



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IX

75 Hawthorne Street

San Francisco, CA 94105-3901

May 7, 2019

Kenneth A. Harris Jr.
State Oil and Gas Supervisor
Division of Oil, Gas, and Geothermal Resources
California Department of Conservation
801 K Street, MS 18-05
Sacramento, CA 95814-3530

Re: Approval of Aquifer Exemption for the Livermore Oil Field, Alameda County, California

Dear Mr. Harris:

Based on a thorough review of the supporting documents submitted by the California Department of Conservation, Division of Oil, Gas, and Geothermal Resources (DOGGR) and the State Water Resources Control Board (SWRCB), the U.S. Environmental Protection Agency (EPA) hereby approves the aquifer exemption request for portions of the Greenville Sands Member of the Cierbo Formation in the Livermore Oil Field in Alameda County, California.

In accordance with applicable regulations at 40 C.F.R. Parts 144, 145, and 146, we find that this aquifer exemption request is a non-substantial program revision, and the requested formation meets the following federal exemption criteria:

- The portions of the formation proposed for exemption in the field do not currently serve as source of drinking water; and
- The portions of the formation proposed for exemption in the field cannot now and will not in the future serve as a source of drinking water because they have been demonstrated to contain commercially producible quantities of hydrocarbons.

The approved aquifer exemption boundaries and depths, along with the EPA's analysis and rationale in support of the approval, are detailed in the enclosed Record of Decision. In addition, we are enclosing the application and other documents submitted by the DOGGR and SWRCB to the EPA that were considered in this approval decision. Due to the size of these additional enclosures, we are providing, via email, a link to an electronic folder containing all the remaining documents.

If you have any questions, or if you have any difficulty accessing the electronic folder, please contact David Albright, Acting Assistant Director of our Tribal and State Assistance Branch, at (415) 972-3971.

Sincerely,

A handwritten signature in blue ink, appearing to read 'Tomás Torres', with a date 'May 7, 2019' written in blue ink to the right of the signature.

Tomás Torres
Director, Water Division

Enclosures: Aquifer Exemption Record of Decision for the Livermore Oil Field
GIS Shape Files of Approved Aquifer Exemption
Final Livermore Exemption Application
Letter from Kenneth Harris to David Albright dated February 25, 2019

cc: Jonathan Bishop, Chief Deputy Director, State Water Resources Control Board

US Environmental Protection Agency (EPA) Region 9
Underground Injection Control (UIC) Program
AQUIFER EXEMPTION RECORD OF DECISION

This Record of Decision (ROD) provides the EPA’s decision to approve an aquifer exemption (AE) for portions of the Greenville Sands Member within the Livermore Oil Field, background information concerning the AE request, and the basis for the AE decision.

Primacy Agency: California Division of Oil, Gas, & Geothermal Resources (DOGGR)

Date of Aquifer Exemption Request: August 10, 2018

Exemption Criteria: DOGGR requests this exemption because it has determined that it meets the criteria at 40 CFR § 146.4(a) and § 146.4(b)(1).

Substantial or Non-Substantial Program Revision: Non-Substantial

Although the EPA must approve all revisions to EPA-approved state UIC programs, the process differs depending on whether the EPA finds the revision to be a substantial or non-substantial program revision. The EPA determined this is a non-substantial program revision because it is associated with an existing oil field and is not a state-wide programmatic change or a program revision with unique or significant implications for the State’s UIC program. The decision to treat this AE request as a non-substantial program revision is also consistent with the EPA’s “Guidance for Review and Approval of State Underground Injection Control (UIC) Programs and Revisions to Approved State Programs” (“Guidance 34”), which explains that the determination of whether a program revision is substantial or non-substantial is made on a case-by-case basis.

Current Operator: E&B Natural Resources Management Company, LLC.

Well/Project Name: Greenville Sands Member, Cierbo Formation, Livermore Oil Field.

Current Well/Project Permit Number: There are no Class II wells in the Livermore Oil Field within the portion of the aquifer proposed for exemption. In the future, the State anticipates the operator will seek permits for Class II wells to inject within the portion of the aquifer proposed for exemption.

Well/Project Location: The AE is located in portions of: Township 3S Range 3E, Sections 6 and 7, Mount Diablo Base and Meridian (MDB&M). [Refer to Figures 1 and 2.]

County: Alameda

State: California

Well Class/Type: The State anticipates the operator will seek Class II permits from DOGGR for injection for enhanced oil recovery (EOR) and disposal of produced fluids in the area proposed for injection.

DESCRIPTION OF PROPOSED AQUIFER EXEMPTION

Aquifer to be Exempted: Portions of the Greenville Sands Member of the Cierbo Formation within the Livermore Oil Field.

Areal Extent of Aquifer Exemption: DOGGR has proposed a 51.3-acre exemption in an area planned for future commercial oil production. The lateral boundaries of the AE area are defined by sealing faults to the south and east and by the extent of the lowest known oil to the west. DOGGR provided GIS shapefiles that delineate the AE boundary and are included in the administrative record for this ROD. Refer to Figure 2 for a depiction of the areal extent of the aquifer proposed for exemption. The proposed exemption is an expansion to an existing 25.9-acre AE approved by the EPA at the time California's Class II program was approved for primacy in 1983. The combined areal extent of the existing AE and the proposed AE in the Livermore Oil Field is approximately 77.2 acres.

