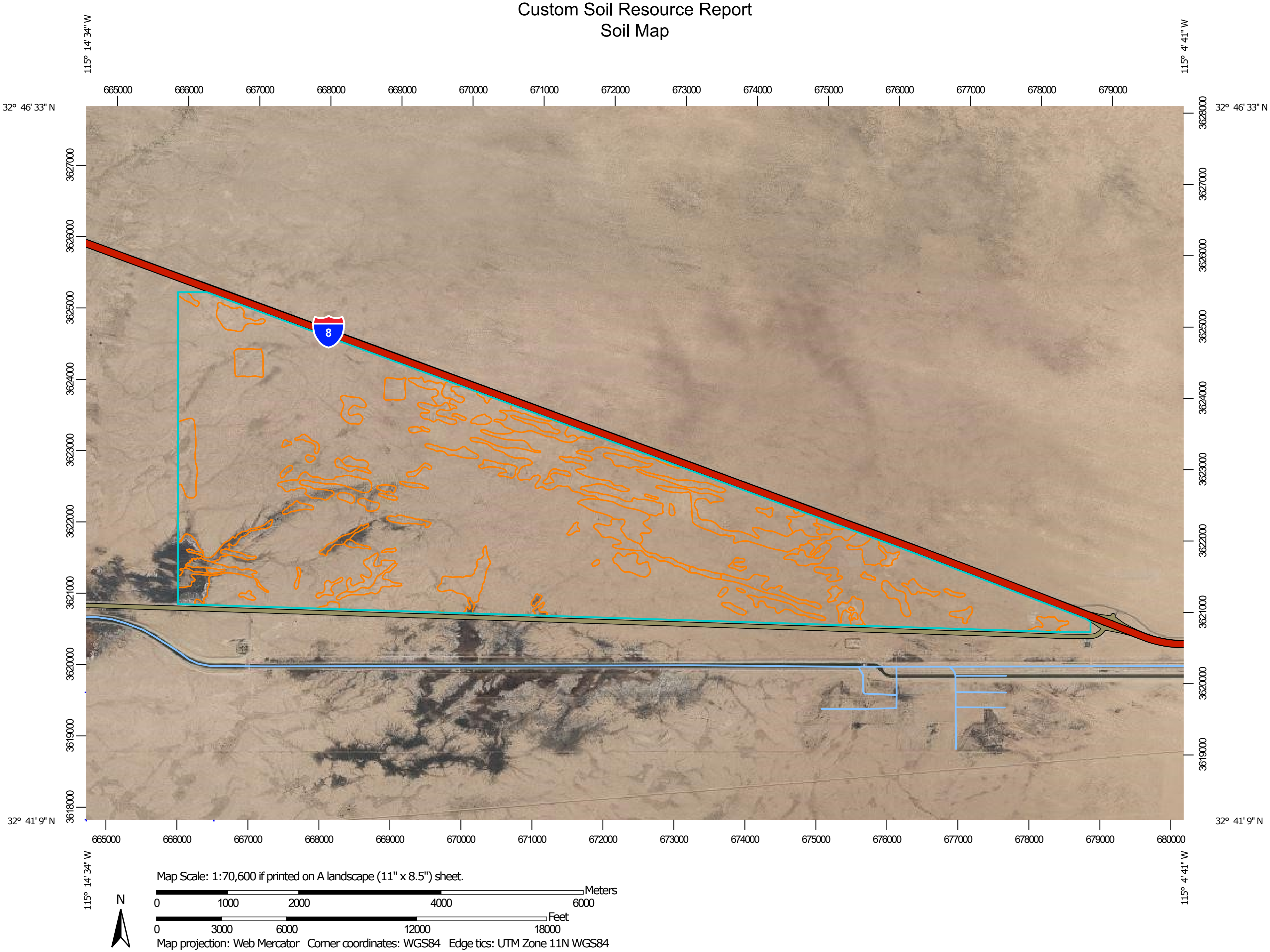
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:70,600 if printed on A landscape (11" x 8.5") sheet.

Meters: 0, 1000, 2000, 4000, 6000

Feet: 0, 3000, 6000, 12000, 18000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Imperial County, California, Imperial Valley Area
Survey Area Data: Version 15, Aug 30, 2023

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 17, 2021—May 22, 2021

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
100	Antho loamy fine sand	0.4	0.0%
108	Holtville loam	11.4	0.2%
111	Holtville-Imperial silty clay loams	80.5	1.1%
127	Niland loamy fine sand	35.1	0.5%
129	Pits	2.4	0.0%
132	Rositas fine sand, 0 to 2 percent slopes	852.8	11.3%
133	Rositas fine sand, 2 to 9 percent slopes	110.1	1.5%
135	Rositas fine sand, wet, 0 to 2 percent slopes	105.5	1.4%
136	Rositas loamy fine sand, 0 to 2 percent slopes	5,967.3	79.3%
139	Superstition loamy fine sand	354.7	4.7%
Totals for Area of Interest		**7,522.5**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Imperial County, California, Imperial Valley Area

100—Antho loamy fine sand

Map Unit Setting

National map unit symbol: h8z6
Elevation: 30 to 350 feet
Mean annual precipitation: 0 to 3 inches
Mean annual air temperature: 72 to 75 degrees F
Frost-free period: 300 to 350 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Antho and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Antho

Setting

Landform: Basin floors
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from mixed sources

Typical profile

H1 - 0 to 13 inches: loamy fine sand
H2 - 13 to 60 inches: sandy loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 6.3 inches)

Interpretive groups

Land capability classification (irrigated): 2s
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: A
Ecological site: R040XD007CA - Lacustrine Basin and Large RIver Floodplain
Hydric soil rating: No

Minor Components

Laveen

Percent of map unit: 5 percent
Hydric soil rating: No

Holtville

Percent of map unit: 5 percent
Hydric soil rating: No

108—Holtville loam

Map Unit Setting

National map unit symbol: h8zg
Elevation: 30 to 350 feet
Mean annual precipitation: 0 to 3 inches
Mean annual air temperature: 70 to 75 degrees F
Frost-free period: 300 to 350 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Holtville and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Holtville

Setting

Landform: Basin floors
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from mixed sources and/or lacustrine deposits derived from mixed sources

Typical profile

H1 - 0 to 14 inches: loam
H2 - 14 to 22 inches: clay
H3 - 22 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Very slightly saline to moderately saline (2.0 to 8.0 mmhos/cm)
Sodium adsorption ratio, maximum: 10.0
Available water supply, 0 to 60 inches: High (about 9.4 inches)

Interpretive groups

Land capability classification (irrigated): 2s
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: R040XD007CA - Lacustrine Basin and Large RIver Floodplain
Hydric soil rating: No

Minor Components

Imperial

Percent of map unit: 3 percent
Hydric soil rating: No

Superstition

Percent of map unit: 3 percent
Hydric soil rating: No

Antho, silty clay surface

Percent of map unit: 3 percent

Laveen

Percent of map unit: 3 percent
Hydric soil rating: No

Antho

Percent of map unit: 3 percent
Hydric soil rating: No

111—Holtville-Imperial silty clay loams

Map Unit Setting

National map unit symbol: h8zk
Elevation: -230 to 350 feet
Mean annual precipitation: 0 to 3 inches
Mean annual air temperature: 72 to 75 degrees F
Frost-free period: 300 to 350 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Holtville and similar soils: 50 percent
Imperial and similar soils: 40 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Holtville

Setting

Landform: Basin floors
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear

Parent material: Alluvium derived from mixed sources

Typical profile

H1 - 0 to 10 inches: silty clay loam
H2 - 10 to 22 inches: clay
H3 - 22 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Very slightly saline to moderately saline (2.0 to 8.0 mmhos/cm)
Sodium adsorption ratio, maximum: 10.0
Available water supply, 0 to 60 inches: High (about 9.6 inches)

Interpretive groups

Land capability classification (irrigated): 3s
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: R040XD007CA - Lacustrine Basin and Large RIver Floodplain
Hydric soil rating: No

Description of Imperial

Setting

Landform: Basin floors
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from mixed and/or lacustrine deposits

Typical profile

H1 - 0 to 12 inches: silty clay loam
H2 - 12 to 60 inches: silty clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Slightly saline to moderately saline (4.0 to 8.0 mmhos/cm)
Sodium adsorption ratio, maximum: 20.0
Available water supply, 0 to 60 inches: Moderate (about 8.6 inches)

Interpretive groups

Land capability classification (irrigated): 3s
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Ecological site: R040XD007CA - Lacustrine Basin and Large RIver Floodplain
Hydric soil rating: No

Minor Components

Niland

Percent of map unit: 5 percent
Hydric soil rating: No

Antho

Percent of map unit: 5 percent
Hydric soil rating: No

127—Niland loamy fine sand

Map Unit Setting

National map unit symbol: h902
Elevation: 30 to 310 feet
Mean annual precipitation: 0 to 3 inches
Mean annual air temperature: 70 to 75 degrees F
Frost-free period: 300 to 350 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Niland and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Niland

Setting

Landform: Basin floors
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from mixed

Typical profile

H1 - 0 to 23 inches: loamy fine sand
H2 - 23 to 60 inches: silty clay

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Very slightly saline to strongly saline (2.0 to 16.0 mmhos/cm)
Sodium adsorption ratio, maximum: 10.0
Available water supply, 0 to 60 inches: Moderate (about 6.5 inches)

Interpretive groups
Land capability classification (irrigated): 3s
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Ecological site: R040XD007CA - Lacustrine Basin and Large RIver Floodplain
Hydric soil rating: No

Minor Components

Imperial
Percent of map unit: 4 percent
Hydric soil rating: No

Holtville
Percent of map unit: 4 percent
Hydric soil rating: No

Rositas
Percent of map unit: 4 percent
Hydric soil rating: No

Superstition
Percent of map unit: 3 percent
Hydric soil rating: No

129—Pits

Map Unit Setting
National map unit symbol: h904
Elevation: 30 to 300 feet
Mean annual precipitation: 0 to 3 inches
Mean annual air temperature: 72 to 75 degrees F
Frost-free period: 300 to 350 days
Farmland classification: Not prime farmland

Map Unit Composition
Pits: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pits

Setting

Landform: Basin floors
Down-slope shape: Linear
Across-slope shape: Linear

Typical profile

H1 - 0 to 60 inches: variable

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8e
Hydric soil rating: No

Minor Components

Unnamed

Percent of map unit: 10 percent
Landform: Sinkholes
Hydric soil rating: Yes

132—Rositas fine sand, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: h907
Elevation: -230 to 350 feet
Mean annual precipitation: 0 to 3 inches
Mean annual air temperature: 70 to 75 degrees F
Frost-free period: 300 to 350 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Rositas and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rositas

Setting

Landform: Basin floors
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from mixed and/or eolian deposits derived from mixed

Typical profile

H1 - 0 to 9 inches: fine sand
H2 - 9 to 60 inches: sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Very slightly saline to slightly saline (2.0 to 4.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): 3s
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: A
Ecological site: R040XD025CA - Sandsheet [2-4" p.z.]
Hydric soil rating: No

Minor Components

Vint

Percent of map unit: 4 percent
Hydric soil rating: No

Niland

Percent of map unit: 4 percent
Hydric soil rating: No

Rositas

Percent of map unit: 4 percent
Hydric soil rating: No

Holtville

Percent of map unit: 1 percent
Hydric soil rating: No

Antho

Percent of map unit: 1 percent
Hydric soil rating: No

Superstition

Percent of map unit: 1 percent
Hydric soil rating: No

133—Rositas fine sand, 2 to 9 percent slopes

Map Unit Setting

National map unit symbol: h908
Elevation: -230 to 360 feet

Mean annual precipitation: 0 to 3 inches
Mean annual air temperature: 70 to 75 degrees F
Frost-free period: 300 to 350 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Rositas and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rositas

Setting

Landform: Sand sheets, alluvial fans
Landform position (three-dimensional): Tread, rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Eolian deposits derived from mixed

Typical profile

H1 - 0 to 9 inches: fine sand
H2 - 9 to 60 inches: sand

Properties and qualities

Slope: 2 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Very slightly saline to slightly saline (2.0 to 4.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): 3s
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: A
Ecological site: R040XD025CA - Sandsheet [2-4" p.z.]
Hydric soil rating: No

Minor Components

Vint

Percent of map unit: 3 percent
Hydric soil rating: No

Antho

Percent of map unit: 3 percent
Hydric soil rating: No

Holtville

Percent of map unit: 3 percent
Hydric soil rating: No

Indio

Percent of map unit: 3 percent
Hydric soil rating: No

Superstition

Percent of map unit: 3 percent
Hydric soil rating: No

135—Rositas fine sand, wet, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: h90b
Elevation: -230 to 350 feet
Mean annual precipitation: 0 to 3 inches
Mean annual air temperature: 70 to 75 degrees F
Frost-free period: 300 to 350 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Rositas, wet, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rositas, Wet

Setting

Landform: Basin floors
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from mixed and/or eolian deposits derived from mixed

Typical profile

H1 - 0 to 9 inches: fine sand
H2 - 9 to 60 inches: sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Very slightly saline to slightly saline (2.0 to 4.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: A
Ecological site: R040XD025CA - Sandsheet [2-4" p.z.]
Hydric soil rating: No

Minor Components

Vint

Percent of map unit: 4 percent
Hydric soil rating: No

Superstition

Percent of map unit: 4 percent
Hydric soil rating: No

Carsitas

Percent of map unit: 4 percent
Hydric soil rating: No

Antho

Percent of map unit: 3 percent
Hydric soil rating: No

136—Rositas loamy fine sand, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: h90c
Elevation: 30 to 350 feet
Mean annual precipitation: 0 to 3 inches
Mean annual air temperature: 70 to 75 degrees F
Frost-free period: 300 to 350 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Rositas and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rositas

Setting

Landform: Basin floors
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from mixed sources and/or eolian deposits derived from mixed sources

Typical profile

H1 - 0 to 4 inches: loamy fine sand
H2 - 4 to 60 inches: sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Very slightly saline to slightly saline (2.0 to 4.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.7 inches)

Interpretive groups

Land capability classification (irrigated): 3s
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: A
Ecological site: R040XD025CA - Sandsheet [2-4" p.z.]
Hydric soil rating: No

Minor Components

Antho

Percent of map unit: 5 percent
Hydric soil rating: No

Superstition

Percent of map unit: 5 percent
Hydric soil rating: No

Holtville

Percent of map unit: 3 percent
Hydric soil rating: No

Rositas

Percent of map unit: 2 percent

139—Superstition loamy fine sand

Map Unit Setting

National map unit symbol: h90g
Elevation: 30 to 350 feet
Mean annual precipitation: 0 to 3 inches
Mean annual air temperature: 72 to 75 degrees F
Frost-free period: 300 to 350 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Superstition and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Superstition

Setting

Landform: Alluvial fans
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from mixed

Typical profile

H1 - 0 to 6 inches: loamy fine sand
H2 - 6 to 60 inches: loamy fine sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): 3s
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: A
Ecological site: R040XD025CA - Sandsheet [2-4" p.z.]
Hydric soil rating: No

Minor Components

Rositas

Percent of map unit: 4 percent
Hydric soil rating: No

Antho

Percent of map unit: 4 percent
Hydric soil rating: No

Holtville

Percent of map unit: 3 percent
Hydric soil rating: No

Laveen

Percent of map unit: 3 percent
Hydric soil rating: No

Superstition

Percent of map unit: 1 percent

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Attachment F.3 Water Supply Assessment

Water Supply Assessment

Perkins Renewable Energy Project

February 2025

Prepared for:

Intersect Power (IP Perkins, LLC, a subsidiary of Intersect Power, LLC) and Aspen Environmental Group

Prepared by:
GSI Water Solutions, Inc.
418 Chapala Street, Suite H, Santa Barbara, CA 93101

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Contents

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Graphs

Abbreviations and Acronyms

°F	degrees Fahrenheit
AAC	All-American Canal
AB	Assembly Bill
AF	acre-feet
AFY	acre-feet per year
BAAH	breaker and a half
bgs	below ground surface
BLM	Bureau of Land Management
BOR	U.S. Bureau of Reclamation
CEC	California Energy Commission
CGPS	Continuous Global Positioning System
DRECP	Desert Renewable Energy Conservation Plan
DWR	California Department of Water Resources
EDP	Equitable Distribution Plan
EHC	East Highline Canal
ET	evapotranspiration
Feasibility Study	Focused Water Supply Feasibility Study (GSI, 2024)
GDE	groundwater-dependent ecosystem
GEI	GEI Consultants, Inc.
gen-tie	generation-tie
GSI	GSI Water Solutions, Inc.
GSWC	Golden State Water Company
HWY	highway
IID	Imperial Irrigation District
InSAR	Interferometric Synthetic Aperture Radar
Intersect Power	IP Perkins, LLC, a subsidiary of Intersect Power, LLC
Imperial IRWMP	Imperial Integrated Regional Water Management Plan
IVGB	Imperial Valley Groundwater Basin
IWSP	Interim Water Supply Policy
JCSD	Jacumba Community Services District
JVGB	Jacumba Valley Groundwater Basin
K	hydraulic conductivity
LCRP	Lower Colorado River Project
LCWSP	Lower Colorado Water Supply Project
LUPA	Land Use Plan Amendment
MAF	million acre-feet
mg/L	milligrams per liter
Model	MODFLOW groundwater model

NAVD 88	North American Vertical Datum of 1988
NCCAG	Natural Communities Commonly Associated with Groundwater
NHD	National Hydrography Dataset
NPDES	National Pollutant Discharge Elimination System
OCVGB	Ocotillo-Clark Valley Groundwater Basin
POR	period of record
Project	Perkins Renewable Energy Project
Project Well	proposed Perkins Renewable Energy Project groundwater supply well
PV	photovoltaic
QSA	Quantification Settlement Agreement
RWQCB	Regional Water Quality Control Board
S	storativity
SB	Senate Bill
Scripps	Scripps Institution of Oceanography at the University of California at San Diego
SDCWA	San Diego County Water Authority
SEZ	Solar Energy Zone
SGMA	Sustainable Groundwater Management Act
SWN	State Well Number
Sy	specific yield
TDS	total dissolved solids
TTHM	total trihalomethanes
USGS	U.S. Geological Survey
UWMP	Urban Water Management Plan
WSA	Water Supply Assessment
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

1 Introduction

This Water Supply Assessment (WSA) evaluates the effects of the proposed Perkins Renewable Energy Project (Project), located in Imperial County, California, on groundwater and surface water sources, pursuant to the requirements of California Assembly Bill (AB) 205 California Energy Commission (CEC) Opt-in Regulations and the Desert Renewable Energy Conservation Plan (DRECP) Land Use Plan Amendment (LUPA) (BLM, 2016a, 2016b).

CEC Opt-in Regulations are based in part on the existing information categories established for the evaluation of thermal powerplants. These regulations require that applications contain the information identified in California Code of Regulations, Title 20, Appendix B (AB 205, CEC Opt-in Regulations, § 1877).

The DRECP LUPA required assessment is specific to groundwater. The DRECP LUPA (SW-23) states:

> … the purpose of the Water Supply Assessment is to determine whether over-use or over-draft conditions exist within the project basin(s), and whether the project creates or exacerbates these conditions. The Assessment shall include an evaluation of existing extractions, water rights, and management plans for the water supply in the basin(s) (i.e., cumulative impacts), and whether these cumulative impacts (including the proposed project) can maintain existing land uses as well as existing aquatic, riparian, and other water-dependent resources within the basin(s). (BLM, 2016a)

Because Project permitting will be completed through the CEC Opt-in process, this WSA is not required to be developed pursuant to California Senate Bill (SB) 610 requirements even though the Project is a qualified project as defined in SB 610. However, planning documents, relied upon in this WSA, for several of the potential Project water sources are required to be developed pursuant to SB 610 requirements. Therefore, evaluation of the respective Project water sources in this WSA is generally completed in accordance with SB 610 requirements.

SB 610 requires qualifying projects to determine "whether the total projected water supplies, determined to be available by the city or county for the project during normal, single dry, and multiple dry water years during a 20-year projection, will meet the projected water demand associated with the proposed project, in addition to existing and planned future uses, including agricultural and manufacturing uses" (California Water Code § 10910(c)(4)).

Water for Project construction, operations, and decommissioning may be obtained from several potential sources, including an on-site groundwater well, off-site groundwater wells, trucked from an off-site water purveyor, and through a water wheeling agreement. A Focused Water Supply Feasibility Study (Feasibility Study) (GSI, 2024) was completed for the Project to identify potential location(s) for the construction of a Project groundwater supply well (Project Well), where the well would not capture potential seepage water from the All-American Canal (AAC) or East Highline Canal (EHC). Although the Feasibility Study identifies a potential well location, IP Perkins, LLC, a subsidiary of Intersect Power, LLC (Intersect Power) understands the Imperial Irrigation District (IID) recommends Project water be sourced from water purveyors served by IID or through a water wheeling agreement. Therefore, this WSA evaluates surface water from an off-site purveyor as the primary water source for the Project, and groundwater as a secondary, or supplemental, water source. The identification of surface water as the primary water source and groundwater as a secondary source is based solely on communications with IID and does not establish a prioritization of evaluated water sources, nor is that the intent of this WSA.

Six potential water sources were evaluated for the proposed Project. As presented herein, the Project could obtain water from any of the six sources for any phase of the Project, for the life of the Project, without causing adverse impacts to existing and planned future uses. Project pumping would not cause (1) a chronic lowering of groundwater levels, (2) a degradation in groundwater quality, (3) a decrease in available supply that may affect existing users or water right claimants, (4) land subsidence, increase the rate of subsidence, or loss of aquifer storage, or (5) an impact to any existing GDEs, springs, or seeps.

2 Project Description

Intersect Power proposes to construct, operate, maintain, and decommission an up to 1,150-megawatt solar photovoltaic (PV) and battery energy storage facility on U.S. Department of the Interior Bureau of Land Management (BLM)-administered public lands and private lands between State Highway (HWY) 98 and Interstate 8 in Imperial County (County) east of El Centro, California (see Figure 1) (Aspen, 2024).

The Project would generate and store up to 1,150 megawatts of renewable electricity via arrays of solar PV panels, a battery energy storage system, and appurtenant facilities. The final Project capacity will be based on optimization of buildable acreage and solar PV technology at the time of procurement. The Project would construct a new generation-tie (gen-tie) line(s) that would connect the Project substation(s) to a new high-voltage breaker and a half (BAAH) substation and switchyard. From the BAAH, two new 500 kilovolt loop-in transmission lines would be constructed to interconnect to the existing San Diego Gas and Electric Southwest Powerlink 500-kilovolt transmission line that travels east-west just south of the southern portion of the Project site crossing U.S. Bureau of Reclamation (BOR) lands and terminating in the Imperial Valley Substation southwest of El Centro (Aspen, 2024).

Depending on the timeline of the interconnection agreement, the Project could be operational by as early as late 2027. The Project could operate for up to 50 or more years. At the end of its useful life, the Project would be decommissioned and revegetation would be conducted in accordance with a Project Decommissioning and Revegetation Plan (Aspen, 2024).

The Project solar area covers approximately 4,707.8 acres of BLM-administered public lands, 827.8 acres of BOR lands, and approximately 485.5 acres of private lands, plus an additional 55 acres on BLM and BOR lands for the gen-tie interconnection to the existing San Diego Gas and Electric 500-kilovolt transmission line (see Figure 2). All of the BLM lands within the Project application area are within the designated Development Focus Area, pursuant to the DRECP and its associated Record of Decision (BLM, 2016a, 2016b).

Water use assumptions for the Project include the following:

- **Construction.** During the construction phase, it is anticipated that a maximum of up to 1,000 acre-feet (AF) would be used for dust suppression, truck wheel washing and other purposes during the 24-month construction timeframe. During construction, restroom facilities would be provided by portable units to be serviced by licensed providers. Construction of the Project is planned to begin as early as 2025.
- **Operation.** During operation, the solar array portion of the Project would require the use of approximately 50 AF annually for solar panel washing (up to four times per year) and other uses. IP Perkins, LLC, understands the BLM is considering issuing right-of-way grants for durations of up to 50 years (BLM, 2023). Therefore, for the purpose of this WSA, the Project operational period will be 48 years.[1]
- **Decommissioning.** Project decommissioning at some future date would require water for dust control and site restoration activities. The amount of water required will depend on requirements in place at the time of decommissioning and any advancements in applicable methodologies and technology. For the purpose of this WSA, water use for Project decommissioning is assumed to be equal to twice the operational water use (50 acre-feet per year [AFY] x 2 = 100 AFY) for a duration equal to Project construction (24 months).

[1] The Project operational period and decommissioning period totals 50 years.

As described in Section 1, the total Project life is estimated to be 52 years (including construction, operation, and decommissioning). Therefore, estimated total water use over the life of the Project is approximately 3,600 AF. For groundwater sources, a projected period of 52 years and total Project water use of 3,600 AF is used in this WSA. For surface water sources, a projected period of 20 years (as required by SB 610), or a period consistent with the most recent applicable water management plan is used in this WSA. Table 1 summarizes the Project durations and water use.

Table 1. Project Durations and Water Use

Project Phase	Duration (years)	Water Use (acre-feet per year)	Total Water Use (acre-feet)
Construction	2	500	1,000
Operation	48	50	2,400
Decommissioning	2	100	200
Total	**52**	Not Applicable	**3,600**

The six potential water sources evaluated for the Project include:

Surface Water

- Golden State Water Company (GSWC) of Calipatria, California
- City of Imperial, California
- Desalinated seawater from San Diego County Water Authority (SDCWA)

Groundwater

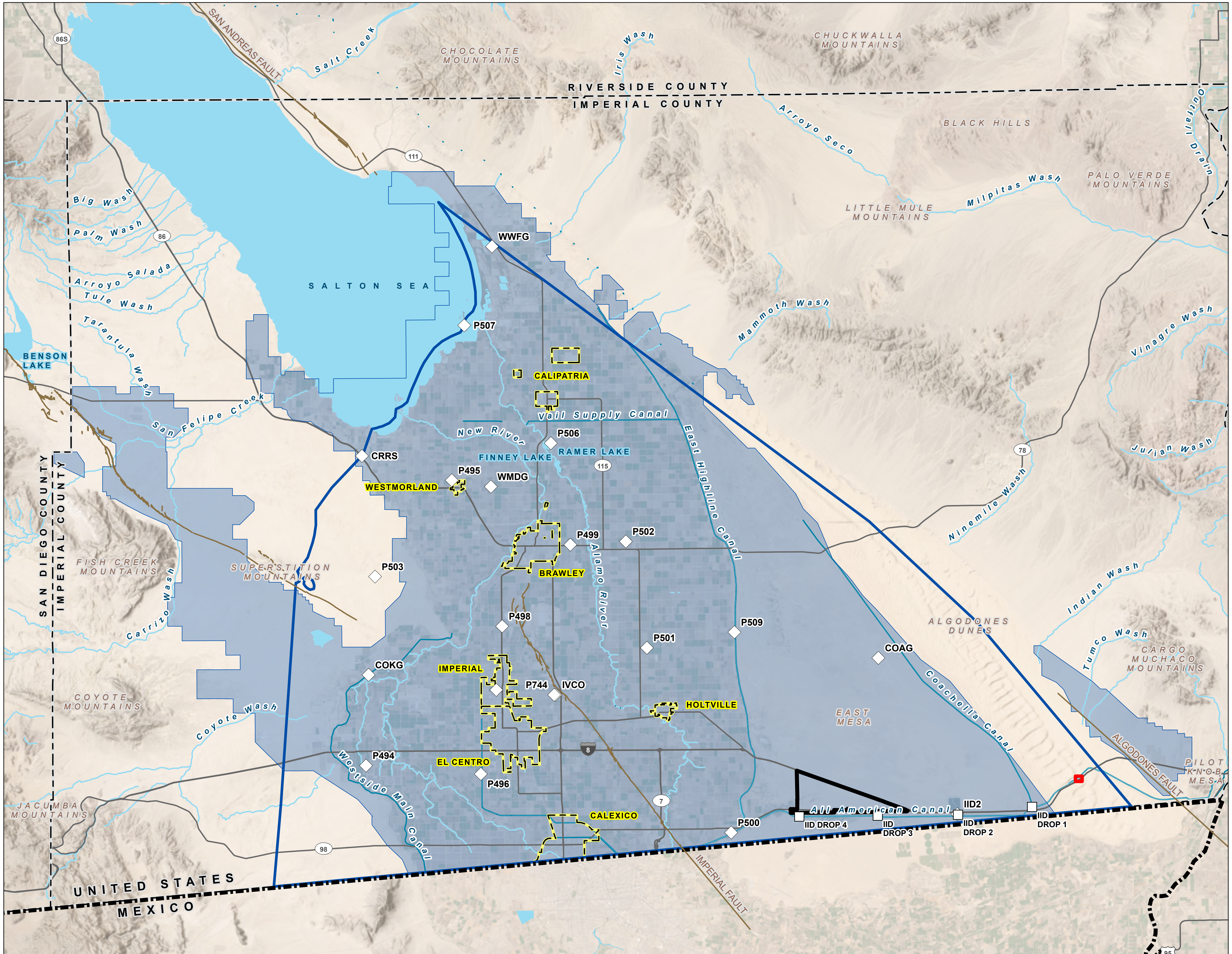
- Project Well within the Imperial Valley Groundwater Basin (IVGB)
- Allegretti Farms' wells within the Ocotillo-Clark Valley Groundwater Basin (OCVGB)
- Jacumba Community Services District (JCSD) wells within the Jacumba Valley Groundwater Basin (JVGB)

Evaluation of Project water sources assumes all Project water requirements are derived entirely from each respective source. Therefore, the analyses presented herein are considered worst-case scenarios.

FIGURE 1

Project Vicinity - Imperial Valley Groundwater Basin

Perkins Renewable Energy Project
Water Supply Assessment



LEGEND

- Proposed Project Boundary
- Imperial Valley Groundwater Basin
- Imperial Irrigation District Boundary
- Lower Colorado River Water Supply Project
- City Boundary
- County Boundary
- International Boundary
- Imperial Irrigation District Drop
- Continuous Global Positioning System Station
- Major Road
- Fault
- Canal
- Watercourse
- Waterbody

N

0 17,500 35,000 52,500
FEET

Date: November 21, 2024
Data Sources: BLM, ESRI, USGS, Imagery (2022)

GSI Water Solutions, Inc.

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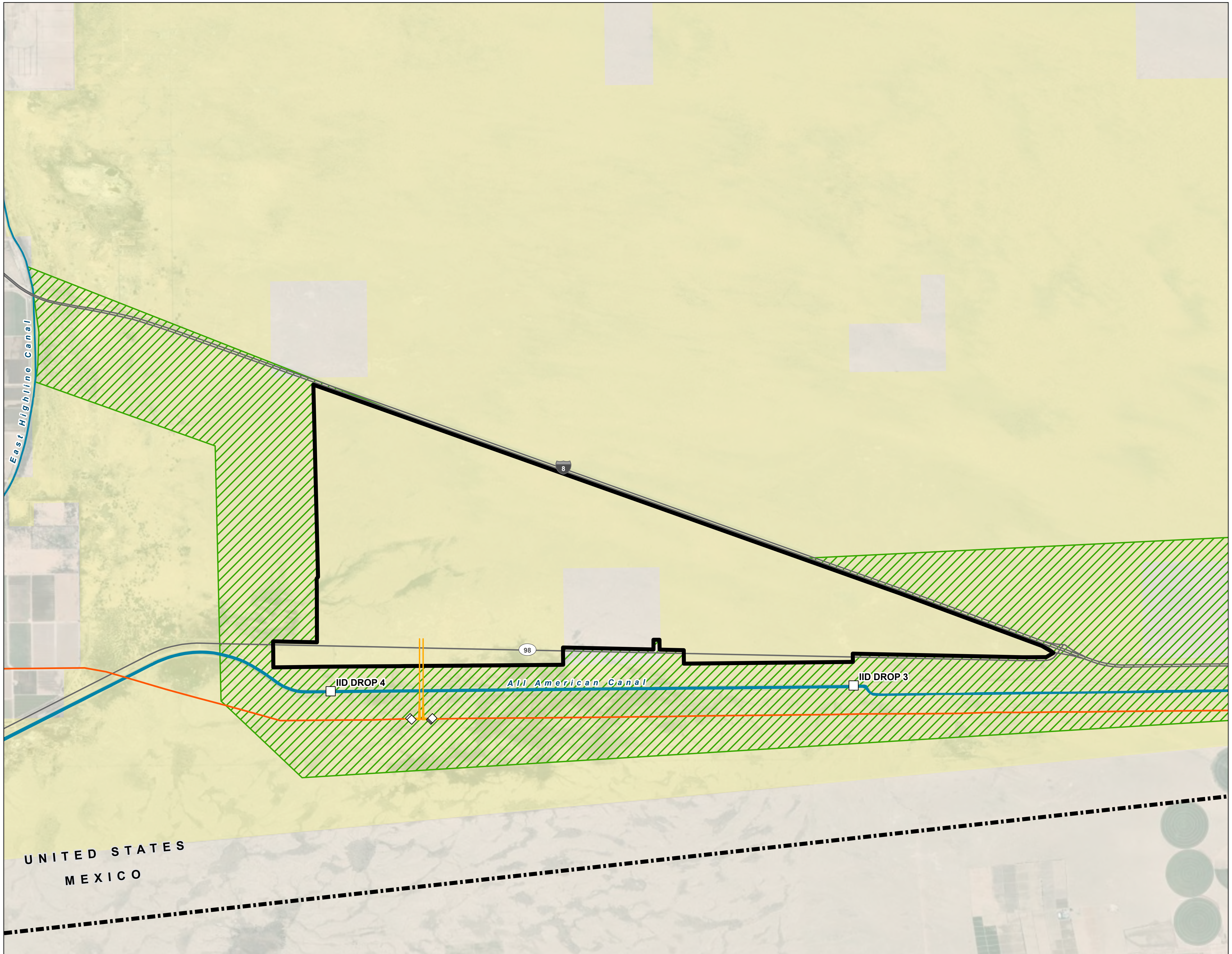

FIGURE 2

Project Area Map

Perkins Renewable Energy Project
Water Supply Assessment

LEGEND

- Imperial Irrigation District Drop
- Transmission Loop-in Structure
- SDG&E Southwest Power Link, 500 Kilovolt Transmission Line
- Proposed 500 Kilovolt Loop-In Transmission Lines (to be included within 175-Feet Right-of-Way)
- Utility Corridor
- Proposed Project Boundary

All Other Features

- International Boundary
- BLM Owned Land
- Major Road
- Canal

NOTES

SDG&E: San Diego Gas and Electric
BLM: Bureau of Land Management

N

0 2,625 5,250 7,875
FEET

GSI Water Solutions, Inc.

Date: November 21, 2024
Data Sources: BLM, ESRI, USGS, Imagery (2022)

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3 Hydrologic Overview

Hydrologic descriptions of the IVGB, OCVGB, and the JVGB are included in the following sections. Each of these basins is evaluated herein as a potential Project water source.

3.1 Imperial Valley Groundwater Basin

The Project is located within the California Department of Water Resources (DWR) Bulletin 118 IVGB (Basin No: 7-030) (DWR, 2004a), which is in Imperial County (see Figure 1). Surface water has been identified as the primary source of water in the IVGB. DWR has categorized IVGB as a very low-priority basin under the Sustainable Groundwater Management Act (SGMA) (DWR, 2020).

The IVGB is located within the Southern Mojave-Salton Sea watershed (Hydrologic Unit Code 4-1810) of the Colorado River Basin. Irrigation return flow is the primary source of groundwater recharge in the IVGB. Other sources include percolation of precipitation and surface water runoff, underflow of groundwater into the IVGB, and seepage from unlined sections of canals in the IVGB (DWR, 2004a).

The Project is bordered by the AAC to the south and EHC to the west. The Coachella Canal is approximately 9 miles east of the Project (see Figure 1). The AAC and the EHC deliver Colorado River water to water rights holders, including IID (Coes et al., 2015). The AAC is aligned approximately east-west and is located south of State HWY 98. Water flow is from the east to the west. The EHC is aligned approximately north-south and conveys water from the AAC to the north. The EHC is located west of the Project and crosses under State HWY 98 and US HWY 8. The Coachella Canal delivers Colorado River water northwest to the Coachella Valley (Coes et al., 2015). These canals were constructed in the 1940s (Coes et al., 2015).

The IID provides surface water deliveries to an area that "contains seven cities (Brawley, Calexico, El Centro, City of Imperial, Holtville, Westmorland and Calipatria), three census-designated places (Niland, Seeley and Heber), the Naval Air Station El Centro & two state prisons (Calipatria and Centinela)" (IID, n.d.[a]).

The Project is approximately 36 miles southeast of the Salton Sea. The New and Alamo Rivers in the IVGB flow north from the Mexican border to the Salton Sea. These rivers formed in the mid- to late 1800s when the Colorado River occasionally escaped from its normal channel and flowed north toward the present-day Salton Sea (DWR, 2004a).

The local climate is arid with high summer temperatures and mild winter temperatures. It is considered a subtropical desert climate (GEI, 2012). Recorded 30-year (1994–2023) average annual precipitation at the El Centro 2 SSW, CA station is 2.21 inches, with the majority received during the winter season (NOAA, 2024). Average daily high temperatures during the summer are above 100 degrees Fahrenheit (°F).

3.2 Ocotillo-Clark Valley Groundwater Basin

The DWR Bulletin 118 OCVGB (Basin No: 7-025) is also being evaluated as a potential Project water source (DWR, 2004b). OCVGB is within both Imperial and San Diego Counties (see Figure 3). The OCVGB is located within the Southern Mojave-Salton Sea watershed (Hydrologic Unit Code 4-1810) of the Colorado River Basin. DWR has categorized the OCVGB as a very low-priority basin under SGMA (DWR, 2020). Average annual precipitation is approximately 5 inches (DWR, 2004b).

Bulletin 118 separately defined Clark Valley and Ocotillo Valley due to identified surface water divides. DWR, however, later combined the valleys based on groundwater divides and barriers to define the OCVGB (DWR, 2004b).

San Felipe Creek serves as one of the primary sources of inflow to the Salton Sea from the OCVGB. A portion of the creek has been filled in for agricultural use. In the 1970s, a berm was constructed to protect farmland from stormwater flow originating from the southwest. The berm diverted stormwater to the Fish Creek Wash, which rejoins the San Felipe Creek channel 5 miles downstream to then drain to the Salton Sea (Todd Engineers, 2013).

3.3 Jacumba Valley Groundwater Basin

The DWR Bulletin 118 JVGB (Basin No: 7-047) is also being evaluated as a potential Project water source (DWR, 2004c). JVGB is within San Diego County (see Figure 4). DWR has categorized the JVGB as a very low-priority basin under SGMA (DWR, 2020).

JVGB lies within the Upper Carrizo Creek Watershed. Inflow of water from Mexico into the basin is primarily from the Flat Creek Watershed, which is approximately 51,052 acres. Jacumba Valley drains through a narrow constriction through Carrizo Gorge (Dudek, 2021).

Average annual precipitation is approximately 14 to 16 inches. Several springs are located in the JVGB (DWR, 2004c). The valley surface gently slopes upward towards the north and has only one surface discharge at the head of Carrizo Gorge. There are a number of ephemeral drains into the valley, but none of them reach Carrizo Gorge. The western side has better developed drainages with Boundary Creek being the most prominent (Swenson, 1981).

FIGURE 3

Ocotillo-Clark Valley Groundwater Basin

Perkins Renewable Energy Project Water Supply Assessment

LEGEND

- Ocotillo-Clark Valley Groundwater Basin
- Allegretti Farms
- City Boundary
- County Boundary
- Continuous Global Positioning System Station
- Major Road
- Fault
- Canal
- Watercourse
- Waterbody

Date: November 14, 2024
Data Sources: BLM, ESRI, USGS, Imagery (2022)

GSI Water Solutions, Inc.

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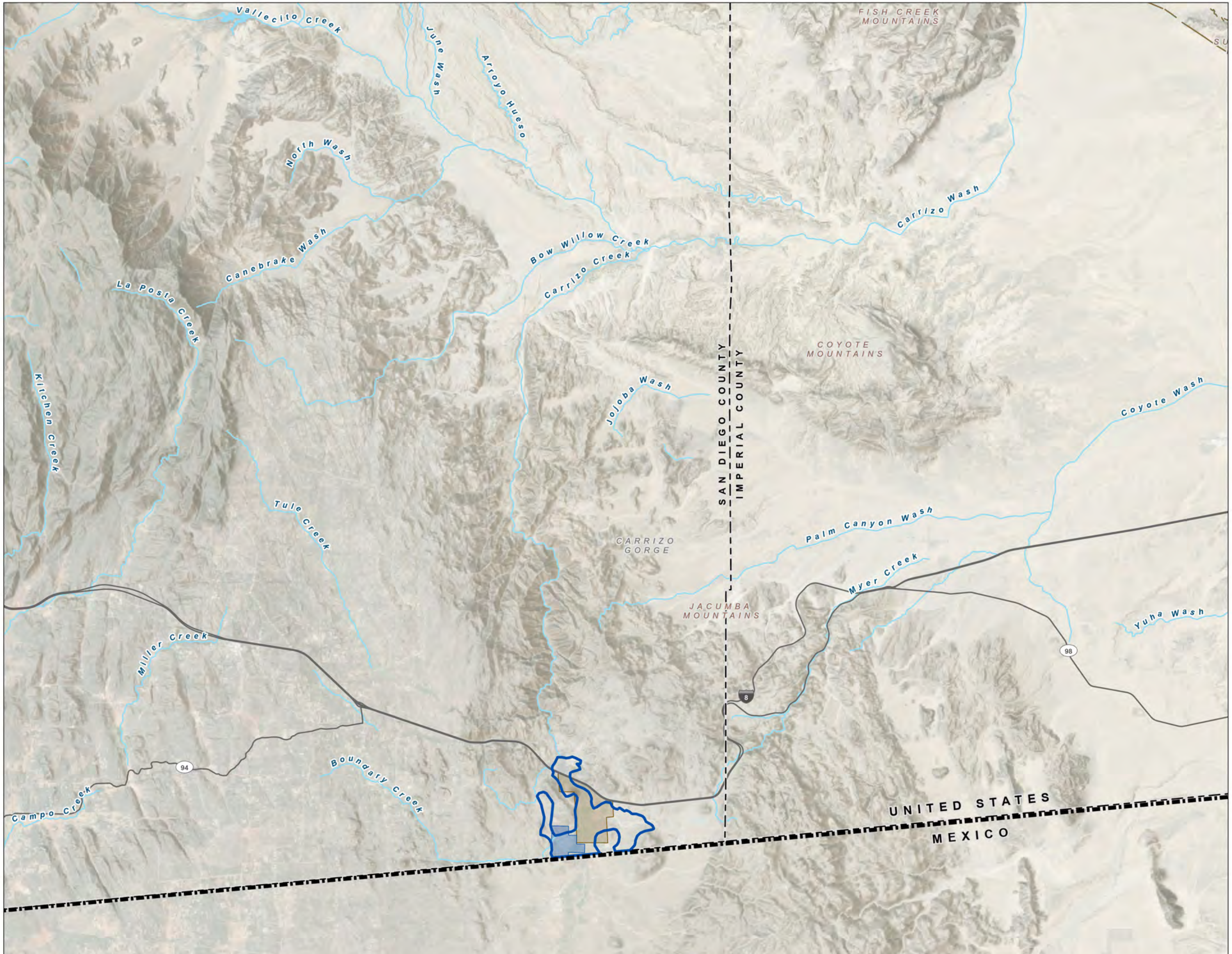
FIGURE 4

Jacumba Valley Groundwater Basin

Perkins Renewable Energy Project
Water Supply Assessment



LEGEND

- Jacumba Valley Groundwater Basin
- Jacumba Community Services District Boundary
- Jacumba Valley Ranch
- County Boundary
- International Boundary
- Major Road
- Fault
- Canal
- Watercourse
- Waterbody

N

0 7,500 15,000 22,500
FEET

Date: November 14, 2024
Data Sources: BLM, ESRI, USGS, Imagery (2022)

GSI Water Solutions, Inc.

