State of New Mexico
Energy, Minerals and Natural Resources Department

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May 28, 2020

Mr. Philip Dellinger, Chief
Ms. Lisa Pham, Environmental Engineer
Ground Water/UIC Section, Region 6
United States Environment Protection Agency
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

RE: UPDATE OF UNDERGROUND INJECTION CONTROL CLASS II ACTIVITIES WITHIN THE STATE OF NEW MEXICO FOR POSSIBLE INJECTION INTO UNDERGROUND SOURCES OF DRINKING WATER: THE CAPITAN REEF AQUIFER SYSTEM

Dear Mr. Dellinger and Ms. Pham:

The Oil Conservation Division (OCD) of the New Mexico Energy, Mineral and Natural Resources Department (EMNRD) previously provided a review to specifically identify impacts due to Underground Injection Control (UIC) Class II operations which were potentially injecting directly into Underground Sources of Drinking Water (USDWs). The OCD submitted a comprehensive review of Class II operations within the state in a correspondence dated October 24, 2016. You have requested, on behalf of the United States Environmental Protection Agency (EPA), for an update of current oil and gas injection activities occurring in association with one specific USDW, the Capitan Reef aquifer system.

Review of the Capitan Reef Aquifer System

The Capitan Reef aquifer system (Capitan Reef) is the lithosome that comprises the reef complex, the Goat Seep reef, and the facies transition of the backreef area (the shelf aquifers contained in the Artesia Group as described by Hiss (1980); see Report Figure 1). The Capitan Reef in New Mexico extends from the surface exposure of the reef at the base of the Guadalupe Mountains, and extends in an arc to the southeast corner of the state south of Jal where the New Mexico-Texas state lines meet (see Report Figure 1).

Hiss describes the general ground-water movement as follows:

> *Water entering the Capitan aquifer in the Guadalupe Mountains moved slowly northeastward and then eastward along the northern margin of the Delaware Basin to a point southwest of present-day Hobbs. Here it joined and comingled with a relatively larger volume of ground water moving northward from the Glass Mountains along the eastern margin of the Delaware Basin. From this confluence, the ground water was discharged from the Capitan aquifer into the San Andres Limestone, where it then moved eastward across the Central Basin Platform and Midland Basin, eventually to discharge into stream draining to the Gulf of Mexico (Page 294; Hiss, 1980).*

Figure 22 of Attachment 1 provides the general flow directions based on Hiss' interpretation and includes more recent water data following the presentation by Hiss. Figure 18 of Attachment 1 provides a map showing the thickness of the Capitan Reef.

The quality of groundwater in the Capitan Reef is variable with location. The western segment of the Capitan Reef is recognized as a USDW and is utilized as a source for both domestic and municipal water supply wells. The eastern portion of the aquifer contains both protectable waters, based on total dissolved solids (TDS) concentrations, as well as productive oil and gas fields in formations of the Artesia Group along the facies transition in the forereef (see Report Figure 2).

Additionally, the western segment of the Capitan Reef where the reef outcrops at surface is an important recharge area mapped as Capitan Outcrop with overlying Quaternary deposits (see Figure 8 of Attachment 1). This area provides vital recharge of the Capitan Reef groundwater that flows northeast and supports water production for the Carlsbad Municipal Water System (see Report Figure 2).

Review of OCD Protocols for Evaluation of UIC Class II Injection Activities

As part of the prior effort to assess the Class II injection activities possibly impacting USDWs, the OCD emphasized the significant difference between Class II activities that were enhanced recovery (ER) projects and injection wells that were approved as disposal operations. The approval process for ER wells offered the following reasoning for limited application of exempted aquifers in areas with ER projects in response to 40 CFR 146.4:

> *"There seems little necessity for elaborate aquifer exemptions related to ER Projects for the following reasons:*
>
> *(1) The pressure sinks surrounding the producing wells in an ER project cause injected fluids to move inward toward producing wells rather than outward toward any other part of the formation. Such contained movement eliminates the direct potential for contamination of USWDs which may be located elsewhere in the same formation.*
>
> *(2) The Division knows of no instance in the State where drinking water is being produced and consumed by the public from an aquifer which is also an oil and/or gas reservoir at the same horizontal and vertical section. Some USDWs exist within the same vertical section but horizontally removed from*

> *the hydrocarbon zone. The San Andres formation in Eddy County provides excellent examples of both of these situations. These conditions are discussed and extensively referenced in Appendix A-1."* [Section j. Aquifer Protection, Aquifer Exemption, *Class II Demonstration,* page 51]

The approval process for produced water (or SWD) wells includes the following stipulation in response to 40 CFR 146.4:

> *"All applications for approval of SWD wells not within an oil or gas zone or within one mile thereof will contain data on water quality in the proposed disposal interval. Any SWD well proposed for disposal into a formation or zone containing water of 10,000 mg/1 TDS* [Total Dissolved Solids] *or less which is not an exempted aquifer will be set for public hearing before a Division examiner*." [Section j. Aquifer Protection, Aquifer Exemption, *Class II Demonstration,* page 52]

This criterion is incorporated in the Division's regulation under Rule 19.15.26.8(E) New Mexico Administrative Code (NMAC). Additionally, the state UIC program included specific regulation by limiting disposal by SWD wells in Lea County to formations older than the Triassic age (Rule 19.15.26.8(E)(1) NMAC).

The primacy demonstration also contained the following recommendation for future assessment for aquifer exemptions for portions of the Capitan Reef aquifer within Lea County:

> *"Based upon this study the Division proposes that the Tansil, Yates, Seven Rivers, Queen, Grayburg, and San Andres formations of Lea County be classified as exempt aquifers. Please refer to Figures 8 and 9 of the Lea County Report, Appendix A-2* [Hiss (1980)] *and Resource Map No. 6 from "Stratigraphy and Ground-Water Hydrology of the Capitan Aquifer, Southeastern New Mexico and Western Texas" by William L. Hiss (PhD Thesis, University of Colorado 1975)* [Hiss (1976)] *for the vertical and horizontal sections to be exempted. Because of the gradational nature of the back reef facies a more precise description is not proposed."* [Section j. Aquifer Protection, Aquifer Exemption, *Class II Demonstration,* page 53]

Review of Injection Wells from the RESPEC Report

In 2009, the OCD identified the need for further study of the Capitan Reef and its relationship with Class II well activities along the eastern portion in Lea County. The EPA provided funding for the evaluation which resulted in a report (Topical Report RSI-2048 by RESPEC Consulting and Services Inc.) that identified a list of wells with a higher risk of injection into the Capitan Reef.

The OCD, through the 2016 UIC Class II activities review, identified existing injection operations in proximity to the Capitan Reef that require supplemental assessment including the high-risk wells identified in the 2009 RESPEC report. The OCD compiled a list of 32 wells which required additional investigation to determine the potential or necessity for establishing exempted aquifers. The list of wells with information and current status is compiled in Table 1 of this report and locations of the wells (labelled as ReefWellsEPA) are provided in Report Figure 2.

For this report, a commercial operation is defined as a disposal well that receives multiple sources of produce water and the operation is not restricted by a daily rate, limited to a specific operator, or limited to specific production leases.

The review of the 32 wells produced the following results:

1. **Injection wells within active ER units:** The first 12 wells listed in Table 1 (Report ID No. 1 through 12) are associated with ER activities. There are three specific ER projects that are authorized to use these injection wells. All three ER projects are active with the injection wells providing the waterflood drive for production of reservoirs within the Artesia Group. The portion of the Capitan Reef where the producing formations of the Artesia Group are part of the backreef transition to the reef begins east of the city of Carlsbad and continues to the southeast corner of the state. Report Figure 2 highlights the locations of the Capitan Reef where hydrocarbon occurrences (classified as pools under OCD rules) in the backreef interact with the reef aquifer.

   These injection wells are assessed as having no impact to that portion of the Capitan Reef characterized as USDWs. Their ER operation and relationship to the Capitan Reef is discussed in a prior section of this report. The active injection wells have very low injection rates while some of the injection wells have been converted back to producing wells.

2. **Injections wells that have lost authority or are plugged:** Six injection wells from Table 1 (Report ID Nos. 16, 18, 21, 24, 27 and 29) are no longer active due to the loss of injection authority *ipso facto* through non-injection for a continuous period of 12 months or because the wells have been plugged. All six wells were originally approved for disposal associated with leases that had production from the Artesia Group. These wells were later approved for expansion into commercial operations that received produced water from multiple formations and operators.

3. **Injection well assessed as not a high-risk to impact the Capitan Reef:** One injection well was evaluated and assessed as not hydrologically connected to the Capitan Reef. The Brown No. 5 (API 30-025-09807; Report ID No. 32) was reviewed as part of OCD Case No. 15723 (see Division Exhibit No. 2 of Attachment 2). The injection pressure for this well has increased to a point where operation of the well is minimal. This increase would indicate the reservoir has reached capacity to accept fluids and shows no apparent communication with the Capitan Reef.

4. **Active injection wells that are shut-in:** Four injection wells from Table 1 (Report ID Nos. 15, 22, 23 and 30) are no longer actively injecting but still retain the authority to inject. All four wells are disposal operations that are commercial. Two of the wells were acquired by a new operator that is being actively petitioned by OCD for plugging. The two remaining wells are shut-in and are part of a bankruptcy case. The OCD is also pursuing the voluntary plugging of these wells or seek denial for renewal should the injection authority lapse.

5. **Active injection wells:** Nine injection wells (Report ID Nos. 13, 14, 17, 19, 20, 25, 26, 28 and 31) remain active and comply with required mechanical integrity testing. All of these wells are commercial disposal operations. Of the nine wells, six have reported current disposal rates of less than 400 barrels of water per day (BWD) or have no reported injection for 2020. The disposal wells were approved with the best information available regarding the delineation of the aquifer and were assessed as having low potential to impact the Capitan Reef water quality.

   The three remaining disposal wells (Report ID Nos. 25, 28, and 31) are active and are subject to continued monitoring of operation and for compliance with OCD UIC rules. It is probable that these wells will be plugged in the near future due to age and changing disposal requirements due to larger midstream participation within the Delaware Basin.

Current OCD Procedures to Protect Water Quality

OCD continues the effort to protect the water quality of those portions of the Capitan Reef that qualifies as an USDW. As part of this effort, four review procedures are being utilized by the OCD for both new applications and existing Class II disposal permits.

1. **Review of Existing UIC Class II Wells Though Change of Operator Applications**
   Recent fluctuations in commodity prices has increased the sale and transfer of ownership for many Class II injection wells along with active producing wells. OCD has expanded its review for change of operators through the processing of OCD Form C-145. When an operator provides this form, those wells with injection authority are reviewed for history, operation, and compliance status. This offers the ability to confirm the status of the injection authority as well as intervene to oppose the transfer of a well that the OCD finds in violation of UIC rules.

2. **Special Well Construction: Four-string Casing Requirement**
   A portion of the Capitan Reef shares the same spatial area with the Known Potash Leasing Area. The economic potash resource is found within the Salado formation which overlies the Capitan Reef where they occur along the Northwest Shelf and adjacent portion of the Delaware Basin (see Report Figure 1B). The area where the four-string casing construction is required is shown in Report Figure 2.

   Due to the salt content of the Salado formation, drilling through this interval requires a brine-saturated drilling mud. To avoid impacting the Capitan Reef below the Salado formation, the Bureau of Land Management and the OCD established a protocol to require a dedicated string of cemented casing (the second casing) to isolate the Salado before drilling into the reef. Another dedicated string (the third casing) is required for the Capitan Reef before continuing to deeper formations. This construction is required for both producing wells and Class II wells.

3. **Application of Wellhead Protection Areas Under the Safe Drinking Water Act**
   The OCD has applied components from the Wellhead Protection Program approved in the

1986 amendments to the Safe Drinking Water Act in assessing UIC applications. Two examples are provided. Attachment 3 contains exhibits for a case prepared by OCD to oppose an application for a Devonian disposal well in an area east of Carlsbad. The proposed well was to be completed in a deep Devonian interval which required drilling through the Capitan Reef. The applicant failed to recognize the protectable status of the reef in this area and address this situation with a proper casing design (see Division Exhibit No. 4 of Attachment 3). The location of the well also exhibited extreme karst geology which was demonstrated by the history of difficult well completions especially for the first casing or the casing designed to protect shallow USDWs (see Division Exhibit No. 2 of Attachment 3). This completion difficulty is further complicated by shallow domestic wells which could easily be contaminated by improper UIC well construction (see Division Exhibit No. 3 of Attachment 3).

The second example is the administrative denial of an application for a disposal well within the recharge area for the reef west of Carlsbad. The reasons for the denial are detailed in the following email content sent to the applicant:

"Denial of the application is based on the following observations:

1. *The well is proposed as a commercial operation with multiple produced water sources for disposal.*
2. *The proposed drilling program at location of the well presented in the application will result in the well penetrating the Capitan Reef aquifer [as projected from Hiss (1976) and mapped by Hayes and Gale (1957)] at shallow depth. This portion of the reef structure is the within the recharge area for the aquifer and is up-gradient of the municipal wells that provides drinking water to the city of Carlsbad. The application also does not address this transition and makes general assumptions of the stratigraphy not supported by the available geologic information as well as aerial photography of the surface geology of the area.*
3. *The application provides a water sample (assumed to be from the BLM stock water well with OSE POD No. C-03936) that demonstrates ground water with very good quality (523 mg/L TDS) at shallow depths. Similar ground water wells in the area note "artesian" conditions. The SWD well design and potential drilling program [based on the stratigraphic column included in the applications] does not address the protection of these occurrences, including the Reef aquifer, of protectable waters.*
4. *Finally, review of both BLM assessments for "Critical Karst Resource Areas" and drilling history for producing wells in this area show extremely high potential for poor well construction for the casing interval designated to protect any USDW. The daily logs for the Exxon Federal Com. No. 3 (30-015-32865), approximately 1600 feet east of the proposed SWD location, provides examples of drilling difficulties at shallow depths:*
    - *07/23/2003: Lost returns at 62'. Mix LCM sweep and pump. Regained circulation. Drill from 62' to 64' and lost returns. Drill string went from 75' to 152' with no returns.*
    - *07/24/2003: Ream from 50' – 81'. When attempting to make connection, cannot get rotary busing in table. Pick up and ream*

several times with same results. [The entry continues to describe the recovery of the drilling string, the pumping of 400 sacks of fiberglass cement into the bore hole, then continuing to ream to 80 feet with no returns].

- *07/25/2003: Reaming from 85' to 112' with no returns and hole falling in as we are attempt to make conn; keep hole open by reaming while waiting for cmt from Hall, TOH; ran 75' of fiberglass tubing, could not get past that depth, hook up Hall & pump 400 sx of cmt, cmt came up into conductor pipe & btm of cellar when hole caved in around cellar; diameter of hole appears to be 14-15' & water level is about 8' below btm of cellar, ordered 1500 sx of Hall "light" cmt for cellar; wait on Hall & monitor hole around cellar, hole still falling in, but conductor pipe still in place, so it appears that cmt job worked as planned and caving is loose sand and rock below cellar; cmt with 400 sx of Hall "light" and cmt came up into cellar, shoveling pea gravel into hole as we cmt, put 6 yards of gravel into hole along with the 400 sx of cmt; cmt did not fall back & samples set up firm in 3 hrs; PU bit & kelly, tag cmt at 35' & drill cmt down to 152' with full returns, having large amt of torque while ramming through previously drilled hole, torque should go away once we start making new hole below 224'.*
- *07/26/2003: Reaming from 152' - 155' with returns. Lost returns at 155' and ream to 175' pumping LCM sweep. Work string out of hole to 80' and pulled free. Build volume in pits. Ream up and down to 121' and attempt to make connection with no success. Trip out of hole and laydown bit and RMR. Run 2.375" Fiberglass tubing to 108' and could not get any deeper. Wait on cement from Halliburton. Cement with 400 sx of Thixatropic at 108'. Level in conductor came up from 40' to flow line and circulated 5 - 7 bbls of water to pits. Drained 10' of good cement from bottom of conductor and level did not fall any farther. Pull on fiberglass tubing and surface joint broke just below rotary table. Wait on cement to set. Mud up in slug pit and transfer to frac tank. Will go to mud after drilling cement and circulate through steel pits. Tag cement at 23' and drill hard cement to 115'. Ream on to 194' with full returns and very high torque String became stuck at 194' and lost returns. Hole appears to have fallen in on drill string. Work drill string and attempt to rotate and circulate. Pulled up 5' to 189' and have partial returns. Kelly beginning to slip in rotary bushings.*
- *07/26/2003: Work stuck pipe at 189'. Kelly bushings stripped and kelly rounded off. Rotary chain broken and sprocket teeth worn off. Replacement parts coming from Hobbs, NM yard. Replace chain and sprocket on rotary table. Wait on kelly. Filling pits with water.*

Unload kelly, Smith Driving tool, and 2.375" tubing. Cut conductor underneath floor to break out kelly. Break out kelly and change out. Make up driving tool on 6" DC and drive bit down 9'. Laydown driving tool. Trip out of hole and build 100 bbls of 100 viscosity mud. Tagged fill at 120' while going in hole to open up for cement plug. Ream in hole from 120' to 197'. Had partial returns when sweep was pumped and hole was open. Ran out of mud and hole fell in at 160' while attempting to pull out. Work stuck pipe at 160'. Ran 5 jts of fiberglass tubing and wash down to 150'. Pumped 100 bbls of mud in attempt to wash fill from around drill string. Presently working pipe.

Based on the consideration of all these elements, the Division will not support the approval of this application."

4. **Administrative Review and Hearing Process**

The OCD continues to review existing Class II injection well operations and new applications for injection wells that are in proximity of the Capitan Reef. Attachment 2 contains the history of a case involving one proposed well for shallow injection near Jal, New Mexico. The proposed injection well was one of four applications for commercial operation within mile and half of each other. The injection interval was identified as the Yates-Seven Rivers formations and the applicant described a projected injection rate of 35,000 BWD for each well.

The applicant stated that the injection fluid would remain within Yates-Seven Rivers formations due to the depleted characteristics of the reservoir which was a former hydrocarbon producing zone. However, the OCD contended that the proposed injection project would connect with the Capitan Reef and impact the current water quality of the aquifer in this area.

Order No. R-14738 was issued by the Division Hearing Examiners that denied the new application and associated applications based on the insufficient information for the hydrology of the reef system in this part of the state, the potential for impact of remaining hydrocarbon potential of the proposed injection zone, and issues with improperly plugged wells within the area of review.

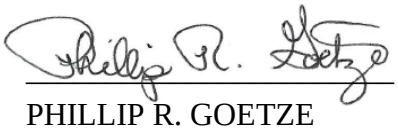
SUMMARY

The OCD remains attentive of the effort to maintain the water quality of the Capitan Reef and prevent further degradation. Portions of the Capitan Reef continue to attract interest as an alternative disposal interval when compared to more expensive, deeper disposal zones. ER projects associated with the backreef formations of the Capitan Reef are active and provide a steady source of hydrocarbon production with minimal capital investment. Expansion of the area of these ER projects is unlikely due to their age and declining reserves. However, modification of injection patterns to improve recovery of the remining hydrocarbons will require new applications for injection wells.

Further characterization of reef could provide a better delineation of areas that are protectable while identifying areas that qualify for exempt aquifer status. However, the scope of this investigation would be significant and would require an enormous scale of effort for proper assessment.

The content of this response was prepared by Phillip Goetze of the Engineering Bureau along with staff of the UIC Group within the Bureau. Please contact Mr. Goetze with any questions regarding the content of this document.

Sincerely,



PHILLIP R. GOETZE
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REFERENCES:

Daniel B. Stephens and Associates, Inc., 2009, *Capitan Reef Complex Structure and Stratigraphy*, Texas Water Development Board. Contract No. 0804830794, p.75.

Hiss, W. L., 1976, Structure of the Permian Guadalupian Capitan Aquifer, Southeast New Mexico and West Texas, Resource Map 6, New Mexico Bureau of Geology and Mineral Resources, one sheet.

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Holland, Michael T., Parkhill, T., Wilson, L., Logsdon, M., and Stahl, M., 1980, *Aquifer Evaluation for UIC: Search for a Simple Procedure*, in New Mexico State Demonstration for Class II Wells, Appendix II (referenced in Demonstration as Appendix A-2). Report prepared for the Oil Conservation Division, Santa Fe, NM.

