DOCKETED

Docket Number:	08-AFC-08A
Project Title:	Hydrogen Energy Center Application for Certification Amendment
TN #:	200285
Document Title:	BVWSD's Response to CEC Data Requests and PSA
Description:	Data Request: 3-21-13 and PSA: 6-28-13
Filer:	Tiffani Winter
Organization:	Buena Vista Water Storage District
Submitter Role:	Public Agency
Submission Date:	8/21/2013 9:13:48 AM
Docketed Date:	8/21/2013

Buena Vista Water Storage District

P.O. Box 756 525 N. Main Street
Buttonwillow, California 93206
Phone: (661) 324-1101
(661) 764-5510
Fax: (661) 764-5053

August 20, 2013

California Energy Commission
Mr. John Heiser, AICP
Siting – Project Manager
1516 Ninth Street, MS-15
Sacramento, CA 95814

RE: Response to CEC Data Request dated March 21, 2013
Response to Preliminary Staff Assessment dated June 28, 2013

Dear Mr. Heiser

On behalf of Buena Vista Water Storage District, I would like offer our apologies for a less than timely response to the CEC Data request. Hopefully this will assist the Commission in processing the HECA application.

The district staff and consultants have prepared the attached response to CEC Data Request dated March 21, 2013 and respectfully submit for your consideration. This submittal should also act as the District's comments to the Preliminary Staff Assessment for the HECA project dated June 28, 2013.

I understand that Public Workshops have been preliminarily planned for September 17 – 19. Unfortunately, I will be out of the country on a trip that has been planned since November 2012. Based on my inability to attend the workshops, I would like to emphasize the District's offer to host appropriate CEC staff on a site visit sometime before September 6, 2013. I believe that the face to face Agency contact will give the CEC staff confidence that the District has the capability and commitment to fulfill its mission of providing the landowners and water users a reliable, affordable and usable water supply. If you have any questions about our response or the coordination of the site visit please contact me 661.324.1101 or Maurice@bvh2o.com.

Sincerely,

Maurice J. Etchechury
Engineer-Manager

Response to CEC Data Request of 21 March, 2013.

The following responses to CEC Data Request are intended to complement the explanations and clarifications on the same or similar issues contained in BVWSD previous response dated 19 March, 2013.

The CEC Data Request asks the district to provide several datasets, to quantify several relationships, and to explain several issues. The requests are presented as inquiries into fourteen specific topics of interest.

Below, we present each CEC data request highlighted in **bold** followed by the BVWSD's response.

CEC DR 1. **Please provide all water quality data from within the potential zone of influence (or within two miles) of the proposed HECA project pumping wells.**

BVWSD Response 1.

- Table 1. CEC- EC & TDS data1.xls
- Attachment 1: Potential Zone of Influence

Attachment 1 shows CEC- EC & TDS data1.xls data coverage which includes sections from four township areas centered on the proposed well field (28s/22-23e, 29s/22-23e). Table 1 includes 285 records, including 284 records of EC and 24 records of TDS, from 77 wells.

District concludes from these dataset that the EC and TDS data which have been collected over the years in and around the project area demonstrate that the area between the West Side Canal and the Main Drain Canal near- and to the north of-the latitude of 7th Standard Rd is underlain by saline groundwater which interfaces with fresher groundwater to the east.

CEC DR 2. **Please provide numeric data that support the conclusion that highly saline water originates in the west (in the Coast Ranges) and enters the BVWSD?**

BVWSD Response 2.

- Table 1. CEC- EC & TDS data1.xls
- Referenced reports: Dale, et al, 1966.

The dataset for this data request is the same as that described for Response 1.

Please refer to Dale, et al, 1966 report. BVWSD provided a copy of the report to the CEC staff on 21 February, 2013.

(Dale R.H., J.J. French, G.V. Gordon, 1966, Ground-water geology and hydrology of the Kern River alluvial fan area, California, U.S. Geol. Surv. Water Res. Div. Open-File Report.)

Based on a preliminary review of BVWSD EC data, EC values in and around the project area is equivalent to a range in TDS of about 3,000 - 5,000 mg/l, with lower values to the east and south and, where present, equal or higher values to the west and north. This data from the BVWSD database are consistent with the findings of the above cited USGS work.

***CEC DR 3.* Please provide time-series water quality data from wells located on either side of the "axial interface" showing the water quality at specific locations is changing over time. Include quantitative data (i.e., extraction volumes) showing the relationship between annual extraction rates and annual water quality changes over times at specific locations.**

BV Response 3.
Data: Table 1. CEC-EC & TDS data1.xls
Figure 1. EC in 4 Project- Area Townships, 1960 - 2010.

All of the available EC data from which time-series can be constructed have been provided in the dataset described above in BVWSD Response 1, i.e., Filename: CEC- EC & TDS data1.xls.