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4 Hydrogeologic Setting

The following sections provide a description of the IVGB, OCVGB, and JVGB hydrogeologic setting, including basin boundaries, geology, hydrogeology, groundwater and surface water management, groundwater conditions, groundwater pumping, land subsidence, and potential groundwater-dependent ecosystems (GDEs).

4.1 Basin Boundaries

A description of the IVGB, OCVGB, and JVGB boundaries is included in the following sections.

4.1.1 Imperial Valley Groundwater Basin

The IVGB covers an area of 1,870 square miles in southern Imperial County and within the Colorado Desert Hydrologic Region (see Figure 1). The IVGB is bounded by the Algodones Dunes on the east and the impermeable rock formations of the Fish Creek and Coyote Mountains on the west. To the north, the IVGB is bounded by the Salton Sea, which is the discharge point for groundwater in the IVGB. The physical IVGB extends across the U.S. and Mexico border into Baja California where it underlies a contiguous part of the Mexicali Valley. However, DWR (2004a) defines the southern boundary of the IVGB politically as the international border with Mexico.

4.1.2 Ocotillo-Clark Valley Groundwater Basin

The OCVGB covers an area of 348 square miles in western Imperial County and San Diego County (see Figure 3). It lies within the Southern Mojave-Salton Hydrologic Region. The OCVGB is bounded by the Santa Rosa Mountains in the north and northeast, Coyote Creek and Superstition Mountains to the west and south, and the Salton Sea to the east. Clark Valley represents the northern portion of the basin and Ocotillo Valley represents the southern portion of the basin. Clark Valley drains towards the dry Clark Lake and the Ocotillo Valley drains to the Salton Sea (DWR, 2004b).

4.1.3 Jacumba Valley Groundwater Basin

The JVGB covers an area of 10 square miles in southeastern San Diego County and within the Southern Mojave-Salton Hydrologic Region (see Figure 4). It lies within the southeastern Peninsular Ranges. The JVGB is bounded by faults on the east and west and by the international border with Mexico on the south. The rest of the JVGB is bounded by crystalline rocks of the Peninsular Ranges (DWR, 2004c).

4.2 Geology

A geological description of the IVGB, OCVGB, and JVGB is included in the following sections.

4.2.1 Imperial Valley Groundwater Basin

The Imperial Valley is in the Salton Trough, a topographic and structural trough of the Basin and Range physiographic province (see Figure 5). The trough is approximately 130 miles long and up to 70 miles wide and is a landward extension of the depression filled by the Gulf of California, from which it is separated by the broad fan-shaped buried delta of the Colorado River. The lowest part of the trough is occupied by the Salton Sea (Loeltz et al., 1975). The surface of the Salton Sea is approximately 230 feet below mean sea level. The axis of the Imperial Valley trends approximately north-northwest to south-southeast within the topographically flat IVGB, where surface elevations are typically at or below sea level (Greer et al., 2013).

Faults in the IVGB include the San Andreas, Algodones, and Imperial faults, but data on whether these faults control groundwater movement is lacking (DWR, 2004a). Figure 5 is a geologic map of the region.

The Project is located within the East Mesa geologic landform of the Imperial Valley, which is elevated relative to the rest of the Imperial Valley (Greer et al., 2013). The East Mesa is located within a triangular area southwest of the Algodones Dunes, north of the international boundary with Mexico, and east of the shoreline of prehistoric Lake Cahuilla (Loeltz et al., 1975). This prehistoric lake existed during the late Pleistocene and Holocene when the Salton Basin was periodically filled by the Colorado River, extending roughly from Palm Springs into Mexico (Gobalet and Wake, 2000). Physiographically, the East Mesa, an extension of the Pilot Knob Mesa to the northeast, is a sloping surface that merges gradually with central Imperial Valley. The East Mesa was formed primarily by fluvial processes but was locally altered by lacustrine, and or possibly marine, processes. The broad, southern part of the East Mesa slopes to the west-southwest at about 6 feet per mile. The East Mesa surface is mantled extensively by irregular sheets of aeolian sand that are generally less than 20 feet thick (Loeltz et al., 1975).

4.2.2 Ocotillo-Clark Valley Groundwater Basin

The OCVGB is an alluvium-filled valley and is underlain by non-water-bearing crystalline bedrock. Ocotillo and Clark Valley fill is likely made up of Pliocene to Holocene stream, alluvial fan, lake, and eolian deposits (see Figure 6). Geologic structures known to restrict groundwater flow include the northwest trending Coyote Creek and Superstition Mountains faults bounding the OCVGB on the south (DWR, 2004b).

4.2.3 Jacumba Valley Groundwater Basin

The JVGB is located in the eastern part of the Peninsular Ranges, which is made up of northwest-oriented mountain ranges with fault-produced valleys separating them (see Figure 7). These valleys primarily contain Quaternary alluvium, but the Jacumba Valley also contains Tertiary sedimentary and volcanic formations (Dudek, 2021). The valley is a graben with metamorphic rock that have had intrusions of the Peninsular Ranges batholith (Swenson, 1981). The alluvium has a thickness of roughly 100 to 175 feet, thinning out towards the sides and the ends of the valley. Jacumba volcanics, composed of basaltic and andesitic pyroclastics and lava flows are also found in the valley (Dudek, 2021).

Lithologic logs from JCSD municipal wells indicate that alluvium is generally underlain by up to 40 feet of decomposed granite, followed by granitic bedrock predominantly composed of granodiorite. Extensive fracturing exists up to a depth of 500 feet (Dudek, 2021).

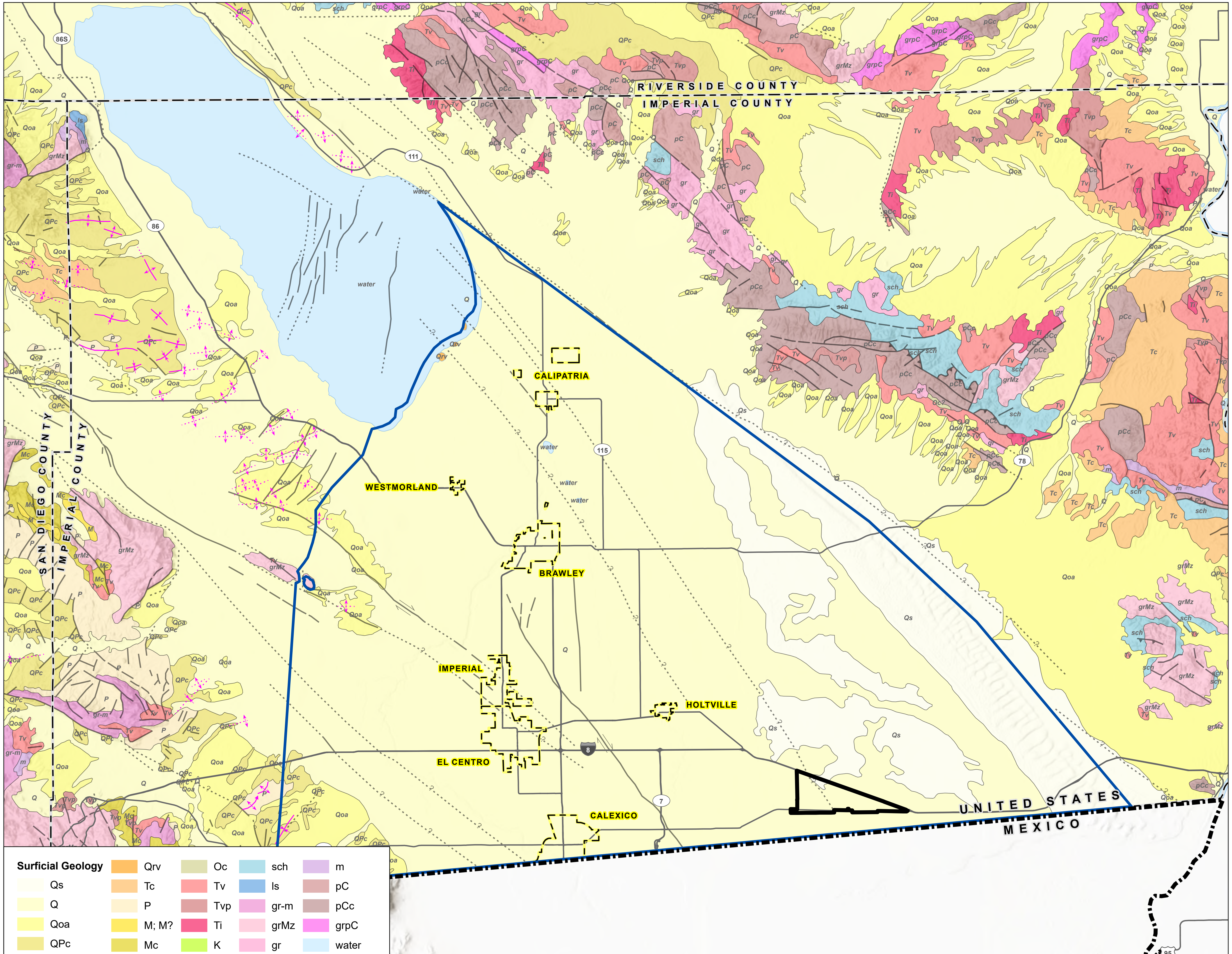

FIGURE 5

Regional Geology of the Imperial Valley Groundwater Basin

Perkins Renewable Energy Project
Water Supply Assessment

LEGEND

- Proposed Project Boundary
- Imperial Valley Groundwater Basin
- City Boundary
- County Boundary
- International Boundary
- Major Road

N

0 17,500 35,000 52,500
FEET

Date: November 21, 2024
Data Sources: BLM, ESRI, USGS, Imagery (2022)

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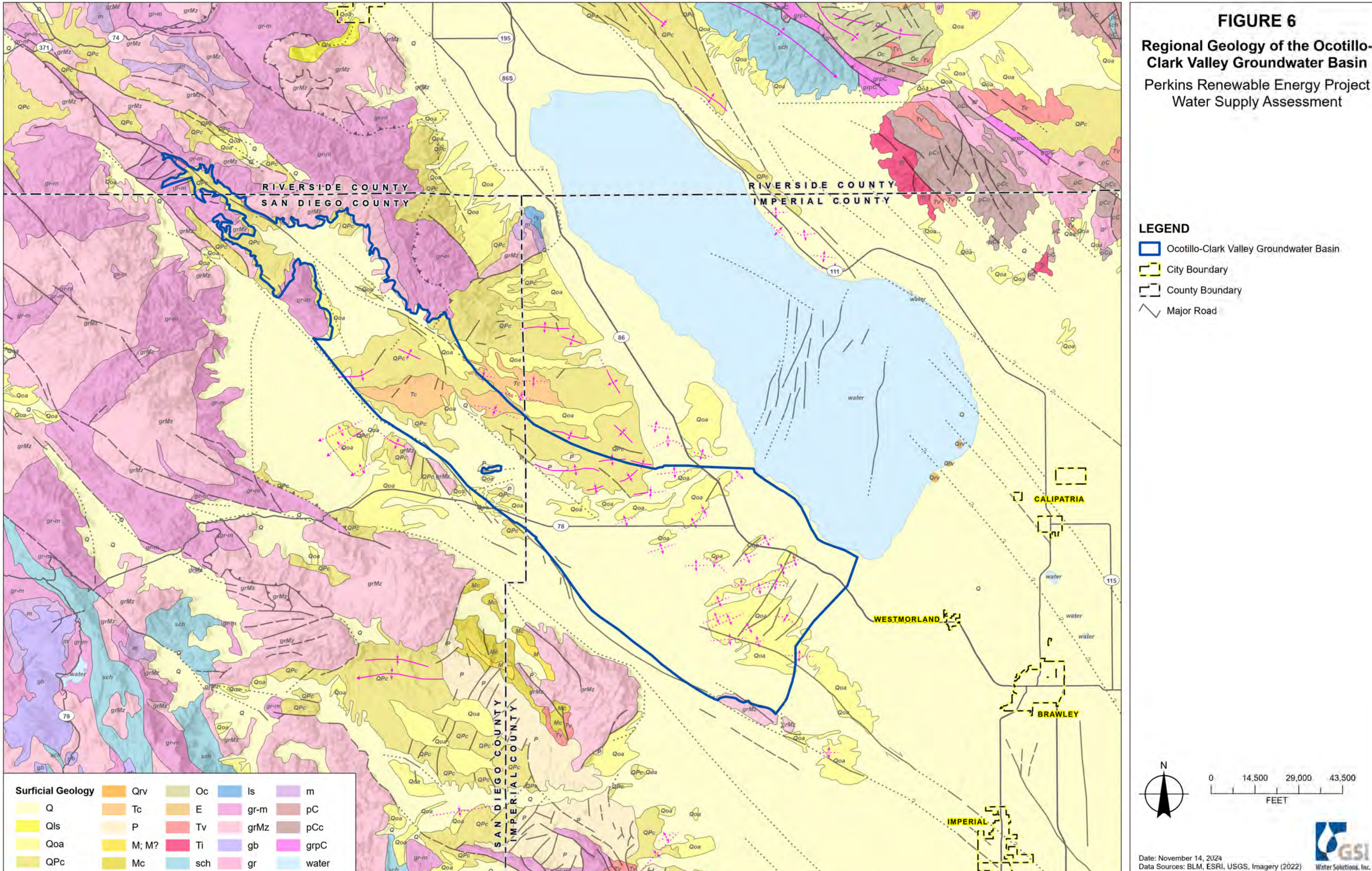


FIGURE 6

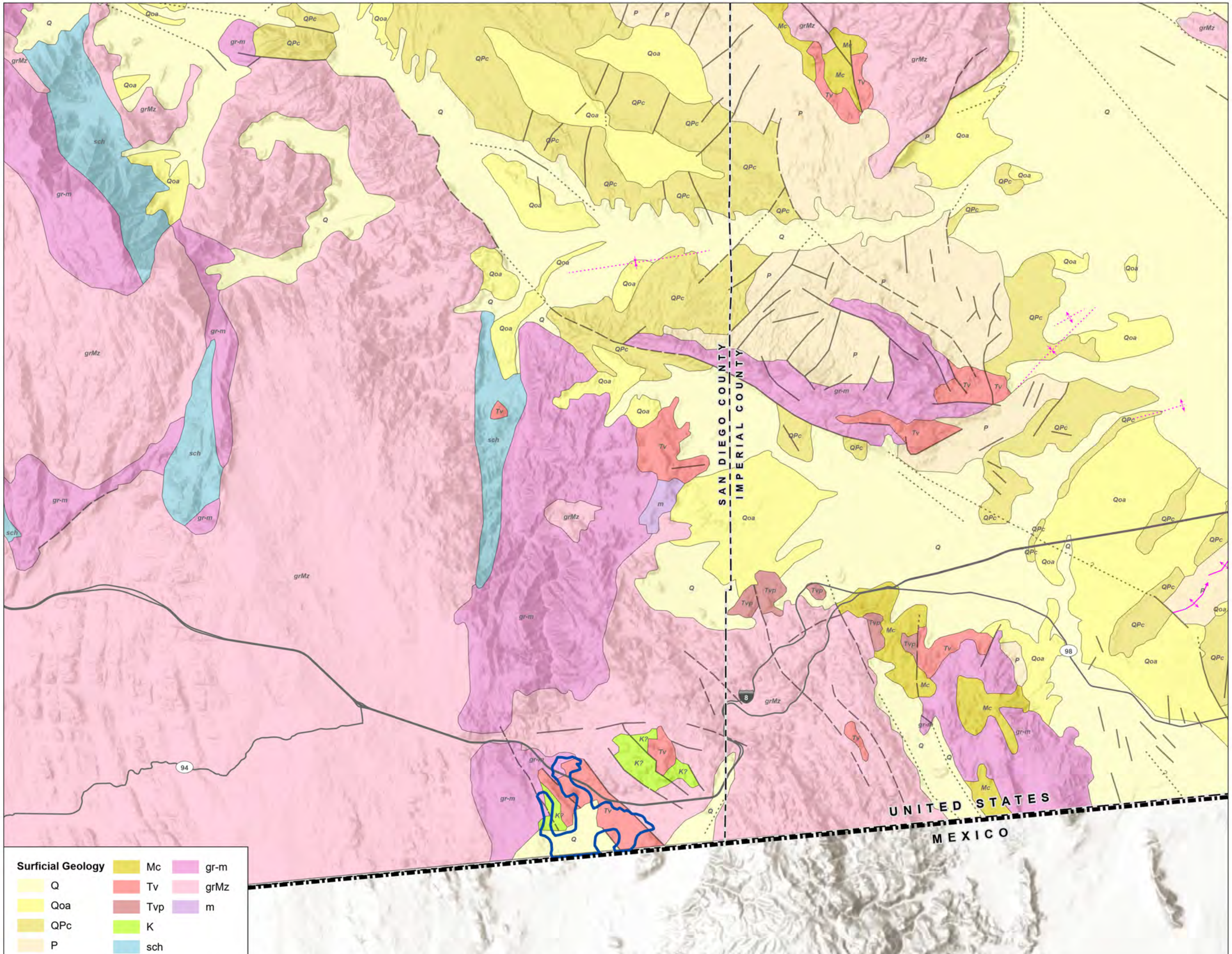
Regional Geology of the Ocotillo-Clark Valley Groundwater Basin

Perkins Renewable Energy Project Water Supply Assessment

FIGURE 7

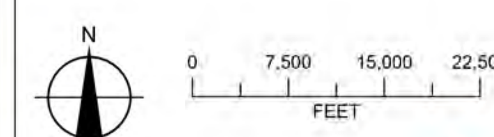
Regional Geology of the Jacumba Valley Groundwater Basin

Perkins Renewable Energy Project
Water Supply Assessment



LEGEND

- Jacumba Valley Groundwater Basin
- County Boundary
- International Boundary
- Major Road



Date: November 14, 2024
Data Sources: BLM, ESRI, USGS, Imagery (2022)

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4.3 Hydrogeology

A hydrogeological description of the IVGB, OCVGB, and the JVGB is included in the following sections.

4.3.1 Imperial Valley Groundwater Basin

Cenozoic Imperial Valley-fill deposits with an estimated thickness greater than 20,000 feet constitute the main water-bearing formation in the Imperial Valley. Underneath lies a pre-Tertiary basement rock complex (see Figure 5). Deep groundwater is saline and is unsuitable for irrigation. Precipitation generally does not percolate down to the lower aquifer to dilute the saline deep groundwater. At the margins of the Imperial Valley, deposits are derived locally and vary from fine- to coarse-grained. Deposits from the Colorado River consist primarily of sand, silt, and clay. These are found in the Imperial Valley's central regions and extend to the margin deposits (Loeltz et al., 1975).

There are two primary aquifers in the IVGB separated by an aquitard with an average thickness of 60 feet and a maximum thickness of 280 feet. The aquifers are predominately alluvial from the late Tertiary and Quaternary age. The upper aquifer has an average thickness of 200 feet and a maximum thickness of 450 feet. The lower aquifer has an average thickness of 380 feet and a maximum thickness of 1,500 feet. Where the prehistoric Lake Cahuilla historically extended, there is up to 80 feet of fine-grained, low permeability lacustrine deposits, creating locally confined aquifer conditions (DWR, 2004a). As a result, the hydraulic connection between the upper and lower aquifers is suspected to be poor (Coes et al., 2015). Total groundwater storage capacity of the IVGB is estimated to be 14,000,000 AF (DWR, 2004a). In the East Mesa, between the EHC and Coachella Canal, storage is estimated to be 1,000,000 AF (GEI, 2012).

Fault control of groundwater movement from the San Andreas, Algodones, and Imperial faults in the IVGB is uncertain. Known barriers to groundwater flow are the prehistoric Lake Cahuilla deposits of clay that obstruct downward seepage of surface waters in the central and western part of the IVGB (Loeltz et al., 1975).

Groundwater recharge in the East Mesa occurs primarily as seepage from the AAC, EHC, and Coachella Canal. The arid climate and low magnitude of annual precipitation result in little percolation of precipitation. Groundwater in the East Mesa is discharged at ground surface and in the subsurface. Groundwater discharge to surface occurs at areas of shallow groundwater along the AAC where the water may be discharged from interceptor wells. Subsurface outflow in the East Mesa occurs toward the central Imperial Valley, toward Mexico, and into a portion of the EHC (GEI, 2012).

4.3.2 Ocotillo-Clark Valley Groundwater Basin

The main water-bearing deposits in the OCVGB are made up of alluvium (see Figure 6), which may reach a thickness of more than 1,800 feet with a specific yield up to 25 percent (DWR, 2004b). In the south-central area, there is a shallow, unconfined aquifer and a deep confined to semi-confined aquifer. Additionally, there are local perched aquifers that hinder irrigation return flows to the deep aquifer. The shallow aquifer likely feeds the San Felipe and Fish Creek wash (Todd Engineers, 2013).

The Coyote Creek fault is known to be a barrier to groundwater flow, as indicated by a water level difference of 100 feet on opposite sides. It is unknown whether the San Jacinto and San Felipe Hills faults impede groundwater flow (DWR, 2004b).

Mountain-front recharge from precipitation in the adjacent mountains is assumed to be the principal source of recharge to the OCVGB aquifers (DWR, 2004b). The amount of groundwater in storage is unknown; however, the storage capacity is estimated to be about 450,000 AF in the Clark Valley and about 5,800,000 AF in Ocotillo Valley. Annual recharge is estimated to be about 1,200 AFY for the Clark Valley and about 1,100 AFY in the Ocotillo Valley. Although there is a history of irrigation water use in the Ocotillo Valley, current extractions are estimated to be minimal (DWR, 2004b).

The shallow aquifer is generally of poor water quality and is not often used; the vast majority of pumping occurs within the lower, confined aquifer (Todd Engineers, 2013).

4.3.3 Jacumba Valley Groundwater Basin

There are two main water-bearing deposits in the JVGB: Quaternary Alluvium and the Table Mountain Formation (see Figure 7). A third water-bearing deposit, consisting of fractured bedrock, exists to the west of Jacumba Valley; however, only a few domestic wells pump water from the bedrock aquifer. The Jacumba Volcanics is the only lithology that does not supply water in the JVGB (Swenson, 1981).

The alluvium is made up of gravel, sand, and clay with deposits ranging from 100 to 175 feet in thickness. The alluvial aquifer has historically provided the majority of groundwater used in the JVGB (Swenson, 1981). Historically, wells in this formation have produced more than 1,000 gpm and specific yield ranges from 5 to 25 percent (DWR, 2004c). In spring of 2020, the JCSD ceased pumping from the alluvial aquifer to meet municipal demand and started pumping from wells within the bedrock aquifers instead (Dudek, 2021). Water pumping within the alluvial aquifer has reduced drastically during the last several years due to decreased amounts of both agricultural and municipal activity.

The Tertiary age Table Mountain Formation is the largest aquifer in the JVGB and consists of medium to coarse-grained sandstone and conglomerate that lies unevenly upon a crystalline basement. Between the alluvium and Table Mountain Formation is the Jacumba Volcanics formation, making the Table Mountain aquifer semi-confined to confined. The Table Mountain aquifer may be up to 600 feet thick and have specific yields of 5 to 10 percent (DWR, 2004c).

While the storage capacity of the aquifers is unknown, the alluvial aquifer is estimated to have 9,600 to 16,000 AF of groundwater in storage. The Table Mountain Formation is estimated to contain 84,000 to 169,000 AF of groundwater in storage. The aquifers are recharged primarily by runoff and subsurface flow originating in surrounding mountains. Isohyetal maps indicate that a greater percentage of regional precipitation occurs to the east; most of this runoff enters the basin via the Boundary Creek and Flat Creek drainages (DWR, 2004c).

4.4 Groundwater and Surface Water Management

Groundwater management policies considered with respect to the Project include:

- SGMA
- Imperial County Title 9 Division 21: Water Well Regulations
- Imperial County Title 9 Division 22: Groundwater Ordinance
- Imperial Integrated Regional Water Management Plan (IRWMP)
- IID Interim Water Supply Policy (IWSP)
- 1988 San Luis Rey Indian Water Rights Settlement Act
- Colorado River Basin Regional Water Quality Control Board (RWQCB) Water Quality Control Plan

The IVGB, OCVGB, and JVGB are unadjudicated groundwater basins.

Sustainable Groundwater Management Act

In 2014, SGMA created a statewide framework in California to help protect groundwater resources in the long-term by requiring local agencies to create Groundwater Sustainability Agencies. These Groundwater Sustainability Agencies develop and implement Groundwater Sustainability Plans to avoid undesirable results and mitigate overdraft within 20 years of adoption (DWR, n.d.[a]). Groundwater Sustainability Plans for the IVGB, OCVGB, and JVGB have not been prepared nor are they required, per SGMA, to be submitted to DWR based on the basins' prioritization as very low priority (DWR, n.d.[b]).

Imperial Integrated Regional Water Management Plan

The Imperial IRWMP was adopted in 2018 to assist in meeting future water demands conforming to DWR guidelines (GEI, 2012). This guiding document is the result of a collaborative process including stakeholder groups to address water supply reliability, water quality, environmental protection and enhancement, flood protection and stormwater management, and policy goals for the region. The Imperial IRWMP is part of DWR's Integrated Regional Water Management Program (GEI, 2012). This plan includes the IVGB.

The County holds responsibility for groundwater management under the land use planning and police powers of the Board of Supervisors in the Imperial Region. The County manages local groundwater management by means of the County Groundwater Ordinance and under the Water Element of the Imperial County General Plan. There are two County ordinances that lay the foundation for managing and protecting groundwater, including groundwater storage and banking, monitoring requirements, and defining the well and project permit process, as well as allowing for the opportunity of public involvement. Requirements for groundwater management are defined in Title 9 of the County Land Use Ordinance. Included in Title 9 is Division 21 – Water Well Regulations and Division 22 – the County Groundwater Management Ordinance (County of San Diego, 2023a).

Permitting new water well construction, reconstruction of existing wells, and destruction of abandoned wells is regulated by the County Planning and Development Department (Imperial County Public Health Department, 2024).

Proposed East Mesa Groundwater Management Area

The proposed East Mesa Groundwater Management Area stretches from the EHC to the Algodones Fault. Groundwater recharge projects are under consideration in this area and the Groundwater Management Area would be designed to include monitoring programs consistent with the County Groundwater Ordinance. An appropriate monitoring program would be put in place to monitor project performance (GEI, 2012).

Imperial Irrigation District Colorado River Water Rights

IID possesses pre-1914 appropriative water rights to Colorado River water under the numerous compacts, state and federal laws, court decisions and decrees, contracts, and regulatory guidelines, known collectively as the "Law of the River." Among the significant elements are the 1921 Colorado River Compact, the 1928 Boulder Canyon Project Act, and the 1931 California Seven-Party Agreement yielding a total of 2,600,000 AF of present perfected rights per year as of 2012. Seepage from the unlined portion of the AAC is considered to be Colorado River water and is tabulated in the water accounting for IID's Colorado River water supply (GEI, 2012).

Imperial County Title 9 Division 21: Water Well Regulations

This Ordinance prescribes minimum requirements for the construction, re-construction, repair, replacement, re-perforation, re-activation, operation, and destruction of a well or wells. The objective of this Ordinance is to protect the health, safety, and general welfare of the people of Imperial County by ensuring that the ground water is not polluted or contaminated.

Imperial County Title 9 Division 22: Groundwater Ordinance

This Ordinance is adopted for the purpose of preserving, protecting and managing the groundwater within the County. The ordinance includes groundwater management, exportation, overdraft, priorities, and factors, fees, recharge standards, groundwater availability, penalties, and review and appeal. Groundwater extraction requires, but is not limited to, a determination of available groundwater supply and a permit from the County. The ordinance states that IID "shall be allowed to extract the water seeping from the All American Canal […] only to the extent that the Groundwater Model shows that such water is still present in the groundwater basin for extraction" (ICPDS, 2017).[2]

Imperial Irrigation District Interim Water Supply Policy

The IID IWSP for Non-Agricultural Projects was adopted to address proposed projects that will rely upon water from the IID during the time that an Integrated Water Resources Management Plan is under development. The Integrated Water Resources Management Plan is used by IID to evaluate the projected water demand of non-agricultural projects and the possible means of supplying that amount of water. The IWSP designates up to 25,000 AFY of water for potential Non-Agricultural Projects within IID's water service area (IID, 2023a). Although the Project qualifies as a non-agricultural project, because the Project is primarily located on federal land, the Project is not eligible to receive water from IID under the IWSP in accordance with the 1988 San Luis Rey Indian Water Rights Settlement Act, Section 206 (WestWater, 2024).

1988 San Luis Rey Indian Water Rights Settlement Act

The 1988 San Luis Rey Indian Water Rights Settlement Act deprioritizes the use of Colorado River water on federal land, including IID's Colorado River entitlement and Project usage of groundwater potentially originating from the AAC. A letter from IID with regard to this Act states that:

> As of the effective date of this Act, any action of the Secretary to use, sell, grant, dispose, lease or provide rights-of-way across Federal public domain lands located within the All American Canal Service Area shall include the following conditions: (1) those lands within the boundary of the Imperial Irrigation District as of July 1, 1988, as shown in Imperial Irrigation District Drawing 7534, excluding Federal lands without a history of irrigation or other water using purposes; (2) those lands within the Imperial Irrigation District Service Area as shown on General Map of Imperial Irrigation District dated January 1988 (Imperial Irrigation District No. 27F 0189) with a history of irrigation or other water using purposes; and (3) those land within the Coachella Valley Water District's Improvement District No. 1 shall have a priority for irrigation or other water using purposes over the lands benefiting from the action of the Secretary… (WestWater, 2024)

[2] "Groundwater Model" here refers to the model accepted by the Board of Supervisors on February 2, 1996, with the title "The County of Imperial and Imperial Irrigation District County-wide Groundwater Model" and any modifications (Imperial County Planning and Development Services, 2017).

Colorado River Basin RWQCB Water Quality Control Plan

The Project is located in the jurisdiction of the Colorado River Basin RWQCB. The Water Quality Control Plan (RWQCB, 2019) establishes water quality objectives, including narrative and numerical standards, to protect the beneficial uses of surface and ground waters in the region. The Water Quality Control Plan describes implementation plans and other control measures designed to ensure compliance with state-wide plans and policies and documents comprehensive water quality planning (RWQCB, 2019).

Beneficial uses of waters, designated by the RWQCB, are of two types: consumptive and non-consumptive. Consumptive uses are those normally associated with people's activities, primarily municipal, industrial, and irrigation uses that consume water and cause corresponding reduction and/or depletion of water supply. Non-consumptive uses include swimming, boating, waterskiing, fishing, hydropower generation, and other uses that do not significantly deplete water supplies. Historical beneficial uses of water within the Colorado River Basin Region have largely been associated with irrigated agriculture and mining. Industrial use of water has become increasingly important in the Region, particularly in the agricultural areas. The Water Quality Control Plan for the Colorado River Basin Region (RWQCB, 2019) lists specific beneficial uses for groundwater. Beneficial uses of the groundwater in the IVGB are Municipal and Domestic Supply (MUN) and Industrial Service Supply (IND) (RWQCB, 2019).

San Diego County Groundwater Management Ordinance

The San Diego County Groundwater Management Ordinance was adopted to ensure that development will not occur in groundwater-dependent areas of San Diego County unless supplies are available to provide water for existing and proposed uses. The ordinance establishes regulations for the protection, preservation, and maintenance of groundwater (County of San Diego, 2023a).

4.5 Groundwater Conditions

The following sections discuss historical and current groundwater conditions, including groundwater levels and groundwater quality. Reported groundwater levels presented were selected based on the availability of the wells' groundwater level time series.

4.5.1 Groundwater Levels

A description of groundwater levels in the IVGB, OCVGB, and the JVGB is presented in the following sections.

4.5.1.1 Imperial Valley Groundwater Basin

The spatial variance of groundwater levels across the IVGB is generally consistent with the surface topography. Depths to groundwater range from approximately 9 feet below ground surface (bgs) to 100 feet bgs in the IVGB (USGS, n.d.; DWR, n.d.[a]). Historical groundwater elevation highs correspond with the topographical highs in the Algodones Dunes (State Well Number [SWN] 016S020E27B001S) (see Figures 8 and 9). Near the Project, groundwater elevations are modestly lower (SWN: 016S011E23B001S and 016S018E32R001S [Lower Colorado River Project (LCRP)-18]). The lowest groundwater elevations are recorded in the low-lying agricultural lands in the central IVGB (SWN: 015S014E18C001S). Groundwater elevations are also elevated in the west IVGB (SWN: 016S011E23B001S and 016S011E27F001S). Groundwater flows from the topographical highs of the IVGB flanks toward the axis of the Imperial Valley and then northwestward towards the Salton Sea.

Reported groundwater level data from the East Mesa before construction of the AAC and the Coachella Canal (pre-1940) indicate stable groundwater levels and a groundwater flow direction of east to west (Loeltz et al., 1975; Coes et al., 2015). After construction of the AAC and Coachella Canal in the 1940s, surface water seepage from the canals raised groundwater elevations by the canals and shifted the direction of groundwater flow toward the northwest. During and after the AAC Lining Project (completed 2007–2010) groundwater levels near the lined portion of the canal declined and the direction of groundwater flow returned to an east to west direction (Coes et al., 2015).[3] Current groundwater level trends within the IVGB generally indicate flow towards the axis of the Imperial Valley and then northwestward towards the Salton Sea.

Groundwater level trends based on reported groundwater levels from select wells (016S018E32R001S, 017S018E03H001S, and 016S020E27B001S) in the East Mesa and Algodones Dunes along the AAC (see Figures 8 and 9) generally indicate declining groundwater level trends since the early 2000s, consistent with the start and completion of the canal lining projects and the area no longer receiving as much recharge through canal leakage. The reported totals depths of 016S018E32R001S and 017S018E03H001S are 815 and 36.5 feet bgs, respectively. 016S018E32R001S is located within the proposed Project boundary and suspected to be completed in the lower aquifer. Recorded groundwater elevations in 016S018E32R001S ranged from approximately 78 to 81 feet North American Vertical Datum of 1988 (NAVD 88), or 40 to 43 feet bgs, between 2020 and 2024 (Coes et al., 2015). Well 017S018E03H001S is located near the Project, south of the AAC, and suspected to be completed in the upper aquifer. Recorded groundwater elevations in 017S018E03H001S ranged from 90 to 103 feet NAVD 88, or 21 to 34 feet bgs, between 2009 and 2011 (USGS, n.d.). Reported groundwater levels in 016S018E32R001S during the same period were 90 to 95 feet NAVD 88, or 26 to 31 feet bgs. 016S020E27B001S is located approximately 10 miles east of the Project and suspected to be completed in the lower aquifer. Reported groundwater levels at the well have been lower than groundwater levels near the Project since 2014. This may be due to the location of 016S020E27B001S in or near the Lower Colorado Water Supply Project (LCWSP) well field (see Figure 8).

Reported groundwater levels from wells located in the western (016S011E23B001S and 016S011E27F001S) and central (015S014E18C001S) (see Figures 8 and 9) portions of the IVGB indicate stable groundwater levels from the 1970s to 1992. After 1992, groundwater levels in 016S011E27F001S and 015S014E18C001S remain stable, while groundwater levels in 016S011E23B001S decrease by about 10 feet and have remained stable at this decreased elevation through 2024. These three wells are located more than 21 miles west of the Project and west of the axis of the Imperial Valley. Historical groundwater level trends observed in these wells are not representative of trends observed in wells located in the East Mesa.

4.5.1.2 Ocotillo-Clark Valley Groundwater Basin

Groundwater levels in Clark Valley have historically remained unchanged. In Ocotillo Valley, however, there was a 30-foot decline between 1952 and 1980 predominantly due to agricultural groundwater pumping (Moyle, 1982).

[3] The AAC Lining Project was started in 2007 and completed in 2010 (SDCWA, 2023), resulting in the concrete lining of 23 miles of the unlined AAC (east of the Project). The concrete-lined section of the AAC reportedly conserves 67,700 AFY of Colorado River water that was previously lost to seepage. (IID, n.d.[c]). The Coachella Canal also underwent a 2-year lining project, ending in December 2006 (GEI, 2012).

Available groundwater level data in the OCVGB is limited. In the northern portion of the OCVGB, or Clark Valley, groundwater levels in well 010S006E01A002S ranged from 20 to 28 feet bgs, or 526 to 533 feet NAVD 88 (USGS, n.d.; DWR, n.d.[a]) during the period from 2006 to 2009 (see Figures 10 and 11). Generally, groundwater levels in the Clark Valley have historically remained unchanged (Moyle, 1982).

In Ocotillo Valley, the shallow aquifer has water levels approximately 100 feet higher than the deep aquifer (Todd Engineers, 2013). U.S. Geological Survey (USGS) monitoring well 012S009E23D001S, or the San Felipe Well, is screened within the deep aquifer and has a period of record (POR) from 1954 to 2014. This well indicated a trend of steadily declining groundwater levels until the early 2000s; reported groundwater levels in the well decreased from 64 to 227 feet bgs (-78 to -240 feet NAVD 88). This decline is likely attributed to historical agricultural demands in the basin.

Agricultural irrigation likely peaked in the OCVGB at approximately 1,700 acres in 1978, with an associated groundwater extraction greater than 10,000 AF. Irrigated acres generally ranged from 500 to 1,000 acres through 2009. A total of 80 irrigated acres were estimated in 2010 and 2011 with an associated groundwater extraction of approximately 200 AF. Groundwater levels have slowly increased since then, indicating that average annual groundwater inflows are greater than average outflows (Todd Engineers, 2013).

4.5.1.3 Jacumba Valley Groundwater Basin

Water levels in JVGB declined from 1955 through the 1960s, likely due to increased water demand in the region from the construction of Interstate 8 and attempted lettuce farming. A study conducted from 1979 to 1980 monitored several wells in Jacumba and observed continuously rising water levels. This was in part attributed to heavy surface flow in the nearby drainages (Swenson, 1981). Groundwater levels in the JVGB remained stable into the 1990s with seasonal fluctuations (DWR, 2004c). Fluctuations in groundwater levels in the JVGB result from groundwater production and climatic variation (Dudek, 2021). Groundwater flow is northward to the head of Carrizo Gorge where it is discharged through evapotranspiration (ET), subsurface flow, and springs (Swenson, 1981).

