

# Initial Application Part I

Received: 06/13/2019

*This application is placed in file for record. It MAY or MAY NOT have been reviewed to be determined Administratively Complete*

RECEIVED: 06/13/2019	REVIEWER: MAM	TYPE: SWD	APP NO: pMAM1916459562
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ABOVE THIS TABLE FOR OCD DIVISION USE ONLY

**NEW MEXICO OIL CONSERVATION DIVISION**  
 - Geological & Engineering Bureau -  
 1220 South St. Francis Drive, Santa Fe, NM 87505



### ADMINISTRATIVE APPLICATION CHECKLIST

THIS CHECKLIST IS MANDATORY FOR ALL ADMINISTRATIVE APPLICATIONS FOR EXCEPTIONS TO DIVISION RULES AND REGULATIONS WHICH REQUIRE PROCESSING AT THE DIVISION LEVEL IN SANTA FE

<b>Applicant:</b> <u>Trove Energy and Water, LLC</u>	<b>OGRID Number:</b> <u>372488</u>
<b>Well Name:</b> <u>SEC SE Federal SWD No.4</u>	<b>API:</b> <u>30-015-xxxxx</u>
<b>Pool:</b> <u>Proposed: SWD; Devonian-Silurian</u>	<b>Pool Code:</b> <u>97869</u>

### SUBMIT ACCURATE AND COMPLETE INFORMATION REQUIRED TO PROCESS THE TYPE OF APPLICATION INDICATED BELOW

1) **TYPE OF APPLICATION:** Check those which apply for [A]

A. Location – Spacing Unit – Simultaneous Dedication

☐ NSL      ☐ NSP (PROJECT AREA)      ☐ NSP (PRORATION UNIT)      ☐ SD

B. Check one only for [ I ] or [ II ]

[ I ] Commingling – Storage – Measurement

☐ DHC    ☐ CTB    ☐ PLC    ☐ PC    ☐ OLS    ☐ OLM

[ II ] Injection – Disposal – Pressure Increase – Enhanced Oil Recovery

☐ WFX    ☐ PMX    ☒ SWD    ☐ IPI    ☐ EOR    ☐ PPR

## SWD-2153

2) **NOTIFICATION REQUIRED TO:** Check those which apply.

- A. ☒ Offset operators or lease holders
- B. ☐ Royalty, overriding royalty owners, revenue owners
- C. ☒ Application requires published notice
- D. ☒ Notification and/or concurrent approval by SLO
- E. ☒ Notification and/or concurrent approval by BLM
- F. ☒ Surface owner
- G. ☒ For all of the above, proof of notification or publication is attached, and/or,
- H. ☐ No notice required

#### FOR OCD ONLY

- ☐ Notice Complete

☐ Application Content Complete

3) **CERTIFICATION:** I hereby certify that the information submitted with this application for administrative approval is **accurate** and **complete** to the best of my knowledge. I also understand that **no action** will be taken on this application until the required information and notifications are submitted to the Division.

**Note: Statement must be completed by an individual with managerial and/or supervisory capacity.**

Ben Stone

Print or Type Name

Signature

6/13/2019

Date

903-488-9850

Phone Number

ben@sosconsulting.us

e-mail Address

## McMillan, Michael, EMNRD

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**From:** ben@sosconsulting.us  
**Sent:** Thursday, June 13, 2019 2:24 PM  
**To:** Goetze, Phillip, EMNRD; McMillan, Michael, EMNRD; Jones, William V, EMNRD  
**Subject:** [EXT] Trove Energy and Water, LLC's C-108 for SWD in its SEC SE Federal SWD #4 prospect...  
**Attachments:** C-108\_Trove\_SEC-SEFed SWD#4\_AsSubmitted\_20190613.pdf

Gentlemen:

Please find the attached subject C-108. This location was vetted w/ EOG and spotted per their development plan criteria.

A link is also provided below.

Please let me know if additional info is needed.

Thanks,  
Ben

<https://sosconsulting.sharefile.com/d-sb347f9e21b640d18>



*Visit us on the web at [www.sosconsulting.us](http://www.sosconsulting.us)!*

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June 13, 2019

New Mexico Oil Conservation Division  
1220 South St. Francis Drive  
Santa Fe, New Mexico 87505

Attn: Ms. Adrienne Sandoval, Director

*Re: Application of Trove Energy and Water, LLC to permit for salt water disposal the proposed SEC SE Federal SWD No.4, located in Section 18, Township 26 South, Range 31 East, NMPM, Eddy County, New Mexico.*

Dear Ms. Sandoval,

Please find the enclosed form C-108 Application for Authority to Inject, supporting the above-referenced request for salt water disposal. The well will be operated as a commercial endeavor offering operators in the area additional options for produced water disposal.

Trove Energy and Water is a developing salt water disposal services to operators in southeast New Mexico and seeks to optimize efficiency, both economically and operationally, of all its operations. Approval of this application is consistent with that goal as well as the NMOCD's mission of preventing waste and protection of correlative rights.

This application for a proposed Devonian SWD interval includes the currently mandated increased One-Mile Area of Review including pertinent and available seismic information for the area and region. Published legal notice ran May 30, 2019 in the Artesia Daily Press and all offset operators and other affected parties have been notified individually. The legal notice affidavit is included with this application. The application also includes a wellbore schematic, area of review maps, affected party plat and other required information for a complete Form C-108. The well is located on federal surface and minerals and the Bureau of Land Management CFO and offset operators have been notified of this application.

I respectfully request that the approval of this salt water disposal well proceed swiftly and if you or your staff requires additional information or has any questions, please do not hesitate to call or email me.

Best regards,

A handwritten signature in blue ink, appearing to read "Ben Stone".


Ben Stone, Partner  
SOS Consulting, LLC  
Agent for Trove Energy and Water, LLC

Cc: Application attachment and file

**APPLICATION FOR AUTHORIZATION TO INJECT**

- I. PURPOSE: *Salt Water Disposal* and the application *QUALIFIES* for administrative approval.
- II. OPERATOR: *Trove Energy and Water, LLC*  
ADDRESS: *1919 North Turner, Hobbs, NM 88240*
- CONTACT PARTY: *Agent: SOS Consulting, LLC – Ben Stone (903) 488-9850*
- III. WELL DATA: *All well data and applicable wellbore diagrams are ATTACHED.*
- IV. *This is not an expansion of an existing project.*
- V. *A map is attached* that identifies all wells and leases within two miles of any proposed injection well with a *ONE-Mile* radius circle drawn around each proposed injection well. This circle identifies the well's area of review.
- \*VI. A tabulation is attached of data on all wells of public record within the area of review which penetrate the proposed injection zone. *There are NO (0) Wells in the subject AOR which Penetrate the proposed Devonian interval.* The data includes a description of each well's type, construction, date drilled, location, depth, and a schematic of any plugged well illustrating all plugging detail. *NO P&A Wells penetrate.*
- VII. *The following data is ATTACHED* on the proposed operation, including:
1. Proposed average and maximum daily rate and volume of fluids to be injected;
  2. Whether the system is open or closed;
  3. Proposed average and maximum injection pressure;
  4. Sources and an appropriate analysis of injection fluid and compatibility with the receiving formation if other than reinjected produced water; and,
  5. If injection is for disposal purposes into a zone not productive of oil or gas at or within one mile of the proposed well, attach a chemical analysis of the disposal zone formation water (may be measured or inferred from existing literature, studies, nearby wells, etc.).
- \*VIII. *Appropriate geologic data on the injection zone is ATTACHED* including appropriate lithologic detail, geologic name, thickness, and depth. Give the geologic name, and depth to bottom of all underground sources of drinking water (aquifers containing waters with total dissolved solids concentrations of 10,000 mg/l or less) overlying the proposed injection zone as well as any such sources known to be immediately underlying the injection interval.
- IX. *Stimulation program – a conventional acid job may be performed to clean and open the formation.*
- \*X. Attach appropriate logging and test data on the well. (If well logs have been filed with the Division, they need not be resubmitted). *Well Logs will be filed with OCD.*
- \*XI. *There are 2 water wells/ PODs within one mile of the proposed salt water disposal well. Representative analyses are included herein and one or both of the subject wells will be sampled and analyzed and submitted.*
- XII. *An affirmative statement is ATTACHED that available geologic and engineering data has been examined and no evidence was found* of open faults or any other hydrologic connection between the disposal zone and any underground sources of drinking water.
- XIII. *"Proof of Notice" section on the next page of this form has been completed and ATTACHED. There are 2 offset lessees and/or mineral owners within 1 mile, federal and state minerals - all have been noticed. Well location is Federal.*
- XIV. Certification: I hereby certify that the information submitted with this application is true and correct to the best of my knowledge and belief.

NAME: *Ben Stone* TITLE: *SOS Consulting, LLC agent for Trove Energy and Water, LLC*

SIGNATURE:  DATE: *6/13/2019*

E-MAIL ADDRESS: *ben@sosconsulting.us*

\* If the information required under Sections VI, VIII, X, and XI above has been previously submitted, it need not be resubmitted. Please show the date and circumstances of the earlier submittal:

**FORM C-108 – APPLICATION FOR AUTHORIZATION TO INJECT (cont.)**

III. WELL DATA – *The following information and data is included (See ATTACHED Wellbore Schematic):*

A. The following well data must be submitted for each injection well covered by this application. The data must be both in tabular and schematic form and shall include:

- (1) Lease name; Well No., Location by Section, Township and Range; and footage location within the section.
- (2) Each casing string used with its size, setting depth, sacks of cement used, hole size, top of cement, and how such top was determined.
- (3) A description of the tubing to be used including its size, lining material, and setting depth.
- (4) The name, model, and setting depth of the packer used or a description of any other seal system or assembly used.

Division District Offices have supplies of Well Data Sheets which may be used or which may be used as models for this purpose. Applicants for several identical wells may submit a "typical data sheet" rather than submitting the data for each well.

B. The following must be submitted for each injection well covered by this application. All items must be addressed for the initial well. Responses for additional wells need be shown only when different. Information shown on schematics need not be repeated.

- (1) The name of the injection formation and, if applicable, the field or pool name.
- (2) The injection interval and whether it is perforated or open-hole.
- (3) State if the well was drilled for injection or, if not, the original purpose of the well.
- (4) Give the depths of any other perforated intervals and detail on the sacks of cement or bridge plugs used to seal off such perforations.
- (5) Give the depth to and the name of the next higher and next lower oil or gas zone in the area of the well, if any.

XIV. PROOF OF NOTICE *pursuant to the following criteria is ATTACHED.*

All applicants must furnish proof that a copy of the application has been furnished, by certified or registered mail, to the owner of the surface of the land on which the well is to be located and to each leasehold operator within one-half mile of the well location.

Where an application is subject to administrative approval, a proof of publication must be submitted. Such proof shall consist of a copy of the legal advertisement which was published in the county in which the well is located. The contents of such advertisement must include:

- (1) The name, address, phone number, and contact party for the applicant;
- (2) The intended purpose of the injection well; with the exact location of single wells or the Section, Township, and Range location of multiple wells;
- (3) The formation name and depth with expected maximum injection rates and pressures; and,
- (4) A notation that interested parties must file objections or requests for hearing with the Oil Conservation Division, 1220 South St. Francis Dr., Santa Fe, New Mexico 87505, within 15 days.