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FIGURES

Report Figure 1A. Map Showing the General Location of the Capitan Reef Aquifer System
Report Figure 1B. Relevant Stratigraphic Column and Relationship to Aquifer Occurrences in the Capitan Reef Lithosome
Report Figure 2. Map showing locations of Injection Wells from Summary Table 1

TABLES

Table 1. Summary Table of Active Injection Wells Requiring Further Investigation

ATTACHMENTS

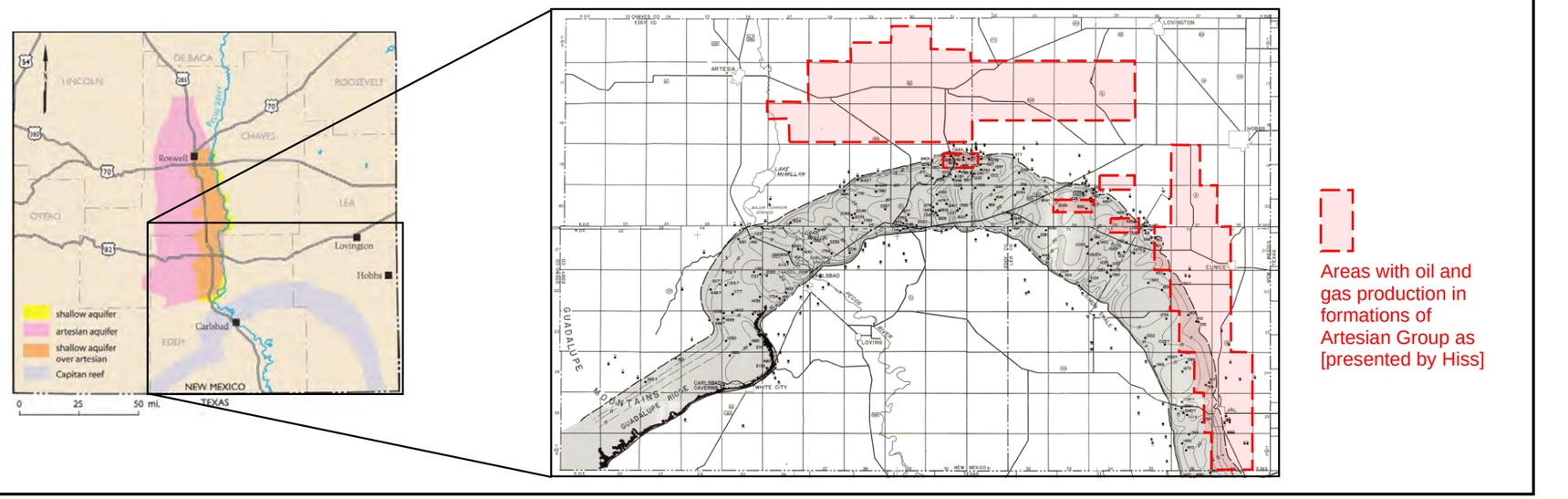
Attachment 1. Figures from *Capitan Reef Complex Structure and Stratigraphy*
Attachment 2. Exhibits from Division Case No. 15723
Attachment 3. Examples of OCD Reviews for Administrative Applications

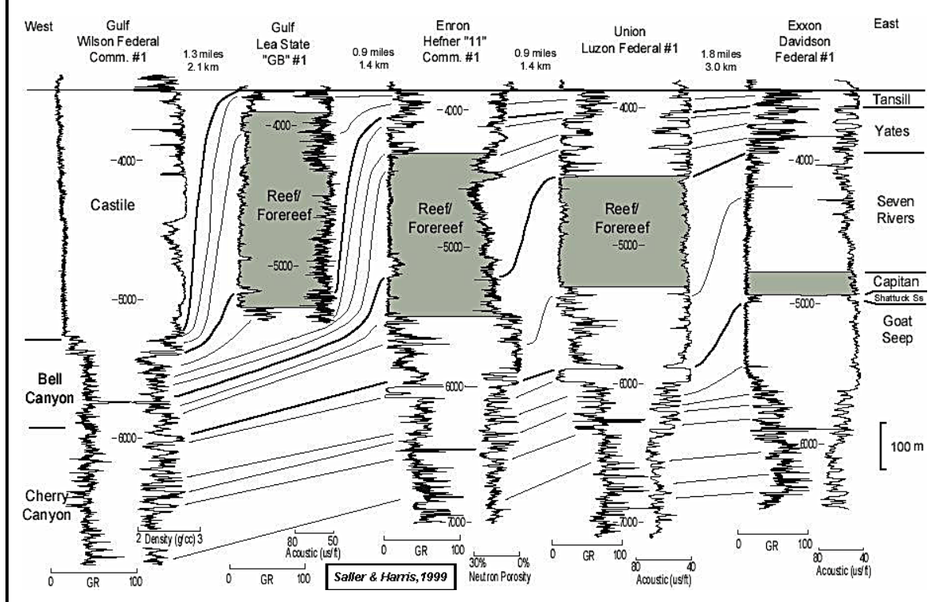
cc: UIC Class II Program Imaging File

State of New Mexico
Energy, Minerals and Natural Resources Department
Oil Conservation Division

Update of UIC Class II Activities Within the State of New Mexico for Possible Injection into USDWs: the Capitan Reef Aquifer System

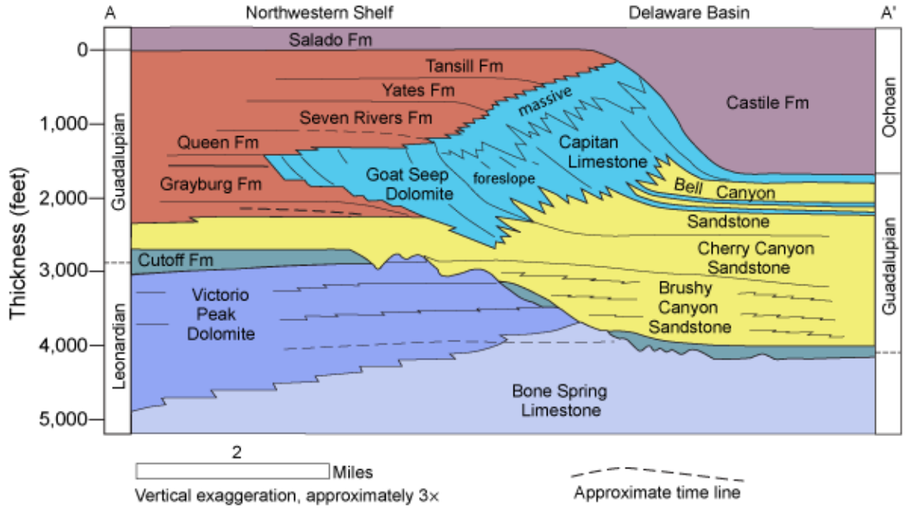
REPORT FIGURE 1A.
Maps Showing the General Location of the Capitan Reef Aquifer System





Era	Period	Northwest Shelf	Delaware Basin
Cenozoic	Quaternary	Pecos Valley alluvial fill	
	Tertiary	Gatuna Formation	
		Ogallala Formation	
		Sierra Blanca volcanics	
Mesozoic	Cretaceous		
	Jurassic		
	Triassic	Santa Rosa Fm./Dockum Grp.	
Paleozoic	Permian	Rustler Fm.	Rustler Fm.
		Salado Fm.	Salado Fm.
		Castile Fm.	
		Artesia Group: Tansill, Yates, Seven Rivers, Queen, Grayburg; Capitan Reef*	Delaware Mountain Group
		San Andres Formation	Bone Spring Formation
		Yeso, Victorio Peak	
		Abo Formation	Hueco Group
		Older Paleozoic strata	

* lower portion of reef section includes the Goat Seep reef



Modified from King, 1948; Hayes, 1964; Tyrrell, 1969; Pray, 1988

REPORT FIGURE 1B. Relevant Stratigraphic Column and Relationship to Aquifer Occurrences in the Capitan Reef Lithosome as Shown in the Schematic and Correlation Cross Sections

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Legend

- Carlsbad_Municipal_Water_System
- 4 String Casing
- ReefWellsEPA
- Artesia Group- Tansill, Yates, Seven Rivers Formations
- Artesia Group- Queen Formation

Geologic Area

- Capitan Reef
- Central Basin Platform
- Delaware Basin
- Permian Shelf

Permian Reef Shelf
(Northwest Shelf)

Central
Basin
Platform

Capitan Reef

Delaware Basin

Artesia
Loco Hills
Malaga
Carlsbad
Carlsbad
Municipal
Water
System
Hobbs
Eunice
Jal
Eddy County
Lea County

Report Figure 2: Map showing locations of Injection Wells from Summary Table 1

State of New Mexico
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Oil Conservation Division

Update of UIC Class II Activities Within the State of New Mexico for Possible Injection into USDWs: the Capitan Reef Aquifer System

Table 1. Updated Summary Table of Active Injection Wells Requiring Further Investigation

Report ID Number	Well Identification No.	Well Name	Current Operator	Location (UL-Sec-Twn-Rge)	OCD Designated Pool	Well Type	Injection Authority	Status as of May 2020 and Comments on Injection	Recommended OCD Action
1	30-015-02446	SALADAR FEDERAL NO. 4	MNA ENTERPRISES LTD CO	K (NE¼SW¼)-33-20S-28E	SALADAR;YATES	ER	WFX-869	Saladar Waterflood Unit; Order No. R-5939	Continued monitoring of operation until waterflood is complete; plug and abandon with no option for conversion to disposal operation.
2	30-015-02448	SALADAR FEDERAL NO. 6	MNA ENTERPRISES LTD CO	K (NE¼SW¼)-33-20S-28E	SALADAR;YATES	ER	WFX-869		
3	30-015-02449	SALADAR FEDERAL NO. 8	MNA ENTERPRISES LTD CO	N (SE¼SW¼)-33-20S-28E	SALADAR;YATES	ER	WFX-869		
4	30-015-02450	SALADAR B NO. 2	MNA ENTERPRISES LTD CO	L (NW¼SW¼)-33-20S-28E	SALADAR;YATES	ER	Shut-in		
5	30-015-24179	SALADAR FEDERAL NO. 12	MNA ENTERPRISES LTD CO	K (NE¼SW¼)-33-20S-28E	SALADAR;YATES	ER	WFX-869		
6	30-025-08606	CONE JALMAT YATES POOL UNIT NO. 105	BREITBURN OPERATING LP	L (NW¼SW¼)-13-22S-35E	JALMAT;TAN-YATES-7 RVRS (OIL)	ER	R-2495^	Cone Jalmat Yates Pool Waterflood Unit; Order No R-2495	Continued monitoring of operation until waterflood is complete; plug and abandon with no option for conversion to disposal operation.
7	30-025-08640	CONE JALMAT YATES POOL UNIT NO. 502	BREITBURN OPERATING LP	L (NW¼SW¼)-24-22S-35E	JALMAT;TAN-YATES-7 RVRS (OIL)	ER	WFX-206		
8	30-025-08648	CONE JALMAT YATES POOL UNIT NO. 107	BREITBURN OPERATING LP	D (NW¼NW¼)-24-22S-35E	JALMAT;TAN-YATES-7 RVRS (OIL)	ER	R-2495^		
9	30-025-08579	JALMAT FIELD YATES SAND UNIT NO. 123	BREITBURN OPERATING LP	P (SE¼SE¼)-10-22S-35E	JALMAT;TAN-YATES-7 RVRS (OIL)	ER	R-2243^	Cooper Jal Waterflood Unit; Order No. R-4020	Continued monitoring of operation until waterflood is complete; plug and abandon with no option for conversion to disposal operation.
10	30-025-08588	JALMAT FIELD YATES SAND UNIT NO. 121	BREITBURN OPERATING LP	N (SE¼SW¼)-11-22S-35E	JALMAT;TAN-YATES-7 RVRS (OIL)	ER	R-2243^		
11	30-025-08590	JALMAT FIELD YATES SAND UNIT NO. 114	BREITBURN OPERATING LP	J (NW¼SE¼)-11-22S-35E	JALMAT;TAN-YATES-7 RVRS (OIL)	ER	R-2243^		
12	30-025-08601	JALMAT FIELD YATES SAND UNIT NO. 116	BREITBURN OPERATING LP	L (NW¼SW¼)-12-22S-35E	JALMAT;TAN-YATES-7 RVRS (OIL)	ER	Currently producer (R-2243)		
13	30-015-26524	HADSON FEDERAL NO. 1	GRIZZLY OPERATING, LLC	O (SW¼SE¼)-11-19S-31E	SWD;YATES-SEVEN RIVERS	SWD	SWD-700	Active disposal well; cumulative injection for 2019 was 83,622 BW or approximately 232 BWD; total injection in 2020 reported as 7023 BW.	Continued monitoring of operation; plug and abandon with no option for new disposal operation.
14	30-015-26730	HADSON FEDERAL NO. 3	GRIZZLY OPERATING, LLC	G (SW¼NE¼)-11-19S-31E	SWD;YATES-SEVEN RIVERS	SWD	SWD-479	Active disposal well; cumulative injection for 2019 was 8097 BW or 22 BWD; total injection in 2020 reported as 21 BW.	Continued monitoring of operation; plug and abandon with no option for new disposal operation.
15	30-025-32735	PRONGHORN SWD NO. 1	SPUR ENERGY PARTNERS, LLC	B (NW¼NE¼)-24-19S-32E	SWD;YATES-SEVEN RIVERS	SWD	SWD-536	Active disposal well; new operator; no injection in Feb. 2020; no injection at time of report; well proposed for plugging by OCD.	Pursue P&A of well with current operator or limit injection through modification of existing order.
16	30-025-02431	LEA UNIT NO. 8	LEGACY RESERVES OPERATING, LP	B (NW¼NE¼)-12-20S-34E	SWD;SEVEN RIVERS	SWD	SWD-189^	**P&A**	
17	30-025-02459	CRUCES FEDERAL NO. 3	BURK ROYALTY CO., LTD.	N (SE¼SW¼)-26-20S-34E	LYNCH;YATES-SEVEN RIVERS	SWD	R-9000	Active disposal well; less than 100 BW per day.	Continued monitoring of operation; plug and abandon with no option for new disposal operation.
18	30-025-02507	W H MILNER FEDERAL NO. 4	BURK ROYALTY CO., LTD.	C (NE¼NW¼)-35-20S-34E	SWD;YATES	SWD	R-3779^	**P&A**	
19	30-025-02501	NEAL NO. 3	BURK ROYALTY CO., LTD.	A (NE¼NE¼)-35-20S-34E	LYNCH;YATES-SEVEN RIVERS	ER	R-4283-A	Active disposal well; total injection for 2019 was 2771 BW; total injection in 2020 reported as 175 BW.	Continued monitoring of operation; plug and abandon with no option for new disposal operation.
20	30-025-02476	SILVER FEDERAL NO. 4	STEVEN D RUPPERT	O (SW¼SE¼)-28-20S-34E	SWD;YATES-SEVEN RIVERS	SWD	R-3724^	Active disposal well; total injection for 2019 was 6000 BW (500 BW per month); no injection reported in 2020.	Continued monitoring of operation; plug and abandon with no option for new disposal operation.
21	30-025-02466	BALLARD DE FEDERAL NO. 3	BLACK MOUNTAIN OPERATING LLC	D (NW¼NW¼)-27-20S-34E	SWD;SEVEN RIVERS	SWD	SWD-354	**P&A**	
22	30-025-02494	B V LYNCH A FEDERAL NO. 2	MAS OPERATING CO.	P (SE¼SE¼)-34-20S-34E	SWD;YATES-SEVEN RIVERS	SWD	R-7971	Active disposal well; last injection Sept 2019; no injection at time of report; operator in bankruptcy.	Pursue P&A of well with current operator or limit injection through modification of existing order.
23	30-025-12580	B V LYNCH A FEDERAL NO. 10	MAS OPERATING CO.	C (NE¼NW¼)-34-20S-34E	SWD;YATES-SEVEN RIVERS	SWD	R-4612	Active disposal well; last injection Sept 2019; no injection at time of report; operator in bankruptcy.	Pursue P&A of well with current operator or limit injection through modification of existing order.
24	30-025-02448	D AND E FEDERAL NO. 1	CHESTNUT EXPLORATION AND PRODUCTION, INC.	N (SE¼SW¼)-22-20S-34E	SWD;SEVEN RIVERS	SWD	SWD-326	**Lost injection authority; P&A authority with BLM**	
25	30-025-20386	WHITTEN NO. 1	NEW MEXICO SALT WATER DISPOSAL COMPANY	I (NE¼SE¼)-14-20S-34E	SWD;SEVEN RIVERS	SWD	SWD-525	Active disposal well; cumulative injection for 2019 was 1,508,689 BW; total injection in 2020 reported as 6550 BW.	Continued monitoring of operation; plug and abandon with no option for new disposal operation.
26	30-025-23985	WALLEN FEDERAL NO. 2	DAKOTA RESOURCES INC (I)	C (NE¼NW¼)-20-20S-34E	SWD;YATES-SEVEN RIVERS	SWD	SWD-249	Active disposal well; cumulative injection for 2019 was 5076 BW; total injection in 2020 reported as 1331 BW (approximately 400 BW per month).	Continued monitoring of operation; plug and abandon with no option for new disposal operation.
27	30-015-26710	WELCH FEDERAL NO. 7	BILL G TAYLOR AND HARVEY R TAYLOR	P (SE¼SE¼)-5-21S-27E	CEDAR HILLS;YATES	SWD	SWD-425	**Lost injection authority; P&A authority with BLM**	
28	30-015-22055	EXXON STATE NO. 8	PERMIAN WATER SOLUTIONS, LLC	O (SW¼SE¼)-15-21S27E	SWD;YATES	SWD	R-13043	Active disposal well; current injection of 2500 BWD; operator in bankruptcy; cumulative 32,092,877 BW.	Continued monitoring of operation; plug and abandon with no option for new disposal operation.
29	30-025-25957	7406 JV-S LEA 20 NO. 1	CHANCES PROPERTIES COMPANY	P (SE¼SE¼)-20-26S-36E	SWD; CAPITAN REEF	SWD	SWD-210^	**Lost injection authority; NMSLO business lease expired and not renewed; well to be P&A**	
30	30-025-01671	FEDERAL 18 B NO. 4	SPUR ENERGY PARTNERS, LLC	H (SE¼NW¼)-18-19S-33E	SWD; SEVEN RIVERS	SWD	SWD-589	Active disposal well; average injection in 2020 of 1410 BWD; no injection at time of report.	Pursue P&A of well with current operator or limit injection through modification of existing order.
31	30-025-09806	MARALO SHOLES B NO. 2	OWL SWD OPERATING, LLC	P (SE¼SE¼)-25-25S-36E	SWD;YATES-SEVEN RIVERS	SWD	SWD-1127	Active disposal well; see Order No. R-14737; last reported dispsoal rate of 27,000 BWD.	Continued monitoring of operation; plug and abandon with no option for new disposal operation.
32	30-025-09807	BROWN NO. 5	OWL SWD OPERATING, LLC	E (SW¼NW¼)-25-25S-36E	SWD;YATES-SEVEN RIVERS	SWD	R-5196^	Active disposal well; MSIP pressure limits injection rate with pressure increase in the reservoir; cumulative injection for 2019 was 120 BW; no injection reported in 2020.	Continued monitoring; current information indicates no hydrologic connection with Capitan Reef aquifer; pursue P&A of well with current operator.

BWD: barrels of water per day; **BW:** barrels of water; **P&A:** plugged and abandoned

^Indicates injection authority predates primacy approval date of March 7, 1982.

Explanation of Color Code

Disposal wells that have either been plugged and abandoned or have lost their injection authority.

Active disposal well that is currently shut-in; OCD effort to plug or limit injection through modification of existing order.

13 Active disposal wells.

Five injection wells within single waterflood unit.

Three injection wells within single waterflood unit.

Four injection wells within single waterflood unit.

