



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901

May 20, 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 Lost Hills Oil Field, Kern 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 Tulare Formation in the Lost Hills Oil Field in Kern 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 formations meet the following federal exemption criteria:

- The portions of the formation proposed for exemption in the field do not currently serve as sources 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 are commercially hydrocarbon-producing.

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,



Tomás Torres
Director, Water Division

May 20, 2019

Enclosures: Aquifer Exemption Record of Decision for Lost Hills Oil Field
GIS Shape Files of Approved Aquifer Exemption
Final Lost Hills Exemption Application
Letter from Kenneth Harris to David Albright dated May 17, 2019

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

US Environmental Protection Agency Region 9
Underground Injection Control (UIC) Program
AQUIFER EXEMPTION RECORD OF DECISION
LOST HILLS OIL FIELD - TULARE FORMATION

This Record of Decision (ROD) provides the United States Environmental Protection Agency's ("EPA's") decision to approve an aquifer exemption (AE) for portions of the Tulare Formation in the Lost Hills 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: November 13, 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 that this is a non-substantial program revision because it is associated with an active 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 Operators: Aera Energy LLC, California Resources Corporation, Chevron Corporation, and Seneca Resources Corporation.

Well/Project Name: The Tulare Formation in the Lost Hills Oil Field (Phase 1).

Well/Project Permit Number: There are currently 451 Class II enhanced oil recovery (EOR) wells and 6 water disposal wells in the Lost Hills Oil Field within the portions of the aquifer proposed for exemption. In the future, the State anticipates there will be additional Class II wells permitted to inject within the portions of the aquifer proposed for exemption.

Well/Project Location: The aquifer proposed for exemption underlies Township 25 South, Range 20 East, Sections 33, 34, and 35; Township 26 South, Range 20 East, Sections 1, 2, 3, 11, 12, 13, and 24; and Township 26 South, Range 21 East, Sections 7, 18, and 19, Mount Diablo Base and Meridian (MDB&M). [Refer to Figure 1.]

County: Kern **State:** California

Current Well Class/Type: Class II EOR and water disposal.

DESCRIPTION OF PROPOSED AQUIFER EXEMPTION

Aquifer to be Exempted: Portions of the Tulare Formation within the Lost Hills Oil Field.

Areal Extent of Aquifer Exemption: The total areal extent of the existing AE and the proposed expansion in the Lost Hills Oil Field is approximately 6,326 acres. This acreage includes 4,518 oil-productive acres within the boundaries of the AE approved by the EPA at the time California's Class II program received primacy to implement the Class II program in 1983. DOGGR proposes to extend the current exemption and add approximately 1,808 acres comprising the current oil producing area outside the existing exempted areas. The lateral extent of the proposed exempt area is defined by pinch-outs of the hydrocarbon-bearing Tulare Formation to the west and east. See Figure 2 for a depiction of the proposed exempt formation.

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

<i>Aquifer</i>	Tulare Formation.
<i>Lithology</i>	Interbedded sequence of poorly consolidated conglomerate, sandstone, siltstone, and mudstone.
<i>TDS (mg/L)</i>	7,490 mg/L (average based on 15 samples); ranges from 3,789 to 12,491 mg/L.
<i>Depth to Top</i>	Ranges from 0 to 160 feet below ground surface (bgs), or 502 to 181 feet above mean sea level (MSL).
<i>Thickness (feet)</i>	150 to over 1,000 feet.
<i>Porosity and Permeability</i>	Porosity ranges from 33% to 45%. Permeability ranges from 200 to 5,000 millidarcies (mD).

Confining Zone(s): In the Lost Hills Oil Field, the Tulare Formation is confined above by a series of mudstone layers and below by the low-permeability mudstones of the Etchegoin Formation. Lateral confinement in the area proposed for exemption is provided by folding and pinch-outs of the Tulare Formation to the west and east and an inward pressure gradient (i.e., a "pressure sink" caused by the withdrawal of fluids). See Figures 3.1 through 3.3.

BACKGROUND

On November 13, 2018, the EPA received a request from DOGGR to exempt portions of the Tulare Formation of the Lost Hills Oil Field, in Kern County, California. DOGGR reviewed the operator's request and proposed 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 DOGGR would be authorized, subject to state regulatory requirements, to approve Class II injection into the identified

formation. As noted above, Class II injection wells are currently permitted for injection into the expanded portion of the formation proposed for exemption. Upon EPA's approval of the AE, injection into these wells will be into an exempt aquifer.

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.*

State Water Resources Control Board (State Water Board's) Concurrence:

In their concurrence on this AE request, the State Water Board determined that the portion of the Tulare Formation that is proposed for exemption does not currently serve as a source of drinking water and is not hydraulically connected to any domestic or public water supply wells. The State Water Board's determination is based on an evaluation of information about water supply wells in the area, groundwater flow patterns, and confinement of groundwater flow. These reviews demonstrate that the portion of the aquifer proposed 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 portion of the Tulare Formation that is proposed for exemption. In addition, 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 formation. Further, within the State's water well search area (described more fully below), the Tulare Formation is not currently a source of drinking water.

Groundwater Flow Patterns: Fluid flow in the Tulare Formation is toward the producing wells in the center of the field (i.e., from high to low pressure) and away from the boundaries of the area proposed for exemption. This is because more fluid is withdrawn from the aquifer than is injected, as shown by injection and production data provided in the AE package.

Water Supply Wells: DOGGR's AE request included information about wells in the area proposed for exemption to establish that no drinking water wells draw from the area of the aquifer proposed for exemption. The search for wells was conducted within a water supply well search area ("study area") that extended 1 mile beyond the boundary of the area proposed for exemption. This area was selected to expand upon the one-quarter mile review area typically used for Class II evaluations because there are no productive water wells within one-quarter mile of the area proposed for exemption.