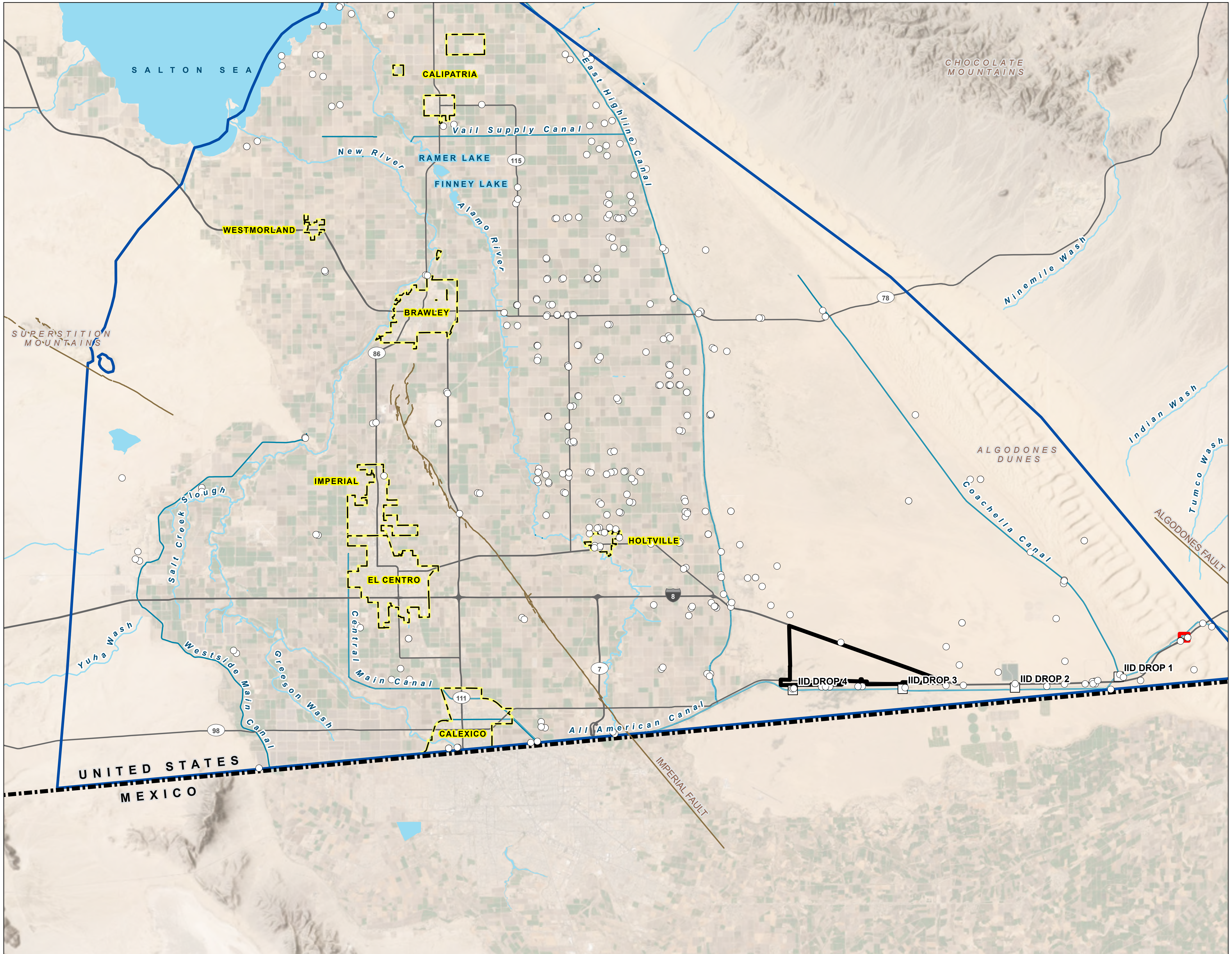
A groundwater well inventory in Jacumba Valley completed in 2021 (Dudek, 2021) identified a total of 56 wells. A total of 12 JCSD wells were identified, with 9 screened presumably in alluvium and 3 in the confined/semi-confined (Table Mountain) aquifer. From June 2012 to June 2018, static water levels in the alluvial JCSD wells ranged from 21 to 72 feet bgs. Reported groundwater levels in the JCSD Table Mountain aquifer wells ranged from 6 to 31 feet bgs during 2018.

Most of the recently available groundwater level data in the JVGB are from wells screened within the alluvial aquifer. Hydrographs presented in the JVR Energy Park Project Groundwater Resources Investigation Report (Dudek, 2021) indicate that between 2017 and 2020, water levels are generally stable or decreasing slightly, with depths to water ranging from roughly 40 to 70 feet bgs. Water levels in the alluvium are typically shallower towards the edges of the basin (see Figure 12). Data from well 018S008E07J001S, located in the town of Jacumba, indicates a groundwater level of 13 feet bgs, or 2,835 feet National Geodetic Vertical Datum of 1929, recorded on September 15, 2023 (see Figure 12) (USGS, n.d.; DWR, n.d.[a]). The reported well depth is 35.75 feet bgs and is presumably screened in the alluvium.

FIGURE 8

Well Location Map
Imperial Valley Groundwater Basin

Perkins Renewable Energy Project
Water Supply Assessment



LEGEND

- GAMA Well
- Imperial Irrigation District Drop
- Proposed Project Boundary
- Imperial Valley Groundwater Basin
- Lower Colorado River Water Supply Project
- City Boundary
- International Boundary
- Major Road
- Fault
- Canal
- Watercourse
- Waterbody

NOTE

Well location data is from California State Water Resources Control Board Groundwater Ambient Monitoring and Assessment Program. Well status is unknown.

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FEET

Date: November 21, 2024
Data Sources: BLM, ESRI, USGS, Imagery (2022)

GSI Water Solutions, Inc.

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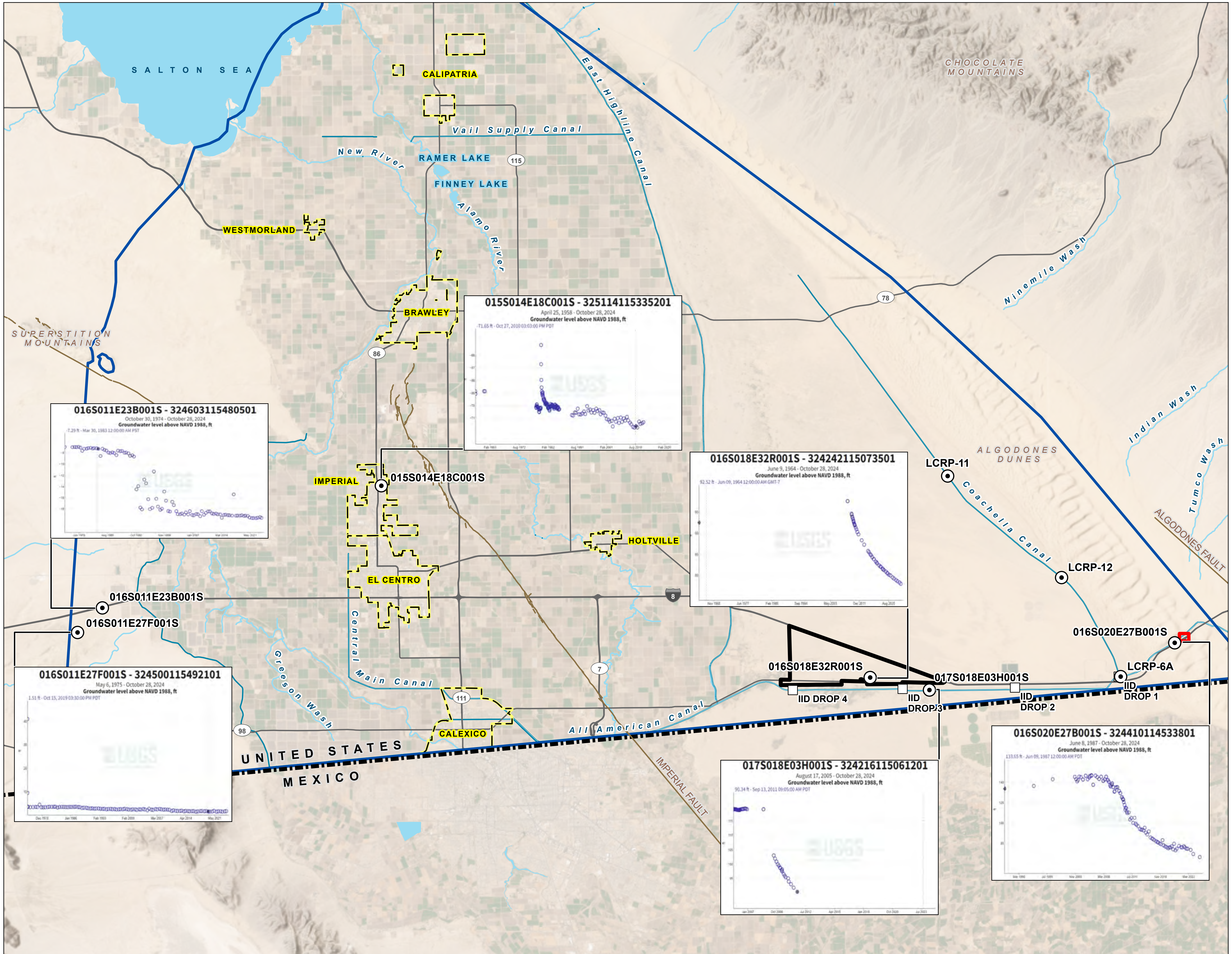

FIGURE 9

Select Imperial Valley Groundwater Basin Hydrographs

Perkins Renewable Energy Project
Water Supply Assessment

LEGEND

- Well Location
- Imperial Irrigation District Drop
- Proposed Project Boundary
- Imperial Valley Groundwater Basin
- Lower Colorado River Water Supply Project
- City Boundary
- International Boundary
- Major Road
- Fault
- Canal
- Watercourse
- Waterbody

NOTE

Well and water level data is from United States Geological Survey (USGS) National Water Information System.

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FEET

Date: November 21, 2024
Data Sources: BLM, ESRI, USGS, Imagery (2022)

GSI Water Solutions, Inc.

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FIGURE 10

Well Location Map
Ocotillo-Clark Valley
Groundwater Basin

Perkins Renewable Energy Project
Water Supply Assessment

LEGEND

- GAMA Well
- Ocotillo-Clark Valley Groundwater Basin
- Allegretti Farms
- City Boundary
- County Boundary
- Major Road
- Fault
- Canal
- Watercourse
- Waterbody

NOTE

Well location data is from California State Water Resources Control Board Groundwater Ambient Monitoring and Assessment Program. Well status is unknown.

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Date: November 15, 2024
Data Sources: BLM, ESRI, USGS, Imagery (2022)

GSI Water Solutions, Inc.

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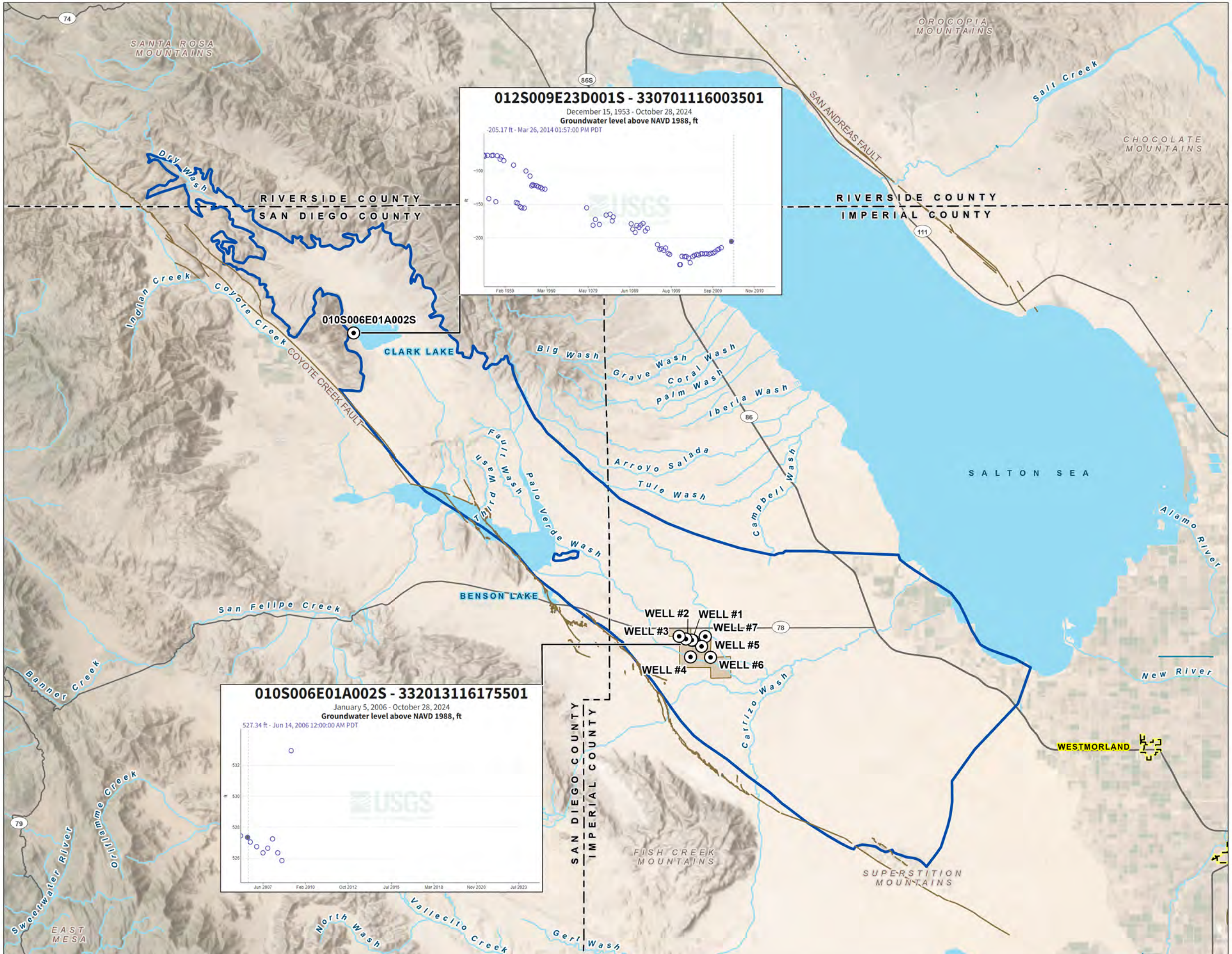

FIGURE 11

Select Ocotillo-Clark Valley Groundwater Basin Hydrographs

Perkins Renewable Energy Project
Water Supply Assessment

LEGEND

- Well Location
- Ocotillo-Clark Valley Groundwater Basin
- Allegretti Farms
- City Boundary
- County Boundary
- Major Road
- Fault
- Canal
- Watercourse
- Waterbody

NOTE

Well and water level data is from United States Geological Survey National Water Information System. Well status is unknown.

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Date: November 14, 2024
Data Sources: BLM, ESRI, USGS, Imagery (2022)

GSI Water Solutions, Inc.

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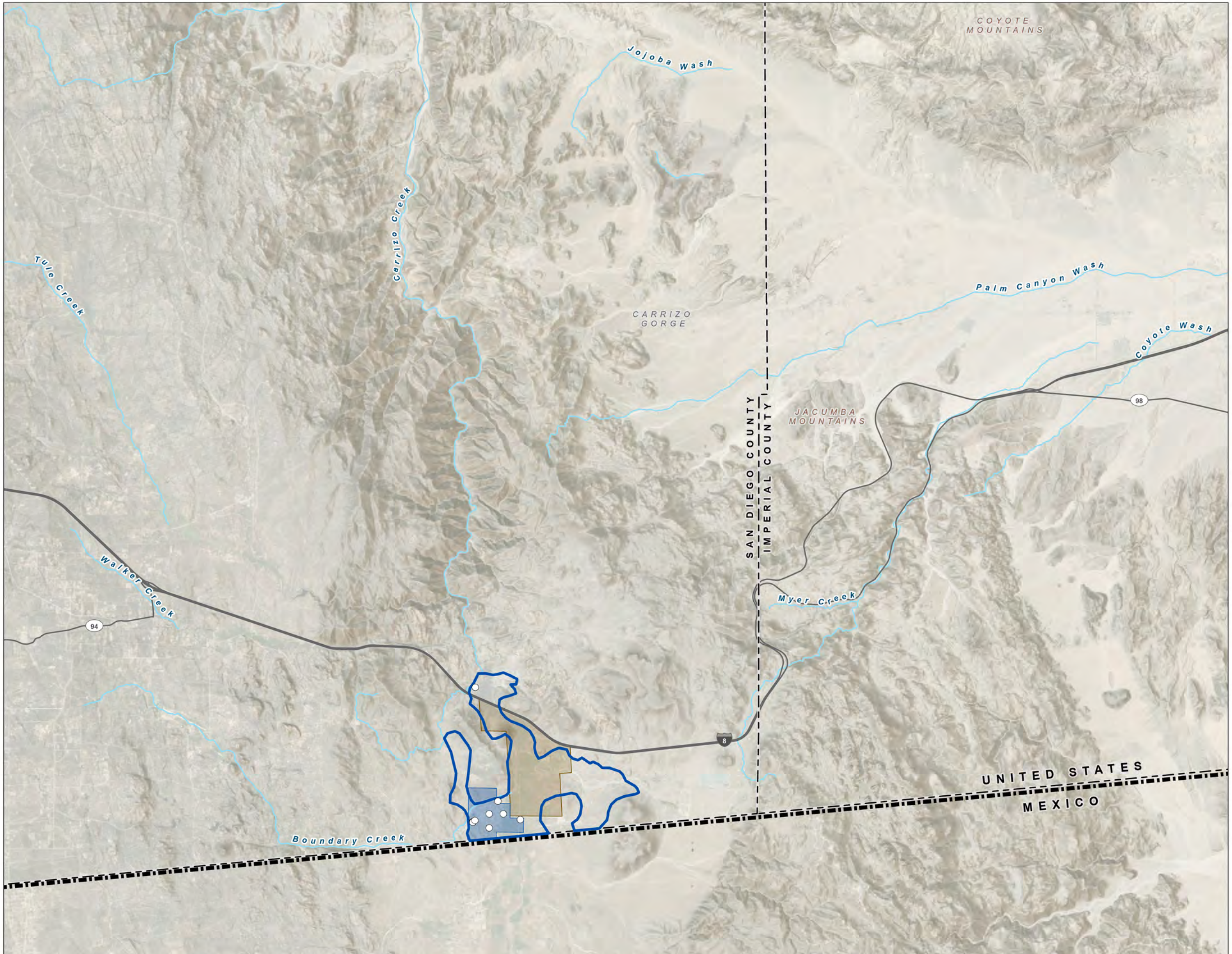

FIGURE 12

Well Location Map
Jacumba Valley Groundwater Basin

Perkins Renewable Energy Project
Water Supply Assessment

LEGEND

- GAMA Well
- Jacumba Valley Groundwater Basin
- Jacumba Community Services District
- Jacumba Valley Ranch
- County Boundary
- International Boundary
- Major Road
- Watercourse

NOTE
Well location data is from California State Water Resources Control Board Groundwater Ambient Monitoring and Assessment Program. Well status is unknown.

N

0 4,500 9,000 13,500
FEET

Date: November 14, 2024
Data Sources: BLM, ESRI, USGS, Imagery (2022)

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4.5.2 Groundwater Quality

A description of groundwater quality in the IVGB, OCVGB, and the JVGB is presented in the following sections.

4.5.2.1 Imperial Valley Groundwater Basin

In the early 1960s, Loeltz et al. (1975) investigated the hydrogeology of the entire Imperial Valley. Then, in 2015, Coes, et al. investigated the hydrogeology along the AAC in the Imperial Valley to better understand the effect of lining the AAC and other management actions upon the quality of water from LCRP wells, which is delivered to the AAC. These two works inform much of the following summary of groundwater quality as it relates to the Project.

Groundwater quality varies throughout the IVGB. Groundwater samples from 51 wells located on the East Mesa indicated total dissolved solids (TDS) concentrations of 498 milligrams per liter (mg/L) to 7,280 mg/L (Loeltz et al., 1975). A limited number of sampled wells in the western portion of the IVGB contained TDS concentrations of less than 2,000 mg/L. The New River drains the Mexicali Valley and contributes approximately 7,000 AFY of recharge to the IVGB (DWR, 2004a). The New River is polluted with elevated concentrations of industrial and domestic waste, negatively impacting groundwater quality in the IVGB (Setmire, 1979; DWR, 2004a).

Where there is substantial groundwater recharge from canal seepage, the groundwater quality is consistent with that of Colorado River water, which has sulfate as the predominant ion. In other areas not recharged by canal seepage, sodium or bicarbonate is the principal ion (Loeltz et al., 1975). Before the completion of the AAC in 1940, groundwater in areas near the AAC was primarily sodium-chloride/sulfate water with relatively low TDS (500 to 820 mg/L). The Colorado River water in the AAC had sodium and chloride concentrations, as well as lower calcium and sulfate concentrations. The variations in TDS in the East Mesa most likely reflect the varying proportions of Colorado River water mixed with groundwater. TDS concentrations in groundwater are typically higher in the East Mesa at a distance from the AAC than they are near AAC seepage locations (Coes et al., 2015).

Loeltz et al. (1975) investigated groundwater quality with depth by logging three deep wells: LCRP-6a, LCRP-11, and LCRP-12 (see Figure 8) (Coes et al., 2015). Depth to brackish water in the three wells varied. Geophysical investigation results from LCRP-6a, located at the intersection of the AAC and Coachella Canal, indicated fresh water to a depth of 2,519 feet bgs. Five and a half miles northwest of LCRP-6a, geophysical results from LCRP-12 indicated freshwater down to 1,000 feet bgs. Thirteen miles to the northwest of LCRP-6a and adjacent to the Coachella Canal geophysical results from LCRP-11 indicated freshwater to 250 feet bgs. In LCRP-11, it was concluded that there was no seepage from the Coachella Canal in that area. Groundwater samples were also analyzed for TDS and it was found that samples with less than 1,000 mg/L were predominant near the AAC and HWY 80.

4.5.2.2 Ocotillo-Clark Valley Groundwater Basin

In the northern part of the OCVGB, near Clark Lake, the dominant cation is sodium or calcium while the dominant anions are sulfate and chloride. TDS averages about 950 m/L. In the southern part of the OCVGB the groundwater is either of a chloride-sulfate or sodium chloride chemistry. Average TDS concentrations are approximately 2,500 mg/L. TDS concentrations generally increase with pumping time in wells in the OCVGB. Elevated levels of TDS, sulfate, chloride, and fluoride are known to impair the use of groundwater for domestic and irrigation purposes. Local impairments of water quality include TDS, sulfate, chloride, and fluoride (DWR, 2004b). According to Todd Engineers (2013), in the south-central area of the basin the deep aquifer has superior water quality as compared to the shallow aquifer. TDS concentrations in the deep Allegretti wells was 1,200 to 1,800 mg/L between 1962 and 2002. Allegretti Well #7, screened in the upper part of the deep aquifer, indicates slightly better water quality in upper part of the deep aquifer with TDS levels at 880 and 930 mg/L (sampled in 1982 and 1995) (see Figure 10) (Todd Engineers, 2013).

4.5.2.3 Jacumba Valley Groundwater Basin

Groundwater chemistry in the JVGB typically ranges from sodium chloride to sodium sulfate and calcium chloride to calcium sulfate. TDS concentrations range from 296 to 6,100 mg/L and conductivity ranges from 499 to 8,030 µohms. Groundwater quality degrades towards Carrizo Gorge in the north where TDS ranges from 2,000 to 6,000 mg/L (DWR, 2004c).

4.6 Groundwater Pumping

A description of groundwater pumping from the IVGB, OCVGB, and the JVGB is presented in the following sections.

4.6.1 Imperial Valley Groundwater Basin

Few production wells, consisting mainly of domestic-use or stock wells, have been drilled on the East Mesa or in eastern Imperial Valley (Coes et al., 2015). Groundwater pumping in the Imperial Valley was estimated to be about 25,600 AFY (Tompson et al., 2008). IID provides surface water to agricultural areas in the Imperial Valley and does not operate production wells (GEI, 2012). IID has two wells adjacent to the AAC to supply cooling water for the electrical turbines at IID drops 3 and 4 (see Figure 1 for Drop locations) (Loeltz et al., 1975). Historically, there has been little need to develop groundwater resources in the Imperial Valley because of the availability of Colorado River Water (GEI, 2012). Attempts at crop irrigation with groundwater were made before 1915, but, as of the 1960s, only a few wells were being used for irrigation (Loeltz et al., 1975).

In 1986, the BOR received authorization to construct, operate, and maintain well-field facilities in the Algodones Dunes area along the AAC in Imperial County, as part of the LCWSP. Since 1996, groundwater from LCWSP wells has supplied up to 10,000 AFY of water to non-agricultural California users who do not hold rights to Colorado River water or whose rights are insufficient to meet their present or anticipated future needs (Coes et al., 2015).

There are several geothermal projects in the East Mesa area and eastern Imperial Valley (ICPDS, 2017). Although these projects are assumed to extract groundwater for project operations, the produced water is assumed to be injected back into the original producing aquifer.[4] Therefore, consumptive groundwater use by geothermal projects is considered de minimis.

4.6.2 Ocotillo-Clark Valley Groundwater Basin

As discussed in Section 4.5.1.2, agricultural irrigation likely peaked in the OCVGB in 1978 at approximately 1,700 acres, with groundwater extractions estimated to be greater than 10,000 AF. Irrigated acreage generally ranged from 500 to 1,000 acres through 2009 and decreased to 80 irrigated acres in 2010 and 2011.

[4] Produced groundwater associated with geothermal facilities likely originates from a source deeper than any adjacent groundwater production wells. Therefore, any groundwater extraction or injection associated with geothermal facilities within the IVGB is assumed to originate from a source deeper than the upper and lower aquifers discussed in Section 4.3.

Based on recovering groundwater levels in the OCVGB, Todd Engineers (2013) inferred that groundwater pumping between 2002 to 2011 was within the OCVGB's perennial yield. Reduced pumping occurred (with the continued decrease of irrigated acres) from 2010 to 2011 and was estimated to be approximately 200 to 225 AFY. Groundwater levels have been gradually recovering since about 2002 due to reduction in irrigated acres (Todd Engineers, 2013).

Groundwater pumped in the OCVGB is mainly used for solar project and agricultural purposes, and small quantities are pumped for dust control and landscape irrigation. Some wells were briefly pumped in the 1980s for irrigation of citrus, however, groundwater was replaced with Colorado River water from IID for irrigation (Todd Engineers, 2013).

4.6.3 Jacumba Valley Groundwater Basin

Groundwater has been the primary source of water for the town of Jacumba since the mid-1950s. The town's first well was drilled in 1956, and due to declining water levels, several additional wells were drilled through the early 1970s. Groundwater pumping increased through the 1960s due to increased water demand in the region from the construction of Interstate 8 and attempted lettuce farming (Swenson, 1981).

The current water demand from the JVGB alluvial aquifer includes potable demand for the Jacumba Valley Ranch Water Company, as well as potable and non-potable demand from the JCSD (Dudek, 2021). Historically, agriculture groundwater pumping on the Jacumba Valley Ranch occurred primarily from the alluvial aquifer; however, as of 2021 no water is being pumped at the Jacumba Valley Ranch for this purpose. The Jacumba Valley Ranch Water Company supplies approximately 5 AFY of potable water for three homes, two gas stations, and two fire hydrants. The JCSD has 239 potable service connections, with an estimated annual demand of 120 AFY. As of spring 2021, this demand is satisfied by pumping wells within the bedrock aquifer. Non-potable demands are approximately 4 AFY. An additional six suspected domestic wells produce from the alluvial aquifer with an estimated demand of 3 AFY. Total potable and non-potable demand from the JVGB alluvial aquifer is estimated at 132 AFY (Dudek, 2021).

4.7 Land Subsidence

DWR Basin Prioritization (DWR, 2020) noted no documented groundwater extraction-induced inelastic subsidence in the IVGB, OCVGB, or the JVGB. The Project is not anticipated to cause lowering of groundwater levels to levels below recorded historical low groundwater levels in any of the three basins. Therefore, the Project is not anticipated to cause subsidence, or increase the rate of subsidence, in the basins. A discussion of available land surface vertical displacement data is included in the following sections.

4.7.1 Imperial Valley Groundwater Basin

There are 20 Continuous Global Positioning System (CGPS) stations located in the Imperial Valley (see Figure 1). Two of the stations were installed in 1999 and have a POR that extends through present. Approximately 14 stations were installed between 2005 to 2007 and have a POR that extends through 2023 or present. Four stations were installed between 2013 to 2015 and have a POR that extends through 2019 or present.

Land surface elevation data from CGPS stations on the west side of the IVGB indicate a positive vertical displacement (uplift of the land surface). Total uplift in the western portion of the IVGB from 2005 to 2024 varies from 0.047 to 0.29 feet. Land surface elevation data from CGPS stations in the eastern and northern portions of the IVGB indicate a negative vertical displacement (subsidence of the land surface) that varies from 0.028 to 0.788 feet, although a majority of the CGPS stations indicate a negative vertical displacement of less than 0.289 feet (DWR, n.d.[b]). See Figure 1 for the CGPS station locations.

4.7.2 Ocotillo-Clark Valley Groundwater Basin

There are three CGPS stations within the OCVGB with PORs starting as early as 2007 and extending through present (see Figure 3). Vertical displacement recorded at these sites are generally ±0.03 feet. Interferometric Synthetic Aperture Radar (InSAR) deduced land subsidence has occurred between the Superstition Hills and the Coyote Creek fault. Land subsidence near the Coyote Creek fault is suspected to be a result of historical pumping from Allegretti Farms (Van Zandt, 2004).

4.7.3 Jacumba Valley Groundwater Basin

No subsidence data or report of subsidence was identified for the JVGB.

4.8 Potential Groundwater Dependent Ecosystems

GDEs are defined as ecological communities or species that depend on groundwater emerging from aquifers or on groundwater present near the ground surface. The following datasets were used to identify the distribution of potential GDEs occurring in the IVGB, OCVGB, and JVGB near the Project and potential Project water source areas.

1. Natural Communities Commonly Associated with Groundwater (NCCAG) was evaluated for nearby groundwater impacted vegetation and wetlands.
2. National Hydrography Dataset (NHD) was evaluated for the occurrence of seeps or springs.
3. U.S. Fish and Wildlife Service Critical Habitat spatial dataset was evaluated for endangered or threatened species.

The NCCAG dataset is a compilation of 48 publicly available state and federal agency datasets that map vegetation, wetlands, springs, and seeps in California. A working group that includes DWR, California Department of Fish and Wildlife, and The Nature Conservancy reviewed the compiled dataset and conducted a screening process to exclude vegetation and wetland types less likely to be associated with groundwater and to retain types commonly associated with groundwater as described in Klausmeyer et al. (2018). Two habitat classes are included in the NCCAG dataset statewide:

- Wetland features commonly associated with the surface expression of groundwater under natural, unmodified conditions
- Vegetation types commonly associated with the subsurface presence of groundwater (phreatophytes)

The data included in the NCCAG dataset do not represent the determination of a GDE by DWR, only the potential existence of a GDE.

4.8.1 Imperial Valley Groundwater Basin

Two vegetation types (desert riparian and alkali desert scrub) and two wetland types (Palustrine, Scrub-Shrub, Broad-Leaved-Evergreen, Seasonally Saturated and Palustrine, Emergent, Persistent, Seasonally Flooded) were located adjacent to the Project along the AAC and EHC in the IVGB (Figure 13). These potential GDEs have been documented to be supported by canal seepage water or mounded groundwater as a result of canal seepage (see Section 3.1) (IID, n.d.[b]).

Based on the cone of depression analysis (see Section 8) and the Feasibility Study (GSI, 2024) for the Project Well, the modeled zone of influence after 2 years of Project construction pumping (500 AFY) is an approximately 1,500-foot radius cone of depression out to 0.1 feet of drawdown. Project operational pumping (50 AFY for 48 years) and decommissioning pumping (100 AFY for 2 years) have negligible effects; no significant cone of depression is estimated for either pumping period. Pumping from the Project Well would not impact or capture canal seepage water and would therefore not have adverse impacts on the identified GDEs.

No springs, seeps, or critical habitat were identified in the vicinity of the Project. The only critical habitat listed in the IVGB is the Peirson's milk-vetch. The nearest occurrence is located approximately 11 miles east of the Project site (see Figure 13). The USGS NHD dataset shows one mapped seep or spring in the IVGB, which is about 40 miles northwest of the Project.

4.8.2 Ocotillo-Clark Valley Groundwater Basin

In the OCVGB, two wetland types were located within the vicinity of the potential Project water source (Allegretti Farms irrigation wells) (see Figure 14). One wetland listed as Palustrine, Emergent, Persistent, Seasonally Flooded is located directly south of the Allegretti Farms property and the second wetland was listed as Riverine, Lower Perennial, Unconsolidated Bottom, Permanently Flooded located within San Felipe Creek and Carrizo Wash, located approximately 2 miles to the east-southeast (downstream) of the potential Project water source. The NCCAG and NHD database also indicate three seeps/springs within San Felipe Creek, Fish Creek Wash, and Carrizo Wash. The U.S. Fish and Wildlife Service critical habitat database indicates one critical habitat area (Desert pupfish [*Cyprinodon macularius*]) located more than 2 miles east-southeast (downstream) of Allegretti Farms, within and adjacent to the mapped wetlands and seeps/springs in San Felipe Creek, Fish Creek Wash, and Carrizo Wash.

The NCCAG database showed alkali desert scrub vegetation located at the Allegretti Farms property. Alkali desert scrub has two phases: xerophytic and halophytic. In areas where the xerophytic phase is abundant, groundwater has been documented as shallow as 5 meters (16.5 feet). In areas where the halophytic phase is abundant, groundwater is usually at or near the surface and heavily mineralized. Some common species of alkali desert scrub include four-wing saltbrush, shadscale, bud sage, Torrey's saltbush, spiny hopsage, and black greasewood (Rowlands, n.d.). Four-wing saltbrush and shadscale have a maximum reported rooting depth of 39.37 feet, bud sage has a maximum reported rooting depth of 4.2 feet, and Torrey's saltbush has a maximum reported rooting depth of 11.81 feet. Spiny hopsage has a maximum reported rooting depth of 7.05 feet and greasewood has a maximum reported rooting depth of 13.13 feet (TNC, 2021).

As discussed in Section 4.3.2, there is a shallow and deep aquifer in the OCVGB. The Allegretti Farms wells pump from the partially confined deep aquifer. A clay layer underlies the shallow aquifer and acts as a semi-confining to confining unit to the lower aquifer. Groundwater levels in the shallow aquifer are about 100 feet higher than the deep aquifer (Todd Engineers, 2013). Historical groundwater level data from the San Felipe well (screened in the deep aquifer adjacent to Allegretti Farms) indicates water levels declined from approximately 80 to 240 feet NAVD 88 from the 1954 to 2001. The most recent measurement in 2014 indicated the groundwater level was approximately 205 feet NAVD 88.

Except for the chronic lowering of groundwater levels observed in the deep aquifer, water levels near Allegretti Farms are generally stable and do not indicate acute climatic responses (e.g., recharge from precipitation). The delay in a change of water levels to precipitation events is suspected to be a result of the distance from the washes (areas of recharge) to the property, the significant thickness of the unsaturated (vadose) zone, and the presence of a clay layer separating the shallow aquifer from the deep aquifer (Todd Engineers, 2013). There are local perched aquifers that hinder irrigation return flows to the deep aquifer. It is likely the potential GDEs are supported by the shallow aquifer or the perched aquifers which are seasonally recharged during heavy precipitation events and historical irrigation runoff. This is also supported by identified GDE maximum documented rooting depths. The shallow aquifer is suspected to feed the San Felipe and Fish Creek wash (Todd Engineers, 2013) which corresponds with the location of documented springs and seeps (see Figure 14).

Temporary Project groundwater pumping from the deep aquifer is unlikely to impact the shallow aquifer. Because the Project proposes to source water from the deep semi-confined to confined aquifer and the identified potential GDEs are not supported by the deep aquifer, the cone of depression analysis (see Section 8) is not applicable to this analysis and the Project would not have an impact on the potential GDEs. Similarly, the Project is not anticipated to impact existing springs or seeps because they are likely sourced from the shallow aquifer based on location and suspected source of the San Felipe Creek.

4.8.3 Jacumba Valley Groundwater Basin

Two types of GDE habitat, desert sink scrub and mesquite bosque, were identified in the JVGB (Figure 15). The dominant species of the desert sink scrub were listed as succulent chenopods, which may include iodine bush (*Allenrolfea occidentalis*), fourwing saltbrush (*Atriplex canescens*), and salt heliotrope (*Heliotropium curassavicum*). The dominant species of the mesquite bosque was listed as mesquite which may include carelessweed (*Amaranthus palmeri*), white bursage, fourwing saltbrush, and allscale (Dudek, 2021). Iodine bush and bursage have a maximum reported rooting depth of 5.91 feet and four-wing saltbrush has a maximum rooting depth of 39.37 feet (TNC, 2021).

The Project water source from the JVGB would be from JCSD alluvial wells (likely Well #2 and Well #3) (see Figure 15). Dudek (2021) measured and recorded water levels for Wells #2 and #3 in in December 2018 to be 56.21 and 35.14 feet bgs, respectively. Dudek (2021) conducted well pumping tests at JCSD Well #2 and Well #3 to estimate groundwater drawdown at nearby GDEs. The results of the pumping tests were used to determine projected drawdown after 90 days, 1 year, and 5 years of pumping using a log-log plot. The projected distance of drawdown was determined using the Theis equation. The nearest GDE at Well #2 was approximately 1,820 feet away. The nearest GDE at Well #3 was approximately 140 feet west of the well. The projected drawdown at the nearest GDE from Well #2 as a result of pumping Well #2 after 90 days, 1 year, and 5 years was predicted to be 1.08 feet, 0.34 feet, and 0.08 feet, respectively. Projected drawdown at the nearest GDE to Well #3 as a result of pumping Well #3 after 90 days, 1 year, and 5 years was predicted to be 3.66 feet, 1.11 feet, and 0.27 feet, respectively (Dudek, 2021). Based on the projected drawdowns, Dudek determined that the effects of proposed pumping for the JVR Energy Park Project on nearby GDEs was anticipated to be less than significant, and not adversely impact nearby GDEs. The Dudek (2021) determination of significance was based on County of San Diego Groundwater Ordinance (County of San Diego, 2023b), which defines the following threshold for determining a significant impact to riparian habitat or a sensitive natural community (County of San Diego, 2010): “The project would draw down the groundwater table to the detriment of groundwater-dependent habitat, typically a drop of 3 feet or more from historical low groundwater levels.”

The Project pumping cone of depression analysis (see Section 8) indicates the modeled zone of influence after 2 years of Project construction pumping (500 AFY) is an approximately 1,200- to 1,500-foot radius cone of depression out to 0.2 feet of drawdown, with approximately 2 feet of drawdown at the Project pumping wells. After 48 years of Project operational pumping (50 AFY), the estimated cone of depression out to 0.2 feet of drawdown extends roughly 1 mile to the east of the pumping wells and 1,700 feet to the west, with approximately 0.8 feet of drawdown at the Project pumping wells. The lateral extent of the cone of depression is similar following 2 additional years of decommissioning pumping (100 AFY), with approximately 1 foot of drawdown occurring at the Project pumping wells.

Based on the Dudek (2021) pumping tests and the Project pumping cone of depression analysis, Project pumping is not anticipated to lower groundwater levels to historical lows when more intensive agricultural irrigation and chronic lowering of groundwater levels occurred. Although the 2018 groundwater level measured in Well #3 was above the deepest recorded rooting depth for four-wing saltbrush, the limited magnitude of the modeled drawdown is not anticipated to adversely impact any existing saltbrush near Well #3 (based on County of San Diego [2010]). Water levels measured in 2018 in Well #2 were deeper than documented rooting depths for the identified species and therefore are not anticipated to be supported by the deeper aquifer.

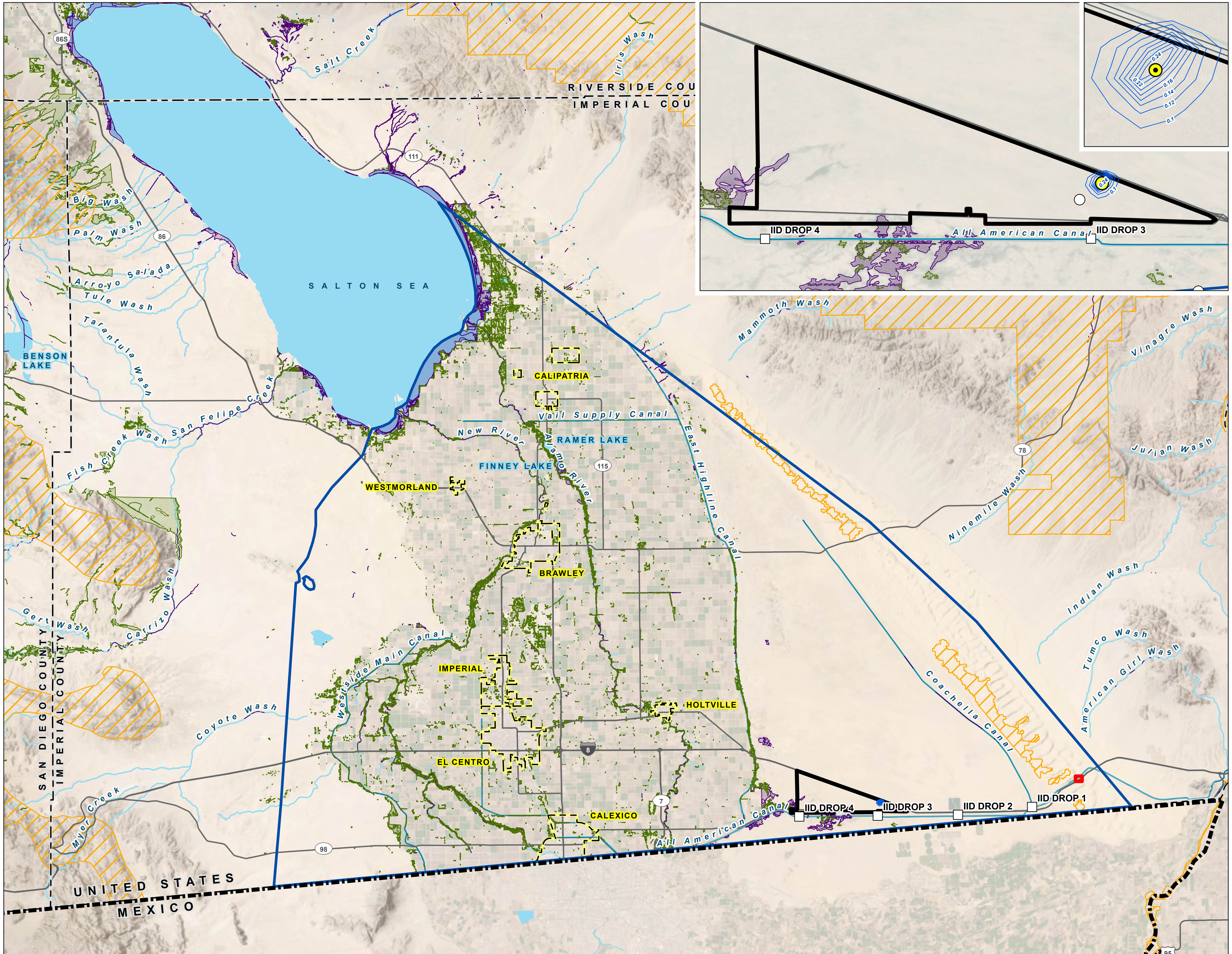

FIGURE 13

Areas Containing Potential Groundwater Dependent Ecosystems and Projected Cumulative Groundwater Drawdown in Imperial Valley Groundwater Basin

Perkins Renewable Energy Project Water Supply Assessment

LEGEND

- NCCAG Vegetation
- NCCAG Wetlands
- USFWS Critical Habitat

All Other Features

- Imperial Irrigation District Drop
- Existing Well
- Proposed Project Well (Layer 9)
- Cumulative Groundwater Drawdown in Feet (0.02' Contour Interval)[1]
- Proposed Project Boundary
- Imperial Valley Groundwater Basin
- Lower Colorado River Water Supply Project
- City Boundary
- County Boundary
- International Boundary
- Major Road
- Canal
- Watercourse
- Waterbody

NOTES

1. Greatest modeled groundwater drawdown after Project construction (End of Year 2; see Figure 16).
2. Project water would be sourced from the lower aquifer and hydrologically upgradient of the unlined portion of the All American Canal. NCCAG and USFWS Critical habitat proximal to the Project are supported by shallow seepage water from the unlined portions of the adjacent canals.

