Appendix G

Water Supply Assessment

Water Supply Assessment

Easley Renewable Energy Project

January 2024

Prepared for:

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Abbreviations and Acronyms

µg/L	micrograms per liter
AF	acre-feet
AFY	acre-feet per year
Argonne	Argonne National Laboratory
bgs	below ground surface
BLM	Bureau of Land Management
CEC	California Energy Commission
CEQA	California Environmental Quality Act
CGPS	Continuous Global Positioning System
CVGB	Chuckwalla Valley Groundwater Basin
DEW	Drier/Extreme Warming
DRECP	Desert Renewable Energy Conservation Plan
DWR	California Department of Water Resources
EMPS	Eagle Mountain Pumped Storage
ET	evapotranspiration
GDE	groundwater dependent ecosystem
gen-tie	generation-tie
GMRMP	Groundwater Monitoring, Reporting, and Mitigation Plan
GSA	groundwater sustainability agency
kV	kilovolt
LUPA	Land Use Plan Amendment
mg/L	milligrams per liter
Model	MODFLOW groundwater model
NCCAG	Natural Communities Commonly Associated with Groundwater
NEPA	National Environmental Policy Act
Oberon Project	Oberon Renewable Energy Project
POD	Plan of Development
POR	period of record
Project	Easley Renewable Energy Project
ROW	right-of-way
RWQCB	Regional Water Quality Control Board
SB	Senate Bill
SGMA	Sustainable Groundwater Management Act
TDS	total dissolved solids
TNC	The Nature Conservancy
USGS	U.S. Geological Survey
WMW	Wetter/Moderate Warming
WSA	Water Supply Assessment

1 Introduction

The objective of this Water Supply Assessment (WSA) is to provide an evaluation of the effects of the proposed Easley Renewable Energy Project (Project) on groundwater and surface water sources, pursuant to the requirements of California Senate Bill (SB) 610 and the Desert Renewable Energy Conservation Plan (DRECP) Land Use Plan Amendment (LUPA) (BLM, 2016a, 2016b). Because the National Environmental Policy Act (NEPA) requires a similar assessment to that of SB 610, this report will fulfill both needs. The Sustainable Groundwater Management Act (SGMA) requires groundwater sustainability agencies (GSAs) to manage groundwater basins sustainably. While SGMA does not apply to the federal government and its groundwater rights, it is in the federal government's best interests to consider the groundwater uses of the GSAs and private users when evaluating sustainable use of groundwater associated with a project.

A California Environmental Quality Act (CEQA) review of the Project will be conducted by Intersect Power (IP Easley, LLC, a subsidiary of Intersect Power, LLC), in consultation with Riverside County. Given that NEPA requires a similar assessment to that of SB 610, this WSA provides the required analysis of water supply availability for solar development projects and analyzes their potential effects on water supply availability.

2 Project Location and Description

The Project would be located in Riverside County, California, to the north of Interstate 10 and approximately 2 miles north of the town of Desert Center, California, on both private land and on U.S. Department of the Interior Bureau of Land Management (BLM) administered land (see Figures 1 and 2). A legal description of the Project is included in Project's *Plan of Development* (POD) (Aspen, 2022). Public lands within the project area include lands designated as Development Focus Areas, which are identified in the DRECP (BLM, 2016a, 2016b) as appropriate for solar energy development.

The Project would cover approximately 3,727 acres and generate and store up to 650 megawatts of renewable electricity via arrays of solar photovoltaic panels, a battery energy storage system, and appurtenant facilities. A 6.7-mile, 500-kilovolt (kV) generation-tie (gen-tie) powerline would mainly traverse across the nearby Oberon Renewable Energy Project (Oberon Project) site and connect into an approved substation that is under construction on the approved Oberon Project site, an adjacent solar and energy storage facility owned by Intersect Power. From the Oberon Project onsite substation, the power generated by the Project would be transmitted to the Southern California Edison Red Bluff Substation via the Oberon Project 500 kV gen-tie line, which began commercial operation November 2023 (see Figure 2).

Depending on the timing of the interconnection agreement, the Project could be online as early as late 2025. The Project would operate for a minimum of 35 years and could be extended for a project life of up to 50 or more years. At the end of its useful life, the Project would be decommissioned, and the land returned to its pre-project conditions. Revegetation would be conducted in accordance with the Decommissioning and Revegetation Plan.[1]

IP Easley, LLC understands the BLM is considering issuing right-of-way (ROW) grants for durations of up to 50 years (BLM, 2023). The Project POD (Aspen, 2022) includes a projected Project construction period of 20 months and an operational period of 35 years, for a total projected period of 37 years. To prepare for potential issuance of an ROW grant by the BLM with a duration longer than planned in the Project POD (Aspen, 2022), this WSA extends the total projected period of the Project by an additional 15 years, totaling 52 years. For the purpose of the Chuckwalla Valley Groundwater Basin (CVGB) water budget (see Section 6) and predictive Project water demand impacts analysis (see Sections 5.4 and 7) presented herein, 52 years is equivalent to the projected total duration of the Project, including construction (20 months), operations (48 years), and decommissioning (20 months).[2]

Water for construction and operations would be obtained from several potential sources, including an on-site groundwater well, an off-site groundwater well, and trucked from an off-site water purveyor. The Project would use approximately 1,000 acre-feet (AF) of water over a 20-month construction period (i.e., an average of approximately 500 acre-feet per year (AFY) expected between the spring of 2024 to the winter of 2025). During operations and decommissioning of the facility, Project water use would total up to 50 AFY.

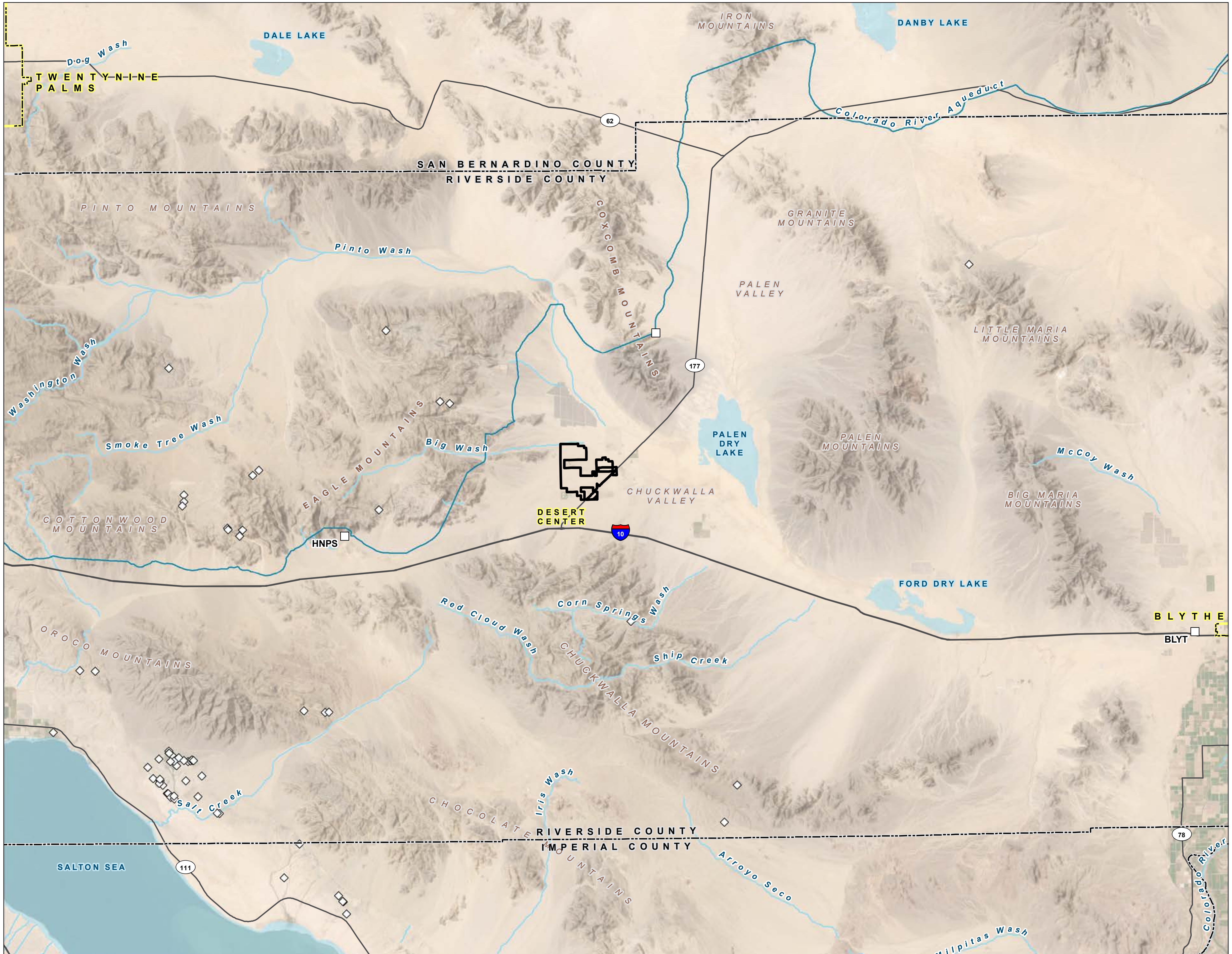
[1] The Project Decommissioning and Revegetation Plan will be developed during the Project's CEQA and NEPA review process. It is assumed that Project decommissioning would take approximately 20 months, similar to the construction duration, and have the same water use as Project operations (approximately 50 acre-feet per year). Project decommissioning would occur in accordance with an agency-approved Closure and Decommissioning Plan. The Project Closure and Decommissioning Plan will include an evaluation of alternate water sources and impacts, if any, in accordance with the DRECP LUPA.

[2] Although the estimated Project construction period described in the Project POD (Aspen, 2022) and the estimated decommissioning period described in this WSA is 20 months, the water budgets (see Section 6) and Cone of Depression and Cumulative Drawdown Analysis (see Section 7) presented herein, were developed in 1-year time steps, and therefore assume the same water use but Project construction and decommissioning periods of 1 year.

FIGURE 1

Project Vicinity

Easley Renewable Energy Project
Water Supply Assessment



LEGEND

- Proposed Project Boundary
- City Boundary
- County Boundary
- Major Road
- Colorado River Aqueduct
- Watercourse
- Waterbody
- Spring/Seep
- Continuous Global Positioning System Station

NOTE

Minor reconfigurations of the Project are not anticipated to significantly impact the results of this Water Supply Assessment.

N

0 3 6 9
Miles

Date: January 10, 2024
Data Sources: ESRI, USGS, Maxar Imagery (2018), Aspen (2022)

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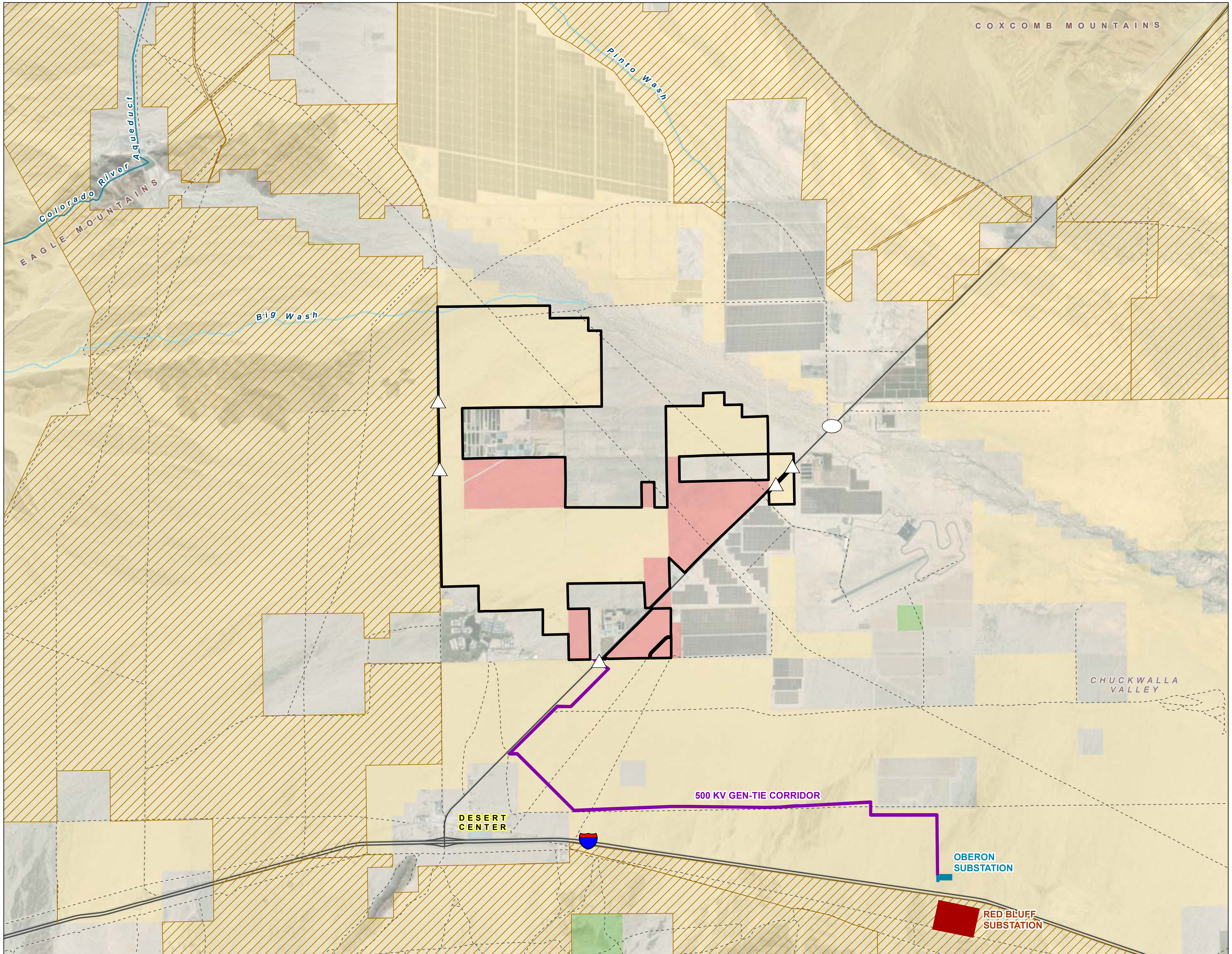

FIGURE 2

Project Area

Easley Renewable Energy Project
Water Supply Assessment

LEGEND

- Ingress/Egress to BLM Lands
- Area of Critical Environmental Concern (ACEC)
- Red Bluff Substation
- Oberon Project 500 kV Substation
- 500 kV Gen-tie Corridor (175 ft wide)

Land Ownership

- Bureau of Land Management (BLM)
- State of California
- Private

All Other Features

- Proposed Project Boundary
- Major Road
- BLM Open OHV Routes
- Colorado River Aqueduct
- Watercourse
- Waterbody

NOTES

Minor reconfigurations of the Project are not anticipated to significantly impact the results of this Water Supply Assessment.

ft: feet
gen-tie: generation-tie
kV: kilovolt
OHV: off-highway vehicle

N

0 2,500 5,000 7,500
Feet

Date: December 18, 2023
Data Sources: ESRI, USGS, Maxar Imagery (2018), Aspen (2022)

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3 Water Supply Assessment Qualifications and Groundwater Source

The Project is subject to CEQA because it would demand an amount of water equivalent to, or greater than, 150 to 250 AFY during construction. SB 610 requires that a project be supported by a WSA if the conditions above are expected to be exceeded. The Project would use up to 1,000 AF during the planned 20-month construction period and, up to 50 AFY during the Project's operational and decommissioning periods. Therefore, according to SB 610 and the DRECP LUPA (BLM, 2016a, 2016b), the Project is a qualifying project and requires the development of a WSA due to the estimated water usage during the construction phase of the Project. Qualifying projects must analyze "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 Section 10910(c)(4)).

The Project is located within the California Department of Water Resources (DWR) Bulletin 118 Chuckwalla Valley Groundwater Basin (CVGB) (Basin No: 7-5), which is in eastern Riverside County and encompasses an area of approximately 940 square miles (DWR, 2004) (see Figure 3). Groundwater has been identified as the primary source of water in the CVGB. DWR has categorized the CVGB as a low-priority basin under SGMA (DWR, 2020a).

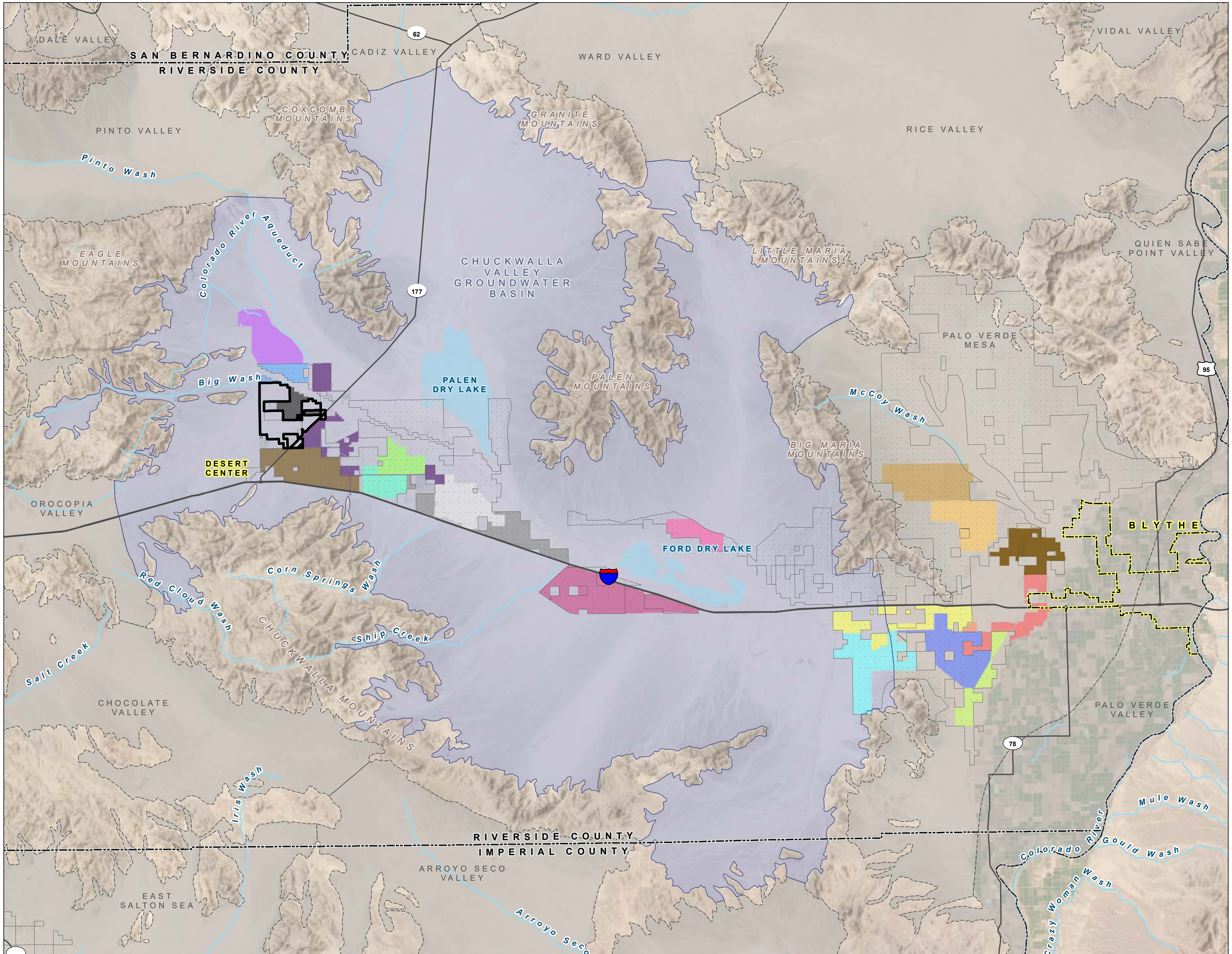

FIGURE 3

East Riverside County Solar Projects

Easley Renewable Energy Project
Water Supply Assessment

LEGEND

Proposed Project Boundary

Existing Solar Project

- Athos I and II
- Blythe Mesa
- Blythe PV Project
- Blythe Solar
- Calypso I
- Calypso II
- Clearway-Africa
- Clearway-Victory Pass
- Crimson Solar
- Desert Harvest
- Desert Quartzsite Solar
- Desert Sunlight
- Genesis Solar
- Lycan
- McCoy
- Oberon Southern Filing
- Pale Verde Mesa Solar
- Palen
- Redonda
- Sapphire

All Other Features

- Chuckwalla Valley Groundwater Basin
- Adjacent Groundwater Basin
- Development Focus Area for All Renewable Energy Technologies
- City Boundary
- County Boundary
- Major Road
- Watercourse
- Waterbody

NOTE

Minor reconfigurations of the Project are not anticipated to significantly impact the results of this Water Supply Assessment.

N

0 13,500 27,000 40,500
Feet

Date: January 10, 2024
Data Sources: ESRI, USGS, Maxar Imagery (2018), Aspen (2022), DWR

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4 Hydrologic Overview

The CVGB is located within the Southern Mojave watershed (Hydrologic Unit Code 8-18100100). The Chuckwalla Valley watershed, a subunit of the South Mojave watershed, contributes to the CVGB via percolation of precipitation. Percolation of precipitation occurs within the Chuckwalla Valley watershed via runoff from the surrounding mountains and from precipitation to the Chuckwalla Valley floor (DWR, 2004; CEC, 2010).

There are no perennial streams in the Chuckwalla Valley. Drainage in the valley is to the Palen and Ford Dry Lakes located in topographic low points (DWR, 2004). All surface water in the western portion of the valley, which includes the Project, flows to Palen Dry Lake, located approximately 10 miles east of the community of Desert Center and roughly 7 miles east of the project area. Surface water in the eastern portion of the Chuckwalla Valley flows to Ford Dry Lake, located approximately 10 miles southeast of the Palen Dry Lake(RWQCB, 2021). Documented springs and seeps in the area are in the surrounding mountains, and none are located such that they could serve as a water supply for the Project (see Figure 1) (Aspen, 2021).