The State's water well search involved reviewing the following sources of information: the State Water Board's GeoTracker GAMA database, driller's reports from the California Department of Water Resources, and Kern County Environmental Health Department data. In addition to the data searches, engineers and operator staff physically checked the locations of wells in the field.

The State's expanded water well search identified 28 active water wells; none of which are located within the area proposed for exemption. These include: 2 domestic drinking water wells (both of which are completed in the Alluvium, which is hydraulically isolated from the aquifer proposed for exemption), 20 monitoring wells, 1 agricultural well, and 5 other types, none of which are used for drinking water purposes. See Table 1.

The nearest municipal drinking water supply wells are operated by the Lost Hills Utility District (LHUD). The LHUD currently operates two wells (the East Well and the North Well) which are 615 and 625 feet deep, respectively, and will operate two new wells, planned to be used as monitoring wells (which are anticipated to be operational in mid-2019) which will be 450 feet and 650 feet deep. All of these wells are located about 14 miles east-southeast of the study area (see wells #14 through #17 on Table 1) and they do not draw water from the aquifer proposed for exemption.

In addition, DOGGR contacted the local water districts (Lost Hills Water District, Belridge Water Storage District, and Lost Hills Utility District) and the Kern County Water Agency regarding the Lost Hills proposed AE. No comments were received from any of these districts regarding the proposed AE.

Thus, the State's well search investigation confirmed that there are no domestic or public drinking water supply wells that draw water from the portion of the Tulare Formation that is proposed for exemption, and that the formation proposed for exemption is not currently a source of drinking water.

Confinement of the Formation to Groundwater Flow: Upward confinement of the Tulare Formation is provided by discontinuous, overlapping low-permeability mudstone layers that form barriers to the upward migration of oil, gas, and water. While none of the mudstones are continuous throughout the area proposed for exemption, they are continuous over short distances and range from 5 to 25 feet thick. Evidence of the confining nature of these mudstones is a lack of oil seeps in the Lost Hills Oil Field and the trapping of the steam that is injected for steaming operations to recover oil, as shown in temperature logs provided by DOGGR. Sidewall core data in wells throughout the area proposed for exemption indicate permeability values for the mudstones that range from less than 1 mD to 10mD.

Below the Tulare Formation, confinement is provided by the low-permeability Upper Etchegoin Formation mudstones, which range in thickness from 5 to over 300 feet. The permeability of the lower confining layer, based on core data, ranges from 0.1 to 2.8 mD.

Lateral confinement is provided by a combination of structural trapping, stratigraphic pinch-outs (i.e., changes in rock properties) to the west and east, and an inward pressure gradient caused by the withdrawal of fluids. See Figures 3.1 through 3.3.

Geologically, the Lost Hills Oil Field is composed of a series of folded rock layers that form a dome (known as an anticline) that traps the oil that is produced from the field. Evidence for the trapping nature of the anticline includes the accumulation of oil within the dome over geologic time. The anticline also traps the steam that is injected for EOR. Evidence for confinement of the injected steam is provided in data from temperature monitoring wells used by operators in the field to monitor steam injection operations; these data show no temperature increases above the upper confining layer.

Stratigraphic controls include pinch-outs of the Tulare Formation along the anticline to the west and east that provide confinement. To the west, the oil-bearing Tulare Formation pinches out into impermeable mudstones and silts; to the east, it pinches out into impermeable mudstones. These pinch-outs are illustrated on cross sections that were developed based on interpretation of well

log data that are correlated with core samples. The well logs show that the Tulare Formation is present in wells in the oil producing area but is absent in other wells outside of the pinch-outs.

As a secondary means of containment, confinement is also provided by an inward pressure gradient that is created by the withdrawal of fluids from the Tulare Formation in the Lost Hills Oil Field. Fluid balance data provided in the AE package indicate that more fluid has been withdrawn from the formation than has been injected. Injection and production data indicate that, between 1915 and 2016, a total of 270,123,106 bbls of oil and water were produced from the Tulare Formation, and 235,527,361 bbls of water and steam were injected, for a net withdrawal of 34,595,745 bbls of fluid during that period. This withdrawal causes the fluids within the proposed AE area to move toward the producing wells and away from the boundary of the AE area. Additional evidence of this pressure sink is provided by maps showing pressure changes that were derived from temperature data from wells in the field.

After reviewing information regarding the location and depth of the existing drinking water supply wells, groundwater flow within the Tulare Formation, and the lateral and vertical confinement of the formation as described above, the EPA concludes that the portion of the Tulare Formation 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 current producing wells, well logs, and sidewall core sample data to demonstrate the presence of commercially producible quantities of oil in the Tulare Formation within the Lost Hills Oil Field.

The Tulare Formation is the uppermost hydrocarbon-bearing zone in the Lost Hills Oil Field; it is productive in the northern part of the field, and there is evidence of hydrocarbons throughout the field. Since its discovery in 1915, the Tulare Formation in the Lost Hills Oil Field has produced over 62 million bbls of oil through 2016. Figure 4 shows the location of the more than 760 wells that currently produce from the Tulare Formation in the Lost Hills Oil Field.

Throughout the field, the presence of hydrocarbons in the Tulare Formation is demonstrated through historic production data, evaluation of well logs, and the physical properties (including the presence of oil) in cores that were collected when the wells in the area proposed for exemption were drilled. The oil saturation of the Tulare Formation within the Lost Hills Oil Field ranges from 50% to 70%.