State of New Mexico
Energy, Minerals and Natural Resources Department
Oil Conservation Division

Update of Underground Injection Control Class II Activities Within the State of New Mexico for Possible Injection into Underground Sources of Drinking Water: the Capitan Reef Aquifer System

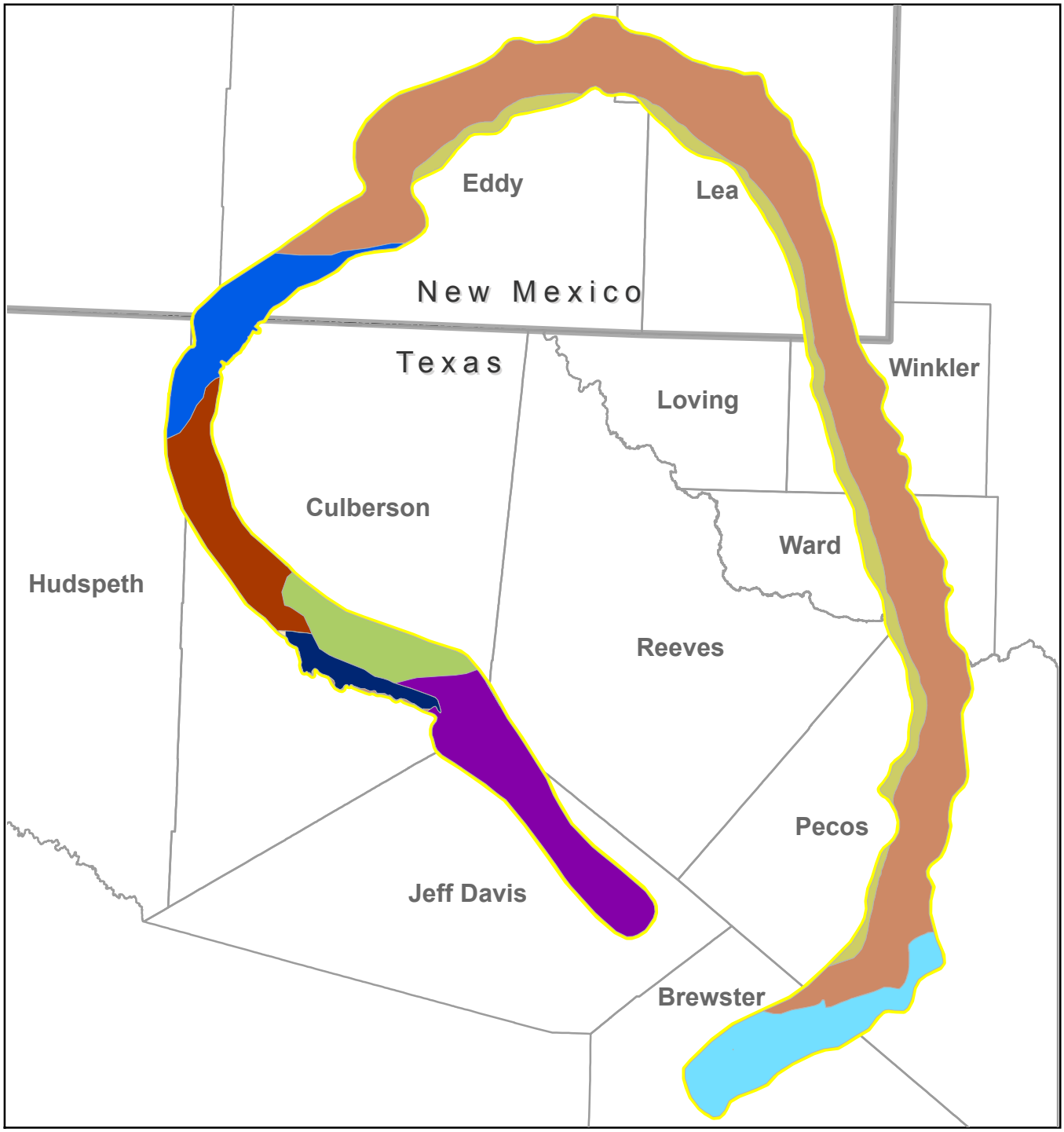
ATTACHMENT 1

Source: Daniel B. Stephens and Associates, Inc., 2009, *Capitan Reef Complex Structure and Stratigraphy*, Texas Water Development Board

Figure 8: Geologic Formations Overlying the Reef Complex

Figure 18: Capitan Reef Complex Thickness Contours

Figure 22: Regional Groundwater Flow



Explanation

- Capitan Reef Complex outline (revised)
- Texas/New Mexico border

Overlying units

- Salt Basin sediments
- Quaternary deposits and Cretaceous formations
- Artesia Group
- Castile and Salado formations
- Castile or Salado formations
- Capitan Outcrop with overlying Permian, Triassic, Cretaceous, and Quaternary deposits
- Capitan Outcrop with overlying Quaternary deposits
- Capitan Outcrop, with overlying Artesia and Quaternary deposits
- Erosional Base of Capitan Reef Complex

0 10 20 30 Miles

N

Source: Modified after King, 1937, 1948; Woods, 1968; Hiss, 1975.

CAPITAN REEF COMPLEX

Geologic Formations Overlying the Capitan Reef Complex

Daniel B. Stephens & Associates, Inc.

08/28/2009 JN WR08.0039

Figure 8

N:/Client/Water Resources/Capitan Aquifer/GIS/MXDs/New figures_082509/Figure 8.mxd

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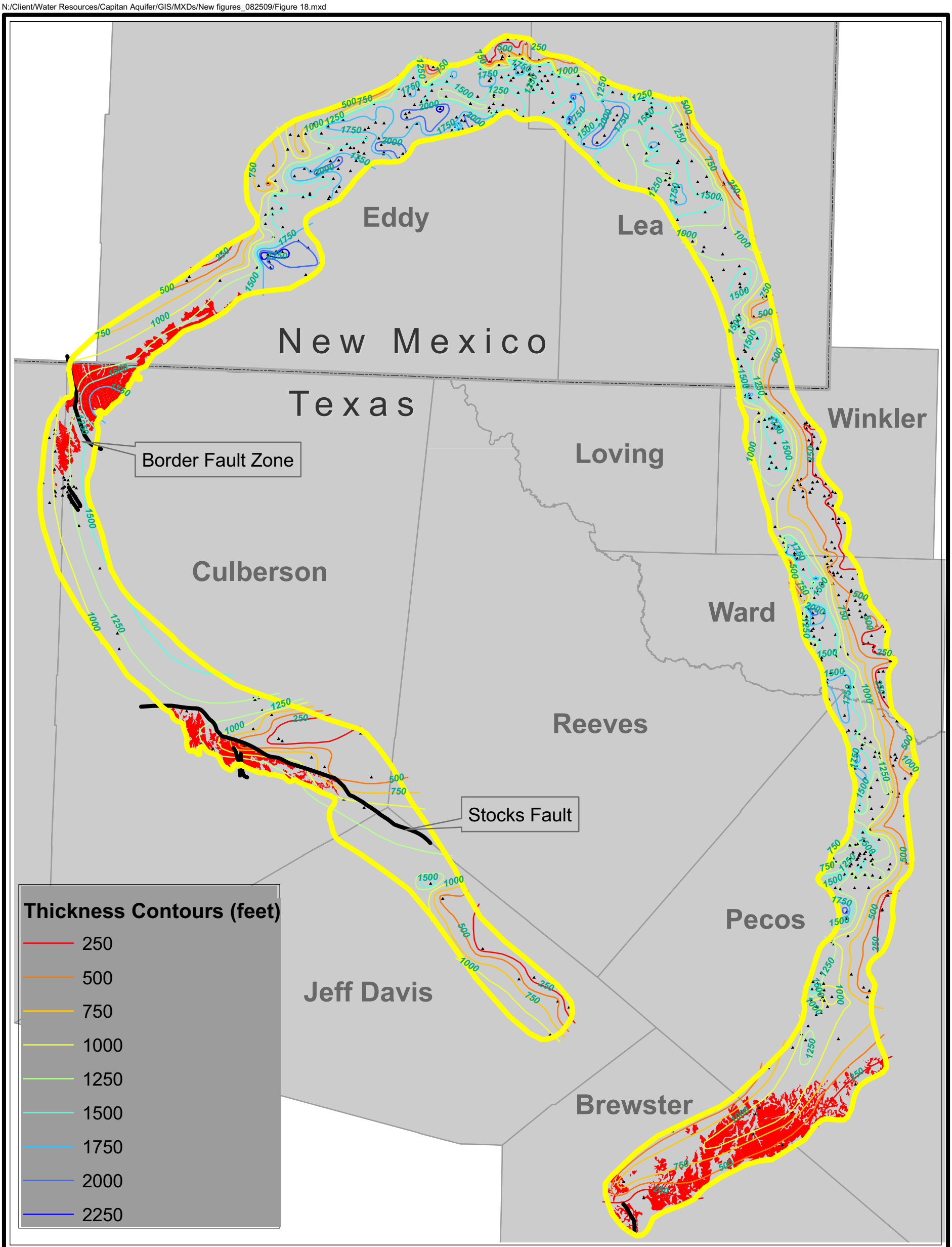


Figure 18

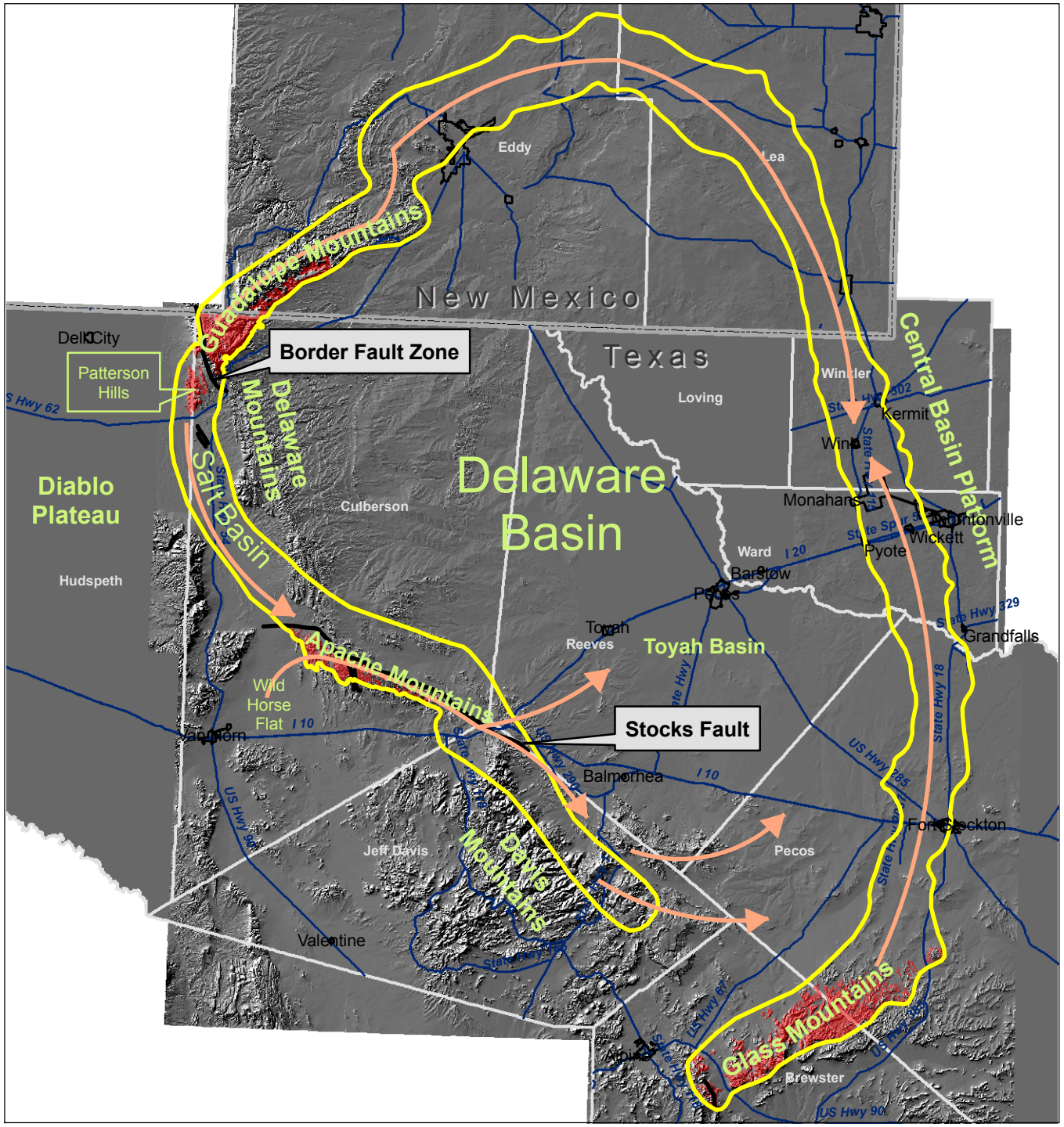
CAPITAN REEF COMPLEX

Capitan Reef Complex Thickness Contours

Daniel B. Stephens & Associates, Inc.

08/28/2009

JN WR08.0039



Explanation

- Regional groundwater flow
- Capitan Reef Complex outline (revised)
- Capitan Reef Complex outcrop
- Mapped faults
- Cities
- Major roads
- Texas/New Mexico border
- County boundary

0 10 20 30 Miles

N

Source: After Sharp, 2001; Hiss, 1976, 1980; Uliana, 2001.

CAPITAN REEF COMPLEX

Regional Groundwater Flow

N:/Client/Water Resources/Capitan Aquifer/GIS/MXDs/New figures_082509/Figure 22.mxd

Daniel B. Stephens & Associates, Inc.

08/28/2009 JN WR08.0039

Figure 22

State of New Mexico
Energy, Minerals and Natural Resources Department
Oil Conservation Division

Update of Underground Injection Control Class II Activities Within the State of New Mexico for Possible Injection into Underground Sources of Drinking Water: the Capitan Reef Aquifer System

ATTACHMENT 2

Source: OCD Case No. 15723; Hearing Order No. R-14738; Division Exhibits
http://ocdimage.emnrd.state.nm.us/imaging/CaseFileView.aspx?CaseNo=15723

Division Exhibit No. 1: Map Showing Location of Proposed Bobcat SWD Well No. 1

Division Exhibit No. 2: Aerial Photograph Map Showing Major Features and Wells Near the Bobcat SWD Well No. 1 Location

Division Exhibit No. 3: Relevant Excerpts from Referenced Reports on the Capitan Reef Aquifer

Division Exhibit No. 4: Map Showing Capitan Reef Aquifer Monitoring Wells and Water Production Wells Near Jal, New Mexico

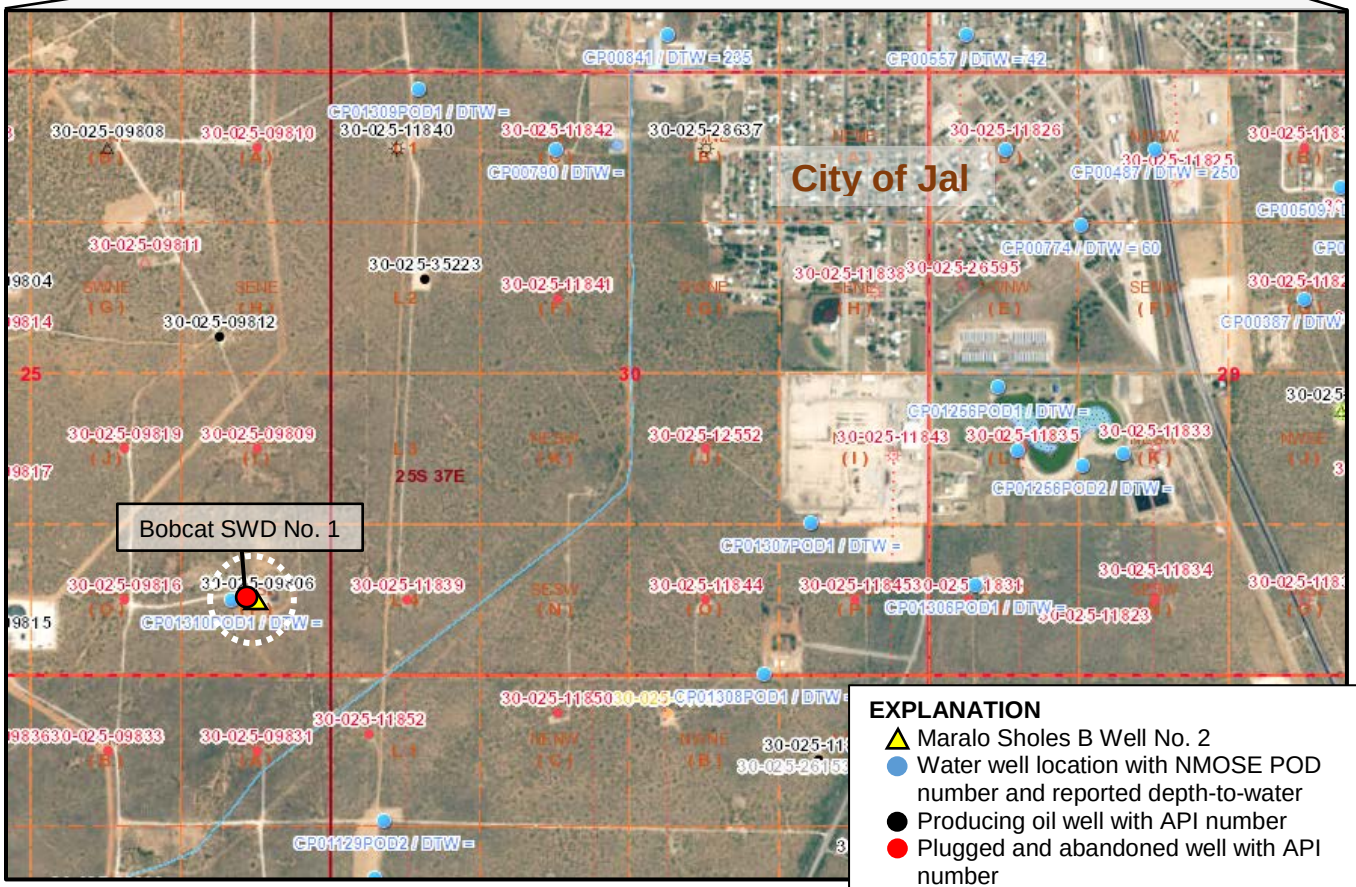
Division Exhibit No. 5: Graph Showing Water Production of Sholes B 25 Well No. 1 and Water Injection of Maralo B Sholes Well No. 2 vs. Time

Copy of Division Order No. R-14738

Oil Conservation Division
Energy, Minerals and Natural Resources Department
State of New Mexico

CASE NO. 15723 Division Exhibit No. 1:
Map Showing Location of Proposed Bobcat SWD No. 1

Index Map

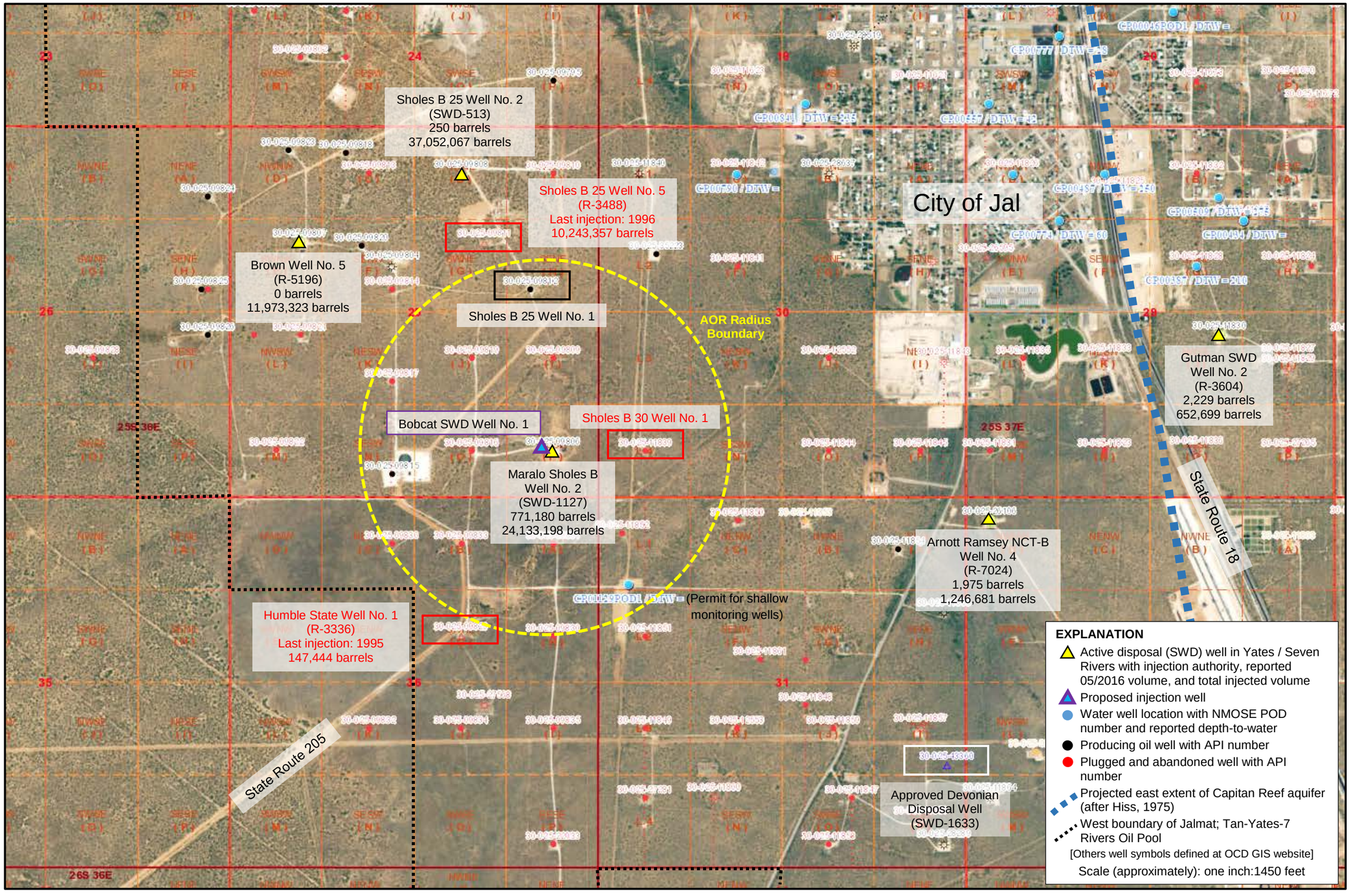


EXPLANATION
- Maralo Sholes B Well No. 2
- Water well location with NMOSE POD number and reported depth-to-water
- Producing oil well with API number
- Plugged and abandoned well with API number