NO ACTION WILL BE TAKEN ON THE APPLICATION UNTIL PROPER PROOF OF NOTICE HAS BEEN SUBMITTED.

## **C-108 - Items III, IV, V**

### **Item III - Subject Well Data**

Wellbore Diagram - PROPOSED

### **Item IV – Tabulation of AOR Wells**

NO wells penetrate the proposed injection interval.

### **Item V – Area of Review Maps**

1. Two Mile AOR Map with One-Mile Fresh Water Well Radius
2. One-Mile AOR Map

All Above Exhibits follow this page.



## WELL SCHEMATIC - PROPOSED SEC SE Federal SWD Well No.4

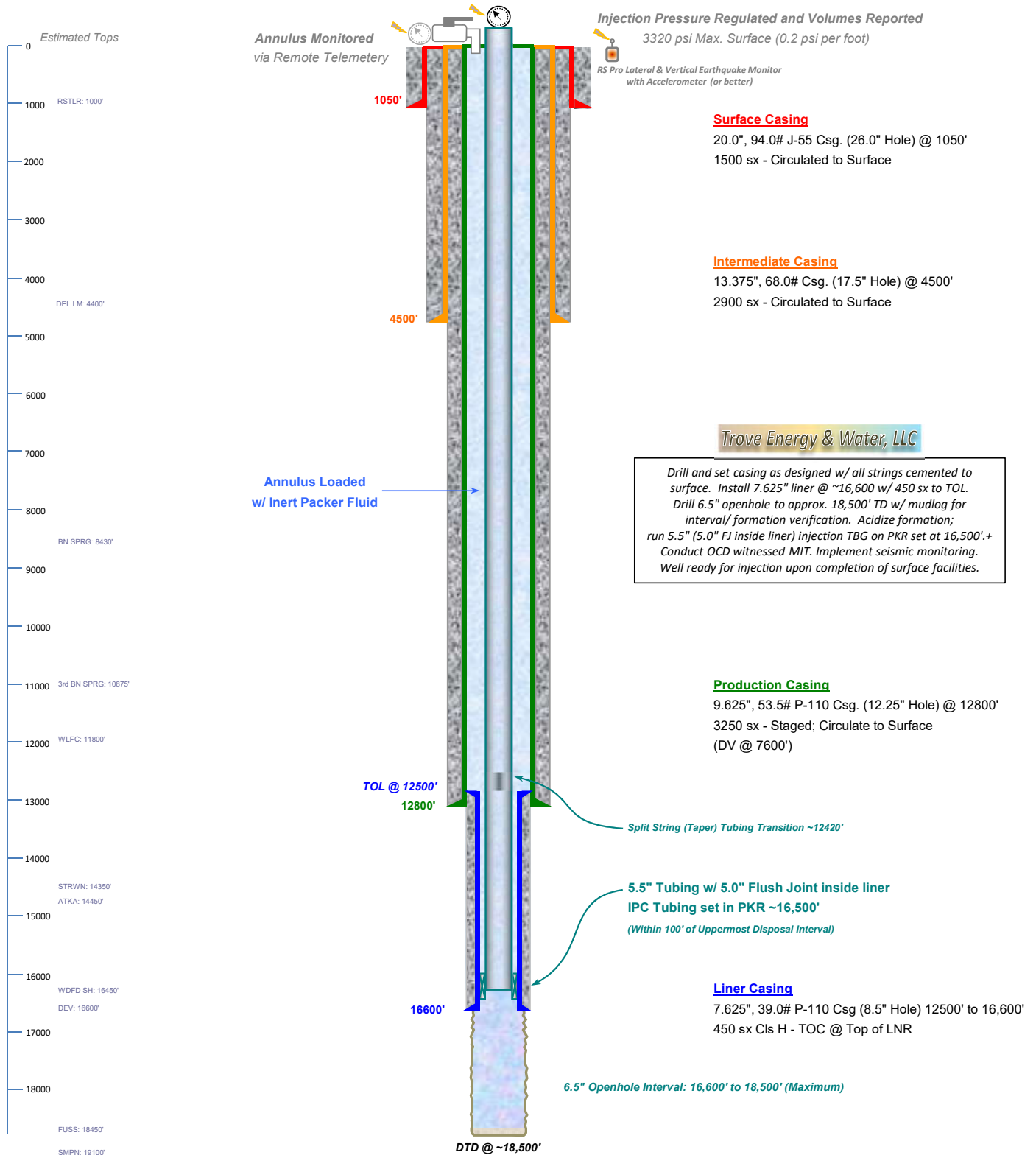
API 30-015-xxxxx

1000' FSL & 185' FWL, SEC. 18-T26S-R31E  
EDDY COUNTY, NEW MEXICO

SWD; Devonian-Silurian (97869)

Spud Date: 2/15/2020

SWD Config Dt: 4/01/2020



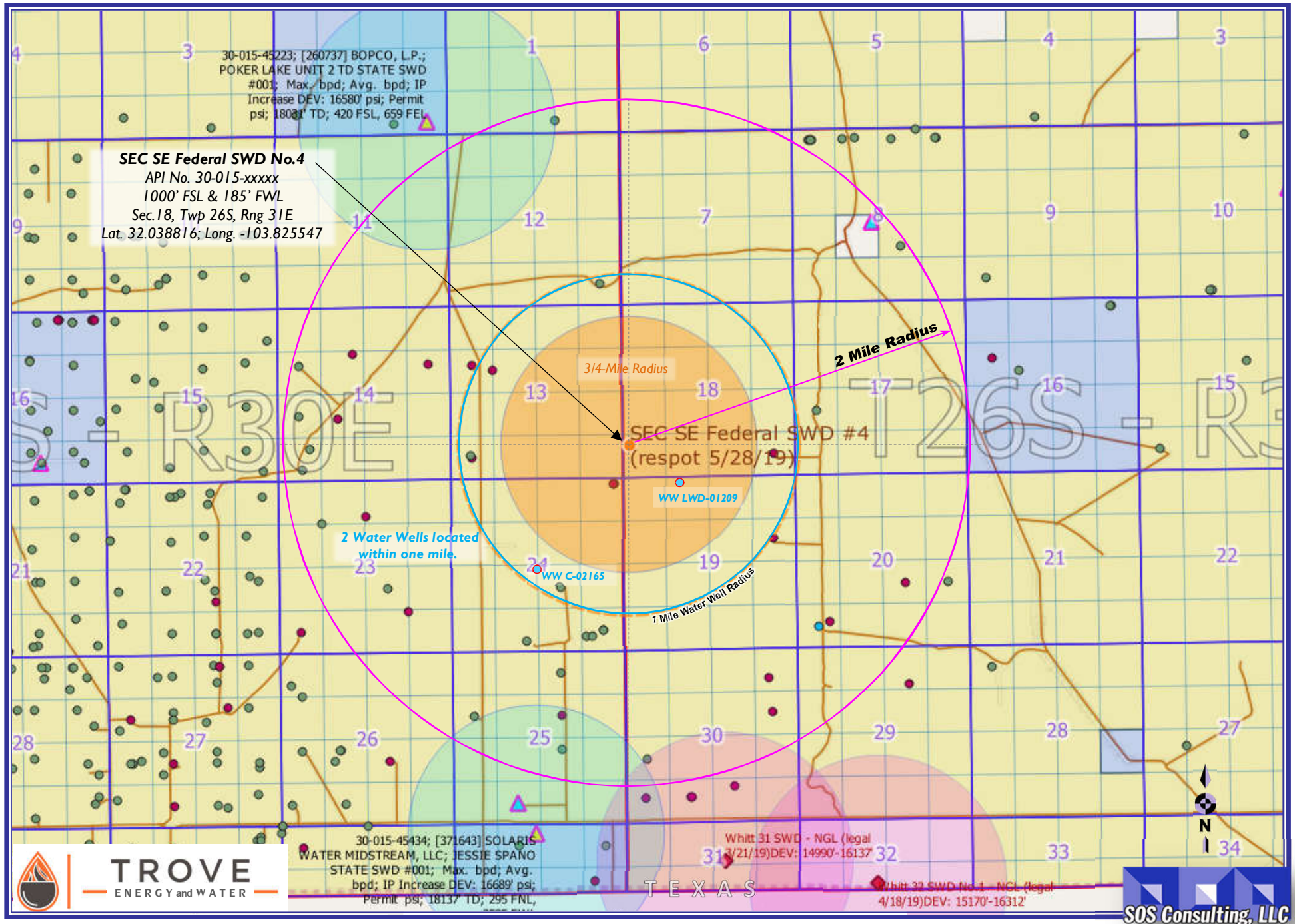
Drawn by: Ben Stone, 5/13/2019





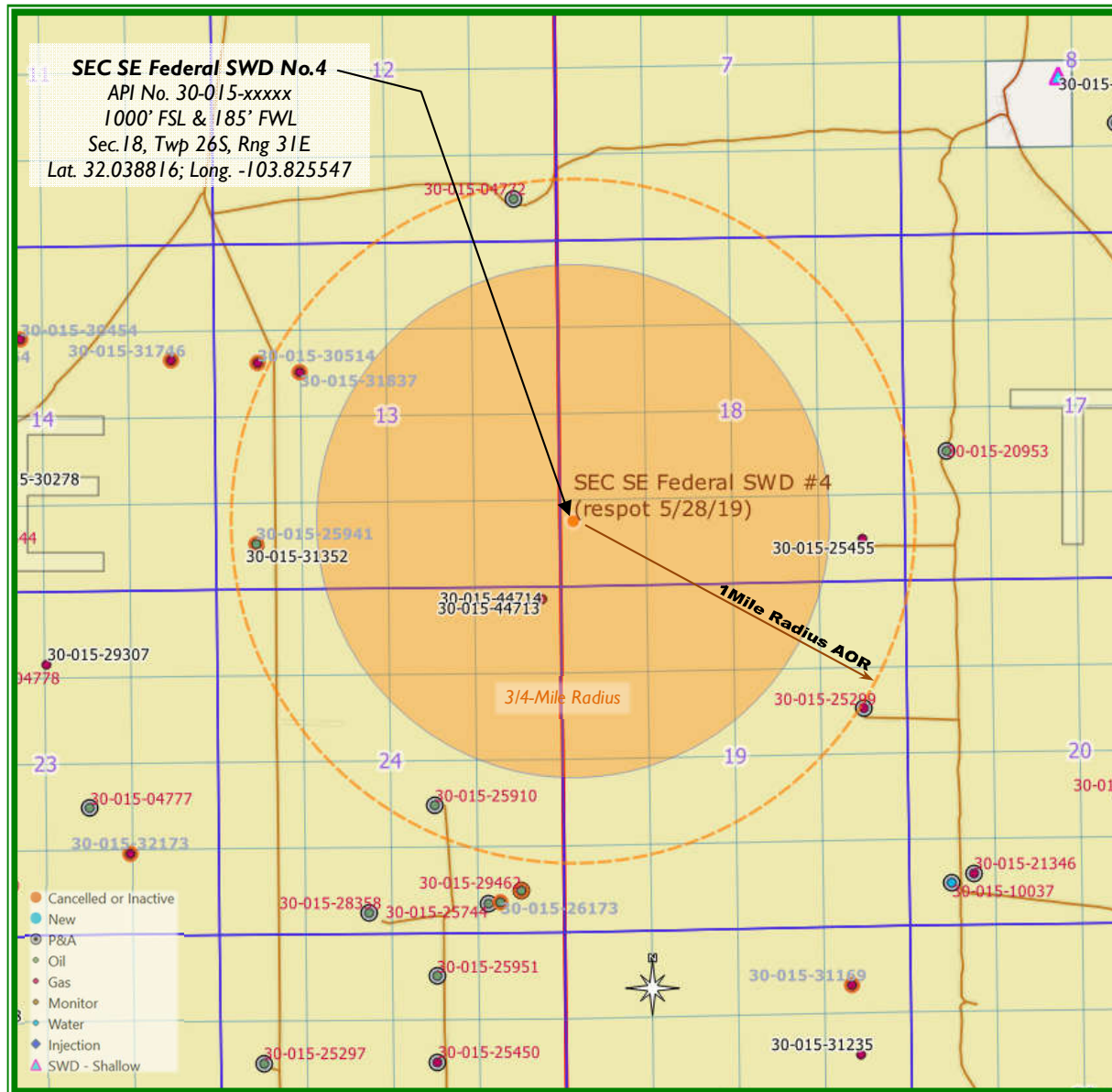
# SEC SE Federal SWD No.4 - Area of Review / 2 Miles