NCCAG: Natural Communities Commonly Associated with Groundwater
USFWS: U.S. Fish and Wildlife Service

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FEET

Date: February 5, 2025
Data Sources: BLM, ESRI, USGS, Imagery (2022)

GSI Water Solutions, Inc.

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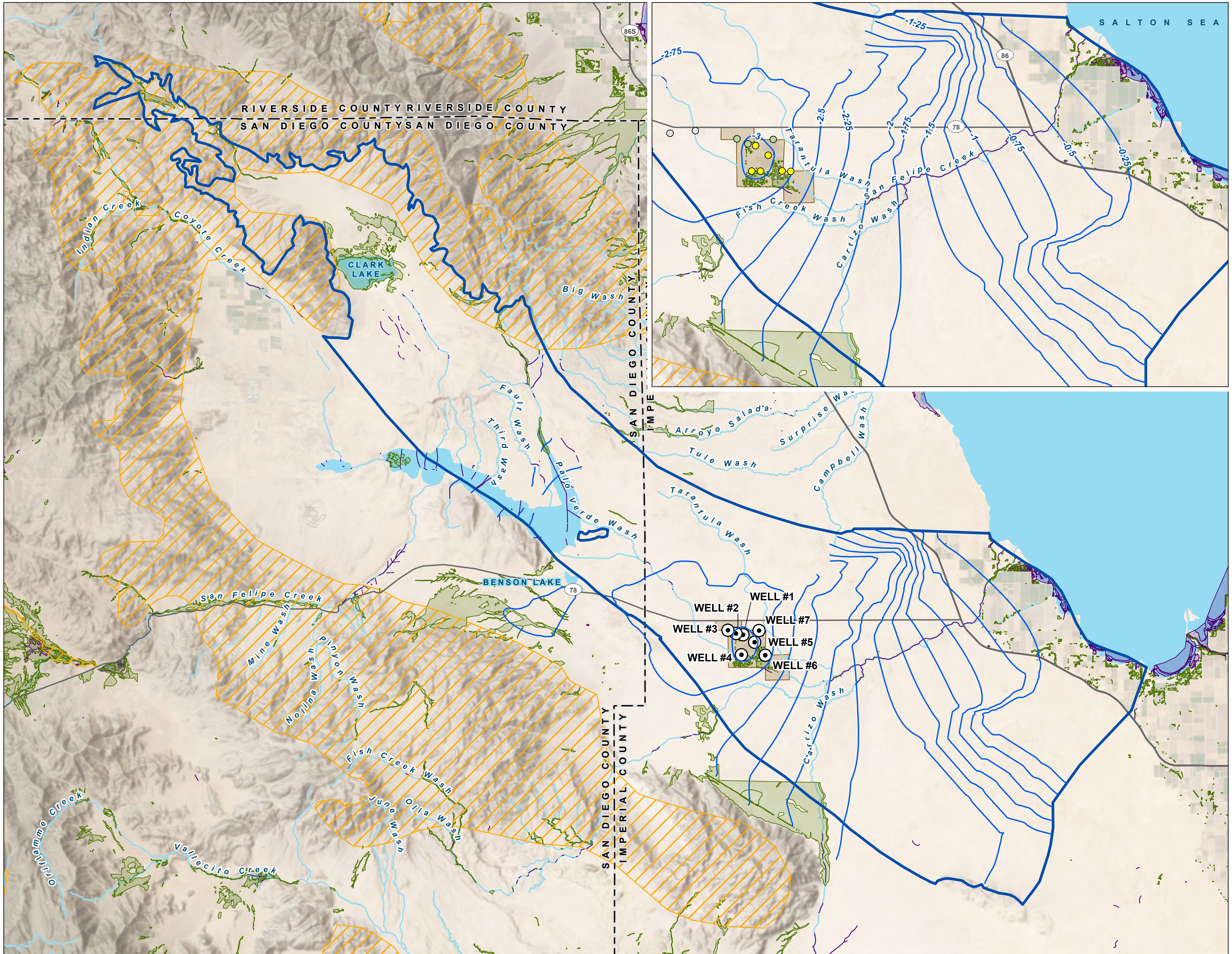
FIGURE 14

Areas Containing Potential Groundwater Dependent Ecosystems and Projected Cumulative Groundwater Drawdown in Ocotillo-Clark Valley Groundwater Basin

Perkins Renewable Energy Project
Water Supply Assessment



LEGEND

- NCCAG Vegetation
- NCCAG Wetlands
- USFWS Critical Habitat

All Other Features

- Allegretti Farms Well Location
- Commercial Pumping Well
- Domestic Pumping Well
- Other Pumping Well
- Cumulative Groundwater Drawdown in Feet (0.25' Contour Interval)[1]
- Ocotillo-Clark Valley Groundwater Basin
- Allegretti Farms
- County Boundary
- Major Road
- Canal
- Watercourse
- Waterbody

NOTES

1. Greatest modeled groundwater drawdown of the deeper, confined to semi-confined, aquifer after Project construction (End of Year 2; see Figure 17).
2. Project water would be sourced from the deeper, confined to semi-confined aquifer, using the Allegretti Farms well(s). NCCAG and USFWS Critical habitat are suspected to be supported by shallow groundwater, such as the alluvial aquifer.

NCCAG: Natural Communities Commonly Associated with Groundwater
USFWS: U.S. Fish and Wildlife Service

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Date: February 5, 2025
Data Sources: BLM, ESRI, USGS, Imagery (2022)

GSI Water Solutions, Inc.

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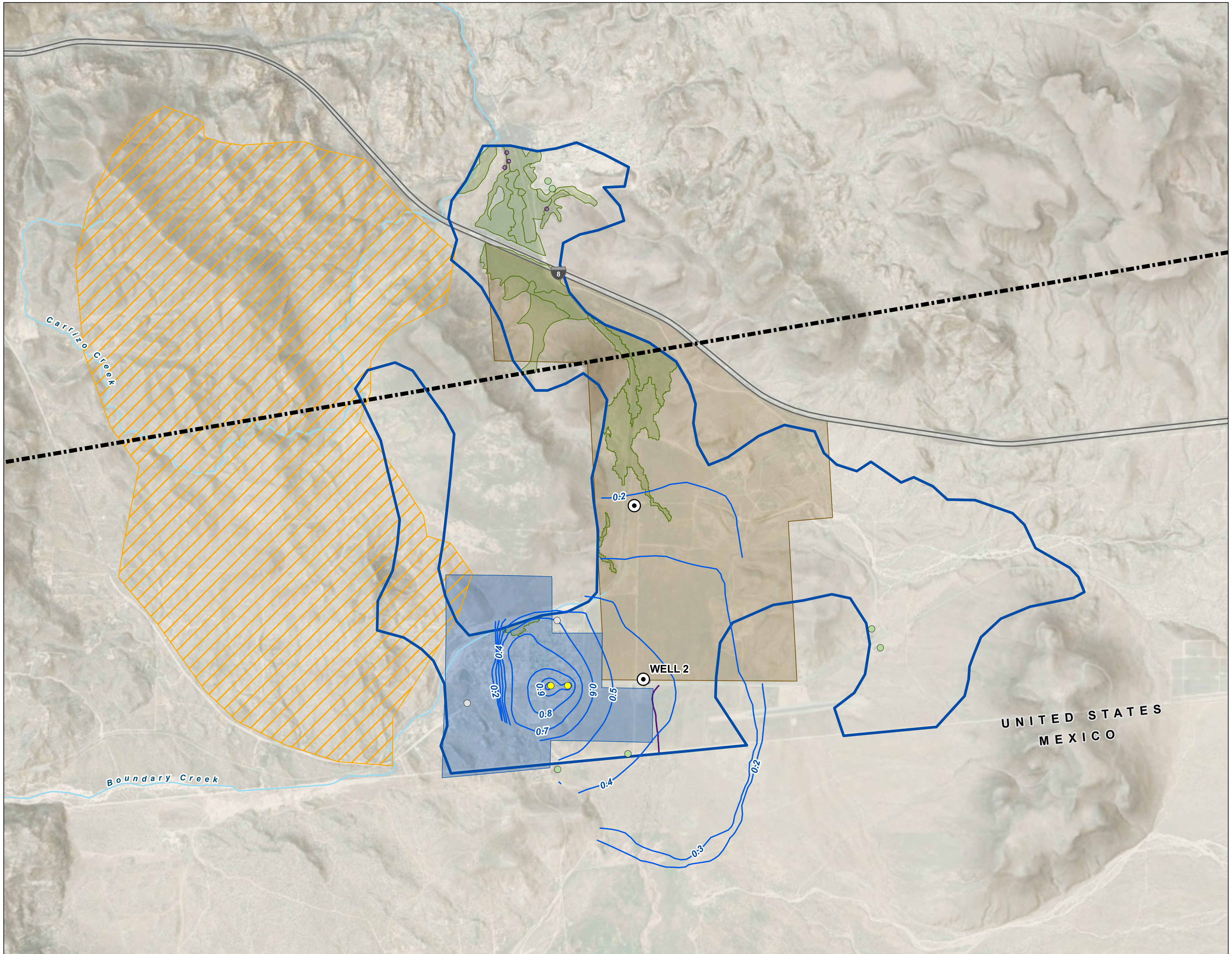

FIGURE 15

Areas Containing Potential Groundwater Dependent Ecosystems and Projected Cumulative Groundwater Drawdown in Jacumba Valley Groundwater Basin

Perkins Renewable Energy Project
Water Supply Assessment

LEGEND

- NCCAG Vegetation
- NCCAG Wetlands
- USFWS Critical Habitat

All Other Features

- Jacumba Community Services District Well Location
- Commercial Pumping Well
- Domestic Pumping Well
- Other Pumping Well
- Cumulative Groundwater Drawdown in Feet (0.1' Contour Interval)[1]
- Jacumba Valley Groundwater Basin
- Jacumba Community Services District (JCSD)
- Jacumba Valley Ranch
- International Boundary
- Major Road
- Canal
- Watercourse

NOTES

1. Greatest modeled groundwater drawdown after Project decommissioning (End of Year 52; see Figure 22).
2. Project water would be sourced from the deeper, bedrock aquifers, using the JCSD well(s). NCCAG and USFWS Critical habitat are suspected to be supported by shallow groundwater, such as the alluvial aquifer.

NCCAG: Natural Communities Commonly Associated with Groundwater
USFWS: U.S. Fish and Wildlife Service

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0 1,200 2,400 3,600
FEET

Date: February 4, 2025
Data Sources: BLM, ESRI, USGS, Imagery (2022)

GSI Water Solutions, Inc.

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4.9 Projected Effects of Climate Change

Climate change may affect water supply availability in the region due to predicted changes in the frequency, duration, and severity of droughts, changes in timing and volume of precipitation, altered fire and weather conditions, and availability of imported water supplies (SDCWA, 2021).

Scripps Institution of Oceanography at the University of California at San Diego (Scripps) climate change scenarios predict a decrease in annual runoff from the Colorado River watershed. Scripps estimates that the Colorado River would only be able to provide its full allocation 10 to 40 percent of the time (Stark, 2009). The BOR similarly predicted that by 2050, the Colorado River would only be able to provide its full allocation 27 to 42 percent of the time (GEI, 2012). The *California Adaptation Planning Guide* (CALEMA and CNRA, 2012) projects that by 2050, average temperatures in the Colorado River hydrologic region could increase by 5°F and the annual number of extreme heat days (exceeding 105°F) could increase. Similarly, by 2050, precipitation could decline by a few inches per year (West & Associates, 2022).

SDCWA evaluated projected impacts on water demand in their service area due to climate change using climate models and various climate scenarios (SDCWA, 2021). Five climate change scenarios were selected to reflect wet/cool, dry/cool, moderate, wet/warm, and dry/warm climates for a period of 2040 through 2060. According to these modeled scenarios, no major changes in seasonal patterns of precipitation or average maximum daily temperature were predicted to occur. However, precipitation was projected to become more concentrated in the winter, with less rainfall in the spring and fall (SDCWA, 2021).

Two SDCWA scenarios modeled a decrease in annual precipitation compared to the 1980–2010 historical average, while all scenarios indicated warming relative to historical climate conditions. The wet/cool and dry/cool scenarios projected lower estimates of total water demand above the baseline regional forecast for normal years, whereas the wet/warm and dry/warm scenarios projected higher estimates of water demand. For projections from 2080 through 2099, the warm/dry scenario results modeled impacts ranging from a 3 percent decrease to a 10 percent increase in water demand relative to the historical normal weather conditions. The SDCWA concluded that temperature affects water demand greater than precipitation for the scenarios selected (SDCWA, 2021).

For the Imperial Region, climate change predictions were analyzed using global climate model simulations (GEI, 2012). Six climate scenarios that considered precipitation, temperature, wind, and ET were analyzed to assess the projected impact of climate change on Imperial Region water demands. All modeled scenarios project temperature increases, with greater increases in minimum temperatures (2 to 14 percent) than maximum temperatures (1 to 5 percent). The largest increase in minimum temperatures are projected to occur in winter and fall. Predicted changes in wind range from a decrease of 3 percent to an increase of 2 percent. Most modeled scenarios project an increase in ET of less than 4 percent; however, a few models predict decreases. All models showed an increase in ET during the summer. In addition, the analysis showed that crop development will be impacted with an increase in the growing day degree in all seasons as much as 19 percent during the winter and spring of 2050. As a result, it is estimated that irrigation water demand will likely increase if cropping patterns do not change (GEI, 2012).

All models projected varying changes in precipitation. Precipitation changes range from a 12 percent decrease to a 24 percent increase in the summer and a 21 percent decrease to a 28 percent increase in the fall, A majority of the models projected that precipitation will increase in the winter by 3 to 19 percent, and decrease in the spring by 15 to 30 percent. The projected impacts in the Imperial Region are likely to impact crop production and yield, altered water use patterns, and an increase in water demand and power consumption (GEI, 2012).

5 Project Water Supply

Water for Project construction, operations, and decommissioning may be obtained from several potential sources, including an on-site groundwater well, off-site groundwater wells, trucked from an off-site water purveyor, and through a water wheeling agreement. A Feasibility Study (GSI, 2024) was completed for the Project to identify potential location(s) for the construction of a Project Well, where the Project Well would not capture seepage water from the AAC or EHC. Although the Feasibility Study identifies a potential Project Well location, IP Perkins, LLC, understands the IID recommends Project water be sourced from water purveyors served by IID or through a water wheeling agreement. Therefore, this WSA evaluates surface water from an off-site purveyor as the primary water source for the Project, and groundwater as a secondary, or supplemental, water source.

As described in Section 2, the total Project life is estimated to be 52 years (including construction, operation, and decommissioning). Therefore, a projected period of 52 years and total Project water use of 3,600 AF is used for groundwater sources in this WSA. For surface water sources, a projected period of 20 years or a period consistent with the most recent applicable water management plan is used in this WSA. Table 1 summarizes the Project duration and water use.

5.1 Surface Water

This WSA assumes the primary water source for the Project would be from a water purveyor(s) served by IID or a virtual transfer of desalinated ocean water from the SDCWA. Water purveyors identified include GSWC of Calipatria and City of Imperial.

Golden State Water Company. GSWC is a private utility company that operates within Imperial County. GSWC receives and treats water from IID and distributes potable water to more than 1,000 service connections (SWRCB, 2023). Untreated water is conveyed to GSWC through the EHC and associated lateral canals. GSWC operates the Water Treatment Plant (WTP) and distribution system for the cities of Niland and Calipatria, and the Calipatria State Prison. The Calipatria WTP treatment capacity is approximately 6,720 AFY, however the WTP's annual flow is based on allocations from IID. GSWC's 2024 allocation is 1,481 AF. The WTP has two finished water reservoirs (approximately 14 AF each) and two raw water reservoirs (approximately 3.5 AF each), totaling 34 AF of storage capacity. The Calipatria WTP discharge point is the "G" Drain, which drains to the Alamo River and ultimately the Salton Sea.

City of Imperial. The City of Imperial receives and treats water from IID and distributes potable water to more than 6,000 service connections. The City's only water supply is surface water from IID via the AAC. The City's water system includes three concrete-lined raw water ponds (approximately 3 AF each) and three treated water storage tanks (approximately 6 AF each), totaling 28 AF of storage capacity. The City's WTP has a capacity of approximately 21 AF per day, or 7,840 AFY, however typical peak flow is approximately 13 AF per day. The City's average imported surface water from 2016 through 2020 was approximately 2,878 AFY, which is considerably less than the WTP capacity (West & Associates, 2022).

From 2016 through 2022 the City of Imperial collected and treated 1,215 AFY of effluent (wastewater generated in the service area) on average. The City's Wastewater Treatment Plant (WWTP) has a capacity of approximately 5,379 AFY. As of the City's 2020 Urban Water Management Plan (UWMP) (West & Associates, 2022), the treated effluent is discharged to percolation ponds, where the water percolates into the IVGB or evaporates. However, IP Perkins, LLC understands the City has installed additional treatment processes which allows for discharge of effluent to an agricultural drain (Dolson Drain, a tributary to the Alamo River) through a National Pollutant Discharge Elimination System (NPDES) permit (CA0104400) (SWRCB, n.d.). Based on the City's UWMP (West & Associates, 2022), projected wastewater flows will increase to 1,934 AFY by 2045, remaining within the capacity of the WWTP.

San Diego County Water Authority. IID transfers up to 277,700 AFY of Colorado River water to the SDCWA as resolved in the Quantification Settlement Agreement (QSA) (SDCWA, n.d.; IID. n.d.[b]). The QSA became effective in October 2003 and includes the ability to conserve, transfer and acquire conserved Colorado River water for up to 75 years.[5] IID transfers Colorado River water to SDCWA as a result of water conserved by IID from delivery system improvements and on-farm efficiency improvements, in return for payments from the SDCWA, including funding of the lining of the AAC and Coachella Canal (SDCWA, n.d.). SDCWA water supply portfolio also includes desalinated seawater. In November 2012, the SDCWA approved a 30-year Water Purchase Agreement with Poseidon Water for the purchase of up to 56,000 AFY of desalinated seawater (SDCWA, n.d.). Currently, SDCWA is using 48,000 AFY (SDCWA, 2024a). Annual availability of desalinated water is not impacted by climatic conditions and is therefore considered a drought-proof supply (SDCWA, n.d.).

Imperial Irrigation District. IID owns and operates the major water supply and drainage infrastructure in the Imperial Valley. Except for a small volume from LCWSP pumping, IID surface water supply is entirely from the Colorado River. Based on historical state law appropriates, IID's Colorado River entitlement is 3.1 million AFY (IID, 2021). IID's Colorado River water rights are senior and are highly reliable and relatively stable compared to more junior water right holders on the Colorado River, even in dry or multiple dry years (GEI, 2012). IID's delivery system begins at Imperial Dam where Colorado River water is diverted and conveyed by gravity through the 80-mile-long AAC. The AAC discharges water to several turnouts, including the Coachella Canal and IID's three main canals, the EHC, Central Main, and Westside Main. EHC, a 49-mile unlined canal, serves eastern and central portions of the IID water service area. The canal roughly follows the northeastern boundary of the IID water service area and conveys irrigation water to agricultural fields via a series of east-to-west laterals. The Central Main Canal connects to the AAC just east of Calexico and serves most of the central part of the IID water service area. The Westside Main Canal extends from the AAC near the western edge of the IID water service area and serves the western portion of the IID water service area (IID, 2021).

5.1.1 Current Surface Water Conditions

A description of current surface water conditions with respect to IID, GSWC, City of Imperial, and SDCWA is included in the following sections.

5.1.1.1 Surface Water Budget

According to IID (2021), the IID water budget from calendar year 2015 through 2019 was balanced (i.e., the amount of water inflow equals the amount of water outflow). In 2019, approximately 93 percent of water distributed by IID was used for agricultural use. The remaining 7 percent was non-agricultural, environmental, and recreational deliveries. Table 2 summarizes select IID water budget components (as presented in IID [2021]) applicable to the Project.

[5] Of the 277,700 AFY, 200,000 AFY are allotted for up to 75 years and 77,700 AFY for 110 years.

Table 2. Select Imperial Irrigation District Water Budget Components (2015–2019)

IID Water Budget Component	Calendar Year				
	2015	2016	2017	2018	2019
Water Year Type[1]	**Above Normal**	**Below Normal**	**Below Normal**	**Critical**	**Below Normal**
Total Precipitation[1] (inches)	**3.26**	**0.81**	**2.9**	**0.04**	**3.29**
IID Inflows					
Total Precipitation[2]	97,100	90,600	105,900	63,300	146,400
Total Inflows[3]	**2,802,600**	**2,803,800**	**2,824,600**	**2,766,300**	**2,779,900**
IID Outflows					
Alamo River Flow to Salton Sea	554,400	549,600	534,400	569,500	558,800
Total Outflows[3]	**2,802,600**	**2,803,800**	**2,824,800**	**2,766,300**	**2,779,900**
IID Non-Agricultural (MCI) Flows					
Non-Agricultural Water Delivery	91,700	89,100	92,200	91,000	90,900
Precipitation on Non-Agricultural Land	15,000	14,200	16,800	10,000	23,300
Total Inflows	**106,700**	**103,200**	**109,000**	**101,000**	**114,200**
Non-Agricultural Consumptive Use of Delivered Water	56,500	54,900	56,800	56,100	56,000
Precipitation Evapotranspiration, Runoff, and Percolation	50,200	48,300	52,200	44,900	58,200
Total Outflows	**106,700**	**103,200**	**109,000**	**101,000**	**114,200**
IID Consumptive Use with Transfer Accounting					
IID/SDCWA Transfer	100,000	100,000	100,000	130,000	160,000
AAC Lining Project Transfer	67,700	67,700	67,700	67,700	67,700
Total Consumptive Use	**3,009,976**	**3,009,976**	**3,009,976**	**3,009,976**	**3,009,976**

Notes

[1] Imperial Valley Groundwater Basin water year type as defined in DWR (2021) based on precipitation recorded at meteorological station El Centro 2 SSW.

[2] Total precipitation calculated for the IID Service Area (GEI, 2012).

[3] Not all inflow and outflow components included in the total are shown (see Table 36 of GEI, 2012).

All volumes are expressed in acre-feet.

AAC = All-American Canal

AF= acre-feet

DWR = California Department of Water Resource

IID = Imperial Irrigation District

SDCWA = San Diego County Water Authority

Source: GEI, 2012.

Although the amount of precipitation within the IVGB does impact the total inflow, it does not have a proportionate impact on Alamo River Flow to Salton Sea or Non-Agricultural Water Delivery. Average precipitation is less than 3 inches per year and does not currently contribute to IID's water delivery, although at times it does increase or reduce agricultural water demand (GEI, 2012).[6]

GSWC and the City of Imperial are water purveyors supplied by IID. Therefore, Table 2 is applicable to these two potential surface water sources and the respective allocations are included in the IID Non-Agricultural (MCI) Flows. The average annual allocation for GSWC from 2015 through 2019 was approximately 1,592 AF (IID, 2024). The average annual allocation for the City of Imperial from 2016 through 2020 was approximately 2,878 AF (West & Associates, 2022).

SDCWA receives desalinated seawater from Poseidon Water. SDCWA received an average of 37,152 AFY of desalinated seawater from 2016 through 2020, and an average of 41,782 AFY from 2021 through 2023 (both exclude member agency supplies) (SDCWA, n.d.).

5.1.1.2 Surface Water Quality

The primary water quality constraint for IID is the salinity of Colorado River water, drainage water and groundwater. A secondary concern is the possibility of contaminants in (agricultural) drainage water. The average flow-weighted salinity from 1970 to 2007 from Colorado River inflow at Imperial Dam was 749 mg/L. Salinity concentrations exceeding 1,000 mg/L have been recorded during months of reduced flow. Salinity in IID drains has been measured in the range of 1,000 to 2,200 mg/L. Reported salinity concentrations in the Alamo River from 1963–2007 average approximately 2,500 mg/L. Salinity concentrations in IID drainage water, including the Alamo River, are expected to increase with full implementation of the Colorado River Water Delivery Agreement. Salinity concentration in the Salton Sea has increased from 40,000 parts per million (ppm) to 65,000 ppm from 1982 to 2019. Contributing factors include lower average precipitation and decreased inflows into Salton Sea. Decreased drainage inflow as a result of Colorado River Water Delivery Agreement implementation is expected to result in Alamo River average salinity concentrations increasing to approximately 3,000 mg/L (IID, 2021).

GSWC generates an annual water quality report. The *GSWC Calipatria Water System Consumer Confidence Report on Water Quality for 2023* (GSWC, 2024) includes an assessment of source water quality and distribution water quality. The source water for GSWC is conveyed through the C West lateral which is part of the EHC. The EHC is considered most vulnerable to the following activities not associated with any detected contaminants:

- Active and historical mining operations
- Agricultural operations - animal feed lots
- Pesticide use
- Farm chemical distribution
- Confirmed leaking underground storage tanks
- Geothermal wells
- Illegal dumping
- Landfills/dumps
- Military installations (GSWC, 2024)

[6] One inch of rainfall across the IID irrigated area results in a reduction of about 50,000 AF in net consumptive use.

Water received from GSWC for the Project would be post-treatment (distribution water) and meet drinking water quality standards.

The City of Imperial also generates an annual water quality report. The *Annual Water Quality Report, Reporting Year 2023* (City of Imperial, 2023) includes measured constituent concentrations present in the City's source water. As previously discussed, the City's WWTP treats raw source water from the AAC. The City conducts weekly, monthly, and quarterly sampling of its water at several locations across its distribution system, as well as at the source. Testing is performed on multiple constituents, such as organic and inorganic chemicals, bacteriological contaminants, pesticides and herbicides, and radiological contaminants (West & Associates, 2022). The raw source water from the AAC exceeds regulatory drinking water limits for aluminum and iron, however, after treatment, the water meets all applicable drinking water quality standards (City of Imperial, 2023). Historically, the City's treated water has exceeded the drinking water standards for total trihalomethanes (TTHMs). In 2018, the City installed a set of Granular Activated Carbon columns to its WWTP to aid in the removal of TTHMs. Water received from the City for the Project would be post-treatment (distribution water) and meet drinking water quality standards.

Colorado River water is the primary imported water source for the SDCWA. High salinity, uranium, and perchlorate are the main constituents of concern in the Colorado River. Desalinated water SDCWA receives from Poseidon Water from the Carlsbad Desalination Plant uses a reverse osmosis membrane to reduce the TDS concentration of seawater from an average of approximately 37,000 mg/L to less than 350 mg/L to meet drinking water standards. Desalinated water from the treatment plant is blended with other treated water sources from the SDCWA at the Twin Oaks WTP (SDCWA, 2021). The intake for SDCWA desalinated ocean water is located in Agua Hedionda Lagoon.

5.1.1.3 Water Conservation and Drought Contingency

IID has several conservation programs, including infrastructure maintenance and improvement, management actions, and incentive programs. Collectively, with all conservation efforts, IID plans to conserve 15 percent of its annual entitlement (West & Associates, 2022). Applicable to the Project, IID has implemented the Equitable Distribution Plan (EDP). The EDP is IID's primary mechanism for managing its 3.1 million acre-feet (MAF) annual water supply cap implemented under the QSA (IID, 2023b). The EDP is a water management tool to address years in which water demand is expected to exceed supply (supply/demand imbalance) (GEI, 2012). Under the EDP:

> Municipal users are apportioned first, and as such retain the highest level of water supply assurances. IID manages municipal apportionments collectively; to the extent an individual municipal water user may exceed its annual apportionment, an increase is not necessary provided the cumulative uses of the municipal sector remain within the total municipal apportionment. Should the cumulative uses exceed the quantified apportionment for all municipal users, IID will ensure that sufficient Colorado River supplies are available in accordance with the EDP to address all municipal water user demands for reasonable and beneficial uses that are implementing appropriate best management practices for this area. (IID, n.d.[c])

In addition to Calipatria and Niland, GSWC provides potable water to multiple communities around California. GSWC offers several conservation rebates, incentives, and programs to its residential and commercial customers to help improve was use efficiency. Additionally, GSWC has a Water Shortage Contingency Plan (GSWC, 2022) for all its service areas. The Water Storage Contingency Plan has six stages to mitigate a water supply shortage that range from voluntary water reduction (Stage 1), mandatory reduction of 20 to 30 percent during moderate to severe shortages (Stages 2 and 3), mandatory reduction of 40 to 50 percent during critical and crisis shortages (Stages 4 and 5), and 55 percent reduction (Stage 6) during emergency shortage (GSWC, 2022).

The City of Imperial promotes water conservation through six demand management measures which include water waste prevention, metering, conservation pricing, public education and outreach, programs to assess and manage distribution system real loss, and water conservation program coordination and staffing support (West & Associates, 2022). The City also has a Water Shortage Contingency Plan that provides guidance on stages of action to be taken in response to water supply shortages caused by intentional or accidental human-caused catastrophes, natural catastrophes, equipment failure, or groundwater contamination. The intent of the plan is to reduce the effect of water shortage on the consumers. The City is legally obligated to implement the plan during sudden water supply interruptions or drought. The City also prepares an Annual Water Shortage Assessment Report that details water production and consumption data each year. In the event of a water shortage, phased water conservation is implemented. Water shortage stages are ranked on a scale of 1 through 6 and each corresponds to a water supply reduction target ranging from 10 percent (Stage 1), to more than 50 percent (Stage 6). Stages 1 through 3 regulate customer responses to shortages and Stages 4 through 6 regulate the City's response efforts.

The SDCWA has several water conservation programs to improve the efficiency of water systems, educate the public about water conservation, and provide incentives and rebates to commercial, residential, and industrial users. In addition, SDCWA has a Water Shortage Contingency Plan, which is a management document that describes actions to be taken in response to various degrees of water shortage, methodology for supply allocation, and a communications plan. It is designed to minimize impacts to the San Diego region's economy and quality of life. This document was approved and in place (under a different name) beginning in 2006 and has been activated from 2007 to 2011 and 2014 to 2016. Each year, the SDCWA performs an assessment to evaluate its Municipal & Industrial supplies and projected water demands. If the annual assessment identifies a shortfall in supply, the SDCWA determines specific actions that should be taken depending on the level of severity. These actions are listed as six different levels and include guidelines for water use restrictions and water conservation. For example, depending on the level of severity, water use could be restricted by voluntary measures (up to 10 percent reduction), mandatory measures (up to 20 to 50 percent reduction), and catastrophic emergency response measures (above 50 percent reduction) (SDCWA, 2021).

5.1.2 Projected Surface Water Conditions

Colorado River water measured at the Imperial Dam and conveyed through the AAC composed 93 percent of IID monthly water supply (calendar year 2019). The remaining 7 percent includes effective precipitation (4 percent) and capture of Colorado River seepage water (3 percent) (IID, 2021). Per the Law of the River, IID has significant historical legal protections to maintain its water right and be able to provide a reliable water supply even during dry periods (GEI, 2012). IID's water rights based on annual Colorado River flows are summarized below.

- **Normal or Average Flows.** During years with normal or average Colorado River flows and adequate reservoir storage in Lakes Powell and Mead, IID's allocation will remain capped at 3.1 MAF (GEI, 2012).
- **Surplus Flows.** During years with surplus flows of more than 7.5 MAF in the Lower Basin (triggered by elevation of Lake Mead), the Seven-Party Agreement and the QSA/Transfer Agreements provide for diversions above 4.4 MAF for use in California. The likelihood of surplus flows in the Colorado River has been diminished by increased Colorado River water use by Nevada and Arizona and by the 11-year drought (1999–2010) in the Colorado River watershed that resulted in historically low levels in Lake Mead (GEI, 2012).

- **Low Flows.** During drought years, with Lower Colorado River flows less than 7.5 MAF at Lees Ferry, existing laws and agreements provide security that IID will receive its annual present perfected right of 2.6 MAF and its overall annual water allocation of 3.1 MAF. However, should levels in Lake Mead fall below 1,075 feet (critical shortage), other agreements take effect (GEI, 2012).

Although projected IID deliveries are required to gradually decrease to approximately 2.6 AFY by 2026, the reduction in net consumptive use is planned to be achieved through IID conservation programs and policies (GEI, 2012).

Various studies have concluded that climate change factors will reduce flows in the Colorado River by approximately 1 to 3 MAF (6 percent to 20 percent) in the next few decades. However, due to IID's senior water rights and associated historical legal protections, the projected reduction in annual Colorado River flows is not anticipated to impact IID's right to 3.1 million AFY of Colorado River water as reported at Imperial Dam (GEI, 2012).

GSWC and the City of Imperial are water purveyors supplied by IID. Therefore, the discussion above regarding projected IID surface water conditions is applicable to these two potential surface water sources. During low flow years, as potable water users, as stated in the EDP and included above, "municipal users (e.g., GSWC and City of Imperial) are apportioned first, and as such retain the highest level of water supply assurances" (IID, n.d.[c]).

Although projections of demand of surface water from IID determined by GSWC is not publicly available, GSWC calculates projected water demands by multiplying the average AFY per connection during the last 10 years by the projected number of service connections. The projected number of service connections is estimated by calculating the increase in service connections during the last 10 years and extrapolating to the projected year (SDCWA, 2024b). Based on this methodology, GSWC demand (and allocations) are projected to increase to 1,607 AFY by 2050, approximately 24 percent of the GSWC WWTP capacity and 3,596 AF less than the projected 2050 GSWC allocation in GEI Consultants, Inc. (GEI) (2012).

The City of Imperial UWMP (West & Associates, 2022) uses a maximum availably supply (apportionment from IID) of 7,824 AFY (100 percent of the WTP capacity) and a likely available supply (80 percent of the WTP capacity) of 6,260 AFY through 2040; an increase of 4,946 AFY and 3,381 AFY, respectively, from the 2016 through 2020 imported surface water supply averages.

Because of the QSA conservation transfers between SDCWA and IID, the SDCWA 2020 UWMP uses a planned supply of 277,700 AFY through the planning period (2045). Similarly, because the annual availability of desalinated seawater is generally not impacted by climatic conditions, and SDCWA approved a 30-year Water Purchase Agreement with Poseidon Water, the SDCWA 2020 UWMP uses a planned supply of 50,000 AFY of desalinated seawater through the planning period (SDCWA, 2021).[7] In addition, there is the potential to increase annual average production capacity of the Carlsbad Desalination Plant to 61,600 AF as an adaptive management supply. The potential 5,600 AF increment of additional seawater desalination supply from the Carlsbad Desalination Plant could be placed into service before 2025 (SDCWA, n.d.).

[7] Although SDCWA (2021) uses 50,000 AFY of desalinated water from the Carlsbad Desalination Plant over the UWMP planning period, SDCWA is currently using 48,000 AFY of the contracted 56,000 AFY, including member agency supplies (SDCWA, 2024a).

5.2 Projected Demand

GEI (2012) assumes full build out of the IID service area will occur in 2050. The IID IRWMP (GEI, 2012) projects population growth for the various IID regions through 2050. Similarly, the City of Imperial UWMP (West & Associates, 2022) project population growth for its service area through the UWMP planning period (2045). Table 3 presents the population growth for Calipatria, Calipatria California Department of Corrections and Rehabilitation, Niland, Imperial, and the SDCWA service area.

Table 3. Projected Population

Year	2015	2020	2025	2030	2035	2040	2045	2050
Calipatria[1]	4,992	5,602	5,997	6,392	6,515	7,264	8,099	9,030
Calipatria CDCR[1]	4,180	4,180	4,180	4,180	4,180	4,180	4,180	4,180
Niland[1]	1,660	2,000	2,410	2,904	3,499	4,217	5,081	6,122
Imperial[2]	18,117	20,707	23,399	26,091	28,783	31,475	34,167	—
IID Service Area (Total)[1]	186,061	210,773	229,434	248,519	260,131	290,694	324,985	363,502
SDCWA Service Area[3]	—	3,300,000	3,442,340	3,536,336	3,623,655	3,709,299	3,789,443	—

Notes

[1] GEI, 2012.

[2] West & Associates, 2022.

[3] SDCWA, 2021.

— = no data reported

CDCR = California Department of Corrections and Rehabilitation

IID = Imperial Irrigation District

SDCWA = San Diego County Water Authority

Table 4 summarizes the per capita municipal demand for applicable IID service area cities and SDCWA. The values for Calipatria and Niland were calculated using reported values in the 2005 and 2010 UWMP's from select IID service area cities (GEI, 2012). The values for Imperial are as reported in the Imperial UWMP (West & Associates, 2022) and are an average of the reported values from 2016 through 2020. The SDCWA values were calculated using an approximate SDCWA service area 2020 population and reported 2020 demand in the SDCWA UWMP (SDCWA, 2021).

Table 4. Per Capita Demand

Year	GPD	AFY
Calipatria/Niland[1]	251	0.28
Imperial[2]	131	0.15
SDCWA[3]	125	0.14

Notes

[1] GEI, 2012.

[2] West & Associates, 2022.

[3] Based on an approximate 2020 population and reported 2020 water demand reported in SDCWA (2021).

AFY = acre-feet per year

GPD = gallons per day

SDCWA = San Diego County Water Authority

Table 5 summarizes projected water demand for applicable IID service area cities and SDCWA. The reported IID Service Area (including the listed IID service area cities) volumes do not include IID target municipal water demand rates (conservation) of up to a 20 percent reduction in water usage per capita. The reported SDCWA volumes include SDCWA projected conservation.

Table 5. Future Water Demand

Year	2015	2020	2025	2030	2035	2040	2045	2050
Calipatria[1]	1,398	1,569	1,679	1,790	1,824	2,034	2,268	2,528
Calipatria CDCR[1]	961	961	961	961	961	961	961	961
Niland[1]	465	560	675	813	980	1,181	1,423	1,714
Imperial[2]	2,531	3,075	3,338	3,630	3,903	4,164	4,406	—
IID Service Area (Total)[1]	43,159	48,833	53,011	57,272	59,748	66,652	74,412	83,139
SDCWA[3]	539,361	463,128	618,169	645,165	671,509	695,860	716,469	—

Notes

[1] GEI, 2012.

[2] West & Associates, 2022.

[3] SDCWA, 2021.

All values are reported in acre-feet.

— = no data reported

CDCR = California Department of Corrections and Rehabilitation

IID = Imperial Irrigation District

SDCWA = San Diego County Water Authority

The projected water demands in GEI (2012) are generally higher than more recent (e.g., 2020) values published in IID purveyor planning documents (e.g., West & Associates, 2022). GSWC's demand in 2020 was approximately 1,516 AF less than the projected GEI (2012) volume. Similarly, the City of Imperial's 2020 demand was approximately 1,323 AF less than the projected GEI (2012) volume. Depending on the GEI (2012) projected population (greater or less than the reported population), the overestimate of water demand may be a result of a lower than projected population or greater water conservation (lower per capita demand) than projected, which should continue as conservation programs and management action continue to be implemented. Regardless, GSWC and Imperial were projected to be receiving a larger allocation, indicating there is adequate available supplies for all phases of the Project through the life of the Project, as planned in GEI (2012).[8] Because GSWC and Imperial are currently receiving less that the projected GEI (2012) allocations, any additional deliveries to these purveyors for Project use would not be considered a reduction in recharge to the Salton Sea because the deliveries would not be redirected from elsewhere in the respective service areas.

Increased water demand based on a projected increase in population also results in increased effluent (wastewater) generated in the service area. As described in Section 5.1, from 2016 through 2022 the City of Imperial collected and treated 1,215 AFY of effluent on average, approximately 23 percent of the City's WWTP capacity. Imperial's projected wastewater flows will increase to 1,934 AFY by 2045, remaining within the capacity of the WWTP (West & Associates, 2022). IP Perkins, LLC, and Imperial have discussed evaluating the feasibility, including permitting, of using the treated effluent as a Project water source. Because the NPDES permitted effluent is currently discharged to Dolson Drain (a tributary to the Alamo River), temporarily redirecting the WWTP effluent to the Project would result in a reduction of discharge to the Salton Sea. However, due to the limited quantity and temporary Project water demand, no adverse impacts to Salton Sea due to the reduced recharge are anticipated. The greatest annual Project water demand will occur during the construction phase of the Project. Construction water use for the Project is up to 500 AFY (for up to 2 years), which is approximately 0.1 percent of the 2019 discharge from the Alamo River to the Salton Sea (see Table 4).

The projected SDCWA single dry-year supply for 2025 is 791,422 AF with a demand of 596,965 AF, resulting in a surplus of 194,457 AF. The projected surplus through 2045 (under various climatic scenarios) remains above 160,000 AF (SDCWA, 2021). The identified SDCWA water source for the Project is desalinated seawater received from Poseidon Water. SDCWA currently uses approximately 48,000 AFY of the contracted 56,000 AFY (SDCWA, 2024a). Based on the SDCWA projected annual surplus and unused desalinated seawater, the Project could source desalinated seawater from the SDCWA without adversely impacting any existing or planned future uses. SDCWA (2021) indicates SDCWA could meet the projected demand of the SDCWA service area, member agencies, and the Project without expanding the capacity of the Carlsbad Desalination Plant to (56,000 AF to 61,600 AF).

[8] Based on GSWC and Imperial receiving the allocation volumes in GEI (2012).