[Others well symbols defined at OCD GIS website]
Source: NMOCD ArcGIS Database

Oil Conservation Division
Energy, Minerals and Natural Resources Department
State of New Mexico

CASE NO. 15723 Division Exhibit No. 2: Aerial Photograph Map Showing Major Features and Wells Near the Bobcat SWD Well No. 1 Location



Oil Conservation Division
Energy, Minerals and Natural Resources Department
State of New Mexico

CASE NO. 15723 Division Exhibit No. 3: Relevant Excerpts from Referenced Reports on the Capitan Reef Aquifer

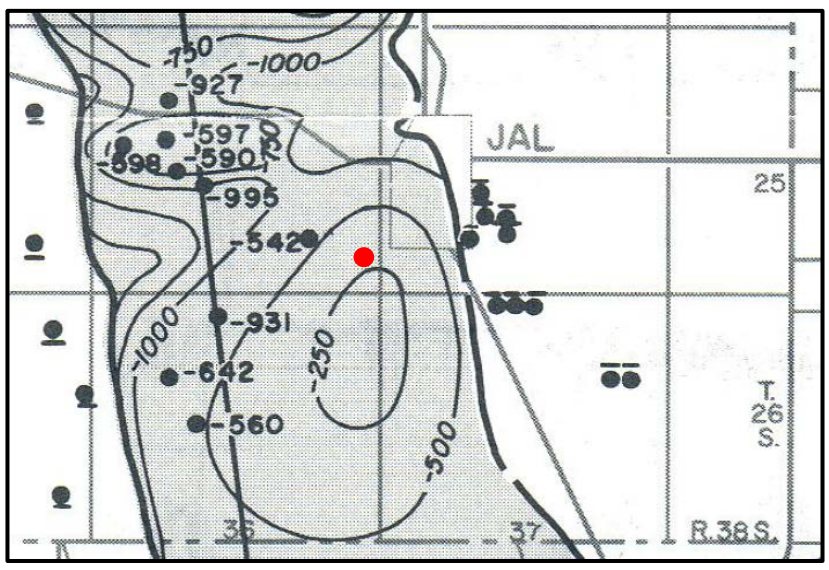


Figure 3A: Map Showing Structure of the Capitan Aquifer
Contour indicates the altitude of the top of the Capitan aquifer; in feet; datum is mean sea level. Source: NMBGMR Resource Map 6; Hiss (1976)

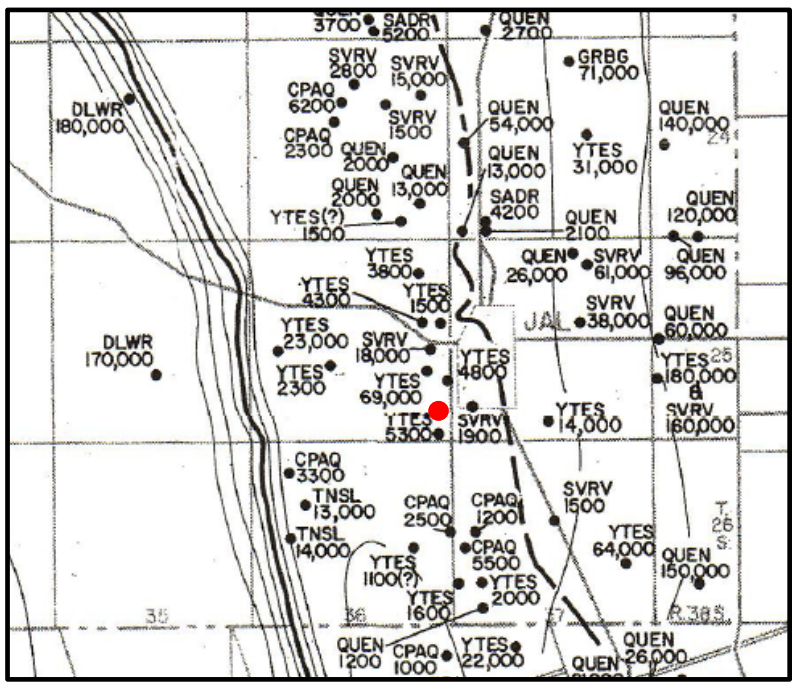


Figure 3B: Map Showing Chloride-Ion Concentration in Permian Age Sedimentary Rocks
Number represents chloride-ion concentration in milligrams per liter; Relevant unit codes: CPAQ – Capitan aquifer; QUEN – Queen formation; SVSR – Seven Rivers formation; YTES – Yates formation. Source: Figure 26; Hiss (1975)

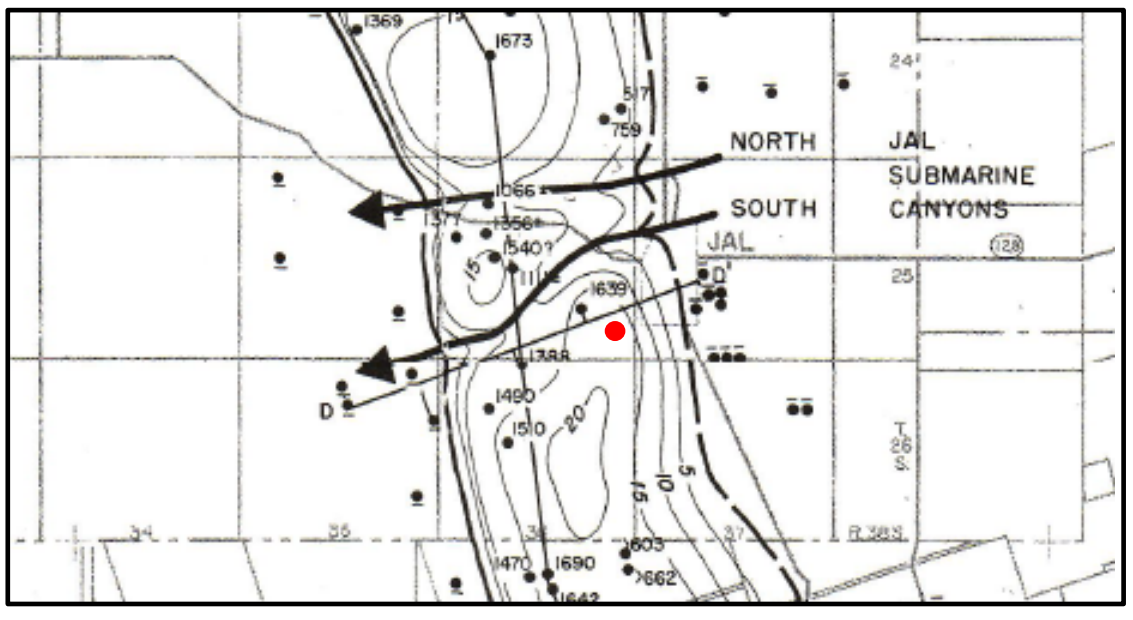
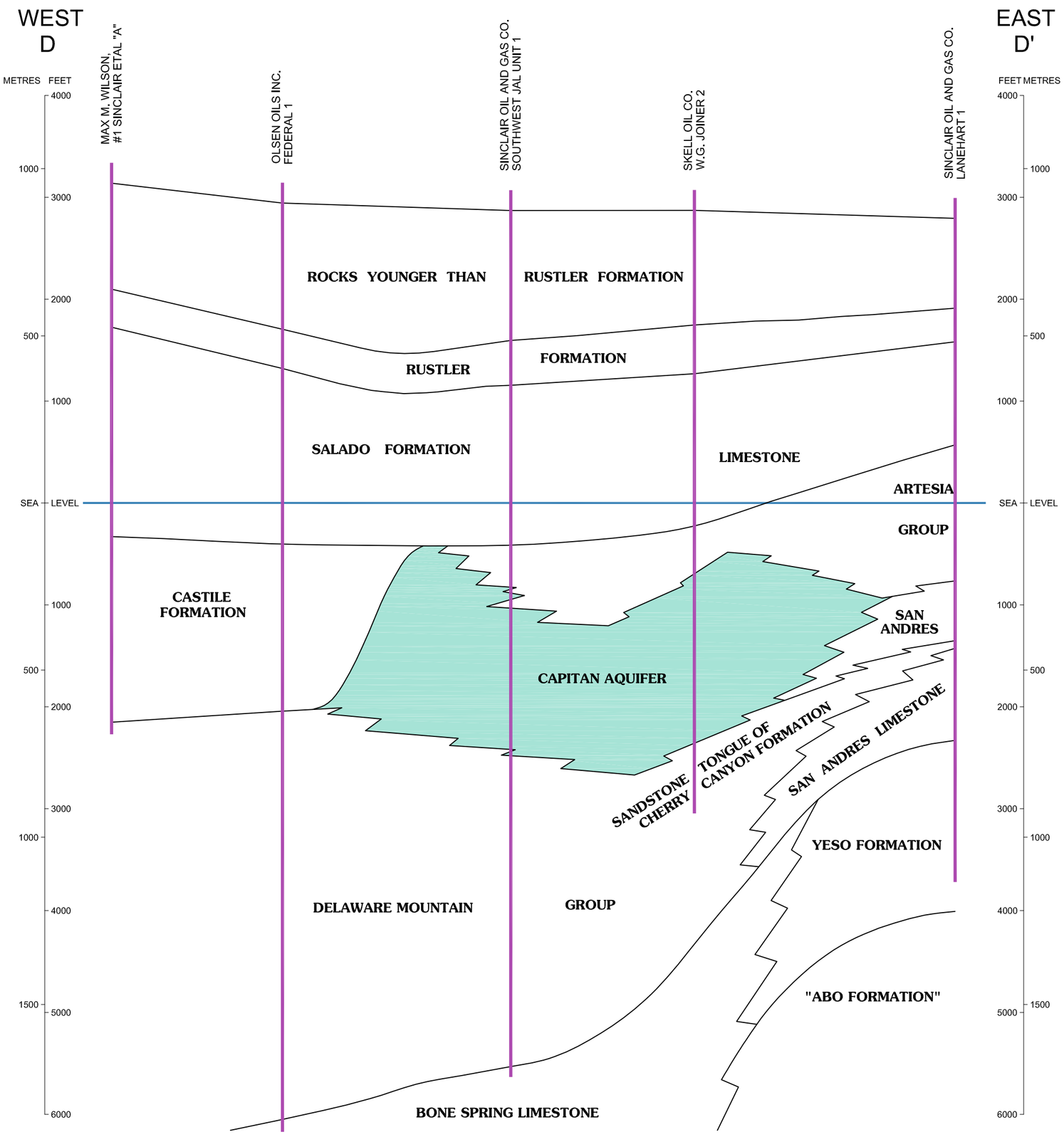


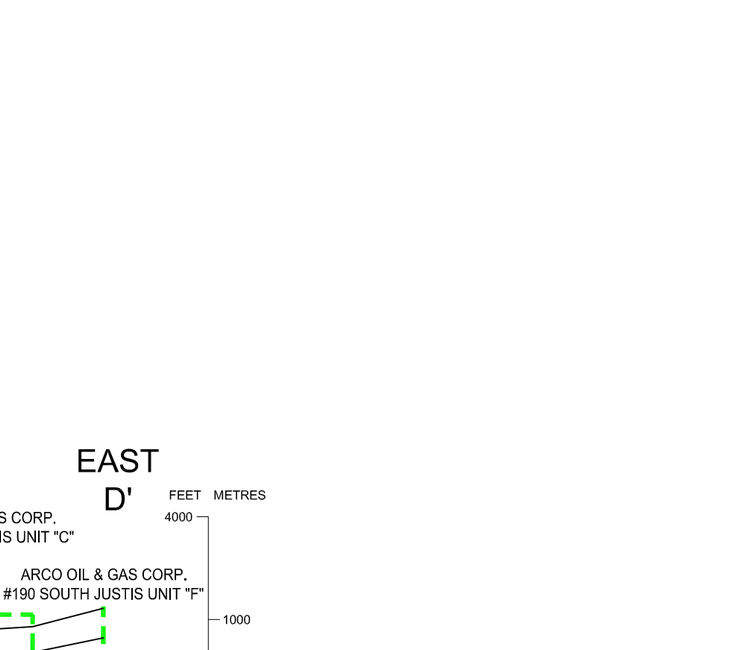
Figure 3C: Map Showing the Thickness of the Capitan Aquifer
Lines of equal thickness; in hundreds of feet and interval is 500 feet; wells: ● wells penetrating reef and (or) shelf margin facies; ● wells penetrating shelf facies; ● wells penetrating basinal facies. (Note: well symbols also used in Figure 3A). Source: Figure 11; Hiss (1975)

EXPLANATION

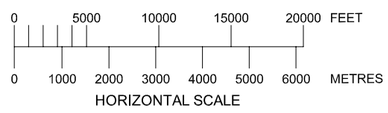
● Approximate location of Maralo Sholes B Well No. 2

CASE NO. 15723
Division Exhibit No. 3:
Figure 3D: Stratigraphic Section D - D'
Source: Water Resources Monitoring Plan, Ochoa Mine Project (INTERA, 2004)

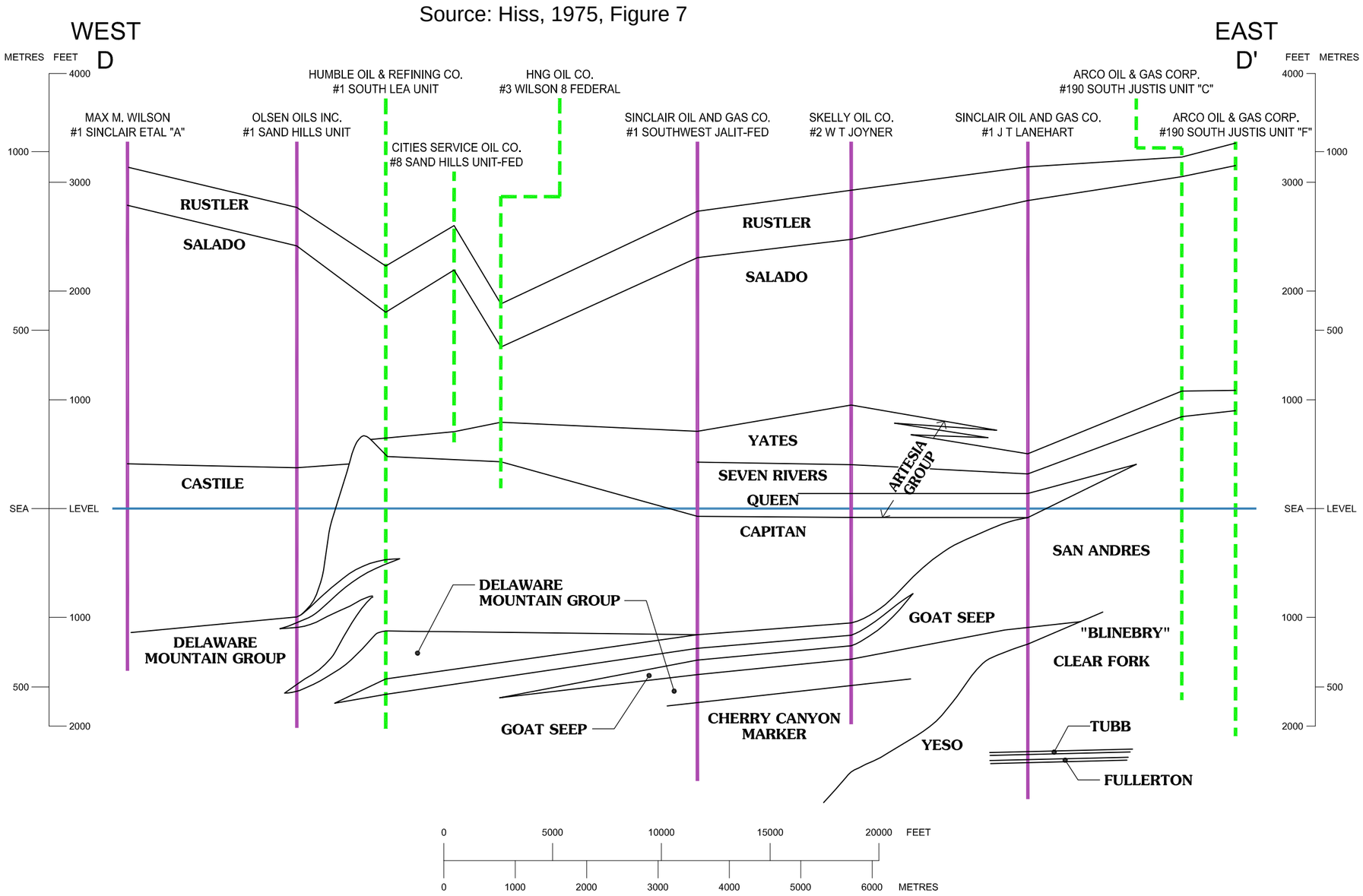


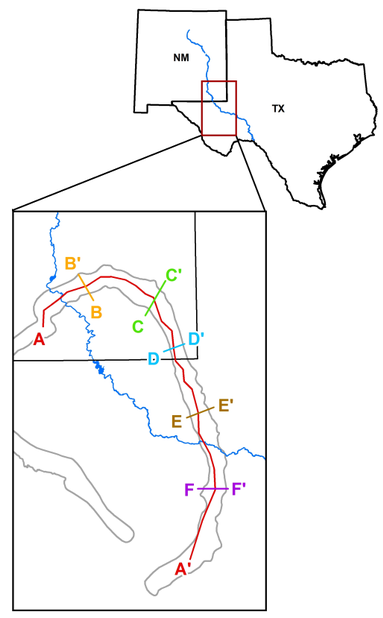


INTERA Model
NOT TO SCALE
(1H : 10V)



HISS SECTION
Source: Hiss, 1975, Figure 7





LAMB SECTION

INTERA

Figure 14
Stratigraphic Section D-D'
Across the Capitan Reef Complex and Aquifer
Ochoa Mine Water Resources Monitoring Plan

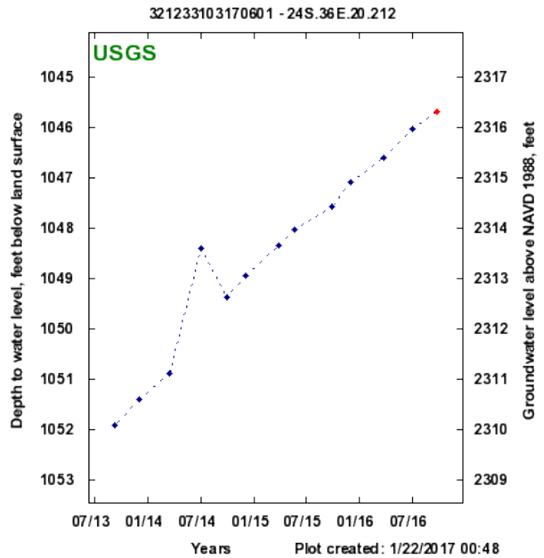
Oil Conservation Division
Energy, Minerals and Natural Resources Department
State of New Mexico

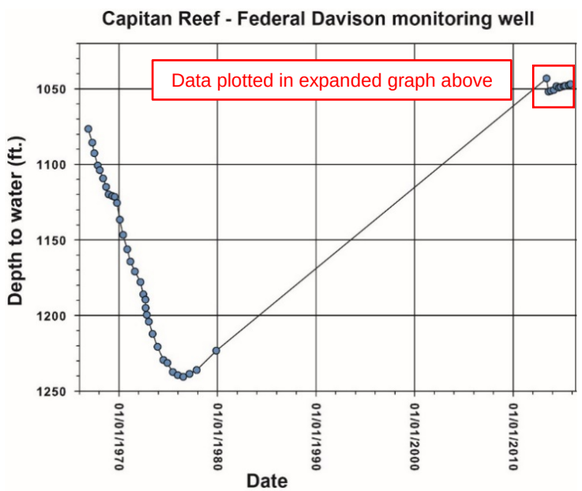
CASE NO. 15732 Division Exhibit No. 4: Map Showing Capitan Reef Aquifer Monitoring Wells and Water Production Wells Near Jal, New Mexico

