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Buena Vista Water Storage District (BVWSD) – Adaptive Management Plan – Brackish Groundwater Remediation program Area B Well Field Development and Operation.

Additional submitted attachment is included below.

Buena Vista Water Storage District

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October 22, 2013

Mike Conway
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California Energy Commission
1516 Ninth Street, MS-15
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Subject: Buena Vista Water Storage District – Adaptive Management Plan – Brackish Groundwater Remediation Program Area B Well Field Development and Operation

Dear Mike,

At our meeting in Fresno on September 5, 2013, the Buena Vista Water Storage District (BVWSD) agreed to provide you with Buena Vista's concept of the Adaptive Management Plan (AMP) that will be used to manage the HECA Well Field Development and Operation. The phrase AMP was used during the meeting to illustrate the adaptive changes that can be made during the design, construction, and operation of the proposed well field to insure that high TDS groundwater will be extracted. Well field-specific geologic and hydrogeologic information will be obtained as the initial part of the AMP. This information will be interpreted and applied to the final well field design, currently envisioned to include five production wells (3 pumping and 2 redundant) set linearly along the extreme west side of the BVWSD Buttonwillow Service Area. The adaptive aspect of the AMP includes the final well field design, pre-project and project monitoring and reporting, and continuous evaluations as to the efficiency of pumping groundwater with elevated Total Dissolved Solids (TDS) for the duration of the HECA Power Plant Project. Changes in well and pumping strategies may be applied, if necessary, to optimize efficient and elevated TDS removal, as is the primary objective of the BGRP.
Attached is our conceptual summary of the AMP. If you have any questions about the AMP please contact me 661.324.1101 or Maurice@bvh2o.com.

Sincerely,

Maurice J. Etchechury
Engineer-Manager
Buena Vista Water Storage District

Attachment: Adaptive Management Plan

Adaptive Management Plan

Brackish Groundwater Remediation Program Area B Well Field Development and Operation

Below is an explanation off the process Buena Vista Waster Storage District (BVWSD) envisions for managing the Brackish Groundwater Remediation Project (BGRP) Area B well field for the process water supply for Hydrogen Energy California Project (HECA.) The main objective of the BGRP Area B well field is to optimize the interception and removal of groundwater with elevated Total Dissolved Solids (TDS) ranging from 2,000 to 4,000 plus mg/L from the local groundwater while providing process water to HECA at sustainable on-demand pumping rates (maximum of 7,500 acre feet per year) for the 25 year project lifetime. BGRP/HECA Area B well field operations will include a robust monitoring and reporting program that can be used to evaluate potential drawdown impacts to neighboring wells, insure only high TDS water is delivered to HECA, record the groundwater quality in the area surrounding the well field and insure no degradation is occurring due to the HECA wells.

The AMP is summarized below:

Exploratory Boring/Test Well Program

While sufficient information currently exists to characterize local hydrogeology, the exploratory well program is directed toward refining that characterization so that the well field design can be optimized with respect to the final number of wells, spacing, well placements, total depths, and screen intervals. Well field drilling and pump specifications will be based on the exploratory boring/test well program findings. The exploratory boring/test well program will include:

- Four stratigraphic borings (three to 600 feet and one to 1,000 feet). The stratigraphic wells will be spaced at intervals of approximately 3,900 feet to provide lateral coverage across the entire length of the proposed BGRP Area B well field area. The final well field would focus on that segment of Area B (wells expected to be spaced at ¼ to ½ mile intervals) that is best suited to meet BGRP objectives.
- Geologic logs (from grab samples and cores over intervals of interest).
- Geophysical logs (SP, resistivity and caliper).
- Samples from select cores will be run for geotechnical analysis (grain size, falling head permeameter, etc. laboratory tests.)
- Discrete groundwater sampling at selected depth intervals (to evaluate TDS stratification in the aquifer system.)
- Reaming out at least two of the exploratory borings and installing nested monitoring wells (3 to 5) for pre-project and project monitoring of discrete zones (water level and water quality).
- Installing at least one test well to be completed as a final production well (well casing and screen expected to be 18- to 20-inches in diameter).
- Running a step-drawdown and 72-hour pumping and recovery test below and above the design pumping rate to evaluate specific capacity of the well and hydraulic parameters of the formation. The nested monitoring wells as well as other nearby wells (as possible) will be used as observation points during the pumping test.
- Developing final well field design and drilling specifications.