The local climate is arid with high summer temperatures and mild winter temperatures. Average annual precipitation in the project area, based on the meteorological station at the nearby Blythe, California, airport, is 3.39 inches (NOAA, n.d.[a], n.d.[b]). Average summer maximum temperatures are above 100 degrees Fahrenheit (NOAA, n.d.[a]). Precipitation is seasonal. Off-site stormwater flows that may impact the Project are suspected to be primarily from the Chuckwalla Mountains to the south of the project area, and from the Eagle Mountains to the west (see Figure 1).

5 Chuckwalla Valley Groundwater Basin

5.1 Basin Overview and Storage

The CVGB covers an area of 940 square miles in eastern Riverside County, California, and underlies the Palen and Chuckwalla Valleys. The CVGB is bounded by the consolidated rocks of the Chuckwalla, Little Chuckwalla, and Mule Mountains on the south; the Eagle Mountains on the west; and the Mule and McCoy Mountains on the east. Rocks of the Coxcomb, Granite, Palen, and Little Maria Mountains bound the valley on the north (see Figure 1) (DWR, 2004).

Water-bearing units of the CVGB include Pliocene to Quaternary age continental deposits divided into Quaternary alluvium, the Pinto Formation, and the Bouse Formation (DWR, 2004). Bedrock is as deep as 5,000 feet below ground surface (bgs) in the eastern portion of the CVGB. Wells in the vicinity of the Project extend to depths of approximately 550 to 875 feet bgs, with water levels approximately 100 to 150 feet bgs (Aspen, 2021; Shen et al., 2017). The age of groundwater within the CVGB has been dated to be from 9,400 to 18,600 years old (USGS, 2013). A regional geological map and cross-section of the CVGB are included as Figures 4 and 5, respectively.

Total groundwater storage capacity of the CVGB is estimated to be from 9,100,000 to 15,000,000 AF (DWR, 2004). A project-specific 2013 analysis estimated the storage capacity of the CVGB to be about 10,000,000 AF (SWRCB, 2013).

The CVGB is located within the jurisdiction of the Colorado River Basin Regional Water Quality Control Board (RWQCB) and is subject to management direction of the *Water Quality Control Plan for the Colorado River Basin* (Region 7) (RWQCB, 2019). The CVGB is bordered by the Pinto Valley, Cadiz Valley, Rice Valley, and Ward Valley Groundwater Basins on the north; the Palo Verde Mesa Groundwater Basin on the east; the Arroyo Seco Valley and Chocolate Valley Groundwater Basins on the south; and the Orocopia Valley Groundwater Basin on the west (see Figure 3).

5.1.1 Groundwater Management

The CVGB is an unadjudicated groundwater basin. Owners of property overlying the CVGB have the right to pump groundwater from the CVGB for reasonable and beneficial use, provided that the water rights are neither severed nor reserved. Groundwater production in the CVGB is not managed by a specific entity and a groundwater sustainability plan has not been prepared nor is required, per SGMA, to be submitted to DWR based on its basin prioritization (low priority). An Urban Water Management Plan and Integrated Regional Water Management Plan do not exist for the area.

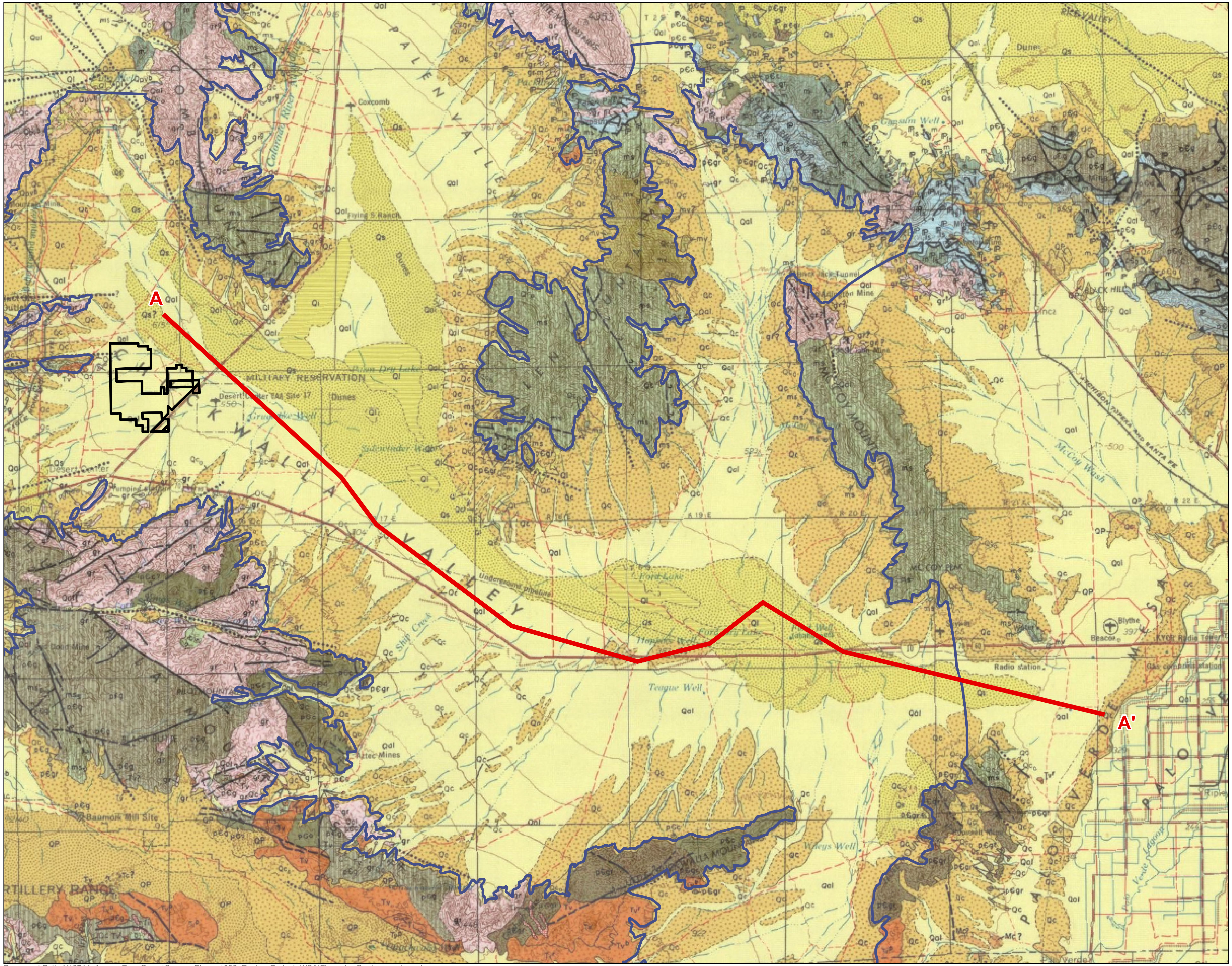

FIGURE 4a

Regional Geology of the Chuckwalla Valley Groundwater Basin

Easley Renewable Energy Project
Water Supply Assessment

LEGEND

- Cross Section Line
- Proposed Project Boundary
- Chuckwalla Valley Groundwater Basin

NOTE

See Figure 5 for cross-section.

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Feet

Date: January 10, 2024
Data Sources: USGS

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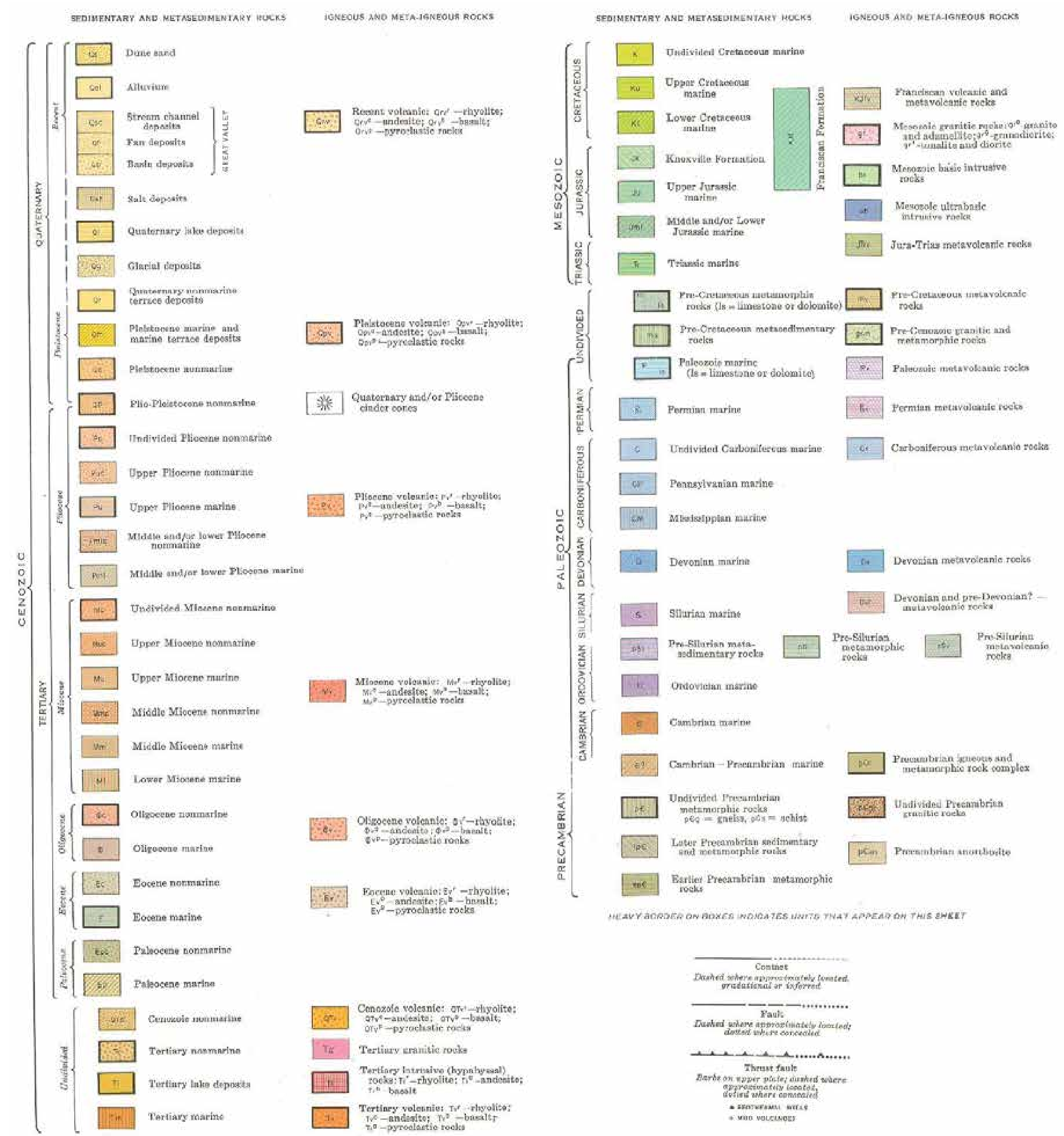

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FIGURE 4b

Regional Geology of the Chuckwalla Valley Groundwater Basin

Easley Renewable Energy Project Water Supply Assessment

NOTE

See Figure 5 for cross-section.

Data Sources: USGS

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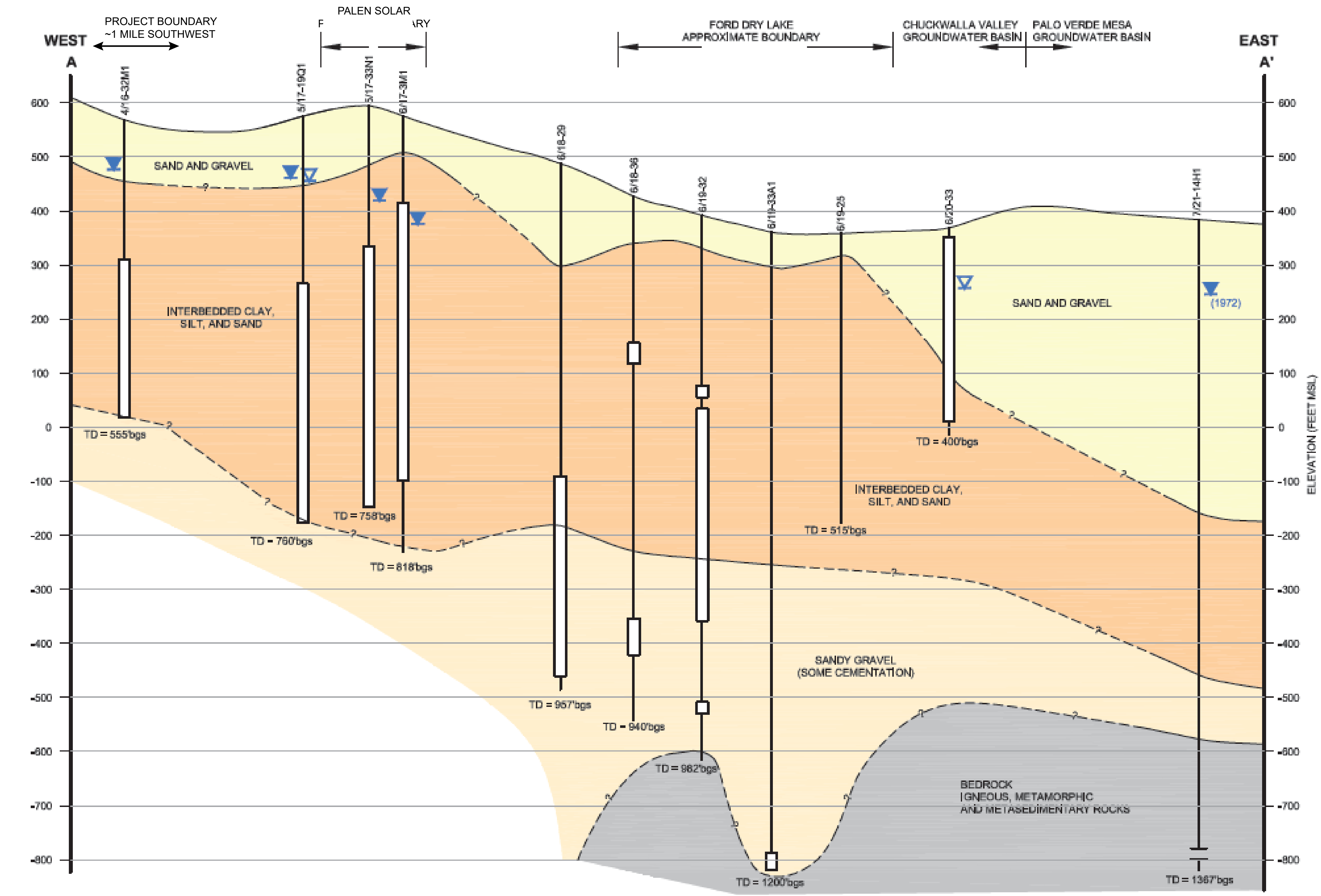
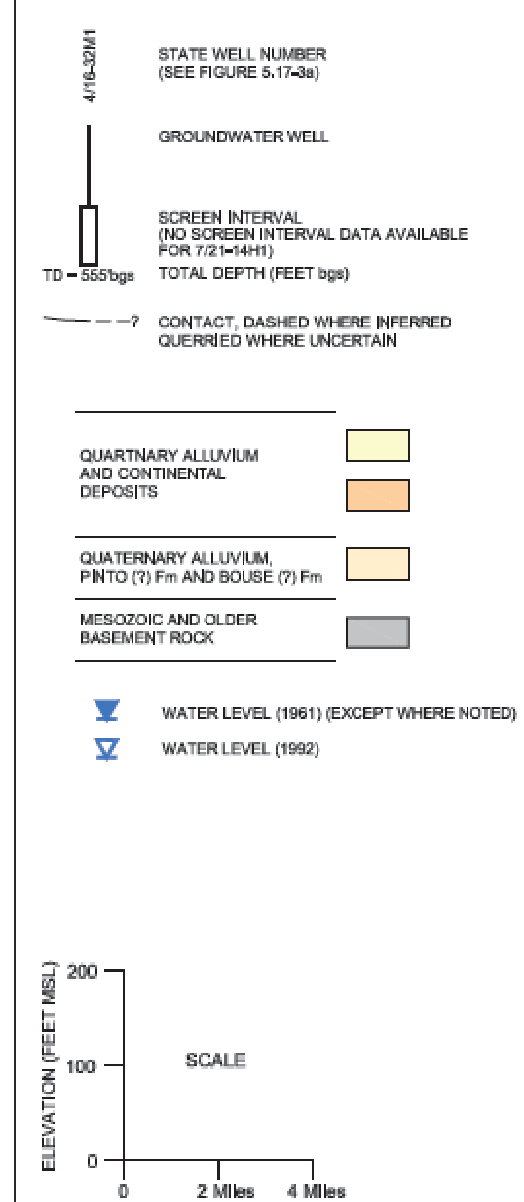
FIGURE 5

Geological Cross-Section A-A'

Easley Renewable Energy Project
Water Supply Assessment





NOTE

See Figure 4 for cross-section location.

Data Sources: AECOM (2010)

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5.2 Groundwater Conditions

A discussion of historical and current groundwater conditions, including groundwater levels, groundwater quality, and subsidence are included in the following subsections.

5.2.1 Groundwater Levels

Depths to groundwater are as deep as about 400 feet bgs in many parts of the CVGB (RWQCB, 2019). Based on groundwater contour data from 1961, 1979, and 1992, groundwater in the CVGB moves from the north and west toward the gap between the Mule and McCoy Mountains at the southeastern end of the Chuckwalla Valley (AECOM, 2010a; DWR, 2004). Available data indicate groundwater levels were stable as of 1963 and that a total groundwater extraction of 9,100 AFY was obtained in 1966 (DWR, 2004).

The direction of groundwater movement is not expected to have changed since 1992, but there have been changes in groundwater levels, especially localized around areas of increased extraction. For example, data from wells within the Desert Center area show a period of water level decline from the mid-1980s through the early 1990s during periods of expanded agricultural operations. During the mid-1980s, combined pumping exceeded 21,000 AFY, which is well above historical water usage for the Desert Center area of the CVGB (AECOM, 2011; GEI, 2010a).

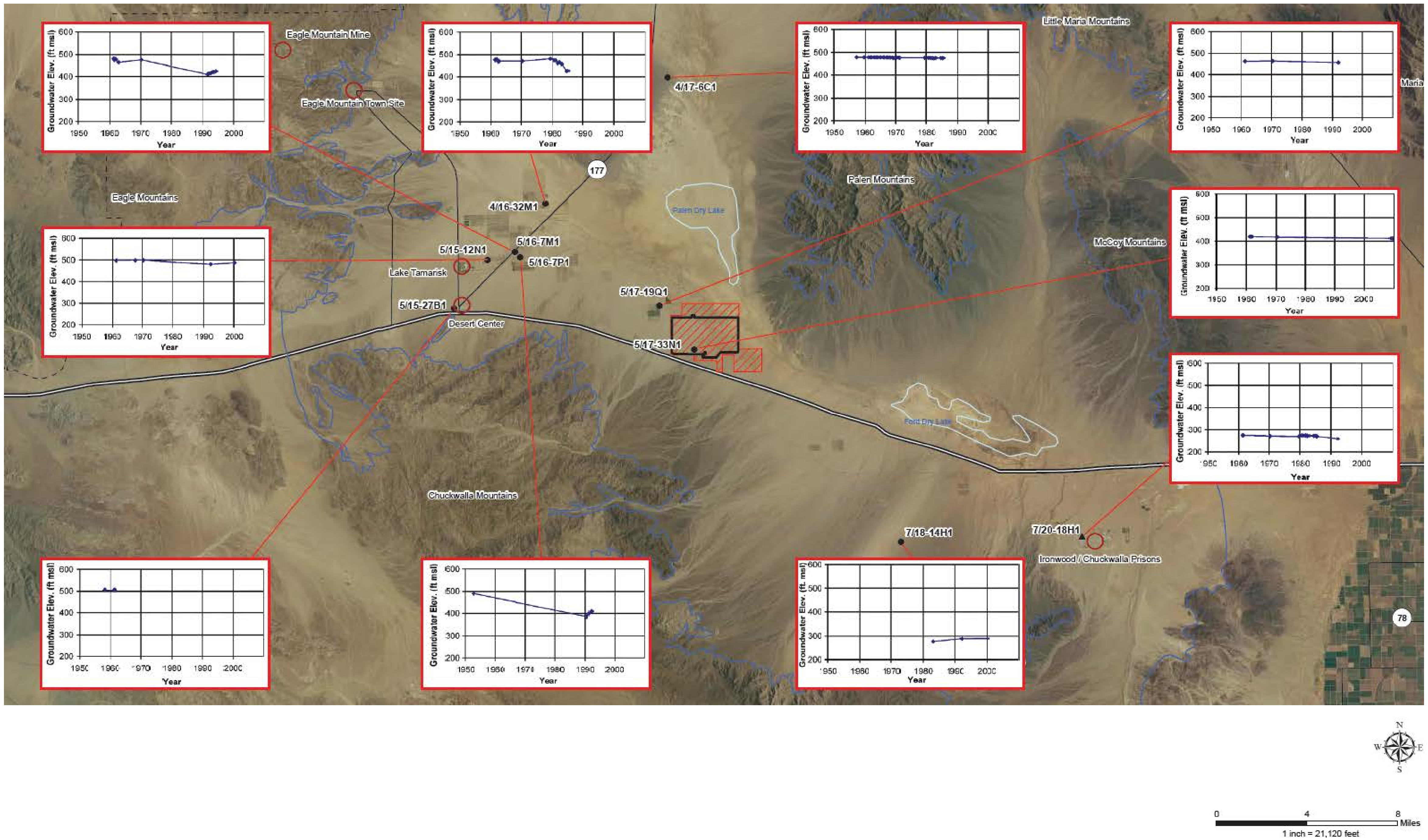
The National Park Service has noted that groundwater levels throughout the CVGB appear to have been trending downward for several decades (BLM, 2012). Most wells in the CVGB have not been used for monitoring data such as groundwater level trends since the 1980s. However, groundwater data collected from several wells for the past 25 years indicate that groundwater level trends have remained largely stable in the eastern CVGB, and that groundwater levels have risen gradually back towards pre-agricultural pumping groundwater levels in the western CVGB (where the Project is located), while dropping steadily in the central CVGB (Aspen, 2018). In 2012, the U.S. Geological Survey (USGS) installed monitoring wells in the eastern CVGB. Water level data from these wells indicate generally rising groundwater levels over the period of data collection (USGS, n.d.).