5.2.1 Projected Non-Agricultural Demand

Industrial (Renewable Energy) Demand is categorized under Non-Agricultural Demand in the IID IRWMP (GEI, 2012). The renewable energy projects identified in GEI (2012) are primarily geothermal and solar thermal energy plants. GEI (2012) states that solar mirror and PV industries will be developed in the Imperial Valley and acknowledge that the associated water demand of the industries is relatively low. Therefore, the projected water use for this industry is based on the water use of the listed projects and references published around the same time (2010–2012). Based on the proposed Project size and water demand, the Project is estimated to require approximately 3 AF/megawatt hour over the life of the Project (assumed to be 52 years).

Since publication of GEI (2012), several PV projects have been developed, or are in the review and permitting process, within the IID service area (ICPDS, n.d.). Water for these projects is generally sourced from IID through the IWSP (see Section 4.3.1).[9] The Imperial County General Plan estimates that at full build-out, water demand for renewable energy plants will be 180,000 AFY (GEI, 2012). Although the Project is not eligible for IID's IWSP, the Project's water demand can be categorized in IID's projected industrial demand. Using the 2025 total demand, the Project water demand for construction would represent approximately 0.5 percent to the total IID industrial demand and the Project operational water demand would represent approximately 0.03 percent of the full build-out estimate. The reported 2019 IID municipal and industrial distribution was 90,899 AF, approximately 2 percent greater than the GEI (2012) projected 2020 volume (IID, 2021). However, the 90,899 AF includes municipal use, indicating actual industrial water use is below the projected volume. Therefore, the addition of Project water use would be well within the non-agricultural demand anticipated and planned for by IID. Table 6 presents IID's projected industrial demand through 2050.

Table 6. Projected Industrial Demand (Without Conservation)

Source of Demand	2015	2020	2025	2030	2035	2040	2045	2050
Geothermal and Solar Thermal	64,824	81,277	97,729	114,170	130,623	147,075	163,528	179,969
Industrial	7,862	7,862	7,862	7,862	7,862	7,862	7,862	7,862
Total	**72,686**	**89,128**	**105,580**	**122,033**	**138,485**	**154,926**	**171,379**	**187,831**

Note

All values are reported in acre-feet.

[9] Based on review of various WSAs available at https://www.icpds.com/planning/environmental-impact-reports (accessed November 1, 2024).

5.3 Groundwater

A discussion of projected groundwater conditions for the IVGB, OCVGB, and JVGB are included in the following sections. A discussion of current groundwater conditions for the three basins is included in Sections 3 and 4. Groundwater for Project use from the IVGB, OCVGB, and JVGB would be sourced from a Project Well, the Allegretti Farms' wells, and the JCSD wells, respectively.

5.3.1 Imperial Valley Groundwater Basin

Due to groundwater quality impairments (see Section 4.5.2) and the availability of surface water in the IVGB, the projected groundwater demand in the IVGB is anticipated to remain generally stable (approximately 25,600 AFY [Tompson et al., 2008]).[10] The Tompson et al. (2008) estimate of annual groundwater demand in the IVGB is approximately 0.2 percent of the IVGB storage capacity and approximately 3 percent of the East Mesa storage capacity.

The IVGB groundwater budget presented in Table 7 is considered conservative. Specifically, the estimate of annual pumping is from 2008 and a more recent DWR estimate completed in 2018 estimated 0 AF (DWR, 2020).[11] Additionally, the calculated annual recharge from precipitation does not include recharge from mountain front recharge originating in higher terrain outside of the Tompson et al. (2008) model domain.

As discussed in Section 4.5.1, groundwater levels in the East Mesa have generally been declining since the AAC and Coachella Canal lining projects. Available water level data in the West Mesa indicate rising or lowering water levels depending on location, and water level data from the Imperial Valley indicate generally stable water levels with minor lowering during the past two decades. The ongoing steady decline in water levels may indicate the IVGB is experiencing an annual groundwater budget balance deficit since the reduction of recharge from canal seepage.

Although the presented groundwater budget indicates an annual deficit, due to the availability of surface water, documented water source for existing GDEs, and results of the cone of depression and cumulative impacts analysis (Section 8.1) the Project could use groundwater from the IVGB for all phases of the Project, through the life of the Project, without adversely impacting any existing or planned future uses. The Project construction, operations, and decommissioning water use is approximately 1.3 percent, 0.1 percent, and 0.3 percent of the IVGB annual deficit. The Project would increase the IVGB cumulative deficit by approximately 0.2 percent over the life of the Project. No cumulative projects were identified in the IVGB. The IVGB annual groundwater budget for this WSA was adopted from Greer et al. (2013) and is summarized in Table 7.[12]

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[10] The calculated annual groundwater demand in the IVGB has reduced since the Tompson et al. (2008) estimate (DWR, 2020). However, the IVGB projected groundwater budget and modeling analysis (Section 7) presented herein use the Tompson et al. (2008) estimate of 25,600 AFY.

[11] Basin priority details are available on the SGMA Basin Prioritization Dashboard. Available at https://gis.water.ca.gov/app/bp-dashboard/final/# (accessed November 21, 2024).

[12] Greer et al. (2013) relies in part on groundwater budget components described in Tompson et al. (2008). The Greer et al. (2013) groundwater model domain includes areas outside of the IVGB but within the Salton Sea watershed. Therefore, some of the water budget components account for inflows and outflows that occur, or are contributed to, by sources outside of the IVGB.

Table 7. Imperial Valley Groundwater Basin Annual Groundwater Budget

Groundwater Budget Component	Volume
Inflows	
Irrigation Return Flow and Canal and River Seepage	250,000
Recharge from Precipitation[1]	4,249
Underflow	173,000
Total	**427,249**
Outflows	
Underflow	270,000
Discharge to Surface, Baseflow, and Salton Sea	169,342
Pumping	25,600
Total	**464,942**
Budget Balance	**-37,693**

Notes

All values are reported in acre-feet.

[1] Does not include mountain front runoff originating in higher terrain outside the model domain.

Source: Greer et al., 2013.

5.3.2 Ocotillo-Clark Valley Groundwater Basin

The OCVGB groundwater budget adopted for this WSA is based on DWR (2004) and Todd Engineers (2013) and is summarized and projected in Table 8. The groundwater budget indicates an average annual surplus of approximately 2,080 AF (2010–2035). As discussed, in Section 4.6.2, groundwater levels in the OCVGB have been recovering since the early 2000s as a result of a reduction in irrigated acreage.

The average annual groundwater demand from 2010 to 2035 in the OCVGB is approximately 9 percent of the average annual groundwater recharge during the same period. Project construction, operation, and decommissioning water use is approximately 24 percent, 2 percent, and 5 percent, respectively, of the average 2010 to 2035 budget balance surplus. Assuming average recharge (2010–2035), over the life of the Project, Project pumping would reduce the cumulative OCVGB total surplus by approximately 3 percent. The addition of Project pumping (regardless of Project phase) would not increase the total OCVGB annual pumping, or reduce the annual budget balance surplus, to historical volumes when more intensive agricultural irrigation and a chronic lowering of groundwater levels were occurring. Using the average annual pumping from 2010 to 2035, plus pumping from the construction, operation, and decommissioning Project phases, total annual pumping within the OCVGB would be approximately 26 percent, 10 percent, and 11 percent, respectively, of the 1996 to 2009 average annual pumping for the OCVGB. Therefore, based on the 2010 to 2035 average total annual pumping and budget balance, the Project could source groundwater from the OCVGB for all phases of the Project, through the life of the Project, without adversely impacting existing or planned future uses. No cumulative projects were identified in the OCVGB.

Table 8. Ocotillo-Clark Valley Groundwater Basin Groundwater Budget

Groundwater Budget Component	1996–2009	2010	2015	2020	2025	2030	2035	2040	2045	2075
Mountain Front Runoff (Inflow)	2,300	2,300	2,300	2,300	2,300	2,300	2,300	2,300	2,300	2,300
Pumping (Outflow)	2,801	224	140	300	210	215	215	215	215	215
Budget Balance	**-501**	**2,076**	**2,160**	**2,000**	**2,090**	**2,085**	**2,085**	**2,085**	**2,085**	**2,085**
Project Water Use	—	—	—	—	500	50	50	50	50	100
Project Water Use (Percent of Budget Balance)	—	—	—	—	24	2	2	2	2	5
Budget Balance with Project Pumping[1]	**—**	**—**	**—**	**—**	**1,590**	**2,035**	**2,035**	**2,035**	**2,035**	**1,985**

Notes

All values are reported in acre-feet.

[1] Project Pumping includes construction demand (500 AFY) for 2025, operational demand (50 AFY) for 2030 through 2045, and decommissioning demand (100 AFY) for 2075.

— = not applicable

Source: Todd Engineers (2013) for 1996 through 2035.

5.3.3 Jacumba Valley Groundwater Basin

The JVGB groundwater budget adopted for this WSA is based off Dudek (2021), supplemented using DWR (2003c), and summarized in Table 9. Groundwater pumping from the alluvial aquifer in the JVGB decreased with the reduction of irrigated acres in the basin. The JCSD was expected to cease pumping from the alluvial aquifer in 2019 following completion of a manganese water treatment system for JCSD's fractured rock wells (Dudek, 2021). The resulting projected annual budget balance surplus is 3,670 AF. Project construction, operation, and decommissioning water use is approximately 14 percent, 1 percent, and 3 percent, respectively, of the projected budget balance surplus. The Project would reduce the cumulative total budget balance surplus by approximately 2 percent over the life of the Project.

Dudek (2021) describes up to six additional solar projects (cumulative projects) that may source water from two of the JCSD wells. If the schedule for all six of these projects were the same and project operational and decommissioning water use is assumed to be equal, total construction, operation, and decommissioning water use for the six projects would be 290 AF (1 year) and 7.3 AF (51 years). Including Project pumping, the cumulative project total annual pumping for construction, operation, and decommissioning would decrease the annual budget balance surplus by 25 percent, 2 percent, and 3 percent, respectively. Cumulative project pumping would decrease the JVGB cumulative total budget balance surplus by approximately 3 percent over the life of the Project.

Groundwater in storage in the JVGB alluvial aquifer is estimated to be 9,005 AF. The perennial yield of the basin is estimated to be less than the historical average annual groundwater pumping rate of 2,212 AFY (Dudek, 2021). Total annual pumping in the JVGB with the Project in place during construction, operation, and decommissioning would be approximately 23 percent, 3 percent, and 5 percent, respectively, of the historical average annual groundwater pumping rate. Total annual pumping with all cumulative projects in place during construction, operation, and decommissioning would be approximately 43 percent, 4 percent, and 6 percent, respectively, of the historical average annual groundwater pumping rate.

Therefore, based on the projected total annual pumping and budget balance, the Project could source groundwater from the JVGB for all phases of the Project, through the life of the Project, without adversely impacting existing or planned future uses, including known cumulative projects.

Table 9. Jacumba Valley Groundwater Basin Groundwater Budget (Alluvial Aquifer)

Groundwater Budget Component	Baseline (No Project)			Projected with Project In-Place[1] (Project Phase)			Projected with All Cumulative Projects In-Place (Project Phase)		
	Historical	Current	Projected	Construction	Operation	Decommissioning	Construction	Operation	Decommissioning
Recharge from Runoff (Inflow)	3,682	3,682	3,682	3,682	3,682	3,682	3,682	3,682	3,682
Pumping (Outflow)	2,212	132	12	512	62	112	942	80	130
Budget Balance	**1,470**	**3,550**	**3,670**	**3,170**	**3,620**	**3,570**	**2,740**	**3,602**	**3,552**

Notes

All values are reported in acre-feet per year (AFY).

[1] Project pumping includes construction demand (500 AFY) for 2025 through 2026, operational demand (50 AFY) for 2027 through 2075, and decommissioning demand (100 AFY) for 2075 through 2076.

Source: Dudek, 2021.

6 Climate Scenarios

Projected supply during various climatic conditions for the potential Project water sources is presented in the following sections. As described in Section 2, the Project would require the greatest amount of water during the 24-month construction phase. Approximately 1,000 AF (or 500 AFY) would be required during the 24-month period. Water requirements for the Project would decrease to 50 AFY for 48 years during operations, and 100 AFY for 2 years during decommissioning.

IID, SB 610, and DWR (2021) use different methodologies to define water year type:

- IID's guidance (GEI, 2012) is based off the calculated Imperial Valley 90-year average of 2.85 inches of precipitation per year. The year 2003 had a total precipitation of 2.72 inches and, when the guidance was published, was the closest in recent years to the 90-year average. Therefore, 2003 and 2.72 inches of annual precipitation is considered the baseline normal year. The 2003 IID net consumptive use and supply are also the baseline for a normal year. Although the definition of a dry year is not provided, during a dry year the water demand should be assumed to be 50,000 AF greater for every inch of rainfall less than the water demand in a normal year (GEI, 2012).
- SB 610 guidance suggests a dry year as a year with a precipitation amount that is at 10 percent probability of occurrence, meaning 10 percent of the years would be drier. A critical dry year would be a year with a 3 percent probability of occurrence. This methodology is heavily dependent on the POR of the available precipitation data. It also does not account for climate change or consider the preceding year types (antecedent conditions).
- DWR (2021) defines water years based on a calculated (using hydrologic region-specific weighted multipliers for the current and previous water year's total precipitation) water year index. The water year index is then ranked with the water year indices calculated for the preceding 29 years. Based on the rank of the water year index, the water year is classified as wet, above normal, below normal, dry, or critical. The methodology defined in DWR (2021) accounts for climate change by using a rolling 30-year water year index rank, and for the same reason considers the preceding year types.

The SB 610 methodology is used in GSWC, the City of Imperial, and SDCWA planning documents, and is therefore used to evaluate climate scenarios for those Project surface water sources. The DWR (2021) methodology is used for the climate scenario analysis of the IVGB, OCVGB, and the JVGB groundwater sources because it better accounts for changing climatic and antecedent conditions.

6.1 Normal (Average) Year Conditions

Golden State Water Company. Surface water deliveries from IID is GSWC's only source of water. During average year conditions, GSWC would receive their full allotment from IID. The average annual allocation for GSWC from 2015 through 2019 was approximately 1,592 AF (IID, 2024). GSWC's allocation in 2020 (1,574 AF) was approximately 1,516 AF less than the projected GEI (2012) 2020 volume for GSWC, and 23 percent of the GSWC WTP annual capacity. Based on GEI (2012), GSWC is projected to receive a larger allocation, indicating there is adequate available supplies for all phases of the Project during normal year conditions. Table 10 summarizes the projected available supply and demand for GSWC during normal year conditions.

Based on GSWC's methodology for calculating projected demand, GSWC demand (and allocations) are projected to increase to 1,607 AFY by 2050, approximately 24 percent of the GSWC WWTP capacity and 3,596 AF less than the projected 2050 GSWC allocation in GEI (2012). GSWC demand is projected to remain below GEI (2012) GSWC projections.

Table 10. Golden State Water Company Supply and Demand Projections – Normal Year

Year	IID Net Consumptive Use Amount[1]	Water Supply Capacity[2]	GSWC Projected Demand[3]	IID Projected Demand (for GSWC)[4]	Leftover Planned Available Supply[5]	Project Water Use	Project Water Use (Percent of Leftover Planned Available Supply)[6]	Determination of Adequate Supply[7]
2025	2,618,000	6,720	1,561	3,315	1,754	500	29	Yes
2030	2,613,000	6,720	1,570	3,564	1,994	50	3	Yes
2035	2,613,000	6,720	1,579	3,765	2,186	50	2	Yes
2040	2,613,000	6,720	1,588	4,176	2,588	50	2	Yes
2045	2,613,000	6,720	1,598	4,652	3,054	50	2	Yes
2050	2,618,000	6,720	1,607	5,203	3,596	50	1	Yes

Notes

All values are reported in acre-feet per year.

[1] Measured at Imperial Dam and does not include IID system losses and hidden services (GEI, 2012).

[2] Equal to the annual capacity of the GSWC Water Treatment Plant.

[3] Based on the methodology described in SDCWA (2024b)

[4] GEI (2012).

[5] Difference between previous two columns

[6] Project Water Use includes construction demand (500 AFY) for 2025 and operational demand (50 AFY) for 2030 through 2050.

[7] “Yes” if Planned available supply is equal to greater than Project water demand.

— = not applicable

GSWC = Golden State Water Company

IID = Imperial Irrigation District

City of Imperial. Similar to GSWC, surface water deliveries from IID are the City of Imperial's only source of water, and during average year conditions the City of Imperial would receive their full allotment from IID. The average annual allocation for the City from 2016 through 2020 was approximately 2,878 AF (West & Associates, 2022). The City's allocation in 2020 (1,002 AF) was approximately 3,396 AF less than the projected GEI (2012) 2020 volume for the City, and 13 percent of the City's WTP annual capacity (West & Associates, 2022). Based on GEI (2012), the City is projected to receive a larger allocation, indicating there are adequate available supplies for all phases of the Project during normal year conditions without adversely impacting existing or planned future uses. The City's 2020 UWMP includes water supply availability and demand projections for a normal water year through 2045 (see Table 11). No shortages are anticipated in the service area during a normal water year through 2045. Project construction water use is approximately 26 percent of the 2025 available leftover supply. Project operational water use is approximately 3 percent to 6 percent of the available leftover supply between 2030 and 2045. Based on West & Associates (2022), the Project could source water from the City of Imperial for all phases of the Project without adversely impacting existing or planned futures uses during normal year conditions.

As discussed in Section 5, City effluent is also being considered as a Project water source. Between 2016 and 2022 the average annual volume of treated effluent at the City WWTP was approximately 1,215 AF. The volume of treated effluent is projected to increase over the City UWMP planning period (2045) and remain within the current WWTP capacity (West & Associates, 2022). During a normal year, the volume of effluent is expected to remain consistent with the 2016 through 2022 average, or increase, with projected demand. Temporarily redirecting the WWTP effluent to the Project would result in a reduction of discharge to the Salton Sea. However, due to the limited quantity and temporary Project water demand, no adverse impacts to Salton Sea due to the reduced recharge are anticipated. Therefore, there is adequate treated effluent from the City WWTP for all phases of the Project during normal year conditions without adversely impacting existing or planned future uses.

Table 11. City of Imperial Availability and Demand Projections – Normal Year

Water Sources	2025	2030	2035	2040	2045
Population					
Water Service Area Population	23,399	26,091	28,783	31,475	34,167
Consumption Rate (AFCY) *Including 0.5% Annual Passive Savings*	0.14	0.14	0.14	0.13	0.13
Supply					
Total Normal Supply	**3,338**	**3,630**	**3,903**	**4,164**	**4,406**
Potential Supply *Two-Thirds Capacity of Water Treatment Plant (5,226 AFY)*	5,226	5,226	5,226	5,226	5,226
Projected Supply/Demand[1]	4,696	4,994	5,136	5,726	6,384
Demand					
Total Normal Demand	**3,338**	**3,630**	**3,903**	**4,164**	**4,406**
Percent of Average Demand from Previous 5 Years *2016 to 2020 (2,878 AF)*	116	126	136	145	153
Supply/Demand Comparison					
Supply *minus* Demand	0	0	0	0	0
Available Leftover Supply[2]	1,887	1,596	1,322	1,062	819
Planned Available Leftover Supply[3]	1,358	1,364	1,233	1,562	1,978
Project Water Use	500	50	50	50	50
Project Water Use (Percent of Available Leftover Supply)[4]	26	3	4	5	6
Determination of Adequate Supply[5]	Yes	Yes	Yes	Yes	Yes

Notes

Values reported in acre-feet per year (AFY), unless otherwise noted.

[1] GEI (2012) projected supply/demand for the City of Imperial.

[2] Equal to Potential Supply minus Total Normal Demand. Sum of values may not be exact due to rounding.

[3] GEI (2012) projected supply/demand for the City of Imperial minus Total Normal Demand.

[4] Project Water Use includes construction demand (500 AFY) for 2025 and operational demand (50 AFY) for 2030 through 2045.

[5] "Yes" if Planned available supply is equal to greater than Project water demand.

AF = acre-feet

AFCY = acre-feet per capita per year

Based on West & Associates, 2022.

San Diego County Water Authority. As resolved in the QSA, IID transfers up to 277,700 AFY to the SDCWA. The QSA became effective in October 2003 and includes the ability to conserve, transfer and acquire conserved Colorado River water for up to 75 years.[13] The SDCWA water source for the Project would be the SDCWA desalinated seawater purchased from Poseidon Water. In November 2012, the SDCWA approved a 30-year Water Purchase Agreement with Poseidon Water for the purchase of up to 56,000 AFY of desalinated seawater (SDCWA, 2024a). Currently, SDCWA is using 48,000 AFY (SDCWA, 2024a). Annual availability of desalinated water is not impacted by climatic conditions and is therefore considered a drought-proof supply (SDCWA, 2024a). There is the potential to increase annual average production capacity of the Carlsbad Desalination Plant to 61,600 AF as an adaptive management supply. The potential 5,600 AF increment of additional seawater desalination supply from the Carlsbad Desalination Plant could be placed into service before 2025 (SDCWA, 2024a).

The SDCWA 2020 UWMP (SDCWA, 2021) includes a normal water year assessment, summarizing total water demands in the SDCWA service area through 2045, along with the supplies necessary to meet demand under normal conditions (see Table 12). No shortages are anticipated in the service area during a normal water year through 2045. Project construction water use is approximately 6 percent of the 2025 available Carlsbad Desalination Plant supply. Project operational water use is approximately 1 percent of the available Carlsbad Desalination Plant supply between 2030 and 2045. Based on the SDCWA (2021) normal year water budget, the Project could source desalinated water from the SDCWA for all phases of the Project without adversely impacting existing or planned futures uses.

Imperial Valley Groundwater Basin. The IVGB groundwater budget included in Section 5.3.1 is considered a normal year water budget. Therefore, based on the rationale provided in Section 5.3.1, the Project could use groundwater from the IVGB for all phases of the Project, through the life of the Project, without adversely impacting any existing or planned future uses during normal year conditions.

Ocotillo-Clark Valley Groundwater Basin. The OCVGB groundwater budget included in Section 5.3.2 is considered a normal year water budget. Therefore, based on the rationale provided in Section 5.3.2, the Project could use groundwater from the OCVGB for all phases of the Project, through the life of the Project, without adversely impacting any existing or planned future uses during normal year conditions.

Jacumba Valley Groundwater Basin. The JVGB groundwater budget included in Section 5.3.3 is considered a normal year water budget. Therefore, based on the rationale provided in Section 5.3.3, the Project could use groundwater from the JVGB for all phases of the Project, through the life of the Project, without adversely impacting any existing or planned future uses during normal year conditions.

[13] Although SDCWA (2021) uses 50,000 AFY of desalinated water from the Carlsbad Desalination Plant over the UWMP planning period, SDCWA is currently using 48,000 AFY of the contracted 56,000 AFY, including member agency supplies (SDCWA, 2024a).

Table 12. San Diego County Water Authority Supply and Demand Assessment – Normal Year

	2025	2030	2035	2040	2045
SDCWA Supplies					
Imperial Irrigation District Water Transfers	200,000	200,000	200,000	200,000	200,000
AAC and Coachella Canal Lining Projects	78,700	78,700	78,700	78,700	78,700
Carlsbad Desalination Plant	50,000	50,000	50,000	50,000	50,000
Subtotal	***328,700***	***328,700***	***328,700***	***328,700***	***328,700***
Member Agency Supplies (Verified)					
Surface Water	43,957	43,957	44,659	44,659	44,659
Water Recycling	41,963	45,513	45,628	45,749	45,854
Groundwater	21,900	23,100	23,100	19,600	19,600
Brackish Groundwater Recovery	8,400	8,400	8,400	8,400	8,400
Seawater Desalination	6,000	6,000	6,000	6,000	6,000
Potable Reuse	33,042	53,202	112,562	112,562	112,562
San Luis Rey Water Transfers	15,800	15,800	15,800	15,800	15,800
Subtotal	***171,062***	***195,972***	***256,146***	***252,770***	***252,875***
Metropolitan Water District Supplies	55,996	53,572	13,625	32,765	49,196
Total Projected Supplies	**555,578**	**578,244**	**598,474**	**614,235**	**630,771**
Total Long-Range Demand Forecast with Conservation	**555,578**	**578,244**	**598,474**	**614,235**	**630,771**
Project Water Use	500	50	50	50	50
Project Water Use (percent of Carlsbad Desalination Plant available supply)[1]	6	1	1	1	1
Determination of Adequate Supply[2]	Yes	Yes	Yes	Yes	Yes

Notes

Values reported in acre-feet per year, unless otherwise noted.

[1] Although SDCWA (2021) uses 50,000 AFY of desalinated water from the Carlsbad Desalination Plant over the Urban Water Management Plan planning period, SDCWA is currently using 48,000 AFY of the contracted 56,000 AFY (SDCWA approved a 30-year Water Purchase Agreement with Poseidon Water for the purchase of up to 56,000 AFY of desalinated seawater), including member agency supplies (SDCWA, 2024a). Project Water Use includes construction demand (500 AFY) for 2025 and operational demand (50 AFY) for 2030 through 2045.

[2] "Yes" if Planned available supply is equal to greater than Project water demand.

AAC = All-American Canal

AFY = acre-feet per year

SDCWA = San Diego County Water Authority

Source: SDCWA, 2021.

6.2 Dry Year Conditions

Golden State Water Company. Available Colorado River water is largely controlled by precipitation that falls in the Colorado River Basin watershed (see Section 5.1.2). Therefore, water year type within the Colorado River Basin watershed is more applicable to surface water supply within IID than water year type within the IVGB. However, water year type within the IVGB does impact agricultural demand within the service area.[14]

As described in Section 5.1.1.3, the EDP is IID's mechanism to manage water distributions. Municipal users are apportioned first and deliveries to municipal users (e.g., GSWC) are equal to the average allotment received the previous three calendar years. Therefore, non-agricultural allotments received during a particular year are not impacted by that year's precipitation.

The period from 2001 through 2022 was considered a drought period within the Colorado River Basin Watershed (Bruce et al., 2024). Regardless, IID received its annual present perfected right of 2.6 MAF and its overall annual water allocation of 3.1 MAF during the same period. Because of the methodology defined in the EDP to manage deliveries for non-agricultural water users, allotments received during a particular year are not impacted by that year's precipitation.

Although the Project is not explicitly identified in GEI (2012), the Imperial IRWMP does account for projected increased water demands as a result of growing population size and development of renewable energy. Estimates of industrial (renewable energy) demand will increase from approximately 40,000 AFY in 2005 to approximately 180,000 AFY in 2050 (full build-out). As discussed in Section 5.2.1, the Project's water demand can be categorized in IID's projected industrial demand. Using the 2025 total demand, the Project water demand for construction would contribute approximately 0.5 percent to the total IID industrial demand and the Project operational water demand would contribute approximately 0.03 percent of the full build-out estimate. The reported 2019 IID municipal and industrial distribution was 90,899 AF, approximately 2 percent greater than the GEI (2012) projected 2020 volume (IID, 2021). However, the 90,899 AF includes municipal use, indicating actual industrial water use is below the projected volume. Therefore, the addition of Project water use would be well within the non-agricultural demand anticipated and planned for by IID.

Table 13 presents the GSWC supply and demand projection for a dry year. GSWC projected demand assumes an increase of 5 percent during a dry year, however, the supply is assumed to not be reduced during a single dry year based on the methodology of the EDP and the reliability of IID's surface water deliveries.

Based on the rationale presented above and in Section 6.1, the proposed GSWC water source would be able to provide sufficient water for the Project and existing and planned future uses without causing adverse impacts during dry year conditions.

[14] One inch of rainfall across the IID irrigated area results in a reduction of about 50,000 AF in net consumptive use.

Table 13. Golden State Water Company Supply and Demand Projections – Dry Year

Year	IID Net Consumptive Use Amount[1]	Water Supply Capacity[2]	GSWC Projected Demand[3]	IID Projected Demand (for GSWC)[4]	Leftover Planned Available Supply[5]	Project Water Use	Project Water Use (Percent of Leftover Planned Available Supply)[6]	Determination of Adequate Supply[7]
2025	2,618,000	6,720	1,639	3,315	1,676	500	30	Yes
2030	2,613,000	6,720	1,649	3,564	1,916	50	3	Yes
2035	2,613,000	6,720	1,658	3,765	2,107	50	2	Yes
2040	2,613,000	6,720	1,667	4,176	2,509	50	2	Yes
2045	2,613,000	6,720	1,678	4,652	2,974	50	2	Yes
2050	2,618,000	6,720	1,687	5,203	3,516	50	1	Yes

Notes

All values are reported in acre-feet per year.

[1] Measured at Imperial Dam and does not include IID system losses and hidden services (GEI, 2012).

[2] Equal to the annual capacity of the GSWC Water Treatment Plant.

[3] Based on the methodology described in SDCWA (2024b)

[4] GEI, 2012.

[5] Difference between previous two columns

[6] Project Water Use includes construction demand (500 AFY) for 2025 and operational demand (50 AFY) for 2030 through 2050.

[7] “Yes” if Planned available supply is equal to greater than Project water demand.

GSWC = Golden State Water Company

IID = Imperial Irrigation District

City of Imperial. The City's 2020 UWMP (West & Associates, 2022) includes water supply availability and demand projections for a dry year through 2045. Based on West & Associates (2022), no shortages are anticipated in the service area during a dry year through 2045 (see Table 14). Project construction water use is approximately 29 percent of the 2025 available leftover supply. Project operational water use is approximately 4 percent to 8 percent of the available leftover supply between 2030 and 2045. The Project could source water from the City of Imperial for all phases of the Project without adversely impacting existing or planned futures uses during dry year conditions.

As discussed in Section 5, City effluent is also being considered as a Project water source. Between 2016 and 2022 the average annual volume of treated effluent at the City WWTP was approximately 1,215 AF. The average annual volume of treated effluent at the City WWTP is 243 percent of the peak annual water demand for the Project. During a dry year demand is expected to increase by approximately 5 percent. Therefore, the volume of effluent during a dry year would also be expected to increase. Temporarily redirecting the WWTP effluent to the Project would result in a reduction of discharge to the Salton Sea. However, due to the limited quantity and temporary Project water demand, no adverse impacts to Salton Sea due to the reduced recharge are anticipated. Therefore, there is adequate treated effluent from the City WWTP for all phases of the Project during dry conditions without adversely impacting existing or planned future uses.

Table 14. City of Imperial Availability and Demand Projections – Dry Year

Water Sources	2025	2030	2035	2040	2045
Population					
Water Service Area Population	23,399	26,091	28,783	31,475	34,167
Consumption Rate (AFCY) *Including 0.5% Annual Passive Savings*	0.14	0.14	0.14	0.13	0.13
Supply					
Total Dry Supply	**3,504**	**3,811**	**4,099**	**4,369**	**4,627**
Potential Dry Supply	5,226	5,226	5,226	5,226	5,226
Total Normal Supply	3,338	3,630	3,903	4,164	4,406
Projected Supply/Demand[1]	4,696	4,994	5,136	5,726	6,384
Demand					
Total Dry Demand	**3,504**	**3,811**	**4,099**	**4,369**	**4,627**
Total Normal Demand	3,338	3,630	3,903	4,164	4,406
Percent of Normal	105	105	105	105	105
Supply/Demand Comparison					
Normal Supply *minus* Dry Demand	-166	-181	-196	-206	-221
Dry Supply *minus* Dry Demand	0	0	0	0	0
Available Leftover Supply Capacity[2]	1,721	1,415	1,126	856	598
Planned Available Leftover Supply[3]	1,192	1,183	1,037	1,357	1,757
Project Water Use	500	50	50	50	50
Project Water Use (Percent of Available Leftover Capacity)[4]	29	4	4	6	8
Determination of Adequate Supply[5]	Yes	Yes	Yes	Yes	Yes

Notes

Values reported in acre-feet per year (AFY) unless otherwise noted.

[1] GEI (2012) projected supply/demand for the City of Imperial.

[2] Equal to Potential Supply minus Total Normal Demand. Sum of values may not be exact due to rounding.

[3] GEI (2012) projected supply/demand for the City of Imperial minus Total Dry Demand.

[4] Project Water Use includes construction demand (500 AFY) for 2025 and operational demand (50 AFY) for 2030 through 2045.

[5] "Yes" if Planned available supply is equal to greater than Project water demand.

AFCY = acre-feet per capita per year

Based on West & Associates, 2022.

San Diego County Water Authority. The SDCWA 2020 UWMP (SDCWA, 2021) includes a dry year assessment, summarizing total water demands in the SDCWA service area in 5-year increments through 2045, along with the supplies necessary to meet demand under dry conditions (see Table 15). Groundwater and surface water supplies included in the SDCWA (2021) dry year assessment are based on 2015 dry-year supplies. SDCWA (2021) indicates no shortages are anticipated in the service area during a dry year through 2045. Project construction water use is approximately 6 percent of the 2025 available Carlsbad Desalination Plant supply (8,000 AF). Project operational water use is approximately 1 percent of the available Carlsbad Desalination Plant supply between 2030 and 2045. Based on the SDCWA (2021) dry year water budget, the Project could source desalinated water from the SDCWA for all phases of the Project without adversely impacting existing or planned futures uses.

Table 15. San Diego County Water Authority Supply and Demand Assessment – Dry Year

	2025	2030	2035	2040	2045
SDCWA Supplies					
Imperial Irrigation District Water Transfers	200,000	200,000	200,000	200,000	200,000
AAC and Coachella Canal Lining Projects	78,700	78,700	78,700	78,700	78,700
Carlsbad Desalination Plant	50,000	50,000	50,000	50,000	50,000
Subtotal	***328,700***	***328,700***	***328,700***	***328,700***	***328,700***
Member Agency Supplies[1]					
Surface Water	6,004	6,004	6,004	6,004	6,004
Water Recycling	41,963	45,513	45,628	45,749	45,854
Groundwater	15,281	15,281	15,281	15,281	15,281
Brackish Groundwater Recovery	8,400	8,400	8,400	8,400	8,400
Seawater Desalination	6,000	6,000	6,000	6,000	6,000
Potable Reuse	33,042	53,202	112,562	112,562	112,562
San Luis Rey Water Transfers	15,800	15,800	15,800	15,800	15,800
Subtotal	***126,490***	***150,200***	***209,675***	***209,796***	***209,901***
Metropolitan Water District Supplies	336,232	336,674	337,116	337,558	338,000
Total Projected Supplies without Storage Tanks	**791,422**	**815,574**	**875,491**	**876,054**	**876,601**
Total Dry-Year Demands with Water Efficiency Savings	596,965	618,879	639,310	655,054	671,320
Potential Supply (Shortage) of Surplus	194,457	196,695	236,181	221,000	205,281
Use of Carryover Supplies	0	0	0	0	0
Total Projected Core Supplies with Use of Carryover Storage Supplies	**791,422**	**815,574**	**875.491**	**876,054**	**876,601**
Remaining Potential Surplus Supply or (Shortage) that will be addressed through Management Actions	194,457	196,695	236,181	221,000	205,281
Project Water Use	500	50	50	50	50
Project Water Use (percent of Carlsbad Desalination Plant available supply)[2]	6	1	1	1	1
Determination of Adequate Supply[3]	Yes	Yes	Yes	Yes	Yes

Notes

Values reported in AFY, unless otherwise noted.

[1] Member agency local supplies include production from verifiable reliable sources, as well as dry-year totals for actual 2015 surface water and groundwater supplies.

[2] Although SDCWA (2021) uses 50,000 AFY of desalinated water from the Carlsbad Desalination Plant over the Urban Water Management Plan planning period, SDCWA is currently using 48,000 AFY of the contracted 56,000 AFY (SDCWA approved a 30-year Water Purchase Agreement with Poseidon Water for the purchase of up to 56,000 AFY of desalinated seawater), including member agency supplies (SDCWA, 2024a). Project Water Use includes construction demand (500 AFY) for 2025 and operational demand (50 AFY) for 2030 through 2045.

[3] "Yes" if Planned available supply is equal to greater than Project water demand.

AAC = All-American Canal

AFY = acre-feet per year

SDCWA = San Diego County Water Authority

Source: SDCWA, 2021.

Imperial Valley Groundwater Basin. As discussed above, IID surface water supply is more dependent on Colorado River Basin watershed precipitation, however, the recharge of the IVGB is more dependent on precipitation within the IVGB watershed, although it is not the primary source of recharge. SB 610 guidelines indicate a dry year can be considered a year with a precipitation amount that is at 10 percent probability of occurrence, meaning 10 percent of the years would be drier. A critical dry year would be a year with 3 percent probability. Using precipitation data from the last 30 years (1994–2023) from the meteorological station El Centro 2 SSW, an annual precipitation total of 1.34 inches is considered a dry year, and 0.25 inches is a critical dry year. Based on the normal year conditions precented in Section 6.1, recharge from precipitation volume of 4,249 AF occurs during an average precipitation year (2.21 inches), this WSA assumes recharge from precipitation during a dry year and critical dry year would 61 percent (2,580 AF) and 11 percent (481 AF) of the recharge during an average year.

Similar to the dry year supply and demand analyses presented for the City of Imperial and the SDCWA, the dry year analysis for the IVGB assumes groundwater demand would increase by 5 percent during a single dry year. Other groundwater budget terms that could be impacted by a dry year include irrigation return flow, underflow (inflow and outflow), river seepage (inflow), and discharge to streams (outflow). However, due to the arid climate of the region, potential variations of the components are considered to be modest and generally offset one another. Therefore, the remaining groundwater budget components are consistent with those presented in Table 7. Tables 16 and 17 presents the IVGB groundwater budget dry year and critical dry year analysis, respectively.

The estimated dry year annual groundwater demand in the IVGB is approximately 0.2 percent of the IVGB storage capacity and approximately 3 percent of the East Mesa storage capacity. Without the Project in place, a dry year and a critical dry year would increase the annual budget balance deficit by 8 percent and 13 percent, respectively. The Project construction, operations, and decommissioning water use is approximately 1.2 percent, 0.1 percent, and 0.2 percent, respectively, of the IVGB annual deficit and would increase the dry year annual pumping by approximately 1.9 percent, 0.2 percent, and 0.4 percent, respectively.

Although the presented dry year and critical dry year groundwater budgets indicate an annual deficit, due to the availability of surface water, documented water source for existing GDEs, and results of the cone of depression and cumulative impacts analysis (Section 8.1) the Project could use groundwater from the IVGB for all phases of the Project, through the life of the Project, without adversely impacting any existing or planned future uses.

Table 16. Imperial Valley Groundwater Basin Groundwater Budget – Dry Year

Groundwater Budget Component	Volume
Inflows	
Irrigation Return Flow and Canal and River Seepage	250,000
Recharge from Precipitation[1]	2,580
Underflow	173,000
Total	**425,580**
Outflows	
Underflow	270,000
Discharge to Surface, Baseflow, and Salton Sea	169,342
Non-Project Pumping	26,880
Total	**466,222**
Budget Balance	**-40,642**

Notes

All values are reported in acre-feet.

[1] Does not include mountain front runoff originating in higher terrain outside the model domain.

Table 17. Imperial Valley Groundwater Basin Groundwater Budget – Critical Dry Year

Groundwater Budget Component	Volume
Inflows	
Irrigation Return Flow and Canal and River Seepage	250,000
Recharge from Precipitation[1]	481
Underflow	173,000
Total	**423,481**
Outflows	
Underflow	270,000
Discharge to Surface, Baseflow, and Salton Sea	169,342
Non-Project Pumping	26,880
Total	**466,222**
Budget Balance	**-42,741**

Notes

All values are reported in acre-feet.

[1] Does not include mountain front runoff originating in higher terrain outside the model domain.

Ocotillo-Clark Valley Groundwater Basin. Using precipitation data from the meteorological station Ocotillo Wells 2W (POR from 2003 to 2023), an annual precipitation total of 0.39 inches is considered a dry year, and 0.01 inches is a critical dry year. Based on the normal year conditions precented in Section 6.1, recharge from mountain front runoff of 3,682 AF occurs during an average precipitation year (3.11 inches), this WSA assumes recharge from precipitation during a dry year and critical dry year would 12.5 percent (288 AF) and 0.3 percent (7 AF) of the recharge during an average year. Non-Project and cumulative project groundwater demand is assumed to increase by 5 percent during a single dry year. Tables 18 and 19 present the OVCGB groundwater budget dry year and critical dry year analysis, respectively.

Without the Project in place, the OCVGB budget balance indicates an annual surplus of approximately 63 AF during dry years. During a critical dry year, the annual budget balance would be a deficit of approximately 218 AF. During Project construction and decommissioning, there would be an annual deficit of approximately 432 AF and 37 AF, respectively, during a dry year. During Project operations, there would be an annual surplus of approximately 13 AF during a dry year.

The addition of Project pumping (regardless of Project phase), even during dry years, would not chronically increase the total OCVGB annual pumping, or reduce the annual budget balance, to historical volumes (see Table 8) when more intensive agricultural irrigation and a chronic lowering of groundwater levels were occurring.[15] Although the OCVGB may experience temporary annual deficits as result of a dry year or critical dry year and increased water demand for Project construction occurring simultaneously, the OCVGB would remain within the (long-term) basin yield. The reduced water demand of Project operations and the return of average or above average conditions would recover temporary annual deficits. Therefore, the Project could source groundwater from the OCVGB for all phases of the Project, through the life of the Project, without adversely impacting existing or planned future uses during a dry year or critical.

Table 18. Ocotillo-Clark Groundwater Basin Groundwater Budget – Dry Year

Groundwater Budget Component	2025	2030	2035	2040	2045	2075
Mountain Front Runoff (Inflow)	288	288	288	288	288	288
Non-Project Pumping (Outflow)	221	226	226	226	226	226
Budget Balance	**68**	**63**	**63**	**63**	**63**	**63**
Project Water Use	500	50	50	50	50	100
Project Water Use (Percent of Budget Balance)	737	80	80	80	80	160
Budget Balance with Project Pumping	**-432**	**13**	**13**	**13**	**13**	**-37**

Note

All values are reported in acre-feet.

[15] If Project construction were to occur during a dry year or critical dry year, the annual deficit would be comparable to historical volumes during intensive agricultural pumping. Because Project construction duration is planned to be completed within 2 years, the temporary deficit would be recovered when average or above average conditions returned.