MONITORING WELL DESCRIPTION

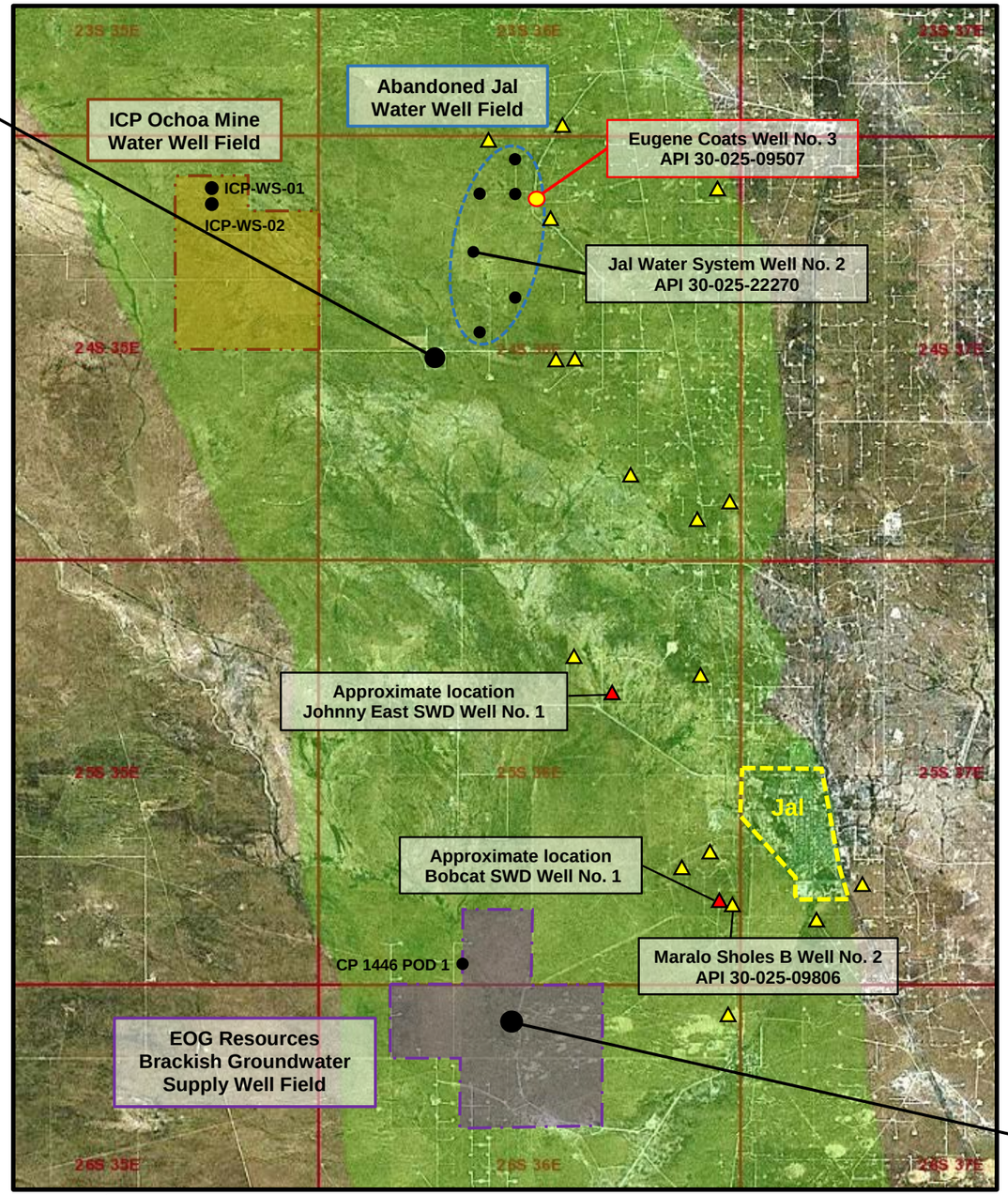
USGS Well Identification: 321233103170601

Location: 660 ft FNL / 1980 ft FEL; Sec 20, T24S, R36E, NMPM
Lat: 32° 12' 33.3" Long: 103° 17' 5.9" NAD83
Original completion information:
Davison Federal No. 1 (30-025-21725)
Spud: 07/22/1965 P&A: 09/30/1966
TD: 17,691 feet PBTD: 5,713 feet
Relinquished to the USGS WRD for monitoring use on 12/08/1967.

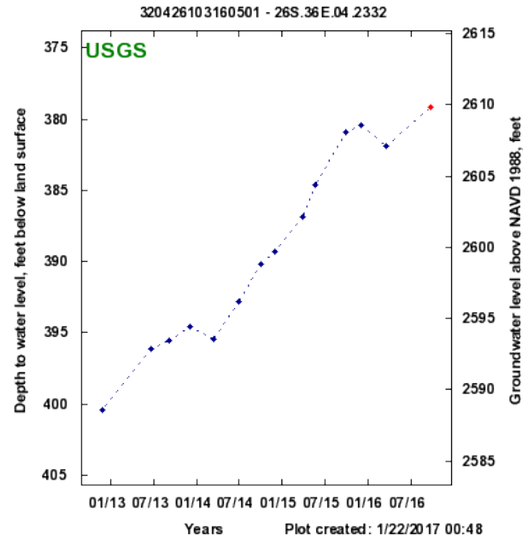


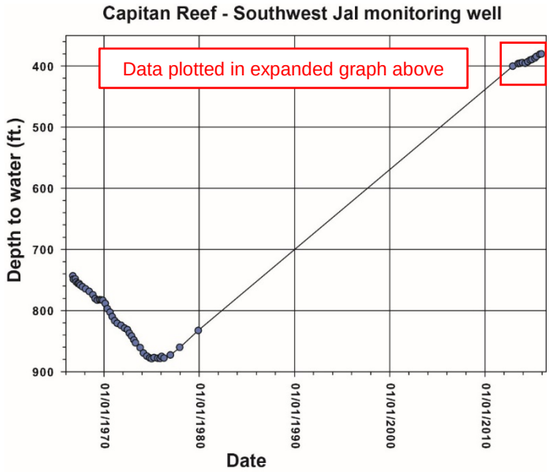


Graph Data Sources: USGS Groundwater Watch database (2016) and Land (2016)
Aerial photobase from OCD GIS map database



EXPLANATION:
- Active salt water disposal wells in Seven Rivers, Yates, or Queen formations (or combination)
- Water wells or monitoring wells in Capitan Reef associated with commercial or municipal projects
- Green shading represents projected lateral extent of Capitan Reef aquifer (after Hiss,1975)





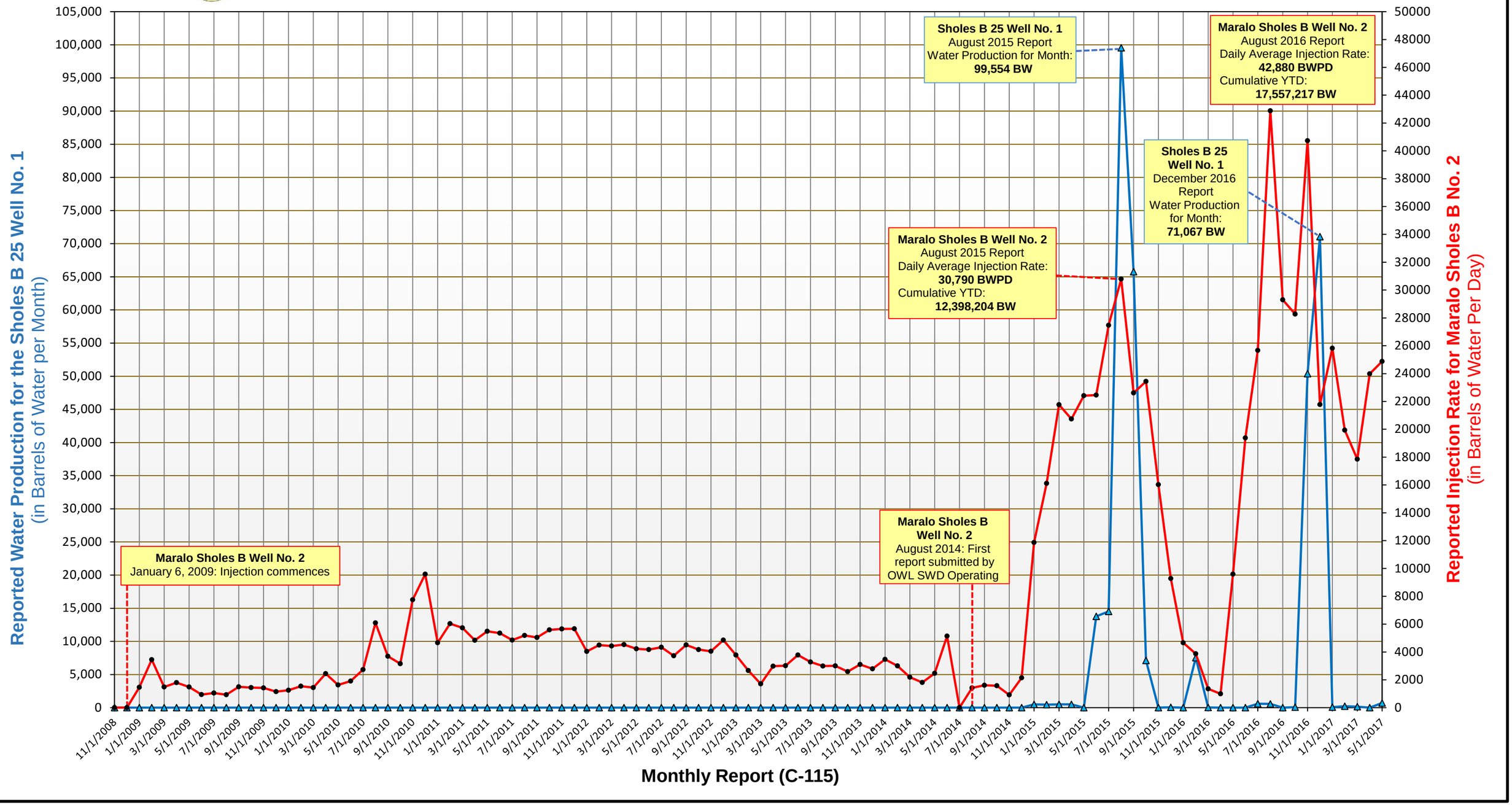
MONITORING WELL DESCRIPTION

USGS Well Identification: 320426103160501

Location: 1980 ft FNL / 1980 ft FEL; Sec 4, T26S, R36E, NMPM
Lat: 32° 4' 25.8" Long: 103° 16' 4.7" NAD83
Original completion information:
Southwest Jal Unit No. 1 (30-025-20843)
Spud: 04/21/1964 P&A: 03/05/1966
TD: 13,505 feet PBTD: 5,300 feet
Relinquished to the USGS WRD for monitoring use on 03/15/1966.

CASE NO. 15723 Division Exhibit No. 5:

Graph Showing Water Production of Sholes B 25 Well No. 1 and Water Injection of Maralo B Sholes Well No. 2 vs. Time



STATE OF NEW MEXICO
ENERGY, MINERALS, AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION

IN THE MATTER OF THE HEARING CALLED BY THE OIL CONSERVATION DIVISION TO CONSIDER:

CASE NO. 15723
ORDER NO. R-14738

THE APPLICATION OF OWL SWD OPERATING, LLC FOR AUTHORIZATION TO INJECT, LEA COUNTY, NEW MEXICO.

ORDER OF THE DIVISION

BY THE DIVISION:

This case came on for hearing at 9:00 a.m. on August 1st, 2nd, and 4th, 2017, at Santa Fe, New Mexico and again on August 31st, 2017, before Examiner William V. Jones.

NOW, on this 15th day of June 2018, the Division Director, having considered the testimony, the record, and the recommendations of the Examiners,

FINDS THAT

(1) Due public notice has been given, and the Division has jurisdiction of this case and its subject matter.

(2) The applicant, OWL SWD Operating, LLC (OGRID 308339) ("OWL"), seeks authorization to use the proposed Bobcat SWD Well No. 1 (API No. 30-025-Pending, "Proposed Well") as a disposal well, replacing its existing, nearby disposal well, the Maralo Sholes B Well No. 2 (API No. 30-025-09806). The Bobcat SWD Well No. 1 will be located 740 feet from the South line and 705 feet from the East line, Unit P of Section 25, Township 25 South, Range 36 East, NMPM, Lea County, New Mexico.

(3) The Oil Conservation Division ("OCD") entered an appearance in opposition to the permit for the Proposed Well and presented one technical witness. The State Land Office ("SLO") also entered an appearance and presented one technical witness.

(4) By letter to the Division dated April 28, 2016, the City of Jal ("Jal") had expressed concerns that the high disposal rates into this well would endanger its potential to exploit its proposed water rights in this Section 25. The City of Jal appeared at the hearing through counsel, questioning witnesses and presenting briefs.

(5) OWL provided notice of the proposed disposal well and the hearing to all affected parties and operators of record within the ½ mile Area of Review as required in Rule 19.15.26.12 NMAC. During the hearing, the hearing examiner required the area of review for notice purposes to be extended from one half mile to a one-mile radius from the

proposed disposal well. The case was continued to August 31, 2017 to provide adequate time for the additional notice.

(6) The Division subsequently received a letter from Special Energy Corporation dated August 30, 2017 as one of the noticed (affected) parties stating there was no objection to the application, so long as only one of the wells [subject wells of Cases No. 15723 and 15753] is allowed by the Division to be used for disposal.

(7) No other party entered appearance or otherwise opposed this application.

(8) Case No. 15753, "Application of the New Mexico Oil Conservation Division Compliance and Enforcement OCD for a Compliance Order Against OWL SWD Operating, LLC for the Maralo Sholes B Well No. 2 Operated in Lea County New Mexico." was heard September 15, 2017. The competence of this existing well and its tubulars for use as a high rate commercial disposal well was the subject in Case No. 15753. Case No. 15753 could be considered a companion case because the disposal well permit being proposed in Case No. 15723 would replace the permit for disposal into the Maralo Sholes B Well No. 2; which well is also located in Unit P of Section 25, Township 25 South, Range 36 East, NMPM, Lea County, New Mexico. The parties considered whether to combine the two cases for purposes of testimony but agreed to present the cases separately. A separate order will be issued in Case No. 15753.

(9) OWL had proposed this application administratively by submittal of Form C-108 on May 1 of 2017. The matter was evaluated and referred to an Examiner hearing by the OCD Engineering Bureau.

(10) OWL appeared at the hearing through counsel and presented the following by testimony and exhibits.

a. The Proposed Well would replace the existing Maralo Sholes B Well No. 2 disposal well which would be plugged and abandoned.

b. The Proposed Well would have two casing strings. The 9-5/8-inch casing would be set to the top of the Salado formation at 1325 feet and cemented to surface, covering all potential fresh water sources. The 7-inch casing is proposed to be set in the Yates formation, just above the top of the proposed disposal interval at 2915 feet. A 5-7/8-inch open hole would be drilled to 3060 feet and the open hole interval used for disposal through 4-1/2-inch duo-lined tubing set in a 7-inch packer at no higher than 2815 feet.

c. OWL anticipates a maximum injection rate of 30,000 barrels of water per day. The waste water would be sourced from locally produced water in the Delaware, Bone Spring, Devonian, and Yates-Seven Rivers formations. The maximum anticipated injection pressure would be 580 psi at surface.

d. The closest fresh water well is located 2328 feet and one other well may be located within one mile. OWL will attempt to supply a fresh water analysis to the Division from these wells.

e. The affirmative statement in the application says, "Based on the available engineering and geologic data we find no evidence of open faults or any other hydrologic connection between the disposal zone and any underground sources of drinking water." The form C-108 application was signed by a consulting engineer and agent for OWL.

f. The Proposed Well would be part of a series of wells permitted for disposal into either the Yates Seven Rivers or the Devonian formations.

g. The disposal wells will support a water handling system intended to reliably recycle and dispose of oil field waste water for many years to come. The system is designed to consist of a landfill, two 500,000-barrel water ponds, and be fed from oil field operations located to the west through a 16-inch fiberglass lined water pipeline. The pipeline system is necessary to largely eliminate truck traffic and wear on existing roads and will be much more reliable and much larger in size than a system based on trucking. The system has over a dozen clients and is necessary to the drilling, completion, and production operations near the Red Hills area. OWL intends to continue to scale up the recycling of oil field waste water.

h. The proposed disposal interval is located geologically in the backreef facies. The well is laterally several miles east of the Capitan Reef. The earlier, older portion of the Capitan Reef extends under the proposed disposal interval below the Seven Rivers formation.

i. Within the nine-township area surrounding the Proposed Well are three or four hundred Yates-Seven Rivers injection wells within the Langlie Mattix; 7Rvrs-Q-Grayburg Pool (Pool code 37240). There have been numerous other SWD wells permitted by the Division in this area and some in this same Section 25 – all within the same Yates and Seven Rivers formations.

j. OWL presented an analysis of the Hiss water quality data [report published in 1975] from wells in the surrounding nine-township area of the Proposed Well. Most of the Hiss wells were located to the east of the Proposed Well. The analysis indicated that the waters in the Yates-Seven Rivers formations average above 10,000 TDS of total salinity with a median of 14,650.

k. Injection into the Proposed Well would be filling up depleted pore space in this reservoir and not harming correlative rights. The Yates and Seven Rivers formations in this area have been produced since the 1920's and by the 1950's had been severely depleted by primary production. In the 1960's injection projects were put in to recover additional oil in place.

l. The oil reservoir is within the lower Yates and upper Seven Rivers formations which trend roughly north/south and dip gently to the east. Beginning in the west and moving east, the reservoir grades from a free gas phase to oil and then to water in the east. The western edge of Section 25 is near the line at which

the phase changes from gas to oil. The current disposal and the Proposed Well would be disposing just below this contact. There has been significant gas produced from the gas cap of this reservoir.

m. Original reservoir pressure in the 1920's is estimated to have been 1400 psi or near the bubble point. By the 1950's the gas cap had increased in size and the reservoir pressure had decreased to about 200 psi. The gas cap helped in oil recovery until it was blown down by recompletions up-hole.

n. The productive rock in this reservoir has been the clean sands with an estimated permeability of at least 350 millidarcies as measured in a core from an adjacent well. The carbonates contain anhydrites which have reduced the permeability. Therefore, the proposed disposal is expected to be contained in the sands and not migrate vertically through the rock.

o. In the Maralo Sholes B Well No. 2, the initially completed pay interval was above the oil to water contact, therefore the well did not produce any water and only began producing some water after pressure depletion.

p. Near the Proposed Well, the Yates or Seven Rivers formations would not be a valid source of water for the City of Jal not only due to higher salinity but also due to the initial pay interval not having water.

q. Within this immediate project area, there is 85 to 90 million barrels of pore space that must be filled before a waterflood would be successful. Other waterflood attempts in this portion of the reservoir have not been successful.

r. Waterflood operations would not be successful until this reservoir was again restored to original pressures. Small waterfloods have been tried without success. High rate water disposal into the Proposed Well may be positive to surrounding producers and should not be detrimental or cause waste.

s. The Capitan Reef exists both laterally from and vertically below the Proposed Well. The Capitan Reef trends north/south and the youngest aged, highest portion of the Reef is located several miles to the west where the proposed disposal interval grades into the reef. Older, lower portions of the Capitan Reef are located vertically below the proposed disposal interval anywhere from 250 to 700 feet depending on which estimate was provided.

t. There are nearby water supply wells and observation wells in the Capitan Reef. The reported water analysis from this area in the Reef indicates waters higher than the 10,000 TDS fresh water limit and dangerous levels of hydrogen sulfide, with a black, corrosive quality.

u. Disposed waters are not expected to move vertically down due to low permeable dolomites in the lower Seven Rivers formation and the low reservoir pressures in the depleted sand disposal intervals, as compared with the lower intervals.

v. Disposed waters are not expected to move vertically upward due to the impermeable Salado formation overlying the stratified target disposal interval. The injection survey run in December of 2016 on the Maralo Sholes B Well No. 2 shows that waters are not moving up-hole around the packer and injection water is staying in the permitted disposal interval.

w. The target disposal interval has been depleted of pressure after years of production; therefore, injected fluids should remain in this interval and not move laterally out of this interval. Any horizontal movement of waste water should be preferentially in an easterly direction because of the lower pressures existing in the east from all the prior oil production. Movement to the west towards the reef is up dip but should not happen due to the higher pressures in the Reef.

x. The City of Jal currently gets its water from the Pecos Alluvium, the shallowest aquifer in the area. Jal would most likely find additional waters first in the Santa Rosa formation and then in the Rustler formation. The Capitan Aquifer waters would be the third choice and would be expensive to pump and purify.

y. The State Engineer defines the "Capitan Underground Water Basin" for purposes of administering water rights within that defined extent. This basin includes the Capitan Reef Aquifer and water sources above the Reef but the two sources are not identical in lateral extent.

z. The Capitan Reef Aquifer is a poor choice for the City of Jal because of its depth and the higher salinity and contaminates in southern Lea County. The newest installed wells in the Capitan Reef in this area were for the Ochoa Mine project. Those wells were pumped for seven days and the final water salinity measured was 70,000 mg/l of TDS.

aa. The multilayer hydrologic model presented by a hydrologist showed that disposed waste waters would most likely never reach the Capitan Reef. Currently the Capitan water pressures are higher than the pressures in the target disposal interval. In addition, there are layers of low permeability rocks vertically below the target disposal interval. Both factors would prevent or limit movement of injected waters into the Reef.

bb. The reported rebound in water column in the Capitan monitor wells could be explained by the cessation of large water supply projects both to the north and to the south of this location.

cc. There has been no evidence of pressure communication or water movement from the higher-pressure Capitan Reef and the depleted Yates-Seven Rivers target disposal reservoir. Therefore, it can be concluded that the two are not in communication and waters introduced back into the depleted reservoir would not contaminate the Capitan Reef Aquifer.

dd. The flowline installed to this location along with the planned ponds will even-out any injection surges into the Proposed Well. The surface facilities for the Proposed Well are new and designed to Division requirements. The well would be equipped with a SCADA system which monitors rates and pressures and can be used to remotely control the well.

ee. The injection operation into the Proposed Well can be conducted in a safe and responsible manner without causing waste, impairing correlative rights or endangering fresh water, public health or the environment.