In general, historical groundwater level data show relatively stable groundwater levels in the CVGB, interrupted in the Desert Center area in the past mainly by periods of relatively intensive agricultural pumping. Historical groundwater level data from the Desert Center area indicate rising, or recovering, groundwater levels following the cessation of most agricultural usage since the 1980s (AECOM, 2010a). Figure 6 includes select hydrographs from CVGB groundwater wells with available (continuous) historical groundwater level data.

FIGURE 6

Select Chuckwalla Valley Groundwater Basin Hydrographs

Easley Renewable Energy Project
Water Supply Assessment



Project Right-of-Way

Facility Footprint

Chuckwalla Valley Groundwater Basin Boundary

Freeway

Groundwater Well
Location based on Latitude and Longitude in USGS Database

Groundwater Well
Location based on the State Well Number (approximate)

Geographic/Cultural Area of Interest

Data Sources: AECOM (2010)

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5.2.2 Groundwater Quality

The Project is located in the jurisdiction of the Colorado River Basin RWQCB. The Water Quality Control Plan developed by the RWQCB 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 Statewide plans and policies and documents comprehensive water quality planning.

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 (RWQCB, 2019). The RWQCB 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 CVGB are Municipal and Domestic Supply (MUN), Industrial Service Supply (IND), and Agriculture Supply (AGR).

Total dissolved solids (TDS) concentrations across the CVGB range from 274 milligrams per liter (mg/L) to 12,300 mg/L. The lowest TDS concentrations are in the western portion of the CVGB, where TDS concentrations range from 275 to 730 mg/L (DWR, 2004). In the northwest portions of the CVGB, arsenic concentrations have ranged from 9 micrograms per liter (μg/L) to 25 μg/L (GEI, 2010a). Water quality in the CVGB has concentrations of sulfate, chloride, fluoride, and TDS that are higher than recommended levels for drinking water use. Likewise, elevated concentrations of boron, TDS, and percent sodium impair groundwater for irrigation use. In general, groundwater in the CVGB is sodium chloride to sodium sulfate-chloride in character (DWR, 2004).

Recent available water quality data near the proposed Project is limited to four wells, with nitrate being the only constituent analyzed in three of the four wells. Reported nitrate concentrations in all four wells were below the federal and California Maximum Contaminant Level of 10 mg/L (nitrate measured as nitrogen).[3]

5.2.3 Subsidence

There is one Continuous Global Positioning System (CGPS) Station located with the CVGB. The UNAVCO maintained CGPS Station P511 is located adjacent to the Colorado River Aqueduct, north of the Project, west of California State Highway 177, and east of the Coxcomb Mountains. CGPS Station P511 has a period of record (POR) from 2005 through present. During the available POR, no significant land subsidence in the CVGB has been recorded at CGPS Station P511 (last measured displacement of 0.001 feet). Likewise, based on available data from CGPS stations located in the Orocopia Valley (POR from 1999 through present) and Palo Verde Mesa (POR from 1996 through present) Groundwater Basins, no significant land subsidence has been recorded (last measured displacements of 0.009 and 0.09 feet, respectively).[4] See Figure 1 for the locations of the three UNAVCO CGPS stations.

There is no reported evidence of subsidence in the CVGB as a result of historic or present pumping (GEI, 2010a). The Project is not anticipated to cause lowering of groundwater levels to levels below recorded

[3] Reported water quality data were accessed via the State Water Resources Control Board Groundwater Ambient Monitoring and Assessment Program Groundwater Information System, available at https://gamagroundwater.waterboards.ca.gov/gama/gamamap/public/ (accessed January 10, 2024).

[4] UNACVO CGPS data were accessed via the DWR SGMA Data Viewer, available at https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer#landsub (accessed January 10, 2024).

historical low groundwater levels. Therefore, the Project is not anticipated to cause subsidence, or increase the rate of subsidence, in the CVGB.

5.3 Groundwater Pumping

Current and historical groundwater pumping in the CVGB includes agricultural water demand, pumping for Chuckwalla and Ironwood State Prisons, pumping for the Tamarisk Lake development and golf course, domestic pumping, and a minor amount of pumping by Southern California Gas Company. In addition, historical pumping included water supply for the Kaiser Corporation Eagle Mountain Mine. Except for pumping for Chuckwalla Valley and Ironwood State Prisons, most of the current groundwater pumping occurs in the western portion of the CVGB, near Desert Center. Current pumping is estimated to be approximately 7,900 AFY in the western CVGB and 2,605 AFY in the eastern CVGB (CEC, 2010).

Based on available Statewide Crop Mapping, the total number of irrigated acres in the CVGB has increased slightly since 2007. There were reportedly 1,108 irrigated acres in 2007 and approximately 1,198 irrigated acres in 2019 (GEI, 2010a).[5] Agricultural irrigation comprises approximately 60 percent of all groundwater pumped from the CVGB (see Section 6 for a discussion of the CVGB groundwater budget).

5.4 Potential Groundwater Dependent Ecosystems

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 within the CVGB.

1. Natural Communities Commonly Associated with Groundwater (NCCAG). Three different wetland types and three potentially groundwater dependent vegetation types are identified within the CVGB. These are discussed in more detail below.
2. The National Hydrography Dataset was evaluated for occurrence of springs. There are no identified springs located within the CVGB.
3. The U.S. Fish and Wildlife Service Critical Habitat spatial dataset was evaluated. There are no critical habitat areas identified in the CVGB for species reliant on groundwater.[6]

Principal plant types of the CVGB include palo verde (*Parkinsonia florida*), shrubby seepweed (*Suaeda moquinii*), honey mesquite (*Prosopis glandulosa*), desert lavender (*Condea emoryi*), creosote-bush (*Larrea tridentata*), iodine bush (*Allenrolfea occidentalis*), and ironwood (*Olneya tesota*). There are no identified springs located in the CVGB and there are no known special-status species (e.g., threatened or endangered) occurring within the CVGB that are dependent on groundwater.

[5] Statewide Crop Mapping data were accessed via the California Department of Water Resources Sustainably Groundwater Management Act Data Viewer, available at https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer (accessed January 10, 2024).

[6] Critical habitat area for desert tortoise is identified in portions of the Basin.

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 (TNC) 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. The potential GDE areas identified in the CVGB from the NCCAG dataset are summarized in Tables 1 and 2.

Table 1. Potential Groundwater Dependent Vegetation Areas in the Chuckwalla Valley Groundwater Basin Identified in the Natural Communities Commonly Associated with Groundwater (NCCAG) Dataset

Natural Communities Vegetation Classification	Acres
Honey Mesquite (*Prosopis glandulosa*)	3,118
Iodine Bush *(Allenrolfea occidentalis)*	1,102
Shrubby Seepweed *(Suaeda moquinii)*	9,150
Total	**13,370**

Table 2. Wetland Areas in the Chuckwalla Valley Groundwater Basin Identified in Natural Communities Commonly Associated with Groundwater (NCCAG) Dataset

Natural Communities Wetland Classification	Acres
Palustrine, Scrub-Shrub, Broad-Leaved- Evergreen, Seasonally Saturated	3
Riverine, Unknown Perennial, Unconsolidated Bottom, Semi-permanently Flooded	1,025
Riverine, Upper Perennial, Unconsolidated Bottom, Semi-permanently Flooded	48
Total	**1,076**

The Palustrine and Riverine NCCAG wetland areas are classified as Seasonally Saturated and Semi-permanently Flooded. However, upon inspection of Google Earth historical imagery, the areas identified as Semi-permanently Flooded are mis-classified. The Palustrine and Riverine areas inspected in Google Earth appear to contain water only rarely. In addition, the identified NCCAG wetland areas are coincident with NCCAG vegetation areas mapped as palo verde, a non-groundwater dependent vegetation type. Based on these findings the NCCAG wetland areas identified in the CVGB are removed from further consideration as containing potential GDEs.

Shrubby seepweed, honey mesquite, and iodine bush are the only plants identified in the CVGB that may have some degree of dependence on groundwater. The aerial extent of each plant as mapped in the NCCAG dataset is presented in Figure 7. The extent of these plant communities is generally coincident with the extent of Palen Dry Lake. All three plants are facultative phreatophytes,[7] which extract moisture from a large volume of soil through a well-developed root system (Lichvar and Dixon, 2007; Steinberg, 2001). There is no readily available information regarding rooting depth for shrubby seepweed. The maximum observed rooting depth for iodine bush is 5.91 feet (TNC, 2020). Honey mesquite's taproot commonly reaches depths of 40 feet when subsurface water is available, though a taproot 190 feet deep has been observed (Steinberg, 2001). In areas where the soil is shallow, where water does not penetrate deeply, or where a distinct calcium carbonate layer is present, the taproot seldom extends more than 3 to 6 feet, and an extensive system of lateral roots often extends up to 60 feet away from the plant base (Steinberg, 2001). Most active lateral roots occur in the upper 2.5 feet of soil and sprouting from lateral roots is common (Steinberg, 2001). These adaptations allow honey mesquite to retain most leaves in all but the most severe droughts (Steinberg, 2001).

An analysis of depth to groundwater in the regional aquifer within the western portion of the CVGB was used to screen areas in which honey mesquite and iodine bush could potentially gain access to groundwater from the regional aquifer. Water level measurements taken in spring 2023[8] were converted to groundwater elevations and gridded using Surfer®. This grid was then subtracted from the regional USGS digital elevation model to produce an extrapolated depth to water coverage (Figure 8). There are no areas with the CVGB identified with depths to groundwater less than 20 feet in the regional aquifer. Areas of less than 190 feet depth to water are considered areas where honey mesquite trees could gain access to groundwater from the regional aquifer (this includes the entire area mapped as honey mesquite [Figure 7]). This is a conservative approach considering that honey mesquite tree tap roots are on average only 40 feet deep (Steinberg, 2001). The occurrence of iodine bush in the CVGB is contained mostly within an area with spring 2023 water levels of less than 50 feet bgs. However, there are no areas indicated with depth to water in the regional aquifer within reach of the maximum documented rooting depth of iodine bush (5.91 feet). It is therefore assumed that the iodine bush communities in the CVGB are supported by seasonal precipitation and potentially a perched alluvial aquifer that is disconnected from the regional aquifer system. Shrubby seepweed is excluded from this groundwater level screening analysis as there is no readily available information regarding its rooting depth.

[7] Facultative phreatophytes require groundwater at some stage of their life cycle, and although not requiring continuous access as do obligate phreatophytes, the availability of groundwater at those times may be critical for their survival (Hose et al., 2022).

[8] Based on recent precipitation records, spring 2023 water levels are likely to be the highest experienced in years. Use of spring 2023 water levels for this analysis is considered conservative for this reason. Ambient water levels are likely to be lower during average/normal water year conditions.

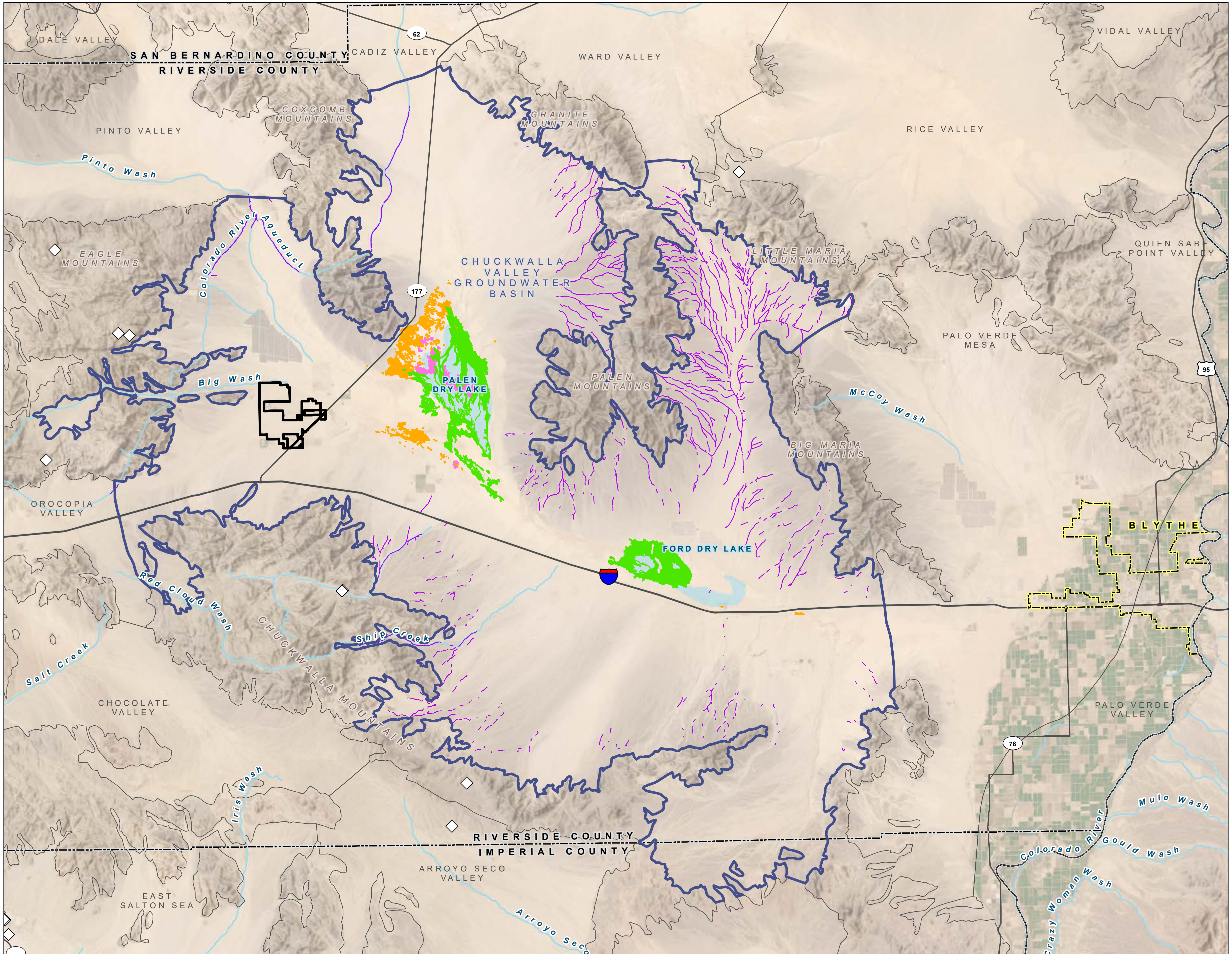

FIGURE 7

Areas Containing Potential Groundwater Dependent Ecosystems

Easley Renewable Energy Project
Water Supply Assessment

LEGEND

Spring/Seep

Natural Communities Commonly Associated with Groundwater (NCCAG)

- Wetland
- Honey Mesquite
- Iodine Bush
- Shrubby Seepweed

All Other Features

- Proposed Project Boundary
- Chuckwalla Valley Groundwater Basin
- Adjacent Groundwater Basin
- City Boundary
- County Boundary
- Major Road
- Watercourse
- Waterbody

N

0 13,500 27,000 40,500
Feet

Date: January 10, 2024
Data Sources: ESRI, USGS, NCCAG
Maxar Imagery (2018), Aspen (2022), DWR

GSI Water Solutions, Inc.

Document Path: Y:\0714_Aspen_Env_Group\Source_Figures\002_Easley_Project_WSA\Figure7_GW_Dependent_Eco.mxd, npalmer

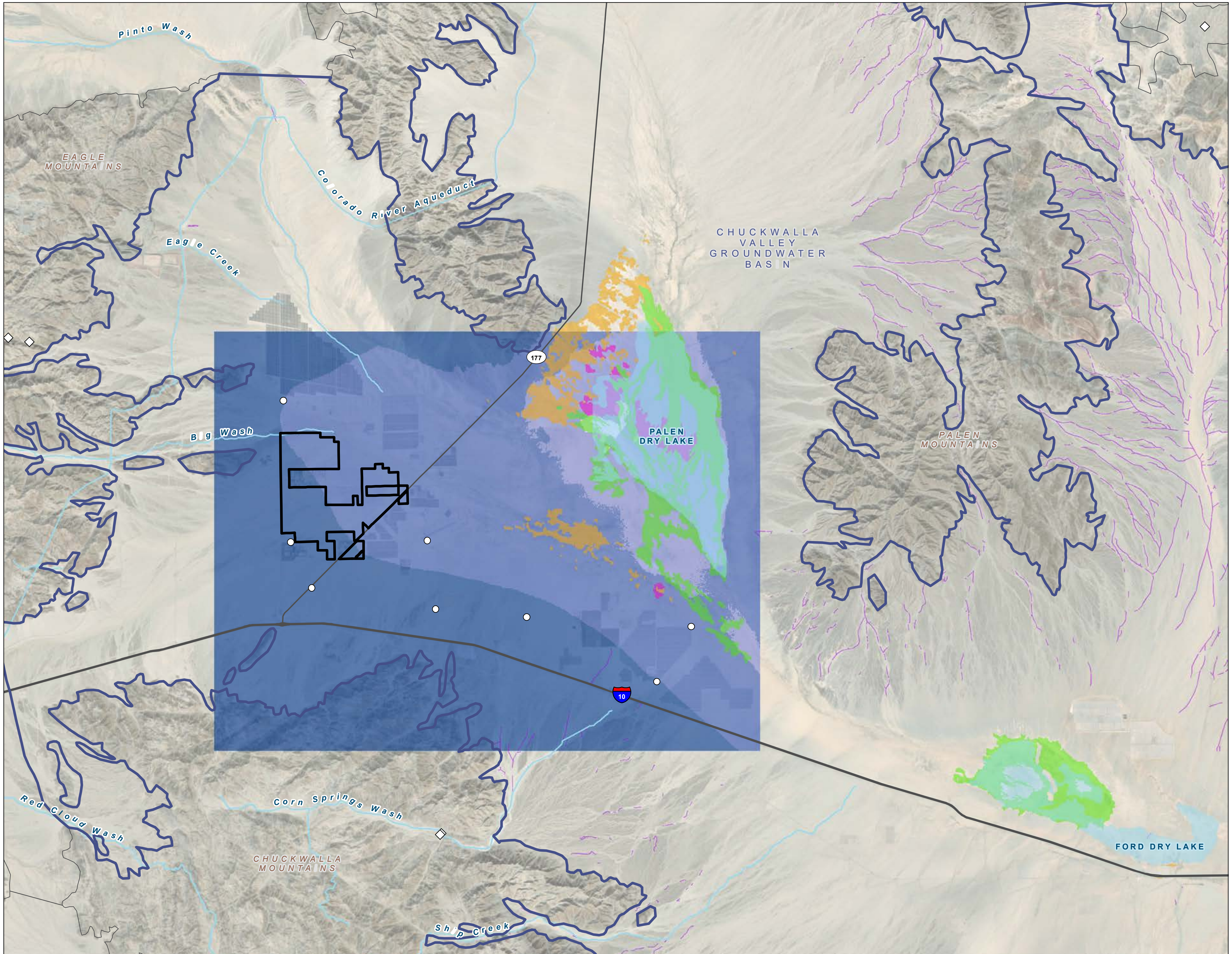

FIGURE 8

Spring 2023 Depth to Groundwater as Related to Potential Groundwater Dependent Ecosystems

Easley Renewable Energy Project
Water Supply Assessment

LEGEND

- Location of Spring 2023 Water Level Measurement
- Spring/Seep

Spring 2023 Depth to Water, feet

- < 25
- 25 - 50
- 50 - 190
- > 190

Natural Communities Commonly Associated with Groundwater (NCCAG)

- Wetland
- Honey Mesquite
- Iodine Bush
- Shrubby Seepweed

All Other Features

- Proposed Project Boundary
- Chuckwalla Valley Groundwater Basin
- Adjacent Groundwater Basin
- Major Road
- Watercourse
- Waterbody

N

0 7,000 14,000 21,000
Feet

Date: January 10, 2024
Data Sources: ESRI, USGS, NCCAG
Maxar Imagery (2018), Aspen (2022), DWR

GSI Water Solutions, Inc.

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The groundwater model was used to simulate changes in regional water levels in response to solar project development through expected project decommissioning in the year 2075. The modeling results show that only minor changes in regional groundwater levels would result from development of the planned cumulative solar projects (see Table 10) compared to simulated 2075 baseline conditions. Figure 9 shows that regional aquifer water levels would drop 0.5 feet or less due to development of the planned solar projects within the area of honey mesquite occurrence and would drop generally less than 0.25 feet within the areas of iodine bush and shrubby seepweed occurrence.

Based on the analyses presented above, it is concluded that the cumulative groundwater level changes associated with all the planned solar projects being developed in this area will not have an effect on the ability of either iodine bush or honey mesquite to access groundwater. All three plants identified in the CVGB that may have some degree of dependence on groundwater (honey mesquite, iodine bush, and shrubby seepweed) are facultative phreatophytes that do not require continuous access to groundwater.

The maximum documented rooting depth of the iodine bush (5.91 feet) indicates that these communities are supported by seasonal precipitation and potentially a perched alluvial aquifer that is disconnected from the regional aquifer system. The recorded instance of a honey mesquite tap root depth of 190 feet indicates that the predicted 0.5 feet or less drop in regional aquifer water levels would be inconsequential.

