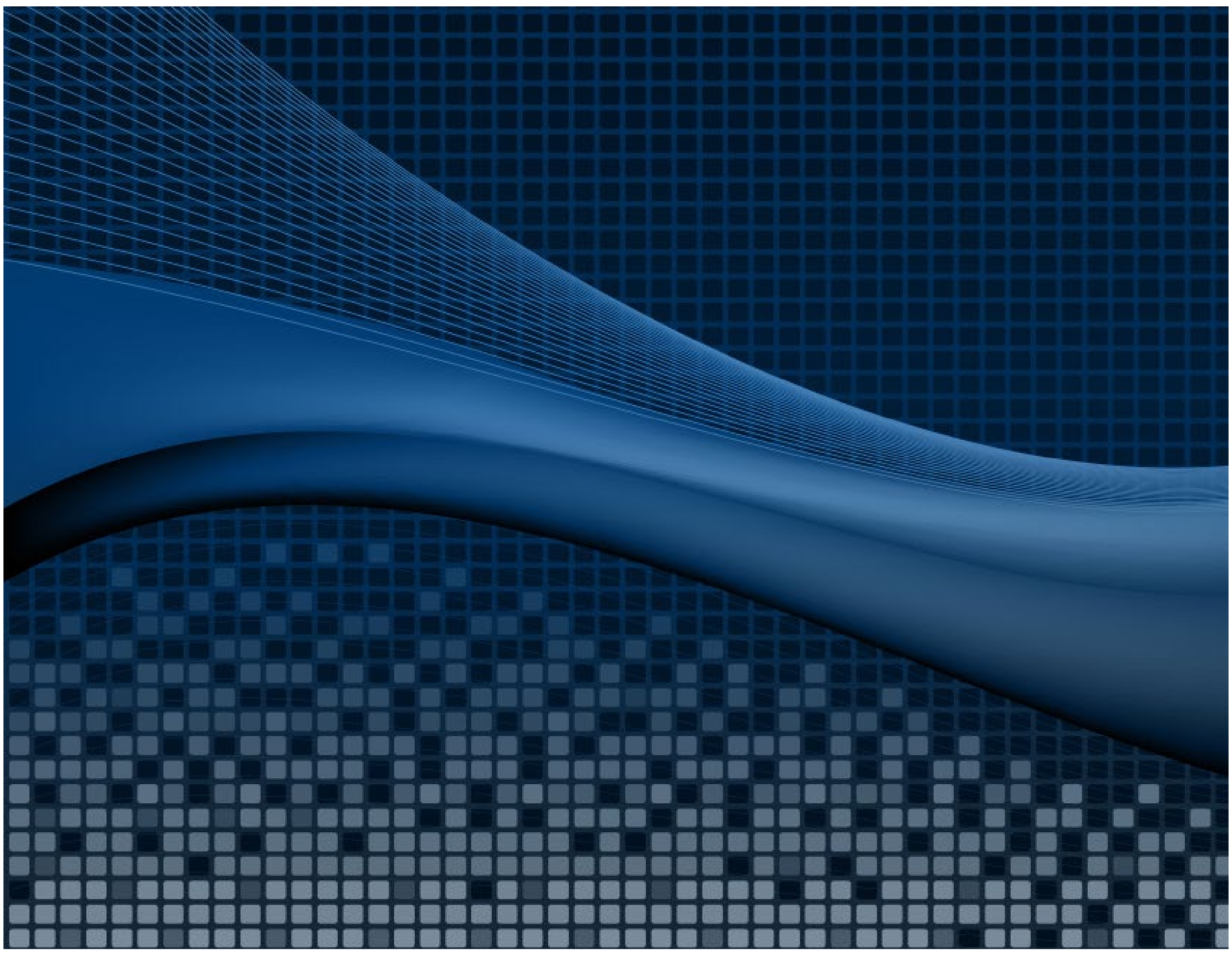
APPENDIX H
WATER SUPPLY ASSESSMENT

Janus Solar, LLC

Janus Solar Water Supply Assessment

Draft



TETRA TECH

July 21, 2021

Janus Solar Water Supply Assessment

July 21, 2021

Draft

PREPARED FOR

RWE Solar Development, LLC
20 California Street, Suite 500
San Francisco, CA 94111

PREPARED BY

Tetra Tech
160 Via Verde, Suite 240
San Dimas, CA 91773
Phone: 909.305.2930
tetratech.com

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1 INTRODUCTION

1.1 PROJECT OVERVIEW

Janus Solar PV, LLC is proposing a photovoltaic (PV) electricity generating facility, with a battery energy storage system and associated facilities and infrastructure, to be known as the Janus Solar Project (Project). The Project would generate and store up to 80 megawatts on approximately 1,024 acres of land in unincorporated western Colusa County. The proposed battery energy storage system would extend the period of time each day that the Project could contribute PV-generated energy to the electrical grid. The Project would connect to the electrical grid at the existing Cortina Substation, which is owned and operated by Pacific Gas and Electric Company, approximately 3 miles northeast of the Project site.

1.2 PURPOSE OF WATER SUPPLY ASSESSMENT

The purpose of the Water Supply Assessment (WSA) is to evaluate whether the total projected water supplies 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.