Oil was first discovered in the Etchegoin Formation of the Lost Hills Oil Field in 1910. Production from the Tulare Formation began in 1915. EOR operations in the Tulare Formation using steam injection (i.e., steaming) began in 1964.

The Lost Hills Oil Field is the 19th largest oil field in California. As of 2016, the oil field has produced a total of 345,944,804 barrels (bbls) of oil and 564,110,576 million cubic feet of gas.

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

PUBLIC NOTICE AND COMMENT

DOGGR provided public notice of this proposed AE on May 18, 2018, and held a public hearing on June 19, 2018, in Bakersfield, CA. The public comment period closed on June 19, 2018. 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. Specific responses not addressed by DOGGR are provided below.

One commenter (The Center for Biological Diversity) wrote to DOGGR and commented that the EPA should reject the AE request until an environmental review has occurred under the National Environmental Policy Act (NEPA). NEPA review is not required because 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 species under the federal Endangered Species Act. 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 upon a number of considerations. First, the AE approval changes the jurisdictional status of a confined aquifer below the ground surface under the SDWA. None of the species are present in the subsurface portions of the aquifer considered in EPA's approval action and it is speculative whether any listed species or critical habitat overlaps with the surface-level activities. EPA's approval of the AE is only one preliminary step in the process leading to potential fluid injection in 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. For example, new injection well(s) into the AE require a separate permit, which the State of California must review and approve before any fluids may be injected into the AE. Thus, EPA would not be the legal cause of potential effects to listed species or designated critical habitat, if any.

Additionally, the commenter questioned whether the current AE criteria reflect changing climate conditions and modern water treatment technologies. In considering whether the portion of the aquifer proposed for exemption cannot now and will not in the future serve as a source of drinking water because it is hydrocarbon producing, the EPA reviewed data about hydrocarbon

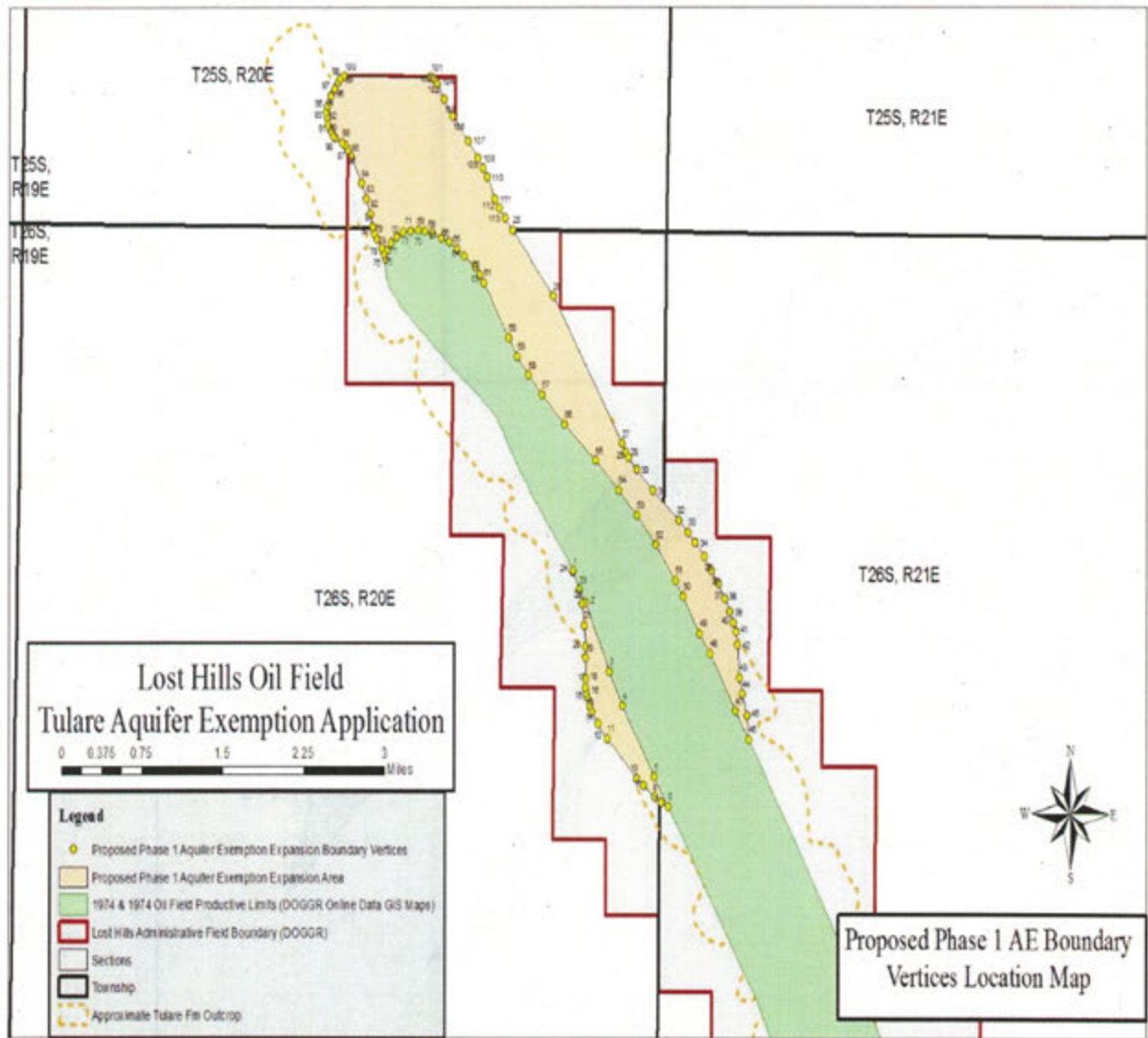
production in the portion of the Tulare Formation that is proposed for exemption. Based on a review of historic production data, well logs, and core data, the EPA believes that it is reasonable to conclude that the formation will continue to be commercially producible into the foreseeable future and meets the requirements at 40 CFR § 146.4(b)(1).