Out of a total of 77 wells from CEC- EC & TDS data1.xls dataset (Table 1.), there are only 25 wells that were sampled frequently enough to provide a time-series of EC data from the late 1980s/early 1990s to the present. Of those, EC data from seven wells (7) can be composited with earlier EC data from nearby wells to provide a time-series of EC data from the 1960s to the present.

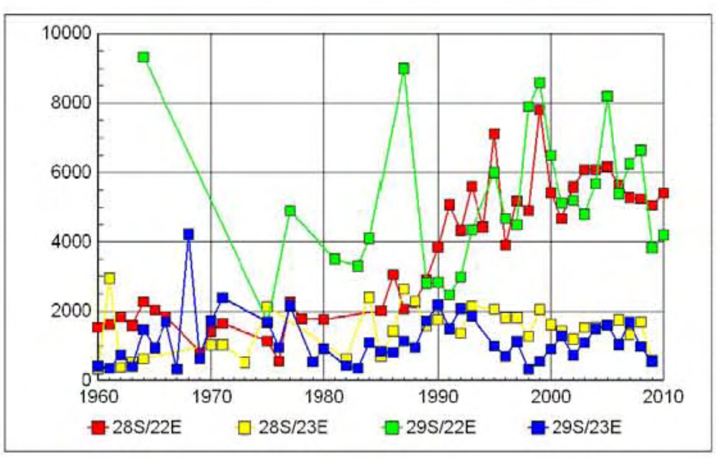


Figure1. EC in 4 Project- Area Townships, 1960 - 2010.

Time-series data constructed from the CEC- EC & TDS data1.xls dataset shows that the EC for the last 25 years has been in the range of 4,000 -10,000 uS/cm, which is approximately equivalent to a range in TDS of 2,560 -6,400 mg/l, assuming a conversion constant of 0.64 mg/l/uS/cm.

Prior to the late-1980s, there is insufficient data to illustrate the temporal EC trends in individual wells. Therefore the District has calculated the average annual EC value for each year from 1960 to 2010 for the sections covered by the dataset in Table 1.

The average groundwater ECs in the two easterly townships (T28s/R23e and T29s/R23e) in the potential zone of influence (Attachment 1) are approximately constant for the 50-year period from 1960 to 2010 at 1,450 uS/cm and 1,170 uS/cm, respectively, equivalent to an average TDS of 928 mg/l and 748 mg/l, respectively.

The average groundwater ECs in the two westerly townships (T28s/R22e and T29s/R22e) are significantly higher and show increases in EC over time. In township T28s/R22e, the average EC from 1960 to 1989 is 1,820 uS/cm (1,164 mg/l TDS) and the average EC from 1990 to 2010 is an average 5,373 uS/cm (3,439 mg/l TDS). In this township, most of the increase in EC occurs during the last half of the 1980s. In township T29s/R22e, the average EC from 1960 to 1989 is 4,829 uS/cm (3,091 mg/l TDS) and the average EC from 1990 to 2010 is 5,308 uS/cm (3,397 mg/l TDS). In this township, most of the increase in EC appears to occur from the early 1980s to the early 1990s.

The low spatial data density makes it difficult to map the lateral boundary (i.e., the interface) between the fresh and brackish waters under the district. Regardless of whether we define the boundary between fresh and brackish water as 1,000 or 1,500 mg/l, we have insufficient data to identify the exact location of the lateral boundary between the fresh and brackish waters under the district more precisely than somewhere east of the main drain, i.e., more than 1.9 miles east of the axis of the proposed well field. Similarly, we have insufficient data to determine whether or not the lateral boundary between fresh and brackish water is migrating over time.

The water district does not have extraction-volume or extraction- rate data for the irrigation wells in the project area, so we cannot provide the requested correlation analysis between groundwater EC and annual extraction rates.

CEC DR 4. ***BVWSD's Target Area A is located in the northern portions of the Buttonwillow Service Area, where reportedly a shallow "perching layer isolates a persistent zone of shallow, perched, salty groundwater from the underlying aquifer" (Draft Environmental Impact Report for the Buena Vista Water Storage District Buena Vista Water Management Program). In the February, 2013, water workshop in Sacramento, BVWSD stated that project pumping from Target Area B may lower water levels in the areas with problematic shallow water (Target Area A). Please explain and quantify how groundwater extractions from the underlying aquifer beneath Target Area B provides a benefit to shallow groundwater levels in Target Area A where the shallow aquifer is "isolated" from the underlying aquifer.***

BV Response 4.

BVWSD does not have any specific recollection of what might have been said at the February 20, 2013, CEC workshop to give the impression that we expect to see benefits in the perched zone of the Target A area from well field operations in the Target B area.
BVWSD staff have not designed the proposed well field to have any particular impact on the Target A area, nor do we require any particular benefit to accrue in the Target A area from pumping at the proposed well field.

