APPENDIX ALT-4A
WATER SUPPLY ASSESSMENT FOR ALTERNATIVE 1

Water Supply Assessment and Project Impact Analysis (Alternative Project Site Plan)

Sloughhouse Solar Farm Project Sacramento County, California

JULY 2022

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Acronyms and Abbreviations

Acronym or Abbreviation	Definition
AF	acre-feet
AFY	acre-feet per year
APN	Assessor's Parcel Number
CEQA	California Environmental Quality Act
County	County of Sacramento
CWC	California Water Code
DWR	California Department of Water Resources
GDE	groundwater-dependent ecosystem
gpm	gallons per minute
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
mg/L	milligrams per liter
MW	megawatt
OHWD	Omochumne-Hartnell Water District
PMAs	projects and management actions
PWS	public water system
SB	Senate Bill
SGMA	Sustainable Groundwater Management Act
SSFP	Sloughhouse Solar Farm Project
WSA	Water Supply Assessment

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1 Introduction

1.1 Purpose of Document

Senate Bill (SB) 610 was passed on January 1, 2002, amending the California Water Code (CWC) to require detailed analysis of water supply availability for certain types of development projects. The primary purpose of SB 610 is to improve the linkage between water and land use planning by ensuring greater communication between water providers and local planning agencies, and ensuring that land use decisions for certain large development projects are fully informed as to whether a sufficient water supply is available to meet project demands. SB 610 requires preparation of a Water Supply Assessment (WSA) for a project that is subject to the California Environmental Quality Act (CEQA) and meets certain requirements. SB 610 is codified in CWC Division 6, Part 2.10 (Sections 10910–10915).

The Sloughhouse Solar Farm Project (SSFP or project) has been determined to be subject to CEQA by the County of Sacramento (County), acting as lead agency. The SSFP satisfies the statutory definition of a "project" for the purpose of determining SB 610 applicability because it is considered an industrial facility in excess of 40 acres in size, per CWC Section 10912(a)(5). Furthermore, because the SSFP is not within the service area of a public water system (PWS), as defined in CWC Section 10912(c), the County, as the CEQA lead agency, is responsible for the preparation of a WSA, which will be included in the CEQA documentation for consideration. The lead agency will make an independent determination as to whether there is adequate water supply for the proposed SSFP, having considered the entire administrative record. In compliance with SB 610, this WSA examines the availability of the identified water supply under normal-year, single-dry-year, and multiple-dry-year conditions over a 20-year projection and the 35-year estimated project life, accounting for the projected water demand of the SSFP plus other existing and planned future uses of the identified water supply.

1.2 Project Location and Description

The SSFP would be located on the southwest corner of Meiss Road and Dillard Road at 7794 Dillard Road in unincorporated Sacramento County on Assessor's Parcel Number (APN) 126-0110-001 and APN 126-0110-003. The site is southeast of and bordering the Cosumnes River (Figure 1, Project Location). The SSFP facilities would occupy about 400 acres of the approximately 808 acres within the SSFP parcels, excluding the existing solar electricity generation facilities occupying approximately 90 acres of APN 126-0110-003 (County of Sacramento 2010) (Figure 2, Site Aerial Map). The SSFP would have capacity to generate about 50 megawatts (MW) of solar power. The existing photovoltaic project was constructed in 2011 and generates approximately 9.4 MW of solar power (Rodgers 2011).

The SSFP is designed to use photovoltaic technology and would connect to the pre-existing 69-kilovolt power line. The facility substation would be located on the west side of Dillard Road near the boundary between the two parcels (Figure 2). Associated SSFP facilities may include raw and/or treated water storage for dust and fire suppression, parking facilities, septic systems, stormwater retention basins, and related equipment buildings. SSFP construction is estimated to take approximately 8 months and would require placement of temporary construction trailers, parking areas, and associated construction-related facilities. Most of the SSFP site would be disturbed during construction. The expected life of the project is 35 years, at the end of which project facilities would be decommissioned and removed from the site.

1.2.1 Historical Project Site Water Demand

Historical uses of the SSFP parcels included agriculture such as alfalfa, irrigated pasture, cattle grazing, and planted grass (Rodgers 2011). A review of satellite imagery of the area proposed for the SSFP indicates two separate irrigated areas. A total of 90 acres of row crops border the Cosumnes River at the northwestern extremity of the project site. Based on water diversion reports, this area has been primarily used for growing alfalfa and irrigated using water from the fully appropriated Cosumnes River (Figure 3, Agricultural Areas and Water Right; Section 3.1). Water diverted for this purpose averaged 270 acre-feet per year (AFY) from 2002 to 2020. The maximum quantity of water diverted during these years was 368 acre-feet (AF) and no water was diverted in recent years (Table 1). A center pivot irrigation system was last used approximately 3 years ago within the proposed project footprint (see Pivot Well in Figure 3). Based on satellite imagery, the center pivot system likely irrigated non-cultivated range land for much of the last 20 years. The system is estimated to have used 68 AFY of extracted groundwater to irrigate 90 acres (McIssac, pers. comm. 2020). Much of the rest of the project site appears to have been non-irrigated open space. It is estimated that approximately 237 AFY of groundwater was extracted from on-site wells for irrigation of the site now occupied by solar facilities. The groundwater demand of the existing solar facility is estimated to be 169 AFY through 2035, and does not include water demand from construction, which was estimated to be 22 AF (Rodgers 2011). A fire in 2018 burned a significant part of the property.

Table 1. Cosumnes River Water Diversions

Year	Acre Feet
2002	352
2003	352
2004	352
2005	350
2006	350
2007	350
2008	368
2009	368
2010	368
2011	368
2012	368
2013	368
2014	92
2015	368
2016	368
2017	0
2018	0
2019	0
2020	0
Average	**270**

Source: eWRIMS GIS 2020.

1.3 Water Supply Assessment Applicability

Because the SSFP is a “project” per CWC Section 10912(a)(5), it is subject to SB 610 and therefore requires the preparation of a WSA. SB 610 requires that a WSA address the following questions:

- Is there a public water system that will service the project?
- Is there a current urban water management plan that accounts for the project demand?
- Is groundwater a component of the supplies for the project?
- Are there sufficient supplies to serve the project over the next 20 years?

The WSA is required to answer the following primary question:

> Will the total projected water supplies available during normal, single-dry, and multiple-dry water years during a 20-year projection meet the projected water demand of the proposed project, in addition to existing and planned future uses of the identified water supplies, including agricultural and manufacturing uses?

The following sections address the SB 610 WSA questions as they relate to the SSFP.

1.3.1 Is there a public water system that will service the project?

CWC Section 10912 defines a PWS as a system that has 3,000 or more service connections and provides piped water to the public for human consumption. The SSFP site is not connected to a PWS as defined by CWC Section 10912, but it is within the planning area of the Southeast Sacramento County Agricultural Water Authority, a joint powers authority that includes the Clay Water District, Galt Irrigation District, and Omochumne-Hartnell Water District (OHWD). The Southeast Sacramento County Agricultural Water Authority prepared a Groundwater Management Plan for the area of southern Sacramento County underlying the SSFP site, including the part of the Cosumnes Subbasin within Sacramento County. The OHWD has historically purchased supplemental water from the Central Valley Project and implemented groundwater recharge projects to benefit its agricultural constituents within its jurisdiction along the Cosumnes and Deer Rivers. The SSFP is within the Sacramento Resource Conservation District service area, which includes most of southern Sacramento County, where the Sacramento Resource Conservation District assists landowners and other interests with groundwater and agricultural projects and education. Both the OHWD and Sacramento Resource Conservation District are members of the Groundwater Sustainability Agency (GSA) for the San Joaquin Valley – Cosumnes Subbasin (see Section 5.1, Sustainable Groundwater Management Act). Figure 4 shows the water agency service areas in and around the SSFP site. None of the agencies is a PWS because none supplies piped water to the public.

1.3.2 Is there a current urban water management plan that accounts for the project demand?

There is no Urban Water Management Plan for the SSFP site.

1.3.3 Is groundwater a component of the supplies for the project?

Groundwater is the primary component of the proposed water supply for the SSFP along with surface water from the Cosumnes River as a secondary supply.

1.3.4 Are there sufficient supplies to serve the project over the next 20 years?

Based on the assessment discussed in Section 2, Project Water Demand, and Section 4, Project Impact Analysis, of this report, the estimated water demand of the construction and operational phases of the SSFP is insubstantial compared to the proposed sources of groundwater and surface water, either of which is a sufficient source for SSFP demand. Groundwater supply is buffered from short-term impacts of wet and dry climate cycles, and therefore groundwater for the SSFP supply would remain largely unaffected by SSFP normal-year, single-dry-year, and multiple-dry-year conditions over the 20-year projection. To further evaluate and quantify the potential groundwater-related impacts of the SSFP, a Project Impact Analysis was prepared, the results of which are included in Section 4 and Appendix A of this WSA. The analysis indicates that there is sufficient groundwater supply to serve the SSFP over the 20-year period required by the legislation and the 35-year project life. In addition, SSFP implementation would not significantly impact groundwater resources, groundwater-dependent ecosystems (GDEs), adjacent groundwater wells, or land subsidence in the vicinity of the SSFP.

2 Project Water Demand

Water demand for the construction phase of the SSFP is estimated to be approximately 96 AF during the 8-month construction period. Subsequent operation and maintenance of the SSFP during the anticipated 35-year SSFP operational life would require approximately 2 AFY of water, primarily for solar module washing. Plans for decommissioning and potential revegetation of the site at the end of the 35-year project life are not yet complete. Therefore, water demand equal to that required for SSFP construction is used as a conservative estimate (Table 2).

Table 2. SSFP Water Demand Estimates

SSFP Phase	Estimated Water Demand
Construction	96 AF
Operation and Maintenance	2 AFY
Decommissioning and Removal	96 AF

Note: SSFP = Sloughhouse Solar Farm Project; AF = acre-feet; AFY = acre-feet per year

2.1 Construction Water Demand

The water demand for SSFP construction is based on its disturbance footprint because the primary water demand associated with construction would be dust control. Dudek personnel gathered metered water use data associated with construction of five solar projects in Southern California and Nevada. The average construction water demand for these projects was 0.24 AF per acre, ranging from a minimum of 0.13 AF per acre to a maximum of 0.33 AF per acre. The projects selected for comparison are located primarily in dry, hot, and dusty environments, and therefore represent a conservative approach to preparing a demand estimate for the SSFP. Using the comparison value of 0.24 AF per acre for the approximately 400-acre SSFP, the total estimated construction water demand is 96 AF.

2.2 Operation and Maintenance Water Demand

Per the June 2022 environmentally preferred project description operation and maintenance water demand is estimated to be 2 AFY mainly for dust control and panel washing.

2.3 Decommissioning Water Demand

The SSFP operational life is anticipated to be 35 years. At the end of that time, the SSFP infrastructure would be removed, including surface and underground electrical equipment and solar photovoltaic modules. The site would be disked and revegetated as needed for reclamation. Water use during decommissioning would be primarily for dust control and reseeding. Reseeding requirements will be unknown until the end of the project life. Therefore, water demand for decommissioning is conservatively assumed to be equivalent to that for SSFP construction (96 AF). Table 3 is an amortization of SSFP water demand over the 20-year timeframe specified by SB 610 and the 35-year SSFP operational life consisting of construction, operation, and decommissioning.

Table 3. SSFP Amortized Construction, Operations and Maintenance, and Decommissioning Water Demand

WSA 20-Year Amortization*	Project Life 35-Year Amortization
6.7 AFY	7.4 AFY

Notes: SSFP = Sloughhouse Solar Farm Project; WSA = Water Supply Assessment; AFY = acre-feet per year

* Decommissioning water demand was not included in the 20-year amortization because the SSFP would still be operational at the end of that time.

3 Water Resources Inventory

3.1 Local Surface Water

The subject parcels are located on the west side of the Sierra Nevada range in the Sacramento Valley. The Cosumnes River flows southward along the northern-most SSFP parcel (APN 126-0110-001), and within the parcels are various seasonal and perennial water features, including a stream-connected artificial pond in the western portion of APN 126-0110-003 (Figure 2). Other surface water features include seasonal wetlands, swales, and vernal pools (Dudek 2018). Review of the State Water Resources Control Board water rights information system indicates an active point of diversion (No. S014915) from the Cosumnes River at the northern apex of the property (eWRIMS GIS 2020). Although the water right number was apparently mislabeled in publicly available data, the water right corresponds to the relevant Statements of Diversion and the appropriate Point of Diversion (eWRIMS GIS 2020; also see Figure 3). Some data regarding the history, status, and allocation of the water right are unavailable; however, based on the available Statements of Diversion, it is apparent that the water right is for at least 368 AFY (the reported diversion during several of the past 20 years) and is likely still active, as reports were submitted for years as recent as 2020.