1.3 SENATE BILL 610 OVERVIEW AND APPLICABILITY

Senate Bill (SB) 610, passed in 2002, amended the California Water Code to require detailed analysis of water supply availability for certain types of development projects, and to improve the link between information on water supply availability and certain land use decisions made by cities and counties. SB 610 requires detailed information regarding water availability to be provided to the city and county decision-makers prior to approval of specified large development projects. This information is to be included in the administrative record that serves as the evidentiary basis for an approval action by the city or county on such projects. SB 610 recognizes local control and decision making regarding the availability of water for projects and the approval of projects.

SB 610 requires that a project be supported by a WSA if the project is subject to the California Environmental Quality Act and is an industrial project of more than 40 acres in size regardless of size or type, or would demand an amount of water equivalent to, or greater than, the amount of water required by a 500-dwelling unit project. According to SB 610 Guidelines, one dwelling unit typically consumes 0.3 to 0.5-acre feet per year (AFY), which would amount to 150 to 250 AFY for 500 units. Projects must analyze whether the total projected water supplies determined to be available for the respective 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 the existing and planned future uses, including agricultural and manufacturing uses. The primary question to be answered in a WSA is as follows:

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

2 PROJECT LOCATION, DESCRIPTION, AND WATER DEMAND

2.1 PROJECT LOCATION

The Project is approximately 6.5 miles southwest of the city of Williams. State Route 20 runs about 1 mile from the Project site, north and west. The proposed Project would be located on three parcels totaling 1,023.9 acres of private property currently used for cattle grazing in Colusa County, California. The Project would connect to the Cortina Substation, located on Walnut Drive, approximately 3 miles northeast of the Project site. To interconnect the Project with the electrical grid, the Applicant (Janus Solar PV, LLC) would construct a new, 4.1-mile-long overhead, 60-kilovolt generation tie line, partially located on the County's right-of-way on Walnut Drive and Spring Valley Road and partially on land administered by the United States Bureau of Reclamation, from the Project site to the point of interconnection at the Cortina Substation.

2.2 PROJECT DESCRIPTION

2.2.1 Project Improvements

The Project covers an area of 1,023.9 acres and includes the following components:

- PV solar panels
- Centralized inverters
- One proposed on-site substation
- One battery energy storage system
- 4.1-mile overhead generation tie line of 60 kilovolt electrical circuits along Walnut Drive and Spring Valley Road
- 20-foot wide interior and perimeter access roads

2.2.2 Existing Public Water System

There is no public water system serving the site. The Project site is located approximately 11.4 miles from the city of Williams which owns a public water system.

2.2.3 Existing Land Use

Existing land use is for cattle grazing. The area is not irrigated and cattle graze on naturally grown plants which use water in the form of evapotranspiration.

2.3 PROJECTED WATER DEMANDS

The construction related water demand for the Project is determined by the site preparation activities required, which includes dust control, moisture conditioning when grading/compacting soil, labor workforce needs, and by the duration of the construction period. Only necessary portions of the site will be disturbed for construction reducing the need for water for dust control. To avoid environmental constraints, only approximately 768 acres of the 1,024 acre site would be used for the Project. It is estimated that the construction will occur over a period of 11 months and that it will require approximately 46 acre-feet (AF) of water over the course of construction.

After construction, a solar PV facility requires very little operational water. Operational water is used for panel washing and for drinking water for workers when present. Panel washing is only performed occasionally and as needed. Typically dust and other debris collect on the panels and this is naturally rinsed off during rainstorms. When panels accumulate dust to the point of power generation being significantly affected, the panels may be washed. Washing occurs infrequently (months to years between washings), such that operational water use is estimated to be 1 AFY. If water were unavailable for panel washing, the panels could be cleaned with waterless techniques or cleaning could simply be deferred.

3 WATER SUPPLY

3.1 CITY OF WILLIAMS

The city of Williams is the purveyor of a public water system located approximately 11.4 miles from the site. The City has indicated that it can provide water for the Project through a fire hydrant located at 180 N. Virginia Way in the city of Williams. Water obtained from the fire hydrant would be trucked to the Project site.

The City's potable water system consists of 2,126 service connections and serves a population of 5,698. The City depends on the Colusa Subbasin for water supply and utilizes three active and two standby groundwater wells (which pump from the Colusa Subbasin). The wells are approximately 120 to 500 feet deep.

3.2 LOCAL GROUNDWATER SUPPLY – COLUSA SUBBASIN

General

The Colusa Subbasin is located in the Sacramento Valley and spans both the Colusa and Glenn Counties. The Project site overlays the southwestern area of the Colusa Subbasin and is bounded by Stony Creek to the north, the Coast Ranges to the west, the Sacramento River to the east, and the Yolo Subbasin to the south. The Colusa Subbasin covers approximately 1,131 square miles and contains 73 public supply wells, 3,500 domestic wells, and 2,600 agriculture wells. The current groundwater storage in the Colusa Subbasin is estimated to be 26 million AF.