Table 19. Ocotillo-Clark Groundwater Basin Groundwater Budget – Critical Dry Year

Groundwater Budget Component	2025	2030	2035	2040	2045	2075
Mountain Front Runoff (Inflow)	7	7	7	7	7	7
Non-Project Pumping (Outflow)	221	226	226	226	226	226
Budget Balance	**-213**	**-218**	**-218**	**-218**	**-218**	**-218**
Project Water Use	500	50	50	50	50	100
Project Water Use (Percent of Budget Balance)	-235	-23	-23	-23	-23	-46
Budget Balance with Project Pumping	**-713**	**-268**	**-268**	**-268**	**-268**	**-318**

Note

All values are reported in acre-feet.

Jacumba Valley Groundwater Basin. Using precipitation data from the meteorological station Ejido Jacume (POR from 1973 to 2013) located in Mexico south of Jacumba Hot Springs, an annual precipitation total of 1.72 inches is considered a dry year, and 0.26 inches is a critical dry year. Based on the normal year conditions precented in Section 6.1, recharge from mountain front runoff of 2,300 AF occurs during an average precipitation year (7.01 inches), this WSA assumes recharge from precipitation during a dry year and critical dry year would 25 percent (904 AF) and 4 percent (137 AF) of the recharge during an average year. Groundwater demand is assumed to increase by 5 percent during a single dry year. Tables 20 and 21 present the JVGB groundwater budget dry year and critical dry year analysis, respectively.

During a dry year, Project construction, operation, and decommissioning water use would decrease the annual budget balance by approximately 56 percent, 6 percent, and 11 percent, respectively. During a critical dry year, Project construction, operation, and decommissioning water use would decrease the annual budget balance by approximately 403 percent, 40 percent, and 81 percent, respectively.

If the schedule for the cumulative projects were the same, and project operational and decommissioning water use is assumed to be equal, total construction, operation, and decommissioning annual pumping would decrease the annual budget balance surplus by 104 percent, 8 percent, and 13 percent, respectively, during a dry year. Cumulative project construction, operation, and decommissioning annual pumping would decrease the annual budget balance surplus by 750 percent, 55 percent, and 95 percent, respectively, during a critical dry year.

The addition of Project or cumulative project pumping (regardless of phase), even during dry years or critical dry years, would not chronically increase the total JVGB annual pumping, or reduce the annual budget balance, to historical volumes when more intensive agricultural irrigation and a chronic lowering of groundwater levels were occurring.[16] Although the JVGB may experience temporary annual deficits as result of a dry year or critical dry year and increased water demand for Project construction occurring simultaneously, the JVGB would remain within the (long-term) basin yield. The reduced water demand of

[16] If Project or cumulative construction were to occur during a dry year or critical dry year, the annual deficit would be comparable to historical volumes during intensive agricultural pumping. Because Project and cumulative project construction duration is planned to be completed within 2 years, the temporary deficit would be recovered when average or above average conditions returned.

Project operations and the return of average or above average conditions would recover temporary annual deficits. Therefore, the Project could source groundwater from the JVGB for all phases of the Project, through the life of the Project, without adversely impacting existing or planned future uses during a dry year or critical dry year (including cumulative project groundwater use).

Table 20. Jacumba Valley Groundwater Basin Groundwater Budget (Alluvial Aquifer) – Dry Year

Groundwater Budget Component	Baseline (No Project)	Projected With Project In-Place (Project Phase)[1]			Projected With All Cumulative Projects In-Place (Project Phase)		
	Projected	Construction	Operation	Decommissioning	Construction	Operation	Decommissioning
Recharge from Runoff (Inflow)	904	904	904	904	904	904	904
Pumping (Outflow)	13	513	63	113	943	81	131
Budget Balance	**891**	**391**	**841**	**791**	**-39**	**823**	**773**

Notes

All values are reported in acre-feet per year (AFY).

[1] Project pumping includes construction demand (500 AFY) for 2025 through 2026, operational demand (50 AFY) for 2027 through 2075, and decommissioning demand (100 AFY) for 2075 through 2076.

Source: modified based on Dudek, 2021.

Table 21. Jacumba Valley Groundwater Basin Groundwater Budget (Alluvial Aquifer) – Critical Dry Year

Groundwater Budget Component	Baseline (No Project)	Projected With Project In-Place (Project Phase)[1]			Projected With All Cumulative Projects In-Place (Project Phase)		
	Projected	Construction	Operation	Decommissioning	Construction	Operation	Decommissioning
Recharge from Runoff (Inflow)	137	137	137	137	137	137	137
Pumping (Outflow)	13	513	63	113	943	81	131
Budget Balance	**124**	**-376**	**74**	**24**	**-806**	**56**	**6**

Notes

All values are reported in acre-feet per year (AFY).

[1] Project Pumping includes construction demand (500 AFY) for 2025 through 2026, operational demand (50 AFY) for 2027 through 2075, and decommissioning demand (100 AFY) for 2075 through 2076.

Source: modified based on Dudek, 2021.

6.3 Multiple Dry Year Conditions

Although a single dry year is not expected to adversely impact non-agricultural surface water deliveries (see Section 5.1), multiple dry years could potentially impact delivery volumes. As defined in the EDP, non-agricultural delivery volumes are equal to the average allotment received the previous 3 calendar years. Therefore, if multiple dry years were to occur the annual delivery volume would be expected to decrease until multiple years of normal or above normal conditions returned.

Based on precipitation data recorded at the El Centro 2 SSW metrological station, the driest period on record was between water years 1995 and 2003; however, this was during the QSA era and no longer accurately represents the maximum amount of available supply (GEI, 2012). Partially presented in Table 2, 2007 through 2019 included 1 wet year, 1 above normal year, 8 below normal water years, 1 dry year, and 2 critical water years. Therefore, the years preceding 2015 through 2019 (Table 2) did not increase the average non-agricultural surface water deliveries because of water year type. During the 5-year period, non-agricultural deliveries varied up to 2 percent from the same 5-year period average, indicating several consecutive years of well below average precipitation would need to occur prior to potentially observing a notable reduction in non-agricultural deliveries.

Golden State Water Company. Table 22 presents the GSWC supply and demand projection for a multiple dry year scenario. GSWC projected demand assumes an increase of 5 percent, 10 percent and 2 percent during a 5-year period (consistent with West & Associates [2022]), however, the supply is assumed to not be reduced based on the methodology of the EDP and the reliability of IID's surface water deliveries.

During a multiple dry year scenario, the projected increased GSWC demand would remain below the WTP capacity (up to 26 percent of capacity during the projected period) and less than the GEI (2012) GSWC demand (up to 68 percent of GEI [2012] projected GSWC demand). Based on the rational presented above and in Sections 6.1 and 6.2, the proposed GSWC water source would be able to provide sufficient water for the Project and existing and planned future uses without causing adverse impacts during multiple dry year conditions.

Table 22. Golden State Water Company Supply and Demand Projections – Multiple Dry Years

Year	IID Net Consumptive Use Amount[1]	Water Supply Capacity[2]	GSWC Projected Demand[3]	IID Projected Demand (for GSWC)[4]	Leftover Planned Available Supply[5]	Project Water Use	Project Water Use (Percent of Leftover Planned Available Supply)	Determination of Adequate Supply[6]
2025	2,618,000	6,720	1,639	3,315	1,676	500	30	Yes
2026	—	6,720	1,719	—	—	500	—	Yes
2027	—	6,720	1,596	—	—	50	—	Yes
2028	—	6,720	1,598	—	—	50	—	Yes
2029	—	6,720	1,600	—	—	50	—	Yes
2030	2,613,000	6,720	1,649	3,564	1,915	50	3	Yes
2031	—	6,720	1,729	—	—	50	—	Yes
2032	—	6,720	1,605	—	—	50	—	Yes
2033	—	6,720	1,607	—	—	50	—	Yes
2034	—	6,720	1,609	—	—	50	—	Yes
2035	2,613,000	6,720	1,658	3,765	2,107	50	2	Yes
2036	—	6,720	1,739	—	—	50	—	Yes
2037	—	6,720	1,615	—	—	50	—	Yes
2038	—	6,720	1,617	—	—	50	—	Yes
2039	—	6,720	1,618	—	—	50	—	Yes
2040	2,613,000	6,720	1,668	4,176	2,508	50	2	Yes
2041	—	6,720	1,749	—	—	50	—	Yes
2042	—	6,720	1,624	—	—	50	—	Yes
2043	—	6,720	1,626	—	—	50	—	Yes
2044	—	6,720	1,628	—	—	50	—	Yes
2045	2,613,000	6,720	1,677	4,652	2,975	50	2	Yes
2046	—	6,720	1,759	—	—	50	—	Yes
2047	—	6,720	1,633	—	—	50	—	Yes
2048	—	6,720	1,635	—	—	50	—	Yes
2049	—	6,720	1,637	—	—	50	—	Yes
2050	2,618,000	6,720	1,687	5,203	3,516	50	1	Yes

Notes
All values are reported in acre-feet per year.
[1] Measured at Imperial Dam and does not include IID system losses and hidden services (GEI, 2012).
[2] Equal to the annual capacity of the GSWC Water Treatment Plant.
[3] Based on the methodology described in SDCWA (2024b)
[4] GEI, 2012.
[5] Difference between previous two columns
[6] "Yes" if Planned available supply is equal to greater than Project water demand.
— = not applicable or data not reported
GSWC = Golden State Water Company
IID = Imperial Irrigation District

City of Imperial. The City's 2020 UWMP (West & Associates, 2022) includes water supply availability and demand projections for multiple dry years through 2045. During multiple dry years (5-year drought period), demand is projected to increase by 5 percent, 10 percent, and 2 percent. Based on West & Associates (2022) no shortages are anticipated in the service area during multiple dry years through 2045 (see Table 23). Project construction water use is approximately 27 percent and 30 percent of the 2025 and 2026 available leftover supply, respectively. Project operational water use is approximately 4 to 9 percent of the available leftover supply between 2027 and 2045. The Project could source water from the City of Imperial for all phases of the Project without adversely impacting existing or planned futures uses during multiple dry year conditions.

As discussed in Section 5, City effluent is also being considered as a Project water source. Between 2016 and 2022 the average annual volume of treated effluent at the City WWTP was approximately 1,215 AF. The average annual volume of treated effluent at the City WWTP is 243 percent of the peak annual water demand for the Project. During multiple dry years, demand is expected to increase by up to 10 percent. Therefore, the volume of effluent during multiple dry years would also be expected to increase. Temporarily redirecting the WWTP effluent to the Project would result in a reduction of discharge to the Salton Sea. However, due to the limited quantity and temporary Project water demand, no adverse impacts to Salton Sea due to the reduced recharge are anticipated. Therefore, there is adequate treated effluent from the City WWTP for all phases of the Project during multiple dry conditions without adversely impacting existing or planned future uses.

Table 23. City of Imperial Availability and Demand Projections – Multiple Dry Years

Water Sources	2021	2022	2023	2024	2025
Population					
Water Service Area Population	23,937	24,476	25,014	25,552	26,091
Consumption Rate (AFCY) *Including 0.5% Annual Passive Savings*	0.14	0.14	0.14	0.14	0.14
Supply					
Total Dry Supply	**3,249**	**3,470**	**3,283**	**3,345**	**3,406**
Potential Dry Supply	5,226	5,226	5,226	5,226	5,226
Total Normal Supply	3,093	3,157	3,219	3,280	3,338
Projected Supply/Demand[1]	–	–	–	–	4,696
Demand					
Total Dry Demand	**3,249**	**3,470**	**3,283**	**3,345**	**3,406**
Total Normal Demand	3,093	3,157	3,219	3,280	3,338
Percent of Normal	105	110	102	102	102
Supply/Demand Comparison					
Normal Supply *minus* Dry Demand	-156	-313	-64	-64	-68
Dry Supply *minus* Dry Demand	0	0	0	0	0
Available Leftover Supply Capacity[2]	1,976	1,755	1,942	1,881	1,820
Planned Available Leftover Supply[3]	–	–	–	–	1,290
Project Water Use	–	–	–	–	500
Project Water Use (Percent of Available Leftover Capacity)[4]	–	–	–	–	27
Determination of Adequate Supply[5]	Yes	Yes	Yes	Yes	Yes

Water Sources	2026	2027	2028	2029	2030
Population					
Water Service Area Population	23,937	24,476	25,014	25,552	26,091
Consumption Rate (AFCY) *Including 0.5% Annual Passive Savings*	0.14	0.14	0.14	0.14	0.14
Supply					
Total Dry Supply	**3,569**	**3,805**	**3,587**	**3,645**	**3,704**
Potential Dry Supply	5,226	5,226	5,226	5,226	5,226
Total Normal Supply	3,400	3,458	3,516	3,575	3,633
Projected Supply/Demand[1]	–	–	–	–	6,384
Demand					
Total Dry Demand	**3,569**	**3,805**	**3,587**	**3,645**	**3,704**
Total Normal Demand	3,400	3,458	3,516	3,575	3,633
Percent of Normal	105	110	102	102	102
Supply/Demand Comparison					
Normal Supply *minus* Dry Demand	-169	-347	-71	-71	-71
Dry Supply *minus* Dry Demand	0	0	0	0	0
Available Leftover Supply Capacity[2]	1,657	1,421	1,639	1,580	1,522
Planned Available Leftover Supply[3]	–	–	–	–	2,680
Project Water Use	500	50	50	50	50
Project Water Use (Percent of Available Leftover Capacity)[4]	30	47	3	3	3
Determination of Adequate Supply[5]	Yes	Yes	Yes	Yes	Yes

Water Sources	2031	2032	2033	2024	2035
Population					
Water Service Area Population	26,629	27,168	27,706	28,244	28,783
Consumption Rate (AFCY) *Including 0.5% Annual Passive Savings*	0.14	0.14	0.14	0.14	0.14
Supply					
Total Dry Supply	**3,872**	**4,118**	**3,875**	**3,931**	**3,986**
Potential Dry Supply	5,226	5,226	5,226	5,226	5,226
Total Normal Supply	3,688	3,743	3,799	3,854	3,906
Projected Supply/Demand[1]	—	—	—	—	5,136
Demand					
Total Dry Demand	**3,872**	**4,118**	**3,875**	**3,931**	**3,986**
Total Normal Demand	3,688	3,743	3,799	3,854	3,906
Percent of Normal	105	110	102	102	102
Supply/Demand Comparison					
Normal Supply *minus* Dry Demand	-184	-374	-77	-77	-80
Dry Supply *minus* Dry Demand	0	0	0	0	0
Available Leftover Supply Capacity[2]	1,353	1,108	1,350	1,295	1,240
Planned Available Leftover Supply[3]	—	—	—	—	1,150
Project Water Use	50	50	50	50	50
Project Water Use (Percent of Available Leftover Capacity)[4]	4	5	4	4	4
Determination of Adequate Supply[5]	Yes	Yes	Yes	Yes	Yes

Water Sources	2036	2037	2038	2039	2040
Population					
Water Service Area Population	29,321	29,859	30,398	30,936	31,475
Consumption Rate (AFCY) *Including 0.5% Annual Passive Savings*	0.14	0.13	0.13	0.13	0.13
Supply					
Total Dry Supply	**4,158**	**4,415**	**4,145**	**4,198**	**4,250**
Potential Dry Supply	5,226	5,226	5,226	5,226	5,226
Total Normal Supply	3,961	4,014	4,066	4,115	4,167
Projected Supply/Demand[1]	—	—	—	—	5,726
Demand					
Total Dry Demand	**4,158**	**4,415**	**4,145**	**4,198**	**4,250**
Total Normal Demand	3,961	4,014	4,066	4,115	4,167
Percent of Normal	105	110	102	102	102
Supply/Demand Comparison					
Normal Supply *minus* Dry Demand	-196	-402	-80	-83	-83
Dry Supply *minus* Dry Demand	0	0	0	0	0
Available Leftover Supply Capacity[2]	1,068	810	1,080	1,028	976
Planned Available Leftover Supply[3]	—	—	—	—	1,476
Project Water Use	50	50	50	50	50
Project Water Use (Percent of Available Leftover Capacity)[4]	5	6	5	5	5
Determination of Adequate Supply[5]	Yes	Yes	Yes	Yes	Yes

Water Sources	2041	2042	2043	2044	2045
Population					
Water Service Area Population	32,013	32,551	33,090	33,628	34,167
Consumption Rate (AFCY) *Including 0.5% Annual Passive Savings*	0.13	0.13	0.13	0.13	0.13
Supply					
Total Dry Supply	**4,428**	**4,692**	**4,400**	**4,452**	**4,498**
Potential Dry Supply	5,226	5,226	5,226	5,226	5,226
Total Normal Supply	4,216	4,265	4,314	4,363	4,412
Projected Supply/Demand[1]	—	—	—	—	6,384
Demand					
Total Dry Demand	**4,428**	**4,692**	**4,400**	**4,452**	**4,498**
Total Normal Demand	4,216	4,265	4,314	4,363	4,412
Percent of Normal	105	110	102	102	102
Supply/Demand Comparison					
Normal Supply *minus* Dry Demand	-212	-427	-86	-89	-86
Dry Supply *minus* Dry Demand	0	0	0	0	0
Available Leftover Supply Capacity[2]	798	534	825	773	727
Planned Available Leftover Supply[3]	—	—	—	—	1,886
Project Water Use	50	50	50	50	50
Project Water Use (Percent of Available Leftover Capacity)[4]	6	9	6	6	7
Determination of Adequate Supply[5]	Yes	Yes	Yes	Yes	Yes

Notes

Values reported in acre-feet per year (AFY), unless otherwise noted.

[1] GEI (2012) projected supply/demand for the City of Imperial.

[2] Equal to Potential Supply minus Total Normal Demand. Sum of values may not be exact due to rounding.

[3] GEI (2012) projected supply/demand for the City of Imperial minus Total Normal Demand.

[4] Project Water Use includes construction demand (500 AFY) for 2025 and operational demand (50 AFY) for 2030 through 2045.

[5] "Yes" if Planned available supply is equal to greater than Project water demand.

— = not applicable or data not reported.

AFCY = acre-feet per capita per year

Based on West & Associates, 2022.

San Diego County Water Authority. The SDCWA 2020 UWMP (SDCWA, 2021) includes a multiple dry year assessment, summarizing total water demands in the SDCWA service area in 5-year increments through 2045, along with the supplies necessary to meet demand under multiple dry conditions (see Table 24). Groundwater and surface water supplies included in the SDCWA (2021) dry year assessment are based on 2015 dry-year supplies. SDCWA (2021) indicates no shortages are anticipated in the service area during multiple dry years through 2045. Project construction water use is approximately 6 percent of the 2025 and 2026 available Carlsbad Desalination Plant supply. Project operational water use is approximately 1 percent of the available Carlsbad Desalination Plant supply between 2027 and 2045. The multiple dry year water budget indicates SDCWA would have adequate remaining potential surplus supply if an additional demand, equivalent to the volume of desalinated water currently available, were to occur during the projected period with the Project in place. Based on the SDCWA (2021) multiple dry year water budget, the Project could source desalinated water from the SDCWA for all phases of the Project without adversely impacting existing or planned futures uses.

Table 24. San Diego County Water Authority Supply and Demand Assessment – Multiple Dry Years

	2021	2022	2023	2024	2025
Member Agency Supplies[1]	153,762	152,645	132,982	109,672	126,451
Water Authority Supplies (includes 50,000 AFY from Carlsbad Desalination Plant)	328,700	328,700	328,700	328,700	328,700
Metropolitan Allocation (Preferential Right)	335,878	310,123	310,205	310,286	310,368
Total Estimated Core Supplies without Storage Tanks	**818,340**	**791,468**	**771,887**	**748,658**	**765,519**
Total Multi Dry-Year Demands with Water Conservation Savings	580,626	586,432	592,296	598,219	604,201
Potential Supply (Shortage) of Surplus	237,714	205,036	179,591	150,439	161,318
Use of Carryover Supplies	0	0	0	0	0
Total Projected Core Supplies with Use of Carryover Storage Supplies	**818,340**	**791,468**	**771,887**	**748,658**	**765,519**
Remaining Potential Surplus Supply, or (Shortage) that will be addressed through Management Actions	237,714	205,036	179,591	150,439	161,318
Project Water Use	—	—	—	—	500
Project Water Use (percent of Carlsbad Desalination Plant available supply)[2]	—	—	—	—	6
Determination of Adequate Supply[3]	Yes	Yes	Yes	Yes	Yes

	2026	2027	2028	2029	2030
Member Agency Supplies[1]	212,265	208,498	189,545	166,945	150,200
Water Authority Supplies (includes 50,000 AFY from Carlsbad Desalination Plant)	328,700	328,700	328,700	328,700	328,700
Metropolitan Allocation (Preferential Right)	336,320	310,531	310,613	310,694	310,776
Total Estimated Core Supplies without Storage Tanks	**877,285**	**847,729**	**828,858**	**806,339**	**789,676**
Total Multi Dry-Year Demands with Water Conservation Savings	602,935	608,964	615,054	621,204	627,416
Potential Supply (Shortage) of Surplus	274,350	238,765	213,804	185,135	162,260
Use of Carryover Supplies	0	0	0	0	0
Total Projected Core Supplies with Use of Carryover Storage Supplies	**877,285**	**847,729**	**828,858**	**806,339**	**789,676**
Remaining Potential Surplus Supply, or (Shortage) that will be addressed through Management Actions	274,350	238,765	213,804	185,135	162,260
Project Water Use	500	50	50	50	50
Project Water Use (percent of Carlsbad Desalination Plant available supply)[2]	6	1	1	1	1
Determination of Adequate Supply[3]	Yes	Yes	Yes	Yes	Yes

	2031	2032	2033	2034	2035
Member Agency Supplies[1]	215,128	210,674	191,034	167,747	209,675
Water Authority Supplies (includes 50,000 AFY from Carlsbad Desalination Plant)	328,700	328,700	328,700	328,700	328,700
Metropolitan Allocation (Preferential Right)	336,762	310,939	311,021	311,102	311,184
Total Estimated Core Supplies without Storage Tanks	**880,590**	**850,313**	**830,755**	**807,549**	**849,559**
Total Multi Dry-Year Demands with Water Conservation Savings	625,057	631,318	637,631	644,008	650,448
Potential Supply (Shortage) of Surplus	255,523	218,995	193,124	163,541	199,111
Use of Carryover Supplies	0	0	0	0	0
Total Projected Core Supplies with Use of Carryover Storage Supplies	**880,590**	**850,313**	**830,755**	**807,549**	**849,559**
Remaining Potential Surplus Supply, or (Shortage) that will be addressed through Management Actions	255,523	218,995	193,124	163,541	199,111
Project Water Use	50	50	50	50	50
Project Water Use (percent of Carlsbad Desalination Plant available supply)[2]	1	1	1	1	1
Determination of Adequate Supply[3]	Yes	Yes	Yes	Yes	Yes

	2036	2037	2038	2039	2040
Member Agency Supplies[1]	274,604	270,152	250,513	227,227	209,796
Water Authority Supplies (includes 50,000 AFY from Carlsbad Desalination Plant)	328,700	328,700	328,700	328,700	328,700
Metropolitan Allocation (Preferential Right)	337,204	311,347	311,429	311,510	311,592
Total Estimated Core Supplies without Storage Tanks	**940,508**	**910,199**	**890,642**	**867,437**	**850,088**
Total Multi Dry-Year Demands with Water Conservation Savings	645,703	652,160	658,681	665,268	671,921
Potential Supply (Shortage) of Surplus	294,805	258,039	231,961	202,169	178,167
Use of Carryover Supplies	0	0	0	0	0
Total Projected Core Supplies with Use of Carryover Storage Supplies	**940,508**	**910,199**	**890,642**	**867,437**	**850,088**
Remaining Potential Surplus Supply, or (Shortage) that will be addressed through Management Actions	294,805	258,039	231,961	202,169	178,167
Project Water Use	50	50	50	50	50
Project Water Use (percent of Carlsbad Desalination Plant available supply)[2]	1	1	1	1	1
Determination of Adequate Supply[3]	Yes	Yes	Yes	Yes	Yes

	2041	2042	2043	2044	2045
Member Agency Supplies[1]	274,722	270,266	250,624	227,335	209,901
Water Authority Supplies (includes 50,000 AFY from Carlsbad Desalination Plant)	328,700	328,700	328,700	328,700	328,700
Metropolitan Allocation (Preferential Right)	337,646	311,755	311,837	311,918	312,000
Total Estimated Core Supplies without Storage Tanks	**941,068**	**910,721**	**891,161**	**867,953**	**850,601**
Total Multi Dry-Year Demands with Water Conservation Savings	661,605	668,221	674,903	681,652	688,469
Potential Supply (Shortage) of Surplus	279,463	242,500	216,258	186,301	162,132
Use of Carryover Supplies	0	0	0	0	0
Total Projected Core Supplies with Use of Carryover Storage Supplies	**941,068**	**910,721**	**891,161**	**867,953**	**850,601**
Remaining Potential Surplus Supply, or (Shortage) that will be addressed through Management Actions	279,463	242,500	216,258	186,301	162,132
Project Water Use	50	50	50	50	50
Project Water Use (percent of Carlsbad Desalination Plant available supply)[2]	1	1	1	1	1
Determination of Adequate Supply[3]	Yes	Yes	Yes	Yes	Yes

Notes
Values reported in acre-feet per year (AFY), unless otherwise noted.
[1] Member agency local supplies include production from verifiable reliable sources, as well as dry-year totals for actual 2015 surface water and groundwater supplies.
[2] Although SDCWA (2021) uses 50,000 AFY of desalinated water from the Carlsbad Desalination Plant over the Urban Water Management Plan planning period, SDCWA is currently using 48,000 AFY of the contracted 56,000 AFY (SDCWA approved a 30-year Water Purchase Agreement with Poseidon Water for the purchase of up to 56,000 AFY of desalinated seawater), including member agency supplies (SDCWA, 2024a). Project Water Use includes construction demand (500 AFY) for 2025 and operational demand (50 AFY) for 2030 through 2045.
[3] "Yes" if Planned available supply is equal to greater than Project water demand.
— = not applicable or data not reported.
Source: SDCWA, 2021.

Imperial Valley Groundwater Basin. Using precipitation data from the meteorological station El Centro 2 SSW, the driest 52-year period (projected life of the Project) on record is from 1953 to 2004 (2.57-inch average annual precipitation). The IVGB groundwater budget (multiple dry year scenario), using a repeat of the precipitation record from the driest 52-year period on record, is presented in Table 25. As described in Section 6.1, recharge from precipitation during a normal year is 4,249 AF. Consistent with the IVGB dry year groundwater budget (Table 7), the amount of recharge calculated for a given year is based off the percentage of the total annual precipitation for that year compared to the total annual precipitation during a normal year. All other groundwater budget components presented in Table 25 are consistent with those presented in Table 7, except non-Project pumping demand. Non-Project pumping demand is assumed to increase by 5 percent during a DWR (2020) classified dry year, and 10 percent during a critical dry year. Similarly, non-Project pumping demand is assumed to decrease by 5 percent during above normal years and 10 percent during wet years.

The average estimated annual groundwater demand in the IVGB over the 52-year period is 25,502 AFY, approximately 0.2 percent of the IVGB storage capacity and approximately 3 percent of the East Mesa storage capacity. The Project construction, operations, and decommissioning water use is approximately 1.4 percent, 0.1 percent, and 0.3 percent, respectively, of the IVGB annual deficit and would increase the dry year annual pumping by approximately 2 percent, 0.2 percent, and 0.4 percent, respectively.

The normal year groundwater budget for the IVGB (Table 7) indicates an annual deficit in the IVGB. The IVGB multiple dry year groundwater budget (Table 25) projects the annual deficit using repeat of climatic conditions during the driest 52-year period on record. The projected groundwater budget indicates the IVGB would have an annual deficit with or without the Project. The IVGB has been designated as a very low-priority basin due to a variety of factors, including low population levels and limited groundwater use. Surface water has been identified as the primary source of water in the IVGB. The Project would not make a considerable contribution to the groundwater deficit. The Project would not negatively impact groundwater storage, nor cause substantial impact to the available quantity of groundwater in the IVGB. Due to the availability of surface water, documented water source for existing GDEs, and results of the cone of depression and cumulative impacts analysis (Section 8.1) the Project could use groundwater from the IVGB for all phases of the Project, through the life of the Project, without adversely impacting any existing or planned future uses, and the Project incremental contribution to the IVGB groundwater deficit is not considered cumulatively considerable.

Table 25. Imperial Valley Groundwater Basin Groundwater Budget – Multiple Dry Years

Groundwater Budget Component	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Reference Year	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962
Historical Precipitation	0.83	2.06	3.43	0.34	1.55	4.74	1.02	1.95	1.02	1.97
Water Year Type	Dry	Critical	Dry	Critical	Critical	Above Normal	Dry	Dry	Dry	Dry
Percent of Normal Precipitation	38	93	155	15	70	215	46	88	46	89
Inflows										
Irrigation Return Flow and Canal and River Seepage	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000
Recharge from Precipitation[1]	1,598	3,967	6,605	655	2,985	9,127	1,964	3,755	1,964	3,793
Underflow	173,000	173,000	173,000	173,000	173,000	173,000	173,000	173,000	173,000	173,000
Total Inflows	**424,598**	**426,967**	**429,605**	**423,655**	**425,985**	**432,127**	**424,964**	**426,755**	**424,964**	**426,793**
Outflows										
Underflow	270,000	270,000	270,000	270,000	270,000	270,000	270,000	270,000	270,000	270,000
Discharge to Streams or Baseflow	169,342	169,342	169,342	169,342	169,342	169,342	169,342	169,342	169,342	169,342
Non-Project Pumping	26,880	28,160	26,880	28,160	28,160	24,320	26,880	26,880	26,880	26,880
Total Outflows	**466,222**	**467,502**	**466,222**	**467,502**	**467,502**	**463,662**	**466,222**	**466,222**	**466,222**	**466,222**
Annual Budget Balance	**-41,624**	**-40,535**	**-36,617**	**-43,847**	**-41,517**	**-31,535**	**-41,258**	**-39,467**	**-41,258**	**-39,429**
Project Water Use	500	500	50	50	50	50	50	50	50	50
Project Water Use (Percent of Annual Budget Balance)	-1.2	-1.2	-0.1	-0.1	-0.1	-0.2	-0.1	-0.1	-0.1	-0.1

Groundwater Budget Component	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
Reference Year	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
Historical Precipitation	2.25	0.63	1.45	2.87	2.81	4.01	1.78	2.54	0.49	0.12
Water Year Type	Below Normal	Critical	Critical	Above Normal	Wet	Wet	Above Normal	Below Normal	Critical	Critical
Percent of Normal Precipitation	102	29	66	130	127	182	81	115	22	5
Inflows										
Irrigation Return Flow and Canal and River Seepage	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000
Recharge from Precipitation[1]	4,333	1,213	2,792	5,527	5,411	7,722	3,428	4,891	944	231
Underflow	173,000	173,000	173,000	173,000	173,000	173,000	173,000	173,000	173,000	173,000
Total Inflows	**427,333**	**424,213**	**425,792**	**428,527**	**428,411**	**430,722**	**426,428**	**427,891**	**423,944**	**423,231**
Outflows										
Underflow	270,000	270,000	270,000	270,000	270,000	270,000	270,000	270,000	270,000	270,000
Discharge to Streams or Baseflow	169,342	169,342	169,342	169,342	169,342	169,342	169,342	169,342	169,342	169,342
Non-Project Pumping	25,600	28,160	28,160	24,320	23,040	23,040	24,320	25,600	28,160	28,160
Total Outflows	**464,942**	**467,502**	**467,502**	**463,662**	**462,382**	**462,382**	**463,662**	**464,942**	**467,502**	**467,502**
Annual Budget Balance	**-37,609**	**-43,289**	**-41,710**	**-35,135**	**-33,971**	**-31,660**	**-37,234**	**-37,051**	**-43,558**	**-44,271**
Project Water Use	50	50	50	50	50	50	50	50	50	50
Project Water Use (Percent of Annual Budget Balance)	-0.1	-0.1	-0.1	-0.1	-0.1	-0.2	-0.1	-0.1	-0.1	-0.1

Groundwater Budget Component	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054
Reference Year	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Historical Precipitation	2.51	1.05	1.31	3.68	3.8	3.26	6.14	4.06	3.59	2.32
Water Year Type	Dry	Below Normal	Critical	Wet	Wet	Wet	Wet	Wet	Wet	Wet
Percent of Normal Precipitation	114	48	59	167	172	148	278	184	163	105
Inflows										
Irrigation Return Flow and Canal and River Seepage	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000
Recharge from Precipitation[1]	4,833	2,022	2,523	7,086	7,317	6,278	11,823	7,818	6,913	4,467
Underflow	173,000	173,000	173,000	173,000	173,000	173,000	173,000	173,000	173,000	173,000
Total Inflows	**427,833**	**425,022**	**425,523**	**430,086**	**430,317**	**429,278**	**434,823**	**430,818**	**429,913**	**427,467**
Outflows										
Underflow	270,000	270,000	270,000	270,000	270,000	270,000	270,000	270,000	270,000	270,000
Discharge to Streams or Baseflow	169,342	169,342	169,342	169,342	169,342	169,342	169,342	169,342	169,342	169,342
Non-Project Pumping	26,880	25,600	28,160	23,040	23,040	23,040	23,040	23,040	23,040	23,040
Total Outflows	**466,222**	**464,942**	**467,502**	**462,382**	**462,382**	**462,382**	**462,382**	**462,382**	**462,382**	**462,382**
Annual Budget Balance	**-38,389**	**-39,920**	**-41,979**	**-32,296**	**-32,065**	**-33,104**	**-27,559**	**-31,564**	**-32,469**	**-34,915**
Project Water Use	50	50	50	50	50	50	50	50	50	50
Project Water Use (Percent of Annual Budget Balance)	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.1

Groundwater Budget Component	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064
Reference Year	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Historical Precipitation	7.89	1.12	4.15	3.46	2.92	4.37	0.89	2	2.23	6.76
Water Year Type	Wet	Wet	Above Normal	Wet	Above Normal	Wet	Below Normal	Dry	Below Normal	Wet
Percent of Normal Precipitation	358	51	188	157	132	198	40	91	101	306
Inflows										
Irrigation Return Flow and Canal and River Seepage	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000
Recharge from Precipitation[1]	15,193	2,157	7,991	6,663	5,623	8,415	1,714	3,851	4,294	13,017
Underflow	173,000	173,000	173,000	173,000	173,000	173,000	173,000	173,000	173,000	173,000
Total Inflows	**438,193**	**425,157**	**430,991**	**429,663**	**428,623**	**431,415**	**424,714**	**426,851**	**427,294**	**436,017**
Outflows										
Underflow	270,000	270,000	270,000	270,000	270,000	270,000	270,000	270,000	270,000	270,000
Discharge to Streams or Baseflow	169,342	169,342	169,342	169,342	169,342	169,342	169,342	169,342	169,342	169,342
Non-Project Pumping	23,040	23,040	24,320	23,040	24,320	23,040	25,600	26,880	25,600	23,040
Total Outflows	**462,382**	**462,382**	**463,662**	**462,382**	**463,662**	**462,382**	**464,942**	**466,222**	**464,942**	**462,382**
Annual Budget Balance	**-24,189**	**-37,225**	**-32,671**	**-32,719**	**-35,039**	**-30,967**	**-40,228**	**-39,371**	**-37,648**	**-26,365**
Project Water Use	50	50	50	50	50	50	50	50	50	50
Project Water Use (Percent of Annual Budget Balance)	-0.2	-0.1	-0.2	-0.2	-0.1	-0.2	-0.1	-0.1	-0.1	-0.2

Groundwater Budget Component	**2065**	**2066**	**2067**	**2068**	**2069**	**2070**	**2071**	**2072**	**2073**	**2074**
Reference Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Historical Precipitation	7.66	2.38	3.07	0.32	3.01	2.6	1.34	0.25	1.93	0.09
Water Year Type	Wet	Wet	Below Normal	Dry	Dry	Below Normal	Dry	Critical	Critical	Critical
Percent of Normal Precipitation	347	108	139	15	136	118	61	11	87	4
Inflows										
Irrigation Return Flow and Canal and River Seepage	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000
Recharge from Precipitation[1]	14,750	4,583	5,912	616	5,796	5,007	2,580	481	3,716	173
Underflow	173,000	173,000	173,000	173,000	173,000	173,000	173,000	173,000	173,000	173,000
Total Inflows	**437,750**	**427,583**	**428,912**	**423,616**	**428,796**	**428,007**	**425,580**	**423,481**	**426,716**	**423,173**
Outflows										
Underflow	270,000	270,000	270,000	270,000	270,000	270,000	270,000	270,000	270,000	270,000
Discharge to Streams or Baseflow	169,342	169,342	169,342	169,342	169,342	169,342	169,342	169,342	169,342	169,342
Non-Project Pumping	23,040	23,040	25,600	26,880	26,880	25,600	26,880	28,160	28,160	28,160
Total Outflows	**462,382**	**462,382**	**464,942**	**466,222**	**466,222**	**464,942**	**466,222**	**467,502**	**467,502**	**467,502**
Annual Budget Balance	**-24,632**	**-34,799**	**-36,030**	**-42,606**	**-37,426**	**-36,935**	**-40,642**	**-44,021**	**-40,786**	**-44,329**
Project Water Use	50	50	50	50	50	50	50	50	50	50
Project Water Use (Percent of Annual Budget Balance)	-0.2	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1

Groundwater Budget Component	2075	2076
Reference Year	2003	2004
Historical Precipitation	3.17	2.51
Water Year Type	Dry	Above Normal
Percent of Normal Precipitation	144	114
Inflows		
Irrigation Return Flow and Canal and River Seepage	250,000	250,000
Recharge from Precipitation	6,104	4,833
Underflow	173,000	173,000
Total Inflows	**429,104**	**427,833**
Outflows		
Underflow	270,000	270,000
Discharge to Streams or Baseflow	169,342	169,342
Non-Project Pumping	26,880	24,320
Total Outflows	**466,222**	**463,662**
Annual Budget Balance	**-37,118**	**-35,829**
Project Water Use	100	100
Project Water Use (Percent of Annual Budget Balance)	-0.3	-0.3

Notes

All values are reported in acre-feet.

[1] Does not include mountain front runoff originating in higher terrain outside the model domain.

Ocotillo-Clark Valley Groundwater Basin. The POR at the meteorological station Ocotillo Wells 2W (2003 to 2023) is not long enough to calculate DWR (2021) water year types for a 52-year period nor determine the driest 52-year period. However, because the last two decades were considered a dry period across the state of California and the Colorado River Basin watershed (Bruce et al., 2024), the multiple dry year scenario uses a repeat of the Ocotillo Wells 2W precipitation record. DWR (2021) water year types are available for the San Felipe Creek watershed from 1931 to 2018 and are used in the 52-year projection when considering non-Project pumping. As described in Section 6.1, recharge from precipitation during a normal year is 2,300 AF. Consistent with the OCVGB dry year groundwater budget (Table 8), the amount of recharge calculated for a given year is based off the percentage of the total annual precipitation for that year compared to the total annual precipitation during a normal year. All other groundwater budget components presented in the OCVGB multiple dry year groundwater budget (Table 26) are consistent with those presented in Table 8, except non-Project pumping demand. Non-Project pumping demand is assumed to increase by 5 percent during a DWR (2020) classified dry year, and 10 percent during a critical dry year. Similarly, non-Project pumping demand is assumed to decrease by 5 percent during above normal years and 10 percent during wet years.

Without the Project in place, the OCVGB budget balance indicates an average annual surplus of approximately 2,107 AF and a cumulative surplus of 109,549 AF during the 52-year period. The addition of Project pumping would reduce the cumulative surplus by approximately 3 percent. Project construction, operation, and decommissioning pumping is approximately 24 percent, 2 percent, and 5 percent of the 52-year average annual budget balance surplus. During years of below average precipitation, the annual budget balance could indicate a deficit, however, the cumulative budget would remain in surplus. The addition of Project pumping (regardless of Project phase) would not chronically increase the total OCVGB annual pumping, or reduce the annual budget balance, to historical volumes when more intensive agricultural irrigation and a chronic lowering of groundwater levels were occurring.

Therefore, the Project could source groundwater from the OCVGB for all phases of the Project, through the life of the Project, without adversely impacting existing or planned future uses during multiple dry years.