CEC DR 5. ***The BVWSD FEIR states "The Kern County Subbasin has been classified by DWR as a critically overdrafted groundwater basin (BVWSD, FEIR, 2009)." Please explain how the district is isolated from this condition.***

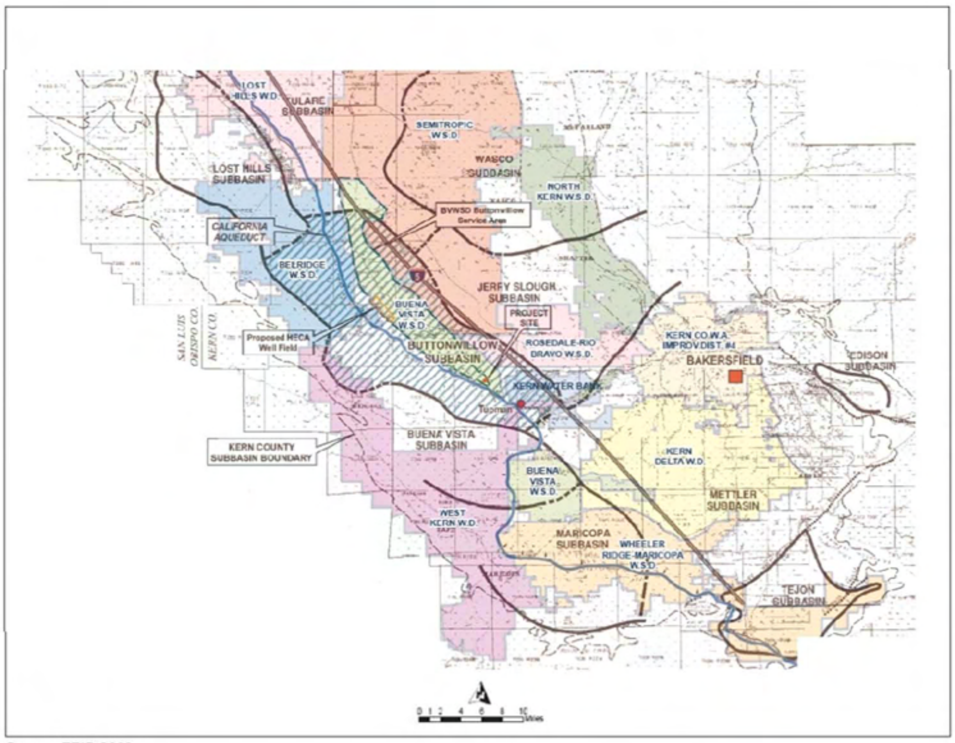
BV Response 5.

We address the overdraft issue in BV Response 6 below and address the issue of physical sub basin isolation in BV Response 5, beginning with some background information.

- Figure 2. Kern County Water Districts and Subbasins.
- Figure 3. Structure Map on Base E-Clay.
- Attachment 2. Water Level Elevation Map, Jan-Feb 1994.
- Attachment 3. Water Level Elevation Map, Jan-Feb 2009.

The Southern San Joaquin Valley (SSJV) groundwater basin lies entirely within the geographic boundaries of Kern County, CA. The basin is bounded on the east, south, and west by the natural flow barriers associated with the geology which causes the topographic slope break between the flat-lying valley fill and the surrounding dissected foothills on three sides. The basin boundary on the north is the Kern County Line between Kern, Kings, and Tulare Counties, which is a political boundary but not a flow boundary.

The SSJV groundwater basin is often considered to be a single, large bathtub- like basin in which the lateral flow of groundwater down the opposite flanks of a persistent elongated recharge mound underlying the southwest- trending Kern River channel separates the basin into two halves with different flow dynamics, one subbasin to the northwest and one subbasin to the southeast. These two subbasins remain fully hydrologically connected and are considered to constitute the main basin.



Source: FEIR 2009

In detail, there are several small subbasins caused by local geological complexities along the east, south, and west basin boundaries. Each of these small subbasins has some degree of isolation from the main basin as manifested by some form of isolated water level behavior,

Figure 2: Kern water District and Subbasin 1

distinct water chemistry, and delayed and/or attenuated pressure response to main- basin events, or vice versa. The Buttonwillow Service Area of the BVWSD occupies one such subbasin. See Figure 2.

The BSA is a 24-mile long, 3- mile wide, thin strip of land along the western basin margin and occupies the overflow lands within the Buttonwillow Syncline, lying between Elk Hills and Buttonwillow Ridge (Dale, et al, 1966) west of the Kern River alluvial fan. The BSA overlies a part of the SSJV groundwater basin which is contained within the flanks of the doubly-plunging Buttonwillow Syncline (Figure 3.) and is geologically separated from the main basin to the east by the doubly-plunging Buttonwillow Anticline (PGA, 1991). There is no surface expression to the Buttonwillow Syncline, but the en echelon, axial ridge of the Buttonwillow Anticline forms the Buttonwillow Ridge which is about 30 ft topographically higher than the flat lands overlying the syncline. The Buttonwillow Anticline is approximately three (3) miles wide. Immediately to the east of the Buttonwillow Anticline is the Jerry Slough Syncline which is another en echelon structural trough which is considered to be part of the main basin north of the Kern River channel.