CONCLUSION AND DECISION

Based on a review of the entire record, including all written and oral comments submitted to DOGGR during its public comment process, the EPA finds that the 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.

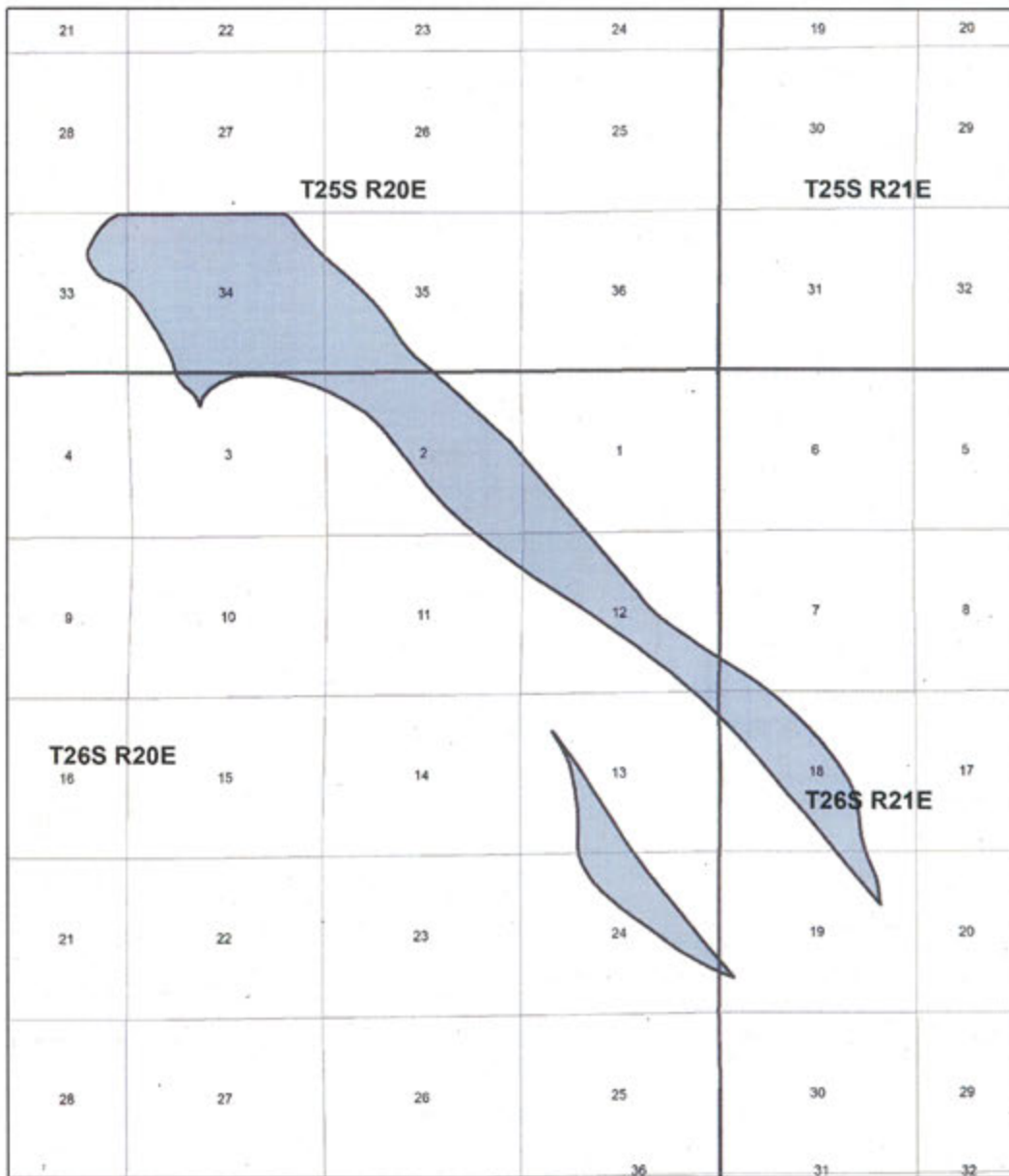
Effective Date: May 20, 2019

Figure 1: Location of the Lost Hills Oil Field, Kern County, California



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

Figure 2: Tulare Formation Aquifer Exemption Location Map, Lost Hills Oil Field, Kern County, California