Potential effects on shrubby seepweed are difficult to assess as there is no readily available rooting depth information for this plant. However, considering that the occurrence of shrubby seepweed is entirely within the Dry Lake Palen bed (Figure 7), it is assumed that, similar to iodine bush, the shrubby seepweed is likely supported by seasonal precipitation and potentially a perched alluvial aquifer that is disconnected from the regional aquifer system. Alternatively, the shrubby seepweed may be supported by the regional aquifer, which generally has spring 2023 water levels within 50 feet of ground surface. Within the area of shrubby seepweed occurrence, the predicted drop in water levels is generally less than 0.25 feet and this minor change could be inconsequentially accommodated by the plants.

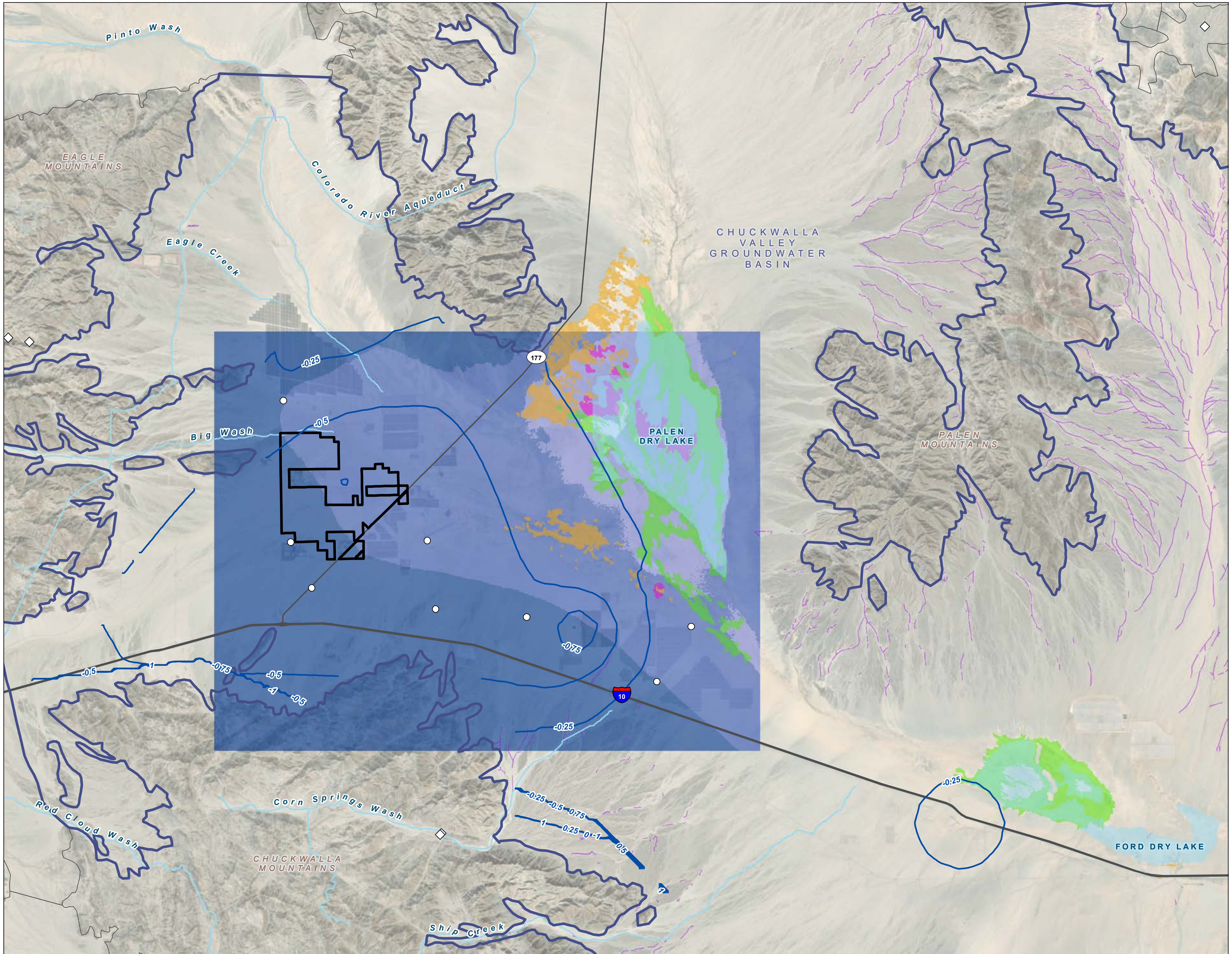

FIGURE 9

Predictive Groundwater Model Results - Regional Water Level Response to Solar Project Development

Easley Renewable Energy Project
Water Supply Assessment

LEGEND

- Location of Spring 2023 Water Level Measurement
- Spring/Seep
- Regional Aquifer Drawdown in Response to Planned Cumulative Solar Project Development in 2075

Spring 2023 Depth to Water, feet

- < 25
- 25 - 50
- 50 - 190
- > 190

Natural Communities Commonly Associated with Groundwater (NCCAG)

- Wetland
- Honey Mesquite
- Iodine Bush
- Shrubby Seepweed

All Other Features

- Proposed Project Boundary
- Chuckwalla Valley Groundwater Basin
- Adjacent Groundwater Basin
- Major Road
- Watercourse
- Waterbody

N

0 7,000 14,000 21,000
Feet

Date: January 10, 2024
Data Sources: ESRI, USGS, NCCAG
Maxar Imagery (2018), Aspen (2022), DWR

GSI Water Solutions, Inc.

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5.5 Projected Effects of Climate Change

Precipitation, evapotranspiration (ET), and streamflow climate change factors for two future climate periods (2030 and 2070) are available on 6-kilometer resolution grids from DWR. The climate datasets were processed by a soil moisture accounting model known as the Variable Infiltration Capacity hydrology model developed by Hamman et al. (2018) and Liang et al. (1994) and routed to the outlet of basins or subbasins contributing water to the basin. The resulting downscaled hydrologic time series are available on the SGMA Data Viewer hosted by DWR.[9] Precipitation and ET data used in this analysis were downloaded from the SGMA Data Viewer for climate grid cells within the basin. Streamflow data were not downloaded and used in this analysis due to the arid climate of the CVGB and lack of perennial streams. Monthly time series change factors were then developed for the CVGB. Mean monthly and annual values were computed from the basin time series to show projected patterns of change under 2030 and 2070 conditions.

The DWR-provided climate change data are based on the California Water Commission's Water Storage Investment Program climate change analysis results, which used the global climate models and radiative forcing scenarios recommended for hydrologic studies in California by the Climate Change Technical Advisory Group. Climate data from the recommended General Circulation Model models and scenarios have also been downscaled and aggregated to generate an ensemble time series of change factors that describe the projected change in precipitation, ET, and streamflow values for climate conditions that are expected to prevail at mid-century and late century, centered around 2030 and 2070, respectively. The DWR dataset also includes two additional simulation results for extreme climate scenarios (Drier/Extreme Warming [DEW] and Wetter/Moderate Warming [WMW]) under 2070 conditions.

In a warmer climate such as that of the CVGB, native vegetation and crops require more water to sustain growth, and this increased water requirement is characterized in climate models using the rate of ET. Under 2030 conditions, the CVGB is projected to experience average annual ET increases of approximately 4 percent relative to the baseline period (1915–2011). The largest monthly changes are projected to occur in the winter, with projected average increases of approximately 6 percent and 7 percent in December and January, respectively. Under 2070 conditions, annual ET is projected to increase by approximately 8 percent relative to the baseline period. The largest monthly changes are projected to occur in winter, with projected average increases of 14 percent in December and January. Under 2070 DEW conditions, annual ET is projected to increase by approximately 12 percent relative to the baseline period. The largest monthly changes are projected to occur in winter, with projected average increases of 19, 22, and 19 percent in December, January, and February, respectively. Under 2070 WMW conditions, annual ET is projected to increase by approximately 3 percent relative to the baseline period. The largest monthly changes are projected to occur in winter, with projected average increases of 8 and 10 percent in December and January, respectively. The DWR-provided climate change data does not include descriptions regarding precipitation intensity.

The seasonal timing and amount of precipitation in the CVGB is projected to change. Under 2030 conditions, the largest monthly changes are projected to occur in December with projected decreases of 16 percent, while the largest monthly increase of approximately 8 percent is projected to occur in January. Under 2070 conditions, the largest monthly decrease is projected to occur in April with a projected decrease of approximately 25 percent, while the largest monthly increase of approximately 43 percent is projected to occur in September. Under 2070 DEW conditions, the largest monthly decrease is projected to occur in April with a projected decrease of approximately 41 percent, while the largest monthly increase of approximately 30 percent is projected to occur in September. Under 2070 WMW conditions, the largest monthly decrease

[9] The SGMA Data Viewer is available at https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer# (accessed January 10, 2024).

is projected to occur in October with a projected decrease of approximately 39 percent, while the largest monthly increase of approximately 103 percent is projected to occur in September. Projected changes in total annual precipitation are a decrease of approximately 4 percent under 2030 conditions, a decrease of 3 percent under 2070 conditions, a decrease of 9 percent under 2070 DEW conditions, and an increase of 12 percent under 2070 WMW conditions.

5.6 Numerical Groundwater Models

Several numerical groundwater models have been developed for, or including, the CVGB. Select groundwater models developed in support of renewable energy projects in the CVGB include Eagle Mountain Pump Storage (EMPS) Project (GEI, 2010b), Desert Sunlight Solar (AECOM, 2010b), Genesis Solar (WorleyParsons, 2009), and Blythe Solar (AECOM, 2010c). Select groundwater models developed to assess a cumulative analysis of renewable energy projects on the CVGB include Leake et al. (2008), Greer et al. (2013), Shen et al. (2017), and Fang et al. (2021). Based on CGBA stakeholder and BLM feedback, the Shen et al. (2017) and Fang et al. (2021) models were primary references in the development of this WSA.

Shen et al. (2017) and Fang et al. (2021) developed a numerical groundwater model to assess the impact utility-scale solar energy projects have on groundwater resources in desert groundwater basins. Specifically, the model evaluated the potential impact(s) on the CVGB from the development of the EMPS Project. The Shen et al. (2017) model is described as an:

> "…observationally-constrained dual-model approach to study the groundwater system in the Chuckwalla basin. This approach integrates a surface-subsurface processes model that simulates both surface and subsurface processes and a groundwater flow and parameter estimation package. The integrated modeling system is constrained by meteorological and soil moisture data collected during the study, and the groundwater calibration is constrained by recharge provided from the integrated model and groundwater head observations" (Shen et al., 2017).

The purpose of the Fang et al. (2021) model is described as:

> "to employ a data-constrained surface subsurface processes model, PAWS (Process-based Adaptive Watershed Simulator) + CLM (Community Land Model), to provide an ensemble of recharges and underflows with perturbed parameters. Then, the Parameter Estimation (PEST) package is used to calibrate MODFLOW (USGS modular hydrologic model) aquifer conductivity and filter out implausible recharges. The novel dual-model approach, potentially applicable in other arid regions, can effectively assimilate groundwater head observations, reject unrealistic parameters, and narrow the range of estimated drawdowns." (Fang et al., 2021)

The EMPS Project involves the construction of a new pumped storage project using two existing mining pits. Water would be pumped from the Lower Reservoir to the Upper Reservoir during periods of low demand, and allowed to flow from the Upper Reservoir to the Lower Reservoir through an underground powerhouse with four turbines to generate peak energy during periods of high demand. The installed capacity of the EMPS Project is expected to be 1,300 megawatts (SWRCB, 2020). The estimated water demand of the EMPS Project is 4,460 AFY during the projected 4-year construction period and 2,050 AFY during the operational phase of the project. During its operational phase, the EMPS Project is projected to use more than six times the groundwater of all other cumulative projects located in the CVGB (see Section 6.2).

Shen et al. (2017) and Fang et al. (2021) generally conclude, during construction and operation of the EMPS Project, the CVGB would likely experience a chronic lowering of groundwater levels and a decrease in groundwater in storage. Fang et al. (2021) states that, “With limited data, we ascertain that groundwater levels will decrease across the basin [CVGB] over the life of the energy-storage Project [EMPS Project].”

Water budget inflow and outflow volumes included in both publications have been considered and are incorporated into the Project’s water budget in this WSA, as appropriate (see Sections 5.7, 5.8, and 6.1). The Fang et al. (2021) model was adapted to simulate future Project groundwater use and cumulative projects scenarios (see Section 7).

5.7 Groundwater Recharge

The following is an explanation of select water budget terms:

- A **Water Budget** is “an accounting of the total groundwater and surface water entering and leaving a basin including the changes in the amount of water stored” (California Water Code 107121). It is an identification, estimate, and comparison of the groundwater inputs and outputs that affect the overall trend of groundwater balance in the CVGB. Inputs such as recharge from precipitation, underflow from other groundwater basins, and other sources are compared to outputs such as loss to other groundwater basins, extractions by humans, and ET. Total inflow minus total outflow equals change in groundwater in storage.
- **Basin Yield**[10] is the volume of pumping that can be extracted from the basin on a long-term basis without creating a chronic and continued lowering of groundwater levels and the associated reduction in the volume of groundwater in storage. Basin yield is not a fixed constant value but a dynamic value that fluctuates over time as the balance of the groundwater inputs and outputs change. In this WSA, the basin yield is calculated for the CVGB as a whole.
- **Groundwater Overdraft** is the condition of a groundwater basin in which the amount of water withdrawn by pumping exceeds the amount of water that recharges the basin over a period of many years during which water supply conditions approximate average conditions (DWR, 2020b). In this WSA, groundwater overdraft is estimated for the CVGB as a whole. Long-term groundwater overdraft could eventually result in increased depths to the groundwater table and potentially a diminished availability of the groundwater resource.

Recharge to the CVGB occurs from subsurface inflow from other groundwater basins (Section 5.7.1), infiltration of precipitation (Section 5.7.2), irrigation return flow (Section 5.7.3), and wastewater return (Section 5.7.4). Leakage from the Colorado River Aqueduct has also been identified as a possible source of inflow (Section 5.7.5) (Greer et al., 2013).

5.7.1 Subsurface Inflow and Mountain Front Recharge

Groundwater in the CVGB generally flows west to east. Subsurface inflow originates from the Pinto Valley and Orocopia Valley Groundwater Basins, which are west of the CVGB (DWR, 2004; BLM, 2011). The amount of inflow from the Pinto Valley and Orocopia Valley Groundwater Basins is highly uncertain, and there have been a wide range of estimates from different publications ranging from a low of 372 AFY to a high of 6,575 AFY (Aspen, 2018; Fang et al., 2021). For this analysis, the groundwater budget uses 877 AFY as established in Fang et al. (2021) as the upper range of the groundwater inflow estimates from the Pinto Valley Groundwater Basin. Groundwater budgets in WSAs for nearby projects in the recent past have used 3,500 AFY (Aspen, 2021), which is approximately in the middle of the range of estimates. The analysis

[10] Basin yield is not the same as sustainable yield. Sustainable yield is defined in SGMA as “the maximum quantity of water, calculated over a period representative of long-term conditions in the basin and including any temporary surplus that can be withdrawn annually from a groundwater supply without causing an undesirable result” (California Water Code 10721).

herein also includes a reduced groundwater recharge scenario in which the low estimate of 372 AFY developed by Fang et al. (2021) is used to provide a probable range for the groundwater budget given the uncertainties involved.

Mountain front subsurface recharge is recorded as lateral subsurface flow that passes from thin mountain soil to the aquifer at the mountain foot (Fang et al., 2021). For this analysis, the groundwater budget uses 210 AFY for mountain front recharge. This analysis also applies 107 AFY for the reduced groundwater recharge scenario. These mountain front recharge volumes represent the upper and lower bounds in Fang et al. (2021).

5.7.2 Recharge from Precipitation

Infiltration recharge to the CVGB by precipitation is difficult to assess due to lack of reliable data and the aridity of the region. Previous estimates have ranged from 2,060 to 11,501 AFY (Aspen, 2018; Fang et al., 2021).

Precipitation recharge has been estimated by previous CVGB studies as a percentage of total precipitation. The CVGB receives a total precipitation of approximately 205,376 AFY (Fang et at., 2021) to 258,000 AFY (CEC, 2010). The BLM estimates that 7 to 8 percent of the precipitation that falls on the bedrock formations present in the mountain areas of the CVGB contributes to groundwater recharge (BLM, 2012), while a smaller percentage of the valley floor precipitation infiltrates and recharges the groundwater basin. For the CVGB, 7 to 8 percent of the precipitation that falls on the mountain fronts would be equivalent to 3 percent of the total precipitation that falls on the total Chuckwalla Valley watershed (BLM, 2012). The California Energy Commission (CEC) calculated precipitation-related recharge by applying estimates of 3 percent, 5 percent, and 7 percent of total incident precipitation contributing to groundwater recharge along with isohyetal precipitation maps for the Chuckwalla Valley watershed (to calculate precipitation distribution and bedrock characteristics by sector).

The results of these calculations determined that precipitation-related recharge for the 3 percent, 5 percent, and 7 percent of the CEC estimated CVGB annual precipitation is 8,588 AFY, 14,313 AFY, and 20,038 AFY, respectively. The CEC recommended using 8,588 AFY (about 3.3 percent of total precipitation) for a conservative groundwater budget analysis (CEC, 2010). These results are supported by the findings of a study included in a USGS report on groundwater recharge in the arid and semiarid southwestern United States (USGS, 2007), which identified a range of approximately 3 to 7 percent of total precipitation for the Mojave Desert, depending on the amount of precipitation received. Fang et al. (2021) (using the CVGB precipitation estimate of 205,376 AFY) estimates a range of approximately 3.4 percent to 5.6 percent of precipitation that falls within the CVGB watershed contributes to groundwater; resulting in a groundwater recharge from precipitation range of approximately 6,983 to 11,501 AFY.

For purposes of this analysis, a recharge from precipitation estimate of 8,846 AFY is used for the groundwater budget. The recharge from precipitation estimate is approximately 4.3 percent of the Fang et al. (2021) estimated annual CVGB watershed precipitation. The 5.6 percent recharge from precipitation from Fang et al. (2021) could not be used in conjunction with all of the inflow water budget components included in the Project WSA. The resulting groundwater inflow estimate would have exceeded the upper bounds of the Fang et al. (2021) total recharge estimate.

For the reduced groundwater recharge scenario, 4,997 AFY of recharge from precipitation is used for the groundwater budget, representing approximately 2.4 percent of average annual precipitation (Fang et al., 2021). Similarly, the 3.4 percent recharge from precipitation from Fang et al. (2021) could not be used in conjunction with all of the inflow water budget components included in this WSA. The resulting groundwater inflow estimate would have exceeded the lower bounds of the Fang et al. (2021) total recharge estimate.

Changes to average annual precipitation and recharge from precipitation for the CVGB are based on 2030 and 2070 DWR climate change data (see Section 5.3) and are summarized below:

- Under 2030 conditions, using Fang et al. (2021) estimated total annual CVGB watershed precipitation, the total average annual precipitation would decrease by approximately 8,200 AF and the associated recharge from precipitation used for the groundwater budget under normal climatic conditions would decrease by approximately 20 AFY. Under the reduced groundwater recharge scenario, the recharge from precipitation would decrease by approximately 70 AFY.
- Under 2070 conditions, the total average annual precipitation would decrease by approximately 6,200 AF and the associated recharge from precipitation used for the groundwater budget under normal climatic conditions would decrease by approximately 18 AFY. Under the reduced groundwater recharge scenario, the recharge from precipitation would decrease by approximately 70 AFY.
- Under 2070 DEW conditions, the total average annual precipitation would decrease by approximately 18,500 AF and the associated recharge from precipitation used for the groundwater budget under normal climatic conditions would decrease by approximately 17 AFY. Under the reduced groundwater recharge scenario, the recharge from precipitation would decrease by approximately 70 AFY.
- Under 2070 WMW conditions, the total average annual precipitation would increase by approximately 24,600 AF and the associated recharge from precipitation used for the groundwater budget under normal climatic conditions would increase by approximately 21 AFY. Under the reduced groundwater recharge scenario, the recharge from precipitation would increase by approximately 80 AFY.

5.7.3 Irrigation Return Flow

Irrigation water applied to crops within the CVGB has the potential to infiltrate to groundwater depending on the amount and method of irrigation, soil, crop type, and climate. The CEC estimated irrigation return recharge as 10 percent of total irrigation volume as determined by a 2009 study (WorleyParsons, 2009), and determined that 800 AFY would reach the CVGB (CEC, 2010). This was based on a total irrigation volume of 7,705 AFY (6,400 AFY for agriculture, 215 AFY for aquaculture pumping, and 1,090 AFY for Lake Tamarisk).

5.7.4 Wastewater Return Flow

Wastewater return flow within the CVGB originates from the Chuckwalla State Prison, the Ironwood State Prison, and the Lake Tamarisk development near Desert Center (CEC, 2010; WorleyParsons, 2009). The two prisons use an unlined pond to dispose of treated wastewater, and it is estimated that 795 AFY infiltrates to the CVGB (WorleyParsons, 2009). Another 36 AFY is estimated to originate from Lake Tamarisk, for a total of 831 AFY (WorleyParsons, 2009).

5.7.5 Colorado River Aqueduct

Leakage from the Colorado River Aqueduct, which runs across the western edge of the CVGB, has not been documented, but was hypothesized by the Argonne National Laboratory (Argonne) in a 2013 study of the Riverside East Solar Energy Zone (Greer et al., 2013). Argonne estimated a 2,000 AFY contribution to the CVGB from the aqueduct based on measured leakage rates from the Central Arizona Project in Arizona (Greer et al., 2013). This recharge component is not well documented and, if it does occur, the use of it would require a corresponding entitlement; therefore, it is not used in this analysis.