Lithology, Total Dissolved Solids (TDS), Depth, Thickness, Porosity, and Permeability of the Aquifer: The following table presents the lithology, TDS levels, depth, thickness, and average porosity and permeability information about the aquifer proposed for exemption.

<i>Aquifer</i>	Greenville Sands Member
<i>Lithology</i>	Fine to coarse grained, very poorly sorted silty sands with occasional fossiliferous sands, gravels, and interbedded silty clays.
<i>TDS (mg/L)</i>	7,450 mg/L (average of four samples taken between 2013 and 2015).
<i>Depth to Top (feet bgs)</i>	Over 800 feet near the top of the structure to over 2,300 feet below ground surface (bgs) at the deepest oil/water contacts.
<i>Thickness (feet)</i>	Average of approximately 450 feet.
<i>Average Porosity and Permeability</i>	Porosity averages 25% to 28%. Permeability averages 100 to 250 millidarcies (mD).

Confining Zone(s): The Greenville Sands Member within the Livermore Oil Field is confined above by 430 feet to over 1,500 feet of silts, clays, shales, sands, and conglomerates of the Green Valley/Tassajara Group, Neroly Formation, and Upper Cierbo Formation; confinement below is provided by a silty shale/sandy silt layer. Lateral confinement is provided by sealing faults to the south and east and an inward pressure sink created by ongoing production in the Livermore Oil Field that defines the oil-water contact to the west. [Refer to Figures 3.1 through 3.3.]

BACKGROUND

On January 22, 2018, the EPA received a request from DOGGR to exempt portions of the Greenville Sands Member of the Cierbo Formation within the Livermore Oil Field, in Alameda County, California pursuant to 40 CFR § 146.4(a) and (c). Based on a review of the information provided in the request and discussions with DOGGR, the State determined that, due to the presence of commercially producible hydrocarbons, the portions of the Greenville Sands

Member proposed for exemption more appropriately met the criteria at 40 CFR § 146.4(a) and (b)(1). Thus, in February 2018, DOGGR requested additional time and proceeded with a request for updated information from the applicant. DOGGR prepared a revised AE package, based on the federal exemption criteria at § 146.4(a) and (b)(1), and solicited public comment on this revised information in April 2018. On August 10, 2018, DOGGR submitted a revised AE request to the EPA.

DOGGR concurred with the operator's proposal for exemption and requested this AE based on the criteria at 40 CFR § 146.4(a): it does not currently serve as a source of drinking water; and at 40 CFR § 146.4(b)(1): it cannot now and will not in the future serve as a source of drinking water because 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. After the EPA's approval of the AE, the exempt formation would not be protected as an "underground source of drinking water" (USDW) under the Safe Drinking Water Act (SDWA) and subject to state regulatory requirements, DOGGR could review and approve proposed Class II injection into the identified formation.

The Livermore Oil Field was discovered in January 1967, when oil was first produced in the field from the Greenville Sands Member. Since 1967, hydrocarbons have been produced from the field, separated from water, and then produced water has been reinjected into the same formation. Over the life of the field, approximately 1.5 million barrels (bbls) of oil have been produced from the Greenville Sands Member. The Greenville Sands Member is the most productive of two formations that have produced oil from the Livermore Field; 1,670 bbls of oil were produced from the underlying Tesla Formation beginning in 1967 until that formation was abandoned in 1969. At the time DOGGR submitted the AE request to EPA, no Class II wells were operating in the portion of the field that is proposed for exemption. There is one Class II well used to dispose of produced water in the previously exempted area. In the portion of the aquifer proposed for exemption, the State anticipates the operator will seek Class II permits for enhanced oil recovery (EOR) injection and disposal of produced fluids into the same hydrocarbon-bearing sands from which they are produced.

BASIS FOR DECISION

Regulatory Criteria under which the AE is Requested and Approved

40 CFR § 146.4(a) It does not currently serve as a source of drinking water.

In their concurrence on this AE package, the State Water Resources Control Board (State Board) determined that the portion of the Greenville Sands Member that is proposed for exemption does not currently serve as a source of drinking water and is not hydraulically connected to domestic or public water supply wells. This is based on the evaluation of information about water supply wells in the area, groundwater flow patterns, and confinement of the formation to groundwater flow. These reviews demonstrated that the portion of the aquifer identified for exemption does not currently serve as a source of drinking water because there are no existing drinking water supply wells, public or private, that currently or in the future would draw water from the

Greenville Sands Member. The data provided indicates that the formation is vertically and laterally confined (i.e., separated) from other USDWs, and no aquifers that serve as sources of drinking water are hydraulically connected to the aquifer. Further, within the State's water well search area (described more fully below), the Greenville Sands Member is not currently a source of drinking water. The Livermore Gravels and Recent Alluvium (the shallow drinking water sources in the area) are more than 550 to 1,800 vertical feet above the top of the Greenville Sands.

Water Supply Wells: DOGGR's AE request included information about water wells in the area proposed for exemption to establish that no drinking water wells or other water supply wells draw water from the portions of the aquifer proposed for exemption.