3.2 Groundwater

Groundwater from on-site wells is to be the primary source of water for the construction, operation, and decommissioning phases of the SSFP with the surface water right to serve as a secondary source. Based on the estimated water demand, single or combined well yields would need to be approximately 89.3 gallons per minute (gpm) for the 8-month construction (or decommissioning) period, and 1.2 gpm for operation and maintenance.[1] California Department of Water Resources (DWR) records indicate on-site well yields of greater than 1,000 gpm, and typical yields throughout the Cosumnes Subbasin in excess of 650 gpm (Table 3) (DWR 2020a). Therefore, existing facilities are likely to exceed the pumping capacity needed to supply the proposed SSFP.

3.2.1 Groundwater Basin Description

The Cosumnes Subbasin (DWR Basin No. 5-022.16) is on the east side of the San Joaquin Valley, the whole of which is within California's Great Valley. The Great Valley is a broad structural trough bounded by the tilted block of the Sierra Nevada on the east and the complexly folded and faulted Coast Ranges on the west. The SSFP site is located in the northeastern part of the San Joaquin Valley Groundwater Basin in the Cosumnes Subbasin along the south bank of the Cosumnes River, which is the boundary between the San Joaquin Valley Groundwater Basin and Sacramento Valley Groundwater Basin (DWR Basin No. 5-021) to the north (Figure 5, Hydrologic Areas). The south side of the Cosumnes Subbasin is commensurate with a dry creek and the southern boundary of Sacramento County. The Cosumnes Subbasin extends east into the southwestern part of Amadore County (DWR 2020b).

The Cosumnes Subbasin is approximately 210,300 acres in area and has an estimated storage capacity of approximately 6 million AF (DWR 2003; EKI 2021) contained within aquifers in three principal geologic formations:

1 96 AF x 325,851 gallons x 12 months/(8 months x 365 days x 1440 minutes) = 89.3 gpm (rounded)
2 AFY x 325,851 gallons x 12months/(12 months x 365 days x 1440 minutes) = 1.2 gpm (rounded)

Floodplain Formations, the Laguna and Riverbank Formations, and Mehrten Formation. Floodplain Formations consist of the silt, sand, and gravels located within the channels of active streams, such as the Cosumnes River. These formations have a maximum thickness of approximately 100 feet and readily yield water to wells. The Laguna and Riverbank Formations are composed of the silt, sand, and gravel of the older alluvium with inter-bedded discontinuous clay lenses. This formation also readily yields water to wells. The underlying Mehrten Formation is of volcanic origin and has a maximum thickness of approximately 1,200 feet. The clay, sand, and silt of this formation are interbedded with tuff breccia (volcanic rock) that acts to confine the high-yielding sand layers (RBI 2011).

Groundwater comprises approximately 90% of the water supply within the Cosumnes Subbasin within Sacramento County. About a quarter of the subbasin is irrigated agriculture consisting largely of pasture, grain, and vineyards with most of the remainder consisting of native and open space (EKI 2021). Minor water supplies include surface and reclaimed water. Agricultural water demand accounts for more than 90% of the total water demand within the Cosumnes Subbasin (RBI 2011). Annual rainfall within the Cosumnes Subbasin is approximately 15 and 22 inches on the west and east sides, respectively. Wells within the Cosumnes Subbasin have yields ranging from approximately 650 to 1,500 gpm (DWR 2003).

3.2.2 Department of Water Resources 2019 Basin Prioritization

The Cosumnes Subbasin is designated as “medium priority” by DWR (DWR 2019). This designation requires the preparation of a Groundwater Sustainability Plan (GSP) under the Sustainable Groundwater Management Act (SGMA) (see Section 5.1, Sustainable Groundwater Management Act). Basin priority is based on a combination of existing population and anticipated population growth; groundwater well density; agricultural demands; and the historical and current documented impacts to water levels and storage, groundwater quality, subsidence, and GDEs. DWR determined the medium ranking for the Cosumnes Subbasin with consideration of the following (DWR 2019):

- Groundwater levels are showing decline over time, and groundwater is a significant component of the Cosumnes Subbasin water supply. Approximately 127,000 AFY of groundwater is extracted comprising approximately 87% of water use within the Cosumnes Subbasin.
- There is approximately 39,943 acres of irrigated agriculture within the Cosumnes Subbasin, resulting in an irrigated agriculture density of approximately 122 acres per square mile.
- There are approximately 3,007 wells within the Cosumnes Subbasin equaling a density of approximately nine groundwater wells per square mile.

A GSA for the Cosumnes Subbasin has been formed, as required by the SGMA. The GSA consists of the Amador County Groundwater Management Authority, City of Galt, Galt Irrigation District, OHWD, County of Sacramento, and Sloughhouse Resource Conservation District. A draft GSP has been prepared and submitted by the GSA and is currently being reviewed by DWR for adequacy. The DWR evaluation is not yet complete and comments have not yet been released. The GSP indicates that reduction of groundwater storage and lowering of groundwater levels may be “undesirable results” occurring in some parts of the Cosumnes Subbasin. The sustainable yield of the subbasin is between 119,000 AFY and 125,700 AFY under current conditions and between 125,700 and 134,900 AFY under future conditions. Groundwater consumption has exceeded recharge by about 10,000 AFY over a historical period of 20 years (EKI 2021). In addition, the GSP considers the implementation of a number of potential projects and management actions (PMAs) to reduce or eliminate the Cosumnes Subbasin overdraft and achieve the sustainable management required by SGMA. Table 4 lists the projects along with their potential to supplement groundwater or reduce groundwater use.

Table 4. Potential Projects and Management Actions for the Cosumnes Groundwater Subbasin

PMA	Potential Water Production or Savings (AFY)
OHWD Agricultural Flood Managed Aquifer Recharge Flood Managed Aquifer Recharge	1,700
SAFCA Flood Managed Aquifer Recharge	4,000–6,000
OHWD Cosumnes River Flow Augmentation	100
City of Galt Recycled Water Project	300
Voluntary Land Fallowing	Variable
Groundwater Banking and Sale	Variable

Note: PMA = projects and management actions; AFY = acre-feet per year; OHWD = Omochumne-Hartnell Water District; SAFCA = Sacramento Area Flood Control Agency.

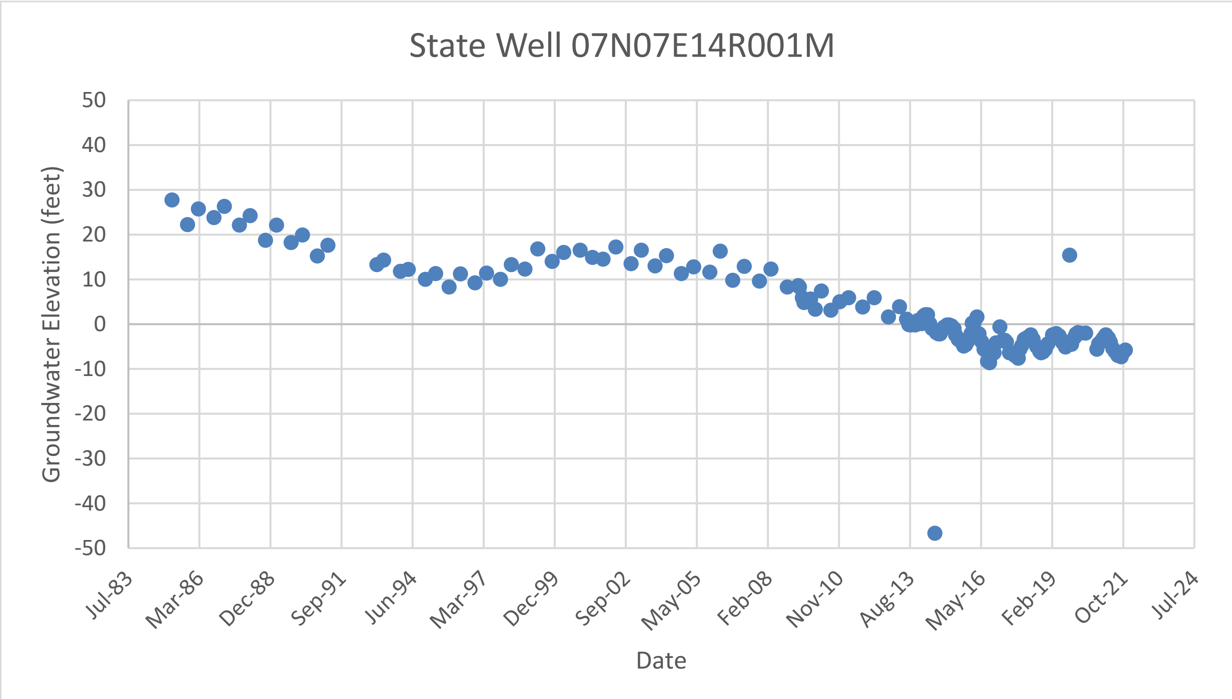
3.2.3 On-Site Well Inventory and Groundwater Levels

DWR has documented declining groundwater levels within the Cosumnes Subbasin as part of its prioritization process (DWR 2020c). Exhibit 1 shows historical groundwater depth in a well located approximately 0.8 miles southeast of the SSFP site (see also Figure 6, Wells Map). Visible within the hydrograph is the groundwater level decline, apparently in response to the 1986–1991 drought; a partial recovery during the subsequent wet period; and stabilization or partial recovery of groundwater level after the dry period ending in 2015. Overall, the groundwater level has declined by approximately 35 feet from 1983 to the present at this location.

Data from DWR's SGMA Data Viewer indicates that the groundwater level at the site was approximately 110 to 140 feet below ground surface in 2018 and flows to the southwest, parallel to the Cosumnes River (DWR 2020b). During the most recent survey, groundwater was measured to be 128.4 feet below land surface (elevation -4.03 feet). Data from this well was used for calculating potential SSFP impacts (see Section 4 and Appendix A).

Figure 7, Area Wells, shows the groundwater wells identified in and around the SSFP site. Wells within the site were documented during a Phase I Environmental Site Assessment conducted by Dudek on October 21, 2020 (Dudek 2020). Those shown on surrounding parcels were compiled from DWR's Well Completion Report Map Application (DWR 2020a). Data for wells from the DWR application may indicate some or all of the following: use (domestic or agriculture), depth, yield estimate, and date and detail of construction. However, the precise location and status of these groundwater wells are often undocumented. Table 5 is a summary of available well statistics by Township, Section, and Range. Note that Figure 7 shows six wells on the SSFP site. Available information for these wells is provided in Table 5.

Exhibit 1. Groundwater Level in North Cosumnes Subbasin, Sacramento County



Source: NWIS 2021

On-site well locations were documented as part of the Phase I Environmental Site Assessment (Dudek 2020). The locations of the wells documented during the site visit, in most instances, deviate significantly from those included in the DWR Well Completion Report Map application, and it was not possible to correlate the wells from each source. Therefore, the well locations determined during the site visit are shown in Figure 7, and the associated well information is included in Table 6. Northwest Ag Well No. 2 correlated reasonably well to Well No. 34-540 from the DWR database. It is the only on-site well with yield information (Table 7). Well No. 2 (Pivot Well) was observed to be non-operational, but not abandoned. Well No. 3, the South Ag Well, was damaged in the 2018 fire and is non-operational but also not abandoned. Well No. 4, Residential Well, is believed to be operational and used to fill stock ponds (McIsaac, pers. comm. 2020).

Table 5. DWR Well Completion Report Statistics in the Vicinity of the SSFP

Township and Range Section	Domestic Well Count	Average Well Depth, in Feet (Range)	Production (Irrigation) Well Count	Average Well Depth, in Feet (Range)	Monitoring Well Count	Average Well Depth, in Feet (Range)
T07N07E02	1	325	1	825	5	259
T07N07E03	2	207	5	380	—	—
T07N07E10	—	—	—	—	1	110
T07N07E11	4	364	2	370	—	—

Table 5. DWR Well Completion Report Statistics in the Vicinity of the SSFP

Township and Range Section	Domestic Well Count	Average Well Depth, in Feet (Range)	Production (Irrigation) Well Count	Average Well Depth, in Feet (Range)	Monitoring Well Count	Average Well Depth, in Feet (Range)
T07N07E14	10	272	3	445	—	—
T07N07E15	7	344	1	269	—	—

Source: DWR 2020b
DWR = California Department of Water Resources; SSFP = Sloughhouse Solar Farm Project

Table 6. Surveyed Well Information

Well Number	Use	Latitude	Longitude	Description
34-540	Irrigation	38.485484	-121.191567	NW Ag Well No. 2
1	Domestic	38.470826	-121.185115	Old Residential Well
2	?	38.473115	-121.177367	Pivot Well
3	Irrigation	38.466166	-121.180717	South Ag Well
4	Domestic	38.48308	-121.187789	Residential Well
5	Irrigation	38.485608	-121.190863	NW Ag Well No. 1

Source: Dudek 2020

Table 7. DWR Well Completion Report Information

Well Number	Use	Date Constructed	Total Depth of Well (Feet)	Depth to First Water at Time of Drilling (Feet)	Yield
34-540	Irrigation	1948	525	41	1,250 gpm at 74 Feet 1,450 gpm at 61 Feet
463542	Irrigation	2002	340	—	—
768829	Irrigation	2002	—	—	—
110958	—	1975	510	95	—
122190	Domestic	1974	—	110	—

Source: DWR 2020b
DWR = California Department of Water Resources; gpm = gallons per minute

3.2.4 Groundwater Quality

Groundwater within the Cosumnes Subbasin is generally of good quality, suitable for domestic and irrigation purposes. Total dissolved solids in the groundwater range from 140 milligrams per liter (mg/L) to 438 mg/L, with an average concentration of 218 mg/L (RBI 2011). Analysis of water from wells in the northwest, southeast, and southwest parts of the Cosumnes Subbasin since 2018 indicate that total dissolved solids concentrations remain below 500 mg/L (GAMA 2020). For comparison, the secondary maximum contaminant level for drinking water set by the U.S. Environmental Protection Agency is 500 mg/L. The secondary maximum contaminant level is the maximum contaminant level that is recommended for drinking water to prevent undesirable effects such as taste, odor, or staining of plumbing. A review of publicly available databases indicated the following:

- No nitrate-impacted wells within at least 2 miles of the subject parcels. Where present, elevated nitrate concentrations may be associated with dairies, septic tanks, or the application of fertilizers (SWRCB 2020).
- No active point sources of contamination within the Cosumnes Subbasin within 1 mile of the subject parcels. Two leaking underground storage tank clean-up projects were identified several thousand feet northwest and northeast of the subject parcels in the South American Subbasin. The status of each site is shown as "case closed," with clean-up complete (GAMA 2020).
- There are no existing, inactive, abandoned, or plugged oil wells within at least 2 miles of the subject parcels (DOGR 2020).

