

Central Valley Regional Water Quality Control Board

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**SUBJECT: REVIEW OF THE NORTH ANTELOPE HILLS OIL FIELD AQUIFER
EXEMPTION FOR THE TULARE FORMATION, KERN COUNTY**

Premier Resource Management, LLC (applicant) submitted the *Aquifer Exemption Application Tulare Formation Aquifer Exemption Justification* (Application) dated 5 January 2023 to the California Geologic Energy Management Division (CalGEM). On 20 September 2023, CalGEM provided the Application to the State Water Resources Control Board and the Central Valley Regional Water Quality Control Board (Central Valley Water Board). The Application proposes to exempt the oil sands zone of the Tulare Formation (Tulare Oil Sand) southeast of the North Antelope Hills Oil Field. The proposed lateral aquifer exemption (AE) area is shown on *Figure 1: Location map showing locations of Proposed Exemption Area along a portion of the west-side of the San Joaquin basin and nearby oil fields* of the Application.

Central Valley Water Board staff (Staff) performed a preliminary review of the Application. The following contains Staff's questions and concerns.

1. Title 40 of the Code of Federal Regulations Section 146.4 criteria for exempted aquifers (a) – It does not currently serve as a source of drinking water.

- A. *Appendix F: Water Well Survey* (Appendix F) of the Application contains information from public databases regarding cathodic protection, monitoring wells, tests wells, and water supply wells. *Section 1. Waterboard GAMA Groundwater Wells* identified two wells within a one-mile radius of the AE area and states "The depth of these wells and the formation they are completed in is not included in the California Water Boards GAMA Groundwater Information System.....". This statement references *Figure 1: DWR Wells* in Appendix F which shows the locations of the two wells. However, the type of water supply well (i.e., domestic, agriculture) is not identified and it is unclear whether these wells are open to the Tulare Oil Sand. The applicant needs to provide the type of water supply well and, if a well is identified as a drinking water supply well, the well status (e.g., active, destroyed), production zone, etc. If information of a

potential drinking water supply well is unknown, additional actions may be warranted (e.g., field survey, telephone communication, email). The applicant needs to include all supporting documentation.

- B. The applicant needs to contact all applicable Department of Water Resources Groundwater Sustainability Agencies (GSAs) to inquire if they have local management goals for the current or future use of groundwater within one mile of the proposed AE area. Supporting communication of the GSA responses needs to be provided.

2. Title 40 of the Code of Federal Regulations Section 146.4 criteria for exempted aquifers (b) – It cannot now and will not in the future serve as a source of drinking water because: (1) It is mineral, hydrocarbon or geothermal energy producing, or can be demonstrated by a permit applicant as part of a permit application for a Class II or III operation to contain minerals or hydrocarbons that considering their quantity and location are expected to be commercially producible.

- A. *Appendix A: Wells with Hydrocarbon Indicators* (Appendix A) in the Application is a table that lists several wells having core data with measurable quantities of oil for the Tulare Oil Sand. Staff reviewed *Appendix C: Formation Core Data* (Appendix C) in the Application that contains supporting core data for wells listed in Appendix A and found missing core data for numerous wells listed. Appendix C needs to be revised to include the core data (i.e., analytical laboratory reports) for all wells listed in Appendix A.
- B. *Table A-2: Tulare Formation Core Samples Records* (Table A-2) in the 27 January 2023 *Aquifer Exemption Application Addendum A: Tulare Formation Discussion Tulare Formation Aquifer Exemption Justification* (Addendum A) has a list of wells with their respective quantity of oil. The “Acronym” and “Explanation” section for Table A-2 (page 12) defines the abbreviations “SHOW” and “OIL” as “Non-Commercial Oil Saturation” and “Potential Commercial Oil Saturation”, respectively. Addendum A needs to be revised to state the criteria used to define “Non-Commercial Oil Saturation” and “Potential Commercial Oil Saturation”. Addendum A needs to clarify the quantity (e.g., percentage, volume) of expected commercially producible oil within the proposed AE area for the Tulare Oil Sand. Additionally, supporting analytical laboratory reports for the referenced core data need to be included in Addendum A.
- C. *Figure A-12: Map showing distribution of wells with core data for the Tulare Formation* (Figure A-12) in Addendum A shows the locations of wells with available core data for the Tulare Oil Sand in the proposed AE area. Staff reviewed core data provided in Appendix C for wells in Figure A-12. Based on these data, information is not available for Sections 28, 29, 32, 33, of Township 27 South (T27S), Range 20 East (R20E), Section 5 of T28S, R20E, or Section 36 of T27S, R19E in the proposed AE area. Supporting data (e.g., core data)

demonstrating that commercially producible oil is present throughout the Tulare Oil Sand within the AE area needs to be provided.