The applicant searched for wells within a water supply well search area ("study area") that extended at least one-quarter mile beyond the boundary of the proposed Greenville Sands Member aquifer exemption area, along with an extension to the west to include a nearby monitoring well. The total study area was approximately 638 acres.

The State Board reviewed and provided information on well data provided by the Zone 7 Water Agency (a local water wholesaler/supplier). The water well survey identified 15 water supply well records, which included: 10 domestic water supply wells (of which 7 are active, 2 were destroyed, and 1 is inactive); 3 abandoned water supply wells; and 2 active irrigation wells. The active water supply wells are screened between 74 feet and 400 feet below ground surface, and all are either completed at least 1,500 feet above the top of the Greenville Sands Member at the location of the well or are on the opposite side of one of the sealing faults and are therefore not hydraulically connected to the Greenville Sands Member (See Table 1.) The well data also indicated that the public or private drinking water supply wells within the study area are screened above the proposed exempt formation and therefore do not draw water from the proposed exempted formation. According to the AE request, the nearest active municipal water source well, which is owned by Cal Water, is approximately 4 miles to the west. The Regional Water Quality Control Board indicated in correspondence that they contacted the Zone 7 Water Agency, who confirmed that there are no municipal drinking water supply wells in close proximity to the area proposed for exemption.

DOGGR's well search investigation confirmed there are no domestic or public drinking water supply wells that draw from the Greenville Sands Member, and that the portion of that formation proposed for exemption is not currently a source of drinking water and is not hydraulically connected to domestic or public water supply wells.

Groundwater Flow Patterns: DOGGR evaluated available hydrogeologic information on the aquifer proposed for exemption, including historical injection and production data, pressure measurements from wells, and pressure maps. Groundwater flow in the Greenville Sands Member has historically been toward the production wells. To date, production of oil and water within the field created an inward pressure gradient (i.e., a "pressure sink") that caused flow from the north and west toward the oil producing wells.

Confinement of the Formation to Groundwater Flow: DOGGR's AE request included information about the vertical and lateral confinement of the Greenville Sands Member within the Livermore Oil Field. The Greenville Sands Member is confined above by a series of formations, including the Green Valley/Tassajara Group, Neroly Formation, and Upper Cierbo Formation, which have a combined vertical thickness of between 430 feet and over 1,500 feet. The percent of impermeable silt, clay, and shale in these formations ranges from 45% to 85%. This is based upon logging and sampling and evaluation of the physical properties of cores that were generated when wells within the Livermore Oil Field were drilled (referred to as mud logs and sidewall cores). The existence of a barrier to vertical flow from the Greenville Sands Member is demonstrated by sidewall cores and mud logs for several wells, which show a range of porosities from 21% to 34% in the silts and shales of the Upper Cierbo Formation, and 24% to 30% in the silts/shales of the Neroly Formation. This permeability data is consistent with lithologic studies of the Miocene marine silts, clays, and shales that form the caprock for many reservoirs in California. DOGGR notes that the differences in water quality between the Greenville Sands Member and that of the Livermore Gravels and Recent Alluvium (based on TDS data from shallow monitoring wells as reported by the Zone 7 Water Agency, and the absence of free oil in shallow monitoring wells near the oil field) also provides evidence of hydraulic separation.

Lower confinement is provided by a 25- to 50-foot thick silty shale/sandy silt at the top of the Lower Cierbo Member. Evidence for the presence of this confining layer is presented in logs taken in the Smith Et Ux #2, Nissen # 3, and Nissen #5 wells.

The Livermore Oil Field is formed by a faulted anticline (dome). Lateral confinement is provided by sealing faults to the south and east and an inward pressure sink that defines the oil-water contact to the west. See Figures 3.1 through 3.3.

- *To the south and east:* the Main Fault (to the south) and the N4 and Greenville Faults (to the east) provide confinement. Evidence for the sealing nature of these faults is the presence of oil in the wells on one side of the faults and a lack of oil on the opposite side of the faults, along with offsets of the oil/water boundary across the faults. This is demonstrated in mud logs and sidewall cores, e.g., from the Nissen #4-7 Well, the Nissen #5-7 Well, and the Smith Et Ux #2-6 Well. The faults juxtapose impermeable rock formations against the Greenville Sands Member to seal the formation and prevent fluid movement. Evidence of this juxtaposition is exhibited in cross sections based on well logs; evidence for the faulting is demonstrated by missing or repeated rock sequences, varying oil-water contact elevations, and breaks in structure contour trends. The faults are also known to be sealing because they have trapped oil within the field.
- *To the northwest:* The proposed exemption boundary is defined by oil-water contacts. Currently fluids do not move beyond the oil-water contact due to the presence of a pressure sink that is created because, during production operations, more fluids are produced from the formation than are injected. According to the AE request, 3,051,689 bbls of oil and water were produced and 1,408,680 bbl of water were injected in the Greenville Sands Member between 1967 and 2015. Evidence of this pressure differential

includes drill stem test data and pressure measurements taken from wells within the field, as presented in pressure maps in the AE request. Evidence of the oil-water contact, based on production records, mud logs, and sidewall core data, is presented in cross section B-B' (refer to Figure 3.3).