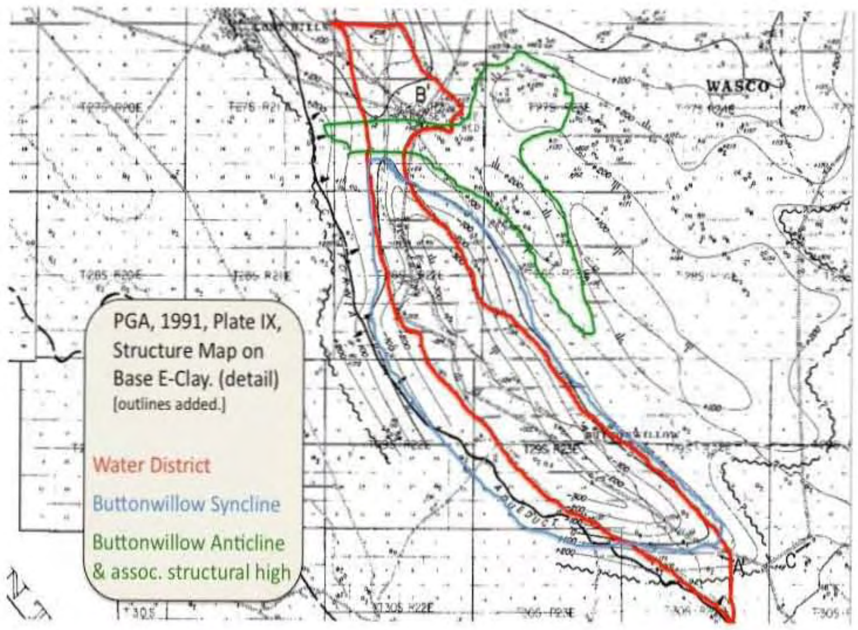


Figure 3. Structural Map on Base E-Clay

Seventh Standard Rd separates the BSA subbasin into two parts of approximately equal length and area, but with different hydrological behavior. The northern half of the BSA shows significant degrees of hydrologic isolation from the basin to the west and north but, most importantly, complete isolation from the main basin to the east. Based on the available basin water level data, BVWSD concludes that there has been no correlatable water level impact in the northern half of the BSA, including the proposed well field area, from any observed groundwater behavior in the main Kern County subbasin to the east. See Attachments 2 & 3.

The empirical evidence is simply that the groundwater elevations within the northern BSA have remained essentially static over time, while a very large pumping depression in the main basin just a few miles to the east- northeast has lowered the groundwater levels across many townships from their 1940 levels. This documented depression does not extend into the Buttonwillow Service Area which is only 2 -3 miles to the west and southwest, even though it would be expected, based on proximity. The capture zone ends abruptly at a narrow band of steep gradients between the BSA and the pumping depression. The groundwater gradients across this 2 -3 mile wide band are -70 ft/mile which accounts for the significant difference in groundwater elevation between the BSA and the area to the east. The groundwater gradient in this narrow band is 7 to 10 times steeper than the inward gradients on the north, east and southeast sides of the pumping depression (approx. -10 ft/mile).

This narrow band of steep gradient in Attachments 2 and 3 represents the manifestation of a northwest - southeast trending flow barrier which runs across four townships (T27s/R22-23e and T28s/R22-23e) between the BSA and the main basin to the east. The water level in the northern Buttonwillow Service Area has remained unimpacted from the pumping depression which is located immediately adjacent to the BSA on the opposite side of this barrier.

The water district concludes, based on the principle of reciprocity that if a groundwater impact cannot propagate from the main basin into the northern BSA, then a groundwater impact cannot propagate in the opposite direction from the BSA into the main basin. The water district also concludes that if a pumping depression, like that in T27s/R23e, caused by scores of wells operating over a period of decades cannot propagate a water level impact across a basin interconnection pathway of only 2 -3 miles, then a smaller well field operating for similar or lesser time periods could not propagate a water level impact.

The water district concludes therefore that the operation of the proposed project well field located on the west side of the BSA must be in complete isolation from the main basin to the east, and that the operation of the proposed well field averaging 10 cfs for years will have no observable impact at any location in the main basin, which begins on the opposite side of the barrier about 4 miles to the northeast.