(Attachment to NMOCD Form C-108 - Item V)

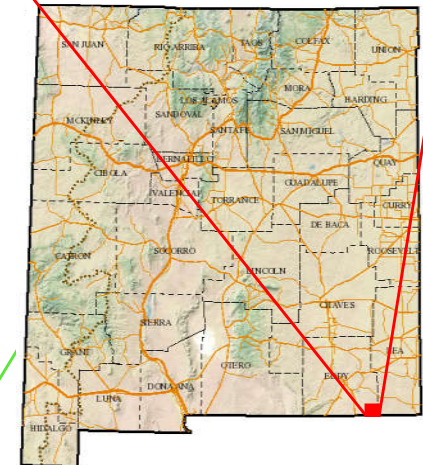
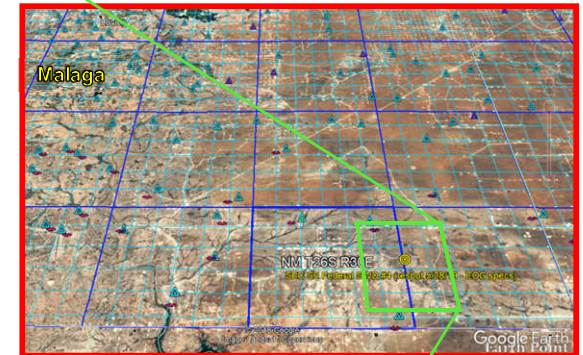


# SEC SE Federal SWD Well No.4 – One Mile Area of Review / Overview Map

(Attachment to NMOCD Form C-108, Application for Authority to Inject.)



19.2 miles Southeast of Malaga, NM



Eddy County, New Mexico

## **C-108 ITEM X**

### **LOGS and AVAILABLE TEST DATA**

**A Standard Suite of Logs will be run after  
drilling the well and submitted to the Division.**

# **C-108 ITEM VII – PROPOSED OPERATION**

## **Trove SEC SE Federal SWD #4**

### ***COMMERCIAL SWD FACILITY***

Upon approval of all permits for SWD, operations would begin within 30 days. Completion of the well operations will take approximately 6-8 weeks. Facility construction including installation of the tank battery, berms, plumbing and other and associated equipment would be occurring during the same interval but at a different location from the well. In any event, it is not expected for the facility construction phase of the project to last more than 60 days, depending on availability of contractors and equipment. Facility design is currently in the planning phase with a company which specializes in such construction.

### ***DRILL AND CONFIGURE FOR SALT WATER DISPOSAL***

#### ***Interval Determination***

Prior to commencing disposal, Trove Energy and Water shall submit mudlog and geophysical logs information, to the Division's District geologist and Santa Fe Engineering Bureau, showing evidence agreeable that only the permitted formation is open for disposal including a summary of depths (picks) for contacts of the formations which the Division shall use to amend any order for a final description of the depth for the injection interval. If significant hydrocarbon shows occur while drilling, the operator shall notify Artesia district office and Trove will seek written permission prior to commencing disposal.

#### ***Casing and Logging***

Trove's design is to circulate all casing strings to surface. If cement does not circulate on any casing string, the Trove will run a cement bond log (CBL) or other log to determine top of cement and shall notify the Artesia district office with the top of cement (emergency phone number if after normal business hours) prior to continuing with any further cement activity with the proposed well. If cement does not tie back in to next higher casing shoe, the operator shall perform remedial cement job(s) to bring cement, at a minimum, 200 feet above the next higher casing shoe. The operator shall run a CBL (or equivalent) for the 7-5/8-inch liner to demonstrate placement cement and the cement bond with the tie-in with 9-5/8-inch casing string. All logs on the well will be copied to the Artesia district office; CBL logs and mudlogs will be provided prior to commencing disposal. Additionally, prior to commencing disposal the operator shall obtain a bottom-hole pressure of the open-hole completion. This information shall be provided with the sundry notice of commencement of disposal operations.

#### ***Monitoring and Reporting***

Prior to commencing any work, an NOI sundry(ies) will be submitted to configure the well for SWD and will detail the completion workover including all work otherwise described above, any change to the procedure noted herein and to perform mechanical integrity pressure test per OCD test procedures. (Notify NMOCD 24 hours prior.) The casing/tubing annulus will be monitored for communication with injection fluid or loss of casing integrity.



# **C-108 ITEM VII – PROPOSED OPERATION**

*(continued)*

## ***OPERATIONAL SUMMARY***

The SWD facility will not be fenced so that trucks may access for load disposal 24/7.

Ultimately, Trove's plans would include tying the SWD into a pipeline, when and if available, so the well and injection equipment will be a closed system and equipped with pressure limiting devices and volume meters. The annulus, loaded with an inert, anti-corrosion packer fluid, will be monitored for pressure.

## ***SCADA System***

The facility and tanks will be equipped with telemetry devices and visual alarms to alert the operator and customers of full tanks or an overflow situation. Operational details including rates, pressures, valve, tank and levels will be continually monitored and either controlled remotely or personnel dispatched for further action.

In addition to operational SCADA system control and monitoring, Trove is considering installing RS Pro Lateral & Vertical Earthquake Monitors with Accelerometer, or better for continuous monitoring. Data will be remotely accessible; monitored and shared as needed. An alternative solution being considered would employ a third party to provide seismic monitoring using public and private seismometers as available.

## ***Rates, Pressures, Releases***

Anticipated daily maximum volume is 30,000 bpd and an average of 22,500 bpd at a maximum surface injection pressure of 3320 psi (.2 psi/ft gradient) – maximum pressure will be adjusted if the top of interval is modified after well logs are run.

Potential releases will be contained and cleaned up immediately. The operator shall repair or otherwise correct the situation within 48 hours before resuming operations. OCD will be notified within 24 hours of any release greater than 5 bbls. If required, remediation will start as soon as practicable. Operator shall comply with 19.15.29 NMAC and 19.15.30 NMAC; as necessary and appropriate and OCD form C-141 will be submitted promptly.

## **C-108 ITEM VII – PRODUCED WATER ANALYSES**

### **Item VII.4 – Water Analysis of Source Zone Water**

Delaware  
Bone Spring  
Wolfcamp

### **Item VII.5 – Water Analysis of Disposal Zone Water**

Devonian

Water Analyses follow this page.

## C-108 Item VII.5 - Produced Water Data

Trove Energy & Water, LLC - SEC SE Federal Project Area

### SOURCE ZONE

#### DELAWARE

API No												Lab ID																	
API No												Sample ID		5532															
Well Name												Sample No																	
SUPERIOR STATE												002																	
Location												ULSTR		08		25		S		30		E		Lat / Long		32.14281		-103.89616	
												1980		S		660		E		County		Eddy							
Operator (when sampled)																													
												Field		CORRAL CANYON				Unit I											
Sample Date																		Analysis Date											
												Sample Source SWAB						Depth (if known)											
												Water Typ																	
ph																		alkalinity_as_caco3_mgL											
ph_temp_F																		hardness_as_caco3_mgL											
specificgravity																		hardness_mgL											
specificgravity_temp_F																		resistivity_ohm_cm											
tds_mgL														155173				resistivity_ohm_cm_temp											
tds_mgL_180C																		conductivity											
chloride_mgL														92820				conductivity_temp_F											
sodium_mgL																		carbonate_mgL											
calcium_mgL																		bicarbonate_mgL		122									
iron_mgL																		sulfate_mgL		133									
barium_mgL																		hydroxide_mgL											
magnesium_mgL																		h2s_mgL											
potassium_mgL																		co2_mgL											
strontium_mgL																		o2_mgL											
manganese_mgL																		anionremarks											
Remarks																													

(Produced water data courtesy of NMT Octane NM WAIDS database.)



## C-108 Item VII.5 - Produced Water Data

Trove Energy & Water, LLC - SEC SE Federal Project Area

### SOURCE ZONE

#### BONE SPRING

E SPRING										Lab ID				
API No		3002533529								Sample ID		6681		
Well Name		THYME APY FEDERAL								002		Sample No		
Location		ULSTR	01	23	S	32	E	Lat / Long		32.33657	-103.62470			
			1650	N		1650	E			County		Lea		
Operator (when sampled)														
		Field		RED TANK								Unit G		
Sample Date		11/27/2001						Analysis Date						
		Sample Source						Depth (if known)						
		Water Typ												
ph		6.1						alkalinity_as_caco3_mgL						
ph_temp_F								hardness_as_caco3_mgL						
specificgravity		1.15						hardness_mgL						
specificgravity_temp_F								resistivity_ohm_cm						
tds_mgL		172896						resistivity_ohm_cm_temp						
tds_mgL_180C								conductivity						
chloride_mgL		104976						conductivity_temp_F						
sodium_mgL								carbonate_mgL						
calcium_mgL		0						bicarbonate_mgL						781
iron_mgL		0						sulfate_mgL						1150
barium_mgL		0						hydroxide_mgL						
magnesium_mgL		2025						h2s_mgL						0
potassium_mgL								co2_mgL						
strontium_mgL								o2_mgL						
manganese_mgL								anionremarks						
Remarks														

(Produced water data courtesy of NMT Octane NM WAIDS database.)