- D. Page 8 in the Application states “Between 2006 and 2012, seven wells were drilled and completed in the proposed expansion area (Figure 34). Six oil-bearing sands in four formations were found, and four of the six sands were completed for production. Premier assumed responsibilities for these wells in 2019 and is moving forward with production activities”. *Figure 34: Location map of wells drilled in Proposed Expansion Area since 2006* (Figure 34) in the Application shows the location of 12 wells. Staff reviewed the well statuses reported on CalGEM’s WellSTAR database for these 12 wells which were 4 plugged and abandoned wells, 4 idle wells, and 4 active wells. None of the idle or active wells appear to have production from the Tulare Oil Sand. It is unclear to Staff which wells, if any, shown on Figure 34 have commercially producible oil in the Tulare Oil Sand. The applicant needs to identify the wells that contain commercially producible oil and provide supporting documentation.
- E. Page 13 in the Application states “The Tulare Oil Sand has oil production within the proposed AE...”. *Figure 7: Top Tulare Oil Sand/Base Tulare Clay (Upper Confining Layer) structure contour map* (Figure 7) has a legend with three different patterns to represent the presence of hydrocarbons within the AE area. Figure 7 shows two of those patterns, the “area with potentially productive hydrocarbon accumulation” and the “area expected to contain hydrocarbons in some form (shows)” but does not depict any area with “area of hydrocarbon accumulations currently under production”. Additionally, Figure 7 does not show any of the three patterns within the eastern portion of the proposed AE area in Sections 28, 29, 32, and 33 of T27S, R20E. The applicant needs to provide data on the current production in the Tulare Oil Sand within the proposed AE area and verify the presence of commercially producible oil in the eastern portion of the proposed AE area.
- F. Page 6 in the Application states “The proposed expansion area coincides with the presence of hydrocarbons demonstrated by oil production, oil measured from mud logs, and oil extracted from sidewall core samples, or oil showings noted in well histories at the time of drilling.” Staff reviewed the following well records located on the eastern portion of the proposed AE area in Sections 32 and 33 T27S, R20E from CalGEM’s WellSTAR database and noted no oil or gas showings: Voigt 26X-33 (American Petroleum Institute [API] 02953331), Core Hole 50 (API 02913658), Core Hole 50-A (API 02913660), Nepple Custodian 32-1 (API 02936554), Core Hole 68 (API 02913662), and Voigt 1 (API 02948624). Staff is concerned there is insufficient evidence to support the presence of commercially productive quantities of oil throughout the eastern proposed AE area. Additional data needs to be provided that expands to the proposed AE boundary to show that the eastern proposed AE area contains hydrocarbons, that considering their quantity and location are expected to be commercially producible.

G. The sub-heading of the Application states “North Antelope Hills Oil Field Expansion”. The Application needs to clarify if the proposed AE area is an expansion of an existing operation. Supporting oil production data from the closest well(s) producing from the Tulare Oil Sand needs to be provided. The Application needs to demonstrate that the quantity of hydrocarbons in the proposed AE area are expected to be commercially producible.

3. California Public Resources Code section 3131, subdivision (a) – (2) The injection of fluids will not affect the quality of water that is, or may reasonably be, used for any beneficial use.

A. Page 13 in the Application states produced fluid from the proposed AE area will be reinjected for waterflood and steamflood activities. The Application does not clarify the source of the proposed injectate nor does the Application include a water quality analysis of the proposed injectate (e.g., after treatment processes have been performed). The Application needs to be revised to state the source of the injectate and include analytical laboratory reports of the injectate (i.e., after any treatment processes have been performed).

B. The summary table on pages 1 and 2 in *Appendix B: TDS Water Data* (Appendix B) in the Application, lists two wells within the proposed AE area that were used to collect water quality samples from the Tulare Formation. The summary table states 16,000 and 10,000 milligrams per liter (mg/L) for well 2-30 (API 03029955), with a note that well 2-30 was completed in the Tulare Formation and the Phacoides sands. The summary table states 9,900, 9,600, and 9,700 mg/L for well 6-30 (API 03041268), with a note that well 6-30 has a liner across the Tulare Oil Sand and an open hole in part of the Point of Rocks sands but that cement isolates the Point of Rocks sands. Review of the *Water Sample Well Locations* figure on page 3 in Appendix B shows wells 2-30 and 6-30 in Section 30 of T27S, R20E. Staff have the following comments:

1) Formation water quality samples solely from the Tulare Oil Sand need to be provided for the proposed AE area.

