DOCKETED	
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Project Title:	Gem Energy Storage Center
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Document Title:	Section 5_15_Water Resources_Gem Energy Storage Center
Description:	This section discusses the existing water resources near the Gem Energy Storage Center (Gem), a 500-megawatt (MW) Advanced Compressed Air Energy Storage (A-CAES) system in unincorporated Kern County, near Willow Springs, California, assesses the potential effects of construction and operations on water resources, and provides mitigation strategies to address the potential effects.
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Submitter Role:	Applicant Representative
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5.15 Water Resources

This section discusses the existing water resources near the Gem Energy Storage Center (Gem), a 500-megawatt (MW) Advanced Compressed Air Energy Storage (A-CAES) system in unincorporated Kern County, near Willow Springs, California, assesses the potential effects of construction and operations on water resources, and provides mitigation strategies to address the potential effects. Section 2, Project Description of this Application for Certification (AFC) provides the overall description of the project.

The proposed project will consist of (1) using off-peak or surplus electricity from the grid to operate air compressors to create high pressured heat compressed air (2) collecting heat from compressed air and storing it in thermal management systems (3) storing air in a purpose-built storage cavern where hydrostatic compensation is used to maintain the system at a near constant air pressure during operation and (4) hydrostatic pressure forces air back to the surface where it is recombined with the stored heat and expanded through turbine generators to generate electricity on demand.

The energy storage systems store compressed air in purpose-built underground storage caverns. The storage caverns are flooded with water through a hydraulic conduit from a water storage compensation reservoir at the ground surface level. The weight of the water in this compensation reservoir maintains a near-constant air-pressure in the cavern throughout both the charging and discharging cycles, supporting efficient operation, and significantly reducing the cavern volume requirements. Two flow conduits connected to the cavern will be necessary to operate the A-CAES facility: one for the conveyance of air, the other for water. Upon completion of construction, one of the construction shafts will be repurposed and converted into the water conduit (the ventilation shaft). The water conduit will be designed for a maximum flow rate of 18 feet per second (fps) or 5.5 meters per second (m/sec)). The lower end of the water shaft will extend into a sump chamber which will be constructed below the cavern, to ensure that a water seal will be maintained at all times during operation.

This section discusses the potential effects related to the following areas:

- Water supply
- Wastewater management
- Stormwater discharge
- Flooding

Section 5.15.1 discusses the existing hydrologic environment. Potential environmental effects of the Gem construction and operation on water resources are presented in Section 5.15.2. A discussion of cumulative project effects is presented in Section 5.15.3. Section 5.15.4 discusses proposed mitigation measures that will prevent significant impacts. Section 5.15.5 presents applicable laws, ordinances, regulations, and standards (LORS) related to water resources. Section 5.15.6 describes permits that relate to water resources, lists contacts with relevant regulatory agencies, presents a schedule for obtaining permits. Section 5.15.7 provides the references used to prepare this subsection.

5.15.1 Affected Environment

The subsection discusses the water features, groundwater, water quality, and water demand and supply for the Gem project.

5.15.1.1 Water Features, Climate, and Drainage

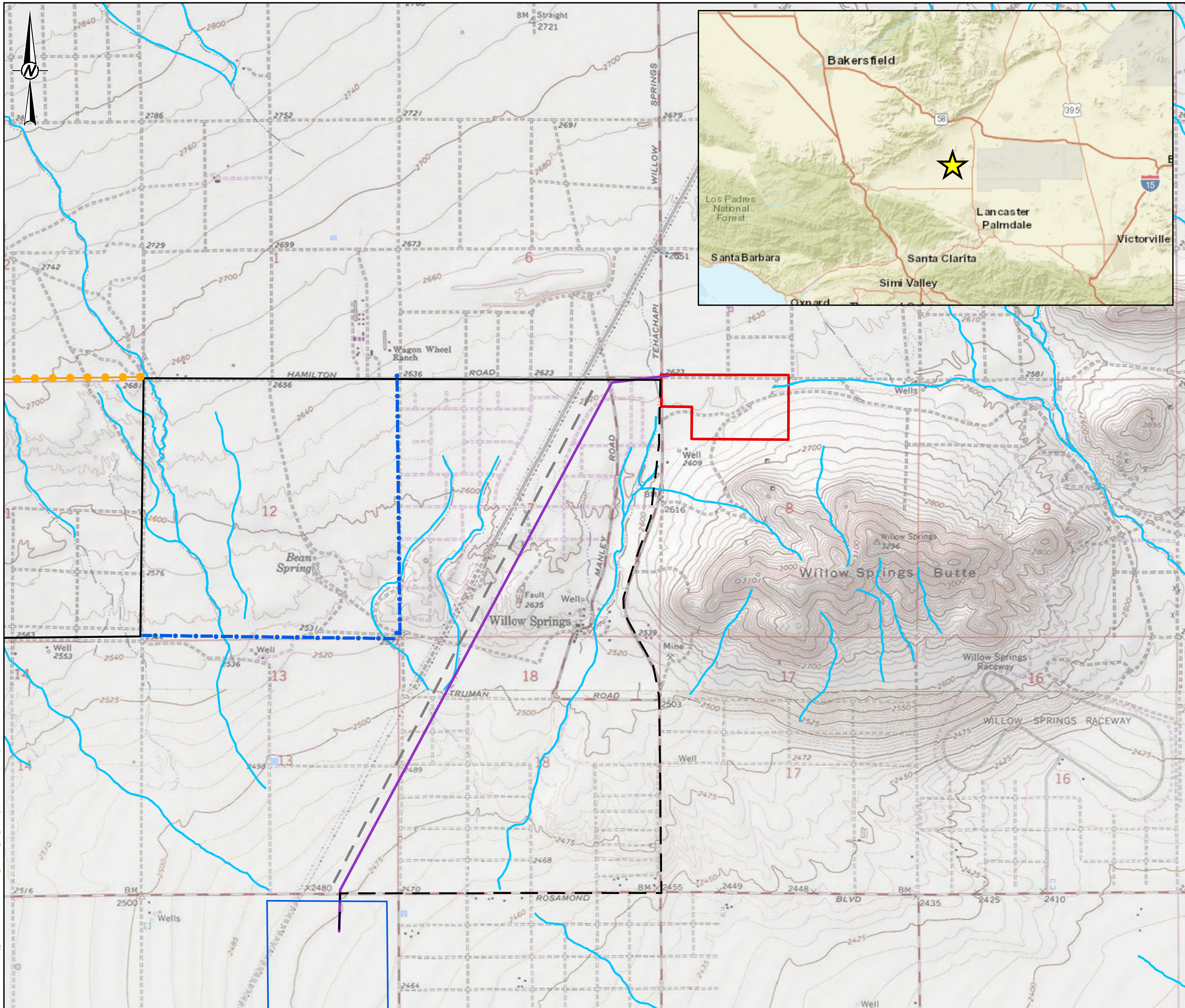
The Gem site is located at an elevation of approximately 2,620 to 2,690 feet above mean sea level (AMSL) and slopes gently to the northwest from Willow Springs Butte (United States Geological Survey (USGS) Willow Springs, California 7.5-minute topographic quadrangle map, Figure 5.15-1). The southern portion of the project site includes the base of the northwest slope of the Willow Springs Butte, which causes increased relief along this portion of the project site. The project site is located in the Willow Springs Sub-Watershed of the Antelope Valley Watershed in the western Mojave Desert (Figure 5.15-1). The Willow Springs Sub-Watershed is a closed basin where runoff from storm events primarily feed ephemeral streams that discharge to playas, where it either infiltrates or evaporates. The closest playa to the project site is Rosamond Lake. The total drainage area for the basin is approximately 4,700 acres with an elevation change greater than 2,400 feet (California Department of Water Resources 2004). Surface water does not provide a direct drinking water source by the project site.

The climate of the regional area is predominantly semiarid, characterized by a warm-dry climate. The average annual precipitation is approximately seven inches (Western Regional Climate Center Mojave Station 2020). Most of the annual precipitation occurs from November through April. The mean summer temperature is 78°F and mean daily summer temperatures range from 63° to 93°F. The mean winter temperature is 45°F and mean daily winter temperatures range from 34° to 57°F.

5.15.1.2 Groundwater

The project site is in the Antelope Valley Groundwater Basin (AVGWB) of the South Lahontan Hydrologic Region (Figure 5.15-2). The AVGWB is designated Basin Number 6-44 and covers a surface area of approximately 1,580 square miles in Los Angeles, Kern, and San Bernardino counties (California Department of Water Resources 2004, 2016). The AVGWB is composed of three large sediment-filled structural basins separated by extensively faulted, elevated consolidated material, which also form the sides and bottom of the groundwater basin (Dibblee 1967; Londquist 1993).