Table 26. Ocotillo-Clark Groundwater Basin Groundwater Budget – Multiple Dry Years

Year	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Reference Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Historical Precipitation	4.32	2.02	7	0.01	3.36	0.62	2.33	3.91	4.25	4.63
Water Year Type	Dry	Below Normal	Wet	Wet	Critical	Dry	Below Normal	Above Normal	Wet	Above Normal
Percent of Normal Precipitation	139	65	225	0	108	20	75	126	137	149
Mountain Front Runoff (Inflow)	3,194	1,494	5,176	7	2,485	458	1,723	2,891	3,143	3,424
Non-Project Pumped Groundwater (Outflow)	221	215	194	194	237	226	215	204	194	204
Annual Budget Balance	**2,974**	**1,279**	**4,983**	**-186**	**2,248**	**233**	**1,508**	**2,687**	**2,949**	**3,219**
Project Water Use	500	500	50	50	50	50	50	50	50	50
Project Water Use (Percent of Annual Budget Balance)	17	39	1	-27	2	21	3	2	2	2
Year	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**	**2041**	**2042**	**2043**	**2044**
Reference Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Historical Precipitation	2.25	0.97	2.1	2.33	4.53	0.39	5.41	6.68	1.67	1.84
Water Year Type	Below Normal	Dry	Dry	Below Normal	Above Normal	Below Normal	Dry	Below Normal	Wet	Wet
Percent of Normal Precipitation	72	31	68	75	146	13	174	215	54	59
Mountain Front Runoff (Inflow)	1,664	717	1,553	1,723	3,350	288	4,000	4,939	1,235	1,361
Non-Project Pumped Groundwater (Outflow)	215	226	226	215	204	215	226	215	194	194
Annual Budget Balance	**1,449**	**492**	**1,327**	**1,508**	**3,145**	**73**	**3,775**	**4,724**	**1,041**	**1,167**
Project Water Use	50	50	50	50	50	50	50	50	50	50
Project Water Use (Percent of Annual Budget Balance)	3	10	4	3	2	68	1	1	5	4
Year	**2045**	**2046**	**2047**	**2048**	**2049**	**2050**	**2051**	**2052**	**2053**	**2054**
Reference Year	2023	2003	2004	2005	2006	2007	2008	2009	2010	2011
Historical Precipitation	4.7	4.32	2.02	7	0.01	3.36	0.62	2.33	3.91	4.25
Water Year Type	Critical	Dry	Below Normal	Above Normal	Wet	Above Normal	Below Normal	Dry	Dry	Below Normal
Percent of Normal Precipitation	151	139	65	225	0	108	20	75	126	137
Mountain Front Runoff (Inflow)	3,475	3,194	1,494	5,176	7	2,485	458	1,723	2,891	3,143
Non-Project Pumped Groundwater (Outflow)	237	226	215	204	194	204	215	226	226	215
Annual Budget Balance	**3,239**	**2,969**	**1,279**	**4,972**	**-186**	**2,280**	**243**	**1,497**	**2,665**	**2,928**
Project Water Use	50	50	50	50	50	50	50	50	50	50
Project Water Use (Percent of Annual Budget Balance)	2	2	4	1	-27	2	21	3	2	2

Year	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064
Reference Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Historical Precipitation	4.63	2.25	0.97	2.1	2.33	4.53	0.39	5.41	6.68	1.67
Water Year Type	Above Normal	Below Normal	Dry	Below Normal	Wet	Wet	Critical	Dry	Below Normal	Above Normal
Percent of Normal Precipitation	149	72	31	68	75	146	13	174	215	54
Mountain Front Runoff (Inflow)	3,424	1,664	717	1,553	1,723	3,350	288	4,000	4,939	1,235
Non-Project Pumped Groundwater (Outflow)	204	215	226	215	194	194	237	226	215	204
Annual Budget Balance	**3,219**	**1,449**	**492**	**1,338**	**1,529**	**3,156**	**52**	**3,775**	**4,724**	**1,031**
Project Water Use	50	50	50	50	50	50	50	50	50	50
Project Water Use (Percent of Annual Budget Balance)	2	3	10	4	3	2	96	1	1	5

Year	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074
Reference Year	2022	2023	2003	2004	2005	2006	2007	2008	2009	2010
Historical Precipitation	1.84	4.7	4.32	2.02	7	0.01	3.36	0.62	2.33	3.91
Water Year Type	Wet	Above Normal	Below Normal	Dry	Dry	Below Normal	Above Normal	Below Normal	Dry	Below Normal
Percent of Normal Precipitation	59	151	139	65	225	0	108	20	75	126
Mountain Front Runoff (Inflow)	1,361	3,475	3,194	1,494	5,176	7	2,485	458	1,723	2,891
Non-Project Pumped Groundwater (Outflow)	194	204	215	226	226	215	204	215	226	215
Annual Budget Balance	**1,167**	**3,271**	**2,979**	**1,268**	**4,950**	**-208**	**2,280**	**243**	**1,497**	**2,676**
Project Water Use	50	50	50	50	50	50	50	50	50	50
Project Water Use (Percent of Annual Budget Balance)	4	2	2	4	1	-24	2	21	3	2

Year	2075	2076
Reference Year	2011	2012
Historical Precipitation	4.25	4.63
Water Year Type	Wet	Wet
Percent of Normal Precipitation	137	149
Mountain Front Runoff (Inflow)	3,143	3,424
Non-Project Pumped Groundwater (Outflow)	194	194
Annual Budget Balance	**2,949**	**3,230**
Project Water Use	100	100
Project Water Use (Percent of Annual Budget Balance)	3	3

Note

All values are reported in acre-feet.

Jacumba Valley Groundwater Basin. The POR at the meteorological station Ejido Jacume (POR from 1973 to 2013 is not long enough to calculate DWR (2021) water year types for a 52-year period nor determine the driest 52-year period. However, the POR does provide 32 years of precipitation data (data gap from 1997 to 2003) and includes typical climatic cycles, includes multiple dry years. The JVGB multiple dry year scenario uses a repeat of the Ejido Jacume precipitation record. DWR (2021) water year types are available for the Carrizo Creek watershed from 1931 to 2018 and are used in the 52-year projection when considering non-Project pumping. As described in Section 6.1, recharge from precipitation during a normal year is 3,682 AF. Consistent with the JVGB dry year groundwater budget (Table 9), the amount of recharge calculated for a given year is based off the percentage of the total annual precipitation for that year compared to the total annual precipitation during a normal year. All other groundwater budget components presented in the JVGB multiple dry year groundwater budget (Table 27) are consistent with those presented in Table 9, except non-Project pumping demand. Non-Project pumping demand is assumed to increase by 5 percent during a DWR (2020) classified dry year, and 10 percent during a critical dry year. Similarly, non-Project pumping demand is assumed to decrease by 5 percent during above normal years and 10 percent during wet years.

Without the Project in place, the JVGB budget balance indicates an average annual surplus of approximately 4,818 AF and a cumulative surplus of 246,945 AF during the 52-year period. The addition of Project pumping and cumulative project pumping would reduce the cumulative surplus by approximately 1 percent and 2 percent, respectively. Project construction, operation, and decommissioning pumping is approximately 10 percent, 1 percent, and 2 percent of the 52-year average annual budget balance surplus. Cumulative project construction, operation, and decommissioning pumping is approximately 19 percent, 1 percent, and 2 percent of the 52-year average annual budget balance surplus. During the 52-year period, the lowest annual budget balance surplus is 126 AF. Therefore, the JVGB would not be anticipated to experience an annual groundwater deficit during the 52-year period with or without Project or cumulative project pumping. The addition of Project pumping (regardless of Project phase) would not chronically increase the total JVGB annual pumping, or reduce the annual budget balance, to historical volumes when more intensive agricultural irrigation and a chronic lowering of groundwater levels were occurring.

Therefore, the Project could source groundwater from the OCVGB for all phases of the Project, through the life of the Project, without adversely impacting existing or planned future uses during multiple dry years.

Table 27. Jacumba Valley Groundwater Basin Groundwater Budget (Alluvial Aquifer) – Multiple Dry Years

Year	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Reference Year	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Historical Precipitation	4.82	6.55	14.09	6.74	16.74	14.82	16.61	8.35	12.12	24.2
Water Year Type	Above Normal	Above Normal	Wet	Wet	Wet	Wet	Wet	Wet	Wet	Wet
Percent of Normal Precipitation	69	93	201	96	239	212	237	119	173	345
Recharge from Runoff (Inflow)	2,533	3,442	7,404	3,542	8,797	7,788	8,728	4,388	6,369	12,717
Non-Project Pumping (Outflow)	11	11	11	11	11	11	11	11	11	11
Annual Budget Balance	**2,521**	**3,430**	**7,393**	**3,531**	**8,786**	**7,777**	**8,717**	**4,377**	**6,358**	**12,706**
Project Water Use	500	500	50	50	50	50	50	50	50	50
Project Water Use (Percent of Annual Budget Balance)	20	15	1	1	1	1	1	1	1	0.4
Budget Balance with Project In-Place	**2,021**	**2,930**	**7,343**	**3,481**	**8,736**	**7,727**	**8,667**	**4,327**	**6,308**	**12,656**
Budget Balance with all Cumulative Projects In-Place	**1,591**	**2,912**	**7,325**	**3,463**	**8,717**	**7,709**	**8,649**	**4,309**	**6,290**	**12,638**
Year	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**	**2041**	**2042**	**2043**	**2044**
Reference Year	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Historical Precipitation	5.81	7.63	16.02	7.28	11.14	4.06	4.23	9.04	10.83	3.57
Water Year Type	Wet	Below Normal	Wet	Above Normal	Above Normal	Dry	Critical	Below Normal	Wet	Wet
Percent of Normal Precipitation	83	109	229	104	159	58	60	129	155	51
Recharge from Runoff (Inflow)	3,053	4,009	8,418	3,825	5,854	2,133	2,223	4,750	5,691	1,876
Non-Project Pumping (Outflow)	11	12	11	11	11	13	13	12	11	11
Annual Budget Balance	**3,042**	**3,997**	**8,407**	**3,814**	**5,842**	**2,121**	**2,210**	**4,738**	**5,680**	**1,865**
Project Water Use	50	50	50	50	50	50	50	50	50	50
Project Water Use (Percent of Annual Budget Balance)	2	1	1	1	1	2	2	1	1	3
Budget Balance with Project In-Place	**2,992**	**3,947**	**8,357**	**3,764**	**5,792**	**2,071**	**2,160**	**4,688**	**5,630**	**1,815**
Budget Balance with all Cumulative Projects In-Place	**2,974**	**3,929**	**8,339**	**3,746**	**5,774**	**2,053**	**2,141**	**4,670**	**5,612**	**1,797**

Year	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054
Reference Year	1994	1995	1996	2004	2005	2006	2007	2008	2009	2010
Historical Precipitation	0.26	3.96	2.05	1.33	11.47	4.19	1.72	7.18	2.94	12.52
Water Year Type	Wet	Above Normal	Dry	Dry	Wet	Above Normal	Critical	Dry	Dry	Below Normal
Percent of Normal Precipitation	4	57	29	19	164	60	25	102	42	179
Recharge from Runoff (Inflow)	137	2,081	1,077	699	6,027	2,202	904	3,773	1,545	6,579
Non-Project Pumping (Outflow)	11	11	13	13	11	11	13	13	13	12
Annual Budget Balance	**126**	**2,070**	**1,065**	**686**	**6,016**	**2,190**	**891**	**3,760**	**1,532**	**6,567**
Project Water Use	50	50	50	50	50	50	50	50	50	50
Project Water Use (Percent of Annual Budget Balance)	40	2	5	7	1	2	6	1	3	1
Budget Balance with Project In-Place	**76**	**2,020**	**1,015**	**636**	**5,966**	**2,140**	**841**	**3,710**	**1,482**	**6,517**
Budget Balance with all Cumulative Projects In-Place	**58**	**2,001**	**996**	**618**	**5,948**	**2,122**	**822**	**3,692**	**1,464**	**6,499**
Year	**2055**	**2056**	**2057**	**2058**	**2059**	**2060**	**2061**	**2062**	**2063**	**2064**
Reference Year	2011	2012	1974	1975	1976	1977	1978	1979	1980	1981
Historical Precipitation	11.83	9.17	4.82	6.55	14.09	6.74	16.74	14.82	16.61	8.35
Water Year Type	Wet	Above Normal	Above Normal	Above Normal	Wet	Wet	Wet	Wet	Wet	Wet
Percent of Normal Precipitation	169	131	69	93	201	96	239	212	237	119
Recharge from Runoff (Inflow)	6,216	4,819	2,533	3,442	7,404	3,542	8,797	7,788	8,728	4,388
Non-Project Pumping (Outflow)	11	11	11	11	11	11	11	11	11	11
Annual Budget Balance	**6,206**	**4,807**	**2,521**	**3,430**	**7,393**	**3,531**	**8,786**	**7,777**	**8,717**	**4,377**
Project Water Use	50	50	50	50	50	50	50	50	50	50
Project Water Use (Percent of Annual Budget Balance)	1	1	2	1	1	1	1	1	1	1
Budget Balance with Project In-Place	**6,156**	**4,757**	**2,471**	**3,380**	**7,343**	**3,481**	**8,736**	**7,727**	**8,667**	**4,327**
Budget Balance with all Cumulative Projects In-Place	**6,137**	**4,739**	**2,453**	**3,362**	**7,325**	**3,463**	**8,717**	**7,709**	**8,649**	**4,309**

Year	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074
Reference Year	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Historical Precipitation	12.12	24.2	5.81	7.63	16.02	7.28	11.14	4.06	4.23	9.04
Water Year Type	Wet	Wet	Wet	Below Normal	Wet	Above Normal	Above Normal	Dry	Critical	Below Normal
Percent of Normal Precipitation	173	345	83	109	229	104	159	58	60	129
Recharge from Runoff (Inflow)	6,369	12,717	3,053	4,009	8,418	3,825	5,854	2,133	2,223	4,750
Non-Project Pumping (Outflow)	11	11	11	12	11	11	11	13	13	12
Annual Budget Balance	**6,358**	**12,706**	**3,042**	**3,997**	**8,407**	**3,814**	**5,842**	**2,121**	**2,210**	**4,738**
Project Water Use	50	50	50	50	50	50	50	50	50	50
Project Water Use (Percent of Annual Budget Balance)	1	0.4	2	1	1	1	1	2	2	1
Budget Balance with Project In-Place	**6,308**	**12,656**	**2,992**	**3,947**	**8,357**	**3,764**	**5,792**	**2,071**	**2,160**	**4,688**
Budget Balance with all Cumulative Projects In-Place	**6,290**	**12,638**	**2,974**	**3,929**	**8,339**	**3,746**	**5,774**	**2,053**	**2,141**	**4,670**

Year	2075	2076
Reference Year	1992	1993
Historical Precipitation	10.83	3.57
Water Year Type	Wet	Wet
Percent of Normal Precipitation	155	51
Recharge from Runoff (Inflow)	5,691	1,876
Non-Project Pumping (Outflow)	11	11
Annual Budget Balance	**5,680**	**1,865**
Project Water Use	100	100
Project Water Use (Percent of Annual Budget Balance)	2	5
Budget Balance with Project In-Place	**5,580**	**1,765**
Budget Balance with all Cumulative Projects In-Place	**5,562**	**1,765**

Note

All values are reported in acre-feet per year.

Source: Dudek, 2021.

7 Numerical Groundwater Models

7.1 Imperial Valley Groundwater Basin

Numerical groundwater models have been developed to simulate the potential effects on groundwater resources from lining the Coachella Canal and AAC (Loeltz and Leake, 1979), to (1) investigate regional water management of groundwater and surface water in the County (Montgomery Watson, 1996), (2) investigate regional groundwater availability in the Salton Sea Basin (Tompson et al., 2008), and (3) investigate the groundwater system in the Colorado River Delta in Mexico (Feirstein et al., 2008).

In 2012, BLM established a Solar Energy Program and, with the U.S. Department of Energy, generated an Environmental Impact Statement for Solar Energy Development in several southwestern states. BLM later identified a subset of Solar Energy Zones (SEZs) for which three-dimensional groundwater models would be developed. This includes the Imperial East SEZ, which covers approximately 5,700 acres in the Imperial Valley.[17] The Imperial East SEZ model was constructed by Argonne National Laboratory in 2013, and represents a "modified version of an earlier, non-calibrated flow model of the Imperial and Mexicali Valleys described by Tompson et al. (2008)" (Greer et al., 2013).

The purpose of the Imperial East SEZ model (2013) model is:

> … to examine potential groundwater impacts associated with proposed solar development of the SEZs, with a particular focus on examining groundwater drawdown and potential loss of connectivity to surface water features, springs, and vegetation. The developed numerical groundwater models are being made available through the Solar PEIS [Programmatic Environmental Impact Statement] Web site (http://blmsolar.anl.gov) so that they can be used for project-scale review and for the development of long-term monitoring programs. (Greer et al., 2013)

7.2 Ocotillo-Clark Valley and Jacumba Valley Groundwater Basins

Numerical groundwater models representing the OCVGB and JVGB were unavailable for use at the time of reporting. To evaluate potential impacts to groundwater (Section 8) caused by Project water demands in these groundwater basins, GSI Water Solutions, Inc. (GSI), developed a MODFLOW groundwater model (Model) for each basin using existing hydrogeological reports and water budgets presented in previously completed WSAs (or similar).

[17] The Imperial East SEZ is included in the Development Focus Area (discussed in Section 2) pursuant to the DRECP and its associated Record of Decision (BLM, 2016a, 2016b).

8 Cone of Depression and Cumulative Impact Analysis

Pursuant to BLM (2016a, 2016b) requirements, a WSA must include an analysis of "estimates of the total cone of depression considering cumulative drawdown from all potential pumping in the basin, including the project, for the life of the project through the decommissioning phase." To evaluate the potential cone of depression induced by proposed Project groundwater pumping and cumulative drawdown from all potential pumping, predictive Models were developed and projected for the 52-year duration (2025–2076) of the Project. The existing Argonne National Laboratory model (Greer et al., 2013) was used for the IVGB, and GSI-constructed models were used for the OCVGB and JVGB. The Models incorporated estimated inflow and outflow terms consistent with the Project water budget presented in Section 5.3 and hydrogeological properties used in the Greer et al. (2013) numerical groundwater model. A summary of the Models' parameters and results is included below.

8.1 Imperial Valley Groundwater Basin - Model Parameters and Results

The native MODFLOW files for the calibrated, transient version of the Imperial East SEZ Model (Greer et al., 2013) were downloaded directly from the BLM website and imported into Groundwater Vistas, the graphical user interface used by GSI for the model simulations discussed in this section.

The Imperial East SEZ represents a small portion of the Model domain, which extends from the Salton Sea in the northwest to the Colorado River in the southeast. The Model consists of nine layers, which represent the aquifers and semi-permeable aquitards that store the majority of groundwater produced in the Imperial and Mexicali Valleys (Greer et al., 2013). The bottom of Layer 9 represents the vertical extent of the Model, which extends to a depth of approximately 550 feet bgs in the vicinity of the SEZ, and up to 2,000 feet bgs in other parts of the Model. Subsurface flow in the Model is generally to the northwest, originating from a combination of mountain-front recharge, irrigation canal leakage, and the Colorado River, and discharging into the drainage ditches of the Imperial Valley and the Salton Sea (Greer et al., 2013). Additional information describing the boundary conditions and hydraulic parameters used in the development of the Model are discussed in the Imperial East SEZ Groundwater Report by Greer et al. (2013).

The transient Imperial East SEZ Model extends from 1942 to 2013 and consists of four stress periods with monthly time steps. The stress periods reflect the variability of the Coachella Canal and AAC, both of which had portions lined and/or shifted in 1980, 2006, and 2008 (Greer et al., 2013).

As described in Greer et al. (2013), the transient Model is adequately calibrated. Wells adjacent to the SEZ show good correlation between computed and observed heads, within 3 to 6.5 feet. Generally, the primary calibration goal is to achieve a relative error of less than 10 percent (ESI, 2000−2020; Spitz and Moreno, 1996), and the Model has a relative error of approximately 6.5 percent. Additional details regarding calibration statistics may be found in the Greer et al. (2013) report.

No major changes were made to aquifer parameters or boundary conditions to improve calibration. The only change made to the boundary conditions of the Model was to modify the conductance of the AAC adjacent to the SEZ to reflect the current lining of the canal east of Drop 3. This was implemented only for stress period four and later.

The original Model (Greer et al., 2013) ends in 2013, so additional stress periods were added to simulate into the future through 2077. The simulated future period includes Project construction pumping (2 years) (see Figure 16), operational pumping (48 years), and decommissioning pumping (2 years), totaling 52 years (January 2026 through December 2077). To assess the impact of the Project, two predictive modeling scenarios were run: a baseline scenario without Project pumping and a scenario with Project pumping. The difference in groundwater elevations between these two scenarios represents the effects of the Project.

The Project effects are discussed in terms of the zones of influence of the total cone of depression considering cumulative drawdown as a result of the Project and other projected pumping within the IVGB. Figure 16 presents the cumulative drawdown and zone of influence caused by Project pumping after 2 years of construction water use (2026–2027).[18] The modeled zone of influence of 2 years of Project construction pumping (500 AFY) is minimal. The model estimates an approximately 1,500-foot radius cone of depression out to 0.1 feet of drawdown, with approximately 0.24 feet of drawdown at the Project Well. Project operational pumping (50 AFY for 48 years) and decommissioning pumping (100 AFY for 2 years) have negligible effects; no significant cone of depression is estimated for either pumping period. Less than 0.1 foot of drawdown is estimated at the well for both operational and decommissioning pumping.

The modeling results indicate that impacts to groundwater levels as a result of Project pumping are minimal and confined to the vicinity of the Imperial SEZ.

8.2 Ocotillo-Clark Valley Groundwater Basin – Model Parameters and Results

GSI constructed a single-layer numerical groundwater flow model (MODFLOW) to represent the lower, confined aquifer unit underlying the Ocotillo Valley. The upper aquifer unit was not included in the model because there is little hydraulic communication between the upper and lower aquifers, and the vast majority of pumping, including the wells that would supply Project water demands, are located in the lower aquifer.

Clark Valley, which is located in the northern portion of the groundwater basin, is separated from the Ocotillo Valley by a watershed divide. Consequently, groundwater extraction in the Ocotillo Valley portion of the basin is not expected to affect water levels in the Clark Valley. Figure 17 shows the active model domain, which covers approximately 170,000 acres.

The top and bottom layers of the model are based on existing well data and aquifer descriptions as presented in Seville Solar Farm Complex WSA (Todd Engineers, 2013). The top elevation of the model ranges between approximately 200 and 270 feet bgs. The modeled thickness of the aquifer is approximately 700 feet in the center of the model domain, which was assumed based on the perforated intervals of existing wells. Hydraulic properties such as hydraulic conductivity (K) and storativity (S) were estimated based on data provided in Todd Engineers (2013). The range of K and S values incorporated into the model are shown in Table 28.

Table 28. Ocotillo-Clark Valley Groundwater Basin – Model Hydraulic Properties

Parameter	Minimum	Maximum
Hydraulic Conductivity[1]	25 ft/day	75 ft/day
Storativity	1e-05	1e-05

Note

[1] Values represent horizontal K. Vertical K assumed to be 10 percent of horizontal.

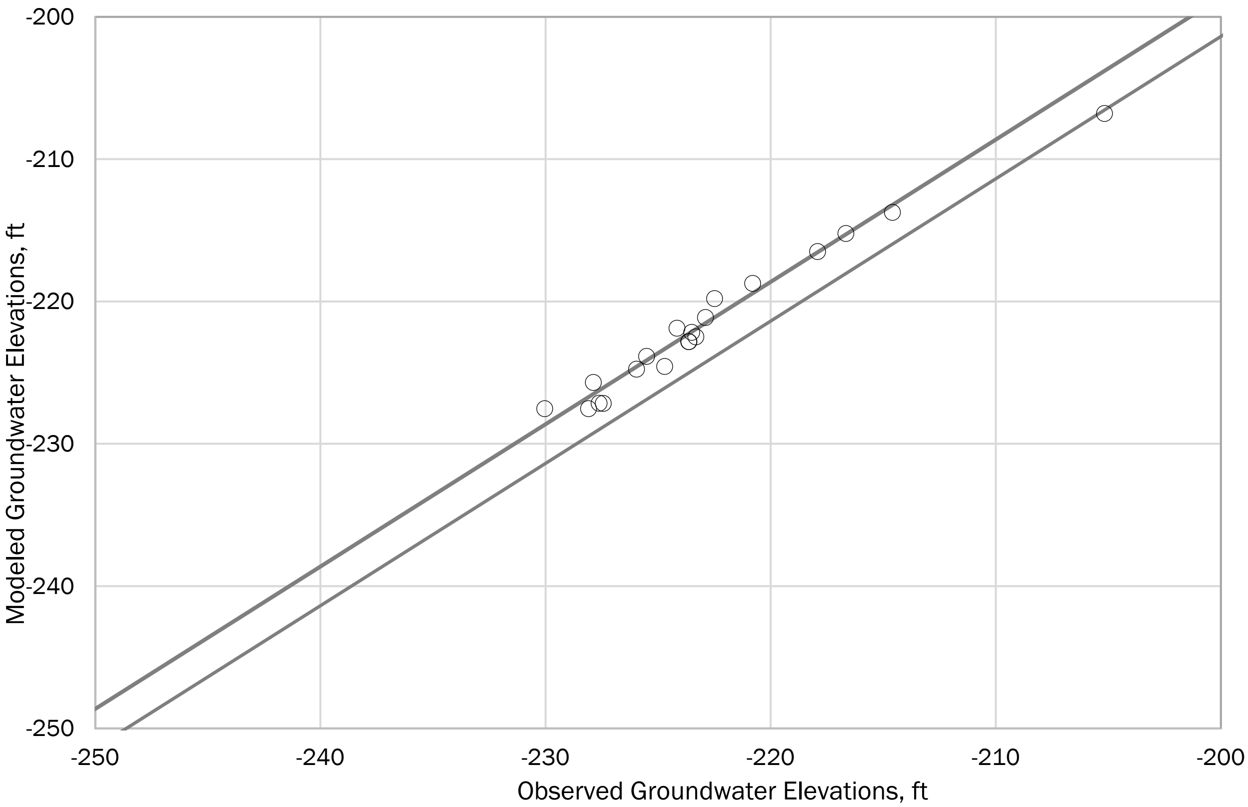
[18] The modeled Project Well was located at least 1 mile from the AAC based on § 92202.01(D) of IID's Title 9, Division 22: Groundwater Ordinance.

Boundary conditions incorporated into the model include mountain-front recharge and pumping. These are assumed to be the main sources of inflow and outflow to the confined aquifer system. Current and future pumping demands were incorporated into the model based on information provided by Todd Engineers (2013). Additionally, the model incorporates a general head boundary where the edge of the model domain meets the Salton Sea to the east. Boundary condition cells are shown on Figure 17.

The model uses semi-annual stress periods. The calibration model is 38 stress periods representing water years 2002 through 2020, which includes the time frame where groundwater elevation data is available. The model was calibrated to water levels in the San Felipe Well, which is monitored by the USGS. The well shows good correlation between computed and observed heads, with an average residual mean of 1.35 feet. The relative error for the calibration model is 6.2 percent. Calibration statistics are shown in Table 29, and a scatter graph of modeled heads versus observed heads is provided in Graph 1.

Table 29. Ocotillo-Clark Valley Groundwater Basin – Model Calibration Results

Statistic	All Wells
Residual Mean	-1.19
Residual Std. Deviation	0.97
Absolute Residual Mean	1.35
Residual Sum of Squares	472
RMS Error	1.54
Minimum Residual	-2.69
Maximum Residual	1.61
Range of Observations	24.87
Scaled Res. Std. Dev.	0.039
Scaled Abs. Mean	0.054
Scaled RMS	0.062
Number of Observations	20



Graph 1. Observed versus Simulated Groundwater Elevation Calibration Scatter Plot – Ocotillo-Clark Valley Groundwater Basin Model

Following calibration, additional stress periods were added to the calibration model to simulate into the future through 2077. To assess the impact of the Project, two predictive modeling scenarios were run: a baseline scenario without Project pumping and a scenario with Project pumping. The difference in groundwater elevations between these two scenarios represents the effect of the Project.

For the future simulation, it was assumed that water supply for the Project would be sourced from the five designated commercial/solar models identified by Todd Engineers (2013). Project water was assumed to be distributed evenly between these five wells.

The Project impacts are discussed in terms of the zones of influence of the total cone of depression considering cumulative drawdown as a result of the Project and other projected pumping within the basin. Figure 17 presents the cumulative drawdown and zone of influence caused by Project pumping after 2 years of construction water use (2026–2027). Figure 18 presents cumulative drawdown caused by Project pumping after 48 years of operational pumping (2028–2075), and Figure 19 presents cumulative drawdown caused by Project pumping after an additional 2 years of decommissioning pumping (2076–2077).

Figure 17 shows that following 2 years of construction pumping, head pressure in the vicinity of the pumping wells is expected to be reduced by an additional 3 feet. However, the contours indicate that the zone of influence extends across the vast majority of the model domain. This is due to the fact that the aquifer is being modeled as fully confined. Unlike in an unconfined aquifer, pumping a confined aquifer will not reduce the saturated thickness, but it will exhibit an immediate pressure head response that permeates through the entire aquifer system.

The model results indicate that following the heightened demand during construction, groundwater head in the confined aquifer will stabilize after approximately 5 years of operational pumping. Figure 18 illustrates the predicted drawdown response due to operational pumping in the vicinity of the pumping wells, expected to be less than 0.5 feet. Figure 19 shows a slight increase in drawdown following 2 years of decommissioning pumping, approximately 0.7 feet in the vicinity of the pumping wells.

8.3 Jacumba Valley Groundwater Basin – Model Parameters and Results

GSI constructed a single-layer numerical groundwater flow model (MODFLOW) to represent the upper, alluvial aquifer unit within the JVGB. The existing groundwater production wells (Well #2 and Well #3) were used to simulate Project pumping from the alluvial aquifer.

The active model domain is based on the extent of mapped alluvium in the JVGB. It covers approximately 2,700 acres, with roughly one-third of the are being located south of the international border with Mexico. The southern extent of the model is based on the alluvial boundary as reported by Swenson (1981). The model domain is shown on Figure 20.

The top layer of the model represents the land surface elevation and the bottom layer is based on borehole data provided in the JVR Energy Park Project Groundwater Resources Investigation Report (Dudek, 2021). Thickness of the modeled alluvial aquifer ranges between 5 and 175 feet. Hydraulic properties such as hydraulic conductivity (K) and specific yield (Sy) were estimated based on data provided in Dudek, 2021. The range of K and Sy values incorporated into the model are shown in Table 30.

Table 30. Jacumba Valley Groundwater Basin – Model Hydraulic Properties

Parameter	Minimum	Maximum
Hydraulic Conductivity[1]	10 ft/day	650 ft/day
Specific Yield	0.08	0.175

Note

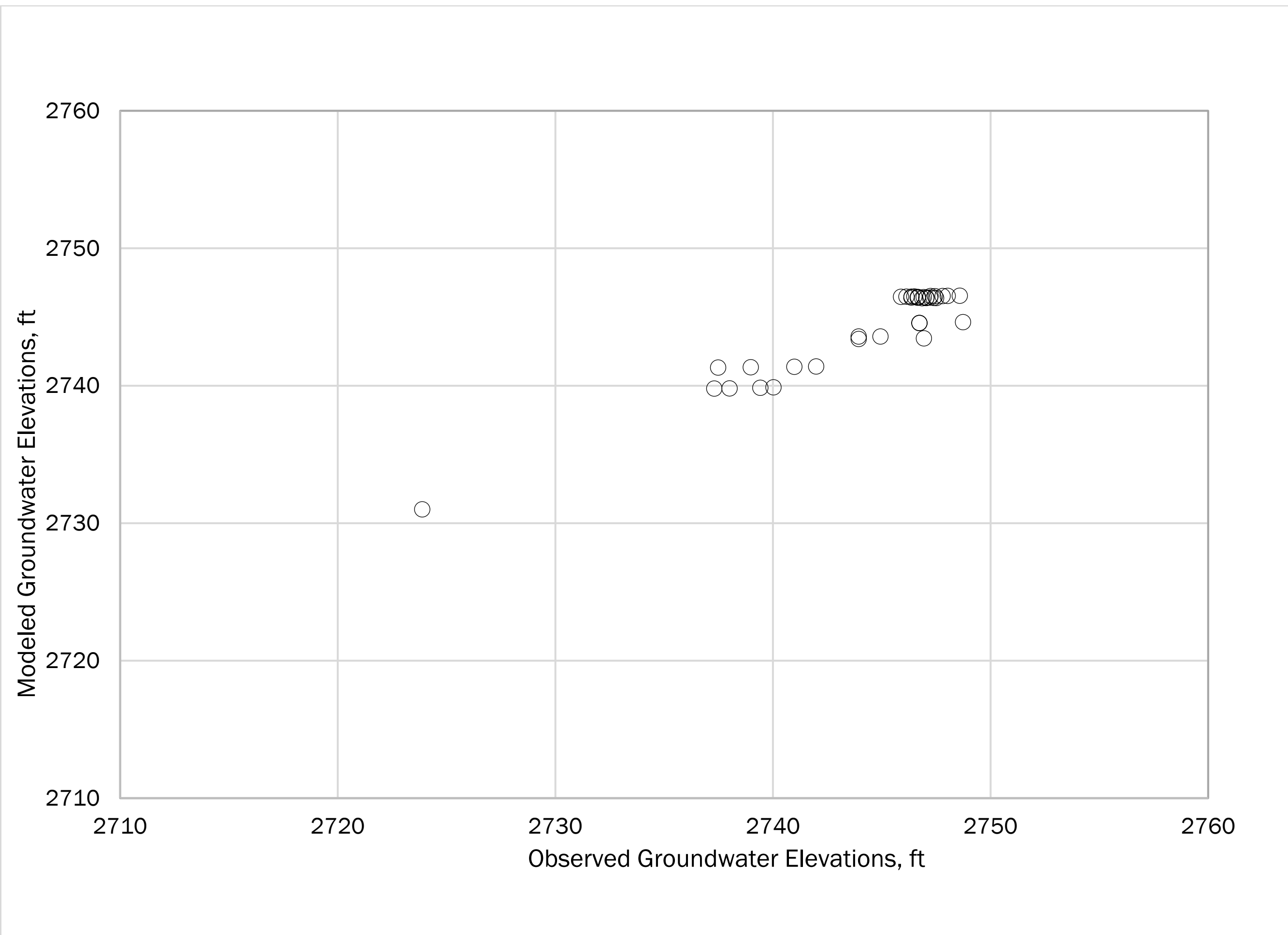
[1] Values represent horizontal K. Vertical K assumed to be 10 percent of horizontal.

Boundary conditions incorporated into the model include recharge, pumping, ET, and subsurface outflow. Recharge cells were placed along the edges of the model domain, as recharge to the alluvium occurs mainly along the boundaries of the alluvial aquifer along bedrock contacts, and is concentrated in the vicinity of the major drainages (Swenson, 1981). Pumping wells were placed based on information from Dudek (2021) and include both public water supply wells and domestic wells. ET is concentrated in the north end of the valley, which is covered by dense phreatophyte growth (Swenson, 1981). Subsurface outflow occurs at the north end of the valley and was modeled using the general head boundary package. Boundary condition cells are shown on Figure 20. Boundary condition cells are shown on Figure 20.

The model uses semi-annual stress periods. The calibration model is 18 stress periods representing water years 2013 through 2021, which encompasses the time frame where both groundwater pumping estimates and groundwater elevation data are available. The model was calibrated to water levels in six alluvial aquifer wells, data for which were reported by Dudek (2021). The well shows good correlation between computed and observed heads, with an average residual mean of 0.27 feet. The relative error for the calibration model is 7.9 percent. Calibration statistics are shown in Table 31, and a scatter graph of modeled heads versus observed heads is provided in Graph 2.

Table 31. Jacumba Valley Groundwater Basin – Model Calibration Results

Statistic	All Wells
Residual Mean	0.27
Residual Std. Deviation	1.93
Absolute Residual Mean	1.33
Residual Sum of Squares	141
RMS Error	1.95
Minimum Residual	-7.13
Maximum Residual	4.11
Range of Observations	24.85
Scaled Res. Std. Dev.	0.078
Scaled Abs. Mean	0.053
Scaled RMS	0.079
Number of Observations	37



Graph 2. Observed versus Simulated Groundwater Elevation Calibration Scatter Plot – Jacumba Valley Groundwater Basin Model

Following calibration, additional stress periods were added to the calibration model to simulate into the future through 2077. To assess the impact of the Project, two predictive modeling scenarios were run: a baseline scenario without Project pumping and a scenario with Project pumping. The difference in groundwater elevations between these two scenarios represents the effect of the Project.

For the future simulation, it was assumed that water supply for the Project would be sourced from the Highland and Park Wells, which are operated by JCSD and provide non-potable water for external transfers. Project water demand was assumed to be distributed evenly between these two wells.

The Project impacts are discussed in terms of the zones of influence of the total cone of depression considering cumulative drawdown as a result of the Project and other projected pumping within the JVGB. Figure 20 presents the cumulative drawdown and zone of influence caused by Project pumping after 2 years of construction water use (2026–2027). Figure 21 presents cumulative drawdown caused by Project pumping after 48 years of operational pumping (2028–2075), and Figure 22 presents cumulative drawdown caused by Project pumping after an additional 2 years of decommissioning pumping (2076–2077).

The modeled zone of influence of 2 years of Project construction pumping (500 AFY) is an approximately 1,200- to 1,500-foot radius cone of depression out to 0.2 feet of drawdown, with approximately 2 feet of drawdown at the Project pumping wells. After 48 years of Project operational pumping (50 AFY), the estimated cone of depression out to 0.2 feet of drawdown extends roughly 1 mile to the east of the pumping wells and 1,700 feet to the west, with approximately 0.8 feet of drawdown at the Project pumping wells. The lateral extent of the cone of depression is similar following 2 additional years of decommissioning pumping (100 AFY), with approximately 1 foot of drawdown occurring at the Project pumping wells.

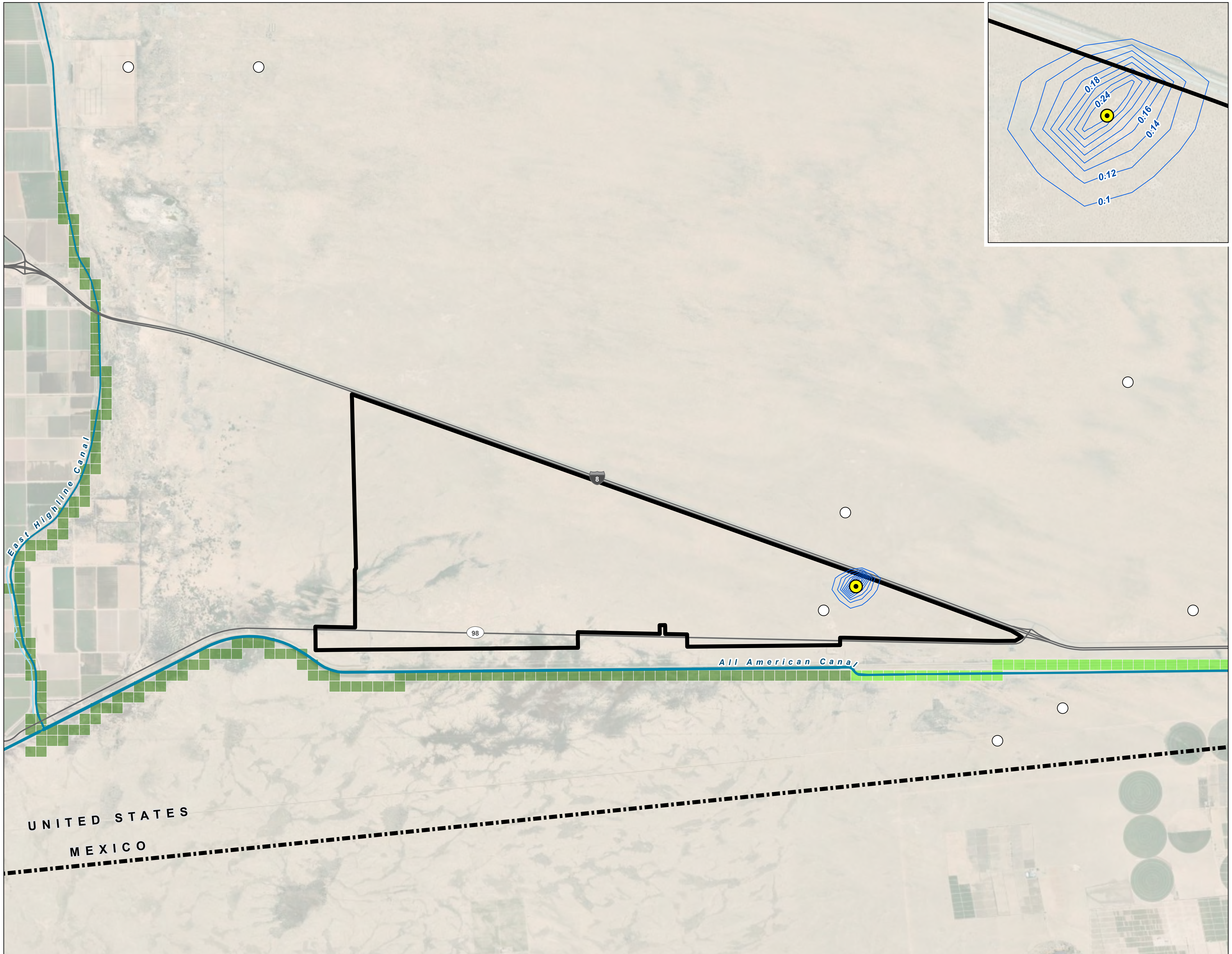


FIGURE 16

Cumulative Impact Analysis
Project Construction
(End of Year 2) – Imperial Valley
Groundwater Basin
Perkins Renewable Energy Project
Water Supply Assessment

LEGEND

Proposed Project Well (Layer 9)
Existing Well
Cumulative Groundwater Drawdown in Feet (0.02' Contour Interval)

Modelled Canal

Lined
Unlined

All Other Features

Proposed Project Boundary
International Boundary
Major Road
Canal

NOTES

1. Modeled using Greer et al. (2013), including well and canal data.
2. Project water would be sourced from the lower aquifer and hydrologically upgradient of the unlined portion of the All American Canal

N

0 2,900 5,800 8,700
FEET

Date: February 5, 2025
Data Sources: BLM, ESRI, USGS, Imagery (2022)

GSI Water Solutions, Inc.