5.8 Groundwater Demand/Outflow

Outflow from the CVGB occurs from subsurface outflow to the Palo Verde Mesa Groundwater Basin (Section 5.8.1), groundwater extraction for agriculture and other uses (Section 5.8.2), and ET from Palen Dry Lake (Section 5.8.3). Outflow as consumptive use of groundwater also occurs, or would occur, from the Project and other similar existing and proposed projects.

5.8.1 Subsurface Outflow

Subsurface outflow from the CVGB is to the Palo Verde Mesa Groundwater Basin and has been estimated as ranging from 400 to 1,162 AFY (CEC, 2010). The Argonne 2013 study of the CVGB assumed zero subsurface outflow (Greer et al., 2013); however, justification was not well documented. Using gravity data, Wilson and Owens-Joyce (1994) found that the area through which discharge is suspected to occur is significantly more limited than previously thought due to the presence of a buried bedrock ridge. Given that this discovery was made after the 1,162 AFY estimate was reported (which was in 1990), the lower estimate of 400 AFY outflow was adopted for this WSA.

5.8.2 Groundwater Extraction

Current and historical groundwater extraction in the CVGB includes agricultural water use, pumping for Chuckwalla and Ironwood State Prisons, pumping for the Lake Tamarisk development and golf course, domestic pumping, and a minor amount of pumping by Southern California Gas Company (CEC, 2010). Using data from 2005 to 2010, DWR (2015) estimated the total amount of pumping at 5,000 AFY for the entire CVGB. Argonne (Greer et al., 2013), using DWR data, estimated 5,100 AFY. Other recent studies have calculated higher estimates. Specifically, the *Palen Solar Project Environmental Impact Study* and CEC staff assessment for the Palen Solar Project, both used 10,361 AFY (BLM, 2011; CEC, 2010). In a WSA for the Palen Solar Power Project, AECOM estimated 5,745 AFY to 7,415 AFY, with no source identified (AECOM, 2010a). For the purposes of this analysis, the most recent estimate of 10,361 AFY is used as a reasonable upper estimate of total extraction, as was used by BLM (2011) and CEC (2010).

Since the reporting of the Palen Solar Project related studies, an additional approximately 340 AFY[11] of groundwater extraction has occurred within the CVGB for qualifying projects located within the Development Focus Area (Aspen, 2021). Therefore, the total baseline groundwater extraction amount determined for purposes of this study is 10,700 AFY. Annualized total pumping used in Fang et al. (2021) was 8,101 AF.

5.8.3 Evapotranspiration at Palen Dry Lake

Worley-Parsons used hand-augur borings in 2009 to identify the presence of the groundwater table at a depth of 8 feet bgs at the Palen Dry Lake (WorleyParsons, 2009). This suggests that groundwater could be close enough to rise through capillary action and be lost through evaporation (CEC, 2010).

The CEC (2010) estimated groundwater discharge rates from Palen Dry Lake using measured evaporation rates at Franklin Lake Playa in Death Valley, adjusted for differences in the characteristics of the two dry lakes, as a reference. The result was 0.0583 feet of ET per month, for 3 months of the year. Over the 2,000-acre area considered susceptible to groundwater ET, this amounts to 350 AFY (CEC, 2010).

[11] Qualifying completed projects (i.e., operational groundwater uses only) contributing to the baseline groundwater extraction include Genesis Solar Electric Plant (218 AFY), Desert Sunlight Solar Farm (0.3 AFY), Desert Harvest Solar Project (40 AFY), Athos Renewable Energy Project (40 AFY), and Palen Solar Project (41 AFY) (Aspen, 2021).

Changes to average ET for the CVGB are based on 2030 and 2070 DWR climate change data (see Section 5.3) and are summarized below:

- Under 2030 conditions, the groundwater ET volume of 350 AFY used in the Project water budget is projected to increase by approximately 10 AFY.
- Under 2070 conditions, the groundwater ET volume is projected to increase by approximately 30 AFY.
- Under 2070 DEW conditions, the groundwater ET volume is projected to increase by approximately 40 AFY.
- Under 2070 WMW conditions, the groundwater ET volume is projected to increase by approximately 10 AFY.

6 Groundwater Budget

Pursuant to SB 610, qualifying projects must analyze “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 Section 10910(c)(4)).

The DRECP LUPA states that:

> “. . . the purpose [of] WSA 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 WSA 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)” (LUPA-SW-23; BLM, 2016a, 2016b).

IP Easley, LLC understands the BLM is considering issuing ROW grants for durations of up to 50 years (BLM, 2023). The Project POD (Aspen, 2022) includes a projected Project construction period of 20 months and an operational period of 35 years, for a total projected period of 37 years. To prepare for potential issuance of an ROW grant by the BLM with a duration longer than planned in the Project POD (Aspen, 2022) and to determine whether there are sufficient supplies to sustain the Project, this WSA extends the total projected period of the Project by an additional 15 years, totaling 52 years. For the purpose of the CVGB water budget (see Section 6) and predictive Project water demand impacts analysis (see Sections 5.4 and 7) presented herein, 52 years is equivalent to the projected total duration of the Project, including construction (20 months), operations (48 years), and decommissioning (20 months).[12] Based upon these quantities of water demand, a total of approximately 3,500 AF of water will be used by the Project over the Project’s construction, operational, and decommissioning periods (52 years [i.e., 2-year construction period, 48-year operational period, and 2-year decommissioning period]).

This section uses the information presented in Section 5 to provide a baseline normal-year groundwater budget for the CVGB. This section also includes a normal-year groundwater budget assuming the Project is in place, and a normal-year groundwater budget assuming the Project and all known qualifying cumulative projects are in place. The same approach is repeated for single and multiple dry-year scenarios.

The CVGB lacks long-term monitoring data for conducting a detailed analysis of historical basin conditions. Wells are only located in a few areas of the CVGB, are not well documented, and the available data are incomplete. Reported groundwater extractions from agricultural activities in the Desert Center area were 11 AFY in 1952 (DWR, 2004), approximately 9,100 AFY in 1966 (DWR, 2004), and approximately 21,000 AFY in 1986 (corresponding to a planted acreage of approximately 5,662 acres) (GEI, 2010a), as described in Section 5.2, resulting in local areas of lowered groundwater levels. Agricultural pumping declined significantly after 1986, with a planted acreage of approximately 355 acres and a corresponding water use of approximately 1,800 AF in 2007 in the Desert Center area (GEI, 2010a); local groundwater levels have recovered to approximately those of the early 1960s (AECOM, 2011).

[12] Although the estimated Project construction period described in the Project POD (Aspen, 2022) and the estimated Project decommissioning period described in this WSA is 20 months, the water budgets (see Section 6) and Cone of Depression and Cumulative Drawdown Analysis (see Section 7) presented herein, were developed in 1-year time steps, and therefore assume the same water use but Project construction and decommissioning periods of 1 year.

Because of the uncertainties involved, the analysis uses two groundwater budgets (see Table 3). The first is a best estimate using data from recently developed numerical groundwater models for the CVGB and data used in previous WSA studies (see Sections 5.7 and 5.8). The second analysis uses lower input estimates (see Sections 5.7 and 5.8). Specifically, the second budget uses a recharge from precipitation estimate of 4,997 AFY, and an underflow from the Pinto Valley Groundwater Basin of 372 AFY. All other inflow/outflow estimates are the same for both budgets. The two together provide insight into a range of potential outcomes related to groundwater use in the CVGB. Table 3 summarizes the water budget components.

Table 3. Chuckwalla Valley Groundwater Basin Baseline Inflow/Outflow Summary

Inflow/Outflow Component	Range (AFY)	Adopted for This Study (AFY)	Reason for Adoption/Source
Recharge from Precipitation	+2,060 to +11,501	+8,846	4.3% of total precipitation (Fang et al., 2021)
Underflow from Pinto Valley and Orocopia Valley Groundwater Basins	+372 to +6,575	+877	Upper bound of water budget component in Fang et al. (2021)
Mountain Front Recharge	+107 to +210	+210	Upper bound of water budget component in Fang et al. (2021)
Irrigation Return Flow	+800	+800	WorleyParsons (2009)
Wastewater Return Flow	+831	+831	WorleyParsons (2009)
Groundwater Extraction	−4,700 to −10,700	−10,700	Recent estimate: −10,579 (Aspen, 2021) + −121 AFY (see Section 5.6.2)
Underflow to Palo Verde Mesa Groundwater Basin	−400	−400	Lower CEC (2010) estimate used due to the restricted discharge area identified by Wilson and Owens-Joyce (1994)
Evapotranspiration at Palen Dry Lake	−350	−350	Estimate from the Franklin Playa study (CEC, 2010)

Notes

Inflow is depicted by a '+' sign; outflow is depicted by a '–' sign.

AFY = acre-feet per year

CEC = California Energy Commission

6.1 Baseline Groundwater Budget

The baseline groundwater budget is the groundwater budget for the CVGB in the absence of the Project and all other known cumulative projects not already in place. For the purposes of this analysis, agricultural uses and existing cumulative projects are considered as part of the baseline budget. There are no manufacturing water uses in the area.

6.1.1 Normal (Average) Year

Table 4 provides a baseline groundwater budget during normal climatic conditions for the CVGB based on the adopted information presented in Sections 5.7 and 5.8 and Table 3. The baseline basin yield for the CVGB is estimated at 100 AFY (total from Table 4). This budget would be for a normal (average) year, in terms of precipitation and water use.

Assuming a 100 AFY average year yield, the CVGB would have a surplus of approximately 5,200 AF at the end of the 52-year period, meaning groundwater levels and groundwater in storage in the CVBG would gradually recover from any deficits that may have been created during past periods of increased historical agricultural pumping.[13]

To provide a range of values, Table 5 presents the same analysis using the lower estimates of precipitation and underflow recharge described in Sections 5.7. This baseline budget shows the CVGB to be in deficit, with a loss of approximately 4,400 AFY, resulting in a cumulative deficit of approximately 228,800 AFY over the 52-year period. Groundwater levels would be expected to lower and the volume of groundwater in storage would decrease.

[13] The 52-year period is equivalent to the Project's approximate 2-year construction period, assumed 48-year operational period, and estimated 2-year decommissioning period.

Table 4. Estimated Normal Baseline Groundwater Budget for Chuckwalla Valley Groundwater Basin

Budget Components	Acre-Feet per Year
Recharge from Precipitation[1]	8,846
Underflow from Pinto Valley and Orocopia Valley Groundwater Basins[2]	877
Mountain Front Recharge[3]	210
Irrigation Return Flow[4]	800
Wastewater Return Flow[5]	831
Total Inflow[9]	11,600
Outflow	
Groundwater Extraction[6]	–10,700
Underflow to Palo Verde Mesa Groundwater Basin[7]	–400
Evapotranspiration at Palen Dry Lake[8]	–350
Total Outflow[9]	–11,500
Budget Balance (Inflow – Outflow)[9]	100

Notes

[1] Fang et al., 2021

[2] Fang et al., 2021

[3] Fang et al., 2021

[4] CEC, 2010

[5] WorleyParsons, 2009

[6] Based on Aspen, 2021, plus extractions of existing cumulative projects.

[7] CEC, 2010

[8] CEC, 2010

[9] Due to rounding, the total does not correspond to the exact sum of all figures shown.

Table 5. Estimated Normal Baseline Groundwater Budget for the Chuckwalla Valley Groundwater Basin Using Reduced Estimates of Precipitation and Subsurface Inflow

Budget Components	Acre-Feet per Year
Recharge from Precipitation[1]	4,997
Underflow from Pinto Valley and Orocopia Valley Groundwater Basins[2]	372
Mountain Front Recharge[3]	107
Irrigation Return Flow[4]	800
Wastewater Return Flow[5]	831
Total Inflow[9]	7,100
Outflow	
Groundwater Extraction[6]	–10,700
Underflow to Palo Verde Mesa Groundwater Basin[7]	–400
Evapotranspiration at Palen Dry Lake[8]	–350
Total Outflow[9]	–11,500
Budget Balance (Inflow – Outflow)[9]	–4,400

Notes

[1] Fang et al., 2021

[2] Fang et al., 2021

[3] Fang et al., 2021

[4] CEC, 2010

[5] WorleyParsons, 2009

[6] Based on Aspen, 2021, plus extractions of existing cumulative projects.

[7] CEC, 2010

[8] CEC, 2010

[9] Due to rounding, the total does not correspond to the exact sum of all figures shown.

6.1.2 Dry Year

According to SB 610 guidelines, 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. The historical precipitation data at Blythe, California, approximately 35 miles east of the Project and at a similar elevation with similar climate, was used as a reference. Historical precipitation data for Blythe, dating from 1893 to 2014, was obtained from the U.S. Historical Climatology Network (NOAA, n.d.[b]). A nearby station at the Blythe Airport (NOAA, n.d.[a]) was used to supplement additional data for up to the year 2021.

The average annual precipitation from 1893 to 2021 at Blythe was 3.39 inches. The 10-percent probability dry year was estimated by ranking precipitation years from 1893 to 2021 from lowest to highest and giving them ranking numbers 1 to 129 with the lowest precipitation year number 1 and the highest precipitation year number 129. Dividing the ranking number by the total (129) gives a relative probability of the precipitation in any given year being less than the corresponding precipitation for the ranking number. For example, the precipitation for 2009 was 1.15 inches and ranked #13. Dividing 13 by 129 and converting to percent gives 10.1 percent. Consequently, 1.15 inches of rain, or about 34 percent of average annual precipitation at Blythe, was considered the 10 percent probability dry year. The critical dry year was estimated in the same way and found to be approximately 0.72 inches of precipitation, or 21 percent of average precipitation (reference precipitation year 2000, ranking #4 of 127 giving 3.1 percent relative probability).

This section provides a revised baseline groundwater budget based on dry year and critical dry year conditions. The following assumptions were used:

- Recharge from precipitation is the primary factor in determining the dry year groundwater budgets. Dry years produce less recharge from precipitation because less runoff would generally be expected to occur in dry years, resulting in less runoff leading to infiltration. This would depend, of course, on the pattern, intensity, and distribution of precipitation in a dry year, which is difficult to predict. The USGS *Ground-Water Recharge in the Arid and Semiarid Southwestern United State*s indicates that lower precipitation years may in general give a lower percentage of precipitation ending up as recharge, but results were reportedly inconsistent, and data presented provides no information below 3 percent (the percentage used as a basis for the infiltration rate used in this analysis) (USGS, 2007). Therefore, for the purposes of this analysis, a simplifying assumption was made that the reduction in infiltration to groundwater is in direct proportion to the reduction in precipitation. A dry year recharge is therefore estimated as 8,846 AFY multiplied by 0.34 (the ratio of dry year to average year precipitation). This calculation indicates 3,008 AFY precipitation recharge for a dry year. Similarly, a critical dry year recharge is estimated as 8,846 AFY multiplied by 0.21 (the ratio of critical dry year to average year precipitation). This calculation indicates 1,858 AFY of precipitation recharge for a critical dry year.
- Mountain front recharge is assumed to be affected proportionally to recharge from precipitation. Therefore, a dry year recharge is estimated as 210 AFY multiplied by 0.34 (the ratio of dry year to average year precipitation). This calculation indicates 71 AFY mountain front recharge for a dry year. Similarly, a critical dry year recharge is estimated as 210 AFY multiplied by 0.21 (the ratio of critical dry year to average year precipitation). This calculation indicates 44 AFY of mountain front recharge for a critical dry year.
- Underflow from the Pinto Valley and Orocopia Groundwater Basins is assumed to be unaffected by water year type. Some dry-year effect could occur, especially in the case of multiple dry years, but groundwater response would likely be delayed following a recharge event, and the magnitude of the effect reduced due to the low volume of groundwater outflowing from the basins.

- Irrigation return flow is assumed to be unaffected by water year type. The region's climate is arid with infrequent precipitation. It is assumed that any precipitation is considered de minimis when determining annual irrigation needs.
- Based on the same rationale as irrigation return flow, wastewater return flow is unaffected by water year type.
- Based on the same rationale as irrigation return flow, groundwater pumping is unaffected by water year type.
- Based on the same rationale as inflow from the Pinto Valley and Orocopia Groundwater Basins, underflow to Palo Verde Mesa Groundwater Basin is unaffected by water year type.
- ET at Palen Dry Lake is unaffected by water year type because a single dry year, or critical dry year, would result in a reduction of a maximum of 6,000 AF of recharge. Given the size of the CVGB (940 square miles) a 1-year reduction of this magnitude would reduce the average groundwater level by only about 0.14 inches (Aspen, 2021). ET could be affected by a significant, long-term groundwater deficit, but, for the purposes of this analysis, ET was assumed to remain constant.

Tables 6 and 7 provide the baseline groundwater budgets for a dry year and critical dry year. Both water budgets indicate an annual groundwater deficit, meaning groundwater outflow would exceed groundwater inflow. A dry year is expected to have a deficit of approximately 5,900 AF, increasing to 7,100 AF for a critical dry year.

Tables 8 and 9 provide the results of the same analysis using the reduced estimates of precipitation and underflow recharge. Each scenario, dry year and critical dry year, would have annual groundwater deficits, amounting to 8,000 AFY and 8,700 AFY, respectively.

Table 6. Estimated Dry Year Groundwater Budget for the Chuckwalla Valley Groundwater Basin

Budget Components	Acre-Feet per Year
Inflow	
Recharge from Precipitation	3,008
Underflow from Pinto Valley and Orocopia Valley Groundwater Basins	877
Mountain Front Recharge	71
Irrigation Return Flow	800
Wastewater Return Flow	831
Total Inflow[1]	5,600
Outflow	
Groundwater Extraction	–10,700
Underflow to Palo Verde Mesa Groundwater Basin	–400
Evapotranspiration at Palen Dry Lake	–350
Total Outflow	–11,500
Budget Balance (Inflow – Outflow)[1]	–5,900

Note

[1] Due to rounding, the total does not correspond to the exact sum of all figures shown.

Table 7. Estimated Critical Dry Year Groundwater Budget for the Chuckwalla Valley Groundwater Basin

Budget Components	Acre-Feet per Year
Inflow	
Recharge from Precipitation	1,858
Underflow from Pinto Valley and Orocopia Valley Groundwater Basins	877
Mountain Front Recharge	44
Irrigation Return Flow	800
Wastewater Return Flow	831
Total Inflow[1]	4,400
Outflow	
Groundwater Extraction	–10,700
Underflow to Palo Verde Mesa Groundwater Basin	–400
Evapotranspiration at Palen Dry Lake	–350
Total Outflow	–11,500
Budget Balance (Inflow – Outflow)[1]	–7,100

Note

[1] Due to rounding, the total does not correspond to the exact sum of all figures shown.

Table 8. Estimated Dry Year Groundwater Budget for the Chuckwalla Valley Groundwater Basin Using Reduced Estimates of Precipitation and Subsurface Inflow

Budget Components	Acre-Feet per Year
Recharge from Precipitation	1,699
Underflow from Pinto Valley and Orocopia Valley Groundwater Basins	126
Mountain Front Recharge	36
Irrigation Return Flow	800
Wastewater Return Flow	831
Total Inflow[1]	3,500
Outflow	
Groundwater Extraction	–10,700
Underflow to Palo Verde Mesa Groundwater Basin	–400
Evapotranspiration at Palen Dry Lake	–350
Total Outflow	–11,500
Budget Balance (Inflow – Outflow)[1]	–8,000

Note

[1] Due to rounding, the total does not correspond to the exact sum of all figures shown.

Table 9. Estimated Critical Dry Year Groundwater Budget for the Chuckwalla Valley Groundwater Basin Using Reduced Estimates of Precipitation and Subsurface Inflow

Budget Components	Acre-Feet per Year
Recharge from Precipitation	1,049
Underflow from Pinto Valley and Orocopia Valley Groundwater Basins	78
Mountain Front Recharge	22
Irrigation Return Flow	800
Wastewater Return Flow	831
Total Inflow[1]	2,800
Outflow	
Groundwater Extraction	–10,700
Underflow to Palo Verde Mesa Groundwater Basin	–400
Evapotranspiration at Palen Dry Lake	–350
Total Outflow	–11,500
Budget Balance (Inflow – Outflow)[1]	–8,700

Note

[1] Due to rounding, the total does not correspond to the exact sum of all figures shown.

6.1.3 Multiple Dry Years

The Blythe, California, airport precipitation data show that in the 129 years of record from 1893 to 2021, the longest consecutive series of dry (10 percent) years on record is two. There are no consecutive critical dry years on record. A 2-year string of dry years would result in a baseline groundwater deficit of twice the amount given in Table 6, or 11,800 AF. A 3-year string of dry years would result in a baseline groundwater deficit of 17,700 AF.

The longest consecutive series of years with below average precipitation on record at the Blythe, California, airport was 12 years, from 1893 to 1904. During this period, the average annual precipitation was 1.42 inches, or about 42 percent of the overall average. This period is considered to be representative of a series of multiple dry years for the purposes of this analysis.

Table 10 presents the results of an estimated 12-year groundwater budget, assuming a repeat of the 1893 to 1904 drought at Blythe, without project conditions. The results show that at the end of the 12-year period, the cumulative groundwater deficit would be approximately 60,950 AF. Table 11 shows the same analysis using the reduced estimates of precipitation and subsurface recharge. In that scenario, at the end of the 12-year period, the cumulative groundwater deficit would be approximately 87,570 AF.