## C-108 Item VII.5 - Produced Water Data

Trove Energy & Water, LLC - SEC SE Federal Project Area

### SOURCE ZONE

#### WOLFCAMP

Lab ID										5096	
API No		3002501678								Sample ID	
Well Name		LAGUNA PLATA FEDERAL UNIT 001								Sample No	
Location		ULSTR	22	19	S	33	E	Lat / Long	32.64341	-103.64461	
			1980	S		710	E	County	Lea		
Operator (when sampled)											
		Field		TONTON						Unit	I
Sample Date						Analysis Date					
		Sample Source DST				Depth (if known)					
		Water Typ									
ph						alkalinity_as_caco3_mgL					
ph_temp_F						hardness_as_caco3_mgL					
specificgravity						hardness_mgL					
specificgravity_temp_F						resistivity_ohm_cm					
tds_mgL		46915				resistivity_ohm_cm_temp					
tds_mgL_180C						conductivity					
chloride_mgL		27270				conductivity_temp_F					
sodium_mgL						carbonate_mgL					
calcium_mgL						bicarbonate_mgL					714
iron_mgL						sulfate_mgL					1116
barium_mgL						hydroxide_mgL					
magnesium_mgL						h2s_mgL					
potassium_mgL						co2_mgL					
strontium_mgL						o2_mgL					
manganese_mgL						anionremarks					
Remarks											

(Produced water data courtesy of NMT Octane NM WAIDS database.)



## C-108 Item VII.5 - Produced Water Data

Trove Energy & Water, LLC - SEC SE Federal Project Area

### DISPOSAL ZONE

#### DEVONIAN

UNIAN											Lab ID			
API No	3002521082										Sample ID	5720		
Well Name	ANTELOPE RIDGE UNIT 003										Sample No			
Location	ULSTR	34	23	S	34	E	Lat / Long	32.25922	-103.46068					
		1980	S		1650	W			County	Lea				
Operator (when sampled)														
	Field	ANTELOPE RIDGE								Unit	K			
Sample Date	11/14/1967					Analysis Date								
	Sample Source	UNKNOWN						Depth (if known)						
	Water Typ													
ph	6.9					alkalinity_as_caco3_mgL								
ph_temp_F						hardness_as_caco3_mgL								
specificgravity						hardness_mgL								
specificgravity_temp_F						resistivity_ohm_cm								
tds_mgL	80187					resistivity_ohm_cm_temp_								
tds_mgL_180C						conductivity								
chloride_mgL	47900					conductivity_temp_F								
sodium_mgL						carbonate_mgL								
calcium_mgL						bicarbonate_mgL					476			
iron_mgL						sulfate_mgL					900			
barium_mgL						hydroxide_mgL								
magnesium_mgL						h2s_mgL								
potassium_mgL						co2_mgL								
strontium_mgL						o2_mgL								
manganese_mgL						anionremarks								
Remarks														

(Produced water data courtesy of NMT Octane NM WAIDS database.)



## **C-108 – Item VIII**

### **Geologic Information**

The Devonian and Silurian consist of carbonates including light colored dolomite and chert intervals interspersed with some tight limestone intervals. Several thick sections of porous dolomite capable of taking water are believed present within the subject formations in the area. Depth control data was inferred from deep wells in the area and charted contours. If the base of Devonian and top of Silurian rocks come in as expected the well will only be drilled deep enough for adequate logging rathole.

At a proposed depth of 18,500' BGL (Below Ground Level) the well will TD approximately 1,900' below the estimated top of the Devonian. Mud logging through the interval will ensure the target interval remains in Devonian and Silurian. Once Devonian is determined, the casing shoe depth will be set at an approximate maximum upper depth of 16,600' BGL. Injection will occur through the resulting openhole interval.

TROVE ATTEMPTS TO BRACKET POTENTIAL INJECTION INTERVALS BASED ON OFFSETTING WELLS, AVAILABLE NEARBY LOGS AND CONTOURS PLOTS; IT IS EXPECTED THAT ONCE DRILLING COMMENCES AND MUDLOGGING RETURNS ARE EVALUATED, THE INTERVAL MAY BE ADJUSTED ACCORDINGLY TO EXPLOIT THE DESIRED FORMATION AS DESCRIBED. C-103 SUNDRY REPORTS WITH APPROPRIATE DATA WILL BE FILED WITH THE OCD AND FINALIZED WITH THE C-105 COMPLETION REPORT.

The Devonian is overlain by the Woodford Shale and Mississippian Lime and underlain by the Middle and Lower Ordovician; Simpson, McKee and Ellenburger.

The SWD prospect is in the Carlsbad Basin. Fresh water in the area is generally available from the Rustler and Santa Rosa formations. State Engineer's records show water wells in the area with a depth to groundwater of 292 to 365 feet and an average depth of 317 feet.

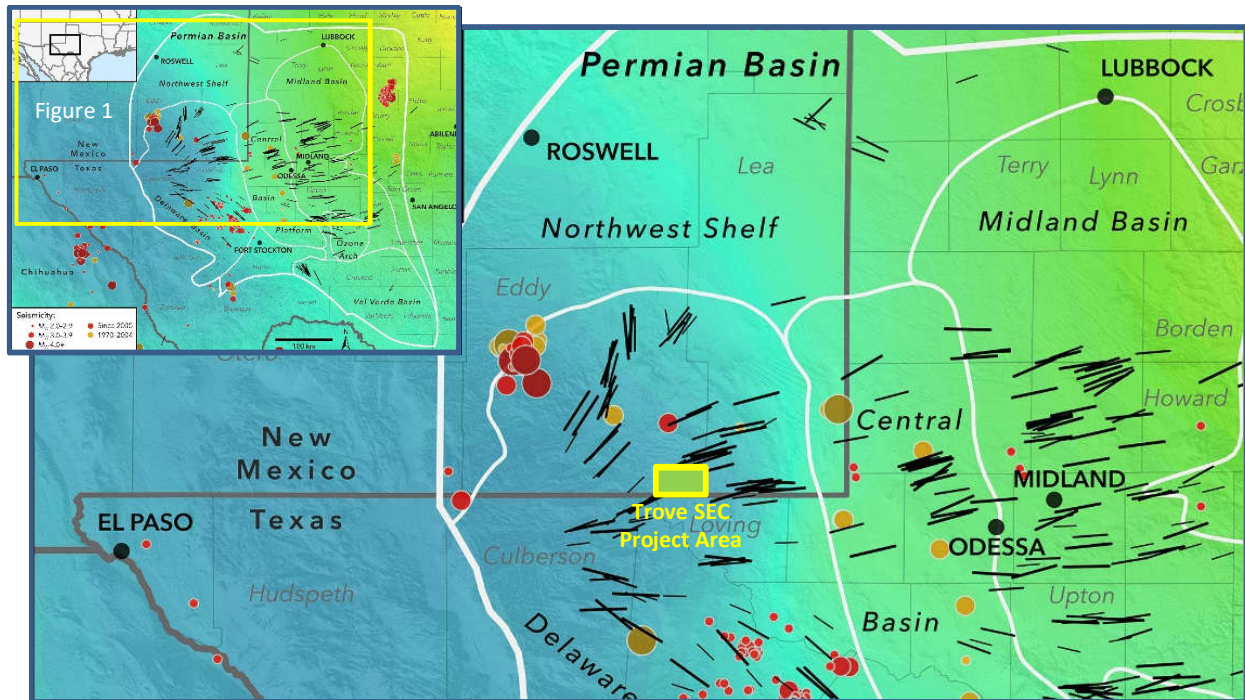
There are 2 (two) water wells located within one mile of the proposed SWD. Representative analyses from the area are included herein and one or both of the subject wells will be sampled, analyzed and submitted to the division.

# C-108 - Item VIII

## Geological Data

### EARTHQUAKE / SEISMIC INFORMATION SUPPLEMENT

Map Source: State of stress in the Permian Basin, Texas and New Mexico: Implications for induced seismicity (Figure 1); Jens-Erik Lund Snee/ Mark Zoback, February 2018



TROVE PSE PROJECT VICINITY

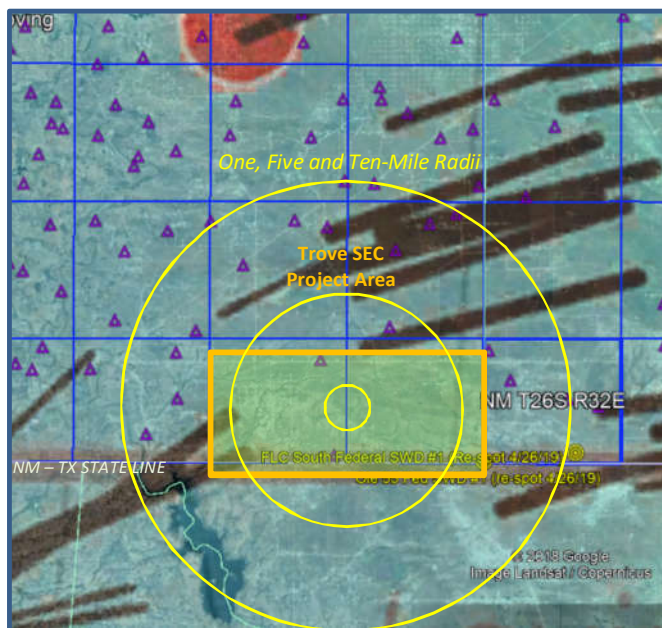


Figure 1. State of stress in the Permian Basin, Texas and New Mexico. Black lines are the measured orientations of the maximum horizontal stress (SHmax), with line length scaled by data quality. The colored background is an interpolation of measured relative principal stress magnitudes (faulting regime) expressed using the  $A\phi$  parameter (see text for details) of Simpson (1997). Blue lines are fault traces known to have experienced normal-sense offset within the past 1.6 Ma, from the USGS Quaternary Faults and Folds Database (Crone and Wheeler, 2000). The boundary between the Shawnee and Mazatzal basement domains is from Lund et al. (2015), and the Precambrian Grenville Front is from Thomas (2006). The Permian Basin boundary is from the U.S. Energy Information Administration, and the subbasin boundaries are from the Texas Bureau of Economic Geology Permian Basin Geological Synthesis Project. Earthquakes are from the USGS National Earthquake Information Center, the TexNet Seismic Monitoring Program, and Gan and Frohlich (2013). Focal mechanisms are from Saint Louis University (Herrmann et al., 2011).