The climate in Colusa County can be described as cool, wet winters and hot, dry summers. There is a wide variation in annual precipitation, as there are periodic multiple-year dry periods. Climate data from the Colusa County weather station (NCEI)[1] is representative of the regional climate. Between 2010 and 2020, the average maximum temperature was 75.7 degrees Fahrenheit (°F), average minimum temperature was 47.4°F, and the average temperature was 61.1°F. The average annual rainfall in the same period was approximately 14.1 inches, with the highest rainfall of 21.45 inches in 2010 and the lowest rainfall of 6.73 inches in 2015 (NCEI 2021). The annual rainfall fluctuated significantly because of the 2007 to 2015 dry period.

Adjudication

The Colusa Subbasin is not adjudicated.

Groundwater Sustainability Plan

The groundwater levels in the Colusa Subbasin have been in decline and a Groundwater Sustainability Plan (GSP) is currently being developed to create a framework to maintain the long-term sustainability of the Colusa Subbasin. The Colusa Groundwater Authority and Glenn Groundwater Authority are working together to develop the GSP for the Colusa Subbasin. The development of the GSP began in September 2020 and a draft of the first four chapters of the GSP was distributed for public review in May 2021. The final draft with all eight chapters is expected to be completed by January 2022.

The GSP utilizes data from various sources and reports. The reports often require monitoring data and analyses. In addition, the reports may not be updated on a regular basis and can therefore be several years old. The GSP, at this time, is based on information through the year 2015 (CGA 2021).

Groundwater Monitoring and Management Programs

Both Glenn County and Colusa County work together to monitor and manage the Colusa Subbasin groundwater. These agencies closely monitor the groundwater levels, groundwater quality, and land subsidence. To monitor the groundwater levels, both counties utilize programs such as the National Water Information System, Water Data Library, California's Statewide Groundwater Elevation Monitoring Program, and County-Specific Groundwater Level Monitoring Programs. The groundwater levels are monitored to evaluate groundwater elevations, reduction in groundwater storage, and stream-aquifer interactions throughout the Colusa Subbasin. The primary concern with the groundwater quality within the Colusa Subbasin is salinity, as there can be an upwelling of brackish water into the principal aquifer (CGA 2021). The land subsidence monitoring network consists of the Interferometric Synthetic Aperture Rader Surveys, Continuous Global Positioning System Benchmarks, Extensometers, and Sacramento Valley Height-Modernization Project. Land subsidence can cause structural damage infrastructure, so the land surface displacement must be monitored. All the data networks to monitor the Colusa Subbasin are used in an effort to prevent the Colusa Subbasin from being critically over drafted.

Groundwater Sustainability Plan

The groundwater levels in the Colusa Subbasin have been in decline and a GSP is currently being developed to create a framework to maintain the long-term sustainability of the Colusa Subbasin. The Colusa Groundwater Authority and Glenn Groundwater Authority are working together to develop the GSP for the Colusa Subbasin. The development of the GSP began in September 2020 and a draft of the first four chapters of the GSP was distributed for public review in May 2021. The final draft with all eight chapters is expected to be completed by January 2022.

The GSP utilizes data from various sources and reports. The reports often require monitoring data and analyses. In addition, the reports may not be updated on a regular basis and can therefore be several years old. The GSP, at this time, is based on information through the year 2015.

Groundwater Level Trends

Changes in land use and multiple-year droughts over the last 23 years have led to increased groundwater pumping, which has created new cones of depression and enlarged existing cones of depression. The groundwater elevations declined during the dry period after 2006 but recovered in 2017 when the drought was over, which is displayed in Figure 1 (CGA 2021). However, there are areas that have not fully recovered from the 2006 to 2016 drought. The communities affected are in Orland, Artois, Williams, Arbuckle, and College Cities. Current groundwater elevations are similar to those measured in 2017, which means the regional groundwater levels have been stable since the end of the drought in 2017 (CGA 2021). It should be noted that the groundwater elevations of the wells in Figure 1 represent the overall elevation trends in response to the wet and dry years and may not accurately display the groundwater elevation of all the wells, as the elevations differ in every well.