There is no indication of point source or regional contamination in the vicinity of the SSFP site.

3.3 Imported Water

OHWD was formed in 1953 to purchase and manage Central Valley Project water for the benefit of the agricultural users along the Cosumnes River. OHWD purchased an average of 1,680 AFY between 1959 and 1987 (RBI 2011). The Sacramento Municipal Utility District jurisdiction covers most of Sacramento County and parts of adjoining counties. The Sacramento Municipal Utility District purchases approximately 1,700 AFY, some of which is delivered through the Folsom South Canal (RBI 2011).

3.4 Reclaimed Water

A small percentage of the Cosumnes Subbasin water demand is met with reclaimed water discharged from fish farms and the City of Galt wastewater treatment plant. Reclaimed water is provided to limited agriculture within the Cosumnes Subbasin. From 2003 to 2007, the City of Galt wastewater treatment plant discharged approximately 900 AFY, which was used for irrigation or discharged to Laguna Creek. Groundwater is also withdrawn from the Cosumnes Subbasin, used, and recycled by fish farms. Approximately 2,000 AFY of this water is used for irrigation, with excess reclaimed water discharged to local creeks (RBI 2011).

4 Project Impact Analysis

A Project Impact Analysis was conducted to evaluate and quantify potential negative effects related to groundwater extraction that could potentially result from implementation of the SSFP. The method employed is adapted from the Stanislaus County Department of Environmental Resources County Groundwater Ordinance, which has developed significance thresholds for CEQA evaluation. The analysis is intended to provide supplemental data and information to that required for the WSA. The analysis includes potential impacts of the SSFP to groundwater levels and storage, surface water connectivity, GDEs, and land subsidence. Because there is not yet a GSP approved for the Cosumnes Subbasin, and Sacramento County has not developed thresholds of significance like those of Stanislaus County, the analysis employs some of the thresholds used by Stanislaus County. Calculations for the analysis are included as Appendix A of this WSA.

4.1 Analysis Method

Potential groundwater impacts of the SSFP are related to reduction of groundwater storage and lowering of groundwater level potentially resulting from the SSFP. The analysis assumes that groundwater will be the sole source of water for the project, although surface water is also available. Reduction of groundwater storage due to the construction, operation, and decommissioning phases, and as amortized for the 20-year period required by SB 610 and the 35-year project life is compared to the existing groundwater storage underlying the SSFP parcels. A significance threshold of 10% reduction in storage has been applied to evaluate impacts (that used by Stanislaus County). Groundwater level decline is used to evaluate impacts to groundwater/surface water connectivity and potential GDEs. Potential GDEs in proximity of the SSFP were mapped in accordance with the Natural Communities Commonly Associated with Groundwater Dataset; only nearby potential GDEs within the Cosumnes River were mapped (Figure 8, Groundwater Dependent Ecosystems). Potential GDEs were assumed to be supported by groundwater within 30 feet of land surface (TNC 2018). Interconnectivity of groundwater and surface water is assumed to require prolonged periods with groundwater at or near the ground surface. Inelastic land subsidence due to groundwater extraction is caused by the dewatering of fine-grained subterranean materials. Therefore, additional land subsidence requires groundwater levels below historical lows and a significant decline in groundwater levels. Water level declines due to the SSFP were examined in relationship to land subsidence risk. For all impact analyses, groundwater extraction for the SSFP was assumed to be from on-site Well No. 1 because it is roughly central to the SSFP and because data from its construction are available (Figure 9, Well No. 1 Completion Report). However, the conclusions of the impact analysis remain valid for other SSFP locations, including if Well No. 2 were to be used.

4.2 Storage Reduction

Table A-1 in Appendix A shows the calculation and parameters used to estimate the storage reduction resulting from the SSFP. Table 8 below shows the resulting volume reduction from the SSFP water demand. The current groundwater in storage beneath the property was estimated using the following equation:

Storage Capacity = (area of project parcels) x (aquifer thickness) x (specific yield of the aquifer)

The specific yield in the previous equation is an aquifer property defined as the volume of water that drains from a saturated soil or rock due to gravity to the total volume of the soil or rock. It is a measure of the groundwater available within an unconfined aquifer. Because no aquifer testing results were available from the property, the specific yield used was from a United States Geological Survey technical report containing estimates of specific yield for several aquifer storage units in the vicinity of the SSFP, including that containing the SSFP site (USGS 1961). Similarly, there was no recent water level from on-site wells. Therefore, the groundwater elevation for December 2020 from an off-site well was used (Figure 6). Aquifer thickness was taken to be this water elevation minus the bedrock elevation from the well construction log for on-site Well No.1 (Figure 6).

Table 8. Groundwater Storage Volume Reduction

SSFP Scenario	Water Demand (AF)	Period (Years)	Total Volume (AF)	Percent of Storage
20-Year Amortized (AFY)	6.7	20	134	1.4
35-Year Amortized (AFY)	7.4	35	259	2.7
First Year (Construction Only) (AF)	96	1	96	1.0
Operation Phase (20 Years)	2	19	38	0.4
Operation Phase (35 Years)	2	33	66	0.7
Decommission (Year 35)	96	1	96	1.0

Note: SSFP = Sloughhouse Solar Farm Project; AF = acre-feet; AFY = acre-feet per year

Groundwater storage within the aquifer underlying the SSFP parcels is estimated to be 9,532 AF. Table 8 shows the maximum groundwater volume consumed by the SSFP during 20-year and 35-year projections, plus that during the maximum single year. The largest volume consumed would be 259 AF for the 35-year amortized project life, corresponding to approximately 2.7% of the underlying storage. This is well below the 10% threshold of significance used by Stanislaus County, indicating that the loss of storage from SSFP groundwater consumption would be less than significant. The potential impact on underlying storage would be further reduced if some portion of the project water is derived from surface water. The estimated annual use of water by the project amortized over the 35-year life of the project is significantly less than the annual historical use of water on the project site from surface and groundwater sources.

4.3 Groundwater Levels

A cone-shaped depression is formed when groundwater is extracted from a well. The shape of the depression depends on several factors, including pumping rate and the properties of the aquifer from which the groundwater is extracted. Because the depression has the potential to interfere with nearby groundwater wells, surface water connectivity, and GDEs, it is evaluated (as shown on Tables A-2 and A-3 in Appendix A) using the Cooper-Jacob approximation of the Theis non-equilibrium flow equation (USGS 1962). The method requires estimation of aquifer properties, including Hydraulic Conductivity (K) and Transmissivity (T). These are both measures of an aquifer's capacity to transmit groundwater to wells, with T being dependent on the thickness of the aquifer. The relationship between the two properties is as follows:

$$T = Kb$$

Where:

T = Transmissivity

K= hydraulic conductivity

b = aquifer thickness

Hydraulic conductivity is estimated by correlating typical K values for different lithologic materials to those described on the well completion report geologic log for Well No. 1 (Figure 9 and Table A-2). K and T are estimated to be 243 feet per day (feet/day) and 43,716 square feet per day (ft^2/day), respectively (Table A-2). Note that aquifer thickness (b) is assumed to be equivalent to the screened interval of Well No. 1 for this analysis. Using these values and the above equations, drawdown from Well No. 1 was estimated for various time periods and at various distances from the well. Drawdown was calculated at the end of 1, 5, 20, and 35 years. Distances from the pumping well (Well No. 1) were chosen to evaluate drawdown at significant locations, including 50 feet, indicative of maximum drawdown near the well; 1,000 feet, the distance to the closest significant surface water feature; 4,134 feet, the distance to the closest mapped GDE; and 5,531 feet, the farthest point of the SSFP parcels. Each time and distance was evaluated for SSFP demand amortized over 20 years, 35 years, and for the maximum extraction during construction or decommissioning. The results of the calculations are shown in Table A-3 in Appendix A. Table 9 below summarizes maximum drawdown estimates at each of the relevant distances.

Table 9. Maximum Drawdown for All Scenarios

Distance from Well (Feet)	Drawdown (Feet) for 20-Year Amortized	Drawdown (Feet) for 35-Year Amortized	Drawdown (Feet) for 8-Month Construction
50 – Near Well	0.022	0.025	0.370
1,000 – Closest Surface Water	0.013	0.016	0.183
4,134 – Closest GDE	0.009	0.011	0.094
5,531 – Farthest Point of Parcels	0.008	0.010	0.076

Drawdown near the well is the greatest due to the conical shape of the well pumping depression. Therefore, drawdown 50 feet from Well No. 1 is the greatest. In addition, the drawdown during the 8-month construction or decommission period is the greatest for all the scenarios. Note that maximum drawdown at the nearest surface water feature, the nearest GDE, and the most distal point of the SSFP parcels is 0.183 feet (2.2 inches), 0.094 feet (1.1 inches), and 0.076 feet (0.9 inches), respectively. These drawdowns are insignificant in relation to the impacts on surface water features and GDEs (see Section 4.4, Surface Water Connectivity and GDEs). Note that the drawdown is initiated from the recent groundwater elevation at the SSFP site, which is estimated to be 151 feet below surface.

4.4 Surface Water Connectivity and GDEs

Groundwater-dependent ecosystems (GDEs) are natural plant and animal communities that rely on water provided entirely or in part by groundwater from an aquifer (TNC 2018). GDEs are addressed by the SGMA because they may be disrupted by the lowering of groundwater levels related to groundwater extraction (see Section 5.1). Among the characteristics used to assess GDEs is groundwater within 30 feet of land surface, which is the average rooting depth (TNC 2018). Figure 8 shows GDEs in the vicinity of the SSFP. The only GDEs mapped adjacent to or within the SSFP parcels are within or along the Cosumnes River. The closest of the GDEs is approximately 4,134 feet northwest of Well No. 1, from which SSFP pumping is assumed to occur. The draft GSP recently released for the subbasin indicates that the Cosumnes River flows are largely disconnected from the principal aquifer adjacent to the SSFP, indicating the absence of GDEs related to groundwater. It shows only potential GDEs, no confirmed GDEs, proximal to the SSFP (EKI 2021).

The existing groundwater level at Well No. 1 is estimated to be more than 150 feet below land surface. Therefore, GDEs at that location cannot be supported by the regional groundwater level because this is greater than the typical rooting depth for GDEs. In addition, the maximum drawdown at the closest mapped GDE resulting from SSFP pumping is approximately 1 inch, which is likely insignificant related to GDE health, given the ability of plant roots to adjust to natural variations in water supply. The GDEs mapped in Figure 8 may be supported by natural flow and recharge projects within the Cosumnes River. Flow within the Cosumnes River is highly variable, both temporally and geographically, and is influenced by reservoir releases and agricultural pumping (RBI 2011). It is likely that there is a groundwater “mounding effect” during high flows, in which groundwater levels are highest at the river’s thalweg and decline with distance.

4.5 Land Subsidence

Land subsidence due to groundwater extraction is the result of the collapsing of fine-grained materials when dewatered. Therefore, it is related to the geology and water level at a particular location. For additional land subsidence to occur beyond what has occurred historically, groundwater elevation must drop below that of the historical low for a significant period of time. Substantial land subsidence has occurred in areas of California’s Central Valley, particularly in association with the Corcoran Clay Formation, because of dewatering. However, significant land subsidence resulting from groundwater extraction has not been measured anywhere within Sacramento County, including at the SSFP parcels (USGS 2021). Figure 10 shows land subsidence in the vicinity of the SFFP from 2015 to 2020 as measured by InSAR (Interferometric Synthetic Aperture Radar). Maximum vertical displacement within the SSFP parcels is mapped to be less than 1 inch of subsidence. The recently released GSP draft shows land subsidence of a similar magnitude (since 2006) and lists the undesirable result of land subsidence of low concern within the subbasin (EKI 2021). Note that changes in land surface elevation may result from forces unrelated to groundwater extraction, including tectonic forces.