(11) The OCD appeared at the hearing through counsel and presented the following.

a. The OCD administratively reviewed the permit for disposal in the Proposed Well and referred it to hearing where the matter of commercial disposal into this depleted, low salinity reservoir could be considered. The OCD also reviewed and denied three other proposals for commercial disposal in this area.

b. The OCD presented maps and a large volume of available data relating to water quality, water availability, water head (or pressure) in the nearby Capitan Reef, and water production in surrounding Area of Review wells.

c. This reservoir is still producing oil and gas. There are few wells located to the west of the Maralo Sholes B Well No. 2. There are many wells to the east and these are mostly plugged. The remaining producing wells seem to be located to the north or south. Because of the presence of many wells in this same disposal interval, the OCD recommends the one-half mile area of review be expanded to a larger area.

d. There is a concern that high rate disposal will cause waste in this reservoir. Within the one-half mile area of review is the Fulfer Oil & Cattle, LLC operated Sholes B 25 Well No. 1 (API No. 30-025-09812) located in Unit H of Section 25, Township 25 South, Range 36 East, NMPM, Lea County, New Mexico. This well has reported spikes in water production that may be correlated with injection of high rates of waters into the Maralo Sholes B Well No. 2.

e. There may be an uncemented well located in the "area of review" that could provide a conduit for high rate disposal waters to move up hole. Within the one-half mile area of review is the Continental Oil Company, Sholes B 30 (API No. 30-025-11839) located in Unit M of Section 30, Township 25 South, Range 37 East, NMPM, Lea County, New Mexico. The well is reported as plugged and abandoned but there are no logs of well file records available in public records to verify depth or plugging method.

f. The Maralo Sholes B Well No. 2 was originally permitted for handling local waters, but after being taken over for commercial disposal has reported a peak disposal rate of 42,880 barrels of water per day.

g. Order No's R-14034 and R-9913 were presented by the OCD as examples of proposals for disposal in this area over the years that were denied after notice and hearing. The reason for denial has been cited as a concern over waste of oil and gas and adverse impact on the relatively low salinity waters in the target interval or adverse impact on the Capitan Reef.

h. The OCD and the Division have received letters from the City of Jal expressing concern over the effects on fresh water supplies of disposal at high rates into the Maralo Sholes B Well No. 2.

i. The water analysis submitted with the original disposal application for the Maralo Sholes B Well No. 2 reported 8,200 mg/l of TDS. That application was not for commercial disposal of outside waters and the applicant indicated an intention to re-inject those same waters or local waters from local operations back into the Yates and Seven Rivers formations.

j. The water analysis recently submitted for the application for the Proposed Well is much higher than that submitted with the original application for the Maralo Sholes B Well No. 2.

(12) The State Land Office ("SLO") appeared at the hearing through counsel and presented the following.

a. SLO explained that the Hiss data confirms a hydrologic model of movement of fresh waters through and near the Capitan Reef. The Artesia group formations near the Proposed Well have clearly been flushed from waters within the Capitan Reef below the original sea water concentrations and are at or below the protectable concentrations.

b. There has been contamination occurring in this area. The older salt water disposal wells have increased the salt level in waters from surrounding producing wells. This is evidence that disposal waters were being brought into those disposal wells from higher salt yielding formations.

c. The waters in this Yates, Seven Rivers, Queen formation aquifer to the north of the Proposed Well range from good drinking water to much higher salt content, a complete range of salinities, but many samples are below the 10,000 mg/l of TDS.

d. There is a well on located to the south of the Proposed Well that had 5800 TDS at one point in time. The salinity in that well degraded over time which has been a pattern for wells in this area.

e. Looking at the samples taken over time in this back-reef area, it is evident that the waters were clearly fresh and in places have been contaminated by drilling or disposal.

f. In 2009, the Texas Water Development Board issued a complete report about the waters in this area, updating and expanding on the Hiss work.

g. From examination of thickness of the Seven Rivers, the Capitan Reef may be within 100 to 300 feet vertically from the open hole, total depth of the Maralo Sholes B Well No. 2. From correlations, the Seven Rivers formation may range in thickness from 100 to 400 feet thick at this location. The lack of deeper wells in this area prevents knowing this thickness precisely.

h. The permeability in the Capitan Reef can be three to ten times as much as the permeability in the back-reef facies. There is sometimes a low ratio of horizontal to vertical permeability in the Artesia group formations. Therefore, vertical migration can and does occur.

i. There is some indication of a fault within one mile of the Proposed Well. The faults in the Reef may have resulted in cavernous porosity and points of recharge in the Reef. This cavernous porosity sometimes extends upward into the rocks of the Artesia group overlying the Capitan Reef, as it does above the entrance to the Carlsbad Caverns.

j. The SLO does not want poor quality water which would be injected into the Proposed Well to migrate under State Trust lands. The SLO has easements for both fresh and naturally brackish water for use by mining companies and oil and gas companies.

k. The SLO is also concerned about waste and believes there is a residual oil saturation in this reservoir even after depletion. Wells set up to dispose of salt water instead of wells set up in a pattern for injection and waterflooding will result in a waste of State Trust oil resources.

l. The SLO stated that oil companies are reluctant to install a waterflood or CO2 flood in this area because of the large liability from poorly plugged wells.

(13) Additional technical details in OWL's submitted form C-108 (application for disposal) and in Division records concerning the Maralo Sholes B Well No. 2 and disposal in this area are pertinent to this case and listed below.

a. The Maralo Sholes B Well No. 2 (as it is now called) was originally drilled in 1947 for production of oil. The oil pay interval (Yates or Seven Rivers formation dolomite) was initially reported to extend from 2945 feet to 2950 feet. In 1961, the operator reported that the oil interval had "watered out" and applied to recomplete the well up hole as a gas well in the Yates formation. On October 6, 1961 the well tested at 780 Mcf per day from upper Yates formation sands at 2871 feet to 2910 feet. These perforations were cement squeezed and a thicker gas pay interval from 2824 feet to 2933 feet was perforated and fractured on October 21, 1981.

b. By 1986, the well had reached its economic limit for production of oil and gas and was deepened at least 50 feet and used as a water supply well for the Jalmat Waterflood. The well continued to produce and sell some gas.

c. After administrative application, on June 1, 2008, the Maralo Sholes B Well No. 2 was permitted by the Division with administrative order SWD-1127 for use as a disposal well into an open hole from 2938 to 3055 in the Lower Yates and Upper Seven Rivers formations. The application for disposal stated the operator's intention to dispose of a maximum of 5,000 barrels of water per day from the same formation and from the operator's own production in the area.

d. OWL took over as operator of record on July 16, 2014, cleaned out the disposal well, and changed the injection tubing from 3-1/2 inch to 4-1/2 inch in diameter, and connected a produced water flowline to the well. The well has since been used for commercial disposal at rates of approximately 25,000 barrels of water per day ("bwpd"), sometimes peaking at much higher rates.

e. The Proposed Well would be a new disposal well to be located near and to replace the Maralo Sholes B Well No. 2.

f. Division records indicate that within one half mile of the Proposed Well are nine (9) plugged and abandoned wells and two (2) other wells that have not yet been plugged, both operated by Fulfer Oil & Cattle, LLC. The producing wells are in the Jalmat; Tansill Yates Seven Rivers (Oil) Pool with Pool Code 33820. All wells located within one-half (½) mile of the Proposed Well are reported in the C-108 application submitted by OWL to be cased and cemented adequately to prevent movement of disposal water up-hole and out of interval.

g. Partially as a check on whether waste will occur, the form C-108 asks for all wells within two miles to be listed in any application for disposal. OWL intends to dispose at relatively high rates over many years into the Proposed Well; therefore, during the hearing the Examiner asked for the radius of notice to be extended from the rule-required one-half mile radius to a one-mile radius, which radius was amended to include all lands in the surrounding four Sections. OWL has done that additional notice. The data indicates that many of the active wells in those Sections are operated by Fulfer Oil & Cattle, LLC and some are operated by Herman L. Loeb, LLC.

h. Two of the active wells in Section 25 are permitted for disposal and being used for salt water disposal into the same proposed interval as the Proposed Well. Division records for these two disposal wells can be summarized as follows:

- The Sholes B 25 Well No. 2 (API No. 30-025-09809)

Located in Unit B of Section 25 and currently operated by Fulfer Oil & Cattle, LLC. This well was permitted by SWD-513 on May 20, 1993 for disposal into the Seven Rivers (open hole) from 3061 feet to 3290 feet. The application stated the intention "to inject water from our wells from the

Yates and Seven Rivers formations" at no more than 7000 barrels of water per day.

- The Brown Well No. 5 (API No. 30-025-09807)

Located in Unit E of Section 25 is now operated by OWL SWD Operating, LLC. This well was permitted by Division Order No. R-5196 issued in Case No. 5655 on April 20, 1976 for disposal into the lower Yates and Seven Rivers formations through an open hole from approximately 3289 feet to 3363 feet.

The testimony in this Case No. 5655 presented in 1976 indicated that water from the producing interval of the Yates formation in surrounding wells would be injected in this well into the (lower) Seven Rivers open hole. *The applicant submitted a water analysis of these Yates waters (Exhibit No. 5 of Case No. 5655) which showed a TDS of 7302 mg/l with (a lot of) H2S.*

The case file also contains a request submitted relatively recently asking to convert the disposal well from lease-only to Commercial Disposal. The request letter included a water analysis sampled in March of 2000 (titled: Project Owner Fulfer and Project Name Brown SWD near Jal New Mexico) showing waters to be disposed into the well. *The Seven Rivers formation water was listed at 8200 TDS and the Queen formation water at 5000 TDS.*

The Case file did not contain a reply from the Division granting or denying permission to convert to commercial disposal.

Issues and Conclusions

(14) Waste of Oil or Gas due to Disposal

a. It was proper that the OCD not approve this disposal application administratively and prudent to require a hearing where the possibility of waste of oil and gas could be further explored.

b. OWL presented an expert opinion from a Petroleum Engineer that this reservoir cannot be waterflooded until the reservoir pressure is restored, previous waterflood attempts have failed, and disposal into this reservoir will not harm oil reserves but may even help recover additional oil. Prior to the production from gas higher in the reservoir, this reservoir may have had a combination of solution gas and pressure depletion from the gas cap. That may have yielded a higher oil recovery or a faster recovery of the same percent of original oil in place.

c. Oil reservoirs producing under a pure solution gas drive have a residual oil saturation that can be significant. OWL did talk about reservoir pressures and about permeability as measured on a core and inferred by the rate of disposal,

but did not specifically list other reservoir, rock, or fluid parameters that would support the conclusion about waterflooding.

d. It does ring true that the reservoir pressure must be restored, and the depleted gas cap would hamper recovery, but waterfloods are often started under depleted conditions where logical patterns of injection and production wells are used to re-pressure and direct the sweep direction.

e. This application is for commercial disposal into a depleted oil and gas reservoir and was not presented as an application for creation of a pressure maintenance project as is commonly done. The choice to qualify the well as disposal and not injection may be logical considering the large number of plugged wells and the small number of remaining production wells in this vicinity.

f. Except for the SLO, owners or operators of the minerals did not attend the hearing or otherwise indicate a concern as to waste of oil and gas. The SLO mentioned that waste of oil and gas could occur due to this proposed disposal well but acknowledged that oil companies have been reluctant to install an enhanced recovery project in this area.

g. The Division has selectively allowed disposal wells into oil productive reservoirs in the past to inexpensively test the waterflooding concept and observe the effect on offsetting production wells. This should not be done administratively, but only after identifying separately owned tracts surrounding the well and providing adequate notice to ALL mineral estate owners of those tracts, and only after convincing testimony from a petroleum engineer. OWL has identified tracts and provided disposal notice to tract owners and presented testimony from a petroleum engineer.

h. There was no waterflooding study or reservoir simulation and therefore, there is still a question as to the effect of commercial disposal, whether this reservoir has recoverable oil, or whether recoverable oil would be profitable.

(15) Influence of Disposal on the Reef

a. There was conflicting testimony as to the distance to the reef. It seems there is a lack of well data available to the witnesses as to exactly where the Reef rocks begin vertically underneath the Maralo Sholes B Well No. 2 and even a question as to exactly how far the reef is offsetting to the west.

b. The low reservoir pressure in the target Yates-Seven Rivers formations is evident by observing the extremely high rate of injection at low surface pressures into the Maralo Sholes B Well No. 2 and the need to use CO2 foam to clean out the fill from the Maralo Sholes B Well No. 2 prior to running the latest injection survey.

c. The current low reservoir pressure indicates that any strong hydrodynamic connection with the Capitan Reef Aquifer (or waters) does not exist. The area

has been essentially depleted since the 1950's, which was 50 to 60 years ago, and reservoir pressures are still extremely low and dramatically lower than the pressures in the Capitan Reef. If there were a strong connection from the reef, then it seems that pressures would have equalized or shown signs of equalizing.

d. It is likely that the planned large disposal volumes into this depleted reservoir will eventually fill up the reservoir. At the estimated disposal rate in the C-108 application of 30,000 barrels of water per day, the well will fill up the 90 million barrels of depleted pore space in this project area within less than nine years. These numbers can be considered as estimates, since OWL did not clearly define the project area or estimated area of invasion and as shown above, the vertical injection interval thickness is not precisely known.

e. As the local reservoir fills up and the pressures rise, injected waters that may be corrosive will migrate somewhere. OWL maintains the waters will migrate to the east where the major depletion has occurred. This is logical; however, there was a slight downward movement of water in the injection survey that was run at only one fifth of the rate that disposal is happening.

f. There is a lack of well data in this area on the lower Seven Rivers formation and the pore pressures existing vertically below the Proposed Well. Therefore, it is prudent to gather more data and until OWL can provide enough data to show the Division differently, it should consider that fluids may more downward and have an interaction with the Capitan Reef as this reservoir achieves fill up.

(16) The Presence of Water in the Target Interval

a. OWL's focus in its testimony was on the oil and gas reservoir and concluded that little water was present in this interval or available for use. A specific look at the well records indicates that the target disposal interval or interval slightly deeper in the Seven Rivers formation does have water present. From the SLO presentation, it could be concluded that the connection to the reef and the brackish near reef waters is not too much deeper than the target disposal interval.

b. The Maralo Sholes B Well No. 2 had produced oil and then reported to have "watered out" prior to recompletion in the gas interval. The well had also been deepened into the water leg of the reservoir [it is not clear as to how far it was deepened] and used as a water supply well for a waterflood.

c. The question remains as to whether a weak bottom water drive existed and what thickness of interval would be effective for disposal. The thickness, or net pay, of the formation taking water from disposal may not be accurately known and is a critical factor in estimating the invasion radius after many years of injection.

d. The recently run injection survey on the existing Maralo Sholes B Well No. 2 was run at 6500 barrels of water per day to obtain usable data from the tracer

survey. This survey did not show waters exiting the well and moving down out of the permitted open hole interval, but the survey was not run at the representative rate of 25,000 barrels of water per day, so that is still a possibility.

e. The conclusion that the sands in the Yates and upper Seven Rivers formations (as those formations are in this backreef lagoonal depositional environment) have dramatically more permeability than the dolomites (which may be filled with anhydrite) would likely still apply to rocks deeper in the water leg.

(17) Yates-Seven Rivers Waters for the City of Jal

a. The State Engineer did not enter an appearance or otherwise express any support or opposition to this application.

b. OWL presented testimony that the State Engineer defines the "Capitan Underground Water Basin" for purposes of administering water rights within a defined extent and this basin includes water sources above the Capitan Reef Aquifer so is not laterally limited to the Capitan Reef Aquifer.

c. OWL opined that the City of Jal would seek waters from many other sources before it would drill wells and produce water from the Capitan Reef Aquifer.

(18) In-Situ Water Quality

a. This is a reservoir with insitu water salinity considerably lower than the salinity of the proposed disposal waters and therefore has been a consideration for use by business and local municipalities.

b. As stated by the City of Jal, it is interested in procuring additional water supplies and interested in protecting waters that may someday be of interest. The City of Jal has applied for water rights in this Section 25 and is concerned about the proposed commercial disposal in this area and what effect it would have on fresh waters.

c. The State Land Office is concerned about waste of oil and gas but also about dilution of potentially valuable waters in the Capitan Reef Aquifer. The State Land Office seems to be taking the position that waters in and around the Capitan Reef even if higher than the protectable limit should be protected from further dilution of waters under State Trust lands by oil field water disposal wells.

(19) Underground Injection Control Program

a. The State of New Mexico was granted primacy on March 7, 1982 by the US Environmental Protection Agency ("EPA") for administering the federal Underground Injection Control ("UIC") Class II well program within most of the lands in New Mexico. The Oil Conservation Division is the lead agency for administering the program.

b. The Division is responsible for permitting, inspecting, and monitoring oil field related disposal wells such as the Proposed Well and for reporting such activity quarterly and annually to the EPA.

c. The following federal definitions are integral with the UIC program:

40 CFR 144.3 - Definitions.

- Aquifer means a geological "formation," group of formations, or part of a formation that is capable of yielding a significant amount of water to a well or spring.

- Total dissolved solids means the total dissolved (filterable) solids as determined by use of the method specified in 40 CFR part 136.

- Underground source of drinking water (USDW) means an aquifer or its portion:

  (a) Which supplies any public water system; or
  Which contains a sufficient quantity of ground water to supply a public water system; and
  (i) Currently supplies drinking water for human consumption; or
  (ii) Contains fewer than 10,000 mg/l total dissolved solids; and

  (b) Which is not an exempted aquifer.

- Even if an aquifer has not been specifically identified by the Director, it is an underground source of drinking water if it meets the definition in § 144.3.