CEC DR 6. It was stated in Crewdson (2009) that "The District's Buttonwillow Service Area is located in the so-called Buttonwillow (hydrologic) Subbasin, which exhibits some isolation from the larger main basin to the east and exhibits groundwater behavior which is consistent with the interpreted shape and structural controls of the Buttonwillow Subbasin." Please quantify the hydrologic isolation from this structural feature. Please provide data showing whether the Buttonwillow Subbasin is in overdraft.

BV Response 6.

As in BV Response 5, above, the district considers the main basin to be completely physically isolated from the potential groundwater impacts of the proposed well field. The groundwater flow barrier will prevent the proposed well field from creating an observable impact on the main basin and will therefore not change the water levels or the water balance of the main basin over the project life.

State of the Buttonwillow Subbasin.

As the CEC has pointed out, the water levels in wells in the BSA spanning the period 1974-2001 show a statistically significant upward trend of +6.8 ft/decade. This represents an estimated gain in the volume of groundwater in aquifer storage of 4,600 -6,100 af/y, assuming a specific yield of 0.15 0.20. The rising water table is the empirical evidence that the volume of water in aquifer storage within the Buttonwillow subbasin is increasing over time. If the definition of overdraft is based on water table behavior, then the Buttonwillow subbasin is not in overdraft.

As mentioned, the district has stored in the SSJV groundwater basin an average 46,409 af/y more of its water supply than the district has consumed over the period 1970 - 2007. For the period, this represents an estimated 36,964 af/y and 1,652 af/y of surface waters which were percolated within the Buttonwillow Service Area and the Maples Service Area, respectively. The remaining 7,793 af/y was banked in out- of-subbasin banking projects. This means that the district is in long term positive balance relative to the basin, and the BSA is in long term positive balance with respect to the Buttonwillow Subbasin. If the definition of overdraft is based on the net balance of district recharge and recovery, then the Buttonwillow Subbasin is not in overdraft.

The 36,964 af/y of BSA recharge and the calculated +4,600 to +6,100 af/y of net BSA basin water level rise are both correct measures of two different quantities. The difference between the two quantities is accounted for by other gains and losses to the physical water balance of the subbasin. Because of southward lateral outflow from the northern BSA into the southern BSA, and lateral outflow from the BSA along the eastern district margin south of 7th Standard Rd (see discussion in BV Response 9), the long- term net gain in aquifer storage within the district's boundaries and corresponding average water level rise is less than would be observed if all of the district water placed into aquifer storage remained within the district boundaries. The water district concludes that the Buttonwillow subbasin is in positive balance and not in a state of overdraft.

<u>CEC DR 7.</u> Groundwater banking is described in "the District's Groundwater Status and Management Plan (GSMP, 2002). A copy of the GSMP is available for review at the District office." Please provide a recent copy of the plan.

BVWSD Response 7.

Data: Attachment 6. BVWSD Groundwater Status and Management Plan, revision of May, 2002.

<u>CEC DR 8.</u> Please provide an updated district water budget and an updated forecast of future water levels. Compare the actual annual water balance with the forecasted balance (2008-2012). Please explain what portion of the historical and forecasted water budget and water levels applies solely to the Buttonwillow Service Area.

BVWSD Response 8.

Data: Table 2: BVWSD Water Balance, 1970 - 2011.

Attached is an update water budget table, Table 2. Forecasting in an individual year is impossible. What is important is forecasting if there will be changes going forward which affect the averages.

Of the average water surplus to groundwater of 46,409 (through 2007) it can be divided as:

1. 1,652 in the Maples Services Area and outside the Buttonwillow Sub-basin but within the larger Kern Basin.
2. 7,793 outside the BVWSD and Buttonwillow Sub-Basin but within the larger Kern Basin.

3. 36,964 within the BVWSD and Buttonwillow sub-basin.

Since the District's water supply should remain stable, BVWSD expects a similar average surplus to groundwater going forward, however any one year will likely vary significantly. However, BVWSD is working to develop new sources for groundwater banking in the BVWSD and Buttonwillow Sub-basin and also within the Buttonwillow Sub-basin but outside the BVWSD.

So the amount in the Maples should remain constant, as with the total surplus, while some of the 7,792 surplus moves into the BVWSD, the Buttonwillow Sub-basin, or both.

The water district does not forecast any foreseeable change which might impact the operation or impacts of the proposed well field.

CEC DR 9. ***Staff reviewed water level records in the district and stated in the recent workshop notice that "observed water levels in wells spanning the period 1974-2001 show a statistically significant upward trend at the 95 percent confidence level. The significant upward trends range from 0.28 foot per year (ft/yr) to 1.27 ft/yr. Please quantify the relationship between these observed trends and BVWSD's historical water budget results. Specifically, quantify the relationship between water considered banked in the Buttonwillow Service Area and the observed water level trends. Also, if the district banks water outside of the Buttonwillow Service Area, as suggested in the February, 2013, workshop, please show where this water was banked and how much. Finally, show the spatial distribution and estimated quantities of the forecasted water that will be banked.***

BVWSD Response 9.