After reviewing information regarding the location and depth of the existing drinking water supply wells, historic groundwater flow within the Greenville Sands Member, and the lateral and vertical confinement of the formation as described in the AE request, the EPA concludes that the portion of the Greenville Sands Member that is proposed for exemption is not currently a source of drinking water and is not hydraulically connected to any domestic or public drinking water supply wells. Therefore, the EPA has determined that the portion of the aquifer proposed for exemption meets the criteria at 40 CFR § 146.4(a).

40 CFR § 146.4(b)(1) *It cannot now and will not in the future serve as a source of drinking water because 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.*

DOGGR provided information on hydrocarbon production in the area proposed for exemption along with supporting documentation such as historic production data, the locations of production wells, well logs, and sidewall core sample data from wells throughout the area. The presence of hydrocarbons in the Greenville Sands Member is further demonstrated in the AE proposal through drill stem tests, the presence of oil seeps and the surface expression of oil where the Cierbo Formation outcrops (over 3 miles northwest and southeast of the field), and the physical properties (including the presence of oil) in cores that were generated when wells in the field were drilled. The oil saturation of the Greenville Sands Member within the Livermore Oil Field is 60 to 65%, based on information in the document "California Oil and Gas Fields, Vol. I, North and East Central California, 1973."

The Cierbo Formation, which includes the Greenville Sands, is the only productive unit in the Livermore Oil Field. Between 1967 and 2015, approximately 1.5 million barrels of oil were produced from the Greenville Sands within the field. Between the mid-1990s and 2015, the Greenville Sands Member produced an average of about 10,000 barrels of oil per year. Figure 4 shows the location of the production wells within the area proposed for exemption.

Based on a review of information such as well logs, production data, the history of oil production, and the implementation of enhanced recovery techniques that have the potential to increase the productivity of the Greenville Sands Member, the EPA has determined that the aquifer proposed for exemption contains commercially producible quantities of oil and meets the criteria at 40 CFR § 146.4(b)(1).

PUBLIC NOTICE AND COMMENT

DOGGR provided public notice of this proposed AE on December 9, 2016 and held a public hearing on January 11, 2017 in Livermore, CA. The written comment period closed on January

25, 2017. After modifying the original proposed AE, DOGGR opened a supplemental 15-day comment period on April 2, 2018, which closed on April 17, 2018. The supplemental comment period was opened to provide the public an opportunity to comment on the revised criteria under which DOGGR was proposing to exempt the Greenville Sands Member. In the August 2018 submittal, DOGGR provided the EPA a summary of the public comments, copies of the public comments submitted, a transcript of the public hearing, and their responses to the written and oral comments.

In making this decision, the EPA considered all the information submitted by the State, including all the written and oral comments submitted to the State during its public comment process. Most of the issues raised in the comments to the State were addressed by DOGGR in its responses and supplemental responses are provided below.

One commenter (The Center for Biological Diversity) wrote to DOGGR and commented that the EPA should reject the aquifer exemption request before an environmental review has occurred under the National Environmental Policy Act (NEPA). The EPA believes that the public comment and hearing process afforded by DOGGR, the technical analysis to protect USDWs required in the aquifer exemption proposal process under the EPA's UIC regulations, and the enabling legislation in the SDWA provide a functionally equivalent environmental review for this decision.

The same commenter also raised concerns regarding protection of listed species and critical habitat under the federal Endangered Species Act (ESA). After consideration of this issue, the EPA has determined that ESA consultation is not required because the AE approval has no effect on any listed threatened or endangered species or the designated critical habitat of such species. EPA's conclusion is based on a number of considerations. First, the AE approval changes the jurisdictional status of a confined aquifer hundreds to thousands of feet underground under the SDWA. None of the species of concern are present in the subsurface portions of the aquifer considered in the EPA's approval action and it is unclear or speculative whether any listed species or critical habitat overlaps with surface-level activities. In addition, the EPA's approval of the AE is only one preliminary step in the process leading to potential fluid injection into the aquifer, with many additional steps (including state actions and decisions and actions by third party operators) that must occur prior to injection and prior to any potential effects to protected species or habitat at the surface. Thus, EPA would not be the legal cause of potential effects to listed species or designated critical habitat, if any.

Some commenters questioned whether the current technical criteria to consider future drinking water uses are adequate given changing climate conditions and new technology available for water treatment. In considering whether the aquifer proposed for exemption cannot now and will not in the future serve as a source of drinking water, the EPA reviewed data about hydrocarbon production in the portion of the Greenville Sands Member that is proposed for exemption. Based on a review of historic production data, well logs, and core data, the EPA believes that it is reasonable to conclude that the portions of the Greenville Sands Member proposed for exemption contain commercially producible quantities of hydrocarbons and can be productive into the foreseeable future thereby meeting the requirements at 40 CFR § 146.4(b)(1). Potential

future changes to the climate and modern water treatment technologies are not criteria EPA considers in reviewing this AE proposal.