It is unclear if groundwater elevations in the vicinity of the SSFP are at historical low elevations because groundwater well hydrographs reviewed extend only from the mid-1980s. However, based on the lithology at the site, as shown on the Geologic Log for Well No. 1 (Figure 9), and the drawdown calculations discussed in Section 4.3, Groundwater Levels, it is unlikely that land subsidence will occur as a result of SSFP implementation.

5 Water Resources Plans and Programs

Because the SSFP is not part of the service area of a PWS or urban water supplier (i.e., subject to urban water management plans/programs), the scope of applicable water resource plans and programs is limited to agricultural water programs and groundwater management.

5.1 Sustainable Groundwater Management Act

The SGMA is a package of three bills (Assembly Bill 1739, SB 1168, and SB 1319) and provides local agencies with a framework for managing groundwater basins in a sustainable manner. The SGMA establishes minimum standards for sustainable groundwater management, roles and responsibilities for local agencies that manage groundwater resources, priorities, and timelines to achieve sustainable groundwater management within 20 years of adoption of a GSP. Central to the SGMA are the identification of critically overdrafted basins; prioritization of groundwater basins; establishment of GSAs; and preparation and implementation of GSPs for medium-priority, high-priority, and critically over-drafted basins. The SGMA required GSAs to be formed by June 30, 2017. GSPs must consider all beneficial uses and users of groundwater in a basin, and include measurable objectives and interim milestones that ensure basin sustainability. A basin may be managed by a single GSP or multiple coordinated GSPs. At the state level, DWR has the primary role in the implementation, administration, and oversight of the SGMA, with the State Water Resources Control Board stepping in should a local agency be found to not be managing groundwater in a sustainable manner. DWR approved regulations and guidelines for implementation of the SGMA. The draft GSP prepared for the Cosumnes Subbasin is available at the Cosumnes Subbasin website: http://cosumnes.waterforum.org/sustainable-groundwater-management-act-sgma.

5.2 Groundwater Well Permitting and Construction Standards

The Sacramento County Environmental Management Wells Program regulates the construction, modification, repair, inactivation, and destruction of wells in Sacramento County in accordance with Chapter 6.28 of the County Code and CWC Section 13801. Chapter 6.28 of the County Code requires the issuance of a well permit prior to construction of groundwater and other types of wells unless exempted by the code. DWR has developed well standards for the state per CWC Sections 13700 to 13806. These standards have been adopted by the State Water Resources Control Board into a statewide model well ordinance (Resolution No. 89-98) for use by the Regional Water Quality Control Boards for enforcing well construction standards where no local well design ordinance exists that meets or exceeds the DWR standards. DWR's Well Standards are presented in Bulletin 74-81 and Bulletin 74-90 and incorporated into the County Groundwater Ordinance by reference (Section 6.28.040, Water Well Standards). In addition to the permit requirement, the construction of most groundwater wells requires the payment of a fee and an inspection to verify correct seal preparation and placement. A well completion report is required in accordance with DWR requirements after construction, repair, modification, or destruction of a well.

5.3 Irrigated Lands Regulatory Program

In 1999, the California Legislature passed SB 390, which eliminated a blanket waiver for agricultural waste discharges. SB 390 required the Regional Water Quality Control Boards to develop a program to regulate agricultural lands under the Porter-Cologne Water Quality Control Act. In 2003, the Central Valley Regional Water Quality Control Board issued an order that sets waste discharge requirements from irrigated lands to protect surface water and groundwater throughout the Central Valley, primarily to address nitrates, pesticides, and sediment discharge. The resulting Irrigated Lands Regulatory Program regulates wastes from commercial irrigated lands that discharge into surface water and groundwater. The program is administered by the Central Valley Regional Water Quality Control Board working directly with a regional or crop-based coalition and growers. The goal of the Irrigated Lands Regulatory Program is to protect surface water and groundwater and to reduce impacts of irrigated agricultural discharges to waters of the state. Because of the Irrigated Lands Regulatory Program, monitoring reports, assessment reports, management plans, surface water quality data, and groundwater quality data are made available to the public.

6 Conclusion

Groundwater is the primary source of water supply proposed for the SSFP with the existing Cosumnes water right serving as a secondary supply. DWR has assigned a “medium” prioritization to the Cosumnes Subbasin, based in part on declining water levels in wells in parts of the Cosumnes Subbasin. Groundwater basins with a medium prioritization are required to comply with the SGMA by forming a GSA, preparing a GSP by 2022, and achieving “sustainable conditions” by 2042. The GSA has submitted a draft GSP to DWR for the subbasin. The draft GSP indicates a historical overdraft of approximately 10,000 AFY, and a future condition overdraft, including climate change, of approximately 10,000 AFY. Potential PMAs have been developed and are included in the GSP (Table 4). These include flood managed aquifer recharge projects, land fallowing, and Cosumnes River flow augmentation. An additional water supply is likely available from a riparian right to surface water diversion at the northern boundary of SSFP. Although incomplete information pertaining to this water right was available, from recent Statements of Diversion, it appears that the right is currently active and provides more than 368 AFY. The maximum water demand from the SSFP would occur during project construction and decommissioning and is estimated not to exceed 100 AF in a single year. Water for operation and maintenance is estimated to be about 2 AFY. The project’s estimated maximum volume of water use in a single year, and as amortized over the life of the project, is significantly less than the historic use of surface water and groundwater for agricultural and other activities on the project site.

An impact analysis was prepared to evaluate potential groundwater impacts from the SSFP. The analysis used estimated SSFP groundwater demand to evaluate reduction in groundwater storage, groundwater level declines, disconnection of groundwater and surface water, GDE distress, and land subsidence. The impact analysis was based on and uses impact thresholds from the Stanislaus County Groundwater Ordinance, which is similar to that of other counties throughout the state. The SSFP analysis indicated no significant impacts to groundwater resources from the SSFP over the 20-year SB 610 legislation period, the 35-year estimated project life, or during the 8-month period of most intense pumping, as summarized below:

- The maximum groundwater storage reduction over the life of the SSFP would be 259 AF, less than 3% of the groundwater volume currently underlying the SSFP parcels. The threshold of significance used in Stanislaus County, and relied upon for this analysis, is a 10% groundwater storage reduction.
- The maximum drawdown resulting from extraction from a single on-site well would occur close to the well (50 feet) during the 8-month construction or decommissioning period and would be approximately 4.5 inches. Drawdown for the 20-year and 35-year amortization scenarios would not exceed 1 foot near the well or at distance (approximately 1 mile from the well).
- Because the recent groundwater level is approximately 150 feet below surface and because SSFP-related drawdown would be minimal, there is no risk of disconnection of surface water and groundwater, and no risk to GDE communities in the vicinity of the SSFP. This conclusion is consistent with that from the recently submitted GSP.
- Because there is little evidence of historical land subsidence, and because groundwater level decline from SSFP pumping would be minimal, there is little risk of the SSFP contributing substantially to land subsidence. This conclusion is consistent with that from the recently submitted GSP.

The SSFP is not within the jurisdiction of any public water supplier, and thus not accounted for or analyzed by an Urban Water Management Plan. However, the adequacy of water supplies for the proposed SSFP was indirectly evaluated in terms of the SSFP water demand, basin-wide water availability, and future basin planning, as discussed below:

- The SSFP is consistent with groundwater sustainability planning in that it would replace the recent groundwater extractions of approximately 68 AFY for irrigation with amortized extractions of less than 8 AFY year for construction, operation, and maintenance of the SSFP.
- The estimated SSFP amortized water demand is less than 8 AFY. This amount is insubstantial when compared to the magnitude of the groundwater supply, and would not substantially contribute to overdraft per the following:
  - The estimated SSFP water demand is 0.006% of the estimated sustainable yield and 0.08% of the estimated Cosumnes Subbasin overdraft.[2]
  - One method that DWR uses for basin prioritization is to evaluate per-acre water use. Per-acre groundwater use within the Cosumnes Subbasin is 0.65 AFY per acre (DWR 2020c). Under sustainable conditions, assuming the estimated overdraft of 10,000 AFY, the sustainable per-acre groundwater use within the Cosumnes Subbasin would be approximately 0.6 AFY per acre. The estimated amortized per-acre groundwater use for the SSFP is approximately 0..02 AF per acre, well below the Cosumnes Subbasin per-acre sustainable use.[3]

The recently prepared GSP includes PMAs to achieve sustainability within the Cosumnes Subbasin in accordance with the SGMA. Several options are now being considered, including flood managed recharge, fallowing of land, and recharge of the groundwater basin via augmented flows in the Cosumnes River. It is noteworthy that development of the solar project would be consistent with fallowing the land within the SSFP footprint. As a user of groundwater within the Cosumnes Subbasin, the applicant will consider offsetting SSFP pumping through funding implementation of the selected PMAs.

In consideration of the minimal water demand of the SSFP, groundwater as the proposed water supply with the availability of a surface water right as backup, the requirement to sustainably manage the subbasin under the SGMA, and the project applicant’s willingness to participate in implementation of PMAs, the proposed water supply is estimated to be sufficient under normal-year, single-dry-year, and multiple-dry-year conditions over a 20-year projection and the estimated 35-year life of the project, accounting for the projected water demand of the SSFP, in addition to other existing and planned future uses of the identified water supply. The Project Impact Analysis supports this conclusion and indicates no significant project impacts related to groundwater.

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2 Sustainable yield estimated to be 125,791 per the DWR prioritization calculations and estimated overdraft value of 10,000 AFY. 8 AFY/125,791 AFY = 0..006%, 8 AFY/10,000 AFY = 0.08%

3 7.4 AFY/400 acres = 0.02 AF/A

7 References

Cosumnes Water Forum. 2020. "Managing Our Local Groundwater." Accessed October 14, 2020. http://cosumnes.waterforum.org/wp-content/uploads/2020/07/Cosumnes-Subbasin-SGMA-fact-sheet-July-2020.pdf.

County of Sacramento. 2010. *Dillard Road Solar Facility Use Permits and Special Development Permit.* Control No. PLNP2010-00173. County of Sacramento Planning Commission. Community Planning and Development Department.

Domenico, P.A., and F.W. Schwartz. 1990. *Physical and Chemical Hydrogeology*. John Wiley & Sons, New York, NY.

DOGR (California Department of Conservation, Division of Oil, Gas, and Geothermal Resources). 2020. "Interactive Web Maps: Oil & Gas Well Finder." Accessed October 9, 2020. https://maps.conservation.ca.gov/doggr/#webmaps.

Dudek. 2018. *Environmental Constraints to Development of APNs 126-0110-001 and -003*. November 21, 2018.

Dudek. 2020. *Phase I Environmental Site Assessment*. Conducted by Dudek on October 21, 2020.

DWR (California Department of Water Resources). 2003. *California's Groundwater*. Bulletin 118. October 1, 2003. https://water.ca.gov/Programs/Groundwater-Management/Bulletin-118.

DWR. 2019. *Sustainable Groundwater Management Act 2019 Basin Prioritization – Process and Results.* Accessed October 2020. https://water.ca.gov/Programs/Groundwater-Management/Basin-Prioritization.

DWR. 2020a. Well Completion Report Map Application and Data Download: T06SR07E13, T06SR07E14, T06SR07E15, T06SR07E23, T06SR07E24, T06SR08E19. Web map application. Accessed April 20, 2020. https://gis.water.ca.gov/app/wcr.

DWR. 2020b. SGMA Data Viewer. Accessed October 7, 2020. https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer.

DWR. 2020c. DWR Prioritization Spreadsheet. Accessed October 15, 2020. https://data.cnra.ca.gov/dataset/sgma-basin-prioritization.

EKI (EKI Environment & Water). 2020. "EKI Technical Presentation #22, Cosumnes Subbasin GSP Development." Presentation. November 18. Accessed November 30, 2020. http://cosumnes.waterforum.org/wp-content/uploads/2020/11/3a-Draft_EKI-Technical-Presentation_2020-11-18_Updated.pdf.

EKI. 2021. *Public Review Draft, Groundwater Sustainability Plan for the Cosumnes Subbasin*. August 2021.

eWRIMS GIS. 2020. State Water Resources Control Board GIS System. Accessed October 2, 2020. https://waterrightsmaps.waterboards.ca.gov/viewer/index.html?viewer=eWRIMS.eWRIMS_gvh#.

GAMA (Groundwater Ambient Monitoring and Assessment Program). 2020. Groundwater Information System. Accessed October 9, 2020. https://gamagroundwater.waterboards.ca.gov/gama/gamamap/public/Default.asp.

McIsaac, C. 2020. Personal communication between Cork McIsaac (Natural Resources Group Inc.) and Jonathan Martin (Dudek Hydrologist). October 21, 2020.