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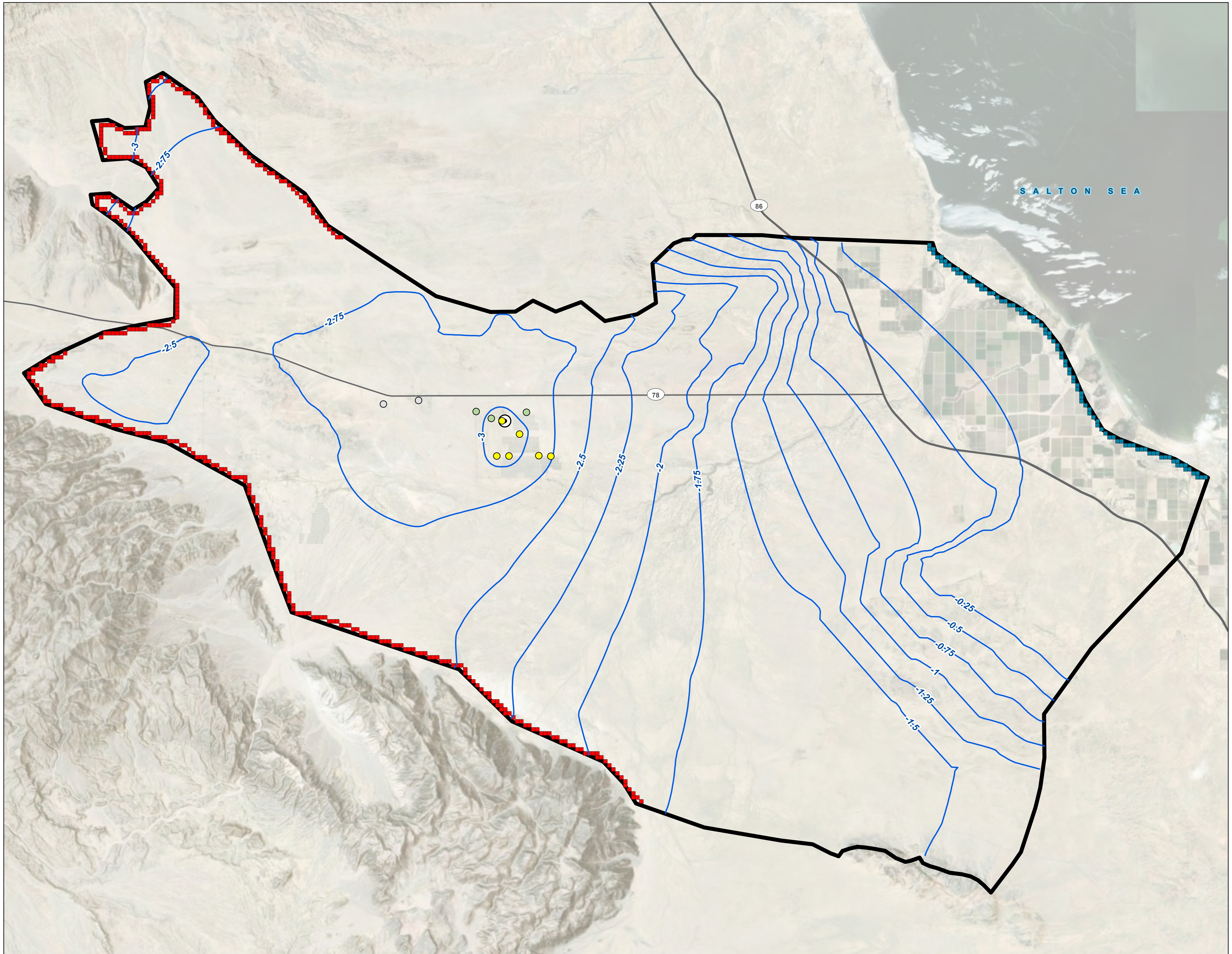

FIGURE 17

Cumulative Impact Analysis *Project Construction (End of Year 2) – Ocotillo-Clark Valley Groundwater Basin*

Perkins Renewable Energy Project
Water Supply Assessment

LEGEND

- San Felipe Monitoring Well (Groundwater Elevation Target)
- Cumulative Groundwater Drawdown in Feet (0.25' Contour Interval)

Model Boundary Conditions

- Commercial Pumping Well
- Domestic Pumping Well
- Other Pumping Well
- General Head Boundary
- Mountain Front Recharge

All Other Features

- Active Model Domain
- Major Road

NOTE

1. Project water would be sourced from the deeper, confined to semi-confined aquifer, using the Allegretti Farms well(s).

N

0 6,000 12,000 18,000
FEET

Date: February 5, 2025
Data Sources: BLM, ESRI, USGS, Todd Engineers (2013), Imagery (2022)

GSI Water Solutions, Inc.

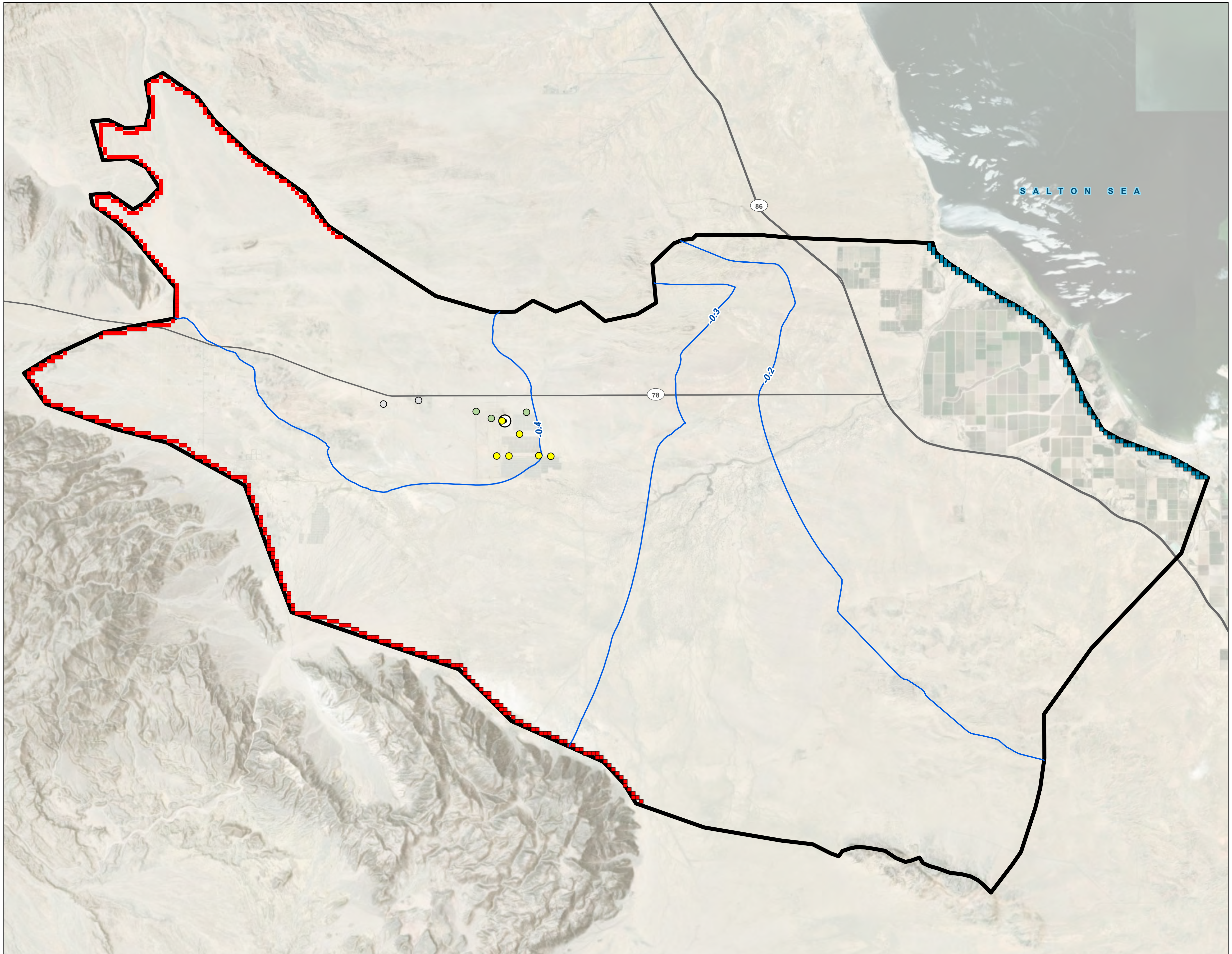

FIGURE 18

Cumulative Impact Analysis
Project Operations
(End of Year 50) – Ocotillo-Clark Valley Groundwater Basin

Perkins Renewable Energy Project
Water Supply Assessment

LEGEND

San Felipe Monitoring Well (Groundwater Elevation Target)

Cumulative Groundwater Drawdown in Feet (0.1' Contour Interval)

Model Boundary Conditions

Commercial Pumping Well

Domestic Pumping Well

Other Pumping Well

General Head Boundary

Mountain Front Recharge

All Other Features

Active Model Domain

Major Road

NOTE

1. Project water would be sourced from the deeper, confined to semi-confined aquifer, using the Allegretti Farms well(s).

N

0 6,000 12,000 18,000
FEET

Date: February 5, 2025
Data Sources: BLM, ESRI, USGS, Todd Engineers (2013), Imagery (2022)

GSI Water Solutions, Inc.

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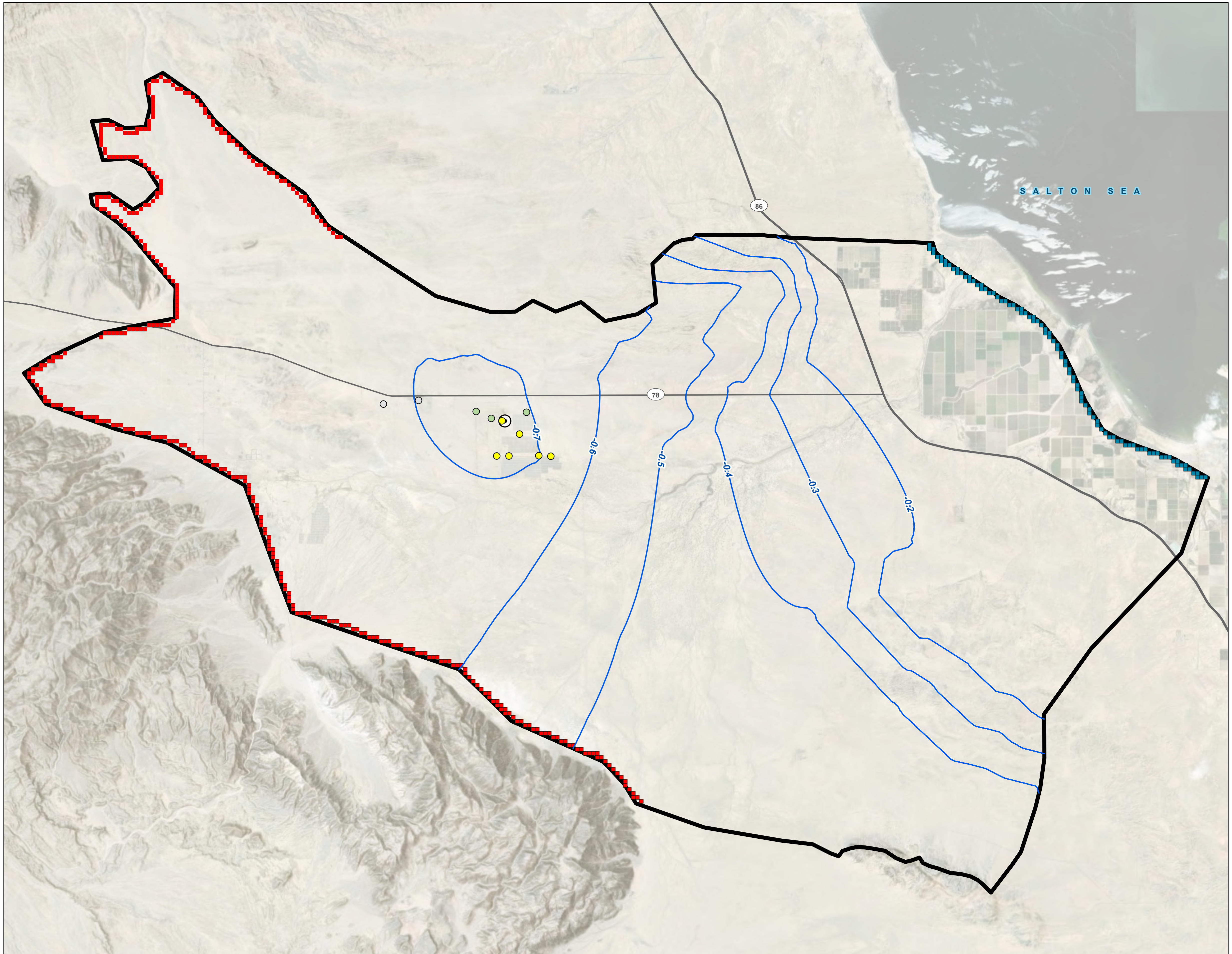

FIGURE 19

Cumulative Impact Analysis
Project Decommissioning (End of Year 52) – Ocotillo-Clark Valley Groundwater Basin

Perkins Renewable Energy Project
Water Supply Assessment

LEGEND

- San Felipe Monitoring Well (Groundwater Elevation Target)
- Cumulative Groundwater Drawdown in Feet (0.1' Contour Interval)

Model Boundary Conditions

- Commercial Pumping Well
- Domestic Pumping Well
- Other Pumping Well
- General Head Boundary
- Mountain Front Recharge

All Other Features

- Active Model Domain
- Major Road

NOTE

1. Project water would be sourced from the deeper, confined to semi-confined aquifer, using the Allegretti Farms well(s).

N

0 6,000 12,000 18,000
FEET

Date: February 5, 2025
Data Sources: BLM, ESRI, USGS, Todd Engineers (2013), Imagery (2022)

GSI Water Solutions, Inc.

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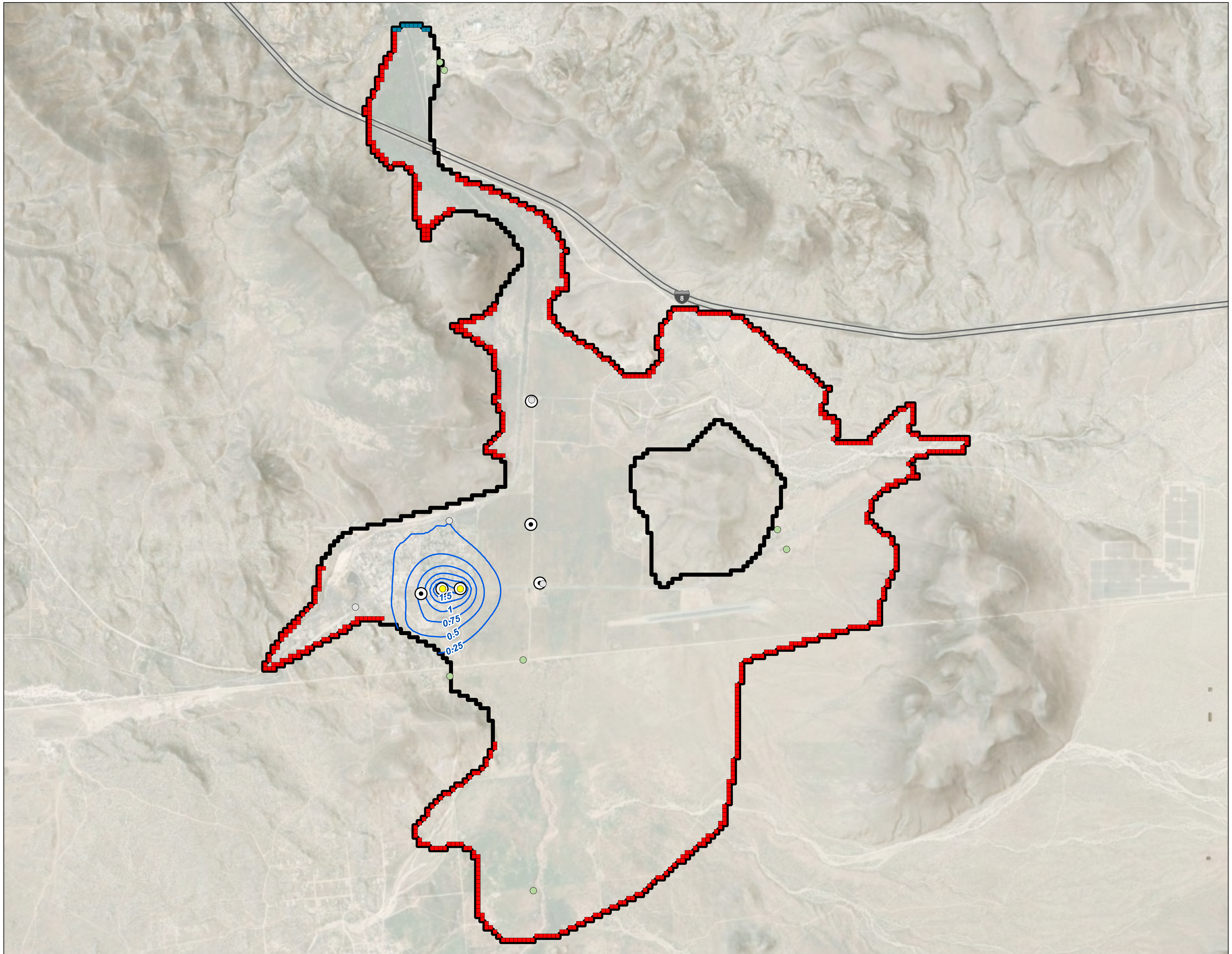

FIGURE 20

Cumulative Impact Analysis
Project Construction (End of Year 2) – Jacumba Valley Groundwater Basin

Perkins Renewable Energy Project
Water Supply Assessment

LEGEND

Groundwater Elevation Target

Cumulative Groundwater Drawdown in Feet (0.25' Contour Interval)

Model Boundary Conditions

Commercial Pumping Well

Domestic Pumping Well

Other Pumping Well

General Head Boundary

Mountain Front Recharge

All Other Features

Active Model Domain

Major Road

NOTE

1. Project water would be sourced from the deeper, bedrock aquifers, using the Jacumba Community Services District well(s).

N

0 1,150 2,300 3,450
FEET

Date: February 5, 2025
Data Sources: BLM, ESRI, USGS, Dudek (2021), Imagery (2022)

GSI Water Solutions, Inc.

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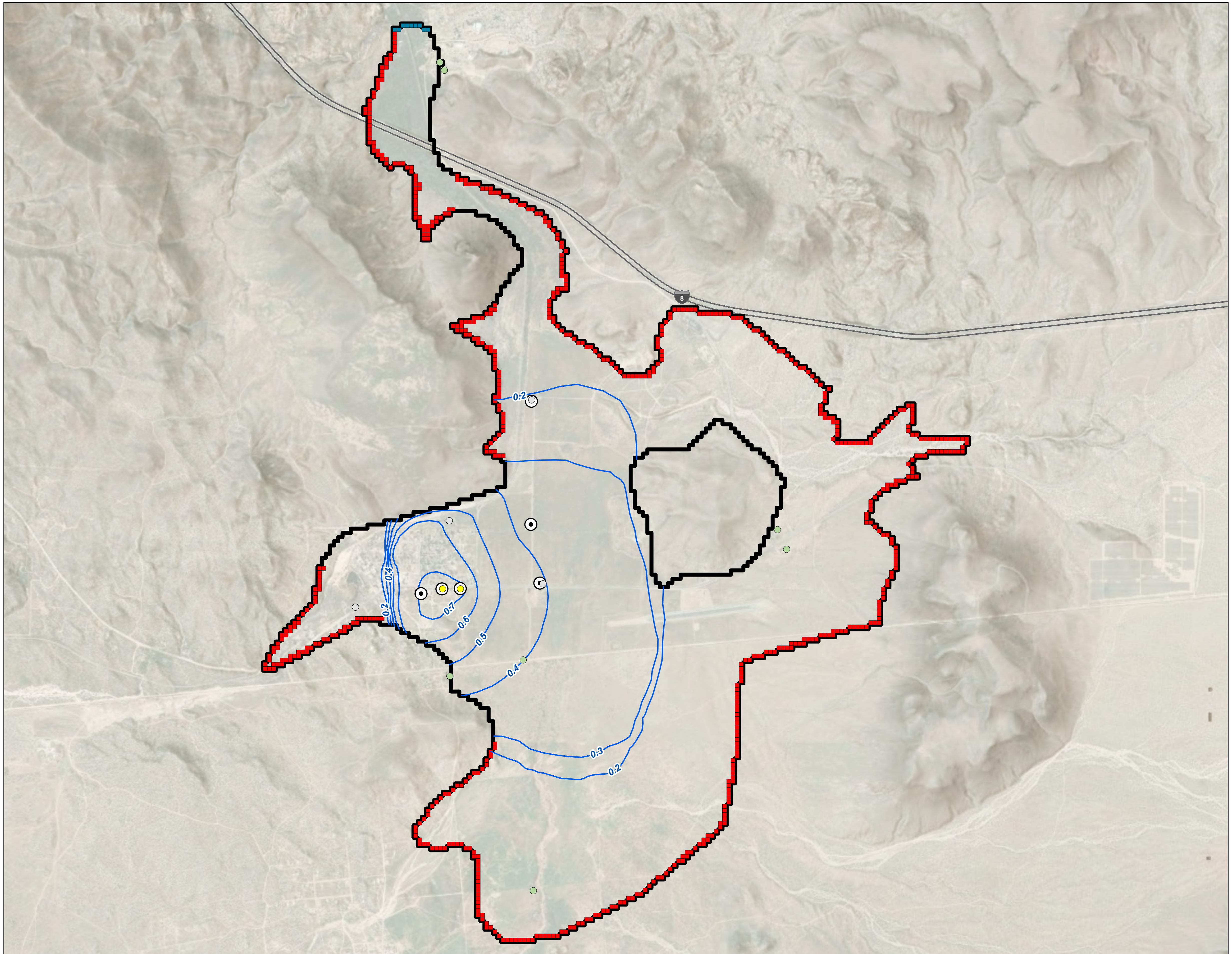

FIGURE 21

Cumulative Impact Analysis
Project Operations
(End of Year 50) – Jacumba Valley Groundwater Basin

Perkins Renewable Energy Project
Water Supply Assessment

LEGEND

- Groundwater Elevation Target
- Cumulative Groundwater Drawdown in Feet (0.1' Contour Interval)

Model Boundary Conditions

- Commercial Pumping Well
- Domestic Pumping Well
- Other Pumping Well
- General Head Boundary
- Mountain Front Recharge

All Other Features

- Active Model Domain
- Major Road

NOTE

1. Project water would be sourced from the deeper, bedrock aquifers, using the Jacumba Community Services District well(s).

N

0 1,150 2,300 3,450
FEET

Date: February 5, 2025
Data Sources: BLM, ESRI, USGS, Dudek (2021), Imagery (2022)

GSI Water Solutions, Inc.

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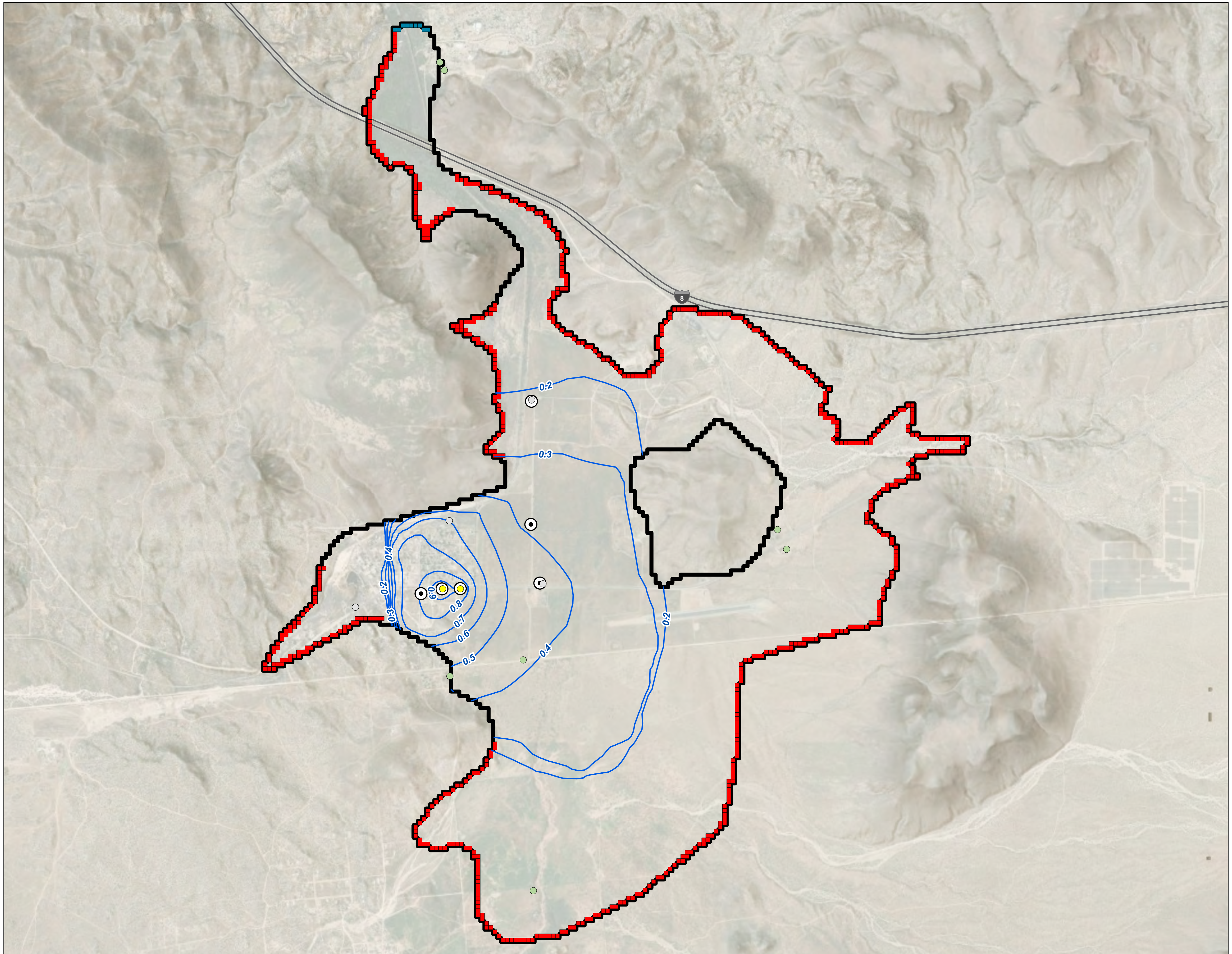

FIGURE 22

Cumulative Impact Analysis
Project Decommissioning (End of Year 52) – Jacumba Valley Groundwater Basin

Perkins Renewable Energy Project
Water Supply Assessment

LEGEND

- Groundwater Elevation Target
- Cumulative Groundwater Drawdown in Feet (0.1' Contour Interval)

Model Boundary Conditions

- Commercial Pumping Well
- Domestic Pumping Well
- Other Pumping Well
- General Head Boundary
- Mountain Front Recharge

All Other Features

- Active Model Domain
- Major Road

NOTE

1. Project water would be sourced from the deeper, bedrock aquifers, using the Jacumba Community Services District well(s).

N

0 1,150 2,300 3,450
FEET

Date: February 5, 2025
Data Sources: BLM, ESRI, USGS, Dudek (2021), Imagery (2022)

GSI Water Solutions, Inc.

9 Conclusions

This WSA was developed pursuant to LUPA-SW-23 and AB 205 applicable requirements and evaluates six potential water sources for the proposed Project. The Project could source water from any of the six sources for any phase of the Project, for the life of the Project, without causing adverse impacts to existing and planned future uses. Project pumping would not cause (1) a chronic lowering of groundwater levels, (2) a degradation in groundwater quality, (3) a decrease in available supply that may affect existing users or water right claimants, (4) land subsidence, increase the rate of subsidence, or loss of aquifer storage, or (5) an impact to any existing GDEs, springs, or seeps. A summary of the data presented in this WSA for each evaluated water source is provided below. Table 32 summarizes available Project water supplies by source.

Golden State Water Company. GSWC's only water source is surface water deliveries from IID. GSWC's average annual allocation from 2015 through 2019 was approximately 1,592 AF. The GEI (2012) projected 2015 and 2020 allocation for GSWC was 2,824 AF and 3,090 AF, respectively. The GSWC WTP has a treatment capacity of 6,720 AFY. The WTP is operating at a rate below the projected GEI (2012) annual allocations and WTP capacity. Using GSWC's methodology to calculate projected demand (SDCWA, 2024b), GSWC demand (and allocations) are projected to increase to 1,607 AFY by 2050, approximately 24 percent of the GSWC WTP capacity and 3,596 AF less than the projected 2050 GSWC allocation in GEI (2012). Based on GEI (2012), GSWC is projected to receive a larger allocation, indicating there are adequate available supplies for all phases of the Project.

Due to IID's senior Colorado River water rights and EDP, municipal user surface water deliveries are the last to be impacted (if at all) by potential surface water shortages as a result of reduced Colorado River flow during drought periods (GEI, 2012).

Although the Project is not explicitly identified in GEI (2012), the Imperial IRWMP does account for projected increased water demands as a result of growing population size and development of renewable energy. The Project's water demand can be categorized in IID's projected industrial demand. Using the 2025 total demand, the Project water demand for construction would represent approximately 0.5 percent to the total IID industrial demand and the Project operational water demand would represent approximately 0.03 percent of the full build-out estimate. The reported 2019 IID municipal and industrial distribution was 90,899 AF, approximately 2 percent greater than the GEI (2012) projected 2020 volume (IID, 2021). However, the 90,899 AF includes municipal use, indicating actual industrial water use is below the projected volume. Therefore, the addition of Project water use would be well within the non-agricultural demand anticipated and planned for by IID.

City of Imperial. The City of Imperial's only water supply is surface water from IID. The City's WTP has a capacity of approximately 7,840 AFY. The City's average imported surface water from 2016 through 2020 was approximately 2,878 AFY (West & Associates, 2022). The City's projected demand (assuming 80 percent capacity of the WTP) through 2040 is 6,260 AFY. GEI (2012) 2040 projected demand (allocation) for the City is 5,726 AF.

No supply shortages are anticipated in the service area during a normal, single dry, or multiple dry year scenario through 2045 (West & Associates, 2022). Project construction and operational water use is up to 30 percent and 9 percent of the available leftover supply between 2025 and 2045, respectively.

The City's treated effluent (wastewater) generated in the service area is also considered as a potential water source. From 2016 through 2022 the City collected and treated an average of 1,215 AFY of effluent. The WWTP has a capacity of approximately 5,379 AFY. West & Associates (2022) projected wastewater flows will increase to 1,934 AFY by 2045, remaining within the capacity of the WWTP. Because the NPDES permitted effluent is currently discharged to Dolson Drain (a tributary to the Alamo River), temporarily redirecting the

WWTP effluent to the Project would result in a reduction of discharge to the Salton Sea. However, due to the limited quantity and temporary Project water demand, no adverse impacts to Salton Sea due to the reduced recharge are anticipated.

Table 32. Summary of Available Project Water Supplies

Water Source	Available Supply (Year 2025)			Limitation
	Normal Year	Dry Year	Multiple Dry Years	
Surface Water				
Golden State Water Company[1]	1,754	1,676	1,676	GSWC annual allocation from IID
City of Imperial[2]	1,887	1,721	1,820	Imperial annual allocation from IID
San Diego County Water Authority[3]	8,000	8,000	8,000	Water Wheeling Agreement
Groundwater (Balance)				
Imperial Valley Groundwater Basin[4]	-37,693	-40,642	-41,624	Construction of Project Well
Ocotillo-Clark Valley Groundwater Basin[5]	2,090	68	2,974	Use of Allegretti Farms' wells
Jacumba Valley Groundwater Basin[6]	3,550	891	2,521	Use of JCSD wells
Project Water Demand	**Duration (years)**	**Water Use (acre-feet per year)**	**Total Water Use**	
Construction	2	500	1,000	—
Operation	48	50	2,400	—
Decommissioning	2	100	200	—

Notes

Values reported in acre-feet (AF), unless noted otherwise.

[1] Difference between SDCWA (2024b) based projected demand and GEI (2012) planned demand.

[2] West & Associates, 2022.

[3] Although SDCWA (2021) uses 50,000 AFY of desalinated water from the Carlsbad Desalination Plant over the Urban Water Management Plan planning period, SDCWA is currently using 48,000 AFY of the contracted 56,000 AFY (SDCWA approved a 30-year Water Purchase Agreement with Poseidon Water for the purchase of up to 56,000 AFY of desalinated seawater), including member agency supplies (SDCWA, 2024a).

[4] Greer et al., 2013.

[5] Todd Engineers, 2013.

[6] Dudek, 2021.

— = not applicable

AFY = acre-feet per year

GSWC = Golden State Water Company

JCSD = Jacumba Community Services District

San Diego County Water Authority. The SDCWA water source for the Project is the SDCWA desalinated seawater purchased from Poseidon Water. In November 2012, the SDCWA approved a 30-year Water Purchase Agreement with Poseidon Water for the purchase of up to 56,000 AFY of desalinated seawater (SDCWA, 2024a). Currently, SDCWA is using 48,000 AFY (SDCWA, 2024a). Annual availability of desalinated water is not impacted by climatic conditions and is therefore considered a drought-proof supply (SDCWA, 2024a). There is the potential to increase annual average production capacity of the Carlsbad Desalination Plant to 61,600 AF as an adaptive management supply. The potential 5,600 AF increment of additional seawater desalination supply from the Carlsbad Desalination Plant could be placed into service before 2025 (SDCWA, 2024a).

SDCWA (2021) indicates no shortages are anticipated in the service area during normal, single dry, or multiple dry years through 2045. Project construction water use is approximately 6 percent of the 2025 and 2026 available Carlsbad Desalination Plant supply. Project operational water use is approximately 1 percent of the available Carlsbad Desalination Plant supply between 2027 and 2045. The multiple dry year water budget indicates SDCWA would have adequate remaining potential surplus supply if an additional demand, equivalent to the volume of desalinated water currently available, were to occur during the projected period with the Project in place.

Imperial Valley Groundwater Basin. Due to groundwater quality impairments (see Section 4.5.2) and the availability of surface water in the IVGB, the projected groundwater demand in the IVGB is anticipated to remain generally stable. The presented IVGB groundwater budgets are conservative. Specifically, the estimate of annual pumping is from 2008 and a more recent DWR estimate completed in 2018 estimated 0 AF (DWR, 2020). Additionally, the calculated annual recharge from precipitation does not include recharge from mountain front recharge originating in higher terrain outside of the Tompson et al. (2008) model domain.

As discussed in Section 4.5.1, groundwater levels in the East Mesa have generally been declining since the AAC and Coachella Canal lining projects. Available water level data in the West Mesa indicate rising or lowering water levels depending on location, and water level data from the Imperial Valley indicate generally stable water levels with minor lowering during the past two decades. The ongoing steady decline in water levels may indicate the IVGB is experiencing an annual groundwater budget balance deficit since the reduction of recharge from canal seepage.

The presented groundwater budgets for the IVGB result in an annual deficit in the IVGB. The annual deficit and chronic lowering of groundwater levels in the IVGB would occur with or without the Project (no cumulative projects were identified in the IVGB). The IVGB has been designated as a very low-priority basin due to a variety of factors, including low population levels and limited groundwater use. Surface water has been identified as the primary source of water in the IVGB. The Project would not make a considerable contribution to the potentially existing groundwater deficit. The Project would not negatively impact groundwater storage, nor cause substantial impact to the available quantity of groundwater in the IVGB. Due to the availability of surface water, documented water source for existing GDEs, and results of the cone of depression and cumulative impacts analysis (Section 8.1), the Project could use groundwater from the IVGB for all phases of the Project, through the life of the Project, without adversely effecting existing or planned future uses, and the Project's incremental contribution to the IVGB groundwater deficit is not considered cumulatively considerable.

Based on the cone of depression analysis (see Section 8) and the Feasibility Study (GSI, 2024) for the Project Well, the modeled zone of influence after 2 years of Project construction pumping (500 AFY) is an approximately 1,500-foot radius cone of depression out to 0.1 feet of drawdown. Project operational pumping (50 AFY for 48 years) and decommissioning pumping (100 AFY for 2 years) have negligible effects; no significant cone of depression is estimated for either pumping period. Pumping from the Project Well would not impact or capture canal seepage water and would therefore not have adverse impacts on the identified GDEs. No springs, seeps, or critical habitat were identified in the vicinity of the Project.

Ocotillo-Clark Valley Groundwater Basin. The average annual groundwater demand from 2010 to 2035 in the OCVGB is approximately 9 percent of the average annual groundwater recharge during the same period. Project construction, operation, and decommissioning water use is approximately 24 percent, 2 percent, and 5 percent, respectively, of the average 2010 to 2035 budget balance surplus. The addition of Project pumping (regardless of Project phase) would not increase the total OCVGB annual pumping, or reduce the annual budget balance surplus, to historical volumes when more intensive agricultural irrigation and a chronic lowering of groundwater levels were occurring. Without the Project in place, the OCVGB budget balance indicates an average annual surplus of approximately 2,107 AF and a cumulative surplus of 109,549 AF over the project multiple dry years scenario. The addition of Project pumping would reduce the cumulative surplus by approximately 3 percent. During years of below average precipitation, the annual budget balance could indicate a deficit, however, the cumulative budget would remain in surplus. No cumulative projects were identified in the OCVGB.

Temporary Project groundwater pumping from the deep aquifer is unlikely to impact the shallow aquifer. Because the Project proposes to source water from the deep semi-confined to confined aquifer and the identified potential GDEs are not supported by the deep aquifer, the Project would not have an impact on the potential GDEs. Similarly, the Project is not anticipated to impact existing springs or seeps because they are likely sourced from the shallow aquifer based on location and suspected source of San Felipe Creek.

The Project pumping cone of depression analysis (see Section 8) indicates that after 2 years of construction pumping, head pressure in the vicinity of the pumping wells is expected to be reduced by an additional 3 feet. However, the contours indicate that the zone of influence extends across the vast majority of the model domain. This is due to the fact that the aquifer is being modeled as fully confined. Unlike in an unconfined aquifer, pumping a confined aquifer will not reduce the saturated thickness, but it will exhibit an immediate pressure head response across the entire aquifer.

The model results indicate that following the heightened demand during construction, groundwater head in the confined aquifer will stabilize after approximately 5 years of operational pumping. The groundwater level drawdown due to operational pumping in the vicinity of the pumping wells is expected to be less than 0.5 feet. After 2 years of Project decommissioning pumping drawdown of approximately 0.7 feet is projected in the vicinity of the pumping wells.

Jacumba Valley Groundwater Basin. The projected annual budget balance surplus in the JVGB during a normal year is 3,670 AF. Project construction, operation, and decommissioning water use is approximately 14 percent, 1 percent, and 3 percent, respectively, of the projected budget balance surplus. Six cumulative projects that may source water from two of the JCSD wells were identified. If the schedule for all six of these projects were the same and project operational and decommissioning water use is assumed to be equal, total construction, operation, and decommissioning water use for the six projects would be 290 AF (1 year) and 7.3 AF (51 years). Including Project pumping, the cumulative project total annual pumping for construction, operation, and decommissioning would decrease the annual budget balance surplus by 25 percent, 2 percent, and 3 percent, respectively. Cumulative project pumping would decrease the JVGB cumulative total budget balance surplus by approximately 3 percent over the life of the Project.

Groundwater in storage in the JVGB alluvial aquifer is estimated to be 9,005 AF. The perennial yield of the basin is estimated to be less than the historical average annual groundwater pumping rate of 2,212 AFY (Dudek, 2021). Total annual pumping in the JVGB with the Project in place during construction, operation, and decommissioning would be approximately 23 percent, 3 percent, and 5 percent, respectively, of the historical average annual groundwater pumping rate (when more intensive agricultural irrigation and a chronic lowering of groundwater levels were occurring). Total annual pumping with all cumulative projects in place during construction, operation, and decommissioning would be approximately 43 percent, 4 percent, and 6 percent, respectively, of the historical average annual groundwater pumping rate. The addition of Project pumping (regardless of Project phase) would not chronically increase the total JVGB annual pumping, or reduce the annual budget balance, to historical volumes when more intensive agricultural irrigation and a chronic lowering of groundwater levels were occurring. Over the projected multiple dry years scenario, the JVGB would not be anticipated to experience an annual groundwater deficit with or without Project or cumulative project pumping.

The Project pumping cone of depression analysis (see Section 8) indicates the modeled zone of influence after 2 years of Project construction pumping (500 AFY) is an approximately 1,200- to 1,500-foot radius cone of depression out to 0.2 feet of drawdown, with approximately 2 feet of drawdown at the Project pumping wells. After 48 years of Project operational pumping (50 AFY), the estimated cone of depression out to 0.2 feet of drawdown extends roughly 1 mile to the east of the pumping wells and 1,700 feet to the west, with approximately 0.8 feet of drawdown at the Project pumping wells. The lateral extent of the cone of depression is similar following two additional years of decommissioning pumping (100 AFY), with approximately 1 foot of drawdown occurring at the Project pumping wells.

Based on the Dudek (2021) pumping tests and the Project pumping cone of depression analysis, Project pumping is not anticipated to lower groundwater levels to historical lows when more intensive agricultural irrigation and chronic lowering of groundwater levels was occurring. Although the 2018 groundwater level measured in Well #3 was above the deepest recorded rooting depth for four-wing saltbrush, the limited magnitude of the modeled drawdown is not anticipated to adversely impact any existing saltbrush near Well #3. Water levels measured in 2018 in Well #2 were deeper than documented rooting depths for the identified species and therefore are not anticipated to be supported by the deeper aquifer.

Groundwater Quality and Land Subsidence. Based on the limited magnitude of the simulated drawdown due to the projected pumping in IVGB, OCVGB, and JVGB, groundwater levels would not be lowered to a level that would cause a degradation of groundwater quality that affect other beneficial uses. Groundwater levels would not be lowered to a level that causes non-Project supply wells near the Project well(s) to begin to capture deeper/older groundwater. Deeper/older groundwater typically contains increased salts and nutrients as a result of prolonged exposure to the aquifer material (leaching of minerals from the host rock into groundwater) (USGS, 2019). Additionally, there are no known (open case) cleanup sites near the proposed Project wells.[19]

The Project is not anticipated to cause lowering of groundwater levels greater than recorded historical lows. There is no reported evidence, nor does available CGPS data indicate, of significant subsidence in the IVGB or the JVGB as a result of historical or current pumping. InSAR deduced land subsidence in the OCVGB has occurred between the Superstition Hills and the Coyote Creek fault. Land subsidence near the Coyote Creek fault is suspected to be a result of historical pumping from Allegretti Farms (Van Zandt, 2004).

[19] Based on available data from the California State Water Resources Control Board GeoTracker online data management system. Available at https://geotracker.waterboards.ca.gov/ (accessed November 1, 2024).

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