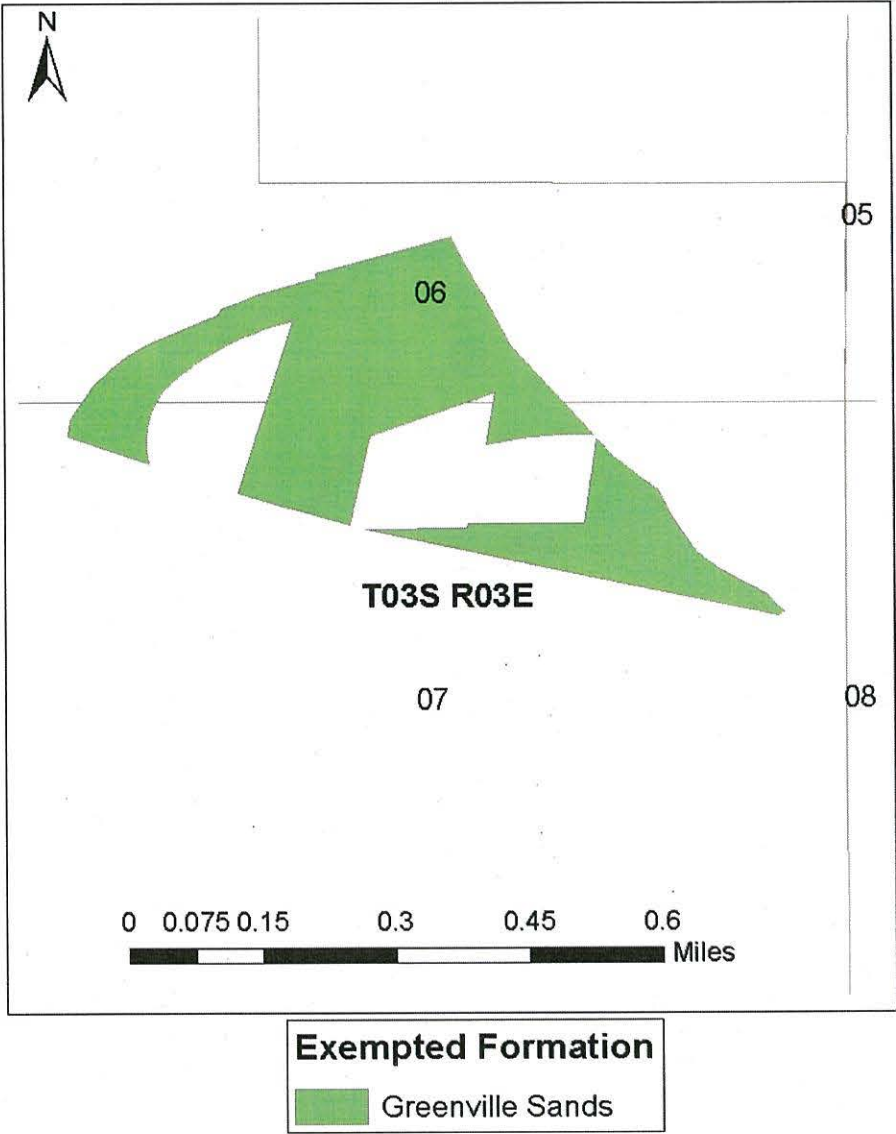
Finally, some commenters raised concerns about the impact that granting an aquifer exemption in the Livermore Oil Field could potentially have on an ongoing groundwater remediation project at the Lawrence Livermore National Laboratory (LLNL). The deepest groundwater that is being remediated at the LLNL site is in the Livermore Gravel, which is approximately 550 feet above the top of the Greenville Sands Member and is separated from underlying units by a regional confining layer and is unaffected by the groundwater flow in the Greenville Sands.

CONCLUSION AND DECISION

Based on a review of the entire record, including all the written and oral comments submitted to DOGGR during its public comment process, the EPA concludes that the existing exemption criteria at 40 CFR § 146.4(a) and § 146.4(b)(1) have been met, and the EPA approves the aquifer exemption request as a non-substantial program revision.