NWIS (National Water Information System). 2021. “Groundwater Levels for the Nation: USGS 382444121123301 007N007E33Q001M.” United States Geologic Survey. Accessed January 13, 2021. https://nwis.waterdata.usgs.gov/usa/nwis/gwlevels/?site_no=382444121123301.

RBI (Robertson – Bryan Inc.). 2011. *South Basin Groundwater Management Plan*. Prepared for the South Area Water Counsel. October 2011.

Rodgers (Wood Rodgers). 2011. *RE Dillard Hodings LLC, Water Supply Assessment, Recurrent Energy.* March 2011.

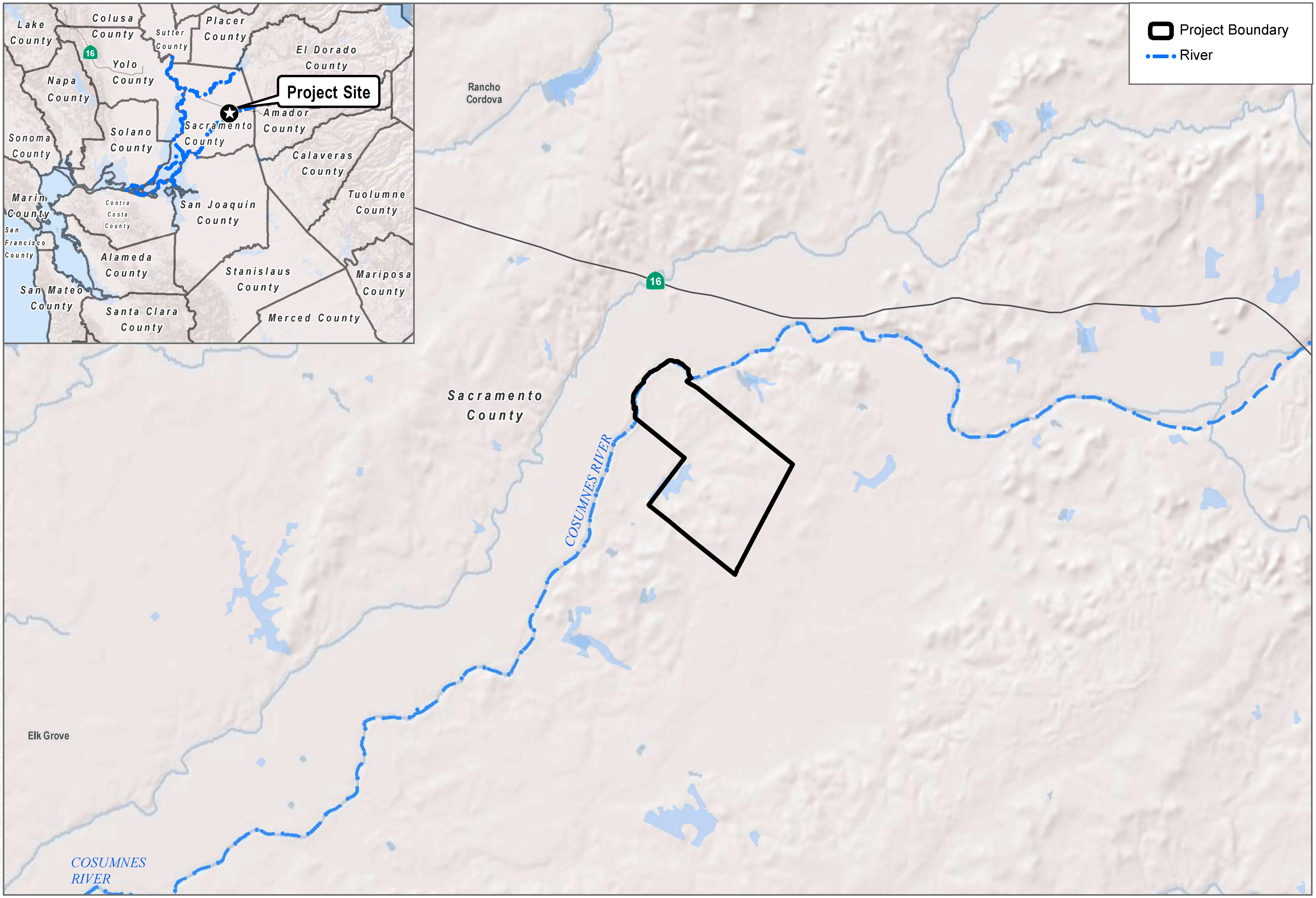
SWRCB (State Water Resources Control Board). 2020. Nitrate Impacted Wells. Web Map Application. Accessed October 9, 2020. https://gispublic.waterboards.ca.gov/portal/apps/MapSeries/index.html?appid=a884c5cc81844b289b666f15fad3dc7d.

TNC (The Nature Conservancy). 2018. *Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans*. Prepared by M.M. Rohde, S. Matsumoto, J. Howard, S. Liu, L. Riege, and E.J. Remson. January 2018.

USGS (United States Geological Survey). 1961. *Geologic Features and Ground-Water Storage Capacity of the Sacramento Valley California, Water Supply Paper 1497.* United States Geologic Survey, Olmsted and Davis.

USGS. 1962. *Theory of Aquifer Tests, Groundwater Hydraulics.* Geological Survey Water-Supply Paper No. 1536-E. Prepared by J.G. Ferris, D.B. Knowles, R.H. Brown, and R.W. Stallman. Denver, Colorado: USGS.

USGS. 2021. “Interactive Web Maps: Areas of Land Subsidence in California.” Accessed January 7, 2021. https://ca.water.usgs.gov/land_subsidence/california-subsidence-areas.html.



SOURCE: ESRI

DUDEK

0 0.5 1 Miles

FIGURE 1

Project Location

Water Supply Assessment and Project Impact Analysis - Sloughhouse Solar Farm Energy Project

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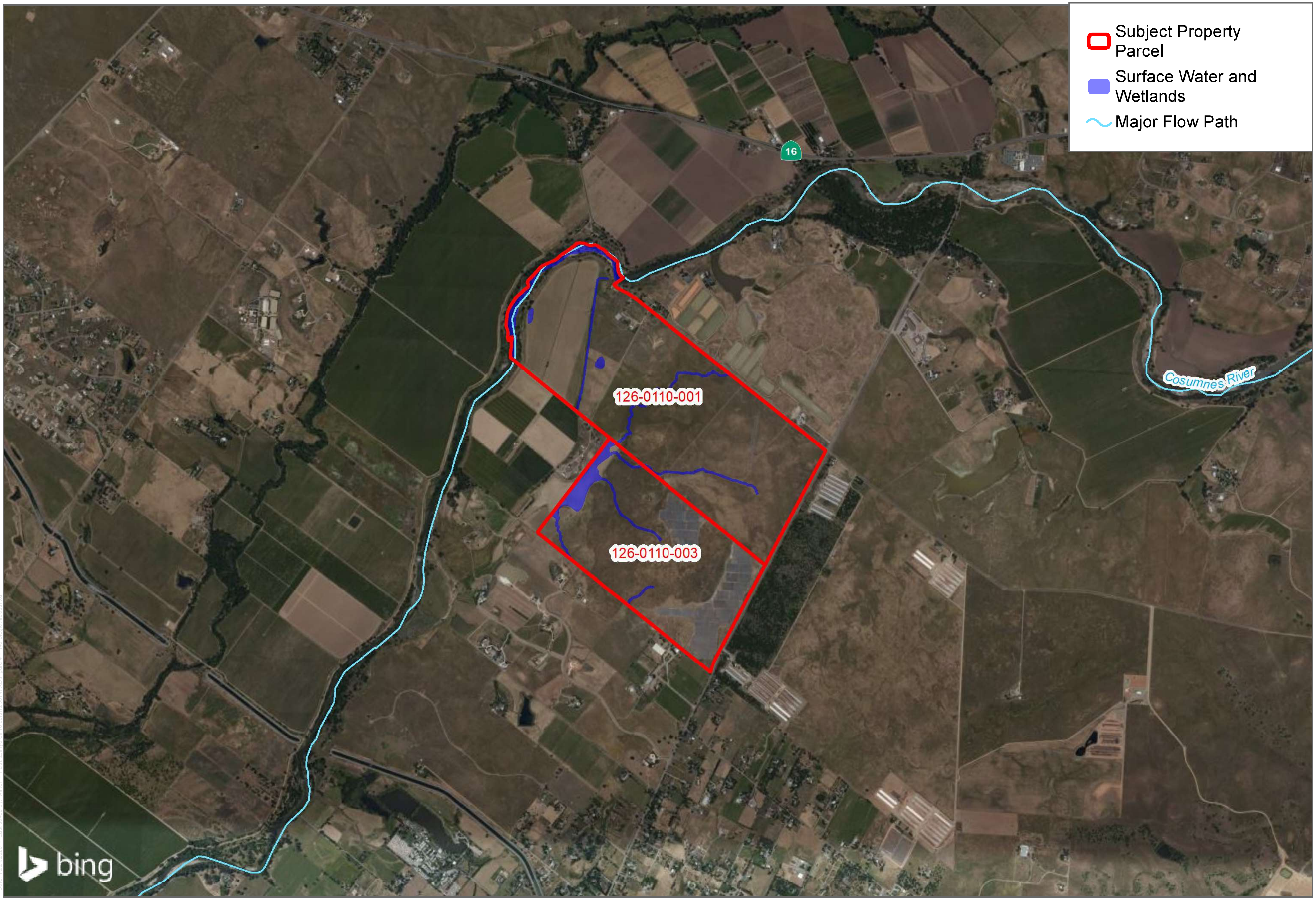

SOURCE: Bing; DWR; NWI

DUDEK

0 0.5 1 Miles

FIGURE 2

Site Aerial Map

Water Supply Assessment and Project Impact Analysis - Sloughhouse Solar Farm Energy Project

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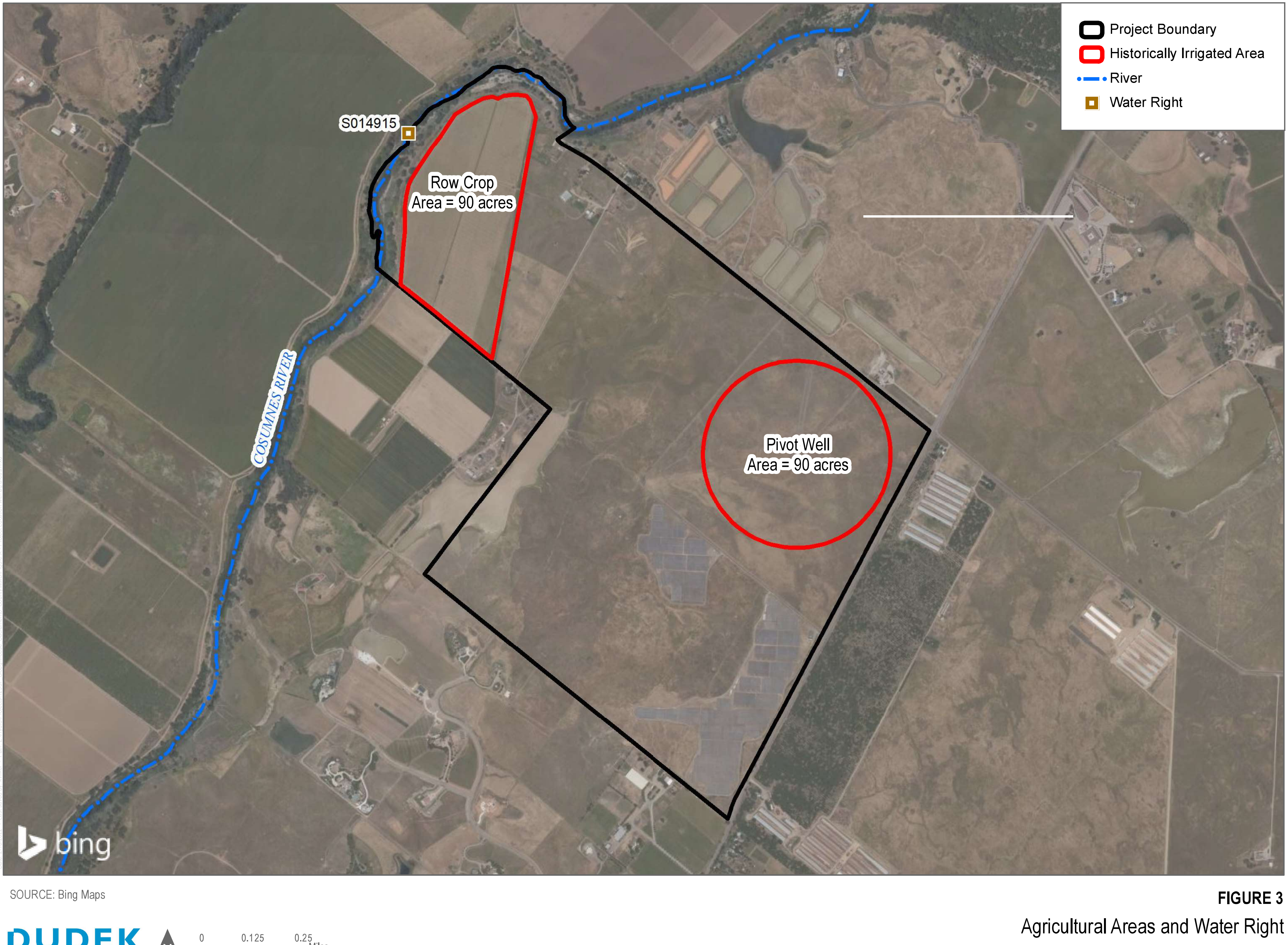