Table 10. Baseline Multiple Dry Year Groundwater Budget

Year	1	2	3	4	5	6
Dry Year Reference Year	1893	1894	1895	1896	1897	1898
Precipitation (inches)	1.75	2.16	1.84	1.29	2.84	1.30
Precipitation as Percentage of Average	52%	64%	54%	38%	84%	38%
Normal Recharge from Precipitation (AF)	8,846	8,846	8,846	8,846	8,846	8,846
Dry Year Adjusted Recharge from Precipitation (AF)	4,567	5,636	4,801	3,366	7,411	3,392
Other Groundwater Recharge (All Sources) (AF)	2,718	2,718	2,718	2,718	2,718	2,718
Total Groundwater Recharge (AF)[1]	7,280	8,350	7,520	6,080	10,130	6,110
Groundwater Outflow (All Sources) (AF)	−11,500	−11,500	−11,500	−11,500	−11,500	−11,500
Budget Balance (Inflow – Outflow) (AF)	−4,220	−3,150	−3,980	−5,420	−1,370	−5,390
Cumulative Budget Balance (Inflow – Outflow) (AF)	−4,220	−7,370	−11,350	−16,770	−18,140	−23,530
Year	**7**	**8**	**9**	**10**	**11**	**12**
Dry Year Reference Year	1899	1900	1901	1902	1903	1904
Precipitation (inches)	0.75	0.56	1.21	1.12	0.88	1.33
Precipitation as Percentage of Average	22%	17%	36%	33%	26%	39%
Normal Recharge from Precipitation (AF)	8,846	8,846	8,846	8,846	8,846	8,846
Dry Year Adjusted Recharge from Precipitation (AF)	1,957	1,461	3,157	2,923	2,296	3,471
Other Groundwater Recharge (All Sources) (AF)	2,718	2,718	2,718	2,718	2,718	2,718
Total Groundwater Recharge (AF)[1]	4,680	4,180	5,880	5,640	5,010	6,190
Groundwater Outflow (All Sources) (AF)	−11,500	−11,500	−11,500	−11,500	−11,500	−11,500
Budget Balance (Inflow – Outflow) (AF)	−6,820	−7,320	−5,620	−5,860	−6,490	−5,310
Cumulative Budget Balance (Inflow – Outflow) (AF)	−30,350	−37,670	−43,290	−49,150	−55,640	−60,950

Notes

[1] Due to rounding, the total does not correspond to the exact sum of all figures shown.

AF = acre-feet

Table 11. Baseline Multiple Dry Year Groundwater Budget Using Reduced Estimates of Precipitation and Subsurface Inflow

Year	1	2	3	4	5	6
Dry Year Reference Year	1893	1894	1895	1896	1897	1898
Precipitation (inches)	1.75	2.16	1.84	1.29	2.84	1.30
Precipitation as Percentage of Average	52%	64%	54%	38%	84%	38%
Normal Recharge from Precipitation (AF)	4,997	4,997	4,997	4,997	4,997	4,997
Dry Year Adjusted Recharge from Precipitation (AF)	2,580	3,184	2,712	1,902	4,186	1,916
Other Groundwater Recharge (All Sources) (AF)	2,110	2,110	2,110	2,110	2,110	2,110
Total Groundwater Recharge (AF)[1]	4,690	5,290	4,820	4,010	6,300	4,030
Groundwater Outflow (All Sources) (AF)	−11,500	−11,500	−11,500	−11,500	−11,500	−11,500
Budget Balance (Inflow – Outflow) (AF)	−6,810	−6,210	−6,680	−7,490	−5,200	−7,470
Cumulative Budget Balance (Inflow – Outflow) (AF)	−6,810	−13,020	−19,700	−27,190	−32,390	−39,860
Year	**7**	**8**	**9**	**10**	**11**	**12**
Dry Year Reference Year	1899	1900	1901	1902	1903	1904
Precipitation (inches)	0.75	0.56	1.21	1.12	0.88	1.33
Precipitation as Percentage of Average	22%	17%	36%	33%	26%	39%
Normal Recharge from Precipitation (AF)	4,997	4,997	4,997	4,997	4,997	4,997
Dry Year Adjusted Recharge from Precipitation (AF)	1,106	825	1,784	1,651	1,297	1,960
Other Groundwater Recharge (All Sources) (AF)	2,110	2,110	2,110	2,110	2,110	2,110
Total Groundwater Recharge (AF)[1]	3,220	2,940	3,890	3,760	3,410	4,070
Groundwater Outflow (All Sources) (AF)	−11,500	−11,500	−11,500	−11,500	−11,500	−11,500
Budget Balance (Inflow – Outflow) (AF)	−8,280	−8,560	−7,610	−7,740	−8,090	−7,430
Cumulative Budget Balance (Inflow – Outflow) (AF)	−48,140	−56,700	−64,310	−72,050	−80,140	−87,570

Notes

[1] Due to rounding, the total does not correspond to the exact sum of all figures shown.

AF = acre-feet

6.2 Groundwater Budget with the Easley Renewable Energy Project and Cumulative Projects

6.2.1 Normal (Average) Year

The CVGB is assumed to be the water source for all groundwater demand (i.e., groundwater will not be imported from outside of the CVGB). Total water use by the Project will be up to 1,000 AF for the 20-month construction period, up to 50 AFY for all subsequent years of operation and decommissioning (for the purpose of this WSA, the Project operational and decommissioning periods are assumed to be 48 years and 2 years, respectively [see Section 6]).

Based on the budget balance given in Table 4, the CVGB under average-year conditions would have a cumulative surplus of 5,200 AF after the 52-year period. The net CVGB surplus with the Project in place would therefore be 1,700 AF, or 33 percent of the surplus that would exist without the Project. By contrast, using the reduced recharge rates for precipitation and underflow (see Table 5), the 52-year deficit without the Project would be 228,800 AF, increased to 232,300 AF by the Project. The Project would contribute about 2 percent to this cumulative deficit.

For a single dry year and single critical dry year with the Project in place, the worst-case scenario is for one of those year types, dry or critical dry, to occur during the construction period of the Project (assumed to be 2024 to 2025) in which up to 1,000 AF of water would be used. If a dry year or critical dry year occurs during this period, the CVGB annual deficit would be approximately 6,400 AF and 7,600 AF, respectively (see the Budget Balance rows [1,000 AF / 2 years] in Tables 6 and 7). The Project would increase the dry year and critical dry year deficit by 8 and 7 percent, respectively, if one of those year types were to occur during the construction period of the Project. Assuming normal precipitation returns, this total deficit (dry year plus Project use) would not be recovered during the 52-year period, with or without the Project.

Using reduced inflow data, the single-year deficits summarized in Tables 8 and 9 are 8,000 AF for dry and 8,700 AF for critical dry years without the Project. These deficits would increase to 8,500 and 9,200 AFY for dry and critical dry years, respectively, during the construction period of the Project (6 percent deficit increases). Assuming normal precipitation returns after the dry year or critical dry year, this deficit would not be recovered during the 52-year period, with or without the Project.

Table 12 lists cumulative projects that are planned or currently being constructed, including their projected water use. Table 12 indicates that the Project contributes approximately 2 percent of the total cumulative operational extractions. Water used for agriculture is not anticipated to increase; therefore, it was not included in the cumulative projects. Peak agriculture in the Desert Center region occurred in the mid-1980s with an estimated 5,700 acres under cultivation (GEI, 2010a). Since then, agriculture has continued to decline with an estimated 1,200 acres under cultivation in 2019 (CNRA, n.d.).

For the purpose of the CVGB water budget (see Section 6) and predictive Project water demand impacts analysis (see Sections 5.4 and 7) presented herein, projects that are operational by 2024 are assumed to have an operational period of 30 years (equal to the duration of existing ROW grants). Likewise, decommissioning water use is assumed to be equal to the project's operational water use for a duration equal to the project's construction period (assumed to be approximately 2 years). Therefore, the last year of groundwater use by the Arica Solar Project, Victory Pass Solar Project, and Oberon Project is assumed to be 2053.

Table 12. Cumulative Projects – Water Use Summary

Project Name	Construction Start (years)	Construction Duration (years)	Project Area Size (acres)	Construction Groundwater Use (AFY)	Operational Groundwater Use (AFY)	Decommissioning Groundwater Use (AFY)[3]
Lycan Solar Project[1]	2024–2025	<2	6,944	780	40	—
Calypso I Solar Project[1]	2024–2025	<2	3,271	370	40	—
Redonda Solar Project[1]	2024–2025	<2	3,483	390	40	—
Arica Solar Project	2022–2023	1.5	2,000	—	10	10
Victory Pass Solar Project	2022–2023	1.3	1,800	—	10	10
Sapphire Solar Project[1]	2024–2025	2	1,140	500	50	—
Eagle Mountain Pumped Storage Project[2]	2024–2027	4	90	4,460	2,050	—
Oberon Renewable Energy Project	2022–2023	1.75	5,000	—	40	40
Easley Renewable Energy Project	2024–2025	2	3,727	500	50	50
			Total Groundwater Use	**7,000**	**2,330**	**110**

Notes

[1] No public information on construction schedule, duration, and water usage is known. This information was calculated based on acreage of project and general solar development assumptions.

[2] On April 12, 2022, the Federal Energy Regulatory Commission issued an order granting an extension of the Eagle Mountain Pumped Storage Project construction deadlines to commence project construction by June 19, 2024, and the extended deadline to complete project construction is June 19, 2027. As no additional public information is known about the potential start date for construction of this Project, 2024 was assumed.

[3] Decommissioning water use is assumed to be equal to the project's operational water use for a duration equal to the project's construction period (assumed to be approximately 2 years).

Qualifying completed projects (i.e., operational groundwater uses only; see Section 5.8.2) are not included as Cumulative Projects. Water use associated with these projects is accounted for in the Chuckwalla Valley Groundwater Basin baseline groundwater budget (see the Groundwater Extraction row in Table 4).

AFY = acre feet per year

— = not applicable to project water budget due to project construction phase completion date or assumed project operational phase completion date.

Table 13 provides a 52-year groundwater budget projection for average years with the Project and all cumulative projects in place and assuming the Project begins using water on January 1, 2024. Only those cumulative projects that would withdraw groundwater during the assumed 2024 to 2075 period of analysis are included. Assuming average precipitation, there would be an initial groundwater deficit of 6,960 AF in the year 2024. The cumulative groundwater deficit would increase to approximately 118,420 AF by the end of the 52-year period. Without the Project and all other cumulative projects in place, there would be a surplus of 5,200 AF at the end of the 52-year period. The same analysis using reduced infiltration and underflow estimates results in a total cumulative project deficit of approximately 352,760 AF, to which the Project would contribute about 1 percent, or 3,500 AF.

As discussed in Section 5.8.2, qualifying completed projects (i.e., operational groundwater uses only) are included in the baseline groundwater budget. For the purpose of the CVGB water budget (see Section 6) and predictive Project water demand impacts analysis (see Sections 5.4 and 7) presented herein, these projects are assumed to have an operational period of 30 years (equal to the duration of existing ROW grants). Likewise, decommissioning water use is assumed to be equal to the Project's operational water use for a duration equal to the Project's construction period (assumed to be approximately 2 years). Therefore, the last year of groundwater use by the Genesis Solar Electric Plant, Desert Sunlight Solar Farm, Desert Harvest Solar Project, Athos Renewable Energy Project, and Palen Solar Project is assumed to be 2043, 2044, 2050, 2050, and 2051, respectively.

Table 13. 52-Year Projected Chuckwalla Valley Groundwater Basin Groundwater Budget for the Easley Renewable Energy Project Plus Cumulative Projects Using Adopted Precipitation and Underflow Recharge Estimates

	2024 (AF)	2025 (AF)	2026 (AF)	2027 (AF)	2028[1] (AF)	2029[1] (AF)	2030[1] (AF)	2031[1] (AF)	2032[1] (AF)	2075[1] (AF)
Arica Solar Project	10	10	10	10	10	10	10	10	10	0
Victory Pass Solar Project	10	10	10	10	10	10	10	10	10	0
Eagle Mountain Pumped Storage Project	4,460	4,460	4,460	4,460	2,050	2,050	2,050	2,050	2,050	2,050
Sapphire Solar Project	500	500	40	40	40	40	40	40	40	40
Oberon Renewable Energy Project	40	40	40	40	40	40	40	40	40	0
Lycan Solar Project	780	780	40	40	40	40	40	40	40	40
Calypso I Solar Project	370	370	40	40	40	40	40	40	40	40
Redonda Solar Project	390	390	40	40	40	40	40	40	40	40
Easley Renewable Energy Project	500	500	50	50	50	50	50	50	50	50
Total Used	7,060	7,060	4,730	4,730	2,320	2,320	2,320	2,320	2,320	2,260
CVGB Baseline Surplus	100	100	100	100	100	100	100	100	100	441
CVGB Surplus Minus Total Use	−6,960	−6,960	−4,630	−4,630	−2,220	−2,220	−2,220	−2,220	−2,220	−1,820
Cumulative CVGB Surplus/Deficit[1]	−6,960	−13,920	−18,550	−23,180	−25,400	−27,620	−29,840	−32,060	−34,280	−118,420

Notes

[1] Due to rounding, the total does not correspond to the exact sum of all figures shown.

This table begins in the year 2024 as this is the year the Easley Renewable Energy Project is planned for construction. The 52-year time period consists of the Easley Renewable Energy Project's construction, operational, and decommissioning periods.

AF = acre-feet

CVGB = Chuckwalla Valley Groundwater Basin

6.2.2 Multiple Dry Years

Table 14 provides a summary of the multiple dry year analysis using the same methods as described for Table 13, and assuming the Project plus all cumulative projects are in place. At the end of the 12-year period, representing the longest consecutive series of years with below average precipitation on record at Blythe, the cumulative groundwater deficit would be 103,040 AF. The Project would contribute 1,500 AF, approximately 1 percent, to this deficit. The same analysis, using the reduced estimates of recharge and outflow, results in a cumulative deficit of 129,740 AF. The Project would cause about 1 percent of this deficit.

The precipitation record indicates that a series of dry years has typically been followed by a series of years with above-average precipitation. To assess the probable effect of this over the 52-year life of the Project, a 52-year running average analysis was made of the 129-year precipitation period of record. This analysis, including the 52-year multiple-dry-year baseline calculation, is summarized in Tables 15 and 16.

The driest 52-year period was the period beginning in 1893 and ending in 1944. Average annual precipitation during this period was 3.44 inches, or about 1 percent greater than normal. Table 15 shows that if a repeat of this 52-year period occurs under current (no qualifying projects not already in place) conditions, at the end of the 52-year period the CVGB would have a surplus of approximately 21,060 AF assuming adopted precipitation and infiltration conditions (see Table 4). The greatest groundwater deficit during the repeated drought period would occur during 2039, in which the total deficit would be approximately 64,170 AF. Using reduced recharge data, the same analysis results in a groundwater deficit totaling approximately 214,020 AF after 52 years.

The same analysis with the Project in place but with no other cumulative projects gives similar results as Table 15 (without project conditions), with a total groundwater surplus of approximately 17,530 AF at the end of 52 years. Using reduced recharge data, the same analysis, with the Project in place, results in a groundwater deficit totaling approximately 217,520 AF after 52 years.

Table 16 provides the cumulative project analysis. With all cumulative projects in place, the CVGB total groundwater deficit at the end of the 52-year period would be approximately 112,560 AF. Using reduced recharge data, the 52-year deficit would total approximately 347,640 AF.

Table 14. Multiple Dry Year Groundwater Budget Analysis with the Easley Renewable Energy Project and All Cumulative Projects in Place, Assuming Adopted Recharge and Inflow Estimates

Year	2024	2025	2026	2027	2028	2029
Dry Precipitation Reference Year	**1893**	**1894**	**1895**	**1896**	**1897**	**1898**
Precipitation (inches)	1.75	2.16	1.84	1.29	2.84	1.30
Precipitation as Percentage of Average	52%	64%	54%	38%	84%	38%
Normal Recharge from Precipitation (AF)	8,846	8,846	8,846	8,846	8,846	8,846
Dry Year Adjusted Recharge from Precipitation (AF)	4,567	5,636	4,801	3,366	7,411	3,392
Other Groundwater Recharge (All Sources) (AF)	2,718	2,718	2,718	2,718	2,718	2,718
Total Groundwater Recharge (AF)[1]	7,300	8,400	7,500	6,100	10,100	6,100
Baseline Groundwater Outflow (AF)	−11,500	−11,500	−11,500	−11,500	−11,500	−11,500
Cumulative Project Groundwater Use (AF)	−7,060	−7,060	−4,730	−4,730	−2,320	−2,320
Total Groundwater Outflow (AF)	−18,560	−18,560	−16,230	−16,230	−13,820	−13,820
Budget Balance (Recharge + Outflow) (AF)	−11,260	−10,160	−8,730	−10,130	−3,720	−7,720
Cumulative Budget Balance (AF)	−11,260	−21,420	−30,150	−40,280	−44,000	−51,720
Year	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**
Dry Precipitation Reference Year	**1899**	**1900**	**1901**	**1902**	**1903**	**1904**
Precipitation (inches)	0.75	0.56	1.21	1.12	0.88	1.33
Precipitation as Percentage of Average	22%	17%	36%	33%	26%	39%
Normal Recharge from Precipitation (AF)	8,846	8,846	8,846	8,846	8,846	8,846
Dry Year Adjusted Recharge from Precipitation (AF)	1,957	1,461	3,157	2,923	2,296	3,471
Other Groundwater Recharge (All Sources) (AF)	2,718	2,718	2,718	2,718	2,718	2,718
Total Groundwater Recharge (AF)[1]	4,700	4,200	5,900	5,600	5,000	6,200
Baseline Groundwater Outflow (AF)	−11,500	−11,500	−11,500	−11,500	−11,500	−11,500
Cumulative Project Groundwater Use (AF)	−2,320	−2,320	−2,320	−2,320	−2,320	−2,320
Total Groundwater Outflow (AF)	−13,820	−13,820	−13,820	−13,820	−13,820	−13,820
Budget Balance (Recharge + Outflow) (AF)	−9,120	−9,620	−7,920	−8,220	−8,820	−7,620
Cumulative Budget Balance (AF)	−60,840	−70,460	−78,380	−86,600	−95,420	−103,040

Notes

[1] Due to rounding, the total does not correspond to the exact sum of all figures shown.

AF = acre-feet

Table 15. 52-Year Projected Chuckwalla Valley Groundwater Basin Groundwater Budget in Acre-Feet for Baseline (No Project) Conditions Using Adopted Precipitation and Underflow Recharge Estimates and Assuming a Repeat of the Driest 52 Years on Record at Blythe

Year	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
Precipitation Reference Year	**1893**	**1894**	**1895**	**1896**	**1897**	**1898**	**1899**	**1900**	**1901**	**1902**	**1903**	**1904**	**1905**
Precipitation (inches)	1.75	2.16	1.84	1.29	2.84	1.3	0.75	0.56	1.21	1.12	0.88	1.33	4.29
Precipitation as Percentage of Average	52%	64%	54%	38%	84%	38%	22%	17%	36%	33%	26%	39%	127%
Normal Recharge from Precipitation (AF)	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846
Adjusted Recharge from Precipitation (AF)	4,567	5,636	4,801	3,366	7,411	3,392	1,957	1,461	3,157	2,923	2,296	3,471	11,194
Other Groundwater Recharge (All Sources) (AF)	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718
Total Groundwater Recharge (AF)[1]	7,280	8,350	7,520	6,080	10,130	6,110	4,680	4,180	5,880	5,640	5,010	6,190	13,910
Non-Project Groundwater Outflow (All Sources) (AF)	−11,500	−11,500	−11,500	−11,500	−11,500	−11,500	−11,500	−11,500	−11,500	−11,500	−11,500	−11,500	−11,500
Total Groundwater Outflow (AF)	−11,500	−11,500	−11,500	−11,500	−11,500	−11,500	−11,500	−11,500	−11,500	−11,500	−11,500	−11,500	−11,500
Budget Balance (Inflow − Outflow) (AF)	−4,220	−3,150	−3,980	−5,420	−1,370	−5,390	−6,820	−7,320	−5,620	−5,860	−6,490	−5,310	2,410
Cumulative Budget Balance (Inflow − Outflow) (AF)	−4,220	−7,370	−11,350	−16,770	−18,140	−23,530	−30,350	−37,670	−43,290	−49,150	−55,640	−60,950	−58,540

Year	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049
Precipitation Reference Year	**1906**	**1907**	**1908**	**1909**	**1910**	**1911**	**1912**	**1913**	**1914**	**1915**	**1916**	**1917**	**1918**
Precipitation (inches)	2.55	2.18	3.21	5.51	4.66	3.58	4.44	4.8	5.82	3.88	3.64	1.82	6.64
Precipitation as Percentage of Average	75%	64%	95%	163%	137%	106%	131%	142%	172%	114%	107%	54%	196%
Normal Recharge from Precipitation (AF)	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846
Adjusted Recharge from Precipitation (AF)	6,654	5,689	8,376	14,378	12,160	9,342	11,586	12,525	15,187	10,125	9,498	4,749	17,327
Other Groundwater Recharge (All Sources) (AF)	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718
Total Groundwater Recharge (AF)[1]	9,370	8,410	11,090	17,100	14,880	12,060	14,300	15,240	17,900	12,840	12,220	7,470	20,040
Non-Project Groundwater Outflow (All Sources) (AF)	−11,500	−11,500	−11,500	−11,500	−11,500	−11,500	−11,500	−11,280	−11,280	−11,280	−11,280	−11,280	−11,280
Total Groundwater Outflow (AF)	−11,500	−11,500	−11,500	−11,500	−11,500	−11,500	−11,500	−11,280	−11,280	−11,280	−11,280	−11,280	−11,280
Budget Balance (Inflow − Outflow) (AF)	−2,130	−3,090	−410	5,600	3,380	560	2,800	3,960	6,620	1,560	940	−3,810	8,760
Cumulative Budget Balance (Inflow − Outflow) (AF)	−60,670	−63,760	−64,170	−58,570	−55,190	−54,630	−51,830	−47,870	−41,250	−39,690	−38,750	−42,560	−33,800

Table 15. 52-Year Projected Chuckwalla Valley Groundwater Basin Groundwater Budget in Acre-Feet for Baseline (No Project) Conditions Using Adopted Precipitation and Underflow Recharge Estimates and Assuming a Repeat of the Driest 52 Years on Record at Blythe