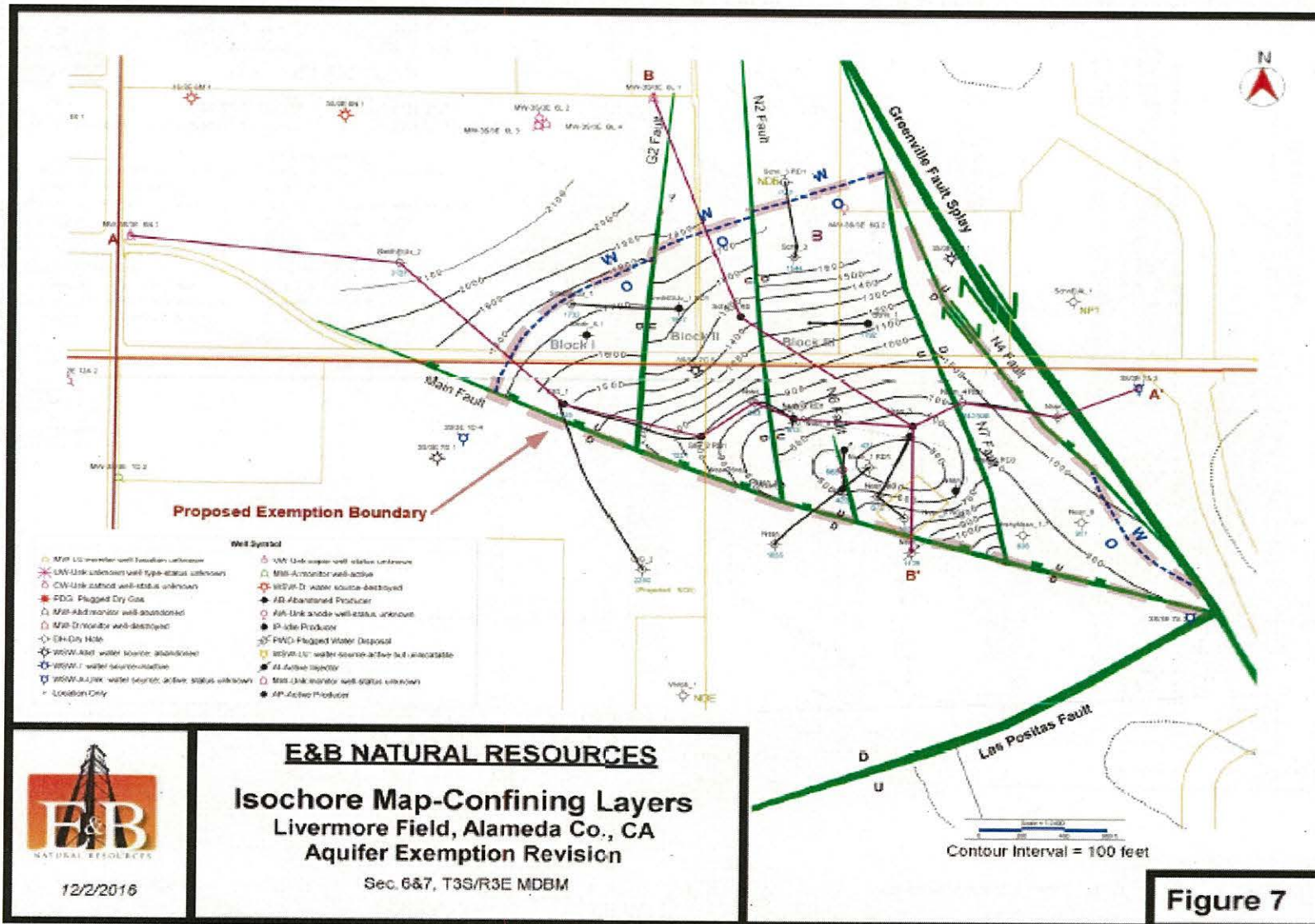
Effective Date: May 7, 2019

Figure 2: Greenville Sands Aquifer Exemption Location Map, Livermore Oil Field, Alameda County, California



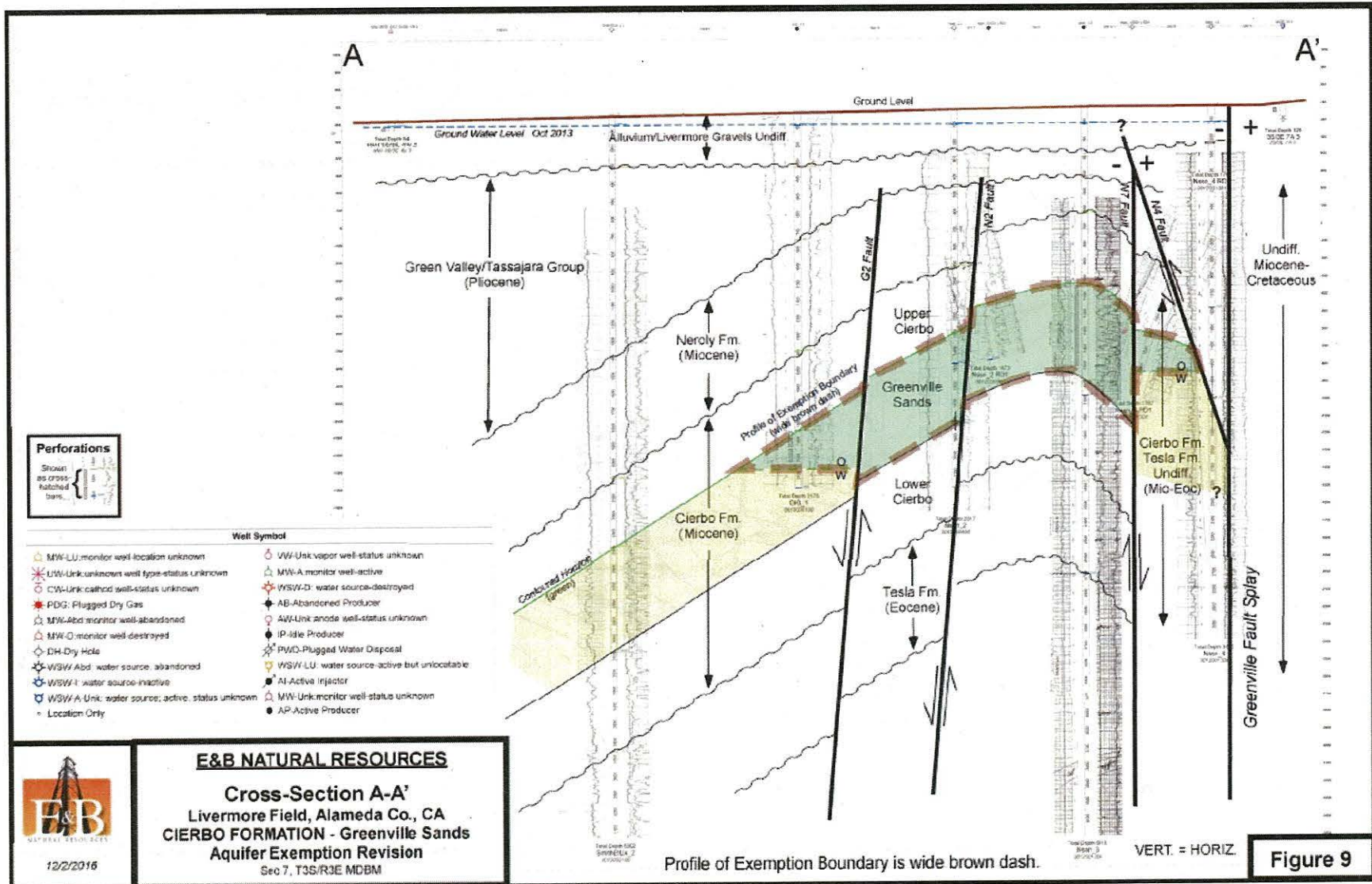
Source: DOGGR's Aquifer Exemption Application for the Livermore Oil Field