Generally, the consolidated material (bedrock) has little permeability and is not a viable source of groundwater. The primary water-bearing materials are Pleistocene and Holocene age unconsolidated alluvial and lacustrine deposits that consist of compact gravels, sand, silt, and clay (California Department of Water Resources 2004, 2016). Coarse alluvial deposits form the two main aquifers of the basin: a lower aquifer and an upper aquifer. Clay deposits form a zone of low permeability between the permeable alluvium of the upper aquifer and that of the lower aquifer, although leakage between the two aquifers may occur (Planert and Williams 1995). The upper aquifer, which is the primary source of groundwater for the valley, is generally unconfined whereas the lower aquifer is generally confined. Wells typically have a moderate to high yield.



LEGEND

ROUTE

- ALTERNATE 1A
- ALTERNATE 1C
- PREFERRED ROUTE 1
- PREFERRED ROUTE 2
- ALTERNATE ROUTE 2A
- LAWDP TRANSMISSION CORRIDOR
- LADWP ROSMOND SUBSTATION

WETLANDS

- FRESHWATER POND
- RIVERINE
- PROJECT SITE

0 1,000 2,000 Feet

1:24,000

REFERENCE

COORDINATE SYSTEM: NAD 1983 STATEPLANE CALIFORNIA V FIPS 0405 FEET

CLIENT
HYDROSTOR INC.

PROJECT
GEM ENERGY STORAGE CENTER

TITLE
ANTELOPE VALLEY WATERSHED

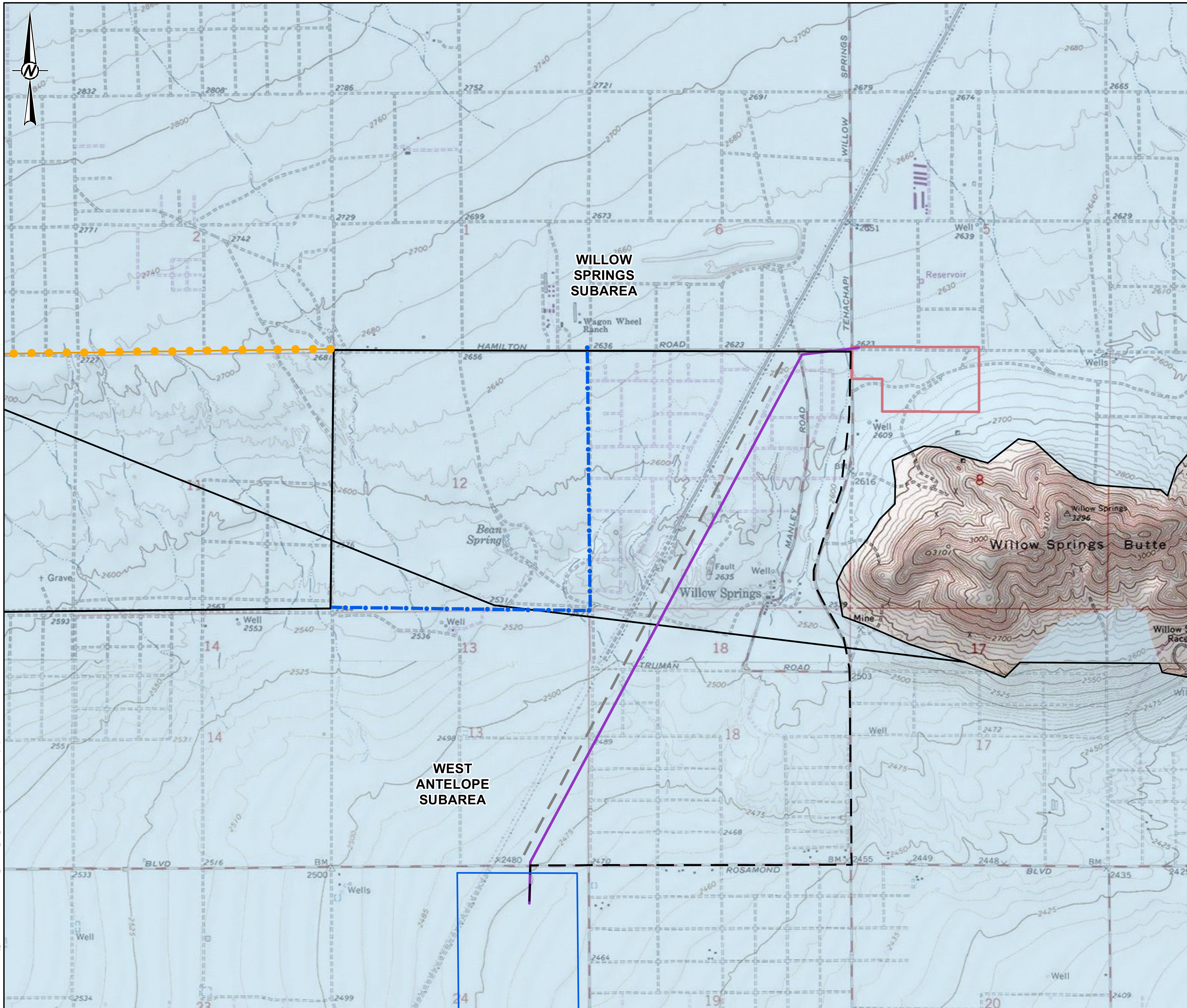
CONSULTANT

GOLDER MEMBER OF WSP

YYYY-MM-DD	2021-08-17
PREPARED	MR
DESIGN	MR
REVIEW	GW
APPROVED	GW

PROJECT No.	CONTROL	Rev.	FIGURE
20449449	---	---	5.15-1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM: ANSI B



LEGEND

ROUTE

- ALTERNATE 1A
- ALTERNATE 1C
- PREFERRED ROUTE 1
- PREFERRED ROUTE 2
- ALTERNATE ROUTE 2A
- LAWDP TRANSMISSION
- LADWP ROSMOND SUBSTATION
- MANAGEMENT SUBAREAS
- ANTELOPE VALLEY GROUNDWATER BASIN
- PROJECT SITE

0 1,000 2,000 Feet

1:24,000

REFERENCE

COORDINATE SYSTEM: NAD 1983 STATEPLANE CALIFORNIA V FIPS 0405 FEET

CLIENT
HYDROSTOR INC.

PROJECT
GEM ENERGY STORAGE CENTER

TITLE
ANTELOPE VALLEY ADJUDICATION AREA AND MANAGEMENT SUBAREAS

CONSULTANT

GOLDER MEMBER OF WSP

YYYY-MM-DD	2021-08-17
PREPARED	MR
DESIGN	MR
REVIEW	GW
APPROVED	GW

PROJECT No.	CONTROL	Rev.	FIGURE
20449449	---	---	5.15-2

Path: G:\GIS\Sites\MorroBay_Rosamond\Maps\Groundwater_Rosamond_Site_Gem\Figure5-15-2-AntelopeValleyadjacentAreas.mxd

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The AVGWB is estimated to have 68 million-to-70-million-acre feet (AF) of storage capacity (California Department of Water Resources 2016). Recharge in the AVGWB occurs mainly by runoff from the mountains (California Department of Water Resources 2004). During high runoff, the streams can overflow onto the valley floor in addition to the playa lakes, which can cause some recharge along stream channels and washes. Most recharge occurs at the foot of the mountains and hills by percolation through the head of alluvial fan systems. Other recharge sources include direct infiltration of precipitation and lateral groundwater underflow from adjacent bedrock areas and basins. Direct infiltration from precipitation is negligible because of elevated evapotranspiration rates and low yearly precipitation.

5.15.1.2.1 Groundwater Use

Groundwater in this basin is primarily used for public and domestic water supply and for irrigation purposes. Public-supply wells in Antelope Valley are completed to depths between 360 and 700 feet, consist of solid casing from the land surface to a depth of 180 to 350 feet, and are screened or perforated below the solid casing. The primary sources of discharge are pumping wells and evapotranspiration near the dry lakebeds (USGS 2013).

Based on the GAMA database review, one well is located within 0.5 miles of the project site as shown below. The blue line represents the 0.5-mile boundary in relation to the project site.