## C-108 - Item VIII

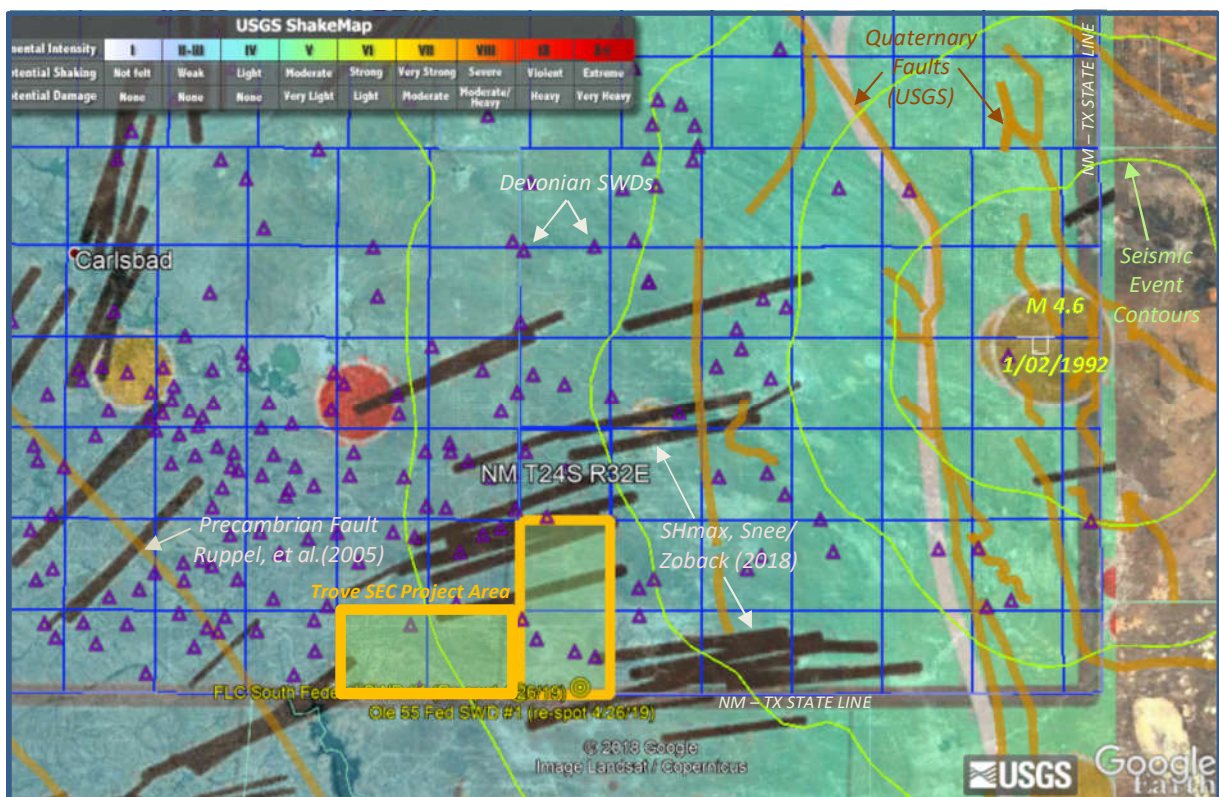
### Geological Data

#### EARTHQUAKE / SEISMIC INFORMATION SUPPLEMENT (cont.)

In the following map, a layer with USGS historical earthquake data is overlaid and, a layer showing lines to represent Precambrian faults as documented by Ruppel, et al. (2005). Finally, a layer showing all currently permitted SWDs completed or proposed to be completed in the Devonian (Silurian) formation.

The USGS earthquakes shown are well known to the area. The 2012 quake located approximately 13 miles due east of Loving is also shown (19.2 miles). This was perhaps the most significant of the area in recent years but was determined to not be related to oil and gas activity. The best known and largest in recent history was the 1992, 4.6 magnitude quake centered south of Eunice, NM (36.0 miles).

The Precambrian faults and existing Devonian SWDs are discussed in more detail on the next page.



REGIONAL VIEW - DEVONIAN SWD LOCATIONS, PRECAMBRIAN FAULTS,  $S_{Hmax}$ , USGS MAGNITUDE

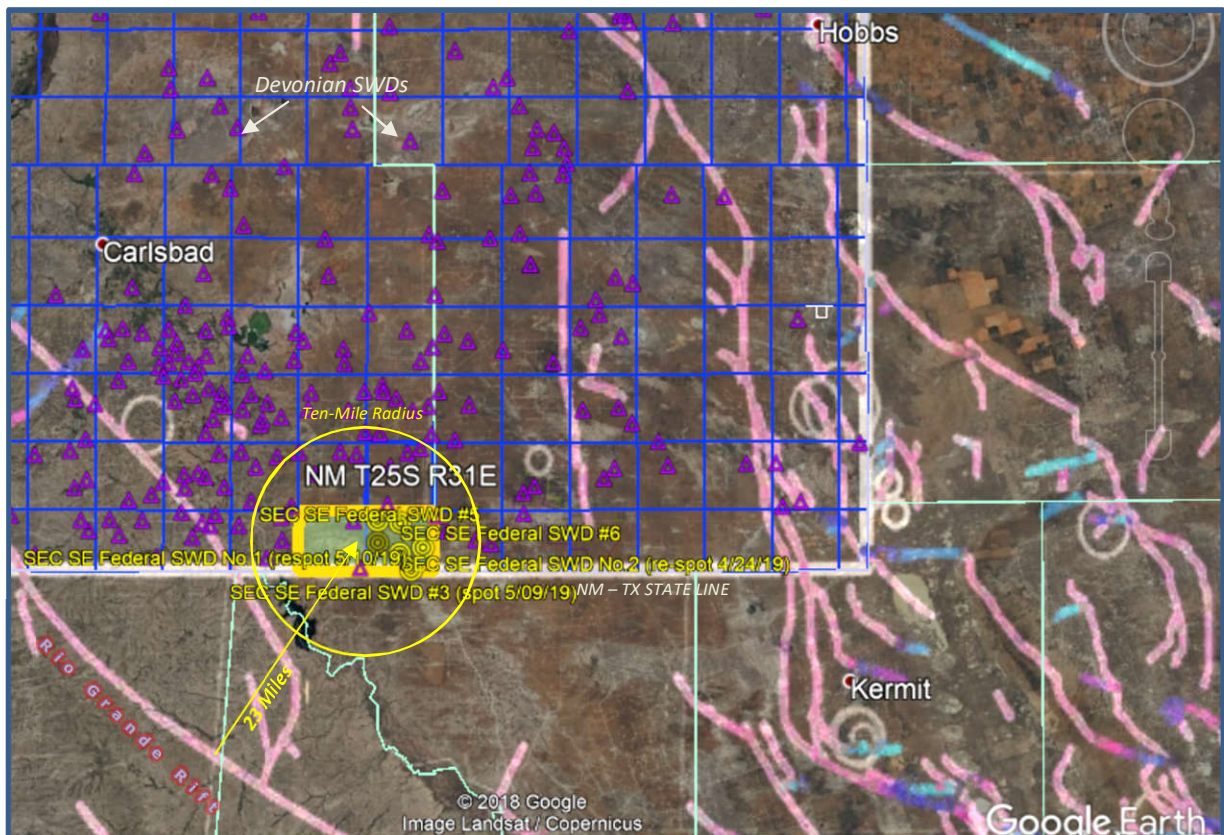
## C-108 - Item VIII

### Geological Data

#### EARTHQUAKE / SEISMIC INFORMATION SUPPLEMENT (cont.)

The primary Precambrian faults in the area as documented by Ruppel, et al. (2005) is represented on this map by the thick, pink colored lines. The most significant of these is the fault associated with the Rio Grande Rift, running southeast to northwest and, runs adjacent to a portion of Hwy 285; a portion the associated fault which runs parallel approximately 15 miles northeast is also depicted below. The Trove SEC Project SWD Area is located some 23 miles from the fault. Other documented faults (USGS, 2000) are shown for eastern Lea County and extending into west Texas. Other Devonian SWDs in the area are also shown (small purple triangles) completed or proposed to be completed in the Devonian (Silurian) formation.

The previously referenced study by Snee and Zoback (shown on previous exhibits) evaluated the strike-slip probability using probabilistic FSP (Fault Slip Potential) analysis of known faults in the Permian Basin. The study predicts that the Precambrian fault shown here has less than a 10% probability of being critically stressed to the point of creating an induced seismicity event. The main reason for the low probability is due to the relationship of the strike of the fault to the regional  $S_{Hmax}$  orientation; the proposed SWD being well removed from the area.



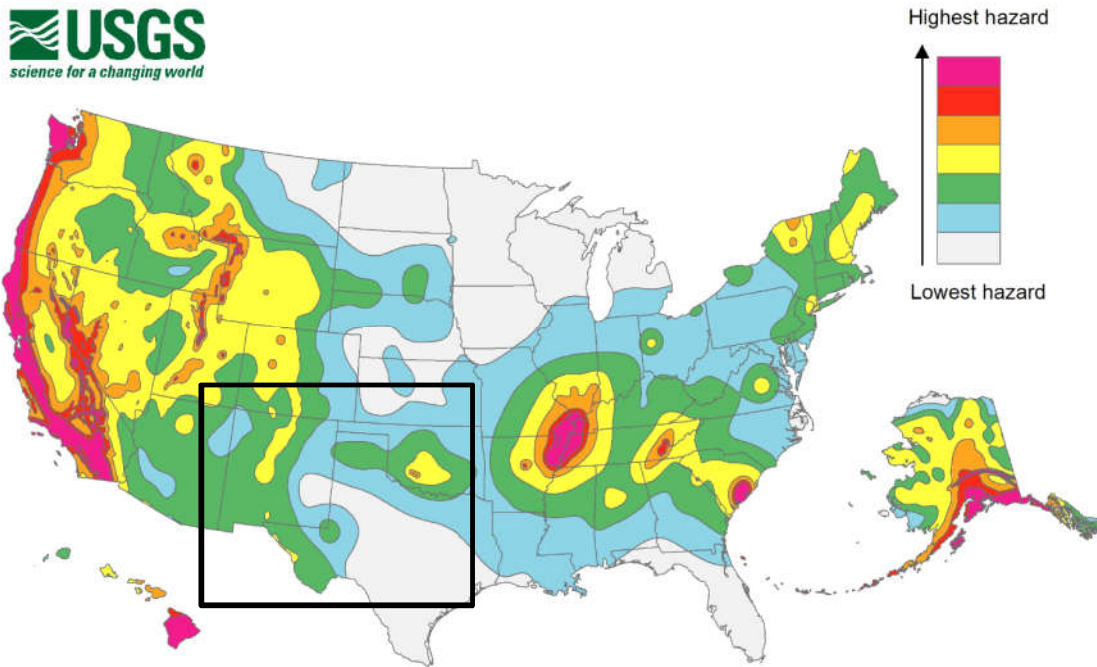
VICINITY - PERMITTED DEVONIAN SWDs, COMPOSITE FAULTS