Proposed Exemption Area

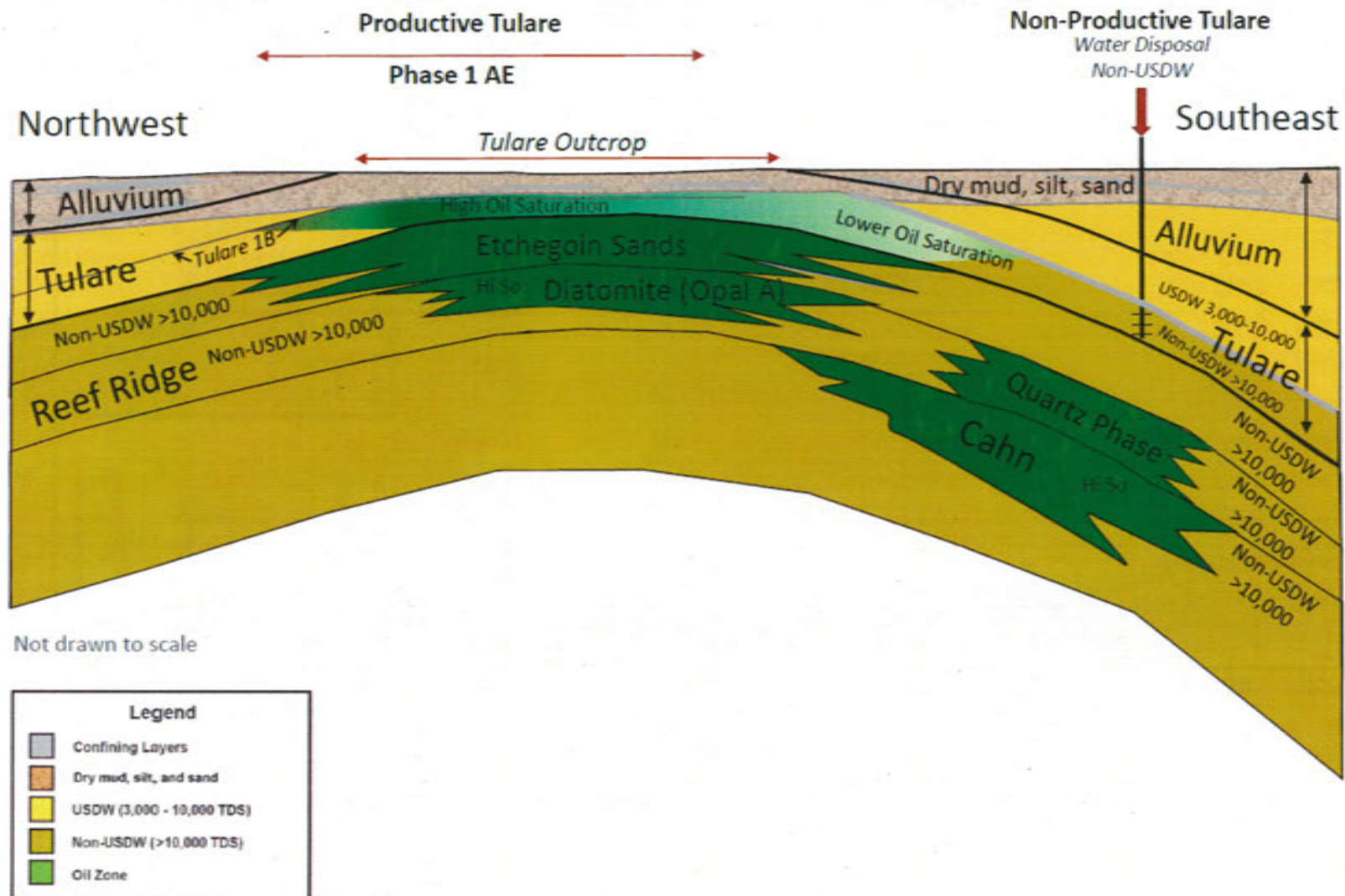
 Tulare Formation - Lost Hills Field Proposed Exemption Area

0 0.5 1 2 Miles



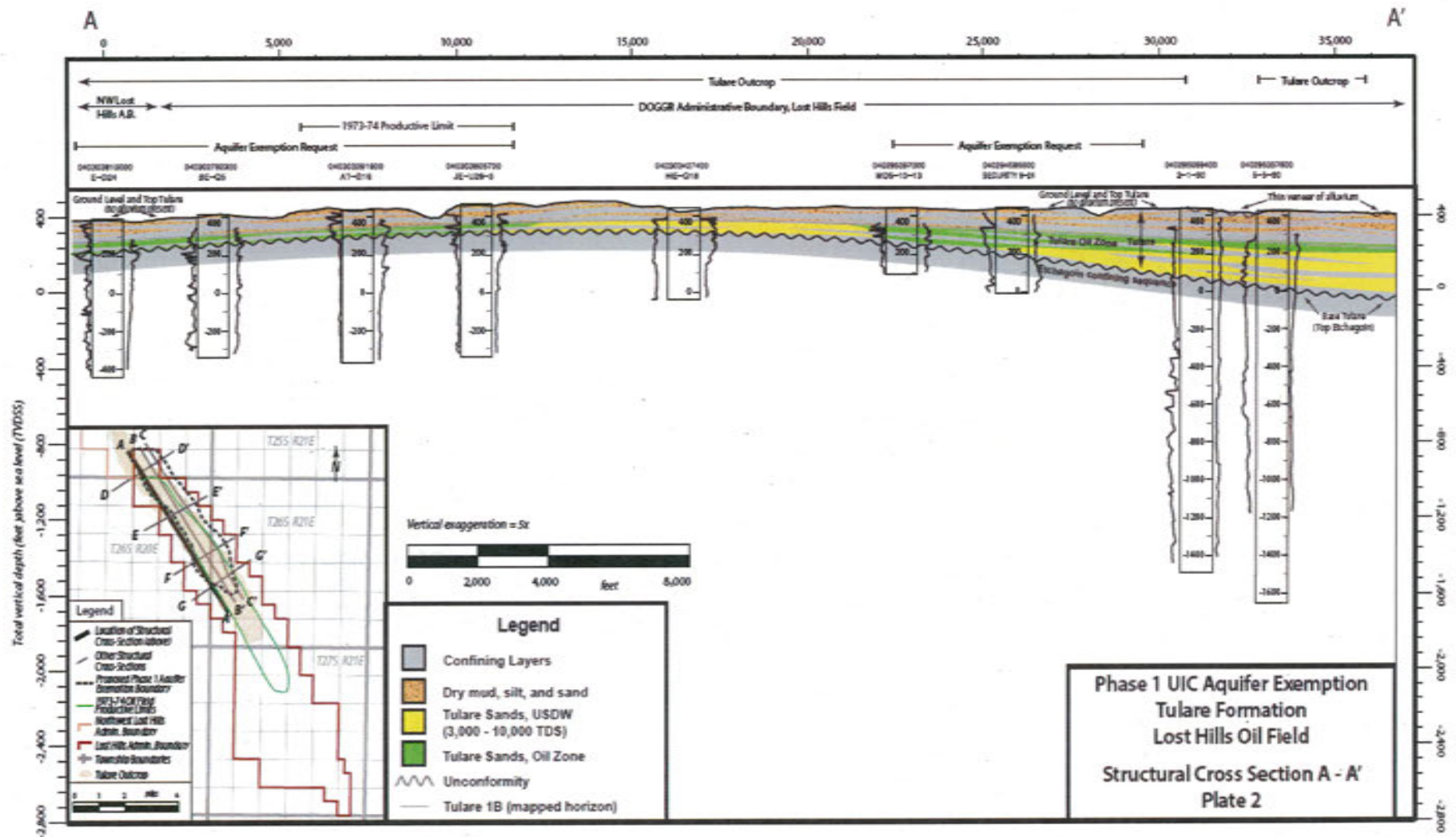
Source: DOGGR's Aquifer Exemption Application for the Lost Hills Oil Field