2) A wellbore diagram of well 6-30 needs to be provided that clarifies the zone the formation water quality sample was collected from with respect to the open hole in the Point of Rocks sands. Dates of when the formation water quality sample was collected and when well cement work was performed need to be included on the wellbore diagram.

3) The summary table on pages 1 and 2 in Appendix B needs to identify the constituent being reported (i.e., total dissolved solids).

C. Appendix F of the Application provides the results of the water supply well survey. No industrial water supply wells were identified within a one-mile radius of the AE boundary. However, Page 15 in the Application states “...the only known potential use of that water is industrial...”. The applicant needs to provide

information of all known industrial water supply wells or industrial beneficial uses within one mile of the proposed AE boundary. The applicant needs to provide the location, status (e.g., active, destroyed), production zone, etc. of each industrial water supply well identified.

4. California Public Resources Code section 3131, subdivision (a) – (3) The injected fluid will remain in the aquifer or portion of the aquifer that would be exempted.

- A. Supporting data for the overlying confining layer (e.g. core data showing permeability) needs to be provided for the proposed AE area.
- B. Page 17 in the Application states that “Confinement of the Tulare Oil Sand on the west is dominantly by fault closure against Fault A...”. *Figure 25: Cross section 3-3’* shows the Tulare Oil Sand west of Fault A, outside of the proposed AE area. Supporting data and analysis (e.g., pressure data, fluid level measurements) used to verify that Fault A is laterally sealing needs to be provided.

5. Additional Questions and Concerns

- A. Pages 15 and 16 in the Application state there is no groundwater in the alluvium and upper portion of the Tulare Formation based on three monitoring wells owned by E&B Natural Resources (E&B) located outside of the proposed AE area, and refers to *Figure 20: Water wells within one mile of the Proposed Aquifer Exemption Area* (Figure 20) and Appendix F. Staff have the following comments:

Based on review of Figure 20, the three monitoring wells shown are within the proposed AE area and do not have the same well names as the well names described in the text of the Application for the E&B wells. Please clarify whether the wells shown on Figure 20 are the referenced E&B monitoring wells or other shallow wells. If the three E&B monitoring wells are located within the proposed AE boundary, supporting data that these wells have been dry needs to be provided along with well construction information including the depth, screened intervals, and name of the completion zone(s) (e.g., alluvium, upper Tulare Formation). If the shallow wells shown on Figure 20 are not the referenced E&B wells, please provide supporting data for the monitoring wells shown on Figure 20.

- B. The United States Geological Survey wells are listed in *Table 2: USGS National Water Information System Water Quality August 2022* and shown on *Figure 2: USGS Wells* of Appendix F. Well USGS-353158119482001 is located just outside the one-mile radius of the proposed AE area, has a total dissolved solids concentration of approximately 2,800 mg/L, and is completed in the upper portion of the Tulare Formation. Page 1 in Addendum A states:

The overlying Quaternary alluvium is widely unsaturated throughout most of the study area, and this interval is commonly referred to as the "air sands". The upper part of the Tulare Formation may be unsaturated as well, which when combined with the similar lithology of the Tulare Formation makes definite determination of the Tulare/alluvium boundary by electric logs very difficult.

The Application does not include supporting data showing that the overlying alluvium and upper portion of the Tulare Formation are unsaturated. Supporting data (e.g., well logs, cross section, formation water samples, core data) needs to be provided.

- C. *Figure 5: Type Log* (Figure 5) shows the log of a well located greater than 6,000 feet from the AE area. Figure 5 needs to be revised with a well from inside the AE boundary and should include the formations/units from the ground surface to at least the lower confining layer and identify the base of all overlying underground sources of drinking water (USDWs), non-USDWs, and/or air sands.
- D. Application cross sections (i.e., Figure 23 through Figure 29) need to be updated to identify all USDWs, non-USDWs, and/or air sands within the overlying formations/units throughout the proposed AE area.
- E. Figures A-12 through A-14 in Addendum A need to be revised where the well name/number are legible. Figure 6 through Figure 12 in the Application need to be revised to define the labels "NP", "N/A", "NDE", and "EST-NDE".