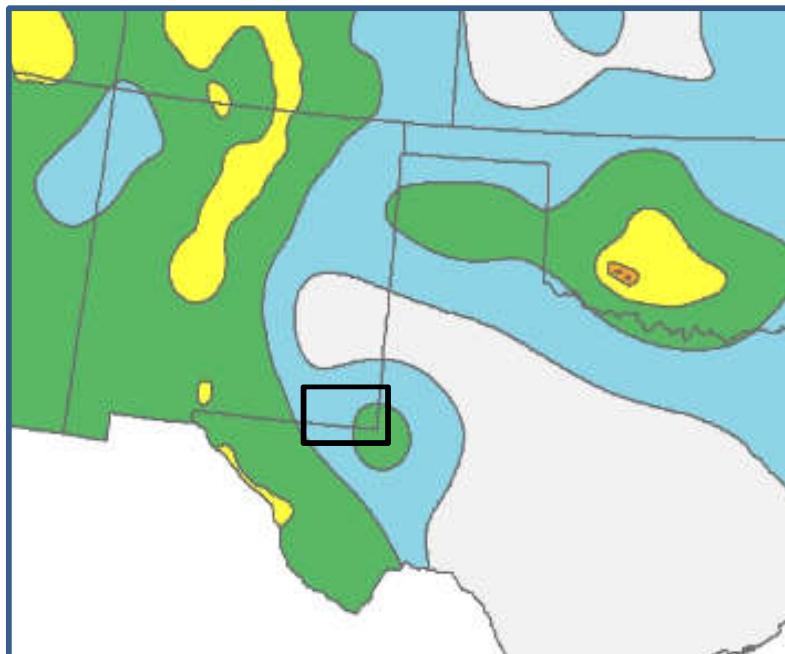
## C-108 - Item VIII

### Geological Data

#### EARTHQUAKE / SEISMIC INFORMATION SUPPLEMENT (cont.)



**2014 map data:** The USGS notes in its report that fracking may be to blame for a sizeable uptick in earthquakes in places like Oklahoma. “Some states have experienced increased seismicity in the past few years that may be associated with human activities such as the disposal of wastewater in deep wells,” the report says. USGS hopes to use that data in future maps but it isn’t included in this one. “Injection-induced earthquakes are challenging to incorporate into hazard models because they may not behave like natural earthquakes and their rates change based on man-made activities,” the report says.

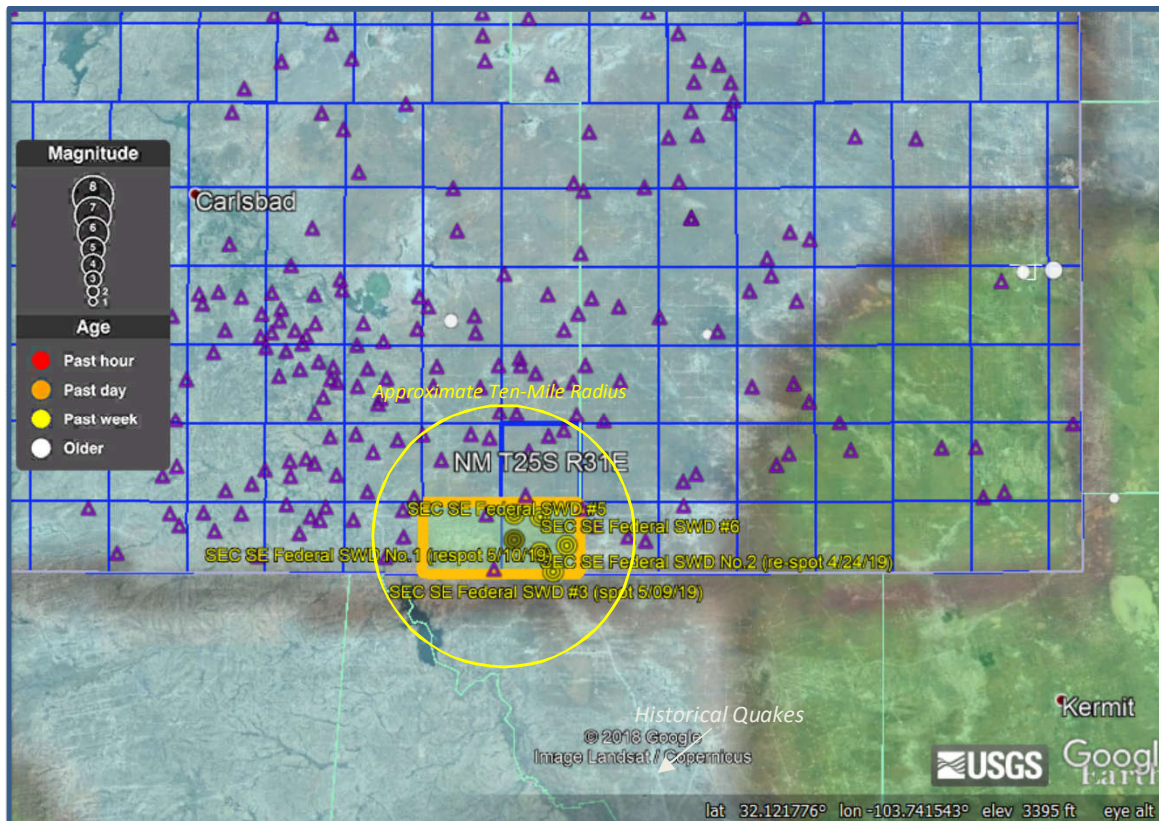


## C-108 - Item VIII

### Geological Data

#### EARTHQUAKE / SEISMIC INFORMATION SUPPLEMENT (cont.)

USGS 2014 REGIONAL MAP DATA OVERLAY IN GOOGLE EARTH W/ HISTORICAL EARTHQUAKES



An updated USGS map for 2018 is on the next page. While methodology remained essentially the same according to USGS, the interpreted results and color-coding did have some modification. However, the subject area in southeast New Mexico on both maps remains very low and on the 2018 map, the area is assigned a value of <1% of “potentially minor-damage ground shaking”.

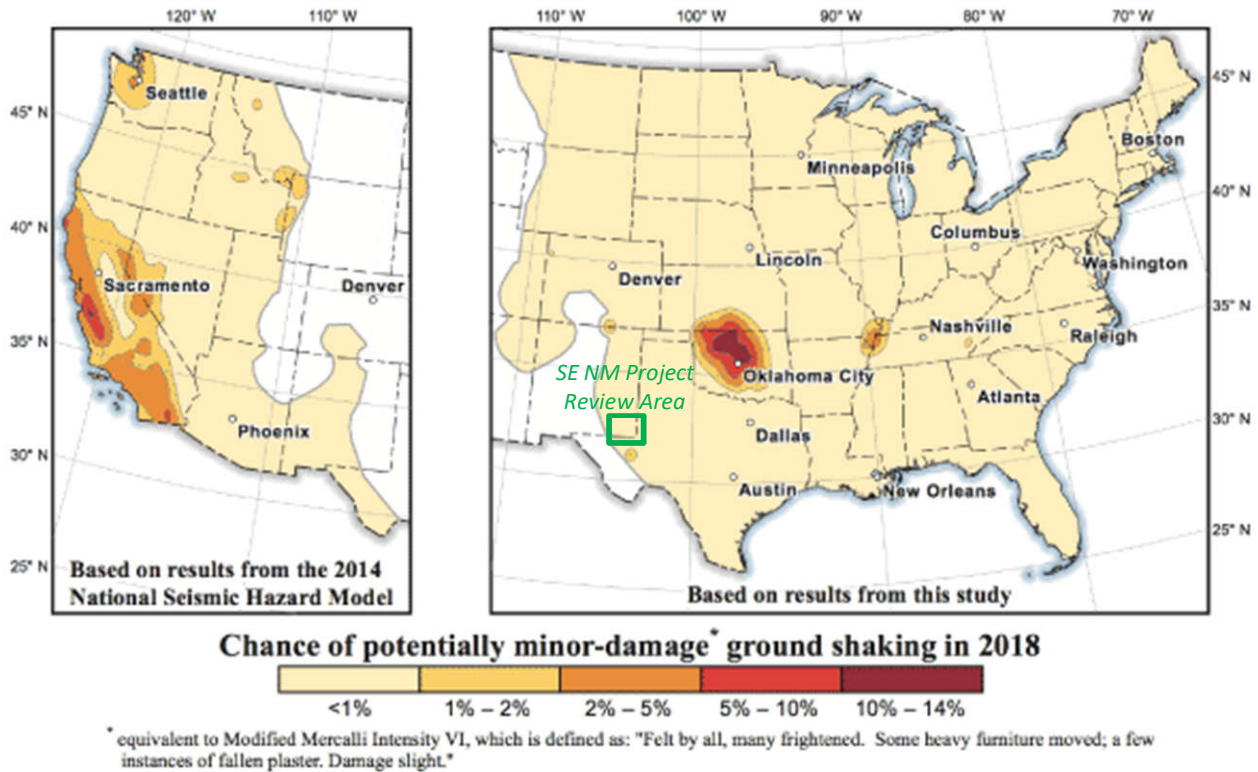


## C-108 - Item VIII

### Geological Data

#### EARTHQUAKE / SEISMIC INFORMATION SUPPLEMENT (cont.)

##### USGS 2018 ONE-YEAR MODEL



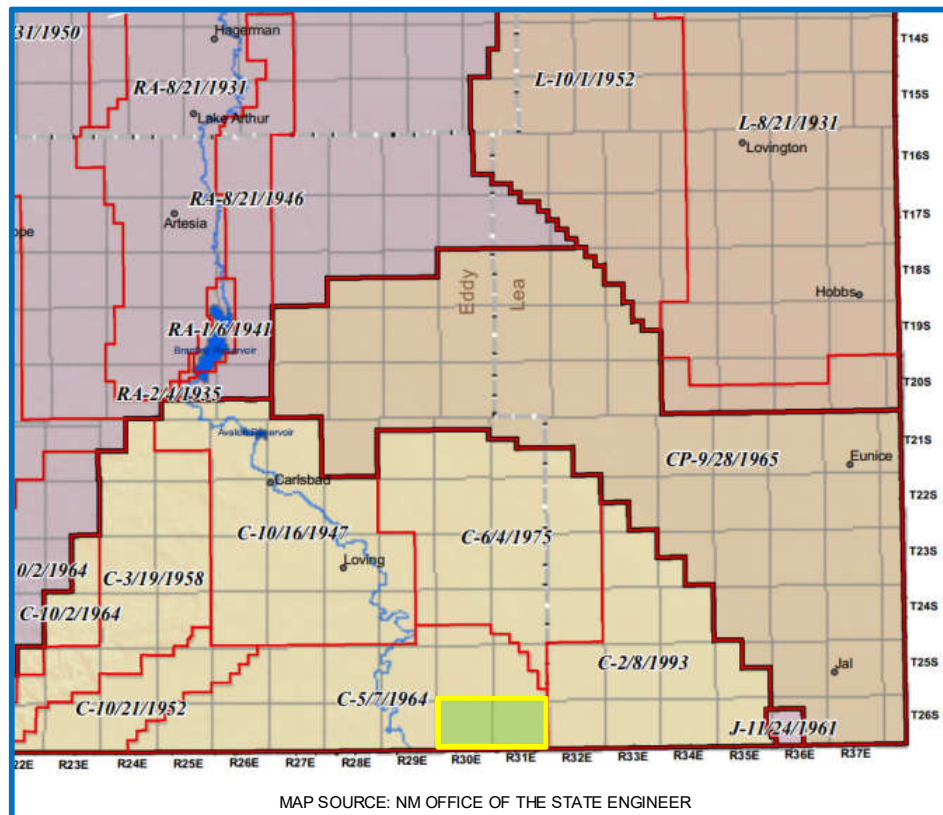
Map showing chance of damage from an earthquake in the Central and Eastern United States during 2018. Percent chances are represented as follows: pale yellow, less than 1 percent; dark yellow, 1 to 2 percent; orange, 2 to 5 percent; red, 5 to 10 percent; dark red, 10 to 12 percent. See Hazard from the western United States from the [2014 National Seismic Hazard Maps](#) (Petersen et al., 2014) for comparison.