Figure 3.1: Isochore Map Showing the Locations of Cross Sections Across the Livermore Oil Field



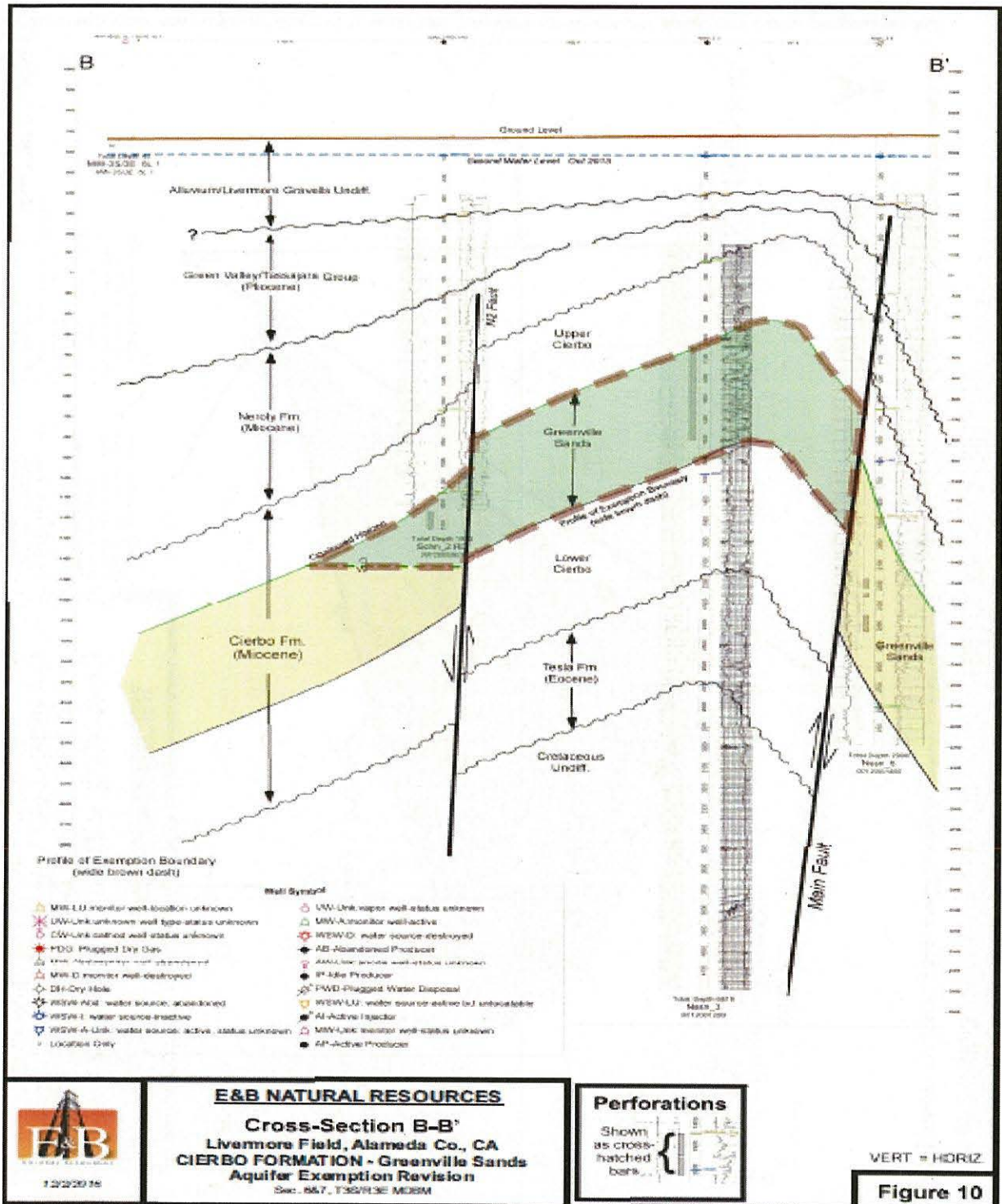
Source: Figure 7, DOGGR's Aquifer Exemption Application for the Livermore Oil Field