Data: Previously reported water balance data.
Attachment 4. Out-of-District Water Banking Facilities Map.

The water district provides responses to the correlation analysis and the out- of-district banking issue separately, below.

Correlation between groundwater recharge and water level behavior in the BSA.
The water balance for the Buttonwillow Service Area can be represented mathematically as follows:
Change in groundwater storage = Water in - Water out.

A positive water balance means that the groundwater aquifer under the BSA is physically gaining water while a negative balance means that the groundwater aquifer under the BSA is physically losing water.

The CEC has represented the BSA water level change over time as a linear increase with a slope of +6.8 ft/decade which they convert to a constant change in groundwater storage of 4,600 af/y at a specific yield of 0.15. The district has linearized the net average annual groundwater recharge in the BSA as +36,964 af/y. Therefore, the net average annual outflow of groundwater from the BSA is -32,364 af/y. This is a relatively small outflow, equal to only 89 af/d, which is equivalent to 9 water wells, each pumping at a constant rate of 5 cfs. This outflow is also equivalent to about 18 irrigation wells, each pumping at a constant rate of 5 cfs for about half a year, which is a reasonable scenario in the subbasin areas outside the BSA for which no surface water delivery system exists which would require crops to be on irrigation- well water. In other words, it is possible that ±32,000 af/y of BV's surplus water is being extracted by non- district water wells which are located outside the district boundary but inside the Buttonwillow subbasin. The district currently has no means to determine to what extent this may be true.

The loss of ±32,000 af/y from the basin may also be due to a limited amount of groundwater lateral outflow from the southern BSA along a 4-mile stretch of the eastern district boundary from about T29s/R23e-Sec14 to T29s/R24e-Sec28. Assuming that there is a significant, but not quite complete, isolation of the southern BSA from the main basin to the east due to the same structural causes as to the north, then an outward flux of 89 af/d, across a 4-mile stretch of district boundary, through a net 40 ft of aquifer thickness under a gradient of 20 ft/mi and a reduced hydraulic conductivity of 10 ft/d will completely explain the loss of ±32,000 af/y from storage under the BSA. The water district currently has insufficient data to determine whether the parameters or the existence of such lateral flow are correct, but all of the combined physical properties which are required to account for such an outflow are completely consistent with the volumetrics and the expected groundwater flow behaviors in the area.

Water banked out- of-district.

BVWSD banks all of the 7,793 af/y average annual volume of out- of-district banked surface water in one or more of the Kern Fan banking projects. See Attachment 4. Going forward, although the banked volume should average the same, BVWSD is developing sources to allow for more recharge within the immediate Buttonwillow area.

<u>CEC DR 10.</u> At the February 2013 workshop BVWSD's Hydrogeologic consultant Robert Crewdson stated that the proposed project pump field is underlain by clean sand and has a specific yield between 0.15 and 0.20 and that this information was used in-lieu of pump test data provided through URS' Hydrogeologic Acquisition Report. Please provide boring logs, geophysical logs, and pump test data that would support the use of the values over the values provided in URS' Report.

BVWSD Response 10.

Attachment 7: Petrographic and Geologic Results of Laboratory testing performed on samples retrieved from eight 100-ft holes drilled in the BSA for 2011 HECA Well Field Phase-2

In April, 2011, BVWSD collected core samples of unconsolidated sediments down to depths of 100 ft from eight (8) hollow stem auger holes located throughout the Buttonwillow Service Area. We consider the lithology from surface to 100ft to be similar to lithology at depths of 500-700ft. This is supported by lithologic data from drillers' and electric logs of over one hundred wells within the boundary of BVWSD.

The laboratory analysis of the retrieved cores were carried out on behalf of BVWSD by Soils Engineering, Inc. in a data package dated 02 September, 2011, referred to as the 2011 Phase-2 HSA data. The data has not yet been vetted, interpreted, or reported in final form because BVWSD has agreed to collect core samples from two additional core holes which have not yet been drilled. A copy of the report is Attachment 1. Our preliminary interpretation is as follows:

For two core samples of clean, medium - coarse-grained quartz sands (07-90C and 08-20B), the specific yield of each is approximately 32%. For three core samples of very fine- grained sandy silt (03-60B, 05-30B, and 05-70B), the specific yields are approximately 17%, 12%, and 13%. For an average aquifer interval under the project area consisting of 60% silt and 40% sand, the bulk average specific yield is 20.6% [(0.6)(0.13) + (0.4)(0.32) = 0.206]. Based on this data, collected from within the project area and from other locations within the Buttonwillow Service Area, the average measured specific yield is approximately 21%, and the value of 18% used by URS prior to the acquisition of this data still appears reasonable. In fact, URS slightly underestimated the specific yield, so the drawdowns computed from their computer model would be approximately 14% smaller than those originally reported by URS if they were to recalculate their model with the value of SY = 20.6%.