SOURCE: Bing Maps

DUDEK

FIGURE 3

Agricultural Areas and Water Right

Water Supply Assessment and Project Impact Analysis - Sloughhouse Solar Farm Energy Project

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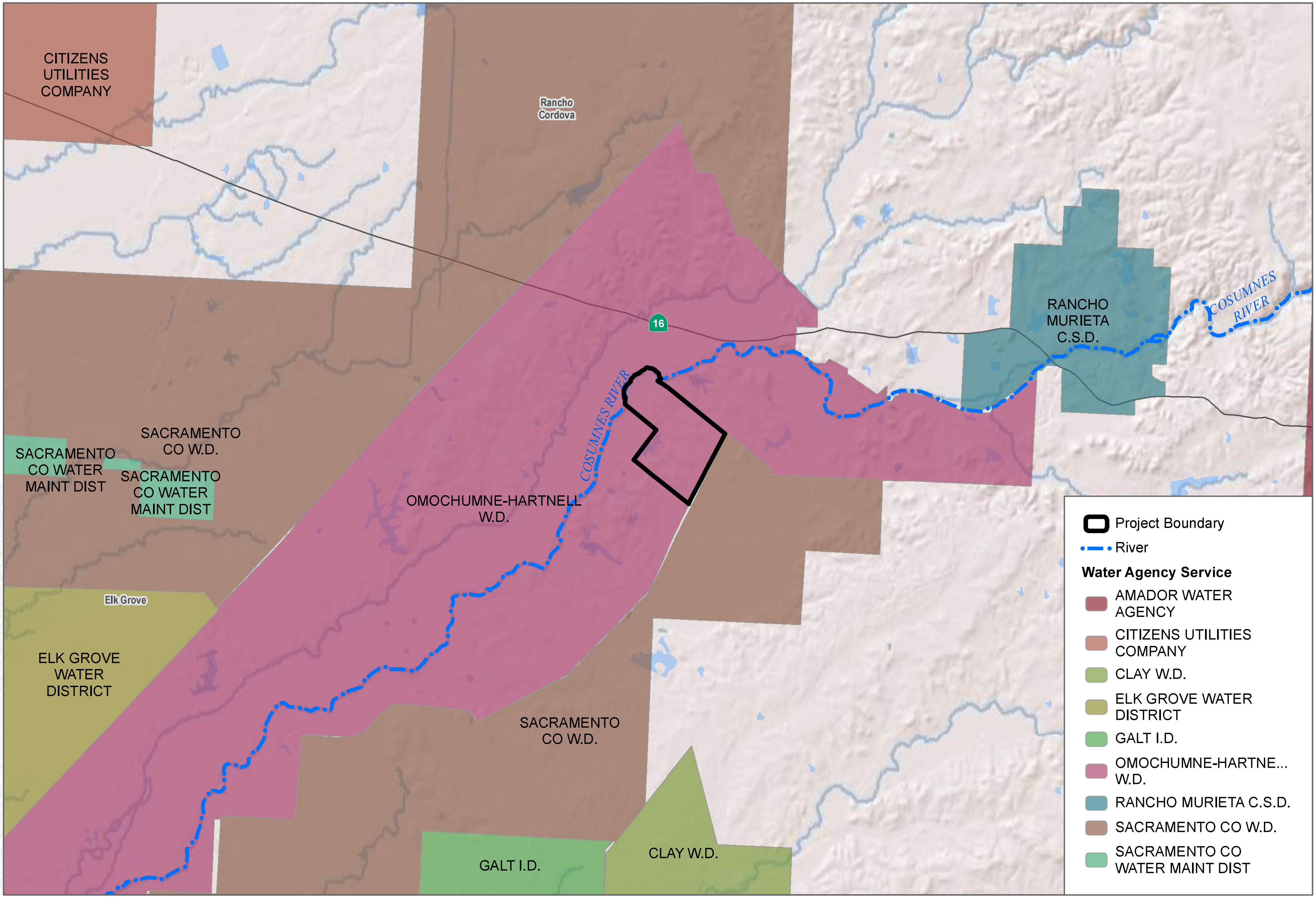

SOURCE: ESRI; Sacramento County

DUDEK

0 1 2 Miles

FIGURE 4

Water Agency Service Areas

Water Supply Assessment and Project Impact Analysis - Sloughhouse Solar Farm Energy Project

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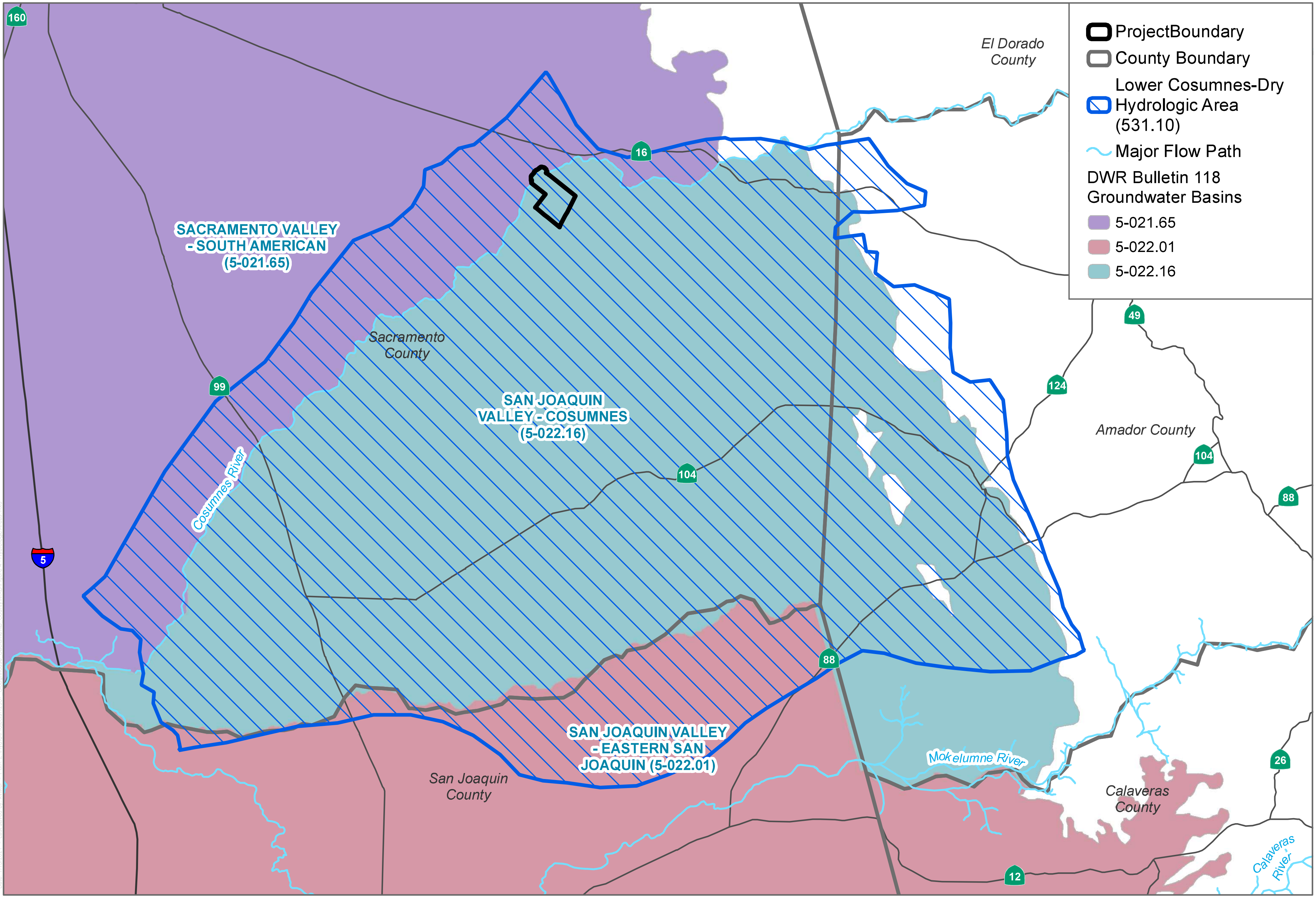

SOURCE: DWR

DUDEK

0 2.5 5 Miles

FIGURE 5

Hydrologic Areas

Water Supply Assessment and Project mpact Analysis - Sloughhouse Solar Farm Energy Project

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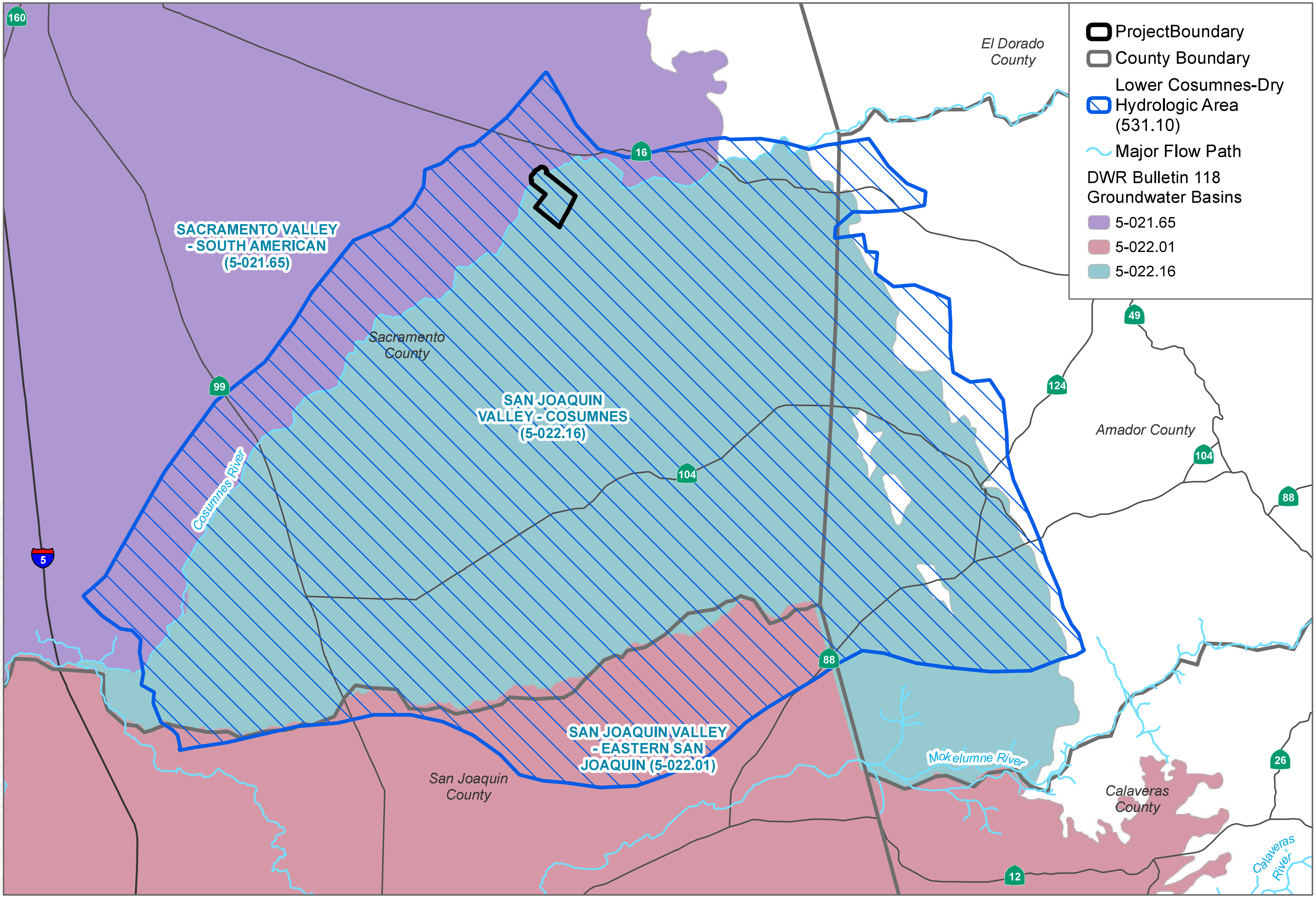

SOURCE: DWR

DUDEK

0 2.5 5 Miles

FIGURE 5

Hydrologic Areas

Water Supply Assessment and Project Impact Analysis - Sloughhouse Solar Farm Energy Project