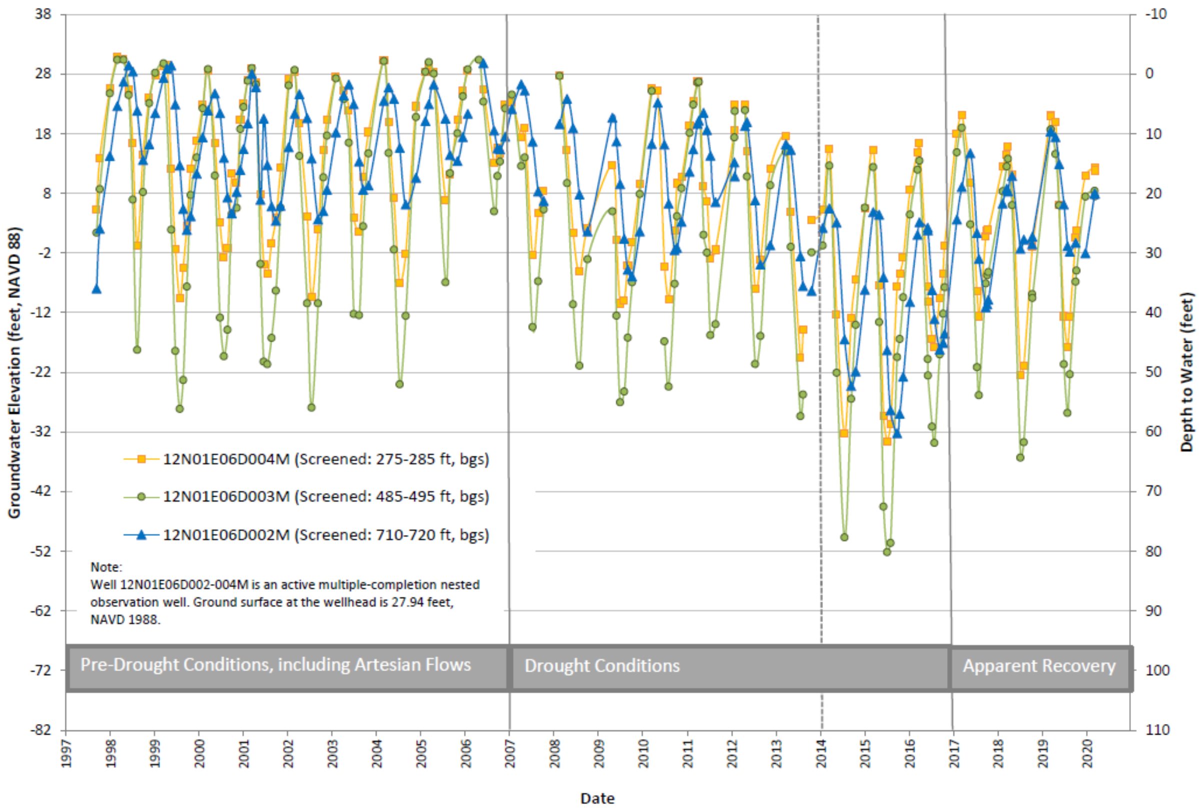


Figure 1**.** Graph of the historical groundwater elevation is provided by the 2021 Draft of the Colusa Subbasin Groundwater Sustainability Plan.

The current groundwater storage volume has a wide range of estimated volume of between 26 million AF and 140 million AF. For this study, the more conservative estimate of 26 million AF will be used. There was an average annual reduction in storage of 28 thousand AFY between 1990 and 2015. This represents anywhere between about 0.02 to 0.1 percent of the estimated capacity of the Colusa Subbasin. The region experienced a series of consecutive, multiple-year droughts between 2007 and 2015.

Safe Yield

The sustainable yield, also referred to as the safe yield, is the maximum quantity of water that can be withdrawn annually from a groundwater supply without causing overdraft. The sustainable yield for current and future scenarios, according to the Colusa Subbasin GSP, is displayed in Table 1 below.

Table 1. Estimated Groundwater Pumping, Change in Groundwater Storage, and Sustainable Yield by Baseline Scenario (Thousands of AFY)

Baseline Scenario	Groundwater Pumping	Change in Groundwater Storage	Sustainable Yield
Current	499.4	0.6	500.1
Future, No Climate Change	498.8	0.6	499.4
Future, 2030 Climate Change	525.4	-2.7	522.7
Future, 2070 Climate Change	558.6	-7.3	551.2

Subsurface Inflow

The Colusa Subbasin receives subsurface inflow from Corning, Butte, Sutter, and Yolo Subbasins, which are neighboring subbasins. The average annual subsurface inflow is approximately 200,000 AF, with a range from 190,000 AF to 210,000 AF.

Seepage Inflow

Seepage into the groundwater occurs when altitude of the water table in the vicinity of the stream is lower than the altitude of the stream-water surface. This causes a seepage inflow into the groundwater from surface water sources such as canals, drains, and streams. There is an average annual inflow of 208,211 AF from streams and 144,457 AF from drains and canals in the Colusa Subbasin.

20-Year Historical Inflow

Data from the 2021 draft of the Colusa and Glenn GSA's GSP for the historical inflow during the 20-year period of 1996 to 2015 is presented in Table 2[2]. During that period, the annual inflow ranged from 740,000 AF to 1,130,000 AF, with an average annual inflow of 1,006,247 AF. The fluctuation in the annual inflow is due to the dry period between 2007 to 2015, which is when less rainfall percolated into the Colusa Subbasin.

20-Year Historical Outflow

The 20-year historical outflow data in Table 2 was taken from the 2021 draft of the Colusa and Glenn GSA's GSP (CGA 2021). Between 1996 and 2015, the annual outflow fluctuated between 900,000 AF and 1,140,000 AF, with an average of 1,031,512 AF. The outflow has increased significantly since 1996 because of the increase in groundwater pumping during the dry period, as there is less surface water that is readily available for use.