(20) Protectable Waters

a. The proposal for injection is into a specific well at a specific location and depth, but the presented facts were of a statistical nature over this generally large area. It is evident that the formations, waters, phases of production, and well data change rapidly in an East to West direction and less rapidly from North to South. The available data gets sparse only a short distance to the West because there were less wells drilled for oil and gas. Both sides presented statistics of water salinity showing much variation.

b. OWL has done a statistical analysis over a nine-township area surrounding this well showing that the median and average water salinities as reported in the 1975 paper by Hiss are both above the protectable level.

c. The OCD and the SLO cited many examples of water samples showing low, sometimes protectable salinities in Yates, Seven Rivers, and Queen formation wells in this north to south trending reservoir. The SLO showed how salinities have trended over time in selected wells, with many water samples beginning at protectable levels of salinity and some contamination occurring from vertically mixing reservoirs [drilling] or from outside disposal of waters [salt water disposal].

d. The specific, local water analysis already present in the Division files for previously issued disposal permits in Section 25 [*see* Brown Well No. 5, API No. 30-025-09807] indicates that the native waters in the Yates, Seven Rivers, and Queen formations are in fact protectable. The Queen formation being equivalent in age to the Capitan Reef, did show lower salinity than the Yates and Seven Rivers formations.

e. Disposal permits in this area have previously been approved for re-injection of local waters from the same formations. This is allowed under the provisions of Division Rule 19.15.26.8 E(3) NMAC which says, *"...the director may authorize disposal into such zones administratively if the waters to be disposed of are of higher quality than the native water in the disposal zone".*

f. However, the Division must consider the disposal of outside waters of higher salinity as is being proposed in this case under a higher standard of consideration under Division Rule 19.15.26.8E(2) NMAC which states that *"The division shall not permit disposal into zones containing waters having total dissolved solids concentrations of 10,000 mg/l or less except after public notice and hearing, provided that the division may, by order issued after public notice and hearing, establish exempted aquifers for such zones where the division may administratively approve the injection".*

Summary of Findings

(27) This application for permit to inject should be denied without prejudice to further proceedings. The following facts, conclusions, and remaining questions support this conclusion:

a. The in-situ waters in this proposed disposal interval of the Yates and Seven Rivers formations within and around Section 25 are protectable and a defined area around the Proposed Well has not yet been declared as an "exempted aquifer" by the Oil Conservation Division and by the US EPA.

b. The Proposed Well may cause waste of oil or gas. The reservoir is largely depleted, yet there remain active producing wells in the target formation in this immediate area. A rigorous analysis or reservoir simulation or waterflood study has not yet been done to determine the additional recovery capability of this reservoir.

c. If additional recovery capability exists, then the applicant must further justify the waste of oil with the overreaching need to use this reservoir for commercial disposal. This would involve both facts and legal arguments.

d. There is a lack of critical data necessary to understand the characteristics of the Yates, Seven Rivers, Capitan Reef, and Queen formations. This data can only come from the drilling, logging, and testing of a nearby well designed to penetrate at least the top of the Capitan Reef. The test well and the location of the test well should be proposed by geologists and engineers and permitted under guidance of the Division.

e. The Continental Oil Company, Sholes B 30 (API No. 30-025-11839) located in Unit M of Section 30, Township 25 South, Range 37 East, NMPM, Lea County, New Mexico, was reported by the OCD as having no well records, no logs, and no plugging records. Records on offsetting wells indicate wells were plugged with small amounts of cement, but placed at adequate locations. The plugging program used on this well may or may not be similar. Most importantly, because there is likely an open hole through the Salado formation, any attempt to re-enter this well would likely fail and during the work over, would expose shallow fresh water intervals to invasion by salts. Despite these assumptions, OWL should attempt to locate records for this well and supply those records to the Division for further review and guidance.

f. The extended pressure radius of influence must be determined and presented to the Division. The well construction of all wells within this agreed upon extended radius must then be examined and presented to the Division with a plan for repair of any cementing or casing concerns.

g. A plan for the periodic monitoring of static reservoir pressures [not just well head injection pressures] near any proposed commercial disposal well must be presented and approved by the Division. Reservoir pressures should rise predictably as disposed water volume increases and the static reservoir pressure should be limited to a pressure that would not cause preferential flow towards the Capitan Reef. And if pressures do NOT rise predictably as water volumes increase, then the confining reservoir and rock assumptions are incorrect, and waste water may be migrating downward and into the Capitan Reef.

IT IS THEREFORE ORDERED THAT

(1) The application of OWL SWD Operating, LLC for permit to inject into the proposed Bobcat SWD Well No. 1 to be located 740 feet from the South line and 705 feet from the East line, Unit P of Section 25, Township 25 South, Range 36 East, NMPM, Lea County, New Mexico, is denied without prejudice.

(2) Jurisdiction is hereby retained for the entry of such further orders as the Division may deem necessary.

DONE at Santa Fe, New Mexico, on the day and year hereinabove designated.

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

Heather Riley

HEATHER RILEY
Director

SEAL

State of New Mexico
Energy, Minerals and Natural Resources Department
Oil Conservation Division

Update of Underground Injection Control Class II Activities Within the State of New Mexico for Possible Injection into Underground Sources of Drinking Water: the Capitan Reef Aquifer System

ATTACHMENT 3

Source: OCD Case No. 20474; Division Exhibits

Division Exhibit No. 1: Figure 1: Map Showing Locations for the Proposed Texas Ranger SWD No. 1 and Existing Disposal Wells in Area

Division Exhibit No. 2: Figure 2: Map Showing Adjacent Production Wells with Sundry Cement Histories for Surface Casing

Division Exhibit No. 3: Figure 3: Map Showing Shallow Drinking Water Sources in Proximity of the Proposed Texas Ranger SWD No. 1

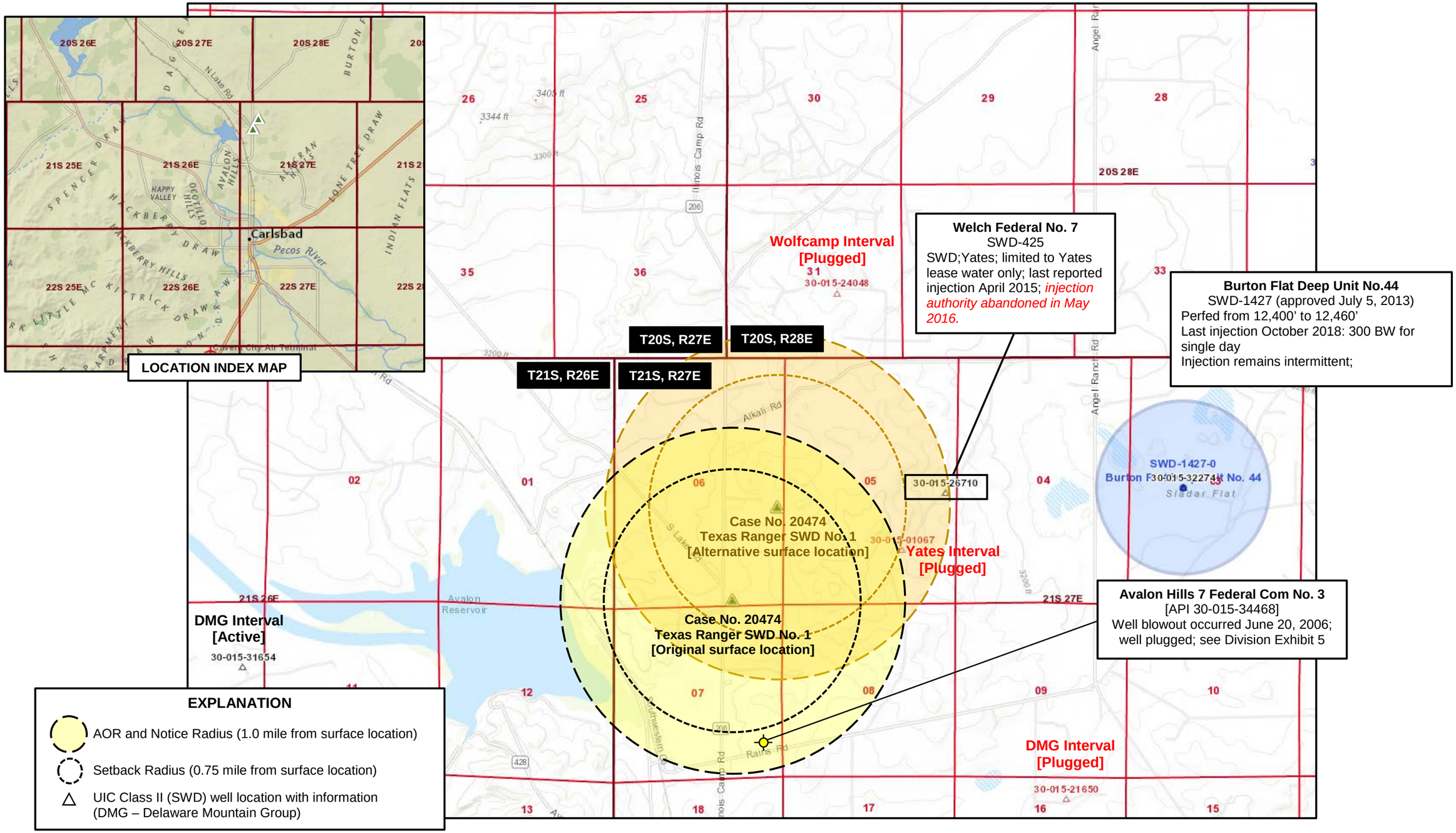
Division Exhibit No. 4: Figure 4: Excerpt from NMBGMR Resource Map No. 5 and Resource Map No. 6

Division Exhibit No. 5

Oil Conservation Division
Energy, Minerals and Natural Resources Department
State of New Mexico

CASE NO. 20474 DIVISION EXHIBIT NO. 1

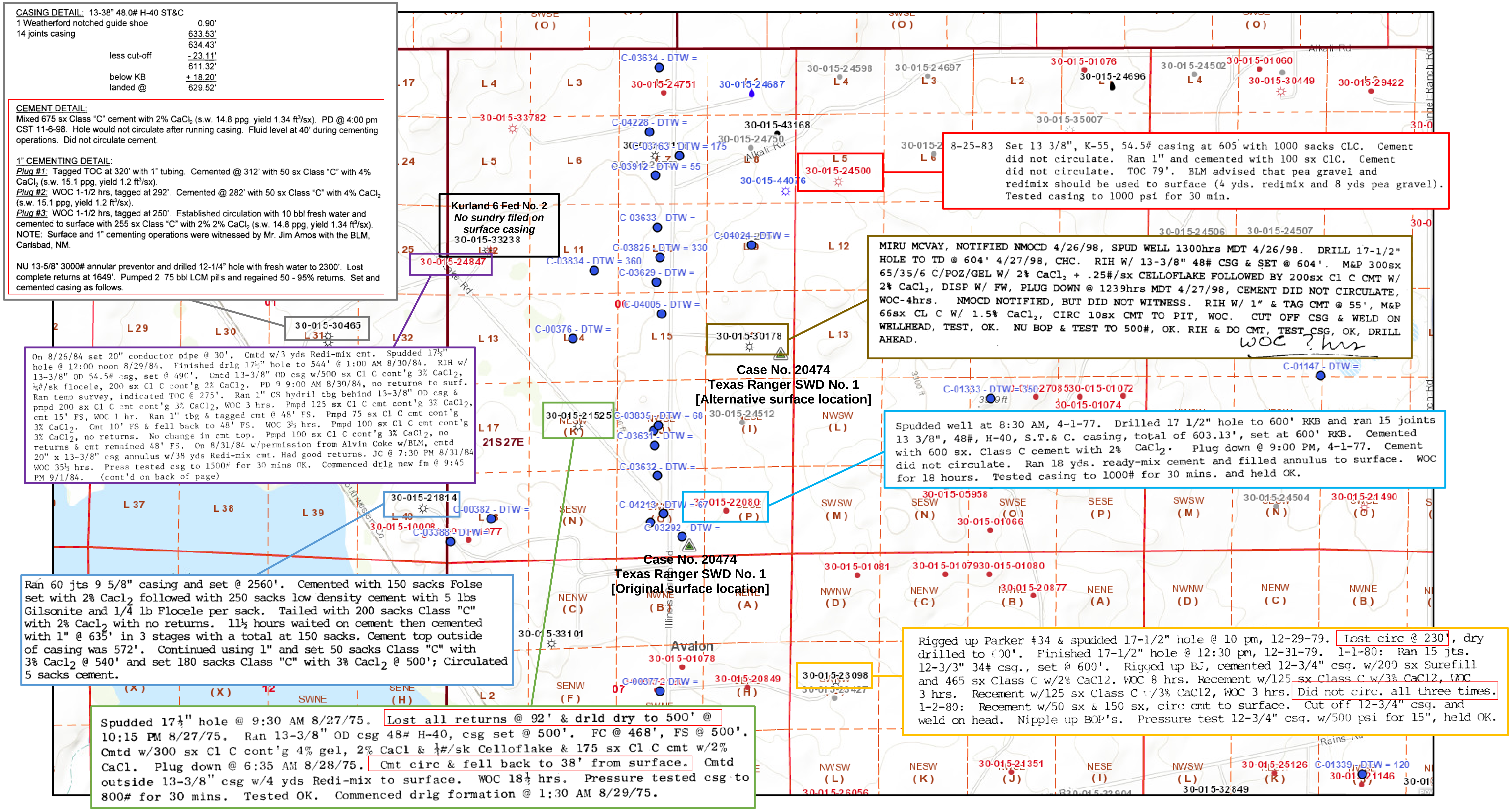
Figure 1: Map Showing Locations for the Proposed Texas Ranger SWD No. 1 and Existing Disposal Wells in Area



Oil Conservation Division
Energy, Minerals and Natural Resources Department
State of New Mexico

CASE NO. 20474 DIVISION EXHIBIT NO. 2

Figure 2: Map Showing Adjacent Production Wells with Sundry Cement Histories for Surface Casing



30-015-30465

CASING DETAIL: 13-38" 48.0# H-40 ST&C

1 Weatherford notched guide shoe		0.90'
14 joints casing		633.53'
		634.43'
	less cut-off	- 23.11'
		611.32'
	below KB	+ 18.20'
	landed @	629.52'

CEMENT DETAIL:
Mixed 675 sx Class "C" cement with 2% $CaCl_2$ (s.w. 14.8 ppg, yield 1.34 ft^3/sx). PD @ 4:00 pm CST 11-6-98. Hole would not circulate after running casing. Fluid level at 40' during cementing operations. Did not circulate cement.

1" CEMENTING DETAIL:
Plug #1: Tagged TOC at 320' with 1" tubing. Cemented @ 312' with 50 sx Class "C" with 4% $CaCl_2$ (s.w. 15.1 ppg, yield 1.2 ft^3/sx).
Plug #2: WOC 1-1/2 hrs, tagged at 292'. Cemented @ 282' with 50 sx Class "C" with 4% $CaCl_2$ (s.w. 15.1 ppg, yield 1.2 ft^3/sx).
Plug #3: WOC 1-1/2 hrs, tagged at 250'. Established circulation with 10 bbl fresh water and cemented to surface with 255 sx Class "C" with 2% 2% $CaCl_2$ (s.w. 14.8 ppg, yield 1.34 ft^3/sx).
NOTE: Surface and 1" cementing operations were witnessed by Mr. Jim Amos with the BLM, Carlsbad, NM.

NU 13-5/8" 3000# annular preventor and drilled 12-1/4" hole with fresh water to 2300'. Lost complete returns at 1649'. Pumped 2 75 bbl LCM pills and regained 50 - 95% returns. Set and cemented casing as follows.

30-015-24847

On 8/26/84 set 20" conductor pipe @ 30'. Cmtd w/3 yds Redi-mix cmt. Spudded 17½" hole @ 12:00 noon 8/29/84. Finished drlg 17½" hole to 544' @ 1:00 AM 8/30/84. RIH w/ 13-3/8" OD 54.5# csg, set @ 490'. Cmtd 13-3/8" OD csg w/500 sx Cl C cont'g 3% $CaCl_2$, ¼#/sk flocele, 200 sx Cl C cont'g 2% $CaCl_2$. PD @ 9:00 AM 8/30/84, no returns to surf. Ran temp survey, indicated TOC @ 275'. Ran 1" CS hydril tbg behind 13-3/8" OD csg & pmpd 200 sx Cl C cmt cont'g 3% $CaCl_2$, WOC 3 hrs. Pmpd 125 sx Cl C cmt cont'g 3% $CaCl_2$, cmt 15' FS, WOC 1 hr. Ran 1" tbg & tagged cmt @ 48' FS. Pmpd 75 sx Cl C cmt cont'g 3% $CaCl_2$. Cmt 10' FS & fell back to 48' FS. WOC 3½ hrs. Pmpd 100 sx Cl C cmt cont'g 3% $CaCl_2$, no returns. No change in cmt top. Pmpd 100 sx Cl C cont'g 3% $CaCl_2$, no returns & cmt remained 48' FS. On 8/31/84 w/permission from Alvin Coke w/BLM, cmtd 20" x 13-3/8" csg annulus w/38 yds Redi-mix cmt. Had good returns. JC @ 7:30 PM 8/31/84 WOC 35½ hrs. Press tested csg to 1500# for 30 mins OK. Commenced drlg new fm @ 9:45 PM 9/1/84. (cont'd on back of page)

30-015-21814

Ran 60 jts 9 5/8" casing and set @ 2560'. Cemented with 150 sacks Folse set with 2% $Cacl_2$ followed with 250 sacks low density cement with 5 lbs Gilsonite and 1/4 lb Flocele per sack. Tailed with 200 sacks Class "C" with 2% $Cacl_2$ with no returns. 11½ hours waited on cement then cemented with 1" @ 635' in 3 stages with a total at 150 sacks. Cement top outside of casing was 572'. Continued using 1" and set 50 sacks Class "C" with 3% $Cacl_2$ @ 540' and set 180 sacks Class "C" with 3% $Cacl_2$ @ 500'; Circulated 5 sacks cement.

30-015-21525

Spudded 17½" hole @ 9:30 AM 8/27/75. Lost all returns @ 92' & drld dry to 500' @ 10:15 PM 8/27/75. Ran 13-3/8" OD csg 48# H-40, csg set @ 500'. FC @ 468', FS @ 500'. Cmtd w/300 sx Cl C cont'g 4% gel, 2% CaCl & ¼#/sk Celloflake & 175 sx Cl C cmt w/2% CaCl. Plug down @ 6:35 AM 8/28/75. Cmt circ & fell back to 38' from surface. Cmtd outside 13-3/8" csg w/4 yds Redi-mix to surface. WOC 18¼ hrs. Pressure tested csg to 800# for 30 mins. Tested OK. Commenced drlg formation @ 1:30 AM 8/29/75.

30-015-24500

8-25-83 Set 13 3/8", K-55, 54.5# casing at 605 with 1000 sacks CLC. Cement did not circulate. Ran 1" and cemented with 100 sx ClC. Cement did not circulate. TOC 79'. BLM advised that pea gravel and redimix should be used to surface (4 yds. redimix and 8 yds pea gravel). Tested casing to 1000 psi for 30 min.

30-015-30178

MIRU MCVAY, NOTIFIED NMOCD 4/26/98, SPUD WELL 1300hrs MDT 4/26/98. DRILL 17-1/2" HOLE TO TD @ 604' 4/27/98, CHC. RIH W/ 13-3/8" 48# CSG & SET @ 604'. M&P 300sx 65/35/6 C/POZ/GEL W/ 2% $CaCl_2$ + .25#/sx CELLOFLAKE FOLLOWED BY 200sx Cl C CMT W/ 2% $CaCl_2$, DISP W/ FW, PLUG DOWN @ 1239hrs MDT 4/27/98, CEMENT DID NOT CIRCULATE, WOC-4hrs. NMOCD NOTIFIED, BUT DID NOT WITNESS. RIH W/ 1" & TAG CMT @ 55', M&P 66sx CL C W/ 1.5% $CaCl_2$, CIRC 10sx CMT TO PIT, WOC. CUT OFF CSG & WELD ON WELLHEAD, TEST, OK. NU BOP & TEST TO 500#, OK. RIH & DO CMT, TEST CSG, OK, DRILL AHEAD.

WOC ? hrs

30-015-22080

Spudded well at 8:30 AM, 4-1-77. Drilled 17 1/2" hole to 600' and ran 15 joints 13 3/8", 48#, H-40, S.T.& C. casing, total of 603.13', set at 600' RKB. Cemented with 600 sx. Class C cement with 2% $CaCl_2$. Plug down @ 9:00 PM, 4-1-77. Cement did not circulate. Ran 18 yds. ready-mix cement and filled annulus to surface. WOC for 18 hours. Tested casing to 1000# for 30 mins. and held OK.