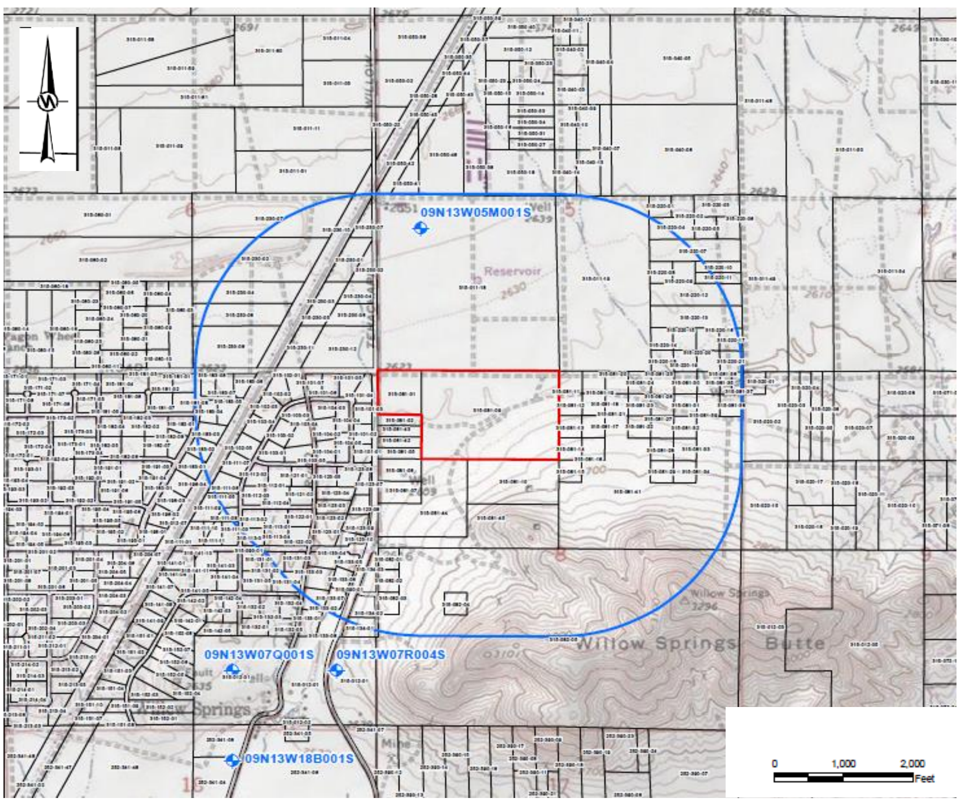


Figure 5.13-3: Groundwater Wells

Well 09N13W05M001S is located 0.5 miles to the north-northwest of the site. The well is classified as “water supply, other” and was installed in 1965 or before (GAMA 2021). The status of the well is unknown. Based on the well’s location, it is inferred to be hydraulically cross gradient of the project site. Also shown on the figure is the USGS Willow Springs, California 7.5-minute topographic quadrangle map. On the Willow Springs topographic map within 0.5 miles of the project site, one well is shown 0.2 miles to the southwest, two wells are shown 0.5 miles to the east, and one well 0.5 miles to the northeast. The status of these wells is unknown.

5.15.1.2.2 Groundwater Level and Flow

The closest identified USGS monitoring well to the project site is Well No. 344400118184501, which is located approximately 1.5 miles to the northwest of the project site. The well depth is reportedly 760.5 feet, and the land surface elevation is 2,689 feet. The depth too groundwater has been measured in this well since 1956. The most recent reported measurement was a depth to groundwater of 199.47 feet on April 29, 2020. The reported data for this monitoring well indicates that the depth to water has dropped approximately 60 feet since monitoring began (USGS 2020). However, the groundwater basin has recently been adjudicated where groundwater levels are expected to stabilize.

Groundwater flows in a southeast direction in this subarea and ultimately enters the Lancaster subunit. Prior to development, groundwater flowed from the surrounding uplands toward natural surface depressions at playa lake beds in the north (Rosamond Lake) and northeast (Rogers Lake). These natural flow directions have been re-directed locally toward pumping wells (Todd Groundwater 2020). Groundwater pumping has caused subsidence of the ground surface where, by 1992, 292 square miles of Antelope Valley had subsided more than one foot. This subsidence has permanently reduced aquifer storage by about 50,000 AF (Sneed 2000; Ikehara and Phillips 1994).

The faulting within the basin creates subbasins, designated by differences in groundwater elevations. In addition to the Garlock and San Andreas fault zones, numerous other faults within the basin impede groundwater flow (Bloyd 1996,Durbin 1978; and Carlson 1998).

5.15.1.3 Water Quality

The Regional Water Quality Control Boards (RWQCBs) make critical water quality decisions for their designated regions, including setting standards, issuing waste discharge requirements, determining compliance with those requirements, and taking appropriate enforcement actions. Federal regulations require that the Total Maximum Daily Loads (TMDL), at a minimum, account for contributions from point sources (federally permitted discharges) and contributions from nonpoint sources. TMDLs are established at the level necessary to implement the applicable water quality standards. In California, the State Water Resources Control Board (SWRCB) has interpreted state law (Porter-Cologne Water Quality Control Act, California Water Code Sections 13000 et. seq.) to require that implementation be addressed when TMDLs are incorporated into water quality control plans (Basin Plans). The Porter-Cologne Act requires each RWQCB to formulate and adopt Basin Plans for all areas within its region. It also requires that a program of implementation be developed that describes how water quality standards will be attained. TMDLs can be developed as a component of the program of implementation, thus triggering the need to describe the implementation features, or alternatively as a water quality standard. When the TMDL is established as a standard, the program of implementation must be designed to implement the TMDL.

The Gem site is within the jurisdictional boundaries of the Lahontan RWQCB. The Lahontan RWQCB Basin Plan (https://www.waterboards.ca.gov/lahontan/water_issues/programs/basin_plan/references.html) establishes water quality objectives to ensure the reasonable protection of beneficial uses and a program of implementation for achieving water quality objectives. For those waters not attaining water quality standards, the RWQCB establishes TMDLs and a program of implementation to meet the TMDL. Section 303(d) of the Clean Water Act (CWA) requires that the states make a list of waters that are not attaining water quality standards. For waters on this list, the states are to develop TMDLs. No waters of the Willow Springs Sub-Watershed are listed as impaired per Section 303(d) of the CWA.

Groundwater quality in the AVGWB is typically characterized as calcium bicarbonate near the surrounding mountains and sodium bicarbonate or sodium sulfate toward the central part of the basin (Duell 1987). Total dissolved solids (TDS), an indicator of overall total salts and mineral content, are present in the groundwater at an average concentration of 300 milligrams per liter (mg/L) and typically ranges from 200 to 800 mg/L (KJC 1995, DWR 2004, and SNMP 2014). Some localized areas can have TDS concentrations above 800 mg/L. In general, water quality shows naturally lower TDS over most of the Basin with concentrations below the Draft California Upper Secondary maximum contaminant level (MCL) of 600 mg/L (Impaired Waters List). The Salt and Nutrient Management Plan (SNMP) for the Antelope Valley includes a groundwater quality monitoring plan developed using well data from the State Water Resource Control Board (SWRCB) Groundwater Ambient Monitoring and Assessment (GAMA) program (Lahontan Water). The plan includes 23 wells owned and operated by established water utilities or the U.S. military that are located in the central and southeast portions of the AVGWB. The program supplements ongoing groundwater monitoring programs by monitoring constituents associated with management goals in the AVGWB including TDS, nitrate, chloride, arsenic, total chromium, fluoride, and boron. Data from these monitoring programs can be accessed by the Watermaster Engineer as needed to evaluate changes in key constituents of concern in local areas. (Todd Groundwater 2020). Concentrations of these constituents (including arsenic, boron, and nitrate) can be elevated locally in the AVGWB, (USGS and SWRCB 2013; KJC 1995). In general, groundwater quality meets drinking water standards and water quality management goals throughout most areas of the AVGWB (SNMP 2014).

5.15.1.4 Flooding Potential

Approximately half of the project site is located within Zone A (blue shaded) as defined by the Federal Emergency Management Agency (FEMA) as shown in Figure 5.15-4. Zone A generally indicates a one percent chance of flooding in any given year, also known as the 100-year floodplain. The 100-year floodplain levels of inundation will be considered during the design of project facilities, including the site grading and drainage plans to avoid potential flood-related impacts to the extent feasible. Should the final design contain elements that encroach on the floodplain, a floodplain permit will be obtained from Kern County to mitigate potential impacts. The floodplain permit application will include any necessary supporting studies.

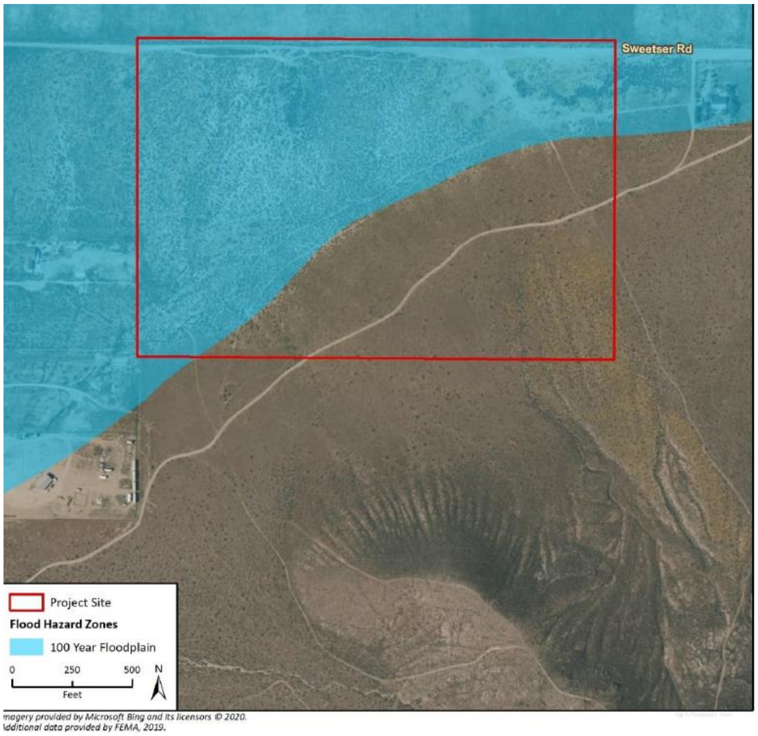


Figure 5.15-4: Flood Zone Potential

5.15.1.5 Water Supply

This subsection describes the quantity of water required, the sources of the water supply, water treatment requirements, and the water quality of the source and treated water.