Table 2. 20-Year Historical Water Budget (1996-2015)

Water Inflow Source	[a]Average	1996[b]	1997[b]	1998[b]	1999[b]	2000[b]	2001[b]	2002[b]	2003[b]	2004[b]	2005[b]	2006[b]	2007[b]	2008[b]	2009[b]	2010[b]	2011[b]	2012[b]	2013[b]	2014[b]	2015[b]
Subsurface Water Inflow	200,027	192,310	200,117	188,933	191,711	193,979	194,506	198,449	192,506	199,804	194,420	196,864	204,638	205,946	207,844	207,110	201,677	203,767	206,758	206,595	212,601
Deep Percolation – Precipitation	169,597	218,722	200,022	310,164	159,467	188,007	145,891	170,567	192,840	179,280	228,652	228,717	97,824	128,709	101,788	178,340	206,544	125,171	134,224	75,275	121,738
Deep Percolation – Applied Surface Water	202,174	188,144	210,973	196,951	192,463	237,227	207,134	246,916	224,756	248,871	206,796	200,859	218,858	222,677	169,184	198,939	191,397	166,391	217,662	140,443	156,844
Deep Percolation – Applied Groundwater	76,480	50,426	86,158	64,566	56,851	69,663	74,746	100,199	68,791	106,682	82,093	78,676	84,821	101,927	72,111	99,368	81,184	70,872	84,460	41,576	54,427
Seepage – Streams	208,211	219,097	221,979	258,661	198,235	200,565	163,569	193,730	236,497	223,251	207,009	253,379	160,723	187,991	190,554	227,109	250,219	184,695	212,971	161,670	212,321
Seepage – Canals and Drains	144,457	126,137	137,599	111,029	132,223	139,386	153,975	161,171	149,907	164,522	157,163	149,048	166,261	157,398	145,188	151,508	149,124	155,165	161,055	114,680	106,603
Total Groundwater Inflows	**1,000,946**	**1,056,848**	**1,130,304**	**930,950**	**1,028,827**	**939,821**	**1,071,032**	**1,065,297**	**1,122,410**	**1,076,133**	**1,107,543**	**933,125**	**1,004,648**	**886,669**	**1,062,374**	**1,080,145**	**906,061**	**1,017,130**	**740,239**	**864,534**	**994,836**
Water Outflow Source																					
Subsurface Water Outflow	200,027	192,310	200,117	188,933	191,711	193,979	194,506	198,449	192,506	199,804	194,420	196,864	204,638	205,946	207,844	207,110	201,677	203,767	206,758	206,595	212,601
Groundwater Pumping – Agriculture	169,597	218,722	200,022	310,164	159,467	188,007	145,891	170,567	192,840	179,280	228,652	228,717	97,824	128,709	101,788	178,340	206,544	125,171	134,224	75,275	121,738
Groundwater Pumping – Urban and Industrial	202,174	188,144	210,973	196,951	192,463	237,227	207,134	246,916	224,756	248,871	206,796	200,859	218,858	222,677	169,184	198,939	191,397	166,391	217,662	140,443	156,844
Groundwater Pumping – Managed Wetlands	76,480	50,426	86,158	64,566	56,851	69,663	74,746	100,199	68,791	106,682	82,093	78,676	84,821	101,927	72,111	99,368	81,184	70,872	84,460	41,576	54,427
Stream Gain from Groundwater	208,211	219,097	221,979	258,661	198,235	200,565	163,569	193,730	236,497	223,251	207,009	253,379	160,723	187,991	190,554	227,109	250,219	184,695	212,971	161,670	212,321
Total Groundwater Outflows	**1,031,512**	**931,933**	**1,053,594**	**900,473**	**1,006,519**	**1,001,240**	**1,049,333**	**1,106,263**	**969,336**	**1,104,497**	**990,116**	**998,065**	**1,115,277**	**1,145,373**	**1,089,255**	**1,021,949**	**967,179**	**1,037,129**	**1,069,732**	**1,014,623**	**1,058,363**
Change in Storage (Inflow – Outflow)	**62,903**	**3,254**	**229,831**	**-75,569**	**27,587**	**-109,512**	**-35,231**	**95,961**	**17,913**	**86,017**	**109,478**	**-182,152**	**-140,725**	**-202,586**	**40,425**	**112,966**	**-131,068**	**-52,602**	**-274,384**	**-193,829**	**62,903**

[a] 20-year average from 1996 through 2015

[b] Estimates are from ‘Colusa GSA and Glenn GSA Draft Report of Groundwater Sustainability Plan’ April 2021

3.3 OTHER WATER

Construction of the Project will reduce the natural vegetation at the Project site. This vegetation currently consumes water through the evapotranspiration process. Based on aerial imagery, it is estimated that vegetation covers approximately 15 percent of the Project site. The evapotranspiration rate of the natural vegetation was estimated based on the average of the estimated evapotranspiration rates of pastures from the Sacramento San Joaquin Delta for the 2014 to 2015 water year and equates to 3.82 feet per year (Medellín-Azuara et al. 2016). Based on a disturbed Project area of 768 acres, the estimated water consumption of the natural vegetation is estimated to be 440 AFY.

Eliminating the natural vegetation at the Project site will result in an increase of 440 AFY of water percolating through the soils and down to the Colusa Subbasin and can be considered a new source of water.

4 SUPPLY SUFFICIENCY ANALYSIS

The primary question to be answered in a WSA that is compliant with SB 610 requirements is:

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

4.1 CITY OF WILLIAMS

The City's potable water supply comes solely from groundwater, which is pumped directly from the Colusa Subbasin through three wells. The city of Williams has indicated that it can provide water to the Project through a fire hydrant located at 180 N. Virginia Way in the city of Williams. The water obtained from the fire hydrant would be trucked to the Project site.