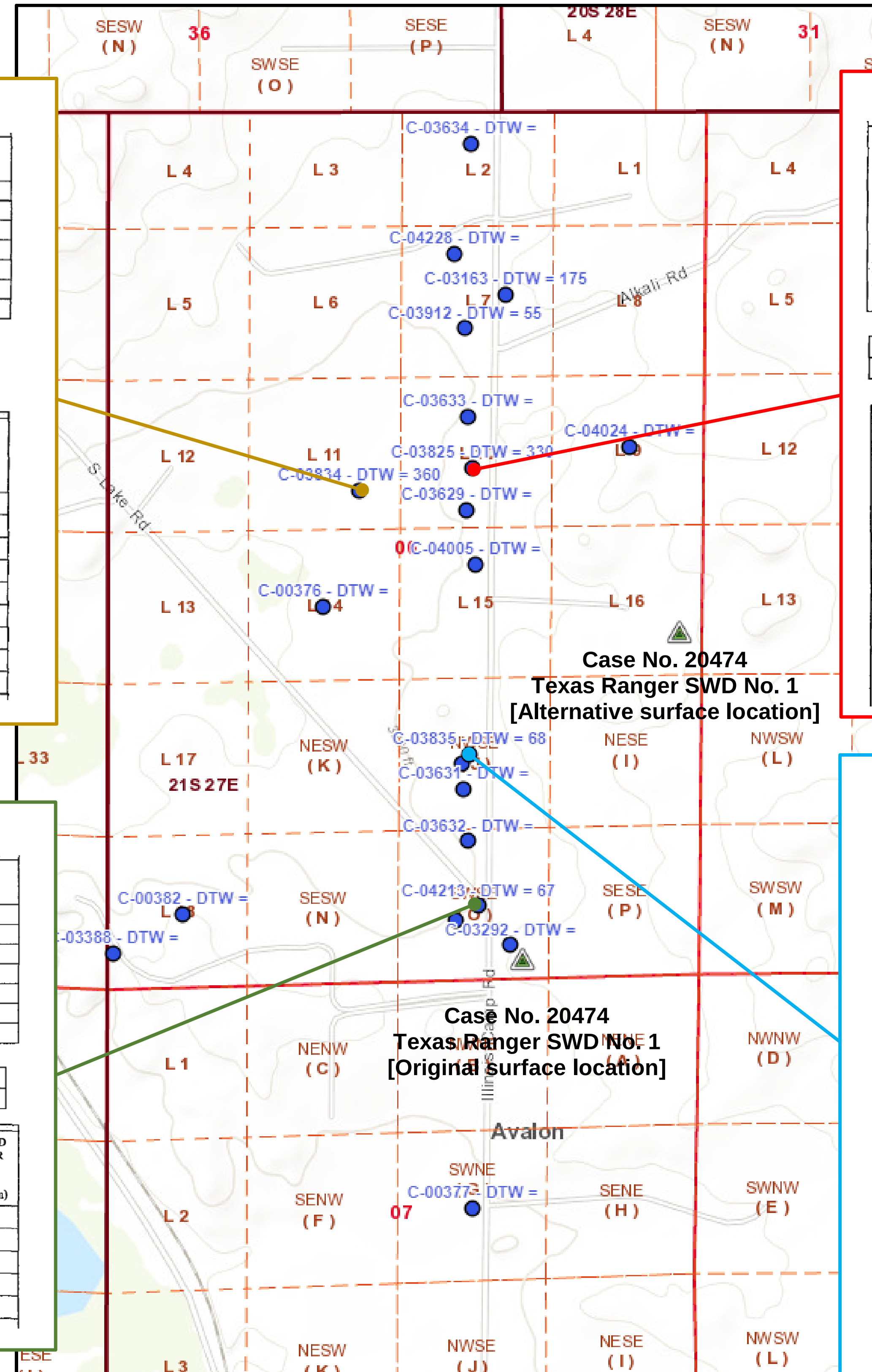
30-015-23098

Rigged up Parker #34 & spudded 17-1/2" hole @ 10 pm, 12-29-79. Lost circ @ 230', dry drilled to 600'. Finished 17-1/2" hole @ 12:30 pm, 12-31-79. 1-1-80: Ran 15 jts. 12-3/3" 34# csg., set @ 600'. Rigged up BJ, cemented 12-3/4" csg. w/200 sx Surefill and 465 sx Class C w/2% CaCl2. WOC 8 hrs. Recement w/125 sx Class C w/3% CaCl2, WOC 3 hrs. Recement w/125 sx Class C w/3% CaCl2, WOC 3 hrs. Did not circ. all three times. 1-2-80: Recement w/50 sx & 150 sx, circ cmt to surface. Cut off 12-3/4" csg. and weld on head. Nipple up BOP's. Pressure test 12-3/4" csg. w/500 psi for 15", held OK.

Oil Conservation Division
Energy, Minerals and Natural Resources Department
State of New Mexico

CASE NO. 20474 DIVISION EXHIBIT NO. 3

Figure 3: Map Showing Shallow Drinking Water Sources in Proximity of the Proposed Texas Ranger SWD No. 1



Point of Diversion C-3834 – Well Record & Log

3. ANNULAR MATERIAL

DEPTH (feet bgl) FROM	TO	BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT
0	20	9	Concrete	18	Down Hole
20	370	9	1/4 Pea Gravel	90	Down Hole

FOR OSE INTERNAL USE — WR-20 WELL RECORD & LOG (Version 06/08/2012)
FILE NUMBER C-3834 POD NUMBER 1 TRN NUMBER 561016
LOCATION 1-2-4 21S,27E,06 PAGE 1 OF 2

LOG OF WELL

DEPTH (feet bgl) FROM	TO	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER-BEARING ZONES (gpm)
0	4	4	Topsoil	N	
4	50	46	Limestone	N	
50	125	75	Brownish Clay & Sandstone	N	
125	200	75	Yellowish Sandstone	N	
200	290	90	Redish/Brown Clay	N	
290	325	35	Brown Sandstone	N	
325	355	30	Red Clay	N	
355	370	15	Fractured Limestone	Y	20+

Point of Diversion C-3825 – Well Record & Log

3. ANNULAR MATERIAL

DEPTH (feet bgl) FROM	TO	BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT
0	20	9	Concrete	18	Down Hole
20	390	9	1/4" Pea Gravel	108	Down Hole

FOR OSE INTERNAL USE — WR-20 WELL RECORD & LOG (Version 06/08/2012)
FILE NUMBER C-3825 POD NUMBER 1 TRN NUMBER 559270
LOCATION 2,1,3 21S,27E,03 PAGE 1 OF 2

LOG OF WELL

DEPTH (feet bgl) FROM	TO	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER-BEARING ZONES (gpm)
0	3	3	Topsoil	N	
3	50	47	Limestone	N	
50	100	50	Brownish Clay	N	
100	135	35	Brown Sandstone	N	
135	175	40	Redish Clay	N	
175	275	100	Yellow and Brown Sandstone	N	
275	315	40	Redish Clay	N	
315	390	75	Fractured Limestone	Y	20+

Point of Diversion C-4213 – Well Record & Log

3. ANNULAR MATERIAL

DEPTH (feet bgl) FROM	TO	BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT
0	20	9.875	Cement	7.619	Poured
20	105	9.875	3/8 Pea Gravel	30.47	Poured

FOR OSE INTERNAL USE — WR-20 WELL RECORD & LOG (Version 06/30/17)
FILE NO. C-4213 POD NO. 1 TRN NO. 621884
LOCATION 21S-27E-06 4-3-4 WELL TAG ID NO. 2CCC4 PAGE 1 OF 2

DEPTH (feet bgl) FROM	TO	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER-BEARING ZONES (gpm)
0	5		Top soil		
5	60	55	Sand		
60	70		Sand Gravel	Y	15
70	105		Sand		

Point of Diversion C-3825 – Well Record & Log

3. ANNULAR MATERIAL

DEPTH (feet bgl) FROM	TO	BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT
0	20	10	Cement	20	Hand
20	120	10	Pea Gravel	100	Hand

FOR OSE INTERNAL USE — WR-20 WELL RECORD & LOG (Version 06/08/2012)
FILE NUMBER C-3835 POD NUMBER 1 TRN NUMBER 561180
LOCATION 21S.27E.6 314 PAGE 1 OF 2

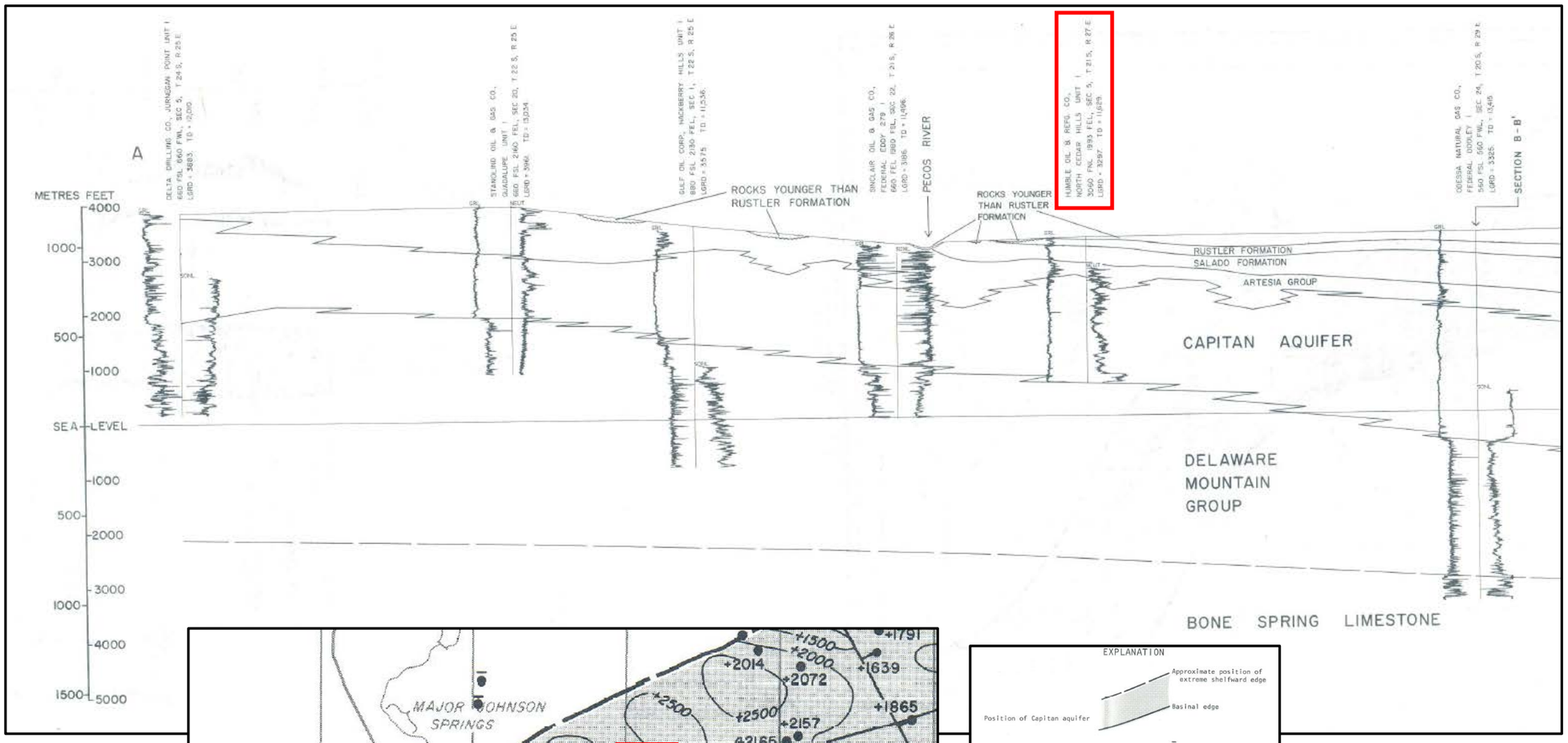
LOG OF WELL

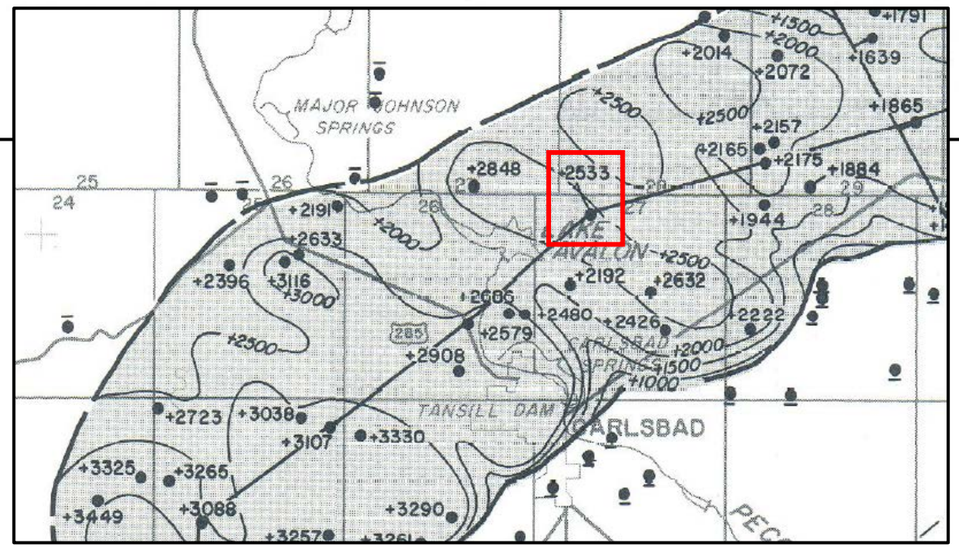
DEPTH (feet bgl) FROM	TO	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER-BEARING ZONES (gpm)
0	2	2	Topsoil	N	
2	10	8	Caliche and Rock	N	
10	23	13	Limestone	N	
23	55	32	Sand & Clay Mix	N	
55	110	87	Brown Sand	Y	20+
110	120	10	Red Clay	N	

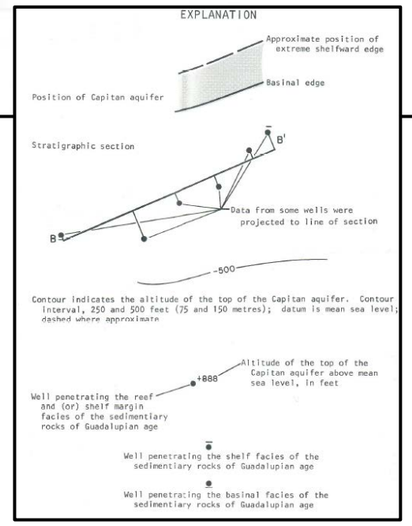
Oil Conservation Division
Energy, Minerals and Natural Resources Department
State of New Mexico

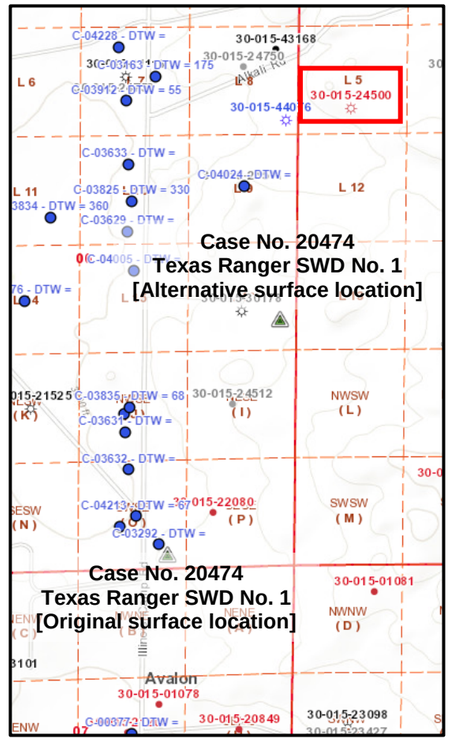
CASE NO. 20474 DIVISION EXHIBIT NO. 4

Figure 4: Excerpt from NMBGMR Resource Map No. 5 and Resource Map No. 6









CASE NO. 20474 DIVISION EXHIBIT NO. 5

Form 3160-5
(August 1999)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
SUNDRY NOTICES AND REPORTS ON WELLS

NMOCD

FORM APROVED
OMB NO. 1004-0135
EXPIRES: NOVEMBER 30, 2000

Do not use this form for proposals to drill or to re-enter an abandoned well. Use Form 3160-3 (APD) for such proposals

SUBMIT IN TRIPLICATE

1a. Type of Well ☐ Oil Well ☑ Gas Well ☐ Other	5. Lease Serial No. NM-0375257-A
	6. If Indian, Allottee or Tribe Name
	7. Unit or CA Agreement Name and No.
2. Name of Operator Devon Energy Production Company, LP	8. Well Name and No. Avalon Hills 7 Fed Com 3
3. Address and Telephone No. 20 North Broadway, Ste 1500, Oklahoma City, OK 73102 405-552-7802	9. API Well No. 30-015-34468
4. Location of Well (Report location clearly and in accordance with Federal requirements)* SESE Lot P 1010' FSL & 660' FEL Sec 7 T21S, R27E	10. Field and Pool, or Exploratory Burton Flat; Morrow
RECEIVED JUL 14 2006 OCD-ARTESIA	12. County or Parish Eddy 13. State NM

CHECK APPROPRIATE BOX(s) TO INDICATE NATURE OF NOTICE, REPORT, OR OTHER DATA

TYPE OS SUBMISSION	TYPE OF ACTION			
☑ Notice of Intent	☐ Acidize	☐ Deepen	☐ Production (Start/Resume)	☐ Water Shut-Off
☐ Subsequent Report	☐ Alter Casing	☐ Fracture Treat	☐ Reclamation	☐ Well Integrity
☐ Final Abandonment Notice	☐ Casing Repair	☐ New Construction	☐ Recomplete	☐ Other
	☑ Change Plans	☐ Plug and Abandon	☐ Temporarily Abandon	
	☐ Convert to Injection	☐ Plug Back	☐ Water Disposal	

13. . Describe Proposed or Completed Operations (Clearly state all pertinent details, and give pertinent dates, including estimated date of starting any proposed work and approximate duration thereof. If the proposal deepen directionally or recomplete horizontally, give subsurface location and measured and true vertical depths of all pertinent markers and zones. Attach the Bond under which the work will be performed or provide the Bond No. on file with BLM/BIA. Required subsequent reports shall be filed within 30 days following completion of the involved operations. If the operation results in a multiple completion or recompletion in a new interval, a Form 3160-4 shall be filed once testing has been completed. Final Abandonment Notices shall be filed only after all requirement, including reclamation, have been completed, and the operator has determined that the site is ready for final inspection)

Devon Energy Production Company, L.P. respectfully requests approval to change plans from initial APD:

Alexis, as a follow-up to telephone conversation on Thursday, June 22nd with Gerald Brockman, Drilling Engineer; the following are the events that have occurred on this well and what we are proposing to do:

While drilling the 8 3/4" hole at 10,427' the well had an influx of gas. The well was shut-in and the gas was being circulated out of the well when gas and water began blowing out of the ground around the rig. The rig was shut down and the well shut in. All personnel were evacuated from the well site with no injuries. The well was subsequently killed with 11.2 ppg mud. It is not known at this time if the 9 5/8" casing failed or if the gas channeled around the 9 5/8" shoe. It is our plan to set a 200' cement plug from 9100' to 8900' that should isolate any gas shows that we had while drilling the well. We will then proceed with inspection of the 9 5/8" casing for a hole in the casing and if so repair the hole. We will then after drilling out the cement plug that was set, with YOUR APPROVAL, proceed to set a string of 7"26# HCP110 LTC casing at our present total depth of 10,427'. The 7" casing will be cemented in 3 stages cemented to the surface. We will then drill a 6 1/8" hole to the original intended TD and set a 4 1/2" 13.5# HCP110 Liner with 250' of overlap cemented to the top of the liner.

Verbal and written approval given June 22nd by Alexis Swaboda (see attached e-mail.) Sundry Notice filed as a follow-up to this.

14. I hereby certify that the foregoing is true and correct

Signed _____ Name Stephanie A. Ysasaga
Title Sr. Staff Engineering Technician Date 6/30/2006

(This space for Federal or State Office use)

Approved by (ORIG. SGD.) ALEXIS C. SWOBODA Title PETROLEUM ENGINEER Date JUL 11 2006
Conditions of approval, if any:

Title 18 U.S.C. Section 1001, makes it a crime for any person knowingly and willfully to make any department or agency of the United States any false, fictitious or fraudulent statements or representations to any matter within its jurisdiction.

*See Instruction on Reverse Side

NEW MEXICO ENERGY, MINERALS and
NATURAL RESOURCES DEPARTMENT

BILL RICHARDSON
Governor
Joanna Prukop
Cabinet Secretary

NEWS RELEASE

For release: June 20, 2006

Contact: Jodi McGinnis Porter, Public Information Officer, 505-476-3226
Mark Fesmire, Director, Oil Conservation Division, 505-476-3460

Oil Well Blowout Near Carlsbad's Avalon Lake

No One Injured and No Evacuations Necessary

SANTA FE, NM – The Oil Conservation Division (OCD) Artesia District Office of the New Mexico Energy, Minerals and Natural Resources Department is investigating a gas well blowout that occurred early this morning north of Carlsbad near Avalon Lake. Work crews were immediately evacuated and no one was injured in the incident. State officials and well control specialists from Wild Well Control, Inc. of Houston, TX. are on location for safety concerns and are working to control the blowout.

"State, local government and company officials are working to stop the flow of gas from this well and there does not appear to be any threat to local residents at this time," said Mark Fesmire, OCD Director. "Once this problem is fixed, we will launch a full investigation and take enforcement action as necessary to ensure that this does not happen again."

Devon Energy Production was drilling a gas well at the Avalon Hills 7 (Federal Com #30-15-34458, P-7-21S-27E) location when the blowout occurred. At approximately 1:30 a.m. Tuesday, June 20, the drilling rig crew was in the process of replacing the drill bit, when the crew noted a large mud flow from the formation. The crew noticed high pressure gas escaping from the ground surface strong enough to penetrate asphalt in the surrounding area

200 yards away. The rupture is believed to have occurred in the casing pipe at a very shallow depth.

The cause of the piping failure is unknown at this time. OCD will require an investigation to determine the cause of the incident and require the company to perform an investigation to determine if fresh water was impacted. The Devon Energy Production Company had reached an approximate depth of 10,427 ft.

# # #

The Energy, Minerals and Natural Resources Department provides resource protection and resource development services to the public and other state agencies.