CEC DR 11. ***At the February, 2013 workshop BVWSD and their consultant's [sic] discussed the absence of the Corcoran Clay as the reason for "low" anisotropy. Staff believes this has nothing to do with potential effects of shallow fine-grained zones on anisotropy in a single model layer that is 100's of feet thick and representing the pumped interval of the extraction wells. Please provide geologic data, boring logs, or geophysical logs that support the conclusion that aquifer conditions are unconfined within the depth interval between the water table and well extraction depths.***

BVWSD Response 11.

BVWSD does not have any specific recollection of what might have been said at the February 20 , 2013, CEC workshop to give the impression that the absence of the Corcoran Clay is the reason for "low" anisotropy.

As part of our preliminary interpretation of data in Attachment 7., BV went ahead and produced lithologic cross sections of the eight (8) hollow stem auger holes. Although the data has not yet been vetted, or reported in final form, our preliminary interpretation confirms that the fine grained horizons of various thicknesses encountered in the holes are laterally non-continuous. These are considered not extensive enough to produce a confined aquifer. We expect the aquifer system to behave in most part as unconfined and to a lesser extent as semi-confined due to the presence of the localized fine grained horizons.

CEC DR 12. ***In Table 2 of the BVWSD FEIR (2009) a crop inventory is provided. Please provide an update to the crop inventory and a recent map showing where specific crops are located within the district.***

BVWSD Response 12.

Data: Attachment 5. Crop Map March/April 2013

CEC DR 13. ***As discussed at the February 2013 workshop, the leaking Reagan Ponds have produced a contaminant plume that may have already reached the Buena Vista Water Storage District. The HECA wells may have some influence on the plume's zone of impact. Please provide data on water quality and aquifer characteristics that can be used to evaluate potential impacts from migration of the plume due to the proposed project pumping. Also, please discuss the following:***

a) Is the District involved in monitoring of this plume?
b) If the HECA project was licensed as proposed, how would the district mitigate for

potential impacts to local well owners?
c) What kind of monitoring program would the district suggest?

BVWSD Response 13.

Reference Cited: *RWQCB Memorandum of 15 November, 2011 to Aera Energy LLC, "Review- Phase II Groundwater Investigation Report, Row4/Lost Hills Wastewater Disposal Facility, south Belridge Opil Field, Kern County.*
Figure 4. Lost Hills Brine Plume.

a. BVWSD is not involved in monitoring the plume. Based on the RWQCB memo, Aera Energy LLC operates a monitoring and reporting program under RWQCB WDRO R5-2006-0073 which includes semi- annual monitoring of 55 accessible monitoring wells. The RWQCB reports that the *"discharge of wastewater ceased in 2006"* and that the groundwater levels in the underlying groundwater mound *"continue to drop."* The monitoring program includes a linear array of sentinel wells located between the Aqueduct and the West Side Canal west- northwest of the project location which have not detected the presence of the plume to date. See Fig 4.

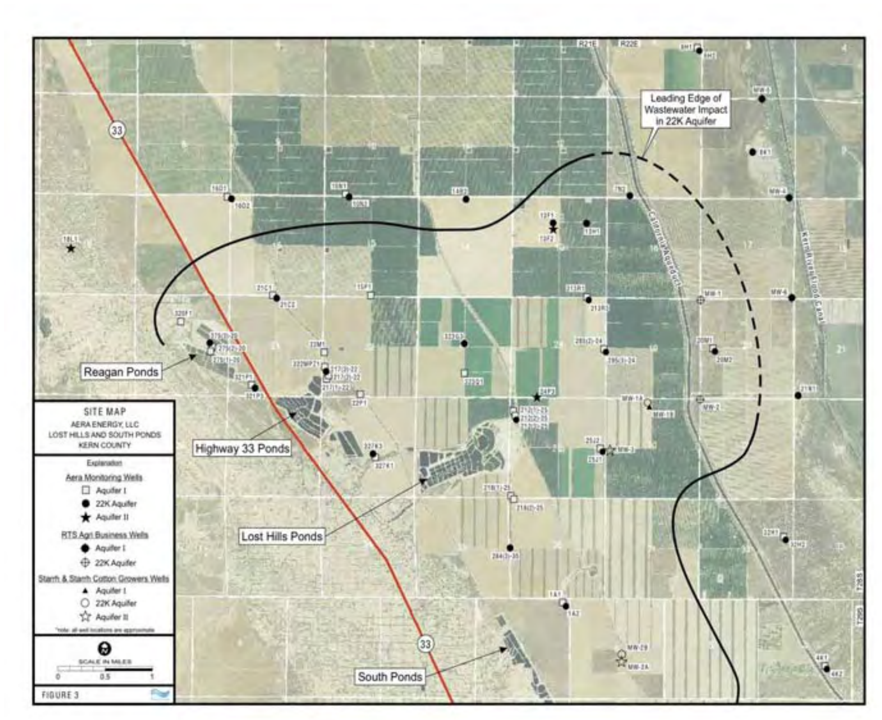


Figure 4. Lost Hills Brine Plume 1

b. The operation of the proposed well field will not induce a significant change in the plume location and, therefore, not significantly change in the groundwater chemistry at any well location within the zone of impact of the proposed well field.