5.15.1.5.1 Process Water

A breakdown of the estimated average quantity of water required for construction and operation of Gem is presented in Section 2.1.15, Water Supply and Use, in Table 2.1-1. Process water for first fill for the Gem project will be sourced by onsite groundwater and/or imported water. For ongoing operations water will mainly come from the recovery of water through (i) the compression of air, (ii) rainwater collection systems, and (iii) if needed sourced by the onsite groundwater wells and/or imported reclaimed water.

5.15.1.5.2 Construction Phase

During construction and the initial filling of the surface compensation reservoir, Gem will require approximately 1115 AF of water over 60 months. Water will be used for cavern development as well for filling the compensation reservoir. The water for cavern development will be used for shaft drilling and for operating construction equipment (rock drills). Water demand for filling the compensation reservoir will be approximately a total of 860 AF. The reservoir fill will require approximately 24 months, accounting for precipitation and evaporation. The compensation reservoir will be equipped with a cover estimated to be 90 percent effective in reducing evaporation. The estimated fill amount conservatively assumes no benefit from the cover.

The average and peak monthly construction demand are calculated by Hydrostor to be 19 AF/month and 41 AF/month, respectively. Section 5.15.2 notes that the site is in an adjudicated basin; therefore, water rights will be obtained and leased through the AV Watermaster. A native safe yield of 82,300 AFY, with a total safe yield of 110,000 AFY, was established by the AV Watermaster under the authority of the Court for the Antelope Valley Area of Adjudication. Gem is in the process of finalizing an agreement with a private entity to lease their carryover water rights to produce onsite groundwater. The entity has capacity over the quantity needed during the construction phase (see Section 5.15.5.3) Groundwater will be extracted from onsite wells at a rate that will not cause adverse effects (i.e., significant decrease in water levels) to adjoining properties.

To supplement groundwater production, Gem may also import water from offsite sources. The potential offsite sources include: the State Water Project, Antelope Valley East Kern Water Agency (AVEK), and Renewable Resources Group. Water from imported sources will be trucked to the site, as a pipeline is not available. The use of recycled water was considered from the Palmdale and Lancaster water reclamation facilities (WRFs); however, because of the distance of the WRFs to the project site, lack of existing pipeline, and current WRF permit restrictions (prohibiting sale of WRF water outside of Los Angeles County), recycled water from these facilities is not considered viable (Antelope Valley Engineering, 2012; Board Order No. R6V-2009-0141). Recycled water from Rosamond Community Service District (RCSD) wastewater treatment plant (WWTP) was also considered. The RCSD is undergoing an update that includes tertiary treatment of wastewater in order to produce reclaimed water. Water from this source is not included with the preferred alternative because of current regulations prohibiting sale of RCSD water outside of its service territory (Golder 2021). The Rosamond WWTP is included as an alternative (Section 6).

For the operations phase of the project, the yearly water balance for the facility, utilizing an average precipitation year and a facility utilization factor of 50 percent year, indicates that there will be a surplus of water of ~9.4 million gallons per year. The following table summarizes the calculated monthly volume of water in gallons.

Table 5.15-1: Yearly Water Balance

	Evap	Produced Water	Precipitation	Evap losses, wash & blowdown	Monthly Inventory (+ve = surplus, -ve = deficit)		
Month	gallons	gallons	gallons	gallons	gallons	usgal/day	usgpm
Jan	-114,049	649,429	888,095	-26,202	1,397,272	45,073	31.3
Feb	-184,783	648,002	1,302,745	-23,667	1,742,298	62,225	43.2
Mar	-256,312	783,369	582,104	-26,202	1,082,959	34,934	24.3
Apr	-396,191	784,251	205,845	-25,357	568,549	18,952	13.2
May	-540,043	944,471	62,899	-26,202	441,124	14,230	9.9
Jun	-609,188	960,498	18,348	-25,357	344,301	11,477	8.0
Jul	-683,896	1,122,986	34,365	-26,202	447,253	14,428	10.0
Aug	-635,813	1,047,182	34,067	-26,202	419,233	13,524	9.4
Sep	-470,104	987,335	88,229	-25,357	580,103	19,337	13.4
Oct	-329,033	824,445	235,563	-26,202	704,773	22,735	15.8
Nov	-189,154	636,182	206,451	-25,357	628,122	20,937	14.5
Dec	-139,879	614,838	613,818	-26,202	1,062,575	34,277	23.8
Total:	-4,548,444	10,002,989	4,272,528	-308,511	9,418,562		

Source: HDS 2021

Figure 5.15-5 depicts the results of the water balance graphically for the same operating conditions assumed above. As noted in the graph, the monthly inventory line depicts the monthly amount of excess water. This annual excess volume correlates to ~29 AFY or 9,418,562 gallons per year of non-potable recharge quality water that will be available for beneficial uses, including agriculture irrigation or aquifer recharge.

To account for monthly variations associated with the changes in climatic conditions from the average case the compensation reservoir will be used as a buffer to mitigate the requirement to draw water from the onsite groundwater wells.

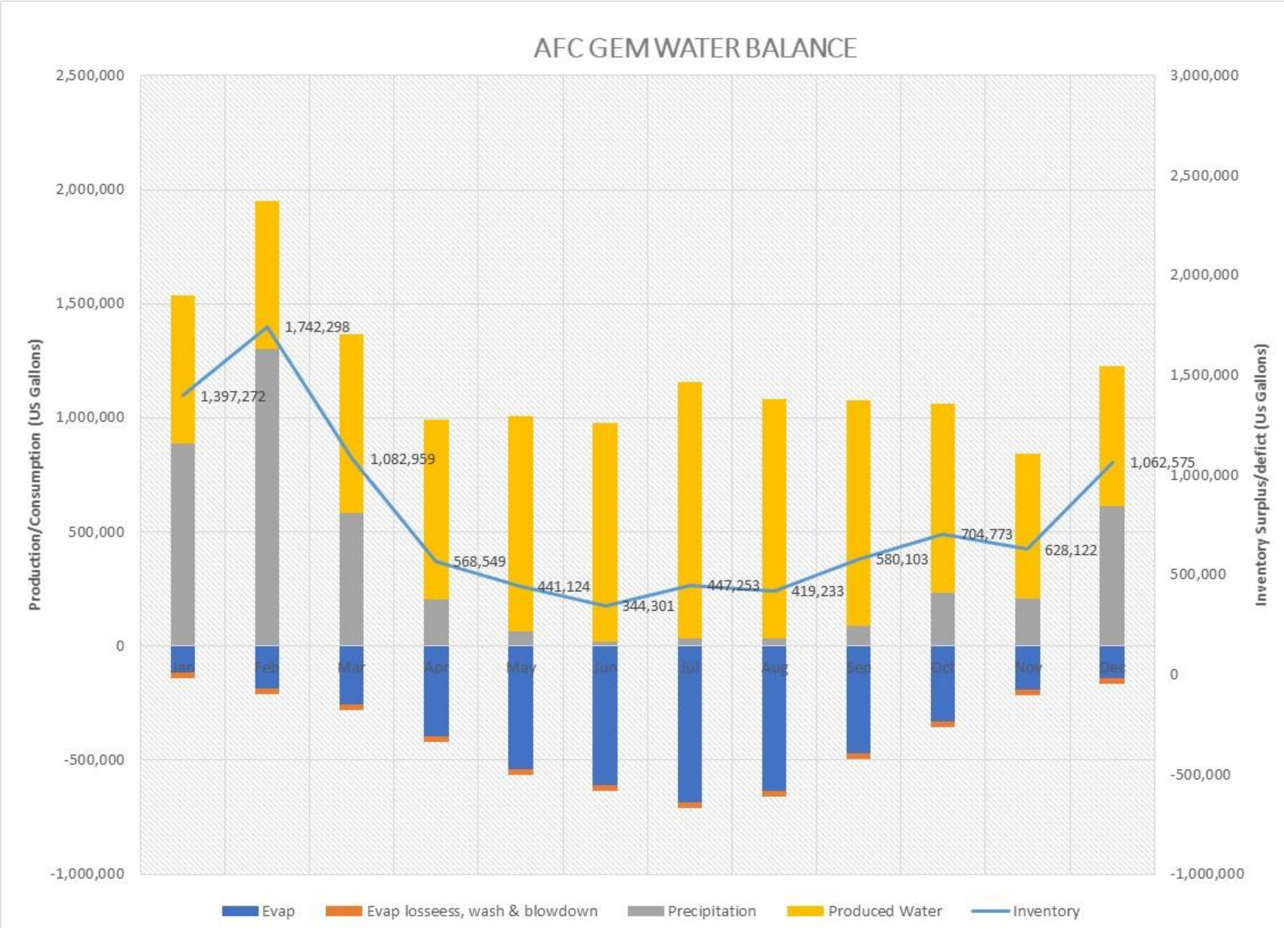


Figure 5.15-5: Water Balance

In all operating cases, the production of water from compression supersedes the anticipated consumption of water required for operations. For clarity the expected losses of water are attributed to hot and cold-water tank evaporation losses, blowdown water from the RO unit(s), and water required for facility maintenance.