Year	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062
Precipitation Reference Year	**1919**	**1920**	**1921**	**1922**	**1923**	**1924**	**1925**	**1926**	**1927**	**1928**	**1929**	**1930**	**1931**
Precipitation (inches)	3.66	4.51	7.08	2.11	4.15	1.29	6.1	5.14	4.09	0.96	1.07	2.5	7.21
Precipitation as Percentage of Average	108%	133%	209%	62%	122%	38%	180%	152%	121%	28%	32%	74%	213%
Normal Recharge from Precipitation (AF)	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846
Adjusted Recharge from Precipitation (AF)	9,551	11,769	18,475	5,506	10,829	3,366	15,918	13,413	10,673	2,505	2,792	6,524	18,814
Other Groundwater Recharge (All Sources) (AF)	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718
Total Groundwater Recharge (AF)[1]	12,270	14,490	21,190	8,220	13,550	6,080	18,640	16,130	13,390	5,220	5,510	9,240	21,530
Non-Project Groundwater Outflow (All Sources) (AF)	−11,280	−11,200	−11,160	−11,160	−11,160	−11,160	−11,160	−11,160	−11,160	−11,160	−11,160	−11,160	−11,160
Total Groundwater Outflow (AF)	−11,280	−11,200	−11,160	−11,160	−11,160	−11,160	−11,160	−11,160	−11,160	−11,160	−11,160	−11,160	−11,160
Budget Balance (Inflow − Outflow) (AF)	990	3,290	10,030	−2,940	2,390	−5,080	7,480	4,970	2,230	−5,940	−5,650	−1,920	10,370
Cumulative Budget Balance (Inflow − Outflow) (AF)	−32,810	−29,520	−19,490	−22,430	−20,040	−25,120	−17,640	−12,670	−10,440	−16,380	−22,030	−23,950	−13,580
Year	**2063**	**2064**	**2065**	**2066**	**2067**	**2068**	**2069**	**2070**	**2071**	**2072**	**2073**	**2074**	**2075**
Precipitation Reference Year	**1932**	**1933**	**1934**	**1935**	**1936**	**1937**	**1938**	**1939**	**1940**	**1941**	**1942**	**1943**	**1944**
Precipitation (inches)	4.7	1.91	3.57	4.6	2.95	5.25	4.46	8.51	3.8	8.69	0.93	2.35	3.62
Precipitation as Percentage of Average	139%	56%	105%	136%	87%	155%	132%	251%	112%	256%	27%	69%	107%
Normal Recharge from Precipitation (AF)	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846
Adjusted Recharge from Precipitation (AF)	12,264	4,984	9,316	12,003	7,698	13,700	11,638	22,206	9,916	22,676	2,427	6,132	9,446
Other Groundwater Recharge (All Sources) (AF)	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718
Total Groundwater Recharge (AF)[1]	14,980	7,700	12,030	14,720	10,420	16,420	14,360	24,920	12,630	25,390	5,140	8,850	12,160
Non-Project Groundwater Outflow (All Sources) (AF)	−11,160	−11,160	−11,160	−11,160	−11,160	−11,160	−11,160	−11,160	−11,160	−11,160	−11,160	−11,160	−11,160
Total Groundwater Outflow (AF)	−11,160	−11,160	−11,160	−11,160	−11,160	−11,160	−11,160	−11,160	−11,160	−11,160	−11,160	−11,160	−11,160
Budget Balance (Inflow − Outflow) (AF)	3,820	−3,460	870	3,560	−740	5,260	3,200	13,760	1,470	14,230	−6,020	−2,310	1,000
Cumulative Budget Balance (Inflow − Outflow) (AF)	-9,760	-13,220	-12,350	-8,790	-9,530	-4,270	-1,070	12,690	14,160	28,390	22,370	20,060	21,060

Notes

[1] Due to rounding, the total does not correspond to the exact sum of all figures shown.

AF = acre-feet

Table 16. 52-Year Projected Chuckwalla Valley Groundwater Basin Groundwater Budget in Acre-Feet Using Adopted Precipitation and Underflow Recharge Estimates and Assuming a Repeat of the Driest 52 Years on Record at Blythe, with All Cumulative Projects in Place

Year	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
Precipitation Reference Year	1893	1894	1895	1896	1897	1898	1899	1900	1901	1902	1903	1904	1905
Precipitation (inches)	1.75	2.16	1.84	1.29	2.84	1.3	0.75	0.56	1.21	1.12	0.88	1.33	4.29
Precipitation as Percentage of Average	52%	64%	54%	38%	84%	38%	22%	17%	36%	33%	26%	39%	127%
Normal Recharge from Precipitation (AF)	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846
Adjusted Recharge from Precipitation (AF)	4,567	5,636	4,801	3,366	7,411	3,392	1,957	1,461	3,157	2,923	2,296	3,471	11,194
Other Groundwater Recharge (All Sources) (AF)	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718
Total Groundwater Recharge (AF)[1]	7,280	8,350	7,520	6,080	10,130	6,110	4,680	4,180	5,880	5,640	5,010	6,190	13,910
Non-Project Groundwater Outflow (All Sources) (AF)	−11,500	−11,500	−11,500	−11,500	−11,500	−11,500	−11,500	−11,500	−11,500	−11,500	−11,500	−11,500	−11,500
Project Groundwater Outflow (All Cumulative Projects) (AF)	−7,060	−7,060	−4,730	−4,730	−2,320	−2,320	−2,320	−2,320	−2,320	−2,320	−2,320	−2,320	−2,320
Total Groundwater Outflow (AF)	−18,560	−18,560	−16,230	−16,230	−13,820	−13,820	−13,820	−13,820	−13,820	−13,820	−13,820	−13,820	−13,820
Budget Balance (Inflow − Outflow) (AF)	−11,280	−10,210	−8,710	−10,150	−3,690	−7,710	−9,140	−9,640	−7,940	−8,180	−8,810	−7,630	90
Cumulative Budget Balance (Inflow − Outflow) (AF)	−11,280	−21,490	−30,200	−40,350	−44,040	−51,750	−60,890	−70,530	−78,470	−86,650	−95,460	−103,090	−103,000
Year	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049
Precipitation Reference Year	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918
Precipitation (inches)	2.55	2.18	3.21	5.51	4.66	3.58	4.44	4.8	5.82	3.88	3.64	1.82	6.64
Precipitation as Percentage of Average	75%	64%	95%	163%	137%	106%	131%	142%	172%	114%	107%	54%	196%
Normal Recharge from Precipitation (AF)	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846
Adjusted Recharge from Precipitation (AF)	6,654	5,689	8,376	14,378	12,160	9,342	11,586	12,525	15,187	10,125	9,498	4,749	17,327
Other Groundwater Recharge (All Sources) (AF)	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718
Total Groundwater Recharge (AF)[1]	9,370	8,410	11,090	17,100	14,880	12,060	14,300	15,240	17,900	12,840	12,220	7,470	20,040
Non-Project Groundwater Outflow (All Sources) (AF)	−11,500	−11,500	−11,500	−11,500	−11,500	−11,500	−11,500	−11,280	−11,280	−11,280	−11,280	−11,280	−11,280
Project Groundwater Outflow (All Cumulative Projects) (AF)	−2,320	−2,320	−2,320	−2,320	−2,320	−2,320	−2,320	−2,320	−2,320	−2,320	−2,320	−2,320	−2,320
Total Groundwater Outflow (AF)	−13,820	−13,820	−13,820	−13,820	−13,820	−13,820	−13,820	−13,600	−13,600	−13,600	−13,600	−13,600	−13,600
Budget Balance (Inflow − Outflow) (AF)	−4,450	−5,410	−2,730	3,280	1,060	−1,760	480	1,640	4,300	−760	−1,380	−6,130	6,440
Cumulative Budget Balance (Inflow − Outflow) (AF)	−107,450	−112,860	−115,590	−112,310	−111,250	−113,010	−112,530	−110,890	−106,590	−107,350	−108,730	−114,860	−108,420

Table 16. 52-Year Projected Chuckwalla Valley Groundwater Basin Groundwater Budget in Acre-Feet Using Adopted Precipitation and Underflow Recharge Estimates and Assuming a Repeat of the Driest 52 Years on Record at Blythe, with All Cumulative Projects in Place

Year	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062
Precipitation Reference Year	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931
Precipitation (inches)	3.66	4.51	7.08	2.11	4.15	1.29	6.1	5.14	4.09	0.96	1.07	2.5	7.21
Precipitation as Percentage of Average	108%	133%	209%	62%	122%	38%	180%	152%	121%	28%	32%	74%	213%
Normal Recharge from Precipitation (AF)	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846
Adjusted Recharge from Precipitation (AF)	9,551	11,769	18,475	5,506	10,829	3,366	15,918	13,413	10,673	2,505	2,792	6,524	18,814
Other Groundwater Recharge (All Sources) (AF)	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718
Total Groundwater Recharge (AF)[1]	12,270	14,490	21,190	8,220	13,550	6,080	18,640	16,130	13,390	5,220	5,510	9,240	21,530
Non-Project Groundwater Outflow (All Sources) (AF)	−11,280	−11,200	−11,160	−11,160	−11,160	−11,160	−11,160	−11,160	−11,160	−11,160	−11,160	−11,160	−11,160
Project Groundwater Outflow (All Cumulative Projects) (AF)	−2,320	−2,320	−2,320	−2,320	−2,260	−2,260	−2,260	−2,260	−2,260	−2,260	−2,260	−2,260	−2,260
Total Groundwater Outflow (AF)	−13,600	−13,520	−13,480	−13,480	−13,420	−13,420	−13,420	−13,420	−13,420	−13,420	−13,420	−13,420	−13,420
Budget Balance (Inflow – Outflow) (AF)	−1,330	970	7,710	−5,260	130	−7,340	5,220	2,710	−30	−8,200	−7,910	−4,180	8,110
Cumulative Budget Balance (Inflow – Outflow) (AF)	−109,750	−108,780	−101,070	−106,330	−106,200	−113,540	−108,320	−105,610	−105,640	−113,840	−121,750	−125,930	−117,820

Year	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075
Precipitation Reference Year	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944
Precipitation (inches)	4.7	1.91	3.57	4.6	2.95	5.25	4.46	8.51	3.8	8.69	0.93	2.35	3.62
Precipitation as Percentage of Average	139%	56%	105%	136%	87%	155%	132%	251%	112%	256%	27%	69%	107%
Normal Recharge from Precipitation (AF)	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846	8,846
Adjusted Recharge from Precipitation (AF)	12,264	4,984	9,316	12,003	7,698	13,700	11,638	22,206	9,916	22,676	2,427	6,132	9,446
Other Groundwater Recharge (All Sources) (AF)	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718
Total Groundwater Recharge (AF)[1]	14,980	7,700	12,030	14,720	10,420	16,420	14,360	24,920	12,630	25,390	5,140	8,850	12,160
Non-Project Groundwater Outflow (All Sources) (AF)	−11,160	−11,160	−11,160	−11,160	−11,160	−11,160	−11,160	−11,160	−11,160	−11,160	−11,160	−11,160	−11,160
Project Groundwater Outflow (All Cumulative Projects) (AF)	−2,260	−2,260	−2,260	−2,260	−2,260	−2,260	−2,260	−2,260	−2,260	−2,260	−2,260	−2,260	−2,260
Total Groundwater Outflow (AF)	−13,420	−13,420	−13,420	−13,420	−13,420	−13,420	−13,420	−13,420	−13,420	−13,420	−13,420	−13,420	−13,420
Cumulative Budget Balance (Inflow - Outflow) (AF)	1,560	−5,720	−1,390	1,300	−3,000	3,000	940	11,500	−790	11,970	−8,280	−4,570	−1,260

Notes

[1] Due to rounding, the total does not correspond to the exact sum of all figures shown.

AF = acre-feet

7 Cone of Depression and Cumulative Drawdown Analysis

Pursuant to BLM (2016a and 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 cumulative projects (see Table 12), a predictive MODFLOW groundwater model (Model) was developed and projected for the 52-year duration of the Project. The Model incorporated estimated inflow and outflow terms consistent with the Project water budget presented in Section 6 as well as hydrogeological properties used in the Fang et al. (2021) numerical groundwater model. A summary of the Model parameters and results is included below.

7.1 Numerical Groundwater Model Parameters and Results

In general, the Model consists of two layers, the upper layer represents the alluvium and the lower layer represents the Bouse Formation (Fang et al., 2021). The water table is typically found in the alluvium sediments throughout the CVGB where both the alluvium and Bouse Formation are productive aquifers. The elevations of the basement, or underlying bedrock were adopted from Fang et al. (2021). Mountain ranges bordering the CVGB were modeled as no-flow boundaries. The Basin's natural recharge from precipitation and mountain front runoff was modeled using the MODFLOW Recharge Package. Recharge from wastewater and agricultural return flows were modeled using the MODFLOW Well Package. Groundwater discharge from pumping was also simulated with the MODFLOW Well Package. The discharge from Palen Dry Lake was modeled with the MODFLOW Evapotranspiration Package.

Aquifer parameters are based on the previous modeling work performed by Fang et al. (2021); however, some adjustments were made to improve model calibration. In general, the hydraulic conductivity ranges from 0.3 feet per day in the central part of the Basin to 40 feet per day closer to the mountain fronts. Groundwater storage in the unconfined aquifers are modeled with a specific yield of 20 percent.

Model calibration demonstrates that the model is capable of simulating field-measured heads and flows (Anderson and Woesnner, 1992). The groundwater model is evaluated primarily on the statistical evaluation of residuals (measured minus observed groundwater elevations) in target wells across the model domain. The primary calibration goal is to achieve a relative error of less than 10 percent (ESI, 2000–2020; Spitz and Moreno, 1996). The CVGB part of the model has a relative error of 6.54 percent.

The Model was set up with monthly stress periods and simulated into the future for Project construction pumping (2 years), operational pumping (48 years), and decommissioning pumping (2 years), for a total model run time of 52 years. To assess the impact of the Project, two predictive modeling scenarios were run: a baseline scenario without Project pumping or pumping from cumulative projects (see Table 12); and a cumulative pumping scenario, which includes Project pumping and all cumulative project pumping. The difference in groundwater elevations between these two scenarios represents the cumulative impacts of the cumulative projects, including the Project.

The CVGB water budget (see Section 6) includes the period from 2024 (start of Project construction) through 2075 (end of Project decommissioning) and assumes the CVGB is in equilibrium (i.e., no groundwater deficit or surplus) at the beginning of 2024. The Model simulates the period from 2020 through 2075. The simulated field measured heads were compared to observed groundwater elevations during the period from 2020 through 2023 as part of the Model calibration. The simulated period from 2000 through 2023 includes construction and operational groundwater pumping from qualifying completed projects (see

Section 5.8.2). Therefore, the simulated 2024 conditions indicate a groundwater deficit of approximately 13,870 AF at the beginning of 2024.

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, cumulative projects, and the CVGB projected agricultural, municipal, and domestic pumping. Figures 10 and 11 present the cumulative zone of influence caused by cumulative project and Project pumping after 2 years of Project construction and 50 years of Project operation (48 years) and decommissioning (2 years), respectively. The zone of influence after 2 years of Project construction pumping (500 AFY) is an approximately 4.5-mile radius cone of depression out to 0.5 feet of drawdown. Project operational and decommissioning pumping (50 AFY) for 50 years has a cumulative drawdown with an approximately 15-mile radius out to 0.5 feet of drawdown. This zone of influence also includes pumping from cumulative projects.

The modeling results indicate that impacts to groundwater levels as a result of Project and cumulative project pumping are confined to the northwestern part of the CVGB. Although most of the non-cumulative project pumping (see Section 5.8.2) in the CVGB occurs in the northwestern part of the CVGB, total agricultural, municipal, and domestic pumping is limited, and the magnitude of the simulated drawdown is not anticipated to adversely affect existing water users and water rights claimants in the CVGB.

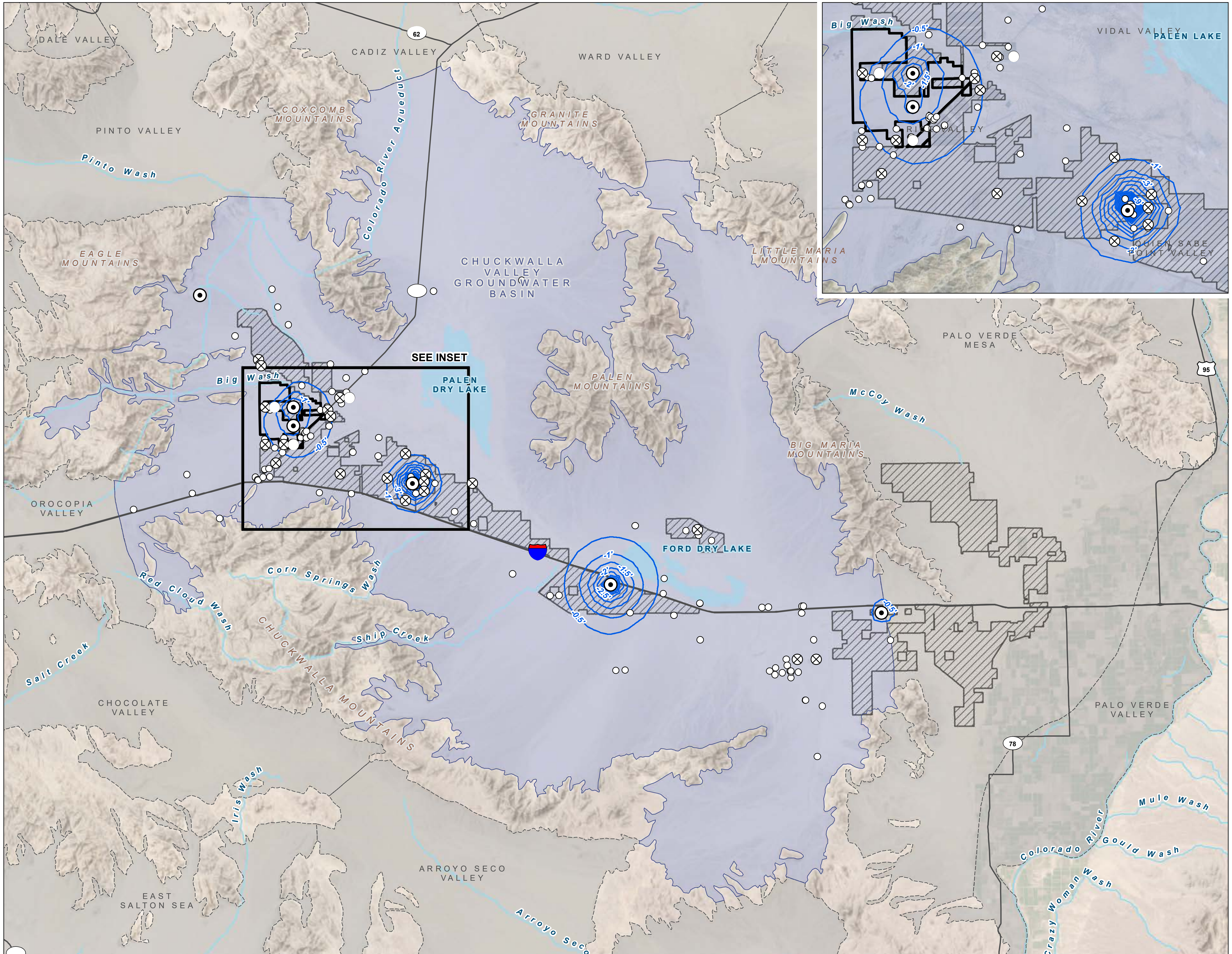

FIGURE 10

Cumulative Contributing Projects Water Demand Analysis Project Construction (End of Year 2)

Easley Renewable Energy Project Water Supply Assessment

LEGEND

Simulated Cumulative Groundwater Drawdown (in feet)

Groundwater Pumping

- Contributing Project Well
- Non-Project Well

All Other Features

- Proposed Project Boundary
- Existing Solar Project
- Chuckwalla Valley Groundwater Basin
- Adjacent Groundwater Basin
- USGS NWIS Well
- Major Road
- Watercourse
- Waterbody

NOTES

The status of the wells included in the USGS NWIS dataset is unknown.

NWIS: National Water Information System
USGS: United States Geological Survey

N

0 13,500 27,000 40,500
Feet

Date: January 10, 2024
Data Sources: ESRI, USGS, Maxar Imagery (2018), Aspen (2022), DWR

GSI Water Solutions, Inc.