The USGS has produced the 2018 one-year probabilistic seismic hazard forecast for the central and eastern United States from induced and natural earthquakes. For consistency, the updated 2018 forecast is developed using the same probabilistic seismicity-based methodology as applied in the two previous forecasts.

***Based on publicly available data for the subject area, it is reasonable to believe the risk of induced seismic activity due to disposal injection into this well is extremely low.***

## C-108 - Item XI

### Groundwater Basins - Water Column / Depth to Groundwater



The subject well is located within the Carlsbad Basin.

State Engineer's records show water wells in the area with a depth to groundwater of 292 to 365 feet and an average depth of 317 feet.

There are NO water wells located within one mile of the proposed SWD.

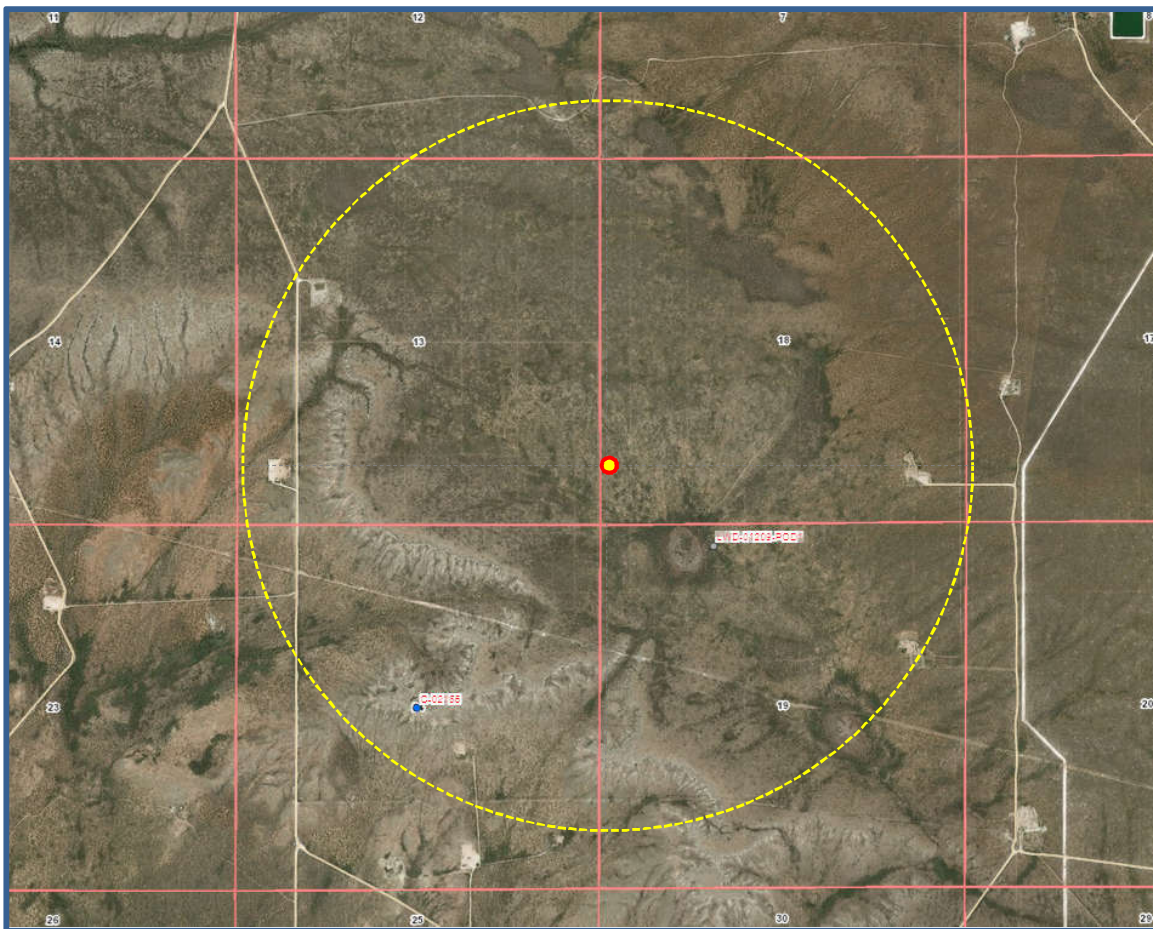
## C-108 Item XI

### Water Wells Within One Mile

#### SEC SE Federal SWD No.4 - Water Well Locator Map

*There are 2 water well (PODs) within a one-mile radius of the proposed SWD.*

*A representative analysis is included with this application. Samples from subject wells will be analyzed and results submitted to the division.*



*Data from NM Office of the State Engineer displayed in OSE-GIS System.*



# C-108 ITEM XI – WATER WELLS IN AOR

## Depth to Ground Water



## New Mexico Office of the State Engineer Water Column/Average Depth to Water








(A CLW##### in the POD suffix indicates the POD has been replaced & no longer serves a water right file.)

(R=POD has been replaced, O=orphaned, C=the file is closed)

(quarters are 1=NW 2=NE 3=SW 4=SE)  
(quarters are smallest to largest)

(NAD83 UTM in meters)

(In feet)

	POD														
	Sub-		Q	Q	Q							Depth	Depth	Water	
POD Number	Code	basin	County	64	16	4	Sec	Tws	Rng	X	Y	Well	Water	Column	
<a href="#">C 01777</a>	C	ED					08	26S	31E	613245	3547409*		325	300	25
<a href="#">C 02090</a>	C	ED		4	4	01	26S	31E	620329	3548533*			350	335	15
<a href="#">C 02248</a>	CUB	ED		1	2	3	08	26S	31E	612942	3547316*		300	292	8
<a href="#">C 02249</a>	CUB	ED		1	2	3	08	26S	31E	612942	3547316*		300	292	8
<a href="#">C 03554 POD1</a>	CUB	ED		2	1	4	01	26S	31E	620547	3549148		630	300	330
<a href="#">C 03639 POD1</a>	CUB	ED		3	4	2	01	26S	31E	620168	3549279		700	365	335
<a href="#">C 04256 POD1</a>	C	ED		4	4	2	01	26S	31E	620384	3549257		666	340	326

Average Depth to Water: **317 feet**

Minimum Depth: **292 feet**

Maximum Depth: **365 feet**

Record Count: 7

PLSS Search:

Township: 26S

Range: 31E

\*UTM location was derived from PLSS - see Help

The data is furnished by the NMOSE/ISC and is accepted by the recipient with the expressed understanding that the OSE/ISC make no warranties, expressed or implied, concerning the accuracy, completeness, reliability, usability, or suitability for any particular purpose of the data.

709 W. INDIANA  
MIDLAND, TEXAS 79701  
FAX (432) 682-8819

# Fresh Water Analysis: Baker Ranch Water Well 1-26S-31E

Chlorides: 399 ppm  
Total Dissolved Solids: 746 ppm



5-1<sup>st</sup> TWP-26S-31E  
Water Analysis

Date: 22-Apr-15

2702 West County Road, Hobbs NM 88240  
Phone (575) 392-5556 Fax (575) 392-7307

## Analyzed For

Company	Well Name	County	State
Mewbourne	Baker #1	Lea	New Mexico

Sample Source Wellhead Sample # 1

Formation Depth

Specific Gravity	1.000	SG @ 80 °F	1.002
pH	7.35	Sulfides	
Temperature (°F)	70	Reducing Agents	

## Cations

Sodium (Calc)	in Mg/L	188	in PPM	188
Calcium	in Mg/L	68	in PPM	68
Magnesium	in Mg/L	29	in PPM	29
Soluble Iron (FE2)	in Mg/L	0.0	in PPM	0

## Anions

Chlorides	in Mg/L	400	in PPM	399
Sulfates	in Mg/L	70	in PPM	70
Bicarbonates	in Mg/L	16	in PPM	16
Total Hardness (as CaCO3)	in Mg/L	290	in PPM	290
Total Dissolved Solids (Calc)	in Mg/L	746	in PPM	746
Equivalent NaCl Concentration	in Mg/L	728	in PPM	728

## Scaling Tendencies

\*Calcium Carbonate Index 898

Below 500,000 Possible / 500,000 - 1,000,000 Possible / Above 1,000,000 Probable

\*Calcium Sulfate (Gyp) Index 4,750

Below 500,000 Possible / 500,000 - 10,000,000 Possible / Above 10,000,000 Probable

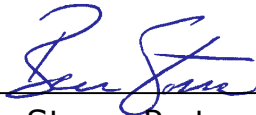
\*This Calculation is only an approximation and is only valid before treatment of a well or several weeks after treatment

Remarks rw=5.0701

## **C-108 ITEM XII**

### Geologic Affirmation

We have examined available geologic and engineering data and have found no evidence of open faults or other hydrologic connection between the disposal interval and any underground sources of drinking water.