Illustrated in Figure 5.15-6 is the depiction of this facility output correlated to the net water balance for all operating outputs of the facility. This figure has excluded the impacts of the reservoir evaporation and the rainwater collection, since both of these variables will contribute to excess water in the balance.

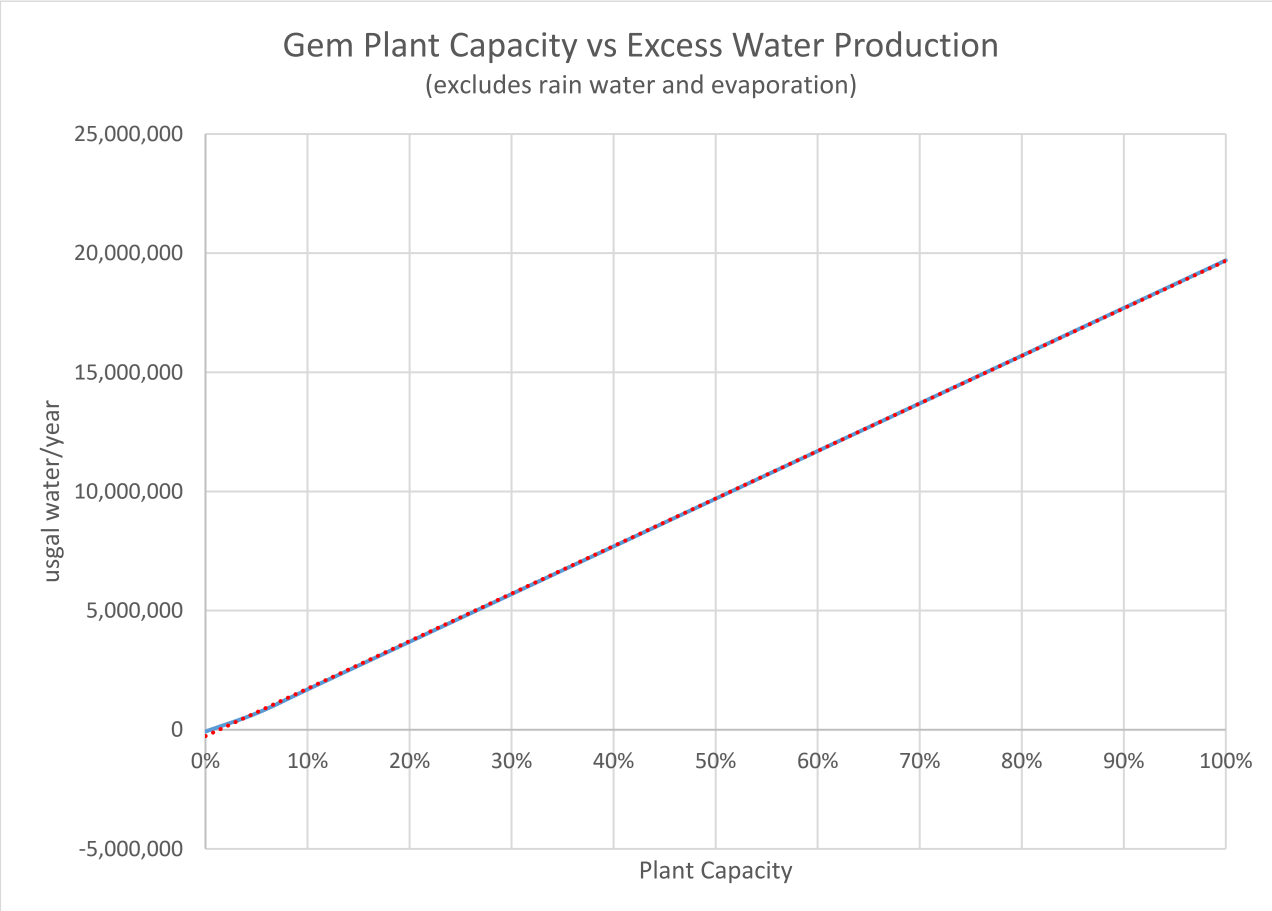
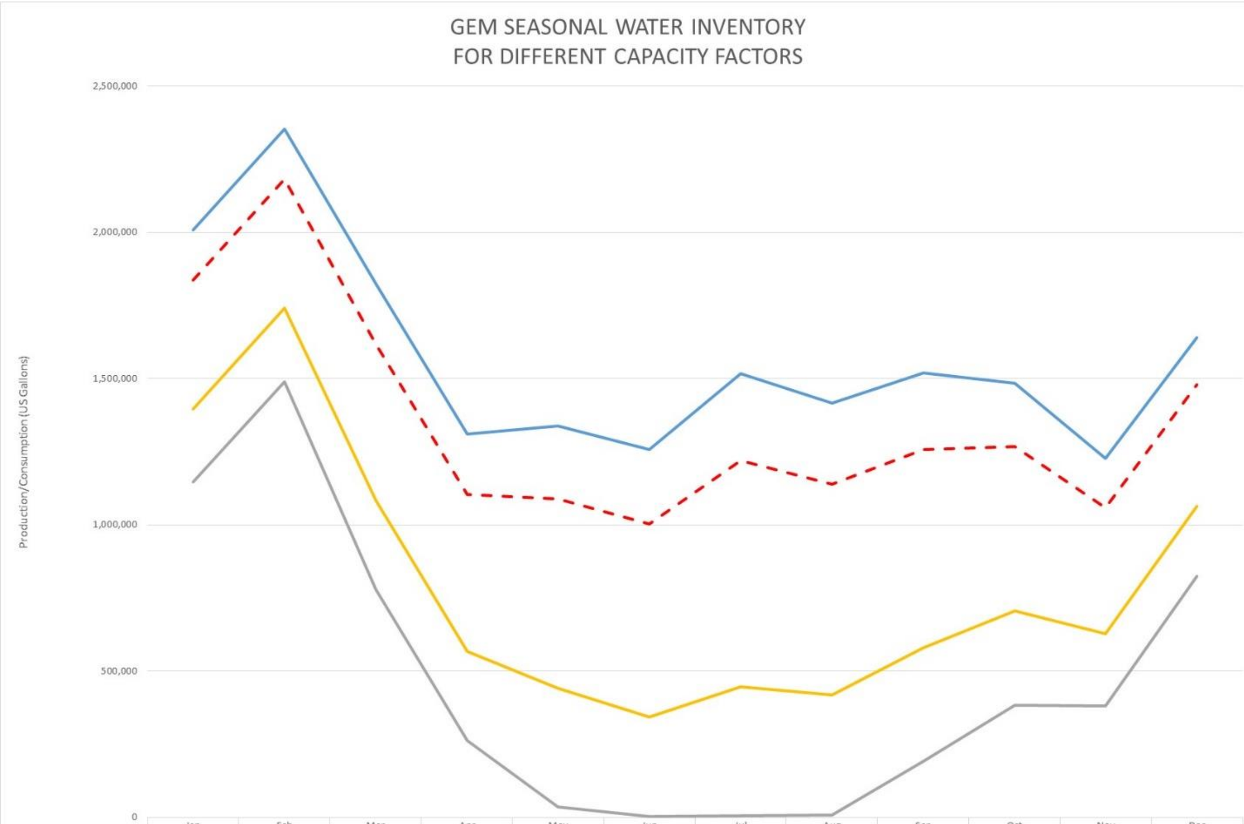


Figure 5.15-6: Plant Capacity vs Excess Water Production

As outlined above, it is expected that during the operating phase of the facility, there will be excess water generated. The total amount of excess water is predicated mainly by the utilization rate of the facility.

Figure 5.15-7 presents the excess water by month for various operating utilization rates based on an average climatic year. Excess water management will be designed based on the nameplate capacity of the facility and the utilization rate of 98.5%, which is equivalent to the facilities expected uptime.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly Inv 98.5%	2,007,476	2,353,028	1,823,084	1,310,167	1,337,519	1,256,879	1,516,807	1,415,257	1,518,712	1,484,743	1,226,114	1,639,226
Monthly Inv 85%	1,837,625	2,183,031	1,617,070	1,103,737	1,088,007	1,002,862	1,219,096	1,138,013	1,257,450	1,267,638	1,059,663	1,478,715
Monthly Inv 50%	1,397,272	1,742,298	1,082,959	568,549	441,124	344,301	447,253	419,233	580,103	704,773	628,122	1,062,575
Monthly Inv 30%	1,145,642	1,490,450	777,752	262,727	35,738	3,719	6,200	8,502	193,047	383,136	381,528	824,781

Figure 5.15-7: Seasonal Water Inventory for Various Capacity Factors

If make up water is required, the sources of the operations make-up water will be the same as the construction phase water sources.