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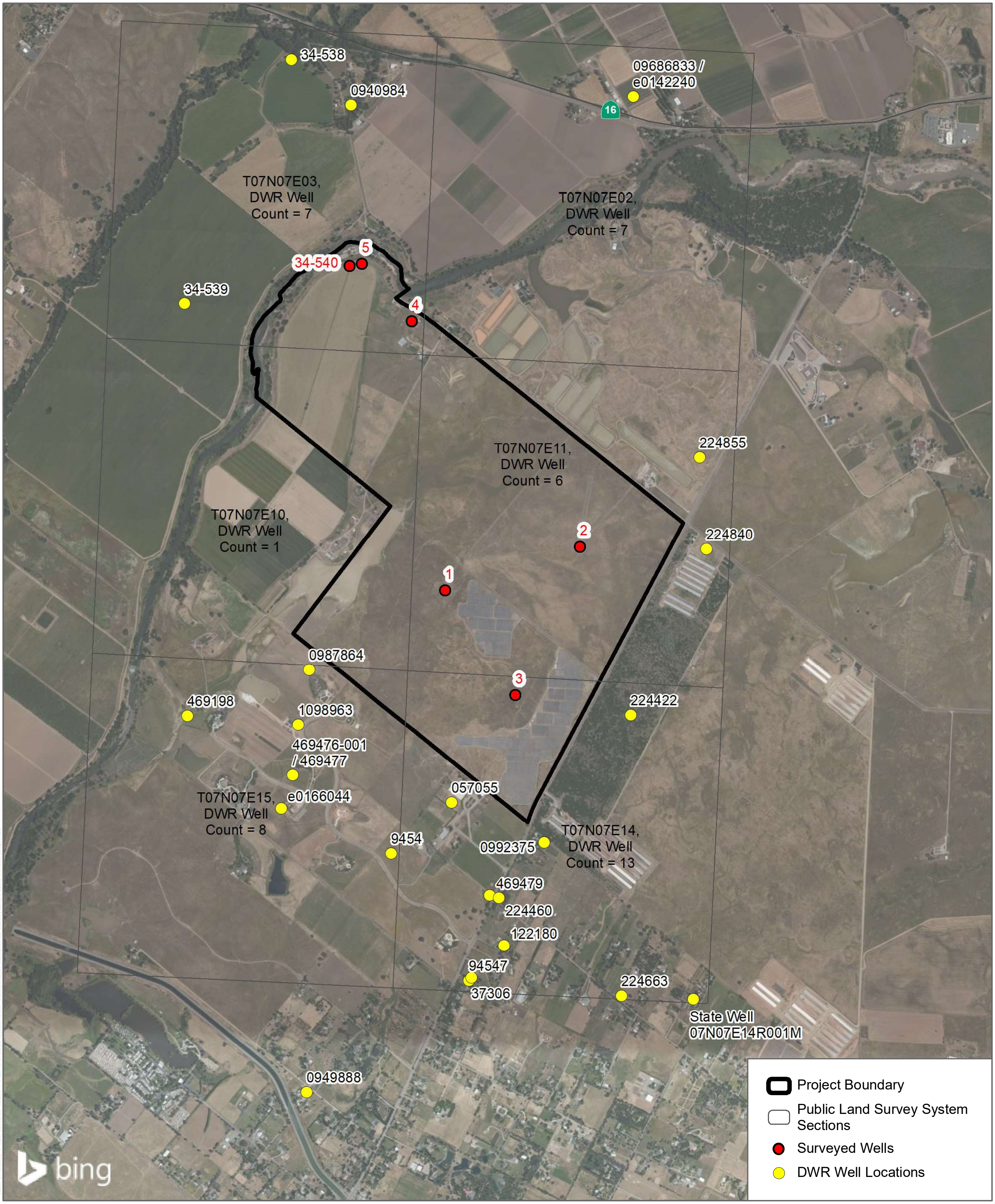

SOURCE: ESRI; Bing; DWR

DUDEK

0 0.25 0.5 Miles

FIGURE 7
Area Wells

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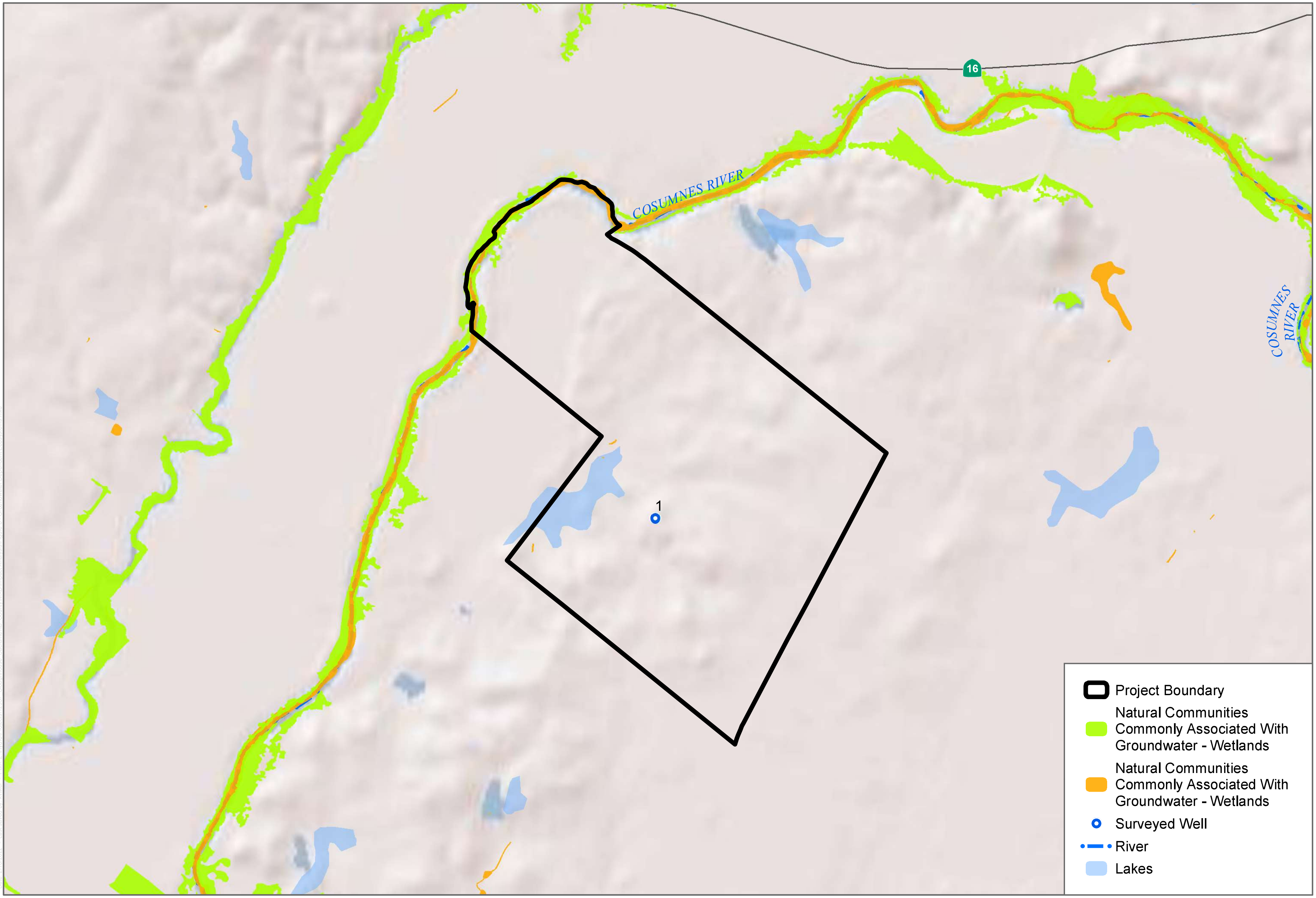

SOURCE: ESRI; Sacramento County

DUDEK

0 0.25 0.5 Miles

FIGURE 8

Groundwater Dependent Ecosystems

Water Supply Assessment and Project Impact Analysis - Sloughhouse Solar Farm Energy Project

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126-0110-003

ORIGINAL
File with DWR

Page 1 of 1

Owner's Well No. #1-2002

Date Work Began 12/11/02 Ended 12/17/02

Local Permit Agency SACRAMENTO COUNTY

Permit No 996254 Permit Date 10/18/02

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. 463542

DWR USE ONLY — DO NOT FILL IN

07N07E

STATE WELL NO / STATION NO

LATITUDE LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DRILLING METHOD REVERSE FLUID ___

DEPTH FROM SURFACE Ft	to Ft	DESCRIPTION Describe material, grain, size, color, etc
0	8	CLAY
8	15	SANDY CLAY
15	58	BROWN CLAY
58	65	FINE SAND
65	116	BROWN CLAY
116	120	MEDIUM SAND
120	157	BROWN CLAY
157	164	CEMENT SAND
164	175	BROWN CLAY
175	177	SAND GRAVEL
177	185	GRAVEL 2" TO 3"
185	195	BROWN CLAY
195	210	MEDIUM SAND GRAVEL
210	220	BROWN CLAY
220	226	SAND RED FINE
226	244	BROWN CLAY
244	251	FINE SAND
251	268	BROWN CLAY
268	276	ROCK
276	290	HANRD BROWN CLAY
290	299	SAND
299	306	BROWN CLAY
306	310	GRAVEL
310	322	HARD CLAY
322	342	GRANITE ROCK

TOTAL DEPTH OF BORING 342 (Feet)

TOTAL DEPTH OF COMPLETED WELL 340 (Feet)

WELL LOCATION

Address 7794 DILLARD RD

City SLOUGHHOUSE CA 95683

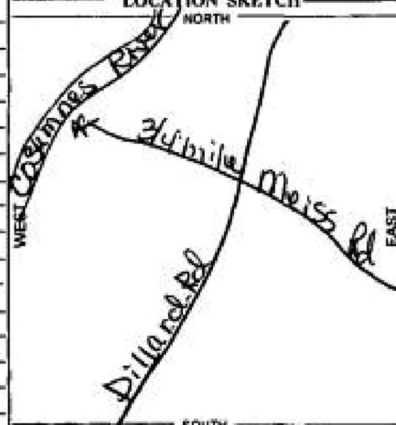
County SACRAMENTO

APN Book 126 Page 110 Parcel 0100

Township ___ Range ___ Section ___

Latitude ___ DEG MIN SEC ___ DEG MIN SEC

LOCATION SKETCH



Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

✓ NEW WELL

MODIFICATION/REPAIR

— Deepen

— Other (Specify)

— DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

PLANNED USES (✓)

WATER SUPPLY

— Domestic — Public

✓ Irrigation — Industrial

MONITORING —

TEST WELL —

CATHODIC PROTECTION —

HEAT EXCHANGE —

DIRECT PUSH —

INJECTION —

VAPOR EXTRACTION —

SPARGING —

REMEDIATION —

OTHER (SPECIFY) —

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER ___ (Ft.) BELOW SURFACE

DEPTH OF STATIC WATER LEVEL ___ (Ft.) & DATE MEASURED ___

ESTIMATED YIELD * ___ (GPM) & TEST TYPE ___

TEST LENGTH ___ (Hrs.) TOTAL DRAWDOWN ___ (Ft.)