As long as the RWQCB continues to be satisfied with the ongoing natural degradation or dilution of the plume and insufficient threat to existing or potential receptors, then BVWSD concludes that the situation requires no additional monitoring facilities, no further impact analyses, and no proposed remediation or mitigation.

c. BVWSD does not recommend any additions or changes to its own in- district monitoring program or to the existing plume monitoring program which Aera is operating under the WDRO. However, the water district may propose to install groundwater monitoring wells around the proposed well field in order to monitor and optimize the operation of the well field, including detection monitoring for potential fresh water breakthrough. If such monitoring wells are located to the west of the proposed well field, they will serve as sentinel wells for the detection of water quality changes, regardless of source.

CEC DR 14. ***BVWSD has stated that the Target Area A could only provide up to 4,500 acre-feet per year to the Brackish Groundwater Remediation Program. Please provide economic data demonstrating whether it would be feasible to use this source for the project supply.***

BVWSD Response 14.

The water district does not have an economic analysis of the BGRP Target- A alternative at this time, except for a rough preliminary cost estimate.

The preliminary Target A BGRP cost estimate is based on the following estimates of the key operating parameters. The purpose of the proposed Target- A BGRP is to uniformly lower the shallow water table by about twenty feet across a specified project area. The proposed method is to use a grid of closely- spaced, low- flow water wells which are completed entirely within the shallow portion of the perched zone. The aquifer parameters are estimated to be: K = 20 ft/d, Ss = 5x10 ft , H = 40 ft, so that T = 800 sqft/d and S = 0.002. A steady, continuous well flow of Q = 80gpm will create a field- wide drawdown of about 20 ft during early pumping. As dewatering progresses, the flow dynamics will change and the well flow rates will have to be adjusted accordingly. Given the natural variability and many unknowns, the operation of such a well field could require a high level of effort at considerable expense. One of the design concerns is that, once this well field dewaters the project area down to ±20 ft, or another similar selected depth, we do not know whether or not the shallow aquifer will continue to yield sufficient water to the well field through inward lateral flow at the perimeter and/or through upward flow from below the completion interval to meet the water supply requirements for the power facility.

If this design scenario is correct and if the aquifer can provide the long-term, continuous flow to the wells, the project will require 581 wells, covering an area of 133 acres to deliver 5,700 af/y. Assuming each well can be installed for $10,000, a variable rate downhole pump can be installed for $8500, and each wellhead can be connected to a water gathering system for $6500, the cost of the wellfield is about $25,000 per well, or $14,525M . The gathering system which is required to connect all of the wells, assuming a rectangular project area of 1,700 ft by 3,400 ft will need to be about 57,800 ft long plus about 2,000 ft of pipeline to manifold all of the gathering pipelines together. Assuming the cost of piping and installation can be done for $18 per linear foot, the gathering system will cost $1,076M. Assuming that the power plant operator will require a 2 out of 3 redundancy, the same as is required for the Target B water supply well field, the estimated cost for the Target A BGRP well field installation is $15,601,000 x 1.67 = $26,001M. If the pipeline which connects the Target A BGRP well field to is 5 miles longer than the pipeline for the Target B well field, then the Target A pipeline cost about 133% more than the Target B pipeline.

Let us compare the estimated well field and pipeline installation costs for the Target- A and Target- B BGRP well fields. Five Target- B wells and pumps (3 plus 2 redundant) are estimated to cost $500k each for a total $2,500M plus an estimated $0.8M for the gathering system. The Target-A wells and gathering system are estimated to cost 7.9 times more than the Target-B wells and gathering system. The Target-A pipeline is estimated to cost 1.7 times more than the Target-B pipeline. We know that the engineering requirements, operating costs, and deliverability risks of a Target-A BGRP would be much greater than those of the proposed Target- B BGRP.

The water district chose not to develop the Target A BGRP for reasons other than the cost, including the fact that the TDS of the shallow groundwater in the perched zone is much more variable than the groundwater TDS in the Target- B site, the operation of the target-A BGRP would require a lot of engineering and supervision beyond the current capability or willingness of the district staff to provide, the Target-A zone of benefit would be smaller than the Target-B zone of benefit, and the installation of the well field and gathering system would make it more difficult to farm the land for which the zone of benefit was intended.