**Figure 3.2: Cross Section A-A' across the Greenville Sands Aquifer Exemption Area
Livermore Oil Field, Alameda County, California**



Source: Figure 9, DOGGR's Aquifer Exemption Application for the Livermore Oil Field

Figure 3.3: Cross Section B-B' across the Greenville Sands Aquifer Exemption Area Livermore Oil Field, Alameda County, California



Source: Figure 10, DOGGR's Aquifer Exemption Application for the Livermore Oil Field

Table 1: List of Water Supply Wells

		ELEVATIONS & DEPTHS (feet)										
WELL NAME	UWI/API#	ELEVATION	REFERENCE	TD(MD)	ELEVATION WATER WELL TOTAL DEPTH	ESTIMATED ELEVATION GREENVILLE SANDS	ESTIMATED DEPTH TO GREENVILLE SANDS	VERTICAL SEPARATION WATER WELL TD TO TOP GREENVILLE SANDS	WELL TYPE & STATUS	COMMENTS		
GROUNDWATER SOURCE WELLS	1	35/3E 6M 1	35/3E 6M 1	620.5	GL	unknown	-2,300	2,921	>2500 ft	WSW-D: water source-destroyed	Down dip of reliable well control.	
	2	35/3E 6N 1	35/3E 6N 1	634.3	GL	136	498.3	-2,300	2,934	2,798	WSW-D: water source-destroyed	Down dip of reliable well control.
	3	35/3E 6Q 1	35/3E 6Q 1	688.3	GL	120	568.3	Unknown		WSW-Abd: water source; abandoned	Other side of N7 Fault. Greenville may not be present or may be below a reverse fault.	
	4	35/3E 7A 2	35/3E 7A 2	701.5	GL	132	569.5	-1,200	1,902	1,770	WSW-A-Unk: water source; active, status unknown	Estimated from structure contours. Near Las Positas Fault.
	5	35/3E 7A 3	35/3E 7A 3	705.7	GL	120	585.7	Unknown		WSW-A-Unk: water source; active, status unknown	Other side of Greenville Fault W. Splay	
	6	35/3E 7C 5	35/3E 7C 5	667.6	GL	74	593.6	-910	1,578	1,504	WSW-Abd: water source; abandoned	Used structure copntours on top Greenville Sands.
	7	35/3E 7D 1	35/3E 7D 1	646.3	GL	400	246.3	-2,000	2,646	2,246	WSW-Abd: water source; abandoned	Down dip of reliable well control.
	8	35/3E 7D 4	35/3E 7D 4	648.5	GL	335	313.5	-2,000	2,649	2,314	WSW-A-Unk: water source; active, status unknown	Down dip of reliable well control.
	9	35/3E 7E 2	35/3E 7E 2	624.4	GL	200	424.4	-2,300	2,924	2,724	WSW-A-Unk: water source; active, status unknown	Down dip of reliable well control.
	10	35/3E 7F 1	35/3E 7F 1	654.7	GL	400	254.7	-2,334	2,989	2,589	WSW-A-Unk: water source; active, status unknown	Nearest well, Webb #1 does not reach Greenville Sands. Used Webb #1 TD as
	11	35/3E 7F 3	35/3E 7F 3	661.1	GL	252	409.1	-2,334	2,995	2,743	WSW-A-Unk: water source; active, status unknown	shallowest possible depth for Top Greenville Sands for this group of water wells.
	12	35/3E 7F 4	35/3E 7F 4	653.3	GL	260	393.3	-2,334	2,987	2,727	WSW-A-Unk: water source; active, status unknown	
	13	35/3E 7K 4	35/3E 7K 4	671	GL	264	407.0	Unknown		WSW-A-Unk: water source; active, status unknown	Other side of Las Positas Fault	
	14	35/3E 7L 1	35/3E 7L 1	648.1	GL	308	340.1	-2,300	2,948	2,640	WSW-A-Unk: water source; active, status unknown	Down dip of reliable well control.
	15	35/3E 7M 2	35/3E 7M 2	629.7	GL	199	430.7	-2,300	2,930	2,731	WSW-I: water source-inactive	Down dip of reliable well control.
					USED GREENVILLE STRUCTURE CONTOURS							
					BELOW LOWEST STRUCTURE CONTOUR. -2300 ft used as a minimum.							
					USED NEARBY WELL TD AS MINIMUM DEPTH							
					STRUCTURALLY ISOLATED FROM FIELD BY FAULTING							

2/17/2016

Source: Appendix IV, DOGGR's Aquifer Exemption Application for the Livermore Oil Field