4.2 COLUSA SUBBASIN

Groundwater Budget

A water budget is an identification, estimate, and comparison of the groundwater inputs and outputs that affect the overall trend of groundwater balance in the Colusa Subbasin. The inputs include subsurface water inflow, deep percolation, and seepage while the outputs include subsurface water outflow, groundwater pumping, and stream gain from groundwater.

Normal Year

The baseline water budget for a normal year in Table 3 is based on the average of historical inflow and outflow between 1996 and 2015 (CGA 2021). Over the 20-year period, there is a loss in groundwater storage of 30,566 AF, which has caused the groundwater elevations to drop.

Table 3. Water Budget Normal (Average) Year[2]	
Water Inflow Source	
Subsurface Water Inflow	**200,027**
Deep Percolation – Precipitation	**169,597**
Deep Percolation – Applied Surface Water	**202,174**
Deep Percolation – Applied Groundwater	**76,480**
Seepage – Streams	**208,211**
Seepage – Canals and Drains	**144,457**
Total Groundwater Inflows	**1,000,946**
Water Outflow Source	
Subsurface Water Outflow	**150,316**
Groundwater Pumping – Agriculture	**471,462**
Groundwater Pumping – Urban and Industrial	**11,271**
Groundwater Pumping – Managed Wetlands	**29,385**
Stream Gain from Groundwater	**369,078**
Total Groundwater Outflows	**1,031,512**
Change in Storage (AF)	**-30,566**

Dry Year

According to the historical precipitation data from 1996 to 2015 from the National Centers for Environmental Information at the Colusa weather station, the lowest annual rainfall occurred in 2015, with 6.73 inches (NCEI 2021). However, the annual water budget with the largest deficit occurred in 2013 and resulted in a reduction of 274,384 AF from the Colusa Subbasin (CGA 2021). The dry year is intended to be the single year worst case for impacts to the water supply and water demand and therefore 2013 was used as the dry year for this study.

Table 4 presents a water budget for a single dry year, which is based on the water inflow and outflow in 2013. Inflow in 2013 was 740,239 AF and outflow was 1,014,623 AF for a deficit of 274,384 AF (CGA 2021). It should be noted that the water budget dry year is based on historical data that may not accurately represent a dry year in the future, as the guidelines set by the GSP will help balance the inflow and outflow volume.

Table 4. Water Budget Dry Year[2]	
Water Inflow Source	
Subsurface Water Inflow	**206,595**
Deep Percolation – Precipitation	**75,275**
Deep Percolation – Applied Surface Water	**140,443**
Deep Percolation – Applied Groundwater	**41,576**
Seepage – Streams	**161,670**
Seepage – Canals and Drains	**114,680**
Total Groundwater Inflows	**740,239**
Water Outflow Source	
Subsurface Water Outflow	**138,604**
Groundwater Pumping – Agriculture	**493,760**
Groundwater Pumping – Urban and Industrial	**9,145**
Groundwater Pumping – Managed Wetlands	**36,349**
Stream Gain from Groundwater	**336,765**
Total Groundwater Outflows	**1,014,623**
Change in Storage (AF)	**-274,384**

Multiple Dry Year

The multiple dry-year water budget is based on the driest, consecutive years of below average precipitation on record. For the Colusa Subbasin, the multiple dry year period is between 2011 and 2015 (CGA 2021). In that specific period, the annual average precipitation was 9.35 inches, which is approximately 30 percent lower than the precipitation during a normal year. As a result, the water budget from 2011 to 2015 represents the scenario for a multiple dry-year period.

Table 5 displays a cumulative groundwater deficit of approximately 538,917 AF, which is estimated to be 2 percent of the conservatively estimated groundwater storage volume of 26 million AF (CGA 2021). The cumulative groundwater deficit is due to the decrease in deep percolation from precipitation and the increase groundwater pumping for agriculture. During the dry years, there is a significant increase in groundwater pumping for agriculture, as the dry years would increase the evapotranspiration rate, which will then increase irrigation demand for crops.

Table 5. Water Budget Multi-Dry Year					
Water Inflow Source	**1 (2011)**	**2 (2012)**	**3 (2013)**	**4 (2014)**	**5 (2015)**
Subsurface Water Inflow	201,677	203,767	206,758	206,595	212,601
Deep Percolation – Precipitation	206,544	125,171	134,224	75,275	121,738
Deep Percolation – Applied Surface Water	191,397	166,391	217,662	140,443	156,844
Deep Percolation – Applied Groundwater	81,184	70,872	84,460	41,576	54,427
Seepage – Streams	250,219	184,695	212,971	161,670	212,321
Seepage – Canals and Drains	149,124	155,165	161,055	114,680	106,603
Total Groundwater Inflows	**1,080,145**	**906,061**	**1,017,130**	**740,239**	**864,534**
Water Outflow Source					
Subsurface Water Outflow	150,444	142,515	149,252	138,604	134,908
Groundwater Pumping – Agriculture	425,013	497,334	530,508	493,760	526,047
Groundwater Pumping – Urban and Industrial	9,359	9,992	10,812	9,145	7,590
Groundwater Pumping – Managed Wetlands	24,568	29,273	29,799	36,349	37,073
Stream Gain from Groundwater	357,795	358,015	349,361	336,765	352,745
Total Groundwater Outflows	**967,179**	**1,037,129**	**1,069,732**	**1,014,623**	**1,058,363**
Change in Storage (AF)	**112,966**	**-131,068**	**-52,602**	**-274,384**	**-193,829**
Cumulative Change in Storage (AF)	**112,966**	**-18,102**	**-70,704**	**-345,088**	**-538,917**

Source: CGA 2021.