5.15.1.5.3 Process Water Quality

Table 5.15-2 shows the expected water quality of the source water. The water quality is based on a review of available water data from groundwater wells and recycling facilities influent and effluent data (Keystone Environmental 2021). It is expected that the water quality in the reservoir will be similar to the source water provided from the groundwater well.

Table 5.15-2: Expected Source Water Quality

Parameter		Unit	Value
Alkalinity	HCO_3	mg/L	600
Ammonia	NH_3	mg/L	55
Barium	Ba	mg/L	4
Calcium	Ca	mg/L	210
Chloride	Cl	mg/L	1000
Copper	Cu	mg/L	0.3
Fluoride	F	mg/L	0.5
Hardness	$CaCO_3$	mg/L	1300
Iron	Fe	mg/L	10
Magnesium	Mg	mg/L	135
Nitrate	NO_3	mg/L	55
pH			6.5 - 8.7
Potassium	K	mg/L	10
Silica	SiO_2	mg/L	15
Sodium	Na	mg/L	300
Sulfate	SO_4	mg/L	600
Total Dissolved Solids	TDS	mg/L	1200
Turbidity		NTU	60
Zinc	Zn	mg/L	0.9

µg/L = microgram(s) per liter; mg/L = milligram(s) per liter; µS = microSiemens per centimeter; NTU = Nephelometric Turbidity Unit

5.15.1.5.4 Domestic Water Supply

Potable water will be delivered to site from a potable source and stored in a tank for use. Potable water will be provided for drinking water, kitchen use, safety showers, and eye-wash stations. Water for sanitary use during operations will be sourced from the reservoir.

5.15.1.6 Wastewater Collection, Treatment, Discharge, and Disposal

5.15.1.6.1 Construction Phase

During the construction phase of the project, water will be required for the cavern development, in particular for shaft drilling. Shaft drilling water will be provided by groundwater wells and this water will be recycled through an aboveground settling pond and re-used through the drilling process. Any wastewater will include spent drill water and groundwater inflow. A water sump will be constructed in the cavern to provide initial separation of solids and traces of hydraulic and engine oil. Further separation of any residual solids and oils is accomplished with settling in frac tanks on the surface and managed similar to the excavation wastewater as described below.

Also, through this phase, sanitary waste, stormwater runoff, equipment washdown water, hydrotest water, and dewatering activities from general construction activities will be potential wastewater waste streams. Wastewaters will be collected and managed based on the type and levels of contamination. Depending on water quality, wastewater could be considered nonhazardous or hazardous. All wastewater will be collected and disposed of off-site if it cannot be reclaimed for onsite use as outlined in Section 5.14.4.

Sanitary Waste. Portable toilets will be housed on Site during construction phase. Sanitary wastewater from portable toilets will be collected in the self-contained in the toilets. The vendor of the portable toilets will be responsible of proper handling and transporting sanitary waste offsite for disposal.

Excavation Wastewater. Excavation water streams are assumed to be nonhazardous and as such will be collected on site in temporary settlement ponds to allow for the settlement of any solids to occur. The water will be periodically tested for chemical quality. Clean water will be reused on site and the remaining water will be allowed to evaporate or infiltrate. In the event that there is too much water within the settlement water ponds, the water will be disposed off-site by third party contractor.

Stormwater. Prior to the start of construction, a stormwater permit will be obtained to outline best management practices for managing stormwater as noted in Section 15.5.2.3. Through the course of construction, stormwater will be controlled to prevent stormwater leaving the site. Water collection ponds will be established in which the water collected is expected to be nonhazardous. The collection ponds will allow for the settling of any solids to occur. The water will be periodically tested for chemical quality. To the extent feasible, water will be reused on site (including reservoir filling) and the remaining water will be allowed to evaporate or infiltrate. If there is excess water within the stormwater ponds, the water will be disposed off-site by a third-party contractor.

Nonhazardous wastewater. For all other wastewater generated, it will be managed by source reduction techniques, water conservation and reuse measures.

Sanitary Waste. Portable toilets will be housed on Site during construction phase. Sanitary wastewater from portable toilets will be collected in the self-contained in the toilets. The vendor of the portable toilets will be responsible of proper handling and transporting sanitary waste offsite for disposal.

5.15.1.6.2 Operations Phase

Gem will employ a water treatment system to treat raw and recycled feed water to the reservoir and to its process. The raw water will be used for makeup to the reservoir system, which in turn will be used for fire protection, makeup requirements for closed loop process systems and general (non-potable) needs such as equipment and surface washdown when needed. The water treatment equipment will include a media filter, ultrafiltration, reverse osmosis (RO), pH control and a chlorination system. A percentage of the RO water will be treated further to boiler feedwater quality to be used for the closed loop thermal fluid and closed loop cooling medium systems. These systems will also have a chemical treatment component for corrosion control. Minimal water will be generated from the RO backwash system. This water will be evaporated in a dry pond.

Appendix 2D includes water mass balance diagrams that illustrate the expected waste streams and describe waste stream flow rates for average and peak conditions. The proposed project has been engineered to maximize collection and recycling onsite of wastewater streams, using water treatment systems with smaller volume discharges collected in tanks for ultimate disposal by third party vendors. Industrial wastewater that could be generated from maintenance activities will be collecting in a holding tank and hauled off site by an approved waste disposal hauler to an approved disposal facility. Potable water will be purchased and trucked in stored in a potable water holding tank which will be used for bathrooms, showers, and kitchen facilities. Wastewater from potable use will be collected in a septic tank.

Wastewater (or other wastes) from occasional small equipment leaks within the building will be collected in holding tanks for testing and disposal. The shop will primarily be operated as a dry shop. Gem will not have a practice of washing down any equipment with oily residues. Equipment that has oily residues will be cleaned with rags and sorbents. Sanitary discharges will be hauled off-site by an approved waste-hauler. Wastewater from infrequent equipment washes will be collected in holding tanks (one for each combustion turbine generator) and will be hauled away by a licensed waste hauler.

Table 5.15-3 shows the blowdown water quality (expected maximum concentrations) from the Gem site.

Table 5.15-3: Blowdown Water Quality (Expected Maximum Concentrations)

Parameter		Units of Measure	Concentrate	Reject
Alkalinity	HCO_3	mg/L	1,900	10,100
Ammonia	NH_3	mg/L	170	890
Barium	Ba	mg/L	13	70
Calcium	Ca	mg/L	700	3,680
Chloride	Cl	mg/L	3,300	17,200
Copper	Cu	mg/L	0.003	1.0
Fluoride	F	mg/L	1.6	8.4
Hardness	$CaCO_3$	mg/L	3,600	18,900
Iron	Fe	mg/L	0.01	33
Magnesium	Mg	mg/L	450	2,400
Nitrate	NO_3	mg/L	160	830
pH			7-8.5	7.5-8.5
Potassium	K	mg/L	32	170
Silica	SiO_2	mg/L	49	258
Sodium	Na	mg/L	2,000	10,300
Sulfate	SO_4	mg/L	2,000	10,500
Total Dissolved Solids	TDS	mg/L	4,800	25,200

Parameter		Units of Measure	Concentrate	Reject
Turbidity		NTU	0.2	0.2
Zinc	Zn	mg/L	0.09	0.47

Source: Keystone Environmental

The water balance schematic diagrams, provided as Appendix 2D, illustrate the process flow, expected overflow streams, and describe the overflow stream flow rates for average and peak scenarios. Water for both the thermal fluid and cooling medium loops will be batch treated and stored in a water storage tank, which will allow for use on an as-needed basis. As part of this treatment, there will be a small amount of RO system reject water, which will be evaporated in a dry pond. Table 5.15-4 lists the potential wastewater that will be generated and disposed offsite.

Table 5.15-4: Potential Wastewater Generated during Operations

Waste	Origin	Composition	Estimated Amount	Classification	Disposal
Industrial wastewater	Wash down	Sediment laden water	~250 gallons per occasion	Nonhazardous	Collected in a tank for disposal
Sanitary	Domestic use	Sanitary water	2,160 gpd	Nonhazardous	Septic Tank (trucked away) and leach field

5.15.1.7 Stormwater

The project site will be developed so that stormwater from the facility is collected in centralized ponds. This stormwater will be collected by perimeter swales/culverts to prevent any water from leaving site and will be directed to onsite ponds. Prior to entry into the ponds, the water will go through an interceptor sump where solids and oils will be separated. These solids and oils will be vacuumed out as part of the maintenance regime. Water will then continue into the stormwater pond which will operate as a dry pond. The stormwater retention system capacity will be greater than the 10 year, 24-hour (5-day storm) and the 100 year, 24-hour storm (TWD 2021). The proposed site grading and drainage plan, stormwater basin design drawings and supporting calculations are provided in Appendix 5.15A.