Production Well Program

The production wells must provide HECA with 7500 af/yr of high TDS cooling and process water. The maximum expected demand is 1050 af/month. The District proposes to provide this supply by drilling three (3) primary wells producing 3.5 -5.5 CFS each and two backup wells for redundancy.

Depending on trends observed from monitoring, production well depths, screen intervals, pump settings, and well configurations may be adjusted to ensure project objectives are effectively met. The conceptual well field design includes a line of five wells (3 pumping and 2 redundant, spaced at ¼ to ½ mile intervals) located on the west side of the BVWSD Buttonwillow Service Area (BSA), near 7th Standard Road. This "Picket Fence" extends the potential extraction zone to provide flexibility in operation as described in the Well Field and Pumping Adaptations section. It has been determined (based on information obtained from the Phase 1 test program, the 2011 HECA Well Field Phase 2 and in-house quality and water level data) that construction the wells in a "Picket Fence" will be most effective in extracting high TDS Water from the aquifer underlying the Buttonwillow Service Area of the District. The production well depths are expected to range between 250 and 400 feet below ground surface (bgs) with screen intervals located adjacent to zones of highest TDS groundwater. The wells will be constructed by a licensed contractor selected by a competitive bidding process. One test well to be completed as a final production well (well casing and screen expected to be 18 to 20-inches in diameter.)

After well development, a step-drawdown test will be run on each production well (below and above the design pumping rate) to evaluate specific capacity, pump, and pump setting requirements.

The District anticipates the horizontal separation between wells will be at an interval that the capture zone of each well (at normal recovery rates) will overlap the capture zone of neighboring wells. The final spacing of wells will consider the impact of one well in the series being out of production.

Monitoring Program

A monitoring program will be developed that can be used to evaluate potential effects on neighboring wells, changes in groundwater quality, water level responses to project-specific and local agricultural pumping, BVWSD BSA recharge, and changes in production well capacity.

BVWSD already has an active monitoring program that includes 14 wells, of which 5 are monitored twice daily using pressure transducers. Three of BVWSD monitoring wells are located within three miles of the proposed well field. It is BVWSD's intent to incorporate HECA-specific monitoring with their on-going program.

For the AMP monitoring program BVWSD will:

- Conduct a 3-mile radius well inventory to select key monitoring wells.
- Secure well access agreements.
- Monitor key wells.
- Monitor the production wells. BGRP/HECA Area B production wells will be outfitted with pressure transducer/data loggers (for monitoring water levels) and totalizing flow meters with data loggers so that discharge rates can be monitored on a continuous basis. Flow-through cells with data loggers will also be installed on the production well discharge lines so that field parameters of pH, electrical conductivity (i.e., TDS with conversion factor) temperature, and turbidity can be monitored on an evolving basis based on data sets and trends.

- Sample wells. The nested wells as well as select key wells within the 3 mile radius, will be periodically sampled for select water quality parameters and constituents to monitor changes in water quality.

Reporting Program

Periodic monitoring reports will be submitted to the CEC and/or other appropriate agencies, that document groundwater monitoring data and evaluations water level and water quality trends. The purpose is to evaluate the effectiveness of meeting the BGRP/HECA Area B Pumping Program objectives. The evaluations will include water quality, pumping rates and changes (if required) to maintain the goals of delivering high TDS water without degrading the existing groundwater. The reports will include:

- Text, tables, figures, and appendices that provide monitoring and well field data on a periodic and cumulative basis.
- Tables would include production and monitoring well construction details and reference point elevations, discharge rate, water level, field parameter, and water quality sample results.
- Conduct trend analysis.
- With completion of the Exploratory Boring / Test Well Program, the existing groundwater model will be refined to periodically judge the effectiveness of the pumping program in meeting project objectives as well as to evaluate if other well depths or configurations may be applied that would improve program effectiveness based on observed data.

Well Field and/or Pumping Adaptations

The District will use the evaluations made during the reporting program to verify that the pumping program is operating effectively or to make adaptive improvements, as necessary. Those improvements would typically be directed at ensuring that TDS concentrations from 2,000 to 4,000 mg/L are sustainable. Adaptive improvements may include but are not limited to:

- Changing pumping schedules between the existing production wells (variable well use and pumping rates to improve TDS removal rates).
- Changing well depths (plugging the base of wells).
- Sealing off certain perforated intervals of the wells.
- Installing new wells that would allow improved effectiveness in TDS interception and removal and the ability to move better quality waters into the zone of maximum benefit for the east side of the BSA.