4.3 GROUNDWATER BUDGET WITH JANUS SOLAR POWER

Existing Water Consumption

The existing land use of the Project site is cattle grazing and the Project area that will be disturbed is approximately 768 acres. There are no public water services within the Project boundaries but the natural vegetation on-site consumes water through evapotranspiration. The natural vegetation makes up approximately 15 percent of the existing land, such that the annual water demand is estimated to be 440 AF.

Project Water Requirement

The PV solar facility requires a minimal amount of water for construction and operational use. Most of the water demand will occur during construction because very little water is required for annual operational uses. During construction, the water is used to keep the dust down and condition the soil for compaction. The soil must maintain adequate moisture levels to be properly compacted, as the soil will act as a subbase for concrete foundation. For the construction phase, it is estimated the Project will require 46 AF of potable water over a period of 11 months. Additionally, some of the natural vegetation will be cleared for the PV solar facility, which may result in a higher percent of return water for construction than the return of water from evapotranspiration.

To operate the PV solar facility, a small amount of water will be used for panel washing, as panel washing is not required regularly and will be conducted only as needed. Rainfall is anticipated to provide occasional cleaning and additional water is only required for cleaning when the performance of the solar panels degrades significantly between precipitation events. Any rainfall or additional water used to clean the panels is expected to return to the basin. The annual operational water demand is estimated to be approximately 1 AF.

Projects Impacts to Water Supply

The water required for construction is significantly lower than the estimated water required for the natural vegetation, which will result in a reduction of water consumption of approximately 394 AF during the construction period of 11 months. After construction, Project water consumption would be reduced even further, as the operational water use is dramatically lower than the construction water use. The operational use of the solar facility is estimated to reduce the typical water consumption by 439 AFY.

The overall reduction in water consumption at the Project site will provide a benefit to the Colusa Subbasin. The Colusa Subbasin will not be negatively impacted with the construction and operation of the PV solar facility.

20-Year Projection with Project

The Project will reduce water consumption on the site, which will positively impact the Colusa Subbasin. In the 20-year water budget projection, the Project will contribute a total of approximately 8,800 AF of water to the Colusa Subbasin due to water that is usually lost to evapotranspiration directly recharging the Colusa Subbasin. With the Project, the Colusa Subbasin will experience a cumulative groundwater deficit of 600,000 AF, compared to a deficit of 612,000 AF without the Project. The 20-year deficit represents less than 3 percent of the groundwater capacity (26 million AF). The calculations for the 20-year projected water budget with the Project are summarized in Table 6 below.

The water budget for a single dry year with the Project is presented in Table 7 below. Similar to the single dry-year water budget without the Project, a groundwater deficit is still expected with the Project, but it is estimated to reduce the deficit from 274,384 AF to 273,990 AF. For a single dry year, the Project will save approximately 400 AFY because of the decrease in water consumption for construction and operational use compared to the current use for cattle grazing.

Table 8 displays the results of an estimated 5-year groundwater budget with the Project that is based on the water budget between 2011 to 2015 (the driest consecutive years at the Colusa Subbasin). At the end of the 5-year period, the cumulative deficit will be reduced from 538,917 AF to 536,767 AF, which equates to less than 3 percent of the total groundwater storage. This reduction results in water savings of approximately 2,150 AF in 5 years.

Table 6. 20-Year Projected Water Budget with Project (2021–2040)

Water Inflow Source	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Inflow[a]	1,000,946	1,000,946	1,000,946	1,000,946	1,000,946	1,000,946	1,000,946	1,000,946	1,000,946	1,000,946	1,000,946	1,000,946	1,000,946	1,000,946	1,000,946	1,000,946	1,000,946	1,000,946	1,000,946	1,000,946
Janus Solar Facility Project Inflow	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440
Total Groundwater Inflows	**1,001,386**	**1,001,386**	**1,001,386**	**1,001,386**	**1,001,386**	**1,001,386**	**1,001,386**	**1,001,386**	**1,001,386**	**1,001,386**	**1,001,386**	**1,001,386**	**1,001,386**	**1,001,386**	**1,001,386**	**1,001,386**	**1,001,386**	**1,001,386**	**1,001,386**	**1,001,386**
Water Outflow Source																				
Outflow[b]	1,031,512	1,031,512	1,031,512	1,031,512	1,031,512	1,031,512	1,031,512	1,031,512	1,031,512	1,031,512	1,031,512	1,031,512	1,031,512	1,031,512	1,031,512	1,031,512	1,031,512	1,031,512	1,031,512	1,031,512
Janus Solar Facility Project Outflow	46	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Total Groundwater Outflows	**1,031,558**	**1,031,513**	**1,031,513**	**1,031,513**	**1,031,513**	**1,031,513**	**1,031,513**	**1,031,513**	**1,031,513**	**1,031,513**	**1,031,513**	**1,031,513**	**1,031,513**	**1,031,513**	**1,031,513**	**1,031,513**	**1,031,513**	**1,031,513**	**1,031,513**	**1,031,513**
Change in Storage (Inflow – Outflow)	**-30,172**	**-30,127**	**-30,127**	**-30,127**	**-30,127**	**-30,127**	**-30,127**	**-30,127**	**-30,127**	**-30,127**	**-30,127**	**-30,127**	**-30,127**	**-30,127**	**-30,127**	**-30,127**	**-30,127**	**-30,127**	**-30,127**	**-30,127**