5.15.2 Environmental Analysis

Project effects on water resources can be evaluated relative to significance criteria derived from the California Environmental Quality Act Appendix G checklist. Under the Act, the project is considered to have a potentially significant effect on water resources if it would do the following:

- Substantially alter the existing drainage pattern of the site or area, including the course of a stream or river, in a manner that will result in substantial erosion or siltation on- or offsite, or in flooding on- or offsite.
- Create or contribute runoff water that will exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff.
- Violate any water quality standards or waste discharge requirements, or otherwise substantially degrade water quality.

- Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there will be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells will drop to a level that will not support existing land uses or planned uses for which permits have been granted).
- Place structures that will impede or redirect flood flows within a 100-year flood hazard area
- Cause inundation by seiche, tsunami, or mudflow.

5.15.2.1 Water Supply

Golder completed a Water Resource Technical Study for Gem (Golder 2021). The study included consideration of water supply reliability in average, single dry, and multiple dry years based on the AV Watermaster Report. The Water Resource Technical Study concluded that supplies will be available in sufficient quantities to meet projected project demands during construction and operations. Based on the safe yield of the aquifer, historical pumping rates, and the adjudicated basin water management, limited offsite impacts are anticipated from onsite groundwater extraction. Extracted groundwater will be augmented by importing water during peak demand periods during the construction phase, as discussed in Section 5.15-2.

5.15.2.2 Wastewater Collection, Treatment, Discharge, and Disposal

The project is expected to have a surplus of water once in operations due predominantly to the strategy that the rainwater from the roofs will be collected and stored in the reservoir and that the water produced through the compression sequence will be collected and directed to the reservoir storage. Since there will be a seasonal variation associated with the production of water as well as evaporation losses, the reservoir will be designed to allow for the management of inventory of water to minimize high levels of discharge. When water is required to be discharge, clean water will be released by one of the following strategies (i) supplemental use for irrigation water in adjacent agriculture fields, (ii) reinjected into the aquifer (iii) or (iv) piped to potential end users.

There will be a small amount of blowdown water from the RO system reject this water will be evaporated in a dry pond.

Septic waste will be collected on site in holding tanks and trucked off site to an approved disposal facility in compliance with applicable LORS. An industrial wastewater discharge permit is not required because impacts related to wastewater collection, treatment, discharge, and disposal will be less than significant.

5.15.2.3 Stormwater Runoff and Drainage

Gem is located partially within Zone A (shaded) of the FEMA-designated floodplain. The site grading and drainage plans will be designed to comply with all applicable LORS to avoid potential flood-related impacts. Furthermore, as part of the site development plan, stormwater will be retained by perimeter swales and culverts to retain all stormwater on site. The collected stormwater will be centralized and through an interceptor sump as described above and the clean effluent will be allowed to flow into a dry stormwater pond, in which the water will be allowed to evaporate and/or infiltrate.

Potential water quality impacts from construction will be controlled through implementing a stormwater pollution prevention plan (SWPPP) and associated best management practices, and through practicing proper housekeeping at the construction site. The site grading and drainage will be designed to comply with all applicable LORS. Successful implementation of the SWPPP will ensure that construction impacts on water resources are mitigated to a less-than-significant level. SWPPP procedures include submitting a Notice of Intent to the Lahontan RWQCB and developing the SWPPP before the start of construction activities.

Compliance with local and regional standards and regulations will ensure Gem will have less than significant impacts on water supply, wastewater collection and disposal, stormwater runoff and flooding, and stormwater quality.

5.15.2.4 Compensation Reservoir

The surface compensation reservoir will have a capacity of approximately 565 AF with a with maximum berm height of ~40 feet from ground elevation and will be designed to be seismically stable, including preventing the formation of seiches. The compensation reservoir exceeds the jurisdictional height greater than six feet and therefore, it meets the definition of a jurisdictional dam. A reservoir is considered a jurisdictional dam per “Statutes and Regulations Pertaining to Supervision of Dams and Reservoirs", California Water Code, Division 3, Dams and Reservoirs, Part 1, Supervision of Dams and Reservoirs, Chapter 1 if the dam jurisdictional height is more than 6 feet and it impounds 50 AF or more of water, or if the dam jurisdictional height is more than 25 feet and it impounds more than 15 AF of water, unless it is exempted. As determined by the Division of Safety of Dams (DSOD), a dam is any artificial barrier used to hold back water, including reservoirs. The jurisdictional height is defined as the vertical distance measured from the lowest point at the downstream toe of the dam to its maximum storage elevation.

5.15.3 Cumulative Effects

A cumulative impact refers to a proposed project’s incremental effect together with other closely related past, present, and reasonably foreseeable future projects whose impacts may compound or increase the incremental effect of the proposed project (Public Resources Code Section 21083; Title 14 California Code of Regulations, Sections 15064[h], 15065[c], 15130, and 15355). Existing land uses surrounding the project site include agriculture, solar and wind generating facilities, open space, and rural residential. The area to the southeast of the site, including Willow Springs Butte, is public land administered by the U.S. Department of the Interior Bureau of Land Management. There are no significant approved projects to be constructed or under construction near the site.

Local and regional standards and regulations have been developed to address regional impacts to water resources such as the cumulative water quality impacts associated with stormwater discharges. The AV Watermaster provides a mechanism to ensure sufficient water is available to allow new projects to be developed (see Section 5.15.2.1). Additionally, Gem will have a positive direct and/or indirect effect on groundwater annual yield during the operations phase as a surplus of water will be available for beneficial uses, including agriculture irrigation or aquifer recharge. For these reasons, there will be no significant cumulative impacts to water supply and compliance with local and regional standards and regulations ensure that Gem will not result in significant cumulative impacts.

5.15.4 Mitigation Measures

The project will mitigate for potential adverse impacts by complying with the requirements of applicable LORS (described in Section 5.15-5). Therefore, no mitigation other than compliance with permit conditions will be required.

5.15.5 Laws, Ordinances, Regulations, and Standards

Federal and state LORS applicable to water resources and anticipated compliance are discussed in this subsection and are summarized in Table 5.15-5.

Table 5.15-5: LORS of Water Resources

LORS	Requirements	Lead Agency	Application for Certification Section Explaining Conformance
Federal			
CWA/Water Pollution Control Act. 1972, amended by Water Quality Act of 1987 P.L. 100-4 (33 Federal Code 466 et seq.) NPDES (CWA, Section 402)	Prohibits discharge of pollutants to receiving waters unless the discharge is in compliance and authorized via a NPDES permit. Applies to all point-source discharges. Applied\s to nonpoint sources through municipal NPDES permits.	Lahontan RWQCB	Compliance with existing state NPDES general construction permit for stormwater (Section 5.15.1.7)
	UIP	EPA	Section 5.15.5.1
State			
Federal CWA (implemented by State of California)	Implements and enforces the federal NPDES permit program.	Lahontan RWQCB	Compliance with existing state NPDES general construction permit for stormwater (Section 5.15.1.7)
Porter-Cologne Water Quality Control Act	Controls discharge of wastewater to surface water and groundwater of California.	Lahontan RWQCB	
California Water Code, Division 3, Dams and Reservoirs, Part 1	Jurisdictional dam oversight	DSOD	5.15.5.2.5
Local			
Kern County General Plan Policy 41 and Water Code Section 10910(b)	Development standards for stormwater quality control, waste supplies, and flood protection. Review of adequate water supply.	Kern County Engineering Department	5.15.5.3
	Kern County Development Specification, Division Four, Standards for Drainage and the Kern County Hydrology Manual.	Kern County Planning Department	
Kern County	Well Permit Application and Water Supply Certificate	Kern County Environmental Health Division Water Wells Program	
	Water production rights	AV Watermaster	5.15.5.3

5.15.5.1 Federal LORS

In California, discharges of wastewater and stormwater into surface waters are regulated by SWRCB and RWQCBs under the CWA and the Porter-Cologne Water Quality Control Act. Relevant NPDES permits for stormwater quality management are discussed in Section 5.15.5.2.

The United States Environmental Protection Agency (EPA) oversees the Underground Injection Control (UIC) Program. The UIC program consists of six classes of injection wells. Each well class is based on the type and depth of the injection activity, and the potential for that injection activity to result in endangerment of an underground source of drinking water (USDW). UIC regulations mandate the consideration of a variety of measures to assure that injection activities will not endanger USDWs. The concept of endangerment is defined in code of federal regulations (40 CFR 144.12). Section 144.12 Prohibition of movement of fluid into underground sources of drinking water:

a) No owner or operator shall construct, operate, maintain, convert, plug, abandon, or conduct any other injection activity in a manner that allows the movement of fluid containing any contaminant into underground sources of drinking water, if the presence of that contaminant may cause a violation of any primary drinking water regulation under 40 CFR part 142 or may otherwise adversely affect the health of persons.