Figure 3.1: Conceptual Cross Section across the Tulare Formation Aquifer Exemption Area, Lost Hills Oil Field, Kern County, California



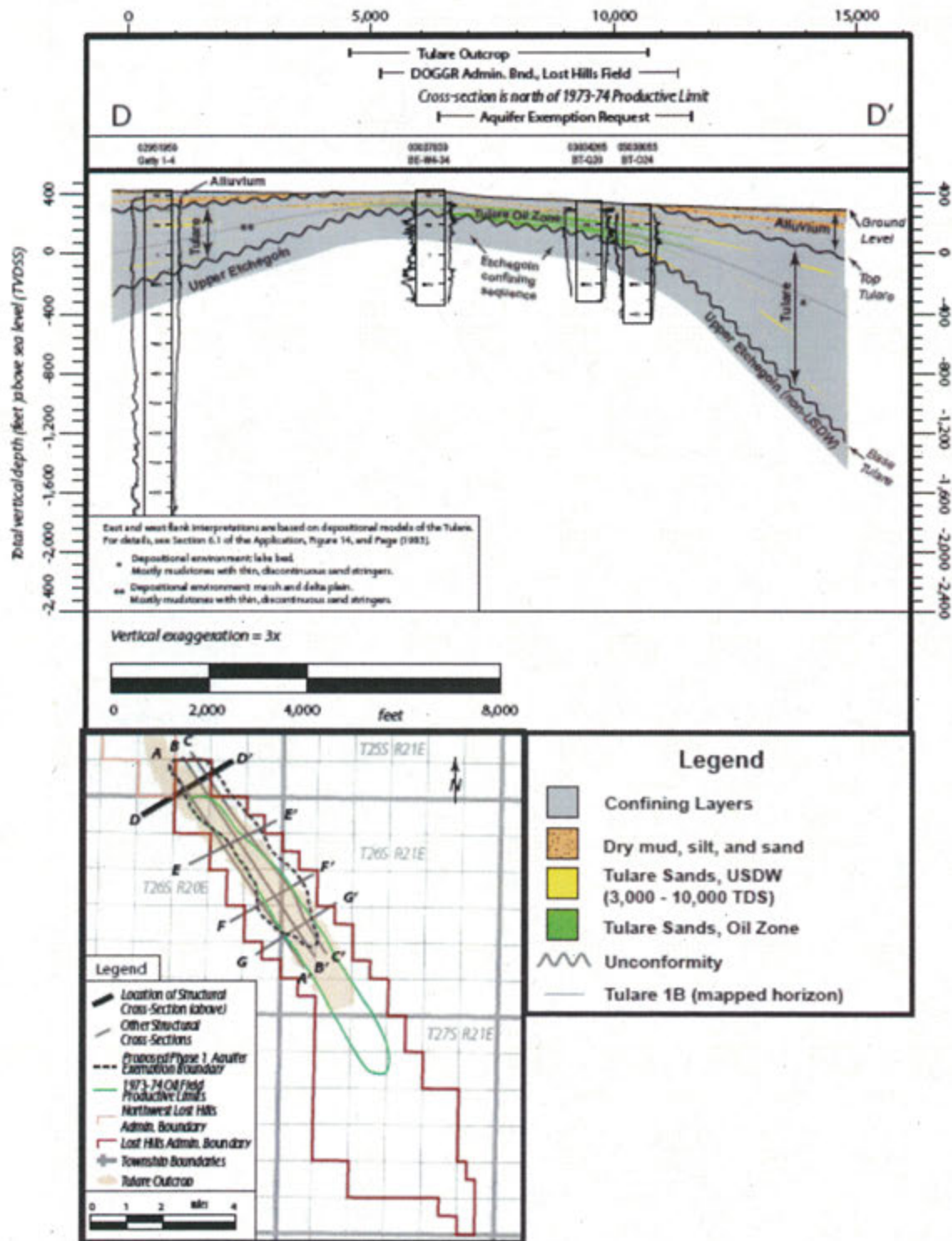
Source: Figure 10, DOGGR's Aquifer Exemption Application for the Lost Hills Oil Field

Figure 3.2: Cross Section A-A' across the Tulare Formation Aquifer Exemption Area
 Lost Hills Oil Field, Kern County, California