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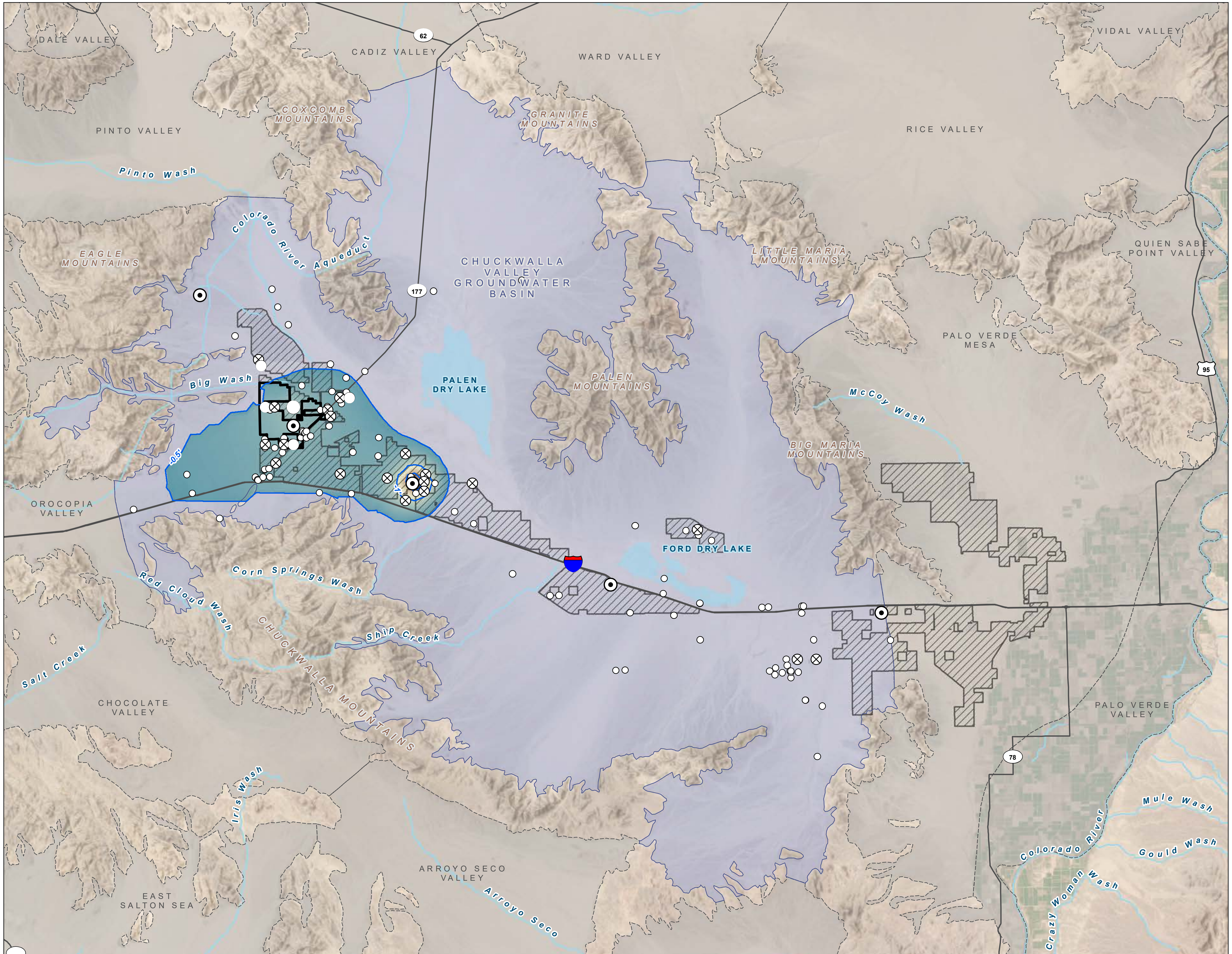

FIGURE 11

Cumulative Contributing Projects Water Demand Analysis Project Construction (End of Year 52)

Easley Renewable Energy Project Water Supply Assessment

LEGEND

Simulated Cumulative Groundwater Drawdown (in feet)

Cumulative Groundwater Drawdown (in feet)

High : -0.5

Low : -2.7

Groundwater Pumping

- Contributing Project Well
- Non-Project Well

All Other Features

- Proposed Project Boundary
- Existing Solar Project
- Chuckwalla Valley Groundwater Basin
- Adjacent Groundwater Basin
- USGS NWIS Well
- Major Road
- Watercourse
- Waterbody

NOTES

The status of the wells included in the USGS NWIS dataset is unknown.

NWIS: National Water Information System
USGS: United States Geological Survey

N

0 13,500 27,000 40,500
Feet

Date: January 10, 2024
Data Sources: ESRI, USGS, Maxar Imagery (2018), Aspen (2022), DWR

GSI Water Solutions, Inc.

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8 Conclusion

The groundwater budget amounts presented in this WSA are based on a series of hydrogeologic assumptions that could affect the reliability of the groundwater budget projections. These assumptions are based on the best available data from the sources cited in this document. The cumulative project list includes projects that are still under consideration, and which could be altered or cancelled in the future. Other projects could be proposed, and could plan to use water sources other than from the CVGB. Likewise, advances in technology could reduce project water use.

Recharge from precipitation is the primary component of the groundwater budget and is inherently challenging to calculate. The long-term average amount of recharge used in this analysis, 8,846 AFY, is based on the technical analyses conducted by Fang et al. (2021), which used the CVGB precipitation estimate of 205,376 AFY and a range of 3.4 percent to 5.6 percent as contributing to groundwater recharge. The recharge from precipitation estimate used in this analysis is 4.3 percent of the Fang et al. (2021) estimated annual Chuckwalla Valley watershed precipitation.[14] Because of the CVGB's arid climate, the overall groundwater budget is weighted heavily on the precipitation input. Previous studies have used recharge from precipitation estimates ranging from 2,060 to 11,501 AFY (Aspen, 2018; Fang et al., 2021).

Based on the use of groundwater budget terms adopted from existing publications, the CVGB's current annual groundwater recharge and outflows are almost balanced, and all estimated groundwater demand for the Project may be sourced from the CVGB without resulting in a cumulative groundwater deficit under average climatic conditions using conservative groundwater recharge estimates. The normal-year baseline groundwater budget for the CVGB indicates an annual groundwater surplus of 100 AF, which is less than the estimated water use for the construction phase of the Project, but more than the estimated water use during the operational and decommissioning phases of the Project. This would result in an initial groundwater deficit during the construction phase of the Project and a recovery of groundwater levels during the operational and decommissioning phases of the Project. Total Project groundwater use over the projected 52-year period is less than the baseline groundwater surplus for the CVGB over the same period. In accordance with DRECP LUPA, a Groundwater Monitoring, Reporting, and Mitigation Plan (GMRMP; LUPA-SW-24) would be implemented for the Project prior to the commencement of any construction activities.

Tables 15 and 16 show similar analyses without all cumulative projects in place and with all cumulative projects in place, respectively, and using the driest consecutive 52 years on record. Table 15 indicates that at the end of the 52-year period the CVGB would have a surplus of approximately 21,060 AF. The greatest groundwater deficit during the repeated period would occur during 2039, in which the total deficit would be approximately 64,170 AF. Using reduced recharge data, the same analysis results in a groundwater deficit totaling approximately 214,020 AF after 52 years. The same analysis with the Project in place but with no other cumulative projects gives similar results as Table 15, with a total groundwater surplus of approximately 17,530 AF at the end of 52 years. Using reduced recharge data, the same analysis, with the Project in place, results in a groundwater deficit totaling approximately 217,520 AF after 52 years. Table 16 provides the cumulative project analysis. With all cumulative projects in place, the CVGB total groundwater deficit at the end of the 52-year period would be approximately 112,560 AF. Using reduced recharge data, the 52-year deficit would total approximately 347,640 AF.

[14] The 5.6 percent recharge from precipitation from Fang et al. (2021) could not be used in conjunction with all of the inflow water budget components included the Project WSA. The resulting groundwater inflow estimate would have exceeded the upper bounds of the Fang et al. (2021) total recharge estimate. Therefore, the recharge from precipitation estimate used in this analysis is considered conservative and representative of CVGB conditions.

In general, historical groundwater level data show relatively stable groundwater levels in the CVGB, interrupted in the Desert Center area in the past mainly by periods of relatively intensive agricultural pumping. Historical groundwater level data from the Desert Center area indicate rising, or recovering, groundwater levels following the cessation of most agricultural usage since the 1980s (AECOM, 2010a). As mentioned above, active and proposed renewable energy projects subject to the DRECP LUPA must implement a GMRMP. These GMRMPs will provide both current and future groundwater level data for the CVGB. Based on the available historical data and the analyses discussed above, the additional proposed groundwater demand of the Project is not anticipated to exacerbate any existing overdraft conditions, nor cause significant change to the quantity of groundwater that affects beneficial uses.

BLM (2016a and 2016b) requirements state that 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 cumulative projects (see Table 12), a Model was developed and projected for the 52-year duration of the Project. The Model incorporated estimated inflow and outflow terms consistent with the Project water budget presented in Section 6 as well as hydrogeological properties used in the Fang et al. (2021) numerical groundwater model.

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, cumulative projects, and the CVGB projected agricultural, municipal, and domestic pumping. The zone of influence after 2 years of Project construction pumping (500 AFY) is an approximately 4.5-mile radius cone of depression out to 0.5 feet of drawdown. Project operational and decommissioning pumping (50 AFY) for 50 years (48 years and 2 years, respectively) has a cumulative drawdown with an approximately 15-mile radius out to 0.5 feet of drawdown. This zone of influence also includes pumping from cumulative projects. The modeling results indicate that impacts to groundwater levels as a result of Project and cumulative project pumping are confined to the northwestern part of the CVGB. Although most of the non-cumulative project pumping (see Section 5.8.2) in the CVGB occurs in the northwestern part of the CVGB, total agricultural, municipal, and domestic pumping is limited, and the magnitude of the simulated drawdown is not anticipated to adversely affect existing water users and water rights claimants in the CVGB.

Based on the simulated drawdown due to Project and cumulative project pumping, and the size and storage capacity of the CVGB, the Project is not anticipated to result in changes in water quality that affect other beneficial uses.

The Project is not anticipated to cause lowering of groundwater levels greater than recorded historical lows. There is no reported evidence of subsidence in the CVGB as a result of historic or present pumping (GEI, 2010a). Additionally, based on available data from CGPS stations located in the CVGB, Orocopia Valley Groundwater Basin, and Palo Verde Mesa (POR from 1996 through present) Groundwater Basin, no significant land subsidence has been recorded. Therefore, the Project is not anticipated to cause subsidence, increase the rate of subsidence, or cause loss of aquifer storage capacity in the CVGB.

BLM (2016a and 2016b) requirements also state that a WSA must include an analysis of “effects on groundwater dependent and groundwater discharge to surface water resources such as streams, springs, seeps, wetlands, and playas that could impact biological resources, habitat, or are culturally important to Native Americans.” Based on the analyses presented in Section 5.4, the planned cumulative solar projects will not have an adverse effect on the ability of either iodine bush or honey mesquite to access groundwater. Likewise, there are no perennial streams in CVGB and documented springs and seeps in the Project area are located in the surrounding mountains (Aspen, 2021). Therefore, no effects on groundwater discharge to surface water resources are anticipated as a result of the cumulative solar projects.

9 References

AECOM. 2010a. *Water Supply Assessment, Palen Solar Power Project, Riverside County, California*. Attachment G. California Energy Commission. January 2010.

AECOM. 2010b. Numerical Groundwater Model: Evaluation of Proposed Project Groundwater Pumping, Desert Sunlight Solar Farm Chuckwalla Valley, Riverside, Calif. Prepared by AECOM. Prepared for Desert Sunlight Holdings LLC. Appearing on pp. G-168 through G-192 of Appendix G in Desert Sunlight Solar Farm Project California Desert Conservation Area Plan Amendment and Final Environmental Impact Statement, DOI Control No. FES 10-39, NEPA Tracking No. 001-BLM-CA-060-0009-0033-EIS, CACA #48649. Prepared by Bureau of Land Management for Palm Springs–South Coast Field Office. April 2011.

AECOM. 2010c. Data Response in Technical Area: Soil and Water Resources (AFC Sections 5.12 and 5.17) Response Date: Jan. 6. Appendix J.3, “Hydrogeologic Investigation Report,” Application for Certification, Blythe Solar Power Project, Riverside, California.

AECOM. 2011. Desert Sunlight Solar Farm Project: Response to Public Comments Regarding Potential Relationship Between Groundwater Pumping Levels and Impacts to the Colorado River. Appendix O – Accounting Surface Technical Memorandum. *Desert Sunlight Solar Farm Project Final EIS and CDGA Plan Amendment*. To Bureau of Land Management, Palm Springs–South Coast Field Office. From Amanda Beck, First Solar. January 5, 2011.

Anderson, M.P. and W.W. Woessner. 1992. *Applied Groundwater Modeling— Simulation of Flow and Advective Transport*. Academic Press, Inc., San Diego, CA, 381 p.

Aspen. 2018. *Palen Solar Project Water Supply Assessment*. Appendix G of the *Final Supplemental Environmental Impact Statement/Environmental Impact Report/Land Use Plan Amendment*. Prepared by Philip Lowe, PE, Aspen Environmental Group (Aspen). Index No. BLM/CA/PL-2017/012+1793+2050, CA State Clearinghouse No. 2011054002. February 2018. https://eplanning.blm.gov/public_projects/nepa/68122/156686/191760/Appendix_G_Water_Supply_Assessment_(1).pdf.

Aspen. 2021. *Oberon Renewable Energy Project Water Supply Assessment*. Prepared for Intersect Power and IP Oberon, LLC. Prepared by Aspen Environmental Group. August 2021.

Aspen. 2022. *Plan of Development, Easley Renewable Energy Project*. Prepared for Intersect Power and IP Easley, LLC. Prepared by Aspen Environmental Group. July 2022.

BLM. 2011. *Plan Amendment/Final EIS for the Palen Solar Power Project*. U.S. Department of the Interior Bureau of Land Management. DOI Control No. FES 11-06. May 2011.

BLM. 2012. *Desert Harvest Solar Project Final Environmental Impact Statement and Proposed California Desert Conservation Area Plan Amendment*. U.S. Department of the Interior Bureau of Land Management. CACA-49491. November 2012.

BLM. 2016a. *Land Use Plan Amendment, Desert Renewable Energy Conservation Plan, Record of Decision for the Land Use Plan Amendment to the California Desert Conservation Plan, Bishop Resource Management Plan, and Bakersfield Resource Management Plan*. U.S. Department of the Interior Bureau of Land Management. September 2016.

BLM. 2016b. *Record of Decision, Desert Renewable Energy Conservation Plan, Record of Decision for the Land Use Plan Amendment to the California Desert Conservation Plan, Bishop Resource Management Plan, and Bakersfield Resource Management Plan*. U.S. Department of the Interior Bureau of Land Management. September 2016.

BLM. 2023. "Rights-of-Way, Leasing, and Operations for Renewable Energy." Department of the Interior, Bureau of Land Management. *Federal Register*, Vol. 88, No. 116 (June 16, 2023): 39726, https://www.govinfo.gov/content/pkg/FR-2023-06-16/pdf/2023-12178.pdf.

CEC. 2010. *Palen Solar Power Project, Revised Staff Assessment, Part II*. Docket Number 09-AFC-07. CEC-700-2010-007-REV-PT2. Prepared by the California Energy Commission (CEC). September 2010.

CNRA. No date. Statewide Crop Mapping. California Natural Resources Agency (CNRA). https://data.cnra.ca.gov/dataset/statewide-crop-mapping (accessed January 10, 2024).

DWR. 2004. California's Groundwater, Working Toward Sustainability: Bulletin 118, Hydrologic Region Colorado River, Chuckwalla Valley Groundwater Basin. Prepared by California Department of Water Resources (DWR).

DWR. 2015. California's Groundwater Update 2013. A Compilation of Enhanced Content for California Water Plan Update 2013. Colorado River Hydrologic Region. Prepared by California Department of Water Resources (DWR).

DWR. 2020a. Sustainable Groundwater Management Act 2019 Basin Prioritization, Process and Results. Prepared by the State of California, California Natural Resources Agency, Department of Natural Resources, Sustainable Groundwater Management Program. May 2020.

DWR. 2020b. *Draft Handbook for Water Budget Development, With or Without Models*. Prepared by the California Department of Water Resources (DWR).

ESI. 2000–2020. *Guide to Using Groundwater Vistas, version 8*. Prepared by Environmental Simulations, Inc. (ESI).

Fang, K., X. Ji, C. Shen, N. Ludwig, P. Godfrey, T. Mahjabin, and C. Doughty. 2021. *Assessing the Nexus between Groundwater and Solar-Energy Plants in a Desert Basin with a Dual-Model Approach under Uncertainty.* United States: N. p., 2023. Web. https://doi:10.2172/2229450.

GEI. 2010a. *Eagle Mountain Pumped Storage Project, Draft Environmental Impact Report*. Volume I. State Clearinghouse No. 2009011010, FERC Project No. 13123. Prepared for the State Water Resources Control Board. Prepared by GEI Consultants, Inc. (GEI). July 2010.

GEI. 2010b. *Eagle Mountain Pumped Storage Project, Draft Environmental Impact Report*. Volume III. Technical Memorandum, Appendix C. Prepared by GEI Consultants, Inc. (GEI). Prepared for the State Water Resources Control Board. July 2010.

Greer, C.B., J.J. Quinn, A.E. Carr, and B.L. O'Connor. 2013. *A Groundwater Model to Assess Water Resource Impacts at the Riverside East Solar Energy Zone*. ANL/EVS/R-13/8. Argonne National Laboratory, Environmental Science Division. Prepared for the Bureau of Land Management. December 2013.

Hamman, J.J., B. Nijssen, T.J. Bohn, D. R. Gergel, and Y. Mao. 2018. "The Variable Infiltration Capacity Model Version 5 (VIC-5): Infrastructure Improvements for New Applications and Reproducibility." *Geoscientific Model Development.* Vol. 11, 3481-96, https://doi.org/10.5194/gmd-11-3481-2018.

Hose G.C., J. Dabovic, T. Nelson, L. Pollitt, and K.L. Korbel. 2022. "Groundwater Dependent Aquatic and Terrestrial Ecosystems." Edited by T. Mehner and K. Tockner. *Encyclopedia of Inland Waters, Second Edition*, Volume 3, pages 339-347. Published by Elsevier. https://doi.org/10.1016/B978-0-12-819166-8.00118-3.

Klausmeyer K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. *Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report*. San Francisco, California.

Leake, S.A., W. Greer, D. Watt, and P. Weghorst. 2008. *Use of Superposition Models to Simulate Possible Depletion of Colorado River Water by Ground-Water Withdrawal*. Scientific Investigations Report 2008-5189. U.S. Department of the Interior, U.S. Geological Survey.

Liang, X, D.P. Lettenmaier, E.F. Wood, and S.J. Burges. 1994. "A Simple Hydrologically Based Model of Land Surface Water and Energy Fluxes for General Circulation Models." *Journal of Geophysical Research*, Vol. 99 No. D7. 14415–28.

Lichvar, R. and L. Dixon. 2007. *Wetland Plants of Specialized Habitats in the Arid West*. Prepared for U.S. Army Corps of Engineers. Cold Regions Research and Engineering Laboratory, U.S. Army Engineer Research and Development Center. June 2007.

NOAA. No date[a]. Applied Climate Information System (ACIS). NOAA Regional Climate Centers. National Oceanic and Atmospheric Administration (NOAA). https://scacis.rcc-acis.org/ (accessed January 10, 2024).

NOAA. No date[b]. Global Summary of the Year Station Details. Network ID: GHCND:USC00040924. Blythe, California. Start Date 1931-01-01, End Date 2021-01-01. National Centers for Environmental Information (NCEI), National Oceanic and Atmospheric Administration (NOAA). https://www.ncdc.noaa.gov/cdo-web/datasets/GSOY/stations/GHCND:USC00040924/detail (accessed January 10, 2024).

RWQCB. 2019. *Water Quality Control Plan for the Colorado River Basin Region (includes amendments effective on or before January 8, 2019)*. California Regional Water Quality Control Board (RWQCB), Colorado Basin Region, State Water Resources Control Board.

Shen, C., K. Fang, N. Ludwig, P. Godfrey, and C. Doughty. 2017. *Impact of Water Use by Utility-Scale Solar on Groundwater Resources of the Chuckwalla Basin, CA: Final Modeling Report*. Prepared for the U.S. Department of Energy. Prepared by the Lawrence Berkeley National Laboratory. https://escholarship.org/uc/item/1m7191xp. June 2017.

Spitz, K. and J. Moreno. 1996. *A Practical Guide to Groundwater and Solute Transport Modeling*. John Wiley & Sons, Inc., New York.

SWRCB. 2013. *Eagle Mountain Pumped Storage Project, Final Environmental Impact Report*. Prepared by the State Water Resources Control Board (SWRCB). July 2013. https://www.waterboards.ca.gov/waterrights/water_issues/programs/water_quality_cert/docs/eagle_mountain_pumped_ferc13123/eir/vol2/em_feir_3_3.pdf (accessed January 10, 2024).

SWRCB. 2020. Federal Energy Regulatory Commission (FERC) Project No. #13123. Project Name: Eagle Mountain Pumped Storage Project (Eagle Mountain Project); FERC #13123. Available at https://www.waterboards.ca.gov/waterrights/water_issues/programs/water_quality_cert/eaglemtn_ferc13123.html (accessed January 10, 2024). Last updated April 1, 2020.

Steinberg, Peter. 2001. Fire Effects Information System (FEIS), Species: Prosopis Glandulosa. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available at https://www.fs.usda.gov/database/feis/plants/tree/progla/all.html (accessed January 10, 2024).

TNC. 2020. Plant Rooting Depth Database. Prepared by The Nature Conservancy (TNC). Available for download at https://www.groundwaterresourcehub.org/where-we-work/california/plant-rooting-depth-database/.

USGS. 2007. *Ground-Water Recharge in the Arid and Semiarid Southwestern United States*. Stonestrom, D.A., J. Constantz, T.P.A. Ferré, T.P.A., and S.A. Leake, eds. U.S. Geological Survey (USGS) Professional Paper 1703.

USGS. 2013. Chuckwalla Valley Multiple-well Monitoring Site, Chuckwalla Valley, Riverside County, California. By R.R. Everett, A.A. Brown, and G.A. Smith. Prepared by the U.S. Geological Survey (USGS), in cooperation with the U.S. Bureau of Land Management, California Desert District. Open-File Report 2013–1221. October 2013.

USGS. No date. Groundwater Levels for California. U.S. Geological Survey (USGS), National Water Information Systems: Web Interface. https://nwis.waterdata.usgs.gov/ca/nwis/gwlevels/?site_no=333527114511901, https://nwis.waterdata.usgs.gov/ca/nwis/gwlevels/?site_no=333527114511902, https://nwis.waterdata.usgs.gov/ca/nwis/gwlevels/?site_no=333527114511903 (accessed January 10, 2024).

Wilson, R.P., and S.J. Owen-Joyce. 1994. *Method to Identify Wells That Yield Water That Will Be Replaced by Colorado River Water in Arizona, California, Nevada, and Utah*. U.S. Geological Survey, Water-Resources Investigations Report 94-4005. Prepared in cooperation with the U.S. Bureau of Reclamation.

WorleyParsons. 2009. *Groundwater Resources Investigation, Genesis Solar Energy Project, Riverside County, California*. Prepared for Genesis Solar, LLC. Prepared by WorleyParsons Infrastructure and Environment. January 8, 2009.