Based on consultation with the EPA's UIC Program office, an UIC permit is not required if the system is a closed loop where the caverns and associated shafts from the surface to the caverns are lined such that there would be no fluid communication (either air or water) with the external environment. Characterization of the surrounding bedrock of the cavern system will be conducted to demonstrate that the rock mechanics are sufficient to provide a hydraulicly isolated system with performance standards equivalent to lining. If the unlined cavern will function similarly to a lined cavern and behave as a closed loop system where water temporarily placed in the cavern during the power generation cycle will not be injected into the surrounding formation, then the caverns may not be lined.

An unlined cavern may be considered by EPA to be a *Class V Wells for Injection of Non-Hazardous Fluids into or Above Underground Sources of Drinking Wate*r. Examples of Class V wells include stormwater, drainage wells, septic system leach fields and agricultural drainage wells. Examples of complex Class V wells include aquifer storage and recovery wells, geothermal electric power wells, and deep injection wells for salinity control.

The EPA has established the following minimum requirements to prevent injection wells from contaminating underground sources of drinking water (USDWs). In most cases Class V wells are "authorized by rule." "Authorized by rule" means that an injection well may be operated without a permit as long as the owners or operators:

- Submit inventory information to their permitting authority and verify that they are authorized (allowed) to inject. The permitting authority will review the information to be sure that the well will not endanger a USDW.
- Operate the wells in a way that does not endanger USDWs. The permitting authority will explain any specific requirements.
- Properly close their Class V well when it is no longer being used. The well should be closed in a way that prevents movement of any contaminated fluids into USDWs.

After reviewing an owner or operator's inventory information the EPA may determine that an individual permit is necessary to prevent USDW contamination (https://www.epa.gov/uic/federal-requirements-class-v-wells).

Gem will establish that the lined or unlined cavern system and associated process water will not contaminate the aquifer or impact any USDW.

In California, the Water Board would also be involved with any water injection into the formation under Waste Discharge Requirements.

5.15.5.2 State LORS

5.15.5.2.1 California Porter-Cologne Water Quality Control Act

The Porter-Cologne Water Quality Control Act (California Water Code, Division 7) is the state law governing water quality of all state waters, including both surface waters and groundwater. Under the Porter-Cologne Water Quality Control Act, SWRCB has the ultimate authority over water quality policy on a state-wide level, and nine RWQCBs establish and implement water quality standards specific for each respective region. The Lahontan RWQCB regulates water quality in the project area, jointly implementing the federal CWA and the state Porter-Cologne Water Quality Control Act.

5.15.5.2.2 NPDES Permit for Wastewater and Municipal Discharges

There will be no wastewater discharges to a surface waters or municipal sewer system during the construction or operation phases of the project; therefore, a site-specific NPDES permit is not required.

5.15.5.2.3 NPDES Construction Stormwater Permit

The federal CWA effectively prohibits discharges of stormwater from construction sites unless the discharge is in compliance with an NPDES permit. SWRCB is the permitting authority in California and has adopted a statewide General Permit for Stormwater Discharges Associated with Construction Activity (SWRCB Water Quality Order No. 99-08-DWQ]) that applies to projects resulting in one acre or more of soil disturbance. The proposed project will result in disturbance of more than one acre of soil. Therefore, the project will require the preparation of a construction SWPPP that will specify site management activities to be implemented during site development. These management activities will include construction stormwater best management practices, dewatering runoff controls, and construction equipment decontamination. The RWQCB requires a Notice of Intent to be filed before any stormwater discharge from construction activities, and it requires that the SWPPP be implemented and maintained onsite. A Construction Drainage Erosion and Sediment Control Plan/SWPPP will be completed before the beginning of construction activities.

5.15.5.2.4 NPDES Stormwater Industrial General Permit

There will be no industrial stormwater discharges during the operation phases of the project; therefore, a NPDES Stormwater Industrial General Permit is not required.

Should the site design be modified where industrial stormwater or process water will be discharged, a NPDES permit will be required.

5.15.5.2.5 DSOD Permit

The surface compensation reservoir will be considered a jurisdictional dam under the oversight of the DSOD. A permit application will be submitted to the DSOD for approval prior to construction of the compensation reservoir.

5.15.5.3 Local LORS

Kern County is the lead review agency as defined by both the Water Code Section 10910(b) and Kern County General Plan Policy 41. Kern County General Plan Policy 41 requires a review of all development proposals within the county to ensure adequate water is available, protect water supplies for projected growth, and review of new high consumptive uses for adequate waste supplies in addition to groundwater. The project site is not located within the service area of a public water system as defined by the Water Code and the AVGWB is adjudicated and under the authority of the AV Watermaster.

The adjudication provides a framework to sustainably manage the basin and reduce groundwater level declines and subsidence. The adjudication defined the boundaries of the groundwater basin, considered hydraulic connection throughout the basin, established the safe yield, and quantified groundwater production. The Final Judgment of the adjudication was entered on December 23, 2015. The Final Judgment identified a state of overdraft, established respective water rights among groundwater producers, and ordered a ramp down of production to the native basin safe yield. The project must source water in compliance with adjudication requirements and groundwater use will need to be obtained through adjudicated water rights.

A native safe yield of 82,300 AFY, with a total safe yield of 110,000 AFY, was established for the AVGWB. The project's total water demand for the construction phase and the operations and maintenance phase represents less than 0.3% and 0.07% of the annual total safe yield of the AVGWB, respectively. It will be the responsibility of the water purveyor to ensure the quantity provided to the customer project site does not exceed safe Productions Right and the annual safe yield.

Production rights will be purchased and a new production well application will be submitted to the AV Watermaster for approval. A new well is any well that does not presently exist but is proposed to be constructed. Prior to approval of a well application, the Watermaster Board must make the following findings:

- Applicant has a known right to produce groundwater under the Judgment, or qualifies as an unknown small pumper, or is a non-pumper with no pumping rights but agrees to purchase replacement water.
- Applicant with a right to produce groundwater requests a replacement well (within 300 feet of an existing well) or a new well from a new point of extraction; or
- Applicant is a non-pumper with no pumping rights and requests a well for new production; or applicant requests a non-production well.

It must be demonstrated that the Applicant's well will not cause Material Injury as defined by the Judgment and the Rules and Regulations. The forms associated with these types of well applications are available on the AV Watermaster website: https://avwatermaster.net; select forms are also included as Appendix 15.5B:

- Small Pumper Qualifying Documentation
- Replacement Well Application
- Non-Production Well Application
- New Point of Extraction Application
- New Production Application
- Transfer Application

Based on the characteristics of the groundwater basin, there would be sufficient capacity to provide groundwater to the project site without causing Material Injury. Well owners that have Production Rights are listed in the AV Watermaster Annual Reports. The list from 2019 is included as Appendix 15.5B. Additionally, the AV Watermaster maintains a transfer bulletin on their website (https://avwatermaster.net/transfer-bulletin/) where interested parties can post inquiries to sell or purchase water production rights, including carryover water. As of June 11, 2021, Steve Selak has 2,600 AF of water for sale as a temporary transfer. Mr. Selak indicated that the water is available for the project. Therefore, adequate supply has been identified with a party that has carryover Production Rights in a quantity that exceeds the construction and operation demands. An agreement is in the process of being executed with Mr. Selak.

Additionally, to supplement groundwater production, if needed, during peak monthly demand during the construction phase, Gem will purchase and import water from sources, including the state water project, AVEK, or Renewable Resources Group.

New groundwater production or monitoring wells will also need to be permitted with the Kern County Environmental Health Division Water Wells Program. The Water Wells Program issues permits to construct, reconstruct, and destroy water wells within Kern County. Example forms are included as Appendix 15.5B.

5.15.6 Agency Contacts, Permits, and Permit Schedule

Agency contacts and required permits are listed in Table 5.15-6.

Table 5.15-6: Agency Contacts, Permits, and Permit Schedule

Permit	Agency Contact	Schedule
NPDES – Construction General Permit	Submit online using Stormwater Multiple Application and Report Tracking System (SMARTS) https://smarts.waterboards.ca.gov	Submit Notice of Intent for coverage under the statewide permit at least 30 days prior to construction.
Production Well Application	AV Watermaster 6500 West Avenue N Palmdale, CA 93551 Phone: 661-234-8233 Email: info@avwatermaster.net	Submit Application at least 120 days prior to water usage needs.
Well Installation Application and Water	Kern County Environmental Health Division Water Wells Program 2700 M Street, Suite 300, Bakersfield, CA 93301 Phone: 661-862-8740 Email: EH@kerncounty.com	Submit Application at least 60 days prior to water usage needs.
Grading Plan	Kern County Public Works Department/ Building & Development	Submit Application at least 60 days prior to water usage needs.
DSOD Permit	Division of Safety of Dams 2720 Gateway Oaks Drive, Suite 300 Sacramento, CA 95833 Phone: (916) 565-7868 Email: damsafety@water.ca.gov	Submit Application at least one year prior to commencement of construction

5.15.7 References

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APPENDIX 15.5A

Grading and Drainage Plan, Stormwater Basin Design Drawings, and Supporting Calculations

APPENDIX 15.5B

AV WM Water Source Forms/ AV Water Production Rights List/ Kern County Well Permit Application Forms

GOLDER
MEMBER OF WSP