---

Ben Stone, Partner  
SOS Consulting, LLC

Project: Trove Energy and Water, LLC  
SEC SE Project Area  
Reviewed 4/26/2019

## **C-108 ITEM XIII – PROOF OF NOTIFICATION**

### IDENTIFICATION AND NOTIFICATION OF INTERESTED PARTIES

#### **Exhibits for Section**

Affected Parties Map

List of Interested Parties

Notification Letter to Interested Parties

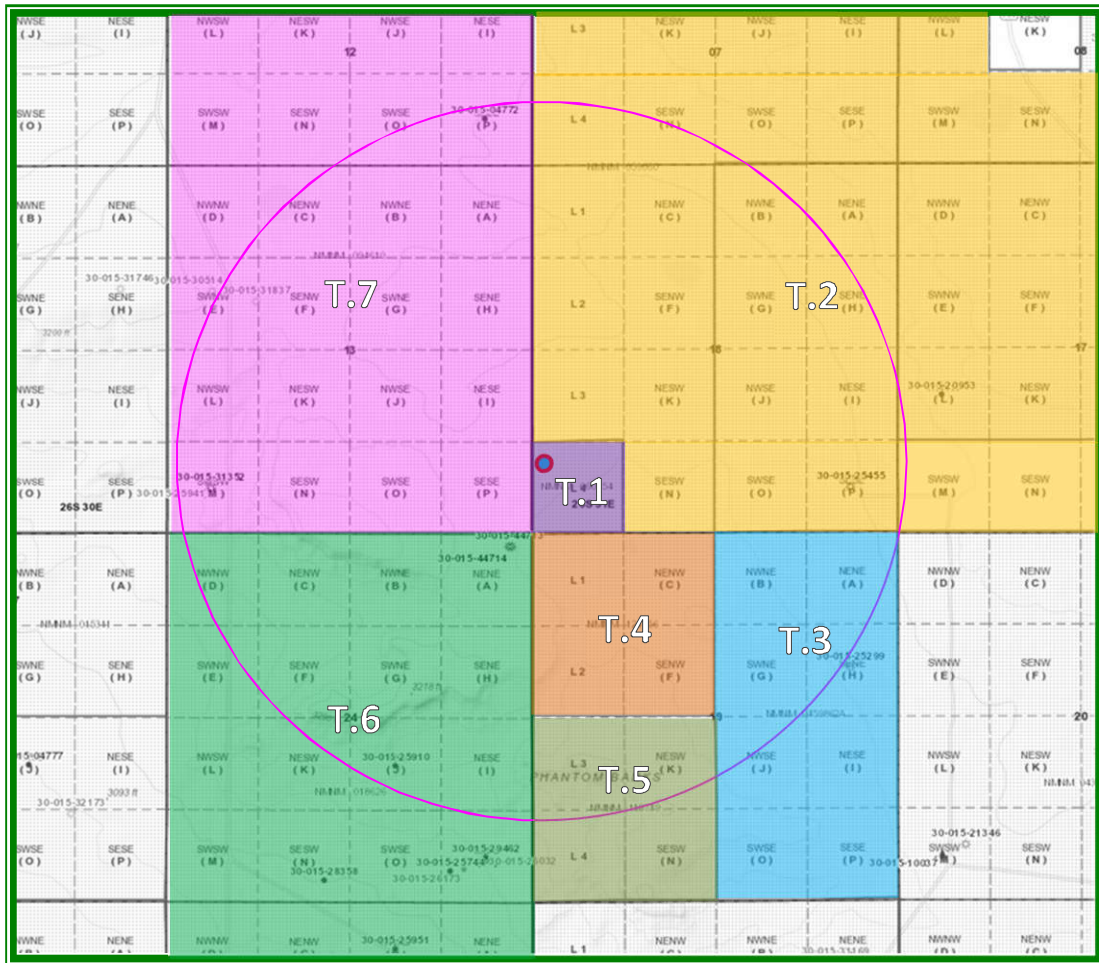
Proof of Certified Mailing

Published Legal Notice



# SEC SE Federal SWD Well No.4 – Affected Parties Plat

(Attachment to NMOCD Form C-108, Application for Authority to Inject.)



## LEGEND

T.1 – NMNM-060354 – Boyd & McWilliams

T.5 – NMNM-118719 – WPX Energy Permian

T.2 – NMNM-059060 – EOG Resources, Inc.

T.6 – NMNM-018626 – Occidental Permian, LP

T.3 – NMNM-0459862A – EOG Resources, Inc.

T.7 – NMNM-094610 – EOG Resources, Inc.

T.4 – NMNM-121956 – WPX Energy Permian

# C-108 ITEM XIII – PROOF OF NOTIFICATION AFFECTED PARTIES LIST

**SOS Consulting is providing electronic delivery of C-108 applications.**

**ALL APPLICABLE AFFECTED PARTIES ARE PROVIDED A LINK IN THE NOTICE LETTER  
TO A SECURE SOS/ CITRIX SHAREFILE® SITE TO VIEW AND DOWNLOAD  
A FULL COPY OF THE SUBJECT C-108 APPLICATION IN PDF FORMAT.**

"AFFECTED PERSON" MEANS THE DIVISION DESIGNATED OPERATOR; IN THE ABSENCE OF AN OPERATOR, A LESSEE WHOSE INTEREST IS EVIDENCED BY A WRITTEN CONVEYANCE DOCUMENT EITHER OF RECORD OR KNOWN TO THE APPLICANT AS OF THE DATE THE APPLICANT FILES THE APPLICATION; OR IN THE ABSENCE OF AN OPERATOR OR LESSEE, A MINERAL INTEREST OWNER WHOSE INTEREST IS EVIDENCED BY A WRITTEN CONVEYANCE DOCUMENT EITHER OF RECORD OR KNOWN TO THE APPLICANT AS OF THE DATE THE APPLICANT FILED THE APPLICATION FOR PERMIT TO INJECT.; PER OCD RULES NMAC 19.15.26.7, A. AND 19.15.26.8, B.2.

## **SURFACE OWNER**

- 1 U.S. DEPARTMENT OF INTERIOR  
Bureau of Land Management  
Oil & Gas Division  
620 E. Greene St.  
Carlsbad, NM 88220  
Certified: 7018 2290 0001 2038 5936

## **OFFSET MINERALS LESSEES and OPERATORS (All Notified via USPS Certified Mail)**

### **BLM Lease NMNM-060354 (T.1 on Map)**

#### ***Lessee***

BOYD & McWILLIAMS  
550 W. Texas St., Ste.704  
Midland, TX 79701

#### ***Operator***

- 2 EOG RESOURCES, INC.  
Attn: Chuck Moran  
5509 Champions Drive  
Midland, TX 79706  
Certified: 7018 2290 0001 2038 5943

### **BLM Leases NMNM-059060, 0459862A, 094610 (T.2, T.3 and T.7 on Map)**

#### ***Lessee & Operator***

EOG RESOURCES, INC.  
Attn: Chuck Moran  
5509 Champions Drive  
Midland, TX 79706

### **BLM Leases NMNM-121956, 118719 (T.4 T.5 on Map)**

#### ***Lessee***

WPX ENERGY PERMIAN, LLC  
P.O. Box 3102, MD 26  
Tulsa, OK 74101

**C-108 ITEM XIII – PROOF OF NOTIFICATION**  
**AFFECTED PARTIES LIST (cont.)**

**BLM Leases NMNM-121956, 118719 (T.4 T.5 on Map – cont.)**

***Operator***

EOG RESOURCES, INC.  
Attn: Chuck Moran  
5509 Champions Drive  
Midland, TX 79706

**BLM Lease NMNM-018626 (T.6 on Map)**

***Lessee***

OCCIDENTAL PERMIAN, LTD  
6001 Deauville Blvd.  
Midland, TX 79706

***Operators***

- 3 MEWBOURNE OIL COMPANY  
Attn: Tim Harrington  
P.O. Box 7698  
Tyler, TX 75711  
Certified: 7018 2290 0001 2038 5950

EOG RESOURCES, INC.  
Attn: Chuck Moran  
5509 Champions Drive  
Midland, TX 79706

**OFFSET MINERALS OWNERS** (Notified via USPS Certified Mail)

U.S. DEPARTMENT OF INTERIOR  
Bureau of Land Management  
Oil & Gas Division  
620 E. Greene St.  
Carlsbad, NM 88220

**REGULATORY**

NEW MEXICO OIL CONSERVATION DIVISION (FedEx'ed original and copy)  
1220 S. St. Francis Dr.  
Santa Fe, NM 87505

NEW MEXICO OIL CONSERVATION DIVISION (FedEx'ed copy)  
811 S. First St.  
Artesia, NM 88210

## C-108 - Item XIV

Proof of Notice (Certified Mail Receipts)

9665 9602 1000 0622 9102

**U.S. Postal Service™  
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For delivery information, visit our website at [www.usps.com](http://www.usps.com)®.

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☐ Return Receipt (electronic) \$ 2.80

☐ Certified Mail Restricted Delivery \$

☐ Adult Signature Required \$

☐ Adult Signature Restricted Delivery \$

Postage \$ .55

Total Postage and Fees \$ 6.85

Sent To **Bureau of Land Management**

Street and **Oil & Gas Division**

City, State, ZIP+4® **620 E. Greene St.  
Carlsbad, NM 88220**

PS Form 3849, October 2016

Postmark Here **JUN 13 2019**

COMO TX 75431

9665 9602 1000 0622 9102

**U.S. Postal Service™  
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☐ Return Receipt (electronic) \$ 2.80

☐ Certified Mail Restricted Delivery \$

☐ Adult Signature Required \$

☐ Adult Signature Restricted Delivery \$

Postage \$ .55

Total Postage and Fees \$ 6.85

Sent To **EOG RESOURCES, INC.**

Street and **Attn: Chuck Moran**

City, State, ZIP+4® **5509 Champions Drive  
Midland, TX 79706**

PS Form 3849, October 2016

Postmark Here **JUN 13 2019**

COMO TX 75431

0565 9602 1000 0622 9102

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☐ Certified Mail Restricted Delivery \$

☐ Adult Signature Required \$

☐ Adult Signature Restricted Delivery \$

Postage \$ .55

Total Postage and Fees \$ 6.85

Sent To **MEWBOURNE OIL COMPANY**

Street and **Attn: Tim Harrington**

City, State, ZIP+4® **P.O. Box 7698  
Tyler, TX 75711**

PS Form 3849, October 2016

Postmark Here **JUN 15 2019**

COMO TX 75431



# Affidavit of Publication

No. 25143

State of New Mexico

County of Eddy:

**Danny Scott**

being duly sworn says that he is the **Publisher**

of the Artesia Daily Press, a daily newspaper of General circulation, published in English at Artesia, said county and state, and that the hereto attached

## Legal Ad

was published in a regular and entire issue of the said Artesia Daily Press, a daily newspaper duly qualified for that purpose within the meaning of Chapter 167 of the 1937 Session Laws of the state of New Mexico for 1 Consecutive weeks/day on the same

day as follows:

First Publication May 30, 2019

Second Publication

Third Publication

Fourth Publication

Fifth Publication

Sixth Publication

Seventh Publication

Subscribed and sworn before me this

30th day of May 2019



OFFICIAL SEAL  
Latisha Romine  
NOTARY PUBLIC-STATE OF NEW MEXICO

My commission expires:

5/12/2023

*Latisha Romine*

Latisha Romine

Notary Public, Eddy County, New Mexico

# Copy of Publication:

## Legal Notice

Trove Energy and Water, LLC, 1919 North Turner, Hobbs, NM 88240, is filing Form C-108 (Application for Authority to Inject) with the New Mexico Oil Conservation Division seeking administrative approval for a salt water disposal well. The proposed well, the SEC SE Federal SWD Well No.4 will be located 1000' FSL and 185' FWL, Section 18, Township 26 South, Range 31 East, Eddy County, New Mexico; approximately 19.2 miles southeast of Malaga, NM.

Produced water from area production will be commercially disposed into the Devonian, Silurian and Fusselman formations at a maximum interval depth of 16,600' to 18,500' at a maximum surface pressure of 3320 psi and a rate limited only by such pressure. Mudlogging and e-logs will confirm final interval depths.

Interested parties wishing to object to the proposed application must file with the New Mexico Oil Conservation Division, 1220 St. Francis Dr., Santa Fe, NM 87505, (505)476-3460 within 15 days of the date of this notice or the OCD receive date, whichever is later. Additional information may be obtained from the applicant's agent, SOS Consulting, LLC, (903)488-9850 or, email info@sosconsulting.us.

Published in the Artesia Daily Press, Artesia, N.M., May 30, 2019 Legal No. 25143.