May not be representative of a well's long-term yield

CASING (S)

DEPTH FROM SURFACE Ft	to Ft	BORE-HOLE DIA (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	50	44"			✓		STEEL	30"	5/16"	
0	150	28"	✓				STEEL	16" OD	1/4"	
150	180	28"		✓			STEEL	16" OD	1/4"	060 STD
180	300	28"		✓			STEEL	16" OD	1/4"	.060 F F
300	330	28"		✓			STEEL	16" OD	1/4"	060 STD.
330	340	28"	✓				STEEL	16" OD	1/4"	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft	to Ft	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	50	✓			6 SACK
0	342			✓	1/4 X 1/8"

ATTACHMENTS (✓)

— Geologic Log

✓ Well Construction Diagram

— Geophysical Log(s)

— Soil/Water Chemical Analyses

— Other

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief

NAME MYERS BROS WELL DRILLING, INC

(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

8650 E. LACEY BLVD. HANFORD CA 93230-4844

ADDRESS CITY STATE ZIP

Signed ___ WELL DRILLER/AUTHORIZED REPRESENTATIVE 12/20/02 DATE SIGNED 548214 C-57 LICENSE NUMBER

DWR 188 REV 11-97

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

SOURCE: DWR

FIGURE 9

Well No. 1 Completion Report

DUDEK

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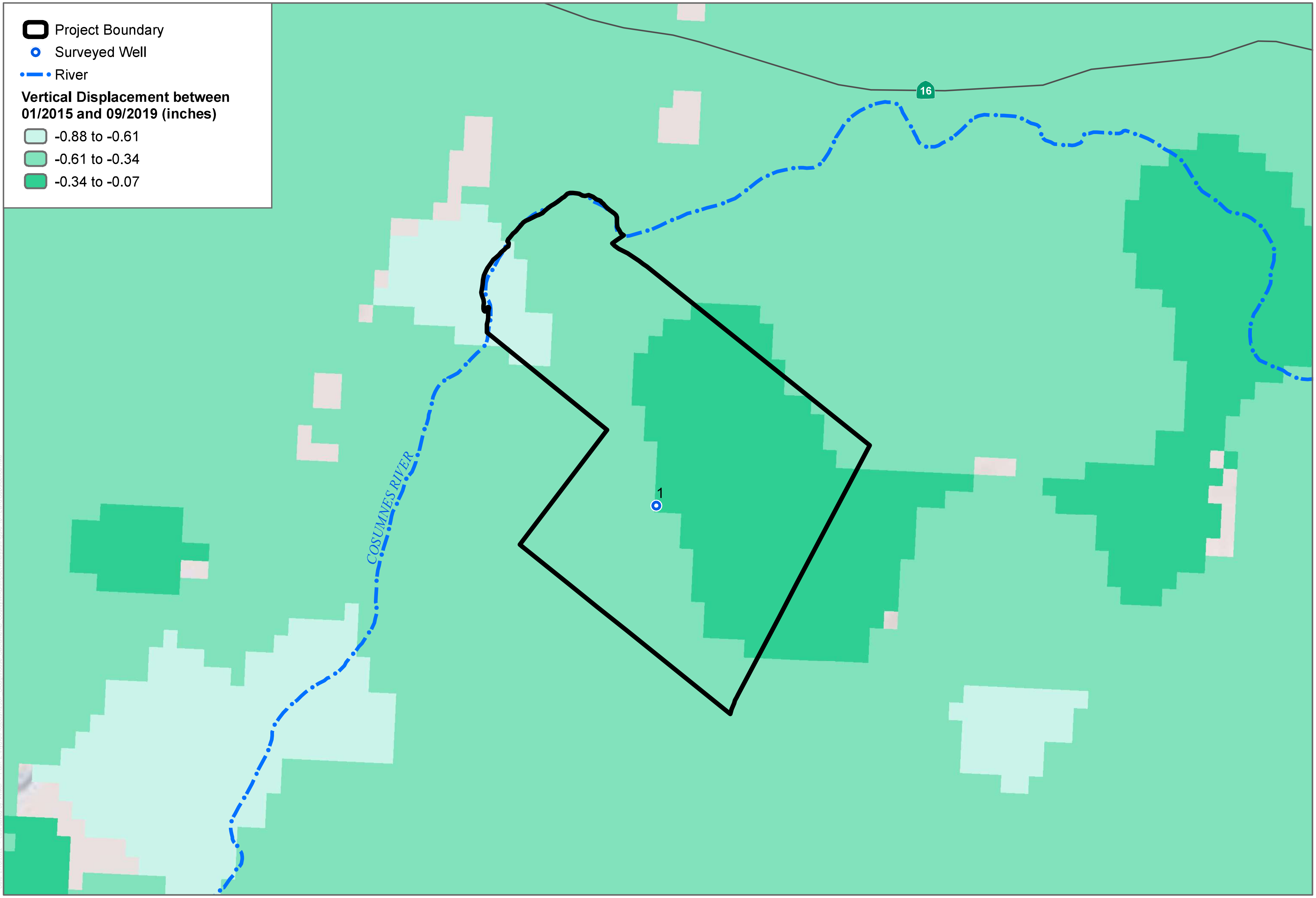

SOURCE: ESRI; Sacramento County; SGMA Data Viewer

DUDEK

0 0.25 0.5 Miles

FIGURE 10

Land Subsidence

Water Supply Assessment and Project Impact Analysis - Sloughhouse Solar Farm Energy Project

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Appendix A

Project Groundwater Impact Analysis Calculations

Table A-1. From Well Completion Report No. 463542 (Well No. 1)

Depth (ending)	Description	K (meters/sec)	K (feet/day)	% Column	K* % column
150	—	—	—	—	—
157	Brown clay	2.36E-09	6.67E-04	0.039	2.60E-05
164	Cement Sand	2.00E-07	5.67E-02	0.039	2.20E-03
175	Brown clay	2.36E-09	6.67E-04	0.061	4.08E-05
177	Sandy Gravel	7.70E-03	2.18E+03	0.011	2.42E+01
185	Gravel 2" to 3"	1.65E-03	4.68E+02	0.044	2.08E+01
195	Brown Clay	2.36E-09	6.67E-04	0.056	3.71E-05
210	Medium sand gravel	7.70E-03	2.18E+03	0.083	1.82E+02
220	Brown clay	2.36E-09	6.67E-04	0.056	3.71E-05
226	Sand Red fine	1.00E-04	2.84E+01	0.033	9.46E-01
244	Brown clay	2.36E-09	6.67E-04	0.100	6.67E-05
251	fine sand	1.00E-04	2.84E+01	0.039	1.10E+00
268	Brown Clay	2.36E-09	6.67E-04	0.094	6.30E-05
276	Rock	0.00E+00	0.00E+00	0.044	0.00E+00
290	Hard brown clay	2.36E-09	6.67E-04	0.078	5.19E-05
299	sand	2.50E-04	7.10E+01	0.050	3.55E+00
306	Brown Clay	2.36E-09	6.67E-04	0.039	2.60E-05
310	Gravel	1.65E-03	4.68E+02	0.022	1.04E+01
322	Hard clay	1.00E-11	2.83E-06	0.067	1.89E-07
330	Granite	0.00E+00	0.00E+00	0.044	0.00E+00
				Estimated Hydraulic Conductivity (K) (feet/day)	**242.87**
				Aquifer Thickness (b) (feet)	**180**
				Transmissivity (T=Kb) (ft^2/day)	**43,716**

Note:
* K Estimated from Domenico and Shwartz 1990

Table A-2a. Storage Capacity of Basin Beneath Property

Input	Value	Units	Source
Area of Property	808	acres	GIS Analysis
Depth to Bedrock	322	feet	Well Completion Report for Well No. 1
Depth to Groundwater	128.4	feet	SGMA Data Viewer for State Well Number: 07N07E14R001M about 4,000 feet SE of property (measurement taken 12/18/2020)
Specific Yield	0.069	—	Omstead and Davis, Table 4, pg 214. Specific Yield = 6.9%. all zones 20 feet to 200 feet
LSE at Well No. 1	147	feet	Google Earth
Bedrock Elev At Well No. 1	-175	feet	147 – 322
LSE at Off-Site Well	124.37	feet	From SMA Data Viewer - State Well Number: 07N07E14R001M
Elevation of Groundwater (Off-Site Well)	-4.03	feet	Taken from off-site well. State Well Number: 07N07E14R001M. December 18, 2020 measurement
Storage Capacity Beneath Property (December 2020)	9,532	AF	**SC = 808 ac * (-4.03 + 175) * .069**

Note:
Storage Capacity = Area of property * (Elevation of GW – Elevation of Bedrock) * Specific yield

Table A-2b. Project Pumping as a Percentage of Storage Capacity

Amortization Period	Water Demand	Units	Period (Years)	Total Volume (AF)	% of Storage
20-Year Amortized	6.7	AFY	20	134	1.4
35-Year Amortized	7.4	AFY	35	259	2.7
First Year (Construction Only)	96	AF	1	96	1.0
Operation Phase (20 Year)	2	AF	19	38	0.4
Operation Phase (35 Year)	2	AF	33	66	0.7
Decommission (Year 35)	96	AF	1	96	1.0

Notes for Tables Below: Drawdown Calculated Using Cooper-Jacob Approximation of the Theis Non-Equilibrium Flow Equation

$$s = \frac{2.3\,Q}{4\pi T}\log_{10}\frac{2.25\,Tt}{r^2 S} \qquad u = \frac{r^2 S}{4Tt}$$

distance u is valid

u valid if sufficiently small ($u < 0.05$)

s= drawdown
Q= amortized pumping rate (cubic feet per day)
T= Transmissivity
t= time (days)
r= distance from pumping well (feet)
S= coefficient of storage (dimensionless)

Table A-3a. Annual Production Amortized Over 20 Years – At Time 1,825 Days (5 Years)

Time (days)	Distance (feet)	Feature at Distance	Discharge (ft^3/day)	Transmissivity (ft^2/day)	Storativity	Drawdown (feet)	u
1825	50	Near well	800	43,716	0.069	0.020	0.0000
1825	1,000	Closest surface water feature	800	43,716	0.069	0.011	0.0002
1825	4,134	Closest GDE	800	43,716	0.069	0.007	0.0037
1825	5,531	Farthest point of property	800	43,716	0.069	0.006	0.0066

Note:
Calculations used for table:
6.7 acre-feet per year
2,183,202 gallons per year
5,981 gallons per day
4.2 gallons per minute

Table A-3b. Annual Production Amortized Over Year for 20 Years – At Time 7,300 Days (20 Years)

Time (days)	Distance (feet)	Feature at Distance	Discharge (ft^3/day)	Transmissivity (ft^2/day)	Storativity	Drawdown (feet)	u
7300	50	Near well	800	43,716	0.069	0.022	0.0000
7300	1,000	Closest surface water feature	800	43,716	0.069	0.013	0.0001
7300	4,134	Closest GDE	800	43,716	0.069	0.009	0.0009
7300	5,531	Farthest point of property	800	43,716	0.069	0.008	0.0017

Note:
Calculations used for table:
6.7 acre-feet per year
2,183,202 gallons per year
5,981 gallons per day
4.2 gallons per minute

Table A-3c. Annual Production Amortized Over Year for 35 Years – At Time 365 Days (1 Year)

Time (days)	Distance (feet)	Feature at Distance	Discharge (ft^3/day)	Transmissivity (ft^2/day)	Storativity	Drawdown (feet)	u
365	50	Near well	883	43,716	0.069	0.020	0.0000
365	1,000	Closest surface water feature	883	43,716	0.069	0.010	0.0011
365	4,134	Closest GDE	883	43,716	0.069	0.005	0.0185
365	5,531	Farthest point of property	883	43,716	0.069	0.005	0.0331

Note:
Calculations used for table:
7.4 acre-feet per year
2,411,297 gallons per year
6,606 gallons per day
4.6 gallons per minute

Table A-3d. Annual Production Amortized Over Year for 35 Years – At Time 1,825 Days (5 Years)

Time (days)	Distance (feet)	Feature at Distance	Discharge (ft^3/day)	Transmissivity (ft^2/day)	Storativity	Drawdown (feet)	u
1825	50	Near well	883	43,716	0.069	0.022	0.0000
1825	1,000	Closest surface water feature	883	43,716	0.069	0.013	0.0002
1825	4,134	Closest GDE	883	43,716	0.069	0.008	0.0037
1825	5,531	Farthest point of property	883	43,716	0.069	0.007	0.0066

Note:
Calculations used for table:
7.4 acre-feet per year
2,411,297 gallons per year
6,606 gallons per day
4.6 gallons per minute

Table A-3e. Annual Production Amortized Over Year for 35 Years – At Time 7,300 Days (20 Years)

Time (days)	Distance (feet)	Feature at Distance	Discharge (ft^3/day)	Transmissivity (ft^2/day)	Storativity	Drawdown (feet)	u
7300	50	Near well	883	43,716	0.069	0.024	0.0000
7300	1,000	Closest surface water feature	883	43,716	0.069	0.015	0.0001
7300	4,134	Closest GDE	883	43,716	0.069	0.010	0.0009
7300	5,531	Farthest point of property	883	43,716	0.069	0.009	0.0017

Note:
Calculations used for table:
7.4 acre-feet per year
2,411,297 gallons per year
6,606 gallons per day
4.6 gallons per minute

Table A-3f. Annual Production Amortized Over Year for 35 Years– At Time 12,775 Days (35 Years)

Time (days)	Distance (feet)	Feature at Distance	Discharge (ft^3/day)	Transmissivity (ft^2/day)	Storativity	Drawdown (feet)	u
12775	50	Near well	883	43,716	0.069	0.025	0.0000
12775	1,000	Closest surface water feature	883	43,716	0.069	0.016	0.0000
12775	4,134	Closest GDE	883	43,716	0.069	0.011	0.0005
12775	5,531	Farthest point of property	883	43,716	0.069	0.010	0.0009

Note:
Calculations used for table:
7.4 acre-feet per year
2,411,297 gallons per year
6,606 gallons per day
4.6 gallons per minute

Table A-3g. Construction or Decommissioning Only (8 Months)

Time (days)	Distance (feet)	Feature at Distance	Discharge (ft3/day)	Transmissivity (ft2/day)	Storativity	Drawdown (feet)	u
243	50	Near well	17,186	43,716	0.069	0.370	0.0000
243	1,000	Closest surface water feature	17,186	43,716	0.069	0.183	0.0016
243	4,134	Closest GDE	17,186	43,716	0.069	0.094	0.0278
243	5,531	Farthest point of property	17,186	43,716	0.069	0.076	0.0497

Note:
Calculations used for table:
96 acre-feet
46,922,544 gallons per 8 months
128,554.92 gallons per day
89.3 gallons per minute

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