[a]Data from the total inflow of a normal year in Table 3
[b]Data from the total outflow of a normal year in Table 3

Table 7. Water Budget Dry Year with Project

Water Inflow Source	
Subsurface Water Inflow	**206,595**
Deep Percolation – Precipitation	**75,275**
Deep Percolation – Applied Surface Water	**140,443**
Deep Percolation – Applied Groundwater	**41,576**
Seepage – Streams	**161,670**
Seepage – Canals and Drains	**114,680**
Janus Solar Facility Project Inflow	**440**
Total Groundwater Inflows	**740,679**
Water Outflow	
Subsurface Water Outflow	**138,604**
Groundwater Pumping – Agriculture	**493,760**
Groundwater Pumping – Urban and Industrial	**9,145**
Groundwater Pumping – Managed Wetlands	**36,349**
Stream Gain from Groundwater	**336,765**
Janus Solar Facility Project Outflow	**46**
Total Groundwater Outflows	**1,014,669**
Change in Storage (AF)	**-273,990**

Table 8. Water Budget Multi-Dry Year with Project

Water Inflow Source	1 (2011)	2 (2012)	3 (2013)	4 (2014)	5 (2015)
Subsurface Water Inflow	201,677	203,767	206,758	206,595	212,601
Deep Percolation – Precipitation	206,544	125,171	134,224	75,275	121,738
Deep Percolation – Applied Surface Water	191,397	166,391	217,662	140,443	156,844
Deep Percolation – Applied Groundwater	81,184	70,872	84,460	41,576	54,427
Seepage – Streams	250,219	184,695	212,971	161,670	212,321
Seepage – Canals and Drains	149,124	155,165	161,055	114,680	106,603
Janus Solar Facility Project Inflow	440	440	440	440	440
Total Groundwater Inflows	**1,080,585**	**906,501**	**1,017,570**	**740,839**	**864,974**
Water Outflow					
Subsurface Water Outflow	150,444	142,515	149,252	138,604	134,908
Groundwater Pumping – Agriculture	425,013	497,334	530,508	493,760	526,047
Groundwater Pumping – Urban and Industrial	9,359	9,992	10,812	9,145	7,590
Groundwater Pumping – Managed Wetlands	24,568	29,273	29,799	36,349	37,073
Stream Gain from Groundwater	357,795	358,015	349,361	336,765	352,745
Janus Solar Facility Project Outflow	46	1	1	1	1
Total Groundwater Outflows	**967,225**	**1,037,130**	**1,069,733**	**1,014,624**	**1,058,364**
Change in Storage (AF)	**113,360**	**-130,629**	**-52,163**	**-273,945**	**-193,390**
Cumulative Change in Storage (AF)	**113,360**	**-17,269**	**-68,432**	**-342,377**	**-536,767**

5 SUMMARY AND CONCLUSIONS

The Project will replace approximately 768 acres of cattle grazing land, which is estimated to consume about 440 AFY of water. The Project will require 46 AF of water for the 11-month construction period and one AFY for subsequent years. The water used for construction will be used to control dust and condition soil while the water for operational use is needed to wash panels. Since the Project will consume a significantly lower amount of water than existing conditions, a decrease in consumption of approximately 437 AF a year or a total of 8,740 AF over the next 20 years is anticipated. Therefore, there is ample water supply for the Project for the next 20 years.

During a single dry year with the Project, there will be an estimated groundwater deficit of 273,990 AF, which is a 394 AF smaller deficit than without the Project. Similarly, a 5-year dry period with the Project is estimated to reduce the cumulative deficit to approximately 537,000 AF with a total water savings of 2,150 AF.

Although the Colusa Subbasin groundwater inflow and outflow is not yet balanced, the Colusa and Glenn GSA are drafting a GSP with the goal of balancing flows in the Colusa Subbasin. The Project will facilitate the goals of the GSP.

6 REFERENCES

National Centers for Environmental Information (NCEI). 2021. Colusa County Precipitation Data; [online]; https://www.ncdc.noaa.gov/cdo-web/results; Accessed July 6, 2021

Colusa Grounwater Authority (CGA). 2021. Colusa Subbasin Groundwater Sustainability Plan. April. Available at: https://colusagroundwater.org/draft-gsp-chapters-available-for-review/.

Medellín-Azuara, Josué, Tha Paw U, Kyaw, Jin, Yufang, Hart, Quinn, Kent, Eric, Clay, Jenae', Wong, Andy, Bell, Andrew, Anderson, Martha, Howes, Daniel, Melton, Forrest, Kadir, Tariq, Orang, Morteza, Leinfelder-Miles, Michelle M., and Lund, Jay R. 2016. Estimation of Crop Evapotranspiration in the Sacramento San Joaquin Delta: Preliminary Results for the 2015-2015 Water Year. Office of the Delta Watermaster. September.