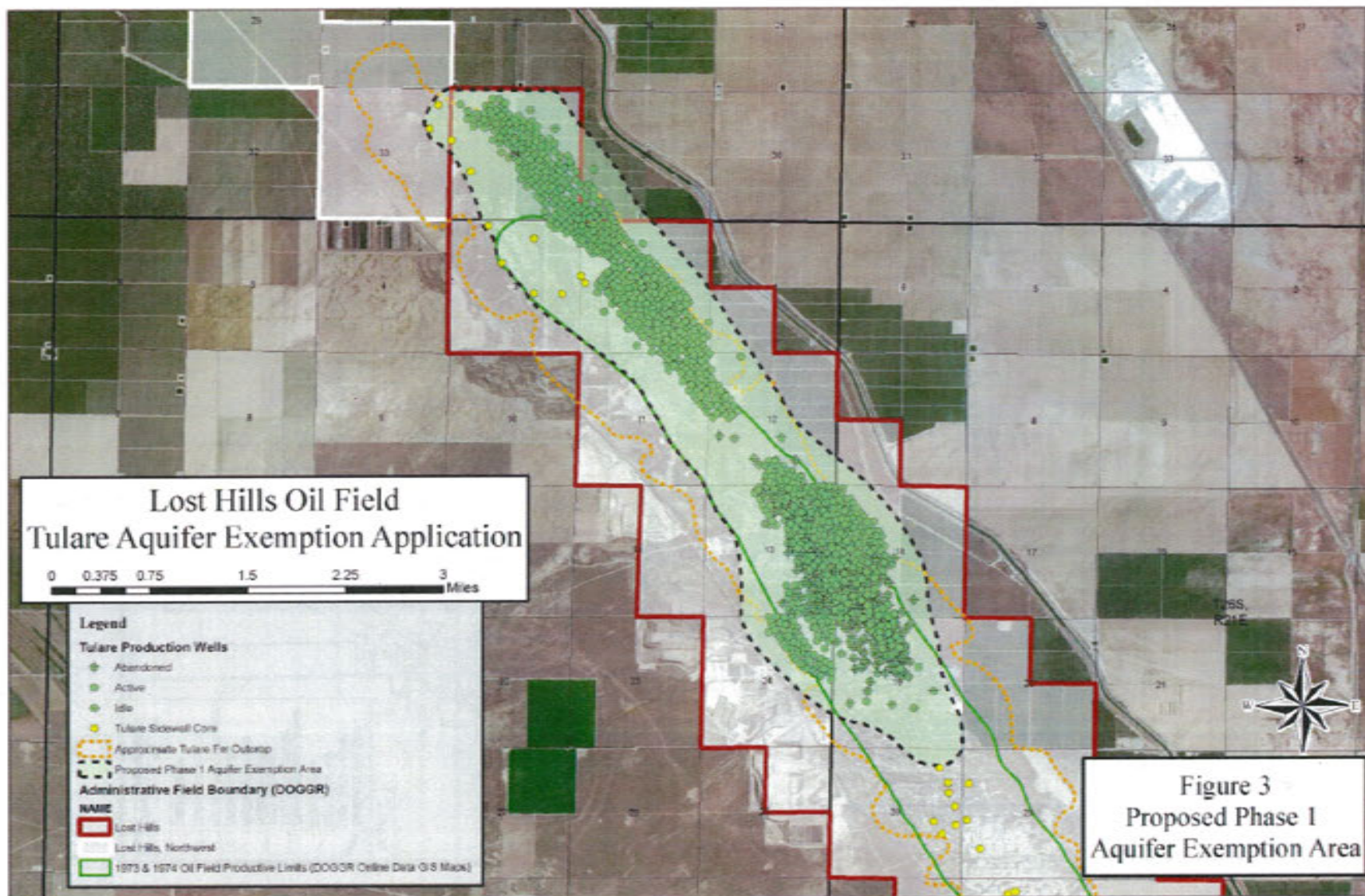
Source: Plate 2, DOGGR's Aquifer Exemption Application for the Lost Hills Oil Field

Figure 3.3: Cross Section D-D' across the Tulare Formation Aquifer Exemption Area
 Lost Hills Oil Field, Kern County, California



Source: Plate 5, DOGGR's Aquifer Exemption Application for the Lost Hills Oil Field

Figure 4: Tulare Formation Producing Wells, Lost Hills Oil Field, Kern County, California



Source: Figure 3, DOGGR's Aquifer Exemption Application for the Lost Hills Oil Field

Table 1: List of Water Supply Wells

#	Well ID	Well Type	Distance from Aquifer Exemption Boundary (ft)	TD	Perf Depth (ft)		SACT	DIMP	BNG	Latitude (NAD 83)	Longitude (NAD 83)	Well Address / Information	Distance from Tubers Outcrop	Flank	Top Tubers, calculated (ft)*			Probable Completed Formations	
					Top	Base									Minimum	Maximum	Mean	Tubers (%)	Allostrata (%)
1	MW #2	Monitoring	3,757	83	53	83	4	265	208	35.702123	-119.83328	Compost Company Monitor Well	1,400	West	84	140	112	0%	100%
2	MW #3	Monitoring	2,305	63	43	63	4	265	208	35.700982	-119.83323	Compost Company Monitor Well	800	West	42	70	56	25%	65%
3	UGD- 25405020479001	Monitoring	3,961	Unknown		27	255	208	35.717528	-119.83175		1,850	East	57	182	129	Unknown		
4	87029	DPN	4,467	Unknown		27	255	208	35.73	-119.83	GAMA well, designated as DPN. Direct Potable Reuse. Coordinates are approximate.	4,530	East	236	294	215	Unknown		
5	T251/0206-2763	OCM	5,380	271	141	271	27	265	208	35.73	-119.80	270 well, 400-ft report marked incorrect. Well location moved per DOGGR field checks. Coordinates are approximate.	6,200	East	114	519	430	0%	100%
6	250290200020M	Domestic / AGR-T	2,317	440	120	366	26	255	208	35.72	-119.79	GAMA well, designated Water Supply from DWR dataset. Well location moved per DOGGR field checks. Coordinates are approximate.	5,200	East	387	446	397	4%	96%
7	255206-2580206-Owner: E	Monitoring	1,617	20	10	20	35	255	208	35.717607	-119.79265		4,270	East	225	373	297	0%	100%
8	250290200020M	AGR-T	3,881	Unknown		35	255	208	35.70	-119.78	GAMA well, designated Water Supply from DWR dataset. DWR image is a raster image note indicating this well is only suitable for stock or industrial applications. Coordinates are approximate.	3,230	East	382	271	217	Unknown		
9	S-126	Coffield Source Wells	Inside	585	387	576	2	265	208	35.695264	-119.73877	California Resources Corp. active.	Outcropping			100%	0%		
10	S-126	Coffield Source Wells	Inside	576	326	526	2	265	208	35.689366	-119.73951	California Resources Corp. active.	Outcropping			**	0%		
11	S-124	Coffield Source Wells	Inside	400	312	399	2	265	208	35.691332	-119.73899	California Resources Corp. active.	Outcropping			100%	0%		
12	State: 26/21-30-089020M	Monitoring	3,021	21	0	0	6	265	216	35.679636	-119.7441		4,700	East	246	401	329	0%	100%
13	MW	Monitoring	3,700	830	140	800	30	265	216	35.658	-119.731	Drilled as agriculture well (2005), 4000 TDS, converted to monitoring well. See Appendix A for geology.	2,600	East	136	227	182	100%	0%
14	UMD (North Well)	Municipal	71,813	625	490	800	33	265	238	35.63861	-119.5082	Lost Hills Utility District / Google Earth	N/A	N/A	400	Unknown	Unknown	100%	0%
15	UMD (East Well)	Municipal	71,441	615	Unknown		33	265	238	35.63894	-119.50870	Lost Hills Utility District / Google Earth	N/A	N/A	400	Unknown	Unknown	100%	0%
16	UMD (New Well)	Municipal	71,917	650	Unknown		33	265	238	35.63839	-119.50830	Lost Hills Utility District / Google Earth	N/A	N/A	400	Unknown	Unknown	100%	0%
17	UMD (New Well)	Municipal	71,917	450	Unknown		33	265	238	35.63839	-119.50830	Lost Hills Utility District / Google Earth	N/A	N/A	400	Unknown	Unknown	100%	0%
18	GMAW-0E	Monitoring	2,600	Unknown		25	265	208	35.640289	-119.76012	GAMA	2,250	West	79	118	98	Unknown		
19	GMAW-0	Monitoring	1,987	Unknown		25	265	208	35.644362	-119.7638	GAMA	1,400	West	49	73	61	Unknown		
20	GMAW-0	Monitoring	2,467	Unknown		24	265	208	35.644917	-119.76098	GAMA	2,330	West	73	110	92	Unknown		
21	GMAW-0	Monitoring	3,400	Unknown		25	265	208	35.640175	-119.76125	GAMA	3,050	West	180	267	213	Unknown		
22	GMAW-0W	Monitoring	3,704	Unknown		25	265	208	35.640517	-119.77124	GAMA	3,550	West	124	188	125	Unknown		
23	FMAW-0W	Monitoring	4,336	Unknown		25	265	208	35.639538	-119.7706	GAMA	4,200	West	220	367	294	Unknown		
24	FMAW-0	Monitoring	4,733	Unknown		25	265	208	35.63741	-119.76879	GAMA	4,600	West	241	402	322	Unknown		
25	FMAW-0	Monitoring	4,074	Unknown		25	265	208	35.638947	-119.76655	GAMA	3,900	West	136	294	170	Unknown		
26	FMAW-0	Monitoring	4,967	Unknown		25	265	208	35.63811	-119.76817	GAMA	4,450	West	233	389	311	Unknown		
27	FMAW-0	Monitoring	5,326	Unknown		25	265	208	35.638498	-119.7688	GAMA	4,300	West	225	376	301	Unknown		
28	EMW-0	Monitoring	5,244	Unknown		25	265	208	35.638695	-119.76812	GAMA	3,100	West	162	271	217	Unknown		
29	State: 26/21-30-Owner: MW 1	Monitoring	4,957	150	120	140	30	265	218	35.638637	-119.76822	Monitoring for Lost Hills Secondary Landfill	2,800	West	70	105	87	100%	0%
30	TULM02098020	Monitoring	2,894	395	375	29	265	218	35.638358	-119.74276	Chevron Monitoring Well	Outcropping			100%	0%			
31	TULM02098020	Monitoring	4,377	626	640	29	265	218	35.638786	-119.73282	Chevron Monitoring Well	Outcropping			100%	0%			
32	237501	Test Well (capped)	2,852	328	152	152	4	265	208	35.6389	-119.817	Capped test well (cannot be located, suspected hydro)	850	West	45	74	59	100%	0%

** Commingled Tubers and Potholes

Dip of Top Tubers used for Top Tubers depth extrapolation	Flank	Minimum, Maximum (degrees)
	East Flank	3, 5
West Flank	2, 3	

Depth to Top Tubers = (Horizontal distance to surface) * (tangent of dip angle)

Source: Appendix H, DOGGR's Aquifer Exemption Application for the